

Government of India
Bhabha Atomic Research Centre, Mysuru
Proj. SMF Challakere, Chitradurga

NOTICE INVITING e-TENDER

TENDER NOTICE No. BARC/SMFC/CS/02/2024-25/NIT; Date: 19-12-2025

I. NIT Details:

1. Online item-rate tender in two parts i.e. Cover-1 –Techno-commercial Bid and Cover-2 – Financial Bid are hereby invited through e-Tendering mode on behalf of the President of India by Tender Inviting Authority as below, Bhabha Atomic Research Centre, Mysuru, 571130 for the following work from eligible bidders.

i)	Name of Work	:	Design & Construction of Fire Station, Drill Tower, Boiler house, Tank farm areas including internal electrical, HVAC and other associated works at SMFC, BARC, Challakere, Karnataka.
ii)	Work Location (s) & Pin Code (s)	:	BARC, DoddUllarthi Kaval, Challakere, Karnataka-577537
iii)	Work/Product Category	:	Construction Works
iv)	Tender inviting Authority	:	Chief Engineer, Bhabha Atomic Research Centre, Mysuru. For and on behalf of the President of India
v	Inviting Officer Address	:	Chief Engineer, Bhabha Atomic Research Centre, Mysuru, P.B No 1, Yelwal, Mysuru-571130.
vi)	Estimated Cost	:	₹15,50,00,000/- + GST as applicable
vii)	Earnest Money	:	₹28,29,000/-
viii)	Cost of tender Document	:	NIL
ix)	Tender Processing Fee	:	NIL
x)	Period of work	:	730 Calendar days including monsoon period.
xi)	'Start/End Date of Download of Bid Documents'	:	19-12-2025 (1600 Hrs.) to 23-01-2026 (1500 Hrs.) To Download – please visit CPPP website on: https://eprocure.gov.in/eprocure/app.NIT is also available on website www.barc.gov.in , for view only
xii)	Seek clarification Start Date	:	19-12-2025 (1600 Hrs.)
xiii)	Seek clarification End Date	:	01-01-2026 (1100 Hrs.)
xiv)	Site Visit Date & Time	:	On or Before 02-01-2026 (1500 Hrs.)
xv)	Pre-Bid meeting Date & Time	:	Pre-Bid meeting will be held at 1100 Hrs. on 02-01-2026. Bidders, who are interested in attending the Pre-Bid meeting, should send their request on or before 31-12-2025 (1000 Hrs.) through e-mail (to the contact details given in Note section, refer Page no 21 of 28)."
xvi)	Pre-Bid meeting Address	:	BARC, DoddUllarthi Kaval, Challakere, Karnataka-577537

xvii)	Bid Submission Start Date	:	06-01-2026 (1500 Hrs.)
xviii)	Bid Submission End Date	:	23-01-2026 (1500 Hrs.)
xix)	Submission of EMD in physical form. Address for submission of physical EMD Form.	:	On or before 28-01-2026 (1500 Hrs.) EMD shall be submitted/Received at following address before due date & time (xix above): “Office of Superintending Engineer, Proj. SMFC, building number SF-2, BARC Mysore, PB. NO.1, Yelwal P.O, Mysuru-571130” in a Sealed superscribed envelope mentioning name of work and Tender Notice No. Note: Original EMD & other documents should be submitted preferably in person. However, documents sent by post or courier will also be considered provided they are received within due date & time.
xx)	Bid opening Date /Date and time of online opening of Cover-1	:	29-01-2026 (1500 Hrs)
xxi)	Bid Opening Place	:	Bhabha Atomic Research Centre, Yelwal, Mysuru-571130
xxii)	Tenderer Class	:	Bidder shall have Valid Electrical Class-I License/ Electrical Super Grade Contractor license or license issued by any government/ Aided officials in India, suitable for execution of the electrical works of the tender. Or Bidder should sub-contract the electrical works to an agency having “Electrical Class-I License/ Electrical Super Grade Contractor license or license issued by any government/ Aided officials in India, suitable for execution of the electrical works of the tender”. The Consent letter of such proposed agency for associating with the bidder along with supporting documents has to be submitted by the bidder.
xxiii)	Date of opening of Cover-2 of qualified bidders	:	Will be notified at a later date through corrigendum (please visit CPPP website on https://eprocure.gov.in/eprocure/app for date)
xxiv)	Validity of Tender (in days)	:	180 (One Hundred Eighty)

II. Initial Eligibility Criteria:

2. i) The bidder shall be compliant to the Public Procurement (Preference to Make in India), Order 2017 (as amended from time to time) issued by Department for Promotion of Industry and Internal Trade (DPIIT), Ministry of Commerce and Industry. Also bidder must submit undertaking along with the bid declaring local content in % offered by them in subject tender (Refer Annexure – 4).

ii) Public Procurement (Preference to Make in India), Order 2017 shall be referred for definition of 'Class-I local supplier', 'Class-II local supplier' and 'Non local suppliers'. Unless clarified through prebid clarification uploaded by tender inviting authority, a bidder shall be eligible to participate in this tender work if they are able to submit an undertaking indicating they are 'Class-I local supplier'. The bidders who find themselves as 'Class-II local supplier' can also participate provided they suggest for the same by seeking clarification with appropriate noting/ declaration from concerned Govt. Department/ ministries and based on such suggestions the prebid clarification uploaded by the department indicates eligibility of 'Class-II local supplier'. However, purchase preference as mandated in Manual for Procurement of Works -2022 shall be followed in such instances. Bidders who are not able to submit undertaking either as 'Class-I local supplier' or as 'Class-II local supplier' shall not be allowed to participate in this tender.

iii) The bidder should have the following:

- (a) Valid Electrical Class-I License/ Electrical Super Grade Contractor license or license issued by any government/ Aided officials in India, suitable for execution of the electrical works of the tender.

Or

Bidder should sub-contract the electrical works to an agency having "Electrical Class-I License/ Electrical Super Grade Contractor license or license issued by any government/ Aided officials in India, suitable for execution of the electrical works of the tender". The Consent letter of such proposed agency for associating with the bidder along with supporting documents has to be submitted by the bidder.

- (b) Bank Solvency Certificate of a Nationalized Bank / Scheduled Bank for a minimum of **₹731.60 Lakhs** and should not be older than one year from the date of opening of tender.
- (c) Average Annual Financial Turnover of the bidder should be at least **₹1829.00 Lakhs** during the immediate last 3 consecutive audited financial years ending **31st March 2024**. This should be duly audited by a registered Chartered Accountant and also should have valid Unique Document Identification Number (UDIN) of the practicing Chartered Accountant
- (d) Should not have incurred any loss in more than two years during last five audited financial years **ending 31st March 2024**. Profit loss statement signed by a registered Chartered Accountant only shall be considered as proof of this eligibility.
- (e) Performance Certificates of all completed similar works cited as experience of similar works.
- (f) Certificate of Registration for GST, EPF (with provident fund code) & ESIC.
- (g) Permanent Account Number (PAN)

3. The bidder should have satisfactorily completed (based on certification of performance by client of the works) 3 (Three) similar works each of value not less than **₹731.60 Lakhs** or 2 (Two) similar works each of value not less than **₹1097.40 Lakhs** or 1 (One) similar work of value at least **₹ 1463.20 Lakhs** during the last 7 (Seven) years ending on the last day of the month previous to the one in which the tenders are invited/the works completed up to previous day of the last date of submission of tenders shall also be considered and if the eligible similar works are not carried out in Central Government / State Government / Public Sector Undertaking of Central or State Governments / Central Autonomous bodies, then statement from income tax record should be produced by bidder, when requested by tender evaluating authority. The statement/ records produced should establish payment from the client to the bidder against similar work.

For the purpose, 'cost of work' shall mean gross value of the completed work including the cost of materials supplied by the Client, but excluding those supplied free of cost. For the purpose of this eligibility criterion, similar work means **“Construction of RCC framed structures with civil finishing works”**. The similar works should have been executed in India.

4. The value of executed works shall be brought to the current costing level by enhancing the actual value of work at simple rate of 7 % per annum, calculated from the date of completion to last date of submission of tenders.
5. The bidding capacity of the bidder applicable should be equal to or more than the estimated cost of the work put to tender **i.e. ₹1829.00 Lakhs**. The bidding capacity shall be worked out by the following formula:

$$\text{Bidding Capacity} = [A \times N \times 2] - B$$

Where,

A = Maximum Value of works executed in any one year during the last five years ending on **31st March 2024**, taking into account the completed as well as works in progress.

N = Number of years prescribed for completion of work for which bids have been invited.

B = Value of existing commitments and ongoing works to be completed during the period of Completion of work for which bids have been invited.

The bidding capacity shall be worked by the bidder with supporting data and submitted for verification. Change of bidding capacity above during tender evaluation due to completion/ award of work shall also be intimated by bidders. Bidding capacity shall be certified from registered Chartered Accountant with UDIN.

6. Bidder should be a registered firm in India. Association of any foreign individual/ firm with this work will not be permitted in any manner. Joint Ventures and or Consortiums are not permitted.

III. Information:

7. Tender document is prepared in two parts viz. Cover-1 (Techno-commercial Bid) and Cover-2 (Financial Bid). Cover-1 consists of Techno-commercial Bid viz. Section I – Notice Inviting e-Tender, Section II - Form of Agreement and General Rules and Directions for the guidance of Bidders, Memorandum, Section III – General Conditions of Contract, Additional conditions, Section IV - Special Instructions to Tenderers, Section V – Technical specifications, Section VI - List of Tender Drawings, Section VII – Schedule 'A' (Schedule of Materials to be supplied by Department), Appendix 'B' – Form of BG bond for performance security, Appendix 'C' – Indenture for secured advance (Applicable for civil works), Appendix 'D' – Guarantee bond for waterproofing works (Applicable for civil works), Appendix 'E' – Guarantee bond for anti-termite treatment (Applicable for civil works), Annexure 'A' – Statement of men and machinery, Annexure 'B' – List of suggested manufacturer of building materials (Applicable for civil works), all corrigendum to tender documents, Construction Safety Manual for Works Contract and Proforma of Schedules 'A' to 'F'. Cover-2 (Financial bid) consists of Schedule 'B' - Schedule of Quantities. All the above documents will form part of Agreement after award of work to ~~the~~ successful bidder.

Obtaining of tender documents: Prospective Bidders or general public can see and download free of cost **PDF format** of the above documents from CPP Portal & BARC website. Sections

II, III, and IV are available for download from BARC website at www.barc.gov.in  [Tenders and NITs](#),  [Other Information](#). Sections I, V, VI, VII, Proforma of Schedules 'A' to 'F' are uploaded in CPP Portal. Bidders are advised to refer to **both** websites and follow the instructions provided to obtain the **complete set** of tender documents. Accessing only one site may result in obtaining an **incomplete** set of documents. All the above documents will form part of Agreement after award of work to the successful bidder.

Note: For Sections II, III, and IV obtained from the BARC website, wherever "BARC, Mumbai/Trombay" is mentioned, it shall be read as "BARC, Mysore", and wherever "CED (Civil Engineering Division)" is mentioned, it shall be read as "Proj. SMFC".

IV. Guidelines for e-Tendering participation in CPPP website:

To participate in the Tendering process on the CPP Portal, Prospective Bidders require a valid Class III Digital Signature Certificates. Data and copy of all the documents related to the eligibility criteria of tender should be submitted electronically through CPPP portal only. The instructions given below are meant to assist the bidders in registering on the CPP Portal, prepare their bids in accordance with the requirements and submitting their bids online on the CPP Portal.

More information useful for submitting online bids on the CPP Portal may be obtained at: <https://eprocure.gov.in/eprocure/app>.

To participate in the tender, Prospective Bidders are required to download all the excel format of Part 'A' – Techno commercial bid containing Techno commercial sheet, and Prequalification Bid containing the following after Login in the Home page of the website <https://eprocure.gov.in/eprocure/app> with their **User ID / Password & Class III Digital Signature Certificate**.

- (i) Letter of transmittal
- (ii) Form 'A'- Financial information
- (iii) Form 'B'- Form of banker's Certificate from Scheduled Bank
- (iv) Form 'C'- Details of all works of similar class completed
- (v) Form 'D'- Projects under execution or awarded
- (vi) Form 'E'- Performance report of works referred to in Form "C" for similar qualifying works – Scanned copy to be uploaded.
- (vii) Form 'F'- Structure & organization
- (viii) Form 'G'- Details of technical & administrative personnel proposed to be employed for the work.
- (ix) Form 'H'- Details of construction plant & equipment likely to be used in carrying out the work.

Prospective bidders are also required to Down Load the excel format of Part 'B'- Financial Bid containing Schedule 'B' after Login in the Home page of the website <https://eprocure.gov.in/eprocure/app> with their User ID / Password & Class III Digital Signature Certificate.

Prospective bidders have to fill all the excel documents and upload the same without renaming it and fill up and upload the scanned copies of documents in PDF format. Letter of Transmittal is to be copied on bidder's letter head and scanned copy has to be uploaded.

The bidders have to also upload an affidavit in the following format in ₹100/- Stamp paper attested by a Public Notary.

"I/ We undertake and confirm that eligible similar work(s) has/have not been got executed through another contractor on back to back basis. Further that, if such a violation comes to the notice of Department, then I/We shall be debarred for tendering in BARC Contracts in future forever. Also, if such a violation comes to the notice of Department before date of start of work, the Engineer-in-Charge shall be free to forfeit the entire amount of Performance Guarantee."

8. Registration

- (i) Bidders are required to enrol on the e-Procurement module of the Central Public Procurement Portal (URL:<https://eprocure.gov.in/eprocure/app>) by clicking on the link **"Online Bidder Enrolment"** on the CPP Portal which is free of charge.
- (ii) As part of the enrolment process, the bidders will be required to choose a unique username and assign a password for their accounts.
- (iii) Bidders are advised to register their valid email address and mobile numbers as part of the registration process. These would be used for any communication from the CPP Portal.
- (iv) Upon enrolment, the bidders will be required to register their valid Digital Signature Certificate (Class III Certificates with signing key usage) issued by any Certifying Authority recognized by CCA India (e.g. Sify / nCode / eMudhra etc.), with their profile.
- (v) Only one valid DSC should be registered by a bidder. Please note that the bidders are responsible to ensure that they do not lend their DSC's to others which may lead to misuse.
- (vi) Bidder then logs in to the site through the secured log-in by entering their user ID / password and the password of the DSC /e-Token.

9. Searching for Tender Documents

- (i) There are various search options built in the CPP Portal, to facilitate bidders to search active tenders by several parameters. These parameters could include Tender ID, Organization Name, Location, Date, Value, etc. There is also an option of advanced search for tenders, wherein the bidders may combine a number of search parameters such as Organization Name, Form of Contract, Location, Date, Other keywords etc. to search for a tender published on the CPP Portal.
- (ii) Once the bidders have selected the tenders they are interested in, they may download the required documents / tender schedules. These tenders can be moved to the respective 'My Tenders' folder. This would enable the CPP Portal to intimate the bidders through SMS/e- mail in case, there is any corrigendum issued to the tender document.
- (iii) The bidder should make a note of the unique Tender ID assigned to each tender, in case, they want to obtain any clarification / help from the Helpdesk.

10. Preparation of Bids

- (i) Bidder should take into account any corrigendum published on the tender document before submitting their bids.
- (ii) Please go through the tender advertisement and the tender document carefully to understand the documents required to be submitted as part of the bid. Please note the number of covers in which the bid documents have to be submitted, the number of documents - including the names and content of each of the document that need to be submitted. Any deviations from these may lead to rejection of the bid. Bidders shall ensure no price bid information gets disclosed through any data/ document/ correspondences submitted by them and available for view before scheduled date of opening of price bid. The tender shall be summarily rejected if any price bid information gets disclosed before scheduled price bid opening date and time.
- (iii) Bidder, in advance, should get ready the bid documents to be submitted as indicated in the tender document / schedule and generally, they can be in PDF / XLS / RAR / DWF/ JPG formats. Bid documents may be scanned with 100 dpi with black and white option which helps in reducing size of the scanned document.
- (iv) To avoid the time and effort required in uploading the same set of standard documents which are required to be submitted as a part of every bid, a provision of uploading such standard documents (e.g. PAN card copy, annual reports, auditor certificates etc.) has been provided to the bidders. Bidders can use "My Space" or "Other Important Documents" area available to them to upload such documents. These documents may be directly submitted from the "My Space" area while submitting a bid, and need not be uploaded again and again. This will lead to a reduction in the time required for bid submission process.

Note: My Documents space is only a repository given to the Bidders to ease the uploading process. If Bidder has uploaded his Documents in My Documents space, this does not automatically ensure these Documents being part of Technical Bid.

11. Submission of Bids

- (i) Bids shall be submitted online only at CPPP website: <https://eprocure.gov.in/eprocure/app>
- (ii) Bidder should log into the site well in advance for bid submission so that they can upload the bid in time i.e. on or before the bid submission time. Bidder will be responsible for any delay due to other issues.
- (iii) The bidder has to digitally sign and upload the required bid documents one by one as indicated in the tender document.
- (iv) Bidder has to select the payment option as "offline" to pay the EMD as applicable and enter details of the instrument.
- (v) Bidder should prepare the EMD as per the instructions specified in the tender document as applicable. The original should be posted/couriered/given in person to the concerned official, latest by the last date of bid submission or as specified in the tender documents. The details of the DD/any other accepted instrument, physically sent, should tally with the details available in the scanned copy and the data entered during bid submission time. Otherwise the uploaded bid will be rejected.
- (vi) The agency shall download the pre bid clarification if any for the work and upload the same (scanned copy) duly signed and sealed. The revised documents (if any) shall be uploaded in e tender portal. Submission of bid by a bidder shall mean they have understood

the full scope of work and agree to all the tender conditions including amendments vide pre-bid clarification document uploaded by department.

- (vii) Bidders are requested to note that they should necessarily submit their financial bids in the format provided and no other format is acceptable. If the price bid has been given as a standard BOQ format with the tender document, then the same is to be downloaded and to be filled by all the bidders. Bidders are required to download the BOQ file, open it and complete the SKY BLUE coloured (unprotected) cells with their respective financial quotes and other details (such as name of the bidder). No other cells should be changed. Once the details have been completed, the bidder should save it and submit it online, without changing the filename. If the BOQ file is found to be modified by the bidder, the bid will be rejected.
- (viii) Tenderers are advised to upload their documents well in advance, to avoid last minutes rush on the server or complications in uploading. BARC, in any case, shall not be held responsible for any type of difficulties during uploading the documents including server and technical problems whatsoever.
- (ix) The server time (which is displayed on the bidders' dashboard) will be considered as the standard time for referencing the deadlines for submission of the bids by the bidders, opening of bids etc. The bidders should follow this time during bid submission.
- (x) Submission of the tender documents after the due date and time (including extended period) shall not be permitted.
- (xi) All the documents being submitted by the bidders would be encrypted using PKI encryption techniques to ensure the secrecy of the data. The data entered cannot be viewed by unauthorized persons until the time of bid opening. The confidentiality of the bids is maintained using the secured Socket Layer 128bit encryption technology. Data storage encryption of sensitive fields is done. Any bid document that is uploaded to the server is subjected to symmetric encryption using a system generated symmetric key. Further this key is subjected to asymmetric encryption using buyers/bid opener's public keys. Overall, the uploaded tender documents become readable only after the tender opening by the authorized bid openers.
- (xii) The uploaded tender documents become readable only after the tender opening by the authorized bid openers.
- (xiii) Upon the successful and timely submission of bids (i.e. after Clicking "Freeze Bid Submission" in the portal), the portal will give a successful bid submission message & a bid summary will be displayed with the bid no. and the date & time of submission of the bid with all other relevant details.
- (xiv) The bid summary has to be printed and kept as an acknowledgement of the submission of the bid. This acknowledgement may be used as an entry pass for any bid opening meetings.
- (xv) Intending Bidders are advised to visit this website regularly till closing date of submission to keep themselves updated as any change/ modification in the tender will be intimated through this website only by corrigendum / addendum/ amendment.
- (xvi) The technical specifications of some of the items/ materials of the tender suggest makes and brands as general recommendation and guidance for bidders to match performance parameters and tender specifications. Bidders can, however, suggest alternate / equivalent makes and brands subject to achieving the performance parameters and tender

specifications, by providing technical details to substantiate the same. In order to ensure equal opportunity and fair and equitable treatment to all the bidders and also to avoid delays during execution of work, the pre-bid clarification stage before submission of bid is the appropriate stage to suggest alternate makes/ brands and recognition of the same by the department in the uploaded pre-bid clarification document after due verification of the submitted technical details. After award of work, delays due to time taken for conveying acceptance/ rejection of alternate / equivalent makes suggested by contractor (if any) shall be attributable to the contractor. Extra cost due to superior specification/ performance of items/ materials shall not be payable.

12. Assistance to Bidders

- (i) Any queries relating to the tender document and the terms and conditions contained therein should be addressed to the Tender Inviting Authority for a tender or the relevant contact person indicated in the tender.
- (ii) Any queries relating to the process of online bid submission or queries relating to CPP Portalin general may be directed to the 24x7 CPP Portal Helpdesk.

V. Conditions:

13. Pre-Qualification:

- (i) Cover-1(Techno-commercial cum PQ Bid) shall be opened on the stipulated date and time indicated. On opening date, the bidders can login and see the status of Bids after opening. Only those bidders who satisfy eligibility criteria shall be evaluated.
- (ii) After opening of Cover-1, tender inviting authority may constitute an evaluation team to evaluate the eligibility of the tenderers based primarily on the following.

Criteria for Evaluation of the Performance of Contractors for Pre-Qualification		
Sl.no	Attribute	Maximum Marks
(a)	Financial strength (Form 'A' & Form 'B')	20 Marks
(b)	Experience in similar nature of Works during last seven years (Form 'C')	20 Marks
(c)	Performance on works (Form 'C' & Form 'E')-Time over run	20 Marks
(d)	Performance on works (Form 'E')-Quality	15 Marks
(e)	Personnel and Establishment (Form 'G')	10 Marks
(f)	Plant & Equipment (Form 'H')	15 Marks
Total		100 Marks

To pre-qualify, the bidders must obtain at least Fifty per cent marks in each criterion and Sixty per cent marks in aggregate. The Department however reserves the right to verify the particulars furnished by the bidder independently and reject any bids without assigning any reason and to restrict the list of pre-qualified contractors to any number deemed suitable in case too many bids are received satisfying the basic Pre-Qualification criteria. The PQ will be evaluated as per the marking system given below.

(iii) MARKING SYSTEM FOR PQ:

Bidders will be evaluated as per the following criteria:

Criteria for Evaluation of the Performance of Contractors for Pre-Qualification							
Attributes					Evaluation		
(I)	Financial strength	(20 marks)					
	(i) Average annual turnover	16 marks	(i) 60% marks for minimum eligibility criteria.				
	(ii) Solvency Certificate	4 marks	(ii) 100% marks for twice the minimum eligibility criteria or more. In between (i) & (ii) - on pro-rata basis.				
(II)	Experience in Similar nature work during last seven years	(20 marks)	(i) 60% marks for minimum eligibility criteria. (ii) 100% marks for twice the minimum eligibility criteria or more. In between (i) & (ii) - on pro-rata basis.				
(III)	Performance on works -Time Over Run (TOR) for Submitted similar works based on Form-C & Form-E.	(20 marks)					
	Parameter	Calculation For points	Score				Maximum Marks
		If TOR =	1.00	2.00	3.00	> 3.50	20.00
	(i) Without levy of compensation		20	15	10	10	
	(ii) With levy of compensation		20	5	0	-5	
	(iii) Levy of compensation not decided		20	10	0	0	
	TOR = AT/ST, where AT= Actual Time; ST= Stipulated Time in the Agreement plus (+) justified period of Extension of Time.						
	Notes: (a) TOR shall be calculated for the similar works submitted by the contractor in Form-C. Calculation shall be based on the details submitted in Form-C & E.						
(b) Marks for value in between the stages indicated above are to be determined by straight line variation basis.							
(c) In case of more than one similar work (1 Similar work having 80% of ECPT or 2 Similar works having 60% of ECPT or 3 Similar works having 40% of ECPT) the final marks shall be average of all the individual works.							
(d) ‘Justified period of Extension of Time’ means extension of contract period without levy of Compensation for delay or without levy of Liquidated damages.							
(e) In case the “Justified period of Extension of Time” is not mentioned by the client in Form-E or the bidder doesn’t submit the documentary proof for the “Justified period of Extension of Time” (to the satisfaction of the Tender Inviting Authority), then the “Justified period of Extension of Time” shall be considered as nil.							
(IV)	Performance on works- Quality of the submitted similar works based on Form C & E		(Max. 15 marks)				
	(i) Very Good		15				

	(ii) Good	12
	(iii) Satisfactory	10
	(iv) Fair	5
	(v) Poor	0
	Notes: (a) Marks shall be based on the Performance of the bidder in quality of work as certified by the client in Form E (for the completed similar works listed by the bidder in Form-C). If there is no mention about the quality of performance on works in the completion certificate, the same will be treated as satisfactorily completed and 10 marks will be awarded. (b) In case of more than one similar work the final marks shall be average of all the individual works.	
(V)	Personnel and Establishment: Based on the Technical Personnel under the employment of the bidder, having qualification and experience as mentioned below (Form 'G').	(Max. 10 marks)
	(i) Graduate Engineer in Civil Engineering Discipline	3 marks for each up to Max. 6 marks
	(ii) Diploma Engineer in Civil Engineering Discipline	2 marks for each up to Max. 4 marks
	(iii) Diploma Engineer in Electrical Engineering Discipline	2 marks for each up to Max. 4 marks
	Notes: (a) Marks will be given based on proposal submitted in Form G. (b) Overall marks shall be restricted to 10 marks.	
(VI)	Plant & Equipment: Based on the details submitted in Form-H	(Max. 15 marks)
	(i) Transit Concrete Mixer Plant with weight batching (AJAX or Equivalent) or Concrete batching plant	2 marks for each up to Max. 4 marks
	(ii) Truck / Tippers / Transit mixer	1 mark for each up to Max. 2 marks
	(iii) Steel shuttering	2 marks for 1000 sqm. 3 marks for 1500 sqm. In between 1000 sqm & 1500 sqm - on pro-rata basis.
	(iv) JCB / Poclain/ Excavator	2 marks for each up to Max. 2 marks
	(v) Vibratory roller	2 marks for each up to Max. 2 marks
	(vi) Earth Rammer Machine	1 mark for each up to Max. 2 marks
	(vii) Building Hoist	2 marks for each up to Max. 4 marks
	(viii) Needle vibrators	1 mark for each up to Max. 2 marks
	(ix) Bar bending/Cutting Machine	1 mark for each up to Max. 2 marks
	(x) Any other plants/ equipment	1 mark for each up to Max. 4 marks
	Note: (a) Marks will be given based on the 'Details of Plant and Equipment likely to be used in carrying out this work' submitted in Form H. (b) Overall marks shall be restricted to 15 marks.	

(iv) Disqualification of PQ Bids

The Department however reserves the right to verify the particulars furnished by the bidder independently and reject any bid without assigning any reason and to restrict the list of pre-qualified contractors to any number deemed suitable in case too many bids are received satisfying the basic Pre-Qualification criteria. Even though a bidder may satisfy the above requirements, the bidder may be liable to disqualification if the bidder has:

- a) Made misleading or false representation or deliberately suppressed the information or not submitted sufficient information in the forms, statements and enclosures required in the pre-qualification document.
- b) Record of poor performance such as abandoning work, not properly completing the contract, or financial failures /weaknesses etc.:

(v) FINANCIAL INFORMATION:

- a) Bidder should furnish the following financial information:

Annual financial statement for the last five years (in Form “A”).

Solvency Certificate from bankers in the prescribed Form “B”

(vi) EXPERIENCE IN SIMILAR WORKS:

- a) Bidder should furnish the following:

- i. List of all works of similar class successfully completed during the last seven years (in Form "C")
- ii. List of all the projects under execution or awarded (in Form "D").
- iii. Particulars of completed works and performance of the bidder duly authenticated /certified by an officer not below the rank of Executive engineer or equivalent should be uploaded for each work completed or in progress (in Form " E")

(vii) ORGANISATION INFORMATION: Bidder is required to submit information in respect of his organisation (in Forms "F" & "G").

- a) Name, Postal Address, including Telephone, Fax Number, E-mail address, etc.
- b) Copies of original documents defining the legal status, place of Registration and principal places of business.
- c) Names & addresses of the Directors and Officers to be concerned with the work, with designation of individuals authorized to act for the organization.
- d) Information on any litigation in which the bidder was involved during the last seven years, including any current litigation.
- e) Authorisation for employer to seek detailed references.
- f) Number of Technical & Administrative Employees in parent company, subsidiary company and how these would be involved in this work (in Form “G”)

(viii) CONSTRUCTION PLANT & EQUIPMENT: Bidder should furnish the list of construction plant and equipment including steel shuttering, centring and scaffolding likely to be used in carrying out the work (in Form "H"). Details of any other plant & equipment

required for the work (not included in Form H and available with the bidder) may also be indicated.

(ix) LETTER OF TRANSMITTAL: The bidder should upload the scanned copy of the letter of transmittal on bidder's letter head as per PQ document.

(x) PRE-BID MEETING FOLLOWED BY SITE VISIT:

- a) A pre-bid conference shall be held on published date, time and venue. All bidders who have downloaded the bid document are requested to go through the entire tender document including tender specifications and list out their deviations, perceptible ambiguities, need of additional clarification etc. and send them by e-mail (refer Note 4 for the e-mail address) before the "Last date of receipt of Pre-bid queries" indicated in tender notice. The tender drawings will be kept for viewing during pre-bid conference. The bidders are requested to send their representative for pre-bid conference positively (although it is not mandatory). The minutes of this pre-bid conference which shall be posted in above website for all bidders to download, shall form a part of tender document. It shall be deemed that all bidders who submit their bid (whether they attended pre bid conference or not) have accepted pre-bid conference minutes without any deviation.
- b) Intending Bidders are advised to inspect and examine the site and its surroundings and satisfy themselves before submitting their bids as to the nature of the ground and sub-soil (so far as is practicable), the form and nature of the site, the means of access to the site, the accommodation they may require and in general shall themselves obtain all necessary information as to risks, contingencies and other circumstances which may influence or affect their bid. Interested bidder can contact tender inviting authority at Telephone Nos. provided in NIT. A bidder shall be deemed to have full knowledge of the site whether he inspects it or not and no extra charge consequent on any misunderstanding or otherwise shall be allowed. The bidders shall be responsible for arranging and maintaining at his own cost all materials, tools & plants, facilities for workers and all other services required for executing the work unless otherwise specifically provided for in the contract documents. Submission of a bid by a bidder implies that he has read this notice and all other contract documents and has made himself aware of the scope and specifications of the work to be done and of conditions and rates at which stores, tools and plant, etc. will be issued to him by the Government and local conditions and other factors having a bearing on the execution of the work.
- c) If required multiple pre-bid conference can be held before opening of Cover-1. The date and time of bid conference shall be notified to the bidders. In case competent authority of BARC decides to revise the technical specification and bids, the revised document shall be uploaded by BARC to invite revised financial bid, and bidder shall upload the revised financial bid within notified date and time. In case no revision of bids is desired by competent authority, only minutes of meeting of the pre-bid conference shall be uploaded. These minutes of meeting shall also be the part of tender. The date of opening of original/ revised Cover-2 (Financial Bid) as applicable shall be notified to the Cover-1 qualified bidders.

(xi) Intimation of Pre-qualification evaluation result:

- a) The qualified bidders shall be intimated within stipulated date indicated in Annexure -3.

- b) The bidders whose PQ bid does not qualify shall also be intimated.
- (xii) Opening of Financial bid (Part B): The Financial bid (Part 'B') of qualified bidders shall only be opened online on the stipulated date and time and will be informed online to qualified bidders.
- (xiii) Placement of Work order: Financial bid shall be evaluated and approved by the competent authority before placement of work order to the successful bidder. The tentative date of placement of work order is indicated in Annexure -3.
- (xiv) Cancellation of tender by competent authority: The competent authority reserves the right to cancel any or all tenders or to allot part of works to different agencies without incurring any liability to the Department and without assigning any reason thereof
- (xv) General:
- a) Letter of transmittal and forms for Pre-qualification for the eligible category are given in subsequent paras.
 - b) All information called for in the enclosed forms should be furnished against the relevant columns in the forms. Even if no information is to be provided in a column, a "Nil" or "no such case" entry should be made in that column. If any particulars /queries are not applicable in case of the bidder, it should be stated as "Not Applicable". The bidders may please note that giving incomplete/ unclear information called for in the tender forms, or making any change in the prescribed forms, or deliberately suppressing any information, may result in disqualification of the bidder summarily.
 - c) References, information and certificates from the respective clients certifying suitability, technical knowhow or capability of the bidder should be signed by an officer not below the rank of Executive Engineer or equivalent.
 - d) The bidder may furnish any additional information, which he thinks is necessary to establish his capabilities to successfully complete the envisaged work. He is, however, advised not to furnish superfluous information. No information shall be entertained after submission of pre-qualification document unless it is called for by the Employer.
 - e) Any information furnished by the bidder found to be incorrect either immediately or at a later date, would render him liable to be debarred from tendering/taking up of work in this Department.
 - f) Prospective bidders may request for clarification of the project requirements and pre-qualification documents. Any clarification given by the Employer will be forwarded to all those agencies who have purchased the pre-qualification document.
 - g) Confidentiality Clauses: -
 - i. Confidentiality: No party shall disclose any information to any 'Third party' concerning the matters under this contract generally. In particular, any information identified as " Proprietary" in nature by the disclosing party shall be kept strictly confidential by the receiving party and shall not be disclosed to any

third party without the prior written consent of the original disclosing party. This clause shall apply to the sub-contractors, consultants, advisors or the employees engaged by a party with equal force.

- ii. "Restricted information" categories under Section 18 of the Atomic Energy Act, 1962 and "Official Secrets" Under Section 5 of the Official Secrets Act, 1923: Any contravention of the above-mentioned provisions by any contractor, sub-contractor, consultant, adviser or the employees of a contractor, will invite penal consequences under the above said legislation.
- iii. Prohibition against use of BARC's name without permission for publicity purposes

The contractor or Sub-contractor, consultant, adviser or the employees engaged by the contractor shall not use BARC's name for any publicity purpose through any public media like Press, Radio, TV or Internet without the prior written approval of BARC.

- h) Work shall be executed according to General Conditions of Contract, Special Instructions to tenderers, Specifications, Drawings, Schedule of Quantities etc. of BARC
- i) Method of Application:
 - i. If the bidder is an individual, the application shall be signed by him above his full name and current address.
 - ii. If the bidder is a proprietary firm, the application shall be signed by the proprietor above his full name and full name of his firm with its current address.
 - iii. If the bidder is a firm in partnership, the application shall be signed by all the partners of the firm above their full names and current addresses or alternatively by a partner holding power of attorney for the firm. In the latter case, a certified copy of the power of attorney should accompany the application. In both cases a certified copy of the partnership deed and current address of all the partners of the firm should accompany the application.
 - iv. If the bidder is a limited company or corporation, the application shall be signed by a duly authorised person holding power of attorney for signing the application accompanied by a copy of the power of attorney. The bidder should also furnish a copy of the Memorandum of Articles of Association duly attested by a Public Notary.
- j) Final Decision Making Authority: The employer reserves the right to accept or reject any bid and to annul the pre-qualification process and reject all bids at any time, without assigning any reason or incurring any liability to the bidders.
- k) Particulars of work are Provisional: The particulars of the work given are provisional. These are liable to change and shall be considered only as advance information.

14. As per the security procedure in force in Bhabha Atomic Research Centre, award of work to the successful bidder shall be vetted by the Security Section of BARC before award of the work.

15. No modifications in the tender shall be allowed after opening Cover-1.

16. Tenders with any condition including conditional rebate shall be rejected. However, tenders with unconditional rebate will be accepted.

17. Debarring of bidder from participating in tenders of BARC/ DFAE:

(i) If any information furnished by the applicant is found to be incorrect at a later stage, they shall be liable to be debarred from tendering / taking up works in BARC. Also, if such a violation comes to the notice of BARC before deposit of performance security, BARC shall forfeit the entire amount of EMD along with debarring. If such a violation comes to the notice of Department after deposit of performance security, BARC shall forfeit the entire amount of Performance Guarantee, EMD (if not released) along with debarring.

(ii) A bidder / contractor shall be debarred from participating in any procurement / tenders in BARC / DAE, as decided by the Competent Authority of BARC, if the competent authority of BARC finds the bidder has rendered themselves liable for action under Rule 151 & 175 (1) of General Financial Rules 2017 or its amendment(s) [<https://doe.gov.in/ordercircular/general-financial-rules2017-0>]; and / or clause 7.5 and sub-clauses (chapter 7) of Manual of Procurement of Works 2022 or its amendment(s) [<https://doe.gov.in/manuals/manual-procurement-works-updated-june-2022>]; and/or clause 2.4 and sub-clauses (chapter 2) Manual for Procurement of Consultancy & Other Services 2022 or its amendments [<https://doe.gov.in/divisions/manual-procurement-consultancy-other-services>]. Decision of Competent Authority of BARC in this regard shall be final and binding on the bidder.

(iii) Bidders must inform unambiguously if they have been debarred to bid for any duration OR an awarded work was terminated due to poor performance OR they are informed by client agency that an awarded work had been relinquished by them before completion in respect of any Government, Semi Government clients. Competent authority of BARC shall review the case and decide if the restriction to bid is applicable for current work.

18. The time allowed for carrying out the work will be reckoned normally from the 15th day after date of written order to commence the work or from the first day of handing over of the site, whichever is later, in accordance with the phasing, if any, indicated in the tender documents. The date of commencement may be modified during award of work which shall be intimated in the work order.

19. Tender will be kept valid for **180** days from the Last date of closing of online submission of tenders.

20. In case the last date of receipt of “**EMD**” in physical form and opening of tender come on a holiday or declared as holiday, the respective dates shall be treated as postponed to the date of next working day.

21. Earnest Money in physical form to be submitted in the form of Fixed Deposit Receipt / Demand Draft / Bankers Cheque / Pay Order of a Scheduled Bank, issued in favour of “**Pay and**

Accounts Officer, BARC, Mysore". The beneficiary bank name and address are: State Bank of India, Main Branch, Mysuru, IFSC SBIN0003130. A part of Earnest Money is acceptable in the form of Bank Guarantee also. In such case minimum 50 % of the Earnest Money or Rs. 20.00 Lakhs, whichever is less, shall be in the form prescribed above and balance can be accepted in the form of Bank Guarantee issued by a Scheduled Bank as per Appendix 'A' of Tender document. Further, Receipt of Hard copy of EMD shall be submitted at afore-mentioned place given in Sr No. 1, sealed, super scribed envelope mentioning name of work and NIT Number. Further, EMD in physical form should be submitted preferably in person. **It should not be put in drop box or any other location.** Dispatch by post or courier may be considered subject to the condition the delivery is received within due date & time on said address given in Sr No. 1. Submission of EMD is compulsory. Bid of bidder shall not be opened in case EMD of respective bidder in recommended physical form is not received within due date and time.

22. The bidder whose tender is accepted will be issued letter of acceptance (LOA) by BARC. After receipt of LOA, the bidder shall be required to deposit an amount equal to 3% of the tendered value of the contract as performance security and after acceptance of performance security by BARC, work order shall be awarded to the bidder. Time allowed for submission of Performance Guarantee shall be 15 days from the date of issue of letter of acceptance. This period can be further extended at the written request of the bidder by E-I-C for a maximum period ranging from 1 to 15 days with late fee @0.1% per day of Performance Guarantee amount. Performance Security of 3% can also be accepted in the form of Bank guarantees (in case Performance Security exceeds 1.00 lakhs), fixed deposit receipts of Scheduled Banks or in the form of Government Securities. If letter of acceptance is issued, Earnest Money Deposit (EMD) of L1 bidder shall be retuned / refunded after acceptance of Performance Security Deposit. If letter of acceptance is not issued EMD of L1 bidder shall be retuned / refunded after cancellation of job by BARC or lapse of validity of offer whichever is earlier. EMD of L2 and other bidders shall be retuned back / refunded after acceptance of Comparative Financial statement (CST) by competent authority of BARC. In case of two/ three bid system EMD of unsuccessful bidders during technical bid evaluation shall be returned within 30 days of uploading of technical bid evaluation in CPPP.

23. The bidder will be required to furnish by way of security deposit for the due fulfilment of his contract, such sum will be amounting to 2.5% (Two-point five Percent) of the tendered value of work. The Security Deposit will be collected by deducting @ 2.5% of the gross amount of the running bill of the bidder till the total security deposit recovered becomes 2.5% of the tendered value of work. The Security deposit will also be accepted in the form of Government Securities, Fixed Deposit Receipts of Scheduled Bank and Nationalized Bank. These shall be endorsed in favour of the Accounts Officer, BARC, Mysore.

24. If the successful tenderer, fails to furnish the prescribed performance guarantee on or before stipulated dates as mentioned in letter of acceptance, BARC shall without prejudice to any other right or remedy, reserves the right to forfeit EMD and further debarment procedure as per extant GFRs.

25. The acceptance of tender shall rest with department which does not bind itself to accept the lowest tender and reserves to itself the authority to reject any or all of the tenders received, without assigning any reason. All tenders in which any of the prescribed conditions are not fulfilled or incomplete in any respect are liable to be rejected.

26. Canvassing in connection with tenders is strictly prohibited and the tenders submitted by the bidders who resort to canvassing will be liable for rejection.

27. On acceptance of the tender, the name of the accredited representative(s) of the bidder who would be responsible for taking instructions from the Engineer-In-charge shall be communicated to the Engineer-In-charge.

28. The department reserves the right to accept the whole or only part of the tender and the tenderer shall be bound to perform the same at the rates quoted.

29. i) GST shall mean Goods and Service Tax – Central, State and Inter State.

ii) All tendered rates quoted in Schedule-B shall be excluding GST but inclusive of all other taxes, royalties, levy or cess applicable on last stipulated date of receipt of tender including extension “if any”.

iii) GST as applicable duly certified by Chartered Accountant on this work contract is reimbursable by BARC subject to production of original documentary proof of GST payment for this work. EPF & ESIC payments shall be reimbursed as per clause given below. Any other taxes, insurance expenses, charges in respect of inputs or outputs for this contract shall be payable by the Bidder and Government will not entertain any claim whatsoever in respect of the same.

iv) The bidders should ensure that they are GST compliant and their quoted tax structure /rates are as per GST Law.

v) 2% TDS on GST, Labour welfare cess @1% of gross value of work done shall be recovered from each bill paid to the bidder.

vi) Income tax and cess as applicable shall be deducted from each bill paid to the bidder.

vii) Bidder should be registered under EPF & ESIC and as per law. Bidder shall pay EPF & ESIC of contract workers to concerned Department and it will be reimbursed to him by BARC after satisfying that it has been genuinely paid by the bidder based on documentary evidence. The bidder shall not consider EPF & ESIC in his rates. Bidder shall comply provisions of the EPF Act, 1952 in respect of all the eligible employees / workers/ labours and submit the documentary proof regularly with every RA Bill.

viii) Any other taxes / cess as per Government directives shall be deducted from each bill paid to the bidder from time to time.

30. If any tenderer withdraws his tender within the validity period and before award of work whichever is earlier or make any modifications in the terms and conditions of the tender which are not acceptable to the department, then BARC shall without prejudice to any right or remedy, be at liberty to forfeit 50 % (Fifty Percent) of the Earnest Money Deposit.

Further, the bidder shall not be allowed to participate in the re-tendering process of the work.

31. After award of work to the successful bidder, the bidder shall submit time schedule & cash flow statement for approval of Competent Authority which will form part of Agreement.

32. The Successful bidder whose tender is accepted will be required to obtain Police Verification Certificate (PVC) issued by Special Branch of Police at his own cost for all his workmen i.e. Engineers, Supervisors and Labourer's to work BARC Premises and should quote accordingly. The PVC will be valid for three years.

In case of receipt of any adverse charter and antecedent remarks/ notification against the Bidder/ Company/ firm/proprietor and/ or his contract personnel, consequent to the security vetting, BARC reserves absolute right to terminate the contract forthwith without assigning reason/ show cause notice. Under the circumstance the Bidder will have no right to claim good any losses/liability that may be incurred as consequence to the above action initiated by BARC. BARC also reserves the right to forfeit in part/full performance security and/ or security deposit in possession of the Government for failure on the part of the bidder to abide/adhere to the Security instruction issued by DAE/ BARC from time to time.

VI. Instructions:

33. The bidder should be registered with <https://eprocure.gov.in/eprocure/app>. Those bidders not registered on the website mentioned above, are required to get registered.

34. The intending bidder must have valid class-III digital signature for Request for purchase / Download of Tender Document (excel / word formats). The bid should only be submitted/uploaded after providing details of Fixed Deposit Receipts and or Bank Guarantee of any Scheduled Bank towards Earnest Money Deposit and other documents as specified

35. Tenders will be received online up to time & date as mentioned in the NIT details above. Cover-1 will be opened on the time & date as mentioned in the NIT details above. After opening of Cover-1, for evaluation, the bidder's Techno-commercial Bid related documents shall be evaluated and accordingly tenderers will be qualified/disqualified by the Competent Authority. The Cover-2 (Financial Bid) of the qualified tenderers shall then be opened at notified date and time. Date of opening of Cover-2 (Financial Bid) will be intimated to all bidders through the CPP Portal website.

36. The Financial Proposal/Commercial bid / BOQ format is provided as BOQ_XXXX.xls along with this tender document at <https://eprocure.gov.in/eprocure/app>. Bidders are advised to download this BOQ_XXXX.xls as it is and quote their offer/rates in the permitted column and upload the same in the commercial bid. **Bidder shall not tamper/modify downloaded price bid template in any manner.** In case if the same is found to be tampered/modified in any manner, tender will be completely rejected.

37. On opening date, the bidder can login and see the status of Bids after opening.

38. Bidder must ensure to quote rate of each item. The column meant for quoting rate in figures appears in SKY BLUE colour. While selecting any of the cells a warning appears **to mandatorily fill all such cells with any value, including "0" (ZERO).**

Note: Prospective agencies shall satisfy themselves of fulfilling all the NIT criteria before submission of tender. Department reserves the right of non-consideration of tender of the agencies not fulfilling the stipulated criteria.

39. Eligible source countries:

Any Bidder, from a country which shares a land border with India must comply to the Order (Public Procurement No.1) & Order (Public Procurement No. 2) issued by Public Procurement Division, Department of Expenditure, ministry of Finance, Government of India vide F. No.

6/18/2019-PPD dated 23.07.2020 and its addendum from time to time. Also, the bidder shall provide a certificate as per proforma given 'Appendix- F' of tender document. If such declaration or certificate is found to be false or to be incorrect at any time of submission of Bid or after awarding the Contract, then the said Contract will be terminated, along with such other actions as may be permissible under the relevant law of India.

40. This tender being a works contract no preference/ exemption for MSME firms is applicable for this tender as per manual of procurement of works updated June 2022

41. List of Documents to be scanned from original & uploaded within the period of bid submission by bidder:

- (i) Letter of transmittal
- (ii) Financial Turn Over certified by CA with valid Unique Document Identification Number (UDIN) of the practicing Chartered Accountant. (Form "A")
- (iii) Profit & Loss statement certified by CA with valid Unique Document Identification Number (UDIN) of the practicing Chartered Accountant. (Form "A")
- (iv) Latest Bank Solvency Certificate. (Form "B")
- (v) List of Similar Works completed in last seven years indicating Agency for whom executed, Value of work, Stipulated and Actual time of completion, Performance certificates of the eligible similar works from the clients, along with Form "C".
- (vi) List of Works in Hand indicating: Agency, Value of Work, Stipulated time of completion / present position, along with Form "D".
- (vii) Form 'E'- Performance report of works referred to in Form "C".
- (viii) Form 'F'- Structure & organization
- (ix) Form 'G'- Details of technical & administrative personnel proposed to be employed for the work (Refer Sl. No. 13).
- (x) Form 'H'- Details of construction plant & equipment likely to be used in carrying out the work for the work (Refer Sl. No. 13).
- (xi) Bidding Capacity Form 'I'-Certified by Chartered Accountant with UDIN.
- (xii) Certificates:
 - a) Valid Electrical Class-I License/ Electrical Super Grade Contractor license or license issued by any government/ Aided officials in India, suitable for execution of the electrical works of the tender.
 - Or
 - The Consent letter of such proposed agency for associating with the bidder along with supporting documents has to be submitted by the bidder.
 - b) Certificate of Registration for GST.
 - c) PAN (Permanent Account Number) Registration
 - d) Certificates of Registration for EPF & ESIC
- (xiii) Undertaking/Declarations - Annexure 1 to Annexure-6 and Appendix-F
- (xiv) List of occasions of debarment/ blacklisting/ termination due to poor performance/ of the bidder by any client firm. If no such adverse case a Nil list to be enclosed. If no list is submitted, it shall be considered the bidder confirms they have not encountered any such adverse occasion.

(xv) Earnest Money Deposit (EMD) for this work.

Note: During technical evaluation missing documents, if any, or additional/ substitute documents can be asked by evaluation committee for submission.

42. The Bidder is required to fill and submit the following complete in all respect:

- (i) Cover-1: Techno-commercial cum PQ Bid, along with EMD
- (ii) Cover-2: Financial Bid (Schedule - 'B')

43. Notes:

- (i) Interested agencies may visit website <https://eprocure.gov.in/eprocure/app> for registration and Bid Submission.
- (ii) Contact for assistance/ clarifications related to tender documents: 0821240 6731/6203/6779/6640/6682
- (iii) Contact for assistance for registration and participation in e-Tendering:
 - a) 24x7 CPP Portal Helpdesk - 0120-4001 002, 0120-4001 005, 0120-6277 787
 - b) email ids at support-eproc@nic.in
- (iv) Bidders who would like to visit site shall email to following email ids with details of Visitor(s) name, his/her ID details (Government issued ID like Aadhaar Card/PAN Card/Passport/Voter ID Card/Driving License, and address of bidder. Visitor has to carry original ID while visiting BARC.
- (v) Email Ids for sending request for site visit/ clarifications related to tender documents:

To: karidisai@barc.gov.in

CC: annukt@barc.gov.in, ankagr@barc.gov.in

-SD-
Chief Engineer
Bhabha Atomic Research Centre, Mysuru
For and on behalf of the President of India

ANNEXURE - 1

**TENDER ACCEPTANCE LETTER
(To be given on Company Letter Head)**

Date :

To,

**Chief Engineer
Bhabha Atomic Research Centre,
P.B. No.1, Yelwal P.O
MYSORE-571 130**

Sub: Acceptance of Terms & Conditions of Tender.

**Tender Reference No: BARC// Dated
Name of Tender / Work : -**

Dear Sir,

1. I/ We have downloaded / obtained the tender document(s) for the above-mentioned Tender / Work from the web site(s) namely: <https://eprocure.gov.in/eprocure/app> and www.barc.gov.in as per your advertisement, given in the above mentioned website(s).
2. I / We hereby certify that I / we have read the entire terms and conditions of the tender documents which will form part of the contract agreement and I / we shall abide hereby by the terms / conditions / clauses contained therein.
3. The corrigendum(s) issued from time to time by your department/ organisation too have also been taken into consideration, while submitting this acceptance letter.
4. I / We hereby unconditionally accept the tender conditions of above-mentioned tender document(s)/ corrigendum(s) in its totality /entirety.
5. I / We do hereby declare that our Firm has not been blacklisted/ debarred by any Govt. Department/Public sector undertaking

OR

Instances of debar/black listing is attached separately

6. I / We certify that all information furnished by our Firm is true & correct and in the event that the information is found to be incorrect/untrue or found violated, then your department/ organisation shall without giving any notice or reason therefore or summarily reject the bid or terminate the contract, without prejudice to any other rights or remedy including actions taken by Department.

Yours Faithfully,

(Signature of the Bidder, with Official Seal)

ANNEXURE 2

(To be given on Company Letter Head)
TO WHOMSOEVER IT MAY CONCERN

Undertaking Pursuant to Section 206 AB of the Income Tax Act 1961
Declaration confirming filing of Income Tax Return from immediate two preceding Years.

I, _____ [Name], in the capacity of Individual / Proprietor/ Partner/ Director/Authorized signatory of _____ [Entity Name] with PAN _____, do hereby make the following declaration as required under the relevant provisions of the Income Act, 1961 (hereinafter referred as 'the Act'):

1. That I/We am /are authorized to make this declaration in the capacity as Individual / Proprietor/Partner/Director.
2. I/We hereby declare and confirm that I/We do not fall under the definition of 'specified person' as provided in section 206AB of the IT Act.
3. I/We have duly filed return of income for FY 20-21 & FY 21-22 within due date as per Section 139 (1) of the Income-tax Act, 1961 -**Yes/No (strike out whichever is not applicable).**
- 4.
5. If return has been filled the details are as follows:

I/We, _____ having PAN _____, hereby confirm that the provision of Section 206 AB is not applicable in my/our case as I/we am/are regular in filling of Income Tax Return. The details (along with proof of documents) of acknowledgement numbers and date of filing of Income Tax Returns for last two financial years are furnished below:

S. No.	Financial Year / (Assessment Year)	Date of Filing Income Tax Return	ITR Acknowledgement Number
1			
2			

6. I /We hereby take responsibility for any loss/liability fully including any tax, interest, penalty, etc. that may arise due to incorrect reporting of above Information.

All the aforesaid representations are true and correct, and we /I agree to furnish any evidence required at any time in support thereof.

On behalf of _____

<< Name of the authorised signatory >>

<< Designation >> Name of the Entity:

**GST UNDERTAKING BY FIRMS/AGENCY
(To be given on Company Letter Head)**

Name of Tender / Work: -

Dear Sir,

1. I/We are registered under GST and compliant to GST provisions.
2. In case non-compliance of GST provisions and blockage of any input credit by us, I/we shall be responsible to indemnify BARC.
3. All the input credits for this work shall be/have been passed on to BARC by us.

Place:

Date:

Yours Faithfully,

(Signature of the Bidder, with Official Seal)

ANNEXURE- 4

Local Content Certification by Bidder

Following Declaration on bidder's letter head as under shall be submitted along with Technical Bid:

Name of Tender / Work: -

Dear Sir,

"I/We _____ (Name of bidder) undertake that we meet the mandatory Local Content (LC) requirement for qualifying as 'Class I Local Supplier' as per the PP-LC Policy, against tender no. _____. The percentage of Local Content in the bid is _____%"

Signature of the Bidder(s), with seal

ANNEXURE- 5

Undertaking as per Clause 11- Conditions of Contract.
(To be submitted on Bidder's Letter head)

CLAUSE 11: WORK TO BE EXECUTED AS PER SPECIFICATIONS, DRAWINGS, ORDERS, ETC.

I / We, hereby tender for the execution of the work specified for the President of India within the time specified in Schedule 'F', viz., Schedule of Quantities and in accordance in all respects with the specifications, designs, drawings and instructions in writing referred to in General Rules & Directions and Clause - 11 of the Conditions of Contract and with such materials as are provided for, by, and in respects in accordance with, such conditions so far as applicable.

Place:

Date:

Signature of the Bidder(s), with seal

ANNEXURE- 6

(To be submitted on ₹100/- Stamp paper attested by a Public Notary)

I/ We undertake and confirm that eligible similar work(s) has/have not been got executed through another contractor on back to back basis. Further that, if such a violation comes to the notice of Department, then I/We shall be debarred for tendering in BARC Contracts in future forever. Also, if such a violation comes to the notice of Department before date of start of work, the Engineer-in-Charge shall be free to forfeit the entire amount of Performance Guarantee.

Place:

Date:

Signature of the Bidder(s), with seal

APPENDIX - F

FORM OF CERTIFICATE FOR ELIGIBLE SOURCE COUNTRIES

(To be submitted on Bidder's Letter head)

I/We, ... (Name of the Bidder), have read the NIT clauses regarding restrictions on procurement from a Bidder of a country which shares a land border with India, and I/we am/are not from such a country'' or, from such a country (indicate country.....), have been registered with Competent Authority and submit a certificate herewith as an evidence of valid registration by the Competent Authority''.

I/We, ... (Name of the Bidder), have read the NIT clauses regarding restrictions on sub-contracting to contractors of a country which shares a land border with India. I/We hereby certify that I/We will not sub-contract any work to a contractor from a country which shares a land border with India unless such contractor is registered with the Competent Authority. This clause is applicable only if sub-contracting is allowed in the tender document.

I/We hereby certify that I/We am/are fulfilling all requirements in this regard and eligible to be considered, in accordance to NIT clauses.

I/We acknowledge the right of the Employer that absence of such a certificate in the bid, if the Bidder belongs to such country stated above, shall disqualify the Bidder.

I/We acknowledge the right of the Employer to terminate the Bidder for false declaration or certificate, along with such other actions as may be permissible under law.

GOVERNMENT OF INDIA
BHABHA ATOMIC RESEARCH CENTRE
ARCH. & CIVIL ENGINEERING DIVISION

TENDER FOR:

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GOVERNMENT OF INDIA
BHABHA ATOMIC RESEARCH CENTRE
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UPLOADED SEPARATELY

SECTION - II

FORM OF AGREEMENT AND GENERAL RULES AND

SECTIONS FOR THE GUIDENCE OF CONTRACTORS

MEMORANDUM

**GOVERNMENT OF INDIA
BHABHA ATOMIC RESEARCH CENTRE
ARCH. & CIVIL ENGINEERING DIVISION**

ITEM RATE TENDER & CONTRACT FOR WORKS

**FORM OF TENDER AND GENERAL RULES AND
DIRECTIONS FOR THE GUIDENCE OF CONTRACTOR**

GENERAL RULES AND DIRECTIONS

1. All works proposed for execution by contract will be notified in a form of invitation to tender pasted in public places and signed by the Officer inviting tender or by publication in Newspapers as the case may be.

This form will state the work to be carried out, as well as the date for submitting and opening tenders and the time allowed for carrying out the work, also the amount of earnest money to be deposited with the application, and the amount of Security Deposit and Performance Guarantee to be deposited by the successful tenderer and the percentage, if any, to be deducted from the bills. Copies of the specifications, designs and drawings any other documents required in connection with the work signed for the purpose of identification by the officer inviting tender shall also be open for inspection by the contractor at the office of the officer inviting tender, during office hours.

2. In the event of the tender being submitted by a firm, it must be signed separately by each partner, thereof, or in the event of the absence of any partner, it must be signed on his behalf by a person holding a power-of-attorney authorising him to do so, such power of attorney to be produced with the tender, and it must disclose that the firm is duly registered under the Indian Partnership Act, 1952.

3. Receipts for payments made on account of work, when executed by a firm, must also be signed by all the partners, except where the contractors are described in their tender as a firm, in which case the receipts must be signed in the name of the firm by one of the partners, or by some other person having due authority to give effectual receipts for the firm.

4. Any person, who submits a tender, shall fill up the usual printed form, stating at what rate he is willing to undertake each item of the work. Tenders, which propose any alteration in the work specified in the said form of invitation to tender, or in the time allowed for carrying out the work, or which contain any other conditions of any sort, including conditional rebates, will be summarily rejected. No single tender shall include more than one work, but contractors who wish to tender for two or more works shall submit separate tender for each. Tender shall have the name and number of the works to which they refer, written on the envelopes.

The rate(s) must be quoted in decimal coinage. Amounts must be quoted in full rupees by ignoring fifty paise and considering more than fifty paise as rupee one.

5. The officer inviting tender or his duly authorized assistant, will open tenders in the presence of any intending contractors who may be present at the time, and will enter the amounts of the several tenders in a comparative statement in a suitable form. In the event of a tender being accepted, a receipt for the earnest money shall thereupon be given to the contractor who shall thereupon for the purpose of identifications sign copies of the specifications and other documents mentioned in Rule 1. In the event of a tender being rejected, the earnest money shall thereupon be returned to the contractor remitting the same, without any interest.

6. The officer inviting tenders shall have the right of rejecting all or any of the tenders and will not be bound to accept the lowest or any other tender.

7. The receipt of an accountant or clerk for any money paid by the contractor will not be considered as an acknowledgment of payment to the officer inviting tender and the contractor shall be responsible for seeing that he procures a receipt signed by the officer inviting tender or a duly authorized Cashier.

8. The memorandum of work tendered for and the schedule of materials to be supplied by the Bhabha Atomic Research Centre and their issue rates, shall be filled and completed in the office of the officer inviting tender before the tender form is issued. If a form is issued to an intending tenderer without having been so filled in and incomplete, he shall request the officer to have this done before he completes and delivers his tender.

9. The tenderers shall sign a declaration under the officials Secret Act 1923, for maintaining secrecy of the tender documents drawings or other records connected with the work given to them. The unsuccessful tenderers shall return all the drawings given to them.
- 9A. Use of correcting fluid, anywhere in tender document is not permitted. Such tender is liable for rejection.
10. In the case of item rate tenders, only rates quoted shall be considered. Any tender containing percentage below/above the rates quoted is liable to be rejected. Rates quoted by the contractor in Item rate tender in figures and words shall be accurately filled in so that there is no discrepancy in the rates written in figures and words. However, if a discrepancy is found the rate which correspond with the amount worked out by the contractor shall unless otherwise proved be taken as correct. If the amount of an Item is not worked out by the contractor or it does not correspond with the rates written either in figures or in words, then the rates quoted by the contractor in words shall be taken as correct. Where the rates quoted by the contractor in figures and in words tally, but the amount is not worked out correctly, the rates quoted by the contractor will unless otherwise proved be taken as correct and not the amount. In event no rate has been quoted for any item(s), leaving space both in figure(s), word(s) and amount blank, it will be presumed that the contractor has included the cost of this/these item(s) in other items and rate for such item(s) will be considered as zero and the work will be required to be executed accordingly.
11. In case of any tender where unit rate of any item / items appear unrealistic, such tender will be considered as unbalanced and incase the tenderer is unable to provide satisfactory explanation, such a tender is liable to be disqualified and rejected.
12. All rates shall be quoted on the tender form. The amount for each item should be worked out and requisite totals given. Special care should be taken to write the rates in figures as well as in words and the amount in figures only, in such a way that interpolation is not possible. The total amount should be written both in figures and in words. In case of figures, the word `Rs.` should be written before the figure of rupees and word `P` after the decimal figures, e.g., `Rs.2.15 P` and in case of words the word `Rupees` should precede and the word `Paise` should be written at the end. Unless the rate is in whole rupees and followed by the word `only` it should invariably be up to two decimal places. While quoting the rate in schedule of quantities, the word `only` should be written closely following the amount and it should not be written in the next line.
13. (i) The contractor whose tender is accepted, will be required to furnish performance guarantee of 5% (five percent) of the tendered amount within the period specified in Schedule `F`. This guarantee shall be in form of cash (in case guarantee amount is less than Rs.10,000/-) or Deposit at call receipt of any scheduled bank/Bankers cheque of any scheduled bank/Demand draft of any scheduled bank/Pay order of any scheduled bank (in case guarantee amount is less than Rs.1,00,000/-) or Government securities or Fixed Deposit Receipts or Guarantee Bonds of any scheduled bank or the State Bank of India in accordance with the prescribed form.
- (ii) The contractor whose tender is accepted, will also be required to furnish by way of security deposit for the fulfillment of his contract, an amount equal to 5% of the tendered value of the work. The security deposit will be collected by deductions from the running bills of the contractor at the rates mentioned above and the earnest money deposited at the time of tenders, will be treated as part of security deposit. The security amount will also be accepted in cash or in the shape of government securities. Fixed Deposit Receipt of scheduled bank or State Bank of India will also be accepted for this purpose provided confirmatory advice is enclosed.
14. On acceptance of the tender, the name of the accredited representative(s) of the contractor who would be responsible for taking instructions from the Engineer in charge shall be communicated in writing to the Engineer-in-Charge.
15. Sales Tax/VAT (except Service Tax for which BARC will provide certificate) Purchase Tax, Turnover tax or any other tax applicable in respect of this contract shall be payable by the contractor and government will not entertain any claim whatsoever in respect of the same.
16. The contractor shall give a list of both gazetted and non-gazetted BARC employees related to him.
17. The tender for the work shall not be witnessed by a contractor or contractors who himself/themselves has/have tendered or who may and has/have tendered for the same work. Failure to observe this condition would render, tenders of the contractors tendering, as well as witnessing the tender, liable to summary rejection.

18. The tender for composite work includes, in addition to building work, all other works such as sanitary and water supply installations drainage installation, electrical work, horticulture work, roads and paths etc. The tenderer apart from being a registered contractor (B&R) of appropriate class, must associate himself with agencies of appropriate class which are eligible to tender for sanitary and water supply drainage, electrical and horticulture works in the composite tender.

19. The contractor shall submit list of works which are in under execution or awarded and certifying that the list of works are complete and no works have been left out in the following form:

PROJECTS UNDER EXECUTION OR AWARDED

Sr. No.	Name of work/ project and location	Owner or sponsoring organisation	Cost of work in Lakhs Rupees	Date of comm.-encement as per contract	Stipulated date of completion	Upto date percent age progress of work	Slow progress if any and reasons thereof	Name and address / telephone number of officer to whom reference may be made	Re-marks
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)

20. The contractor shall comply with the provisions of the Apprentices Act 1961, and the rules and orders issued there under from time to time. If he fails to do so, his failure will be breach of the contract and the Superintending Engineer / Executive Engineer may in his discretion, without prejudice to any other right or remedy available in law, cancel the contract. The contractor shall also be liable for any pecuniary liability arising on account of any violation by him of the provisions of the said Act.

GOVERNMENT OF INDIA
BHABHA ATOMIC RESEARCH CENTRE
ARCHITECTURE & CIVIL ENGINEERING DIVISION
TROMBAY, MUMBAI

Item Rate Tender & Contract for Works

(A) Tender for the work of :-

.....
.....
.....
.....

(i) To be submitted by 15.00 hrs. on

(ii) To be opened in presence of tenderers who may be present at 15.30 hrs. on
in the office of

Issued to :
(contractor)

Signature of officer issuing the documents

Designation

Date of issue :

TENDER

I / We have read and examined the notice inviting tender, schedule, A, B, C, D, E & F. Specifications applicable, Drawings & Designs, General Rules and Directions, Conditions of Contract, clauses of contract, Special conditions and other documents and Rules referred to in the conditions of contract and all other contents in the tender document for the work.

I / We hereby tender for the execution of the work specified for the President of India within the time specified in Schedule 'F', viz., schedule of quantities and in accordance in all respects with the specifications, designs, drawings and instructions in writing referred to in Rule-1 of General Rules and Directions and in Clause 11 of the Conditions of contract and with such materials as are provided for, by, and in respects in accordance with, such conditions so far as applicable.

We agree to keep the tender open for one hundred twenty (120) days from the due date of opening tender in single part / one hundred eighty (180) days from due date of opening part 'A' in two part tender and not to make any modifications in its terms and conditions.

A sum of Rs. Is hereby forwarded in cash / receipt treasury Challan / deposit at call receipt of a scheduled bank / fixed deposit receipt of scheduled bank / demand draft of a scheduled bank /Banker's cheque issued by a scheduled bank/ bank guarantee issued by a scheduled bank as earnest money. If I / We fail to furnish the prescribed performance guarantee within prescribed period, I / We agree that the said President of India or his successors in office shall without prejudice to any other right or remedy, be at liberty to forfeit the said earnest money absolutely. Further, if I / We fail to commence work as specified, I / We agree that President of India or his successors in office shall without prejudice to any other right or remedy available in law, be at liberty to forfeit the said earnest money and the performance guarantee absolutely, otherwise the said earnest money shall be retained by him towards security deposit to execute all the works referred to in the tender documents upon the terms and conditions contained or referred to therein and to carry out such deviations as may be ordered, upto maximum of the percentage mentioned in Schedule 'F' and those in excess of that limit at the rates to be determined in accordance with the provision contained in Clause 12.2 and 12.3 of the tender form.

Further, I / We agree that in case of forfeiture of earnest money or both earnest money and Performance Guarantee as aforesaid, I / We shall be debarred for participation in the re-tendering process of the work.

I / We hereby declare that I / We shall treat the tender documents drawings and other records connected with the work as secret / confidential documents and shall not communicate information derived therefrom to any person other than a person to whom I / We am / are authorized to communicate the same or use the information in any manner prejudicial to the safety of the state.

Dated

*
Signature of contractor
Postal Address

+
Witness :
Address :
Occupation :

A C C E P T A N C E

The above tender (as modified by you as provided in the letters mentioned hereunder) is accepted by me for and on behalf of the President of India for a sum of Rs.
.....)

The letters referred to below shall form part of this contact Agreement :-

- a)
- b)
- c)

@
For & on behalf of the President of India
Signature
Designation

* Signature of contractor before submission of tender
+ Signature of witness to contractor’s signature
@ Signature of the officer by whom accepted

SECTION -III

CONDITIONS OF CONTRACT

ADDITIONAL CONDITIONS

SECTION - III - CONDITIONS OF CONTRACT

DEFINITIONS :

1. The '**Contract**' means the documents forming the tender and acceptance thereof and the formal agreement executed between the President of India and the Contractor, together with the documents referred to therein including these conditions, the specifications, designs, drawings and instructions issued from time to time by the Chief Engineer / Engineer-in-charge and all these documents taken together shall be deemed to form one contract and shall be complementary to one another.
2. In the contract the following expression shall, unless the context otherwise requires, have the meanings hereby respectively assigned to them :-
 - i) The expression '**Works**' or '**Work**' shall, unless there be something either in the subject or context repugnant to such construction, be construed and taken to mean the works by or by virtue of the contract contracted to be executed whether temporary or permanent and whether original, altered, substituted or additional.
 - ii) The '**Site**' shall mean the land and/or other places on, into or through which work is to be executed under the contract or any adjacent land, path or street through which work is to be executed under the contract or any adjacent land, path or street which may be allotted or used for the purpose of carrying out the contract.
 - iii) The '**Contractor**' shall mean the individual, or firm or company, whether incorporated or not, undertaking the works and shall include the legal personnel representative of such individual or the persons composing such firm or company or the successors of such firm or company and the permitted assignees of such individual, or firm or company.
 - iv) The '**President**' means the President of India and his successors.
 - v) The '**Engineer-in-Charge**' means Engineer officer who shall supervise and be in charge of the work and who shall sign the contract on behalf of the President of India as mentioned in Schedule 'F' here under.
 - vi) '**Government**' or '**Government of India**' shall mean the President of India.
 - vii) The term C.E. represents Chief Engineer, of the Arch & Civil Engineering Division, Bhabha Atomic Research Centre, Trombay.
 - viii) Accepting Authority shall mean the authority mentioned in Schedule 'F'.
 - ix) Excepted risk are risks due to riots (other than those on account of contractor's employees), war (whether declared or not) invasion, act of foreign enemies, hostilities, civil war, rebellion revolution, insurrection, military or usurped power, any acts of government, damages from air craft, acts of God such as earthquake, lightening and unprecedented floods, and other causes over which the contractor has no control and accepted as such by the Accepting Authority or causes solely due to use or occupation by Government of the part of the works in respect of which a certificate of completion has been issued or a cause solely due to Government's faulty design of works.
 - x) **Market Rate** shall be the rate as decided by the Engineer-in- Charge on the basis of the cost of materials and labour at the site where the work is to be executed plus the percentage mentioned in schedule 'F' to cover, all overheads and profits.
 - xi) Schedule(s) referred to in these conditions shall mean the relevant schedule(s) annexed to the tender papers or the standard Schedule of Rates of the Government mentioned in Schedule 'F' hereunder, with the amendments thereto issued upto the date of receipt of the tender.
 - xii) Department means Bhabha Atomic Research Centre (BARC), Department of Atomic Energy, Government of India which invites tenders on behalf of President of India as specified in Schedule 'F'.
 - xiii) District specifications means specifications followed by State Government in the area where the work is to be executed. Provided that this is specifically mentioned in Schedule 'F' of the tender
 - xiv) '**Tendered value**' means the value of the entire work as stipulated in the letter of award.
 - xv) Date of commencement of work : The date of commencement of work shall be the date of start as specified in Schedule 'F' or the first date of handing over of the site whichever is later, in accordance with the phasing if any, as indicated in the tender document.
3. Where the context so requires, words imparting the singular only also include the plural and vice versa. Any reference to masculine gender shall whenever required include feminine gender and vice versa.

4. Headings and Marginal notes to these General Conditions of Contract shall not be deemed to form part thereof or be taken into consideration in the interpretation or construction thereof or of the contract.
5. The contractor shall be furnished, free of cost one certified copy of the contract documents except standard specifications, Schedule of rates and such other printed and published documents, together with all drawings as may be forming part of the tender papers. None of these documents shall be used for any purpose other than that of this contract.
6. The work to be carried out under the contract shall, except as otherwise provided in these conditions, include all labour, materials, tools, plants, equipment and transport which may be required in preparation of and for and in the full and entire execution and completion of the works. The descriptions given in the Schedule of Quantities (Schedule –B) shall, unless otherwise stated, be held to include wastage on materials, carriage and cartage, carrying and return of empties, hoisting, setting, fitting and fixing in position and all other labours necessary in and for the full and entire execution and completion of the work as aforesaid in accordance with good practice and recognized principles.
7. The contractor shall be deemed to have satisfied himself before tendering as to the correctness and sufficiency of his tender for the works and of the rates and prices quoted in the Schedule of Quantities, which rates and prices shall, except as otherwise provided, cover all his obligations under the Contract and all matters and things necessary for the proper completion and maintenance of the works.
8. The several documents forming the Contract are to be taken as mutually explanatory of one another, detailed drawings being followed in preference to small scale drawing and figured dimensions in preference to scale and special conditions in preference to General Conditions.
 - 8.1 In the case of discrepancy between the schedule of quantities, the Specifications and/or the Drawings, the following order of preference shall be observed.
 - g) Description of Schedule of Quantities.
 - ii) Particular Specification and Special Condition, if any.
 - iii) Drawings.
 - iv) BARC Specifications.
 - v) Indian Standard Specifications of B.I.S.
 - 8.2 If there are varying or conflicting provisions made in any one document forming part of the contract, the Accepting Authority shall be the deciding authority with regard to the intention of the document and his decision shall be final and binding on the contractor.
 - 8.3 Any error in description, quantity or rate in Schedule of Quantities or any omission there from shall not vitiate the Contract or release the Contractor from the execution of the whole or any part of the works comprised therein according to drawings and specifications or from any of his obligations under the contract.
9. The successful tenderer/contractor, on acceptance of his tender by the Accepting Authority shall, within 15 days from the stipulated date of start of the work, sign the contract consisting of :-
 - i) The notice inviting tender, all the documents including drawings, if any, forming the tender as issued at the time of invitation of tender and acceptance thereof together with any correspondence leading thereto.
 - ii) Standard BARC form as mentioned in Schedule 'F' consisting of :
 - a) Various standard clauses with corrections upto the date stipulated in schedule 'F' along with annexure thereto.
 - b) B.A.R.C safety Code.
 - c) Model Rules for the protection of health, sanitary arrangements for workers employed by BARC or its contractors.
 - d) BARC Contractor's Labour Regulations.
 - e) List of Acts and omissions for which fines can be imposed.
 - iii) No payment for the work done will be made unless contract is signed by the contractor.

CLAUSES OF CONTRACT

CLAUSE 1 : PERFORMANCE GUARANTEE

i) The contractor shall submit an irrevocable Performance Guarantee of 5% (Five percent) of the tendered amount in addition to other deposits mentioned elsewhere in the contract for his proper performance of the contract agreement, (not withstanding and/or without prejudice to any other provisions in the contract) within period specified in Schedule 'F' from the date of issue of letter of acceptance. This period can be further extended by the Engineer-in-charge up to a maximum period as specified in Schedule 'F' on written request of the contractor stating the reason for delays in procuring the Performance Guarantee, to the satisfaction of the Engineer-in-charge. This guarantee shall be in the form of cash (in case guarantee amount is less than Rs.10,000/-) or Deposit at Call receipts of any Scheduled Bank/Banker's Cheque of any Scheduled Bank/Demand Draft of any Scheduled Bank/Pay Order of any Scheduled Bank (in case guarantee amount is less than Rs.1.00 Lakh) or Government Securities or Fixed Deposit Receipts or Guarantee Bonds of any Scheduled Bank or the State Bank of India in accordance with the form annexed as Appendix 'A' hereto. In case a fixed deposit receipt of any Bank is furnished by the contractor to the Government as part of the performance guarantee and the Bank is unable to make payment against the said fixed deposit receipt, the loss caused thereby shall fall on the contractor and the contractor shall forthwith on demand furnish additional security to the Government to make good the deficit.

ii) The Performance Guarantee shall be initially valid up to the stipulated date of completion plus 60 days beyond that. In case the time for completion of work gets enlarged, the contractor shall get the validity of performance Guarantee extended to cover such enlarged time for completion of work. After recording of the completion certificate for the work by the competent authority, the performance guarantee shall be returned to the contractor, without any interest.

iii) The Engineer-in-charge shall not make a claim under the Performance guarantee except for amounts to which the President of India is entitled under the contract (notwithstanding and/or without prejudice to any other provisions in the contract agreement) in the event of :

(a) Failure by the contractor to extend the validity of the Performance Guarantee as described herein above, in which event the Engineer-in-charge may claim the full amount of the Performance guarantee.

(b) Failure by the contractor to pay President of India any amount due, either as agreed by contractor or determined under any of the Clauses/Conditions of the agreement, within 30 days of the service of notice to this effect by Engineer-in-charge.

(iv) In the event of the contract being determined or rescinded under provisions of any of the Clause /Condition of the agreement, the performance guarantee shall stand forfeited in full and shall be absolutely at the disposal of the President of India.

CLAUSE 1-A: RECOVERY OF SECURITY DEPOSIT :

The person/ persons whose tender(s) may be accepted (hereinafter called the contractor) shall permit Government at the time of making any payment to him for work done under the contract to deduct a sum at the rate of 5% of the gross amount of each running bill till the sum along with the sum already deposited as earnest money, will amount to security deposit of 5% of the tendered value of the work. The Earnest Money shall be adjusted first in the Security Deposit and further recovery of Security Deposit shall commence only when the upto date amount of Security Deposit starts exceeding the Earnest Money. Such deductions will be made and held by Government by way of Security Deposit unless he has / they have deposited the amount of Security at the rate mentioned above in cash or in the form of Government Securities or Fixed Deposit Receipts. In case a fixed deposit receipt of any bank is furnished by the contractor to the Government as part of the security deposit and the bank is unable to make payment against the said fixed deposit receipt, the loss caused thereby shall fall on the contractor and the contractor shall forthwith on demand furnish additional security to the Government to make good the deficit.

All compensations or the other sums of money payable by the contractor under the terms of this contract may be deducted from, or paid by the sale of a sufficient part of his security deposit or from the interest arising therefrom, or from any sums which may be due to or may become due to the contractor by Government or any account whatsoever and in the event of his Security Deposit being reduced by reason of any such deductions or sale as aforesaid, the contractor shall within 10 days make good in cash or fixed deposit receipt tendered by the State Bank of India or by Scheduled Banks or Government Securities (if deposited for more than 12 months) endorsed in favour of the Accounts Officer, BARC, any sum or sums which may have been deducted from, or raised by sale of his security deposit or any part thereof. The security deposit shall be collected from the running bills of the contractor at the rates mentioned above and the Earnest Money deposited at the time of tenders will be treated a part of the Security Deposit.

The security deposit as deducted above can be released against bank guarantee issued by a scheduled bank, on its accumulations to a minimum of Rs.5 Lakhs subject to the condition that amount of such bank guarantee, except last one, shall not be less than Rs.5 Lakhs.

Provided further that the validity of bank guarantee including one given against the earnest money shall be in conformity with provisions contained in Clause 17 which shall be extended from time to time depending upon extension of contract granted under provisions of Clause 2 and Clause 5.

NOTE 1 : Government papers tendered as security will be taken at 5% (five per cent) below its market price or at its face value, whichever is less. The market price of Government papers would be ascertained by the Engineer-in-charge at the time of collection of interest and the amount of interest to the extent of deficiency in value of the Government paper will be withheld if necessary.

NOTE 2 : Government Securities will include all forms of securities mentioned in Rule No. 274 of the G.F. Rules except fidelity bond. This will be subject to the observance of the condition mentioned under the rule against each form of security.

NOTE 3 : Note 1 & 2 above shall be applicable for both Clauses 1 & 1A..

CLAUSE 2 - Compensation for delay

If the contractor fails to maintain the required progress in terms of Clause 5 or to complete the work and clear the site on or before the contract or extended date of completion, he shall, without prejudice to any other right or remedy available under the law to the Government on account of such breach, pay as agreed compensation the amount calculated at the rates stipulated below as the authority specified in Schedule 'F' (whose decision in writing shall be final and binding) may decide on the amount of tendered value of the work for every completed day/month (as applicable) that the progress remains below that specified in Clause 5 or that the work remains incomplete.

This will also apply to items or group of items for which a separate period of completion has been specified.

i) Compensation for delay of work - @1.5% per month of delay to be computed on per day basis.

Provided always that the total amount of compensation for delay to be paid under this Condition shall not exceed 10% of the Tendered Value of work or of the Tendered Value of the item or group of items of work for which a separate period of completion is originally given.

The amount of compensation may be adjusted or set-off against any sum payable to the Contractor under this or any other contract with the Government. In case, the contractor does not achieve a particular mentioned milestone in schedule F, or the re-scheduled milestone (s) in terms of Clause 5.4, the amount shown against that milestone shall be withheld, to be adjusted against the compensation levied at the final grant of Extension of Time. Withholding of this amount on failure to achieve a milestone, shall be automatic without any notice to the contractor. However, if the contractor catches up with the progress of work on the subsequent milestone(s) the withheld amount shall be released.

In case the contractor fails to make up for the delay in subsequent milestone(s) amount mentioned against each milestone missed subsequently also shall be withheld. However, no interest, whatsoever shall be payable on such withheld amount.

CLAUSE 2A – Incentive for early completion

In case the contractor completes the work ahead of scheduled completion time, a bonus @ 1% (one percent) of the tendered value per month computed on per day basis, shall be payable to the contractor, subject to a maximum limit of 5% (five percent) of the tendered value. The amount of bonus, if payable, shall be paid alongwith final bill after completion of work. Provided always that provision of the Clause 2A shall be applicable only when so provided in “Schedule F”.

CLAUSE 3 : DETERMINATION OF CONTRACT

Subject to other provisions contained in this clause, the Engineer-in-Charge may, without prejudice to his any other right or remedy against the contractor in respect of any delay, inferior workmanship, any claims for damages and / or any other provisions of this contract or otherwise, and whether the date for completion has or has not elapsed, by notice in writing absolutely determine the contract in any of the following cases:

- i. If the contractor having been given by the Engineer-in-Charge a notice in writing to rectify, reconstruct or replace any defective work or that the work is being performed in an inefficient or otherwise improper or unworkman-like manner shall omit to comply with the requirements of such notice for a period of seven days thereafter.
- ii. If the contractor has, without reasonable cause suspended the progress of work or has failed to proceed with the work with due diligence so that in the opinion of the Engineer in charge (which shall be final and binding) he will be unable to secure completion of the work by the date for completion and continue to do so after a notice in writing of 7 days from the Engineer in charge.
- iii. If the contractor fails to complete the work with in the stipulated date or items of work with individual date of completion, if any stipulated, on or before such date(s) of completion and does not **complete** them within the period specified in a notice given in writing in that behalf by the Engineer-in- Charge.
- iv. If the contractor persistently neglects to carry out his obligations under the contract and/ or commits default in complying with any of the terms and conditions of the contract and does not remedy it or take effective steps to remedy it with in 7 days after a notice in writing is given to him in that behalf by the Engineer-in- Charge.
- v. If the contractor shall offer or give or agree to give to any person in government service or any other person on his behalf any gift or consideration of any kind as an inducement or reward for doing or forbearing to do or for having done or forborne to do any act in relation to the obtaining or execution of this or any other contract for Government.
- vi. If the contractor shall enter into a contract with Government in connection with which commission has been paid or agree to be paid by him or to his knowledge, unless the particulars of any such commission and the terms of payment thereof have been previously disclosed in writing to the Engineer-in-Charge.
- vii. If the contractor shall obtain a contract with Government as a result of wrong tendering or other non-bonafide method of competitive tendering.
- viii. If the contractor being an individual or if a firm, any partner thereof shall at any time be adjudged insolvent or have a receiving **order** or order for administration of his estate made against him or shall take any proceedings for liquidation or composition (other than a voluntary liquidation for the purpose of amalgamation or reconstruction) under any Insolvency Act for the time being in force or make any conveyance or assignment of his effects or composition or arrangement for the benefit of his creditors or purport so to do or if any application be made under any insolvency act for the time being in force for the sequestration of his estate or if a trust deed be executed by him for benefit of his creditors.
- ix. If the contractor being a company shall pass a resolution or the court shall make an order that the company shall be wound up or if a receiver or a manager on behalf of a creditor shall be appointed or if circumstances shall arise which entitle the court or the creditor to appoint a receiver or a manager or which entitle the court to make a winding up order.
- x. If the contractor shall suffer an execution being levied on his goods and allow it to be continued for a period of 21 days.

xi. If the contractor assigns, transfers, sublets (engagements of labour on a piece work basis or of labour with materials not to be incorporated in the work, shall not be deemed to be subletting) or otherwise parts with or attempts to assign, transfer, sublet or otherwise parts with the entire works or any portion thereof without the prior written approval of the Engineer in charge.

When the contractor has made himself liable for action under any of the cases aforesaid, the Engineer-in-Charge on behalf of the President of India shall have powers:

a) To determine the contract as aforesaid (of which termination notice in writing to the contractor under the hand of the Engineer-in-Charge shall be conclusive evidence). Upon such determination the Earnest Money Deposit, Security Deposit already recovered and Performance Guarantee under the contract shall be liable to be forfeited and shall be absolutely at the disposal of the Government.

b) After giving notice to the contractor to measure up the work of the contractor and to take such whole, or the balance or part thereof as shall be un-executed out of his hands and to give it to another contractor to complete the work. The contractor, whose contract is determined as above, shall not be allowed to participate in the tendering process for the balance work .

In the event of above courses being adopted by the Engineer-in-Charge the contractor shall have no claim to compensation for any loss sustained by him by reasons of his having purchased or procured any materials or entered into any engagements or made any advances on account or with a view to the execution of the work or the performance of the contract. And in case action is taken under any of the provisions aforesaid, the contractor shall not be entitled to recover or be paid any sum for any work thereof or actually performed under this contract unless and until the Engineer-in-Charge has certified in writing the performance of such work and the value payable in respect thereof and he shall only be entitled to be paid the value so certified.

CLAUSE 3A : In case the work cannot be started due to reasons not within the control of the contractor within 1/8th of the stipulated time for completion of work, either party may close the contract. In such eventuality, the Earnest Money Deposit and the Performance Guarantee of the contractor shall be refunded, but no payment on account of interest, loss of profit or damages etc. shall be payable at all.

CLAUSE 4 : Contractor liable to pay compensation even if action not taken under Clause 3,

In any case in which any of the powers conferred upon the Engineer-in-Charge by clause 3 thereof, shall have become exercisable and the same are not exercised, the non-exercise thereof shall not constitute a waiver of any of the conditions hereof and such powers shall notwithstanding be exercisable in the event of any future case of default by the contractor and the liability of the contractor for compensation shall remain unaffected. In the event of the Engineer-in-Charge putting in force all or any of the powers vested in him under the preceding clause he may, if he so desires after giving a notice in writing to the contractor, take possession of (or at sole discretion of the Engineer-in-Charge which shall be final and binding on the Contractor) use as on hire (the amount of the hire money being also in the final determination of the Engineer-in-Charge) all or any tools, plant, materials and stores, in or upon the works, or the site thereof, belonging to the contractor, or procured by the contractor and intended to be used for the execution of the work or any part thereof, paying or allowing for the same in account at the contract rates, or, in the case of these not being applicable, at current market rates to be certified by the Engineer-in-Charge whose certificate thereof shall be final and binding on the contractor, clerk of the works, foreman or other authorized agent to remove such tools, plant, materials, or stores from the premises (within a time to be specified in such notice); in the event of the contractor failing to comply with any such requisition, the Engineer-in-Charge may remove them at the contractor's expense or sell them by auction or private sale on account of the contractor and at his risk in all respects and the certificate of the Engineer-in-Charge as to the expense of any such removal and the amount of the proceeds and expense of any such sale shall be final and conclusive against the contractor.

CLAUSE 5 Time and Extension for delay

The time allowed for execution of the Works as specified in the Schedule "F" or the extended time in accordance with these conditions shall be the essence of the Contract. The execution of the works shall commence from such time period as mentioned in Schedule 'F' or from the date of handing over of the site whichever is later. If the Contractor commits default in commencing the execution of the work as aforesaid, Government shall without prejudice to any other right or remedy available in law, be at liberty to forfeit the earnest money & performance guarantee absolutely.

5.1 As soon as possible after the Contract is concluded the Contractor shall submit a Time and Progress Chart for each milestone and get it approved by the Department. The Chart shall be prepared in direct relation to the time stated in the Contract documents for completion of items of the works. It shall indicate the forecast of the dates of commencement and completion of various trades of sections of the work and may be amended as necessary by agreement between the Engineer-in-Charge and the Contractor within the limitations of time imposed in the Contract documents, and further to ensure good progress during the execution of the work, the contractor shall in all cases in which the time allowed for any work, exceeds one month (save for special jobs for which a separate programme has been agreed upon) complete the work as per mile stones given Schedule "F".

5.2 If the work(s) be delayed by :-

- I. Force majeure, or
- II. Abnormally bad weather or
- III. Serious loss or damage by fire, or
- IV. Civil commotion, local commotion of workmen, strike or lockout, affecting any of the trades employed on the work, or
- V. Delay on the part of other contractors or tradesmen engaged by Engineer-in-Charge in executing work not forming part of the Contract, or
- VI. Non-availability of stores, which are the responsibility of Government to supply or
- VII. Non-availability or break down of tools and plant to be supplied or supplied by Government or
- VIII. Any other cause which in the absolute discretion of the Engineer-in-Charge is beyond the Contractor's control.

Then upon the happening of any such event causing delay, the Contractor shall immediately give notice thereof in writing to the authority as indicated in Schedule 'F' but shall nevertheless use constantly his best endeavors to prevent or make good the delay and shall do all that may be reasonably required to the satisfaction of the Engineer-in-Charge to proceed with the works.

5.3 Request for rescheduling of mile stones and extension of time to be eligible for consideration, shall be made by the Contractor in writing within fourteen days of the happening of the event causing delay on the prescribed form to the authority as indicated in Schedule 'F'. The Contractor may also, if practicable, indicate in such a request the period for which extension is desired.

5.4 In any such case the authority as indicated in Schedule "F" may give a fair and reasonable extension of time and reschedule the mile stones for completion of work. Such extension shall be communicated to the Contractor by the authority as indicated in Schedule 'F' in writing, within 3 months of the date of receipt of such request. Non application by the contractor for extension of time shall not be a bar for giving a fair and reasonable extension by the authority as indicated in Schedule 'F' and this shall be binding on the contractor.

CLAUSE 6 – Measurements of the work done

Engineer-in-Charge shall, except as otherwise provided, ascertain and determine by measurement the value in accordance with the contract of work done.

All measurement of all items having financial value shall be entered in Measurement Book and/or level field book so that a complete record is obtained of all works performed under the contract.

All measurements and levels shall be taken jointly by the Engineer-in-Charge or his authorized representative and by the contractor or his authorized representative from time to time during the progress of the work and such measurements shall be signed and dated by the Engineer-in-Charge and the contractor or their representatives in token of their acceptance. If the contractor objects to any of the measurements recorded, a note shall be made to that effect with reason and signed by both the parties.

If for any reason the contractor or his authorized representative is not available and the work of recording measurements is suspended by the Engineer-in-Charge or his representative, the Engineer-in-Charge and the Department shall not entertain any claim from contractor for any loss or damages on this account. If the contractor or his authorized representative does not remain present at the time of such measurements after the contractor or his authorized representative has been given a notice in writing three (3) days in advance or fails to countersign or to record objection within a week from the date of the measurement, then such measurements recorded in his absence by the Engineer-in-Charge or his representative shall be deemed to be accepted by the Contractor.

The contractor shall, without extra charge, provide all assistance with every appliance, labour and other things necessary for measurements and recording levels.

Except where any general or details description of the work expressly shows to the contrary, measurements shall be taken in accordance with the procedure set forth in the specifications notwithstanding any provision in the relevant Standard Method of measurement or any general or local custom. In the case of items which are not covered by specifications, measurements shall be taken in accordance with the relevant standard method of measurement issued by the Bureau of Indian, Standards and if for any item no such standard is available then a mutually agreed method shall be followed.

The contractor shall give not less than seven days notice to the Engineer-in-Charge or his authorized representative in-charge of the work before covering up or otherwise placing beyond the reach of measurement any work in order that the same may be measured and correct dimensions thereof be taken before the same is covered up or placed beyond the reach of measurement and shall not cover up and place beyond reach of measurement any work without consent in writing of the Engineer-in-Charge or his authorized representative in-charge of the work who shall within the aforesaid period of seven days inspect the work, and if any work shall be covered up or placed beyond the reach of measurements without such notice having been given or the Engineer-in-Charge's consent being obtained in writing the same shall be uncovered at the Contractor's expense, or in default thereof no payment or allowance shall be made for such work or the materials with which the same was executed.

Engineer-in-Charge or his authorized representative may cause either themselves or through another officer of the department to check the measurements recorded jointly or otherwise as aforesaid and all provisions stipulate herein above shall be applicable to such checking of measurements or levels.

It is also a term of this contract that recording of measurements of any item of work in the measurement book and/or its payment in the interim, on account or final bill shall not be considered as conclusive evidence as to the sufficiency of any work or material to which it relates nor shall it relieve the contractor from liabilities from any over measurement or defects noticed till completion of the defects liability period.

CLAUSE 6A : COMPUTERISED MEASUREMENT BOOK

Engineer in charge shall, except as otherwise provided, ascertain and determine by measurement the value of work done in accordance with the contract.

All measurements of all items having financial value shall be entered by the contractor and compiled in the shape of the computerized measurement book having pages of A-4 size as per the format of the department so that a complete record is obtained of all the items of works performed under the contract.

All such measurements and levels recorded by the contractor or his authorized representative from time to time during the progress of the work, shall be got checked by the contractor from the Engineer in charge or his authorized representative as per interval or program fixed in consultation with Engineer in charge or his authorized representative. After the necessary corrections made by the Engineer in charge, the measurement sheets shall be returned to the contractor for incorporating the corrections and for resubmission to the Engineer in charge for the dated signatures by the Engineer in charge and the contractor or their representatives in token of their acceptance.

Whenever bill is due for payment, the contractor would initially submit draft computerized measurement sheets and these measurements would be got checked/test checked from the engineer in charge and or his authorized representative. The contractor will, thereafter incorporate such changes as may be done during these check/test checks in his draft computerized measurements, and submit to the department a computerized measurement book duly bound, and with its pages machine numbered. The Engineer in charge and/or his authorized representative would thereafter check this MB and record the necessary certificates for their checks/test checks.

The final, fair, computerized measurement book given by the contractor, duly bound, with its pages machine numbered should be 100% correct, and no cutting or overwriting in the measurements would thereafter be allowed. If at all any error is noticed, the contractor shall have to submit a fresh computerized MB with its pages duly machine numbered and bound after getting the earlier MB cancelled by the dept. Thereafter, the MB shall be taken in the Divisional Office records, and allotted a number as per the Register of Computerized MBs. This should be done before the corresponding bill is submitted to the Division Office for payment. The contractor shall submit two spare copies of such computerized MBs for the purpose of reference and record by the various officers of the Dept.

The contractor shall also submit to the department separately his computerized abstract or cost and the bill based on these measurements, duly bound, and its pages machine numbered along with two spare copies of the `bill.` Thereafter this bill will be processed by the Division Office and allotted a number as per the computerized record in the same way as done for the measurement book meant for measurements.

The contractor shall, without extra charge, provide all assistance with every appliance, labour and other things necessary for checking of measurements/levels by the Engineer in charge or his representative.

Except where any general or detailed description of the work expressly shows to the contrary, measurements shall be taken in accordance with the procedure set forth in the specifications notwithstanding any provision in the relevant standard method of measurement or any general or local custom. In the case of items which are not covered by specifications, measurements shall be taken in accordance with the relevant standard method of measurement issued by the Bureau of Indian Standards and if for any item no such standard is available then a mutually agreed method shall be followed.

The contractor shall give not less than seven days` notice to the Engineer in charge or his authorized representative in charge of the work before covering up or otherwise placing beyond the reach of checking and/or test checking the measurement of any work in order that the same maybe checked and/or test checked and correct dimensions thereof be taken before the same is covered up or placed beyond the reach of checking and/or test checking measurement and shall not cover up and place beyond reach of measurement any work without consent in writing of the Engineer in charge or his authorized representative in charge of the work who shall within the aforesaid period of seven days inspect the work, and if any work shall be covered up or placed beyond the reach of checking and/or test checking measurements without such notice having been given or the Engineer in charge`s consent being obtained in writing the same shall be uncovered at the contractor`s expense, or in default thereof no payment or allowance shall be made for such work or the materials with which the same was executed.

Engineer in charge or his authorized representative may cause either themselves or through another officer of the department to check the measurements recorded by contractor and all provisions stipulated herein above shall be applicable to such checking of measurements or levels.

It is also a term of this contract that checking and/or test checking the measurements of any item of work in the measurement book and/or its payment in the interim, on account of final bill shall not be considered as conclusive evidence as to the sufficiency of any work or material to which it relates nor shall it relieve the contractor from liabilities from any over measurement or defects noticed till completion of the defects liability period.

CLAUSE 7 – Payment on intermediate certificate to be regarded as advances.

No payment shall be made for work, estimated to cost Rs. Twenty thousand or less till after the whole of the work shall have been completed and certificate of completion given. For works estimated to cost over Rs. Twenty thousand the interim or running account bills shall be submitted by the contractor for the work executed on the basis of such recorded measurements on the format of the Department in triplicate on or before the date of every month fixed for the same by the Engineer-in-Charge. The contractor shall not be entitled to be paid any such interim payment if the gross work done together with net payment/adjustment of advances for material collected, if any, since the last such payment is less than the amount specified in Schedule "F", in which case the interim bill shall be prepared on the appointed date of the month after the requisite progress is achieved. Engineer-in-Charge shall arrange to have the bill verified by taking or causing to be taken, where necessary the requisite measurements of the work. In the event of the failure of the contractor to submit the bills, Engineer-in-Charge shall prepare or cause to be prepared such bills in which event no claims whatsoever due to delays on payment including that of interest shall be payable to the contractor. Payment on account of amount admissible shall be made by the Engineer-in-Charge certifying the sum to which the contractor is considered entitled by way of interim payment at such rates as decided by the Engineer-in-Charge. The amount admissible shall be paid by 10th working day after presentation of the bill by the Contractor to the Engineer-in-Charge or his Assistant Engineer together with the account of the material issued by the department or dismantled materials, if any. In the case of works outside the headquarters of the Engineer-in-Charge, the period of ten working days will be extended to fifteen working days.

All such interim payments shall be regarded as payment by way of advances against final payment only and shall not preclude the requiring of bad, unsound and imperfect or unskilled work to be rejected, removed, taken away and reconstructed or re-erected. Any certificate given by the Engineer-in-Charge relating to the work done or materials delivered forming part of such payment may be modified or corrected by any subsequent such certificate(s) or by the final certificate and shall not by itself be conclusive evidence that any work or materials to which it relates is/are in accordance with the contract and specifications. Any such interim payment, or any part thereof shall not in any respect conclude, determine or affect in any way powers of the Engineer-in-Charge under the contract or any of such payments be treated as final settlement and adjustment of accounts or in anyway vary or affect the contract.

Pending consideration of extension of date of completion, interim payments shall continue to be made as herein provided without prejudice to the right of the department to take action under the terms of this contract for delay in the completion of work, if the extension of date of completion is not granted by the competent authority.

The Engineer-in-Charge in his sole discretion on the basis of a certificate from the Asstt. Engineer to the effect that the work has been completed upto the level in question make interim advance payments without detailed measurements for work done (other than foundations, items to be covered under finishing items) upto lintel level (including sunshade etc.) and slab level for each floor working out at 75% of the assessed value. The advance payments so allowed shall be adjusted in the subsequent interim bill by taking detailed measurements thereof.

Payments in Composite Contracts :-

In case of composite tenders, running payment for the major component shall be made by EE of major discipline to the main contractor. Running payment for minor component shall be made by the Engineer-in-Charge of the discipline of minor component directly to the main contractor.

In case main contractor fails to make the payment to the contractor associated by him within 15 days of receipt of each running account payment, then on the written complaint of contractor associated for such minor component, Engineer-in-Charge of minor component shall serve the show cause to the main contractor and if reply of main contractor either not received or found unsatisfactory, he may make the payment directly to the contractor associated for minor component as per the terms and conditions of the agreement drawn between main contractor and associate contractor fixed by him. Such payment made to the associate contractor shall be recovered by Engineer-in-Charge of major or minor component from the next R/A/final bill due to main contractor as the case may be.

CLAUSE 8 Completion certificate and completion plans.

Within ten days of the completion of the work, the contractor shall give notice of such completion to the Engineer-in-Charge and within thirty days of the receipt of such notice the Engineer-in-Charge shall inspect the work and if there is no defect in the work, shall furnish the contractor with a final certificate of completion, otherwise a provisional certificate of physical completion indicating defects (a) to be rectified by the contractor and/or (b) for which payment will be made at reduced rates, shall be issued. But no final certificate of completion shall be issued, nor shall the work be considered to be complete until the contractor shall have removed from the premises on which the work shall be executed all scaffolding, surplus materials, rubbish and all huts and sanitary arrangements required for his/their work people on the site in connection with the execution of the works as shall have been erected or constructed by the contractor(s) and cleaned off the dirt from all wood work, doors windows, walls, floor or other parts of the building in upon or about which the work is to be executed or of which he may have had possession for the purpose of the execution thereof, and not until the work shall have been measured by the Engineer-in-Charge. If the contractor shall fail to comply with the requirements of this Clause as to removal of scaffolding, surplus materials and rubbish and all huts and sanitary arrangements as aforesaid and cleaning off dirt on or before the date fixed for the completion of work, the Engineer-in-Charge may at the expense of the contractor remove such scaffolding, surplus materials and rubbish etc., and dispose of the same as he thinks fit and clean off such dirt as aforesaid, and the contractor shall have no claim in respect of scaffolding or surplus materials as aforesaid except for any sum actually realized by the sale thereof.

CLAUSE 8A Contractor to keep site clean

When the annual repairs and maintenance of works are carried out, the splashes and droppings from white washing colour washing, painting, etc., on walls, floor, windows, etc. shall be removed and the surface cleaned simultaneously with the completion of these items of work in the individual rooms, quarters or premises etc. where the work is done without waiting for the actual completion of all the other items of work in the contract. In case the contractor fails to comply with the requirements of this clause, the Engineer-in-Charge shall have the right to get this work done at the cost of the contractor either departmentally or through any other agency. Before taking such action, the Engineer-in-Charge shall give ten days notice in writing to the contractor.

CLAUSE 8 B Completion plans to be submitted by the contractor.

The contractor shall submit completion plan as required vide General Specifications for Electrical works (Part-1 internal) 2005 and (Part-II external) 1994, as applicable within thirty days of the completion of the work.

In case, the contractor fails to submit the completion plan as aforesaid, he shall be liable to pay sum equivalent to 2.5% of the value of the work subject to a ceiling of Rs.15,000 (Rs. Fifteen thousand only) as may be fixed by the Superintending Engineer concerned and in this respect the decision of the Superintending Engineer shall be final and binding on the contractor.

CLAUSE 9 Payment of final bill

The final bill shall be submitted by the contractor in the same manner as specified in interim bills within three months of physical completion of the work or within one month of the date of the final certificate of completion furnished by the Engineer-in-Charge whichever is earlier. No further claims shall be made by the contractor after submission of the final bill and these shall be deemed to have been waived and extinguished. Payments of those items of the bill in respect of which there is no dispute and of items in dispute, for quantities and rates as approved by Engineer-in-Charge, will, as far as possible be made within the period specified hereinunder, the period being reckoned from the date of receipt of the bill by the Engineer-in-Charge or his authorized Asstt. Engineer, complete with account of materials issued by the Department and dismantled materials.

- i) If the Tendered value of work is up to Rs. 15 Lakhs - 3 months.
- ii) If the Tendered value of work exceeds Rs. 15 Lakhs - 6 months

CLAUSE 9A : PAYMENT OF CONTRACTOR'S BILLS TO BANK:

Payments due to the contractor may if so desired by him be made to his bank instead of direct to him provided that the contractor furnishes to the Engineer-in-Charge (1) an authorization in the form of a legally valid document such as a power of attorney conferring authority on the bank to receive payments and (2) his own acceptance of the correctness of the account made out as being due to him by Government or his signature on the bills or other claim preferred against Government before settlement by the Engineer-in-Charge of the account or claim by payment to the bank. While the receipt given by such banks shall constitute a full and sufficient discharge for the payment, the contractor should wherever possible present his bills duly receipted and discharged through his bankers.

Nothing herein contained shall operate to create in favour of the bank any rights or equities vis-a-vis the President.

CLAUSE 10 : MATERIALS SUPPLIED BY GOVERNMENT :

Materials which Government will supply are shown in Schedule 'A' which also stipulates quantum, place of issue and rate(s) to be charged in respect thereof. The contractor shall be bound to procure them from the Engineer-in-Charge.

As soon as the work is awarded, the contractor shall finalize the programme for the completion of work as per clause 5 of this contract and shall give his estimates of materials required on the basis of drawings/or schedule of quantities of the work. The contractor shall give in writing his requirement to the Engineer-in-Charge which shall be issued to him keeping in view the progress of work as assessed by the Engineer-in-Charge, in accordance with the agreed phased programme of work indicating monthly requirements of various materials. The contractor shall place his indent in writing for issue of such materials at least 7 days in advance of his requirement.

Such materials shall be supplied for the purpose of the contract only and the value of the materials so supplied at the rates specified in the aforesaid schedule shall be set off or deducted, as and when materials are consumed in items of work (including normal wastage) for which payment is being made to the contractor, from any sum then due or which may therefore become due to the contractor under the contract or otherwise or from the security deposit. At the time of submission of bills, the contractor shall certify that balance of materials supplied is available at site in original good condition.

The contractor shall submit along with every running bill (on account or interim bill) material-wise reconciliation statements supported by complete calculations reconciling total issue, total consumption and certified balance (diameter/section-wise in the case of steel) and resulting variations and reasons thereof. Engineer-in-Charge shall (whose decision shall be final and binding on the contractor) be within his rights to follow the procedure of recovery in clause 42 at any stage of the work if reconciliation is not found to be satisfactory.

The contractor shall bear the cost of getting the material issued, loading, transporting to site, unloading, storing under cover as required, cutting assembling and joining the several parts together as necessary. Notwithstanding anything to the contrary contained in any other clause of the contract and (or the CPWA code) all stores/materials so supplied to the contractor or procured with the assistance of the Government shall remain absolute property of Government and the contractor shall be the trustee of the stores/materials, and the said stores/materials shall not be removed/disposed off from the site of the work on any account and shall be at all times open to inspection by the Engineer-in-Charge or his authorised agent. Any such stores/materials remaining unused shall be returned to the Engineer-in-Charge in as good a condition in which they were originally supplied at a place directed by him, at a place of issue or any other place specified by him as he shall require but in case it is decided not to take back the stores/materials the contractor shall have no claim for compensation on any account of such stores/materials so supplied to him as aforesaid and not used by him or for any wastage in or damage to in such stores/materials.

On being required to return the stores/materials, the contractor shall hand over the stores/materials on being paid or credited such price as the Engineer-in-Charge shall determine having due regard to the condition of the stores/materials. The price allowed for credit to the contractor, however, shall be at the prevailing market rate not exceeding the amount charged to him, excluding the storage charge, if any. The decision of the Engineer-in-Charge shall be final and conclusive. In the event of breach of the aforesaid condition, the contractor shall in addition to throwing himself open to account for contravention of the terms of the licences or permit and/or for criminal breach of trust, be liable to Government for all advantages or profits resulting or which in the usual course would have resulted to him by reason of such breach. Provided that the contractor shall in no case be entitled to any compensation or damages on account of any delay in supply or non-supply thereof all or any such material and stores provided further that the contractor shall be bound to execute the entire work if the materials are supplied by the Government within the original schedule time for completion of work plus 50% thereof or schedule time plus 6 months whichever is more if the time of completion of work exceeds 12 months, but if a part of the materials only has been supplied within the aforesaid period, then the contractor shall be bound to do so much of the work as may be possible with the materials and stores supplied in the aforesaid period. For the completion of the rest of the work, the contractor shall be entitled to such extension of time as may be determined by the Engineer-in-Charge whose decision in this regard shall be final and binding on the contractor.

The contractor shall see that only the required quantities of materials are got issued. Any such material remaining unused and in perfectly good/original condition at the time of completion or determination of the contract shall be returned to the Engineer-in-Charge at the stores from which it was issued or at a place directed by him by a notice in writing. The contractor shall not be entitled for loading, transporting, unloading and stacking of such unused material except for the extra lead, if any involved, beyond the original place of issue.

CLAUSE 10A : MATERIALS TO BE PROVIDED BY THE CONTRACTOR:

The contractor shall, at his own expense, provide all materials, required for the works other than those which are stipulated to be supplied by the Government.

The contractor shall, at his own expense and without delay, supply to the Engineer-in-Charge samples of materials to be used on the work and shall get these approved in advance. All such materials to be provided by the Contractor shall be in conformity with the specifications laid down or referred to in the contract. The Contractor shall, if requested by the Engineer-in-Charge furnish proof, to the satisfaction of the Engineer-in-Charge that the materials so comply. The Engineer-in-Charge shall within thirty days of supply of samples or within such further period as he may require intimate to the Contractor in writing whether samples are approved by him or not. If samples are not approved, the Contractor shall forthwith arrange to supply to the Engineer-in-Charge for his approval fresh samples complying with the specifications laid down in the contract. When materials are required to be tested in accordance with specifications, approval of the Engineer-in-Charge shall be issued after the test results are received.

The contractor shall at his risk and cost submit the samples of materials to be tested or analysed and shall not make use of or incorporate in the work any materials represented by the samples until the required tests or analysis have been made and materials finally accepted by the Engineer-in-Charge. The Contractor shall not be eligible for any claim or compensation either arising out of any delay in the work or due to any corrective measures required to be taken on account of and as a result of testing of materials.

The contractor shall, at his risk and cost, make all arrangements and shall provide all facilities as the Engineer-in-Charge may require for collecting, and preparing the required number of samples for such tests at such time and to such place or places as may be directed by the Engineer-in-Charge and bear all charges and cost of testing unless specifically provided for otherwise elsewhere in the contract or specifications. Engineer-in-Charge or his authorised representative shall at all times have access to the works and to all workshops and places where work is being prepared or from where materials, manufactured articles or machinery are being obtained for the works and the contractor shall afford every facility and every assistance in obtaining the right to such access.

The Engineer-in-Charge shall have full powers to require the removal from the premises of all materials which in his opinion are not in accordance with the specifications and in case of default, the Engineer-in-Charge shall be at liberty to employ at the expense of the contractor, other persons to remove the same without being answerable or accountable for any loss or damage that may happen or arise to such materials. The Engineer-in-Charge shall also have full powers to require other proper materials to be substituted thereof and in case of default, the Engineer-in-Charge may cause the same to be supplied and all costs which may attend such removal and substitution shall be borne by the Contractor.

The contractor shall at his own expense, provide a material testing lab at the site for conducting routine field tests. The lab shall be equipped atleast with the testing equipment as specified in schedule F.

CLAUSE 10B: SECURED ADVANCE ON NON-PERISHABLE MATERIALS :

(i) The contractor on signing an indenture in the form to be specified by the Engineer-in-Charge, shall be entitled to be paid during the progress of the execution of the work up to 90% of the assessed value of any materials which are in the opinion of the Engineer-in-Charge non-perishable, non-fragile and non-combustible and are in accordance with the contract and which have been brought on the site in connection therewith and are adequately stored and/or protected against damage by weather or other causes but which have not at the time of advance been incorporated in the works. When materials on account of which an advance has been made under this sub-clause are incorporated in the work, the amount of such advance shall be recovered/deducted from the next payment made under any of the clause or clauses of this contract.

Such secured advance shall also be payable on other items of perishable nature, fragile and combustible with the approval of Engineer-in-Charge provided the contractor provides a comprehensive insurance cover for the full cost of such materials. The decision of the Engineer-in-Charge shall be final and binding on the contractor in this matter. No secured advance, shall however, be paid on high-risk materials such as ordinary glass, sand, petrol, diesel etc.

MOBILISATION ADVANCE

(ii) Mobilization advance not exceeding 10% of the tendered value may be given, if requested by the contractor in writing within one month of the order to commence the work. Such advance shall be in two or more installment to be determined by the Engineer-in-charge at his sole discretion. The first installment of such advance shall be released by the Engineer-in-charge to the contractor on a request made by the contractor to the Engineer-in-charge in this behalf. The second and subsequent installment shall be released by the Engineer-in-charge only after the contractor furnishes a proof of the satisfactory utilization of the earlier installment to the entire satisfaction of the Engineer-in-charge.

Before any installment of advance is released, the contractor shall execute a Bank Guarantee Bond from Scheduled Bank for the amount of advance and valid for the contract period. This shall be kept renewed from time to time to cover the balance amount and likely period of complete recovery, together with interest.

Provided always the provision of Clause 10 B (ii) shall be applicable only when so provided in 'Schedule F'.

PLANT MACHINERY AND SHUTTERING MATERIAL ADVANCE

(iii) An advance for plant, machinery & shuttering material required for the work and brought to site by the contractor may be given if requested by the contractor in writing within one month of bringing such plant and machinery to site. Such advance shall be given on such plant and machinery, which in the opinion of the Engineer-in-charge will add to the expeditious execution of work and improve the quality of work. The amount of advance shall be restricted to 5% of the tendered value. In the case of new plant and equipment to be purchased for the work, the advance shall be restricted to 90% of the price of such new plant and equipment paid by the contractor for which the contractor shall produce evidence satisfactory to the Engineer – in – charge. In the case of second hand and used plants and equipment, the amount of such advance shall be limited to 50% of the depreciated value of plant and equipment as may be decided by the Engineer – in – charge.

The contractor shall, if so required by the Engineer – in – charge, submit the statement of value of such old plant and equipment duly approved by a Registered Valuer recognized by the Central Board of Direct Taxes under the Income – Tax Act, 1961. No such advance shall be paid on any plant and equipment of perishable nature and on any plant and equipment of a value less than Rs.50,000/- Seventy five percent of such amount of advance shall be paid after the plant & equipment is brought to site and balance twenty five percent on successfully commissioning the same.

Leasing of equipment shall be considered at par with purchase of equipment and shall be recovered by tripartite agreement with the following:

1. Leasing company which gives certificate of agreeing to lease equipment to the contractor.
2. Engineer-in-charge and
3. The contractor.

This advance shall further be subject to the condition that such plant and equipment (a) are considered by the Engineer-in-charge to be necessary for the works; (b) and are in working order and are maintained in working order; (c) hypothecated to the Government as specified by the Engineer-in-charge before the payment of advance is released. The contractor shall not be permitted to remove from the site such hypothecated plant and equipment without the prior written permission of the Engineer-in-charge. The contractor shall be responsible for maintaining such plant and equipment in good working order during the entire period of hypothecation failing which such advance shall be entirely recovered in lump sum. For this purpose, steel scaffolding and form work shall be treated as plant and equipment.

The contractor shall insure the Plant and Machinery for which mobilization advance is sought and given, for a sum sufficient to provide for their replacement at site. Any amounts not recovered from the insurer will be borne by the contractor.

INTEREST AND RECOVERY

(iv) The mobilization advance and plant and machinery advance in (ii) & (iii) above bear simple interest at the rate of 10% per annum and shall be calculated from the date of payment to the date of recovery, both the days inclusive, on the outstanding amount of advance. Recovery of such sums advanced shall be made by the deduction from the contractors bills commencing after first ten percent of the gross value of the work is executed and paid, on pro-rata percentage basis to the gross value of the work billed beyond 10% in such a way that the entire advance is recovered by the time eighty percent of gross value of the contract is executed and paid, together with interest due on the entire outstanding amount up to the date of recovery of the installment.

(v) If the circumstances are considered reasonable by the Engineer – in – charge, the period mentioned in (ii) & (iii) for request by the contractor in writing for grant of mobilization advance and plant and equipment advance may be extended in the discretion of the Engineer – in – charge.

CLAUSE 10C

Payment on Account of Increase in Prices / Wages due to Statutory Order(s)

If after submission of the tender, the price of any material incorporated in the works (excluding the materials covered under Clause 10CA and not being a material supplied from the engineer-in-charge's stores in accordance with Clause 10 thereof) and / or wages of labour increases as a direct result of the coming into force of any fresh law, or statutory rule or order (but not due to any changes of rate in Sales Tax / VAT, Central / State Excise / Custom Duty) beyond the prices / wages prevailing at the time of the last stipulated date of receipt of tenders including extensions, if any, for the work during contract period including the justified period extended under the provisions of clause 5 of the contract without any action under clause 2, then the amount of the contract shall accordingly be varied and provided further that any such increase shall be limited to the price / wages prevailing at the time of stipulated date of completion or as prevailing for the period under consideration, whichever is less.

If after submission of the tender, the price of any material incorporated in the works (excluding the materials covered under Clause 10CA and not being a material supplied from the Engineer-in-Charge's stores in accordance with Clause 10 thereof) and / or wages of labour as prevailing at the time of last stipulated date of receipt of tender including extensions, if any, is decreased as a direct result of the coming into force of any fresh law or statutory rules or order (but not due to any changes of rate in Sales Tax / VAT, Central / State Excise / Custom Duty), Government shall in respect of materials incorporated in the works (excluding the materials covered under Clause 10CA and not being material supplied from the Engineer-in-Charge's stores in accordance with Clause 10 hereof) and / or labour engaged on the execution of the work after the date of coming into force of such law statutory rule or order be entitled to deduct from the dues of the contractor, such amount as shall be equivalent to the difference between the prices of the materials and / or wages as prevailed at the time of the last stipulated date for receipt of tenders including extensions if any for the work and the prices of materials and / or wages of labour on the coming into force of such law, statutory rule or order. This will be applicable for the contract period including the justified period extended under the provisions of clause 5 of the contract without any action under Clause 2.

Engineer-in-Charge may call books of account and other relevant documents from the contractor to satisfy himself about reasonability of increase in prices of materials and wages.

The contractor shall, within a reasonable time of his becoming aware of any alteration in the price of any such materials and / or wages of labour, give notice thereof to the Engineer-in-Charge stating that the same is given pursuant to this condition together with all information relating thereto which he may be in position to supply.

For this purpose, the labour competent of the work executed during period under consideration shall be the percentage as specified in Schedule F, of the value of work done during that period and the increase / decrease in labour shall be considered on the minimum daily wages in rupees of any unskilled adult male mazdoor, fixed under any law, statutory rule or order.

CLAUSE 10CA: Payment due to variation in prices of materials after receipt of tender:

If, after submission of the tender, the price of materials specified in schedule F increases / decreases beyond the price(s) prevailing at the time of the last stipulated date for receipt of tenders (including extensions, if any) for the work, then the amount of the contract shall accordingly be varied and provided further that any such variations shall be effected for stipulated period of contract including the justified period extended under the provisions of clause 5 of the contract without any action under clause -2.

However for work done/during the justified period extended as above, it will be limited to indices prevailing at the time of stipulated date of completion or as prevailing for the period under consideration, whichever is less.

The increase / decrease in prices of cement, steel reinforcement & structural steel shall be determined by the all India Wholesale Price Indices of materials as published by the Economic Advisor to Government of India, Ministry of Commerce and Industry and base price for materials as mentioned in schedule-F. In case, price index of a particular material is not issued by the Ministry of Commerce and Industry then the price Index of nearest similar material as indicated in schedule 'F' shall be followed.

The amount of the contract shall accordingly be varied for all such materials and will be worked out as per the formula given below for individual material:-

Adjustment for component of individual material

$$V = P \times Q \times \left(\frac{CI - C_{lo}}{C_{lo}} \right)$$

Where,
V : Variation of material cost i.e. increase or decrease in the amount in rupees to be paid or recovered.
P : Base price of material as mentioned in schedule-F valid at the time of last stipulated date of receipt of tender including extensions if any.

Q : Quantity of material brought at site for bonafide use in the works since previous bill.

Clo : All India Wholesale Price Index for the material as Published by the Economic Advisor to the Government of India, Ministry of Industry and Commerce as valid on the last stipulated date of receipt of tenders including extensions, if any.

CI : All India Wholesale Price Index for the material for period under consideration as published by The Economic Advisor to The Government of India, Ministry of Industry and Commerce

Note (i) In respect of justified period extended under the provisions of Clause 5 of the contract without any action under Clause-2, the index prevailing at the time of stipulated date of completion or the prevailing index of the period under consideration, whichever is less, shall be, considered.

Provided always that provisions of the preceding clause 10 C shall not be applicable in respect of materials covered in this clause.

(ii) In respect of justified period extended under the provisions of Clause 5 of the Contract without any action under Clause 2, the index prevailing at the time of stipulated date of completion or prevailing index of the period under consideration, whoever is less, shall be considered.

CLAUSE 10 (CC) : PAYMENT DUE TO INCREASE / DECREASE IN PRICES / WAGES (excluding materials covered under Clause 10 CA) AFTER RECEIPT OF TENDER FOR WORKS:

If the prices of materials (not being materials supplied or services rendered at fixed prices by the Department in accordance with Clauses 10 & 34 thereof) and/or wages of labour required for execution of the work increase, the contractor shall be compensated for such increase as per provisions detailed below and the amount of the contract shall accordingly be varied, subject to the condition that such compensation for escalation in prices and wages shall be available only for the work done during the stipulated period of the contract including the justified period extended under the provision of clause 5 of the contract without any action under clause 2. However, for the work done during the justified period extended as above, the compensation as detailed below will be limited to prices / wages prevailing at the time of stipulated date of completion or as prevailing for the period under consideration, whichever is less. No such compensation shall be payable for a work for which the stipulated period of completion is equal to or less than the time as specified in schedule 'F'. Such compensation for escalation in the prices of materials and labour, when due, shall be worked out based on the following provisions:

- (i) The base date for working out such escalation shall be the last stipulated date of receipt of tenders including extension, if any.
- (ii) The cost of work on which the escalation will be payable shall be reckoned as below:
 - a) Gross value of work done up to this quarter(A)
 - b) Gross value of work done up to the last quarter.....(B)
 - c) Gross value of work done since previous quarter (A-B) :.....(C)
 - d) Full assessed value of Secured Advance (excluding materials covered under Clause 10 CA) fresh paid in this quarter (D)
 - e) Full assessed value of Secured Advance (excluding materials covered under Clause 10 CA) recovered in this quarter(E)
 - f) Full assessed value of Secured Advance for which escalation is(F) payable in this quarter (D-E).
 - g) Advance payment made during this quarter(G)
 - h) Advance payment recovered during this quarter(H)
 - i) Advance payment for which escalation is payable in this quarter (G-H).....(I)

j) Extra items deviated quantities of items paid as per Clause 12 based on prevailing market rates during this quarter.

Then, $M = C (+/-)F (+/-)I - J$

$N = 0.85 \times M$

k) Less cost of material supplied by the Department
as per Clause 10 and recovered during the quarter. (K)

l) Less cost of services rendered at fixed charges as per Clause 34
and recovered during the quarter. (L)

Cost of work for which escalation is applicable

$W = N - (K + L)$

(iii) Components of materials, (except cement, reinforcement bars, structural steel or other materials covered under Clause 10 CA) labour, P.O.L., etc. shall be pre-determined for every work and incorporated in the Conditions of Contract attached to the tender papers included in Schedule 'E'. 'F' The decision of the Engineer-in-Charge in working out such percentages shall be binding on the contractors.

(iv). The compensation for escalation for other materials (except cement, reinforcement bars, structural steel or other materials covered under Clause 10 CA) and P.O.L. shall be worked as per the formulae given below:

a) Adjustment for civil component (except cement, structural steel, reinforcement bars and other materials covered under Clause 10 CA) / electrical component of construction "MATERIALS"

$V_M = W \times (X_M / 100) \times \{(MI - MI_0) / MI_0\}$

V_M : Variation in Materials cost i.e. increase or decrease in the amount in rupees to be paid or recovered.

W : Cost of work done, worked out as indicated in sub para (ii) of Clause 10 CC.

X_M : Component of 'Materials' (except cement, structural steel, reinforcement bars and other materials covered under Clause 10 CA) expressed as percent of the total value of work.

MI : All India Whole Sale Price Index for **civil component / electrical component** (Note: Relevant component only will be applicable) of construction materials as worked out on the basis of **All India whole sale Price Index for Individual Commodities/ Group items** for the period under consideration as published by the Economic Adviser to Government of India, Ministry of Industry and Commerce, **and applying weightages to the individual Commodities / Group Items**

(In respect of the justified period extended under the provisions of clause 5 of the contract, without any action under clause 2, the index prevailing at the time of stipulated date of completion or the prevailing index of the period under consideration, whichever is less shall be considered).

MI_0 : All India Whole Sale Price Index for **civil component / electrical component** of construction materials as worked out on the basis of **All India whole sale Price Index for Individual Commodities/ group items** valid on the last stipulated date of receipt of tender including extension, if any, as published by the Economic Adviser to Government of India, Ministry of Industry and Commerce, **and applying weightages to the individual Commodities / Group Items**

b) Adjustment for component of “POL”

$$V_F = W \times (Z / 100) \times \{(FI - FI_0) / FI_0\}$$

V_F : Variation in cost of Fuel, Oil and Lubricant i.e. increase or decrease in the amount in rupees to be paid or recovered.

W : ~~Value~~ Cost of work done, worked out as indicated in sub para (ii) of clause 10CC.

Z : Component of Fuel, Oil and Lubricant expressed as percent of the total value of work.

FI : All India Whole Sale Price Index for Fuel, Oil and Lubricant for the period under consideration as published by the Economic Adviser to Government of India, Ministry of Industry and Commerce, New Delhi.

(In respect of the justified period extended under the provisions of clause 5 of the contract, without any action under clause 2, the index prevailing at the time of stipulated date of completion or the prevailing index of the period under consideration, whichever is less shall be considered)

FI_0 : All India Whole Sale Price Index for Fuel, Oil and Lubricant as published by the Economic Adviser to Government of India, Ministry of Industry and Commerce, New Delhi. valid on the last stipulated date of receipt of tender including extension, if any.

v) The following principles shall be followed while working out the indices mentioned in para (iv) above.

(a) The compensation for escalation shall be worked out at quarterly intervals and shall be with respect to the cost of work done as per bills paid during the three calendar months of the said quarter. The first such payment shall be made at the end of three months after the month (excluding the month in which the tender was accepted) and thereafter at three months interval. At the time of completion of the work, the last period for payment might become less than 3 months, depending on the actual date of completion.

(b) The index (MI/FI etc.) relevant to any quarter / period for which such compensation is paid shall be the arithmetical average of the indices relevant to the three calendar months. If the period up to date of completion after the quarter covered by the last such installment of payment, is less than three months, the index MI & FI shall be the average of the indices for the months falling within that period.

vi) The compensation for escalation for **labour** shall be worked out as per the formula given below:

$$V_L = W \times (Y / 100) \times \{(LI - LI_0) / LI_0\}$$

V_L : Variation in labour cost i.e amount of increase or decrease in rupees to be paid or recovered.

W : Value of work done, worked out as indicated in sub-para (ii) above.

Y : Component of labour expressed as a percent of the total value of the work

LI_0 : Minimum daily wage in rupees of an unskilled adult male mazdoor, fixed under any law, statutory rule or order as on the last stipulated date of receipt of tender including extension, if any.

LI : Minimum wage in rupees of an unskilled adult male mazdoor, fixed under any law, statutory rule or order as applicable on the last date of the quarter previous to the one under consideration.

(In respect of the justified period extended under the provisions of clause 5 of the contract, without any action under clause 2, the minimum wage prevailing on the last date of quarter previous to the quarter pertaining to the stipulated date of completion or the minimum wage prevailing on the last date of quarter previous to the one under consideration, whichever is less, shall be considered.).

vii). The following principles will be followed while working out the compensation as per sub para (vi) above.

a) The minimum wage of an unskilled Male Mazdoor mentioned in sub para (vi) above shall be the higher of the wage notified by Government of India, Ministry of Labour and that notified by the local administration, both relevant to the place of work and the period of reckoning.

b) The escalation for labour also shall be paid at the same quarterly intervals when escalation due to increase in cost of materials and/or P.O.L. is paid under this clause. If such revision of minimum wages takes place during any such quarterly intervals, the escalation compensation shall be payable at revised rates only for work done in subsequent quarters.

c) Irrespective of variations in minimum wages of any category of labour, for the purpose of this clause, the variation in the rate for an unskilled adult Male Mazdoor alone shall form the basis for working out the escalation compensation payable on the labour component.

viii) In the event the price of materials and/or wages of labour required for execution of the work decrease(s), there shall be a downward adjustment of the cost of work so that such price of materials and/or wages of labour shall be deductible from the cost of work under this contract and in this regard the formula herein before stated under this clause 10 CC shall mutatis-mutandis apply, provided that:

(a) No such adjustment for the decrease in the price of materials and/or wages of labour aforementioned would be made in case of contracts in which the stipulated period of completion of the work is equal to or less than the time as specified in Schedule 'F'.

(b) The Engineer-in-Charge shall otherwise be entitled to lay down the procedure by which the provision of this sub-clause shall be implemented from time to time and the decision of the Engineer-in-Charge in this behalf shall be final and binding on the contractor.

ix) Provided always that:-

(a) where the provisions of Clause 10 CC are applicable, provision of Clause 10 C will not be applicable but provisions of Clause 10 CA will be applicable

(b) where provisions of Clause 10 CC are not applicable, provisions of Clause 10 C and 10 CA will become applicable.

Clause 10 CC to be applicable in contracts with stipulated period of completion exceeding 18 Months.

CLAUSE 10D : EXCAVATED / DISMANTLED MATERIALS WILL BE GOVT. PROPERTY:

The contractor shall treat all materials obtained during dismantling of a structure, excavation of the site for a work etc. as Government's property and such materials shall be disposed off to the best advantage of Government according to the instructions in writing issued by the Engineer-in-Charge.

CLAUSE 11 : WORK TO BE EXECUTED AS PER SPECIFICATIONS, DRAWINGS, ORDERS, ETC. :

The contractor shall execute the whole and every part of the work in the most substantial and workman like manner and both as regards materials and otherwise in every respect in strict accordance with the specifications. The contractor shall also conform exactly fully and faithfully to the designs, drawings and instructions in writing in respect of the work signed by the Engineer-in-Charge and the contractor shall be furnished free of charge one copy of the contract documents together with standard specification of BARC specified in Schedule 'F' or in any Bureau Indian Standard or any other, published Standard or Code or Schedule of Rates or any other printed publication referred to elsewhere in the contract.

The Contractor shall comply with the provisions of the contract and with the care and diligence execute and maintain the works and provide all labour and materials, tools and plants including for measurements and supervision of all works, structural plans and other things of temporary or permanent nature required for such execution and maintenance in so far as the necessity for providing these, is specified or is reasonably inferred from the contract. The Contractor shall take full responsibility for adequacy, suitability and safety of all the works and methods of construction.

CLAUSE 12 : DEVIATIONS / VARIATIONS : EXTENT AND PRICING:

The Engineer-in-Charge shall have power (i) to make alteration in, omissions from, additions to or substitution for the original specifications, drawings, designs and instructions that may appear to him to be necessary or advisable during the progress of the work, and (ii) to omit a part of the works in case of non-availability of a portion of the site or for any other reasons and the contractor shall be bound to carry out the works in accordance with any instructions given to him in writing signed by the Engineer-in-Charge and such alterations, omissions, additions, substitutions shall form part of the contract as if originally provided therein and any altered, additional or substituted work which the contractor may be directed to do in the manner specified above as part of the works, shall be carried out by the contractor on the same conditions in all respects including price on which he agreed to do the main work except as hereafter provided.

12.1: The time for completion of the work shall, in the event of any deviations resulting in additional cost over the tendered value sum being ordered, be extended, if requested by the contractor as follows:

- (i) In the proportion which the additional cost of the altered, additional or substituted work, bears to the original tendered value, plus
- (ii) 25% of the time calculated in (i) above or such further additional time as may be considered reasonable by the Engineer-in-Charge.

DEVIATION, EXTRA ITEMS AND PRICING:

12.2: In the case of extra item(s), (items that are completely new, and are in addition to the items contained in the contract) the contractor may within fifteen days of receipt of order or occurrence of the item(s) claim rates, supported by proper analysis, for the work and the engineer-in-charge shall within one month of the receipt of the claims supported by analysis, after giving consideration to the analysis of the rates submitted by the contractor, determine the rates on the basis of the market rates and the contractor shall be paid in accordance with the rates so determined.

In the case of substituted items, (items that are taken up with partial substitution or in lieu of items of work in the contract) the rate for the agreement items (to be substituted) and substituted item shall also be determined in the manner as mentioned in the following para:

DEVIATION, SUBSTITUTED ITEMS, PRICING:

- a) If the market rate for the substituted item so determined is more than the market rate of the agreement item (to be substituted), the rate payable to the contractor for the substituted item shall be the rate for the agreement item (to be substituted) so increased to the extent of the difference between the market rates of substituted item and the agreement item (to be substituted).
- b) If the market rate for the substituted item so determined is less than the market rate of the agreement item (to be substituted), the rate payable to the contractor for the substituted item shall be the rate for the agreement item (to be substituted) so decreased to the extent of the difference between the market rates of substituted item and the agreement item (to be substituted).

DEVIATION, DEVIATED QUANTITIES, PRICING :

In the case of contract items, substituted items, contract cum substituted items, which exceed the limits laid down in Schedule ‘F’, the contractor may within fifteen days of receipt of order or occurrence of the excess, claim revision of the rates, supported by proper analysis, for the work in excess of the above mentioned limits, provided that if the rates so claimed are in excess of the rates specified in the schedule of quantities, the Engineer-in-Charge shall within one month of receipt of the claims supported by analysis, after giving consideration to the analysis of the rates submitted by the contractor, determine the rates on the basis of the market rates and the contractor shall be paid in accordance with the rates so determined.

12.3: The provisions of the preceding paragraph shall also apply to the decrease in the rates of items for the works in excess of the deviation limits laid down in Schedule ‘F’, and the Engineer-in-Charge shall after giving notice to the contractor within one month of occurrence of the excess and after taking into consideration any reply received from him within fifteen days of the receipt of the notice, revise the rates of the work in question within one month of the expiry of the said period of fifteen days having regard to the market rates.

12.4: The contractor shall send to the Engineer-in-Charge once every three months an up to date account giving complete details of all claims for additional payments to which the contractor may consider himself entitled and of all additional work ordered by the Engineer-in-Charge, which he has executed during the preceding quarter failing which the contractor shall be deemed to have waived his right. However, the Superintending Engineer may authorise consideration of such claims on merits.

12.5: For the purpose of operation of :Schedule ‘F’ the following works shall be treated as works relating to foundations unless otherwise defined in the contract :

- i) For buildings: All works upto 1.2 metres above ground level or up to- floor 1 level whichever is lower. -*
- ii) For abutments, piers and well stening : All works up to 1.2 m above bed level.*
- iii) For retaining walls, wing walls, compound walls, chimneys, overhead rerservoirs / tanks and other elevated structures : All works upto 1.2 mtrs above the ground level.*
- iv) For reservoirs / tanks (other than overhead reservoirs / tanks) : All works upto 1.2 meters above the ground level.*
- v) For basement : All works upto 1.2 meters above ground level or upto floor 1 level whichever is lower.*
- vi) For roads, all items of excavation and filling including treatment of sub-base.*

12.6: Any operation incidental to or necessarily has to be in contemplation of tenderer while filling tender, or necessary for proper execution of the item included in the Schedule of Quantities or in the schedule of rates mentioned above, whether or not, specifically indicated in the description of the item and the relevant specifications, shall be deemed to be included in the rates quoted by the tenderer or the rate given in the said schedule of rates, as the case may be, Nothing extra shall be admissible for such operations.

Deviation limit beyond which clause 12.2 & 12.3 shall apply:

a)	For building work (Excluding foundation works)	30%
b)	For foundation work	100%
c)	Maintenance works	50%

CLAUSE 13: FORECLOSURE OF CONTRACT DUE TO ABANDONMENT OR REDUCTION IN SCOPE OF WORK:

If at any time after acceptance of the tender Government shall decide to abandon or reduce the scope of the work for any reason whatsoever and hence not require the whole or any part of the works to be carried out, the Engineer-in-charge shall give notice in writing to that effect to the contractor and the contractor shall act accordingly in the matter. The contractor shall have no claim to any payment of compensation or otherwise whatsoever, on account of any profit or advantage which he might have derived from the execution of the works in full but which he did not derive in consequence of the foreclosure of the whole or part of the works.

The contractor shall be paid at contract rates full amount for works executed at site and in addition, a reasonable amount as certified by the Engineer-in-charge for the items hereunder mentioned which could not be utilised on the work to the full extent in view of the foreclosure.

- i) Any expenditure incurred on preliminary site work, e.g temporary access roads, temporary labour huts, staff quarters and site office, storage accommodation and water storage tanks.
- ii) Government shall have the option to take over contractor's materials or any part thereof either brought to site or of which the contractor is legally bound to accept delivery from suppliers (for incorporation in or incidental to the work) provided however, Government shall be bound to take over the materials or such portions thereof as the contractor does not desire to retain. For materials taken over or to be taken over by Government cost of such materials as detailed by Engineer-in-charge shall be paid. The cost shall, however, take into account purchase price, cost of transportation and deterioration or damage which may have been caused to materials whilst in the custody of the contractor.
- iii) If any materials supplied by Government are rendered surplus, the same except normal wastage shall be returned by the contractor to Government at rates not exceeding those at which these were originally issued less allowance for any deterioration or damage which may have been caused whilst the materials were in the custody of the contractor. In addition, cost of transporting such materials from site to Government stores, if so required by Government, shall be paid.
- iv) Reasonable compensation for transfer of T & P from site to contractor's permanent stores or to his other works, whichever is less. If T & P are not transported to either of the said places, no cost of transportation shall be payable.
- v) Reasonable compensation for repatriation of contractor's site staff and imported labour to the extent necessary.

The contractor shall, if required by the Engineer-in-charge furnish to him books of account, wage books, time sheets and other relevant documents and evidence as may be necessary to enable him to certify the reasonable amount payable under this condition.

The reasonable amount of items on (i), (iv) and (v) above shall not be in excess of 2% of the cost of the work remaining incomplete on the date of closure, i.e. total stipulated cost of the work as per accepted tender less the cost of work actually executed under the contract and less the cost of contractor's materials at site taken over by the Government as per item (ii) above. Provided always that against any payments due to the contractor on this account or otherwise, the Engineer-in-charge shall be entitled to recover or be credited with any outstanding balances due from the contractor for advance paid in respect of any tool, plants and materials and any other sums which at the date of termination were recoverable by the Government from the contractor under the terms of the contract.

CLAUSE 14 :

Carrying out part work at risk & cost of contractor

If contractor:

- (i) At any time makes default during currency of work or does not execute any part of the work with due diligence and continues to do so even after a notice in writing of 7 days in this respect from the Engineer-in-Charge; or
- (ii) Commits default in complying with any of the terms and conditions of the contract and does not remedy it or takes effective steps to remedy it within 7 days even after a notice in writing is given in that behalf by the Engineer-in-Charge; or

- (iii) Fails to complete the work(s) or items of work with individual dates of completion, on or before the date(s) so determined, and does not complete them within the period specified in the notice given in writing in that behalf by the Engineer-in-Charge.

The Engineer-in-Charge without invoking action under clause 3 may, without prejudice to any other right or remedy against the contractor which have either accrued or accrue thereafter to Government, by a notice in writing to take the part work / part incomplete work of any item(s) out of his hands and shall have powers to:

- (a) Take possession of the site and any materials, constructional plant, implements, stores, etc., thereon; and / or
- (b) Carry out the part work / part incomplete work of any item(s) by any means at the risk and cost of the contractor.

The Engineer-in-Charge shall determine the amount, if any, is recoverable from the contractor for completion of the part work / part incomplete work of any item(s) taken out of his hands and execute at the risk and cost of the contractor, the liability of contractor on account of loss or damage suffered by Government because of action under this clause shall not exceed 10% of the tendered value of the work.

In determining the amount, credit shall be given to the contractor with the value of work done in all respect in the same manner and at the same rate as if it had been carried out by the original contractor under the terms of his contract, the value of contractor's materials taken over and incorporated in the work and use of plant and machinery belonging to the contractor. The certificate of the Engineer-in-Charge as to the value of work done shall be final and conclusive against the contractor provided always that action under this clause shall only be taken after giving notice in writing to the contractor. Provided also that if the expenses incurred by the department are less than the amount payable to the contractor at his agreement rates, the difference shall not be payable to the contractor.

Any excess expenditure incurred or to be incurred by Government in completing the part work / part incomplete work of any item(s) or the excess loss of damages suffered or may be suffered by Government as aforesaid after allowing such credit shall without prejudice to any other right or remedy available to Government in law or per as agreement be recovered from any money due to the contractor on any account, and if such money is insufficient, the contractor shall be called upon in writing and shall be liable to pay the same within 30 days.

If the contractor fails to pay the required sum within the aforesaid period of 30 days, the Engineer-in-Charge shall have the right to sell any or all of the contractors' unused materials, constructional plant, implements, temporary building at site etc. and adjust the proceeds of sale thereof towards the dues recoverable from the contractor under the contract and if thereafter there remains any balance outstanding, it shall be recovered in accordance with the provisions of the contract.

In the event of the above course being adopted by the Engineer-in-Charge, the contractor shall have no claim to compensation for any loss sustained by him by reason of his having purchased or procured any materials or entered into any engagements or made any advance on any account or with a view to the execution of the work or the performance of the contract.

CLAUSE 15 : SUSPENSION OF WORK :

i) The contractor shall, on receipt of the order in writing of the Engineer-in-Charge, (whose decision shall be final and binding on the contractor) suspend the progress of the works or any part thereof for such time and in such manner as the Engineer-in-Charge may consider necessary so as not to cause any damage or injury to the work already done or endanger the safety thereof for any of the following reasons:

- (a) on account of any default on the part of the contractor or;
- (b) for proper execution of the works or part thereof for reasons other than the default of the contractor; or
- (c) for safety of the works or part thereof.

The contractor shall, during such suspension, properly protect and secure the works to the extent necessary and carry out the instructions given in that behalf by the Engineer-in-Charge.

ii) If the suspension is ordered for reasons (b) and (c) in sub-para (i) above:

(a) the contractor shall be entitled to an extension of time equal to the period of every such suspension PLUS 25%, for completion of the item or group of items of work for which a separate period of completion is specified in the contract and of which the suspended work forms a part, and;

(b) If the total period of all such suspensions in respect of an item or group of items of work for which a separate period of completion is specified in the contract exceeds thirty days, the contractor shall, in addition, be entitled to such compensation as the Engineer-in-Charge may consider reasonable in respect of salaries and/or wages paid by the contractor to his employees and labour at site, remaining idle during the period of suspension, adding thereto 2% to cover indirect expenses of the contractor, provided the contractor submits his claim supported by details to the Engineer-in-Charge within fifteen days of the expiry of the period of 30 days.

iii) If the works or part thereof is suspended on the orders of the Engineer-in-Charge for more than three months at a time, except when suspension is ordered for reasons (a) in sub-para (i) above, the contractor may after receipt of such order serve a written notice on the Engineer-in-Charge requiring permission within fifteen days from receipt by the Engineer-in-Charge of the said notice, to proceed with the work or part thereof in regard to which progress have been suspended and if such permission is not granted within that time, the contractor, if he intends to treat the suspension, where it affects only a part of the works as an omission of such part by Government or where it affects whole of the works, as an abandonment of the works by Government, shall within ten days of expiry of such period of 15 days give notice in writing of his intention to the Engineer-in-Charge. In the event of the contractor treating the suspension as an abandonment of the contract by Government, he shall have no claim to payment of any compensation on account of any profit or advantage which he might have derived from the execution of the work in full but which he could not derive in consequence of the abandonment. He shall, however, be entitled to such compensation, as the Engineer-in-Charge may consider reasonable, in respect of salaries and/or wages paid by him to his employees and labour at site, remaining idle in consequence adding to the total thereof 2% to cover indirect expenses of the contractor provided the contractor submits his claim supported by details to the Engineer-in-Charge within 30 days of the expiry of the period of 3 months.

Provided, further, that the contractor shall not be entitled to claim any compensation from Government for the loss suffered by him on account of delay by Government in the supply of materials in schedule 'A' where such delay is covered by difficulties relating to the supply of wagons, force majeure including non-allotment of such materials by controlling authorities, acts of God, acts of enemies of the state/country or any reasonable cause beyond the control of the Government.

CLAUSE 16 : ACTION IN CASE WORK NOT DONE AS PER SPECIFICATIONS :

All works under or in course of execution or executed in pursuance of the contract shall at all times be open and accessible to the inspection and supervision of the Engineer-in-Charge, his authorised subordinates in charge of the work and all the superior officers, officer of the Quality Assurance Unit of the Department or any organization engaged by the Department for Quality Assurance and of the Chief Technical Examiner's Office, and the contractor shall, at all times, during the usual working hours and at all other times at which reasonable notice of the visit of such officers has been given to the contractor, either himself be present to receive orders and instructions or have a responsible agent duly accredited in writing, present for that purpose. Orders given to the Contractor's agent shall be considered to have the same force as if they had been given to the contractor himself.

If it shall appear to the Engineer-in-Charge or his authorised subordinates incharge of the work or to the Chief Engineer in charge of Quality Assurance or his subordinate officers or officers of the organization engaged by the Department for Quality Assurance to the Chief Technical Examiner or his subordinate officers, that any work has been executed with unsound, imperfect, or unskillful workmanship, or with materials or articles provided by him for the execution of the work which are unsound or of a quality inferior to that contracted or otherwise not in accordance with the contract, the contractor shall, on demand in writing which shall be made within twelve months (six months in case of Work Costing ₹10.00 Lakhs and below except road work) of the completion of the work from the Engineer-in-Charge specifying the work, materials or articles complained of notwithstanding that the same may have been passed, certified and paid for forthwith rectify, or remove and reconstruct the work so specified in whole or in part, as the case may require or as the case may be, remove the materials or articles so specified and provide other proper and suitable materials or articles at his own charge and cost. In the event of the failing to do so within a period specified by the Engineer-in-Charge in his demand aforesaid, then the contractor shall be liable to pay compensation at the same rate as under clause 2 of the contract (for non-completion of the work in time) for this default.

In such case the Engineer-in-Charge may not accept the item of work at the rates applicable under the contract but may accept such items at reduced rates as the authority specified in Schedule 'F' may consider reasonable during the preparation of on account bills or final bill if the item is so acceptable without detriment to the safety and utility of the item and the structure or he may reject the work outright without any payment and/or get it and other connected and incidental items rectified, or removed and re-executed at the risk and cost of the contractor. Decision of the Engineer-in-Charge to be conveyed in writing in respect of the same will be final and binding on the contractor.

CLAUSE 17 : CONTRACTOR'S LIABILITIES DURING MAINTENANCE PERIOD :

If the contractor or his working people or servants shall break, deface, injure or destroy any part of building in which they may be working, or any building, road, road kerb, fence, enclosure, water pipe, cables, drains, electric or telephone post or wires, trees, grass or grassland, or cultivated ground contiguous to the premises on which the work or any part of it is being executed, or if any damage shall happen to the work while in progress, from any cause whatever or if any defect, shrinkage or other faults appear in the work within **12 months (6 months in the case of work costing Rs. 10,00,000/- and below except road work)** after a certificate final or otherwise of its completion shall have been given by the Engineer-in-Charge as aforesaid arising out of defect or improper materials or workmanship, the contractor shall upon receipt of a notice in writing on that behalf make the same good at his own expense, or in default, the Engineer-in-Charge cause the same to be made good by other workmen and deduct the expense from any sums that may be due, or at any time thereafter may become due to the contractor, or from his security deposit, or the proceeds of sale thereof or of a sufficient portion thereof. The security deposit of the contractor shall not be refunded before the expiry of **12 months (6 months in the case of work costing Rs. 10,00,000/- and below except road work)** after the issue of the certificate final or otherwise, of completion of work, or till the final bill has been prepared and passed whichever is later. Provided that in the case of road work, if in the opinion of the Engineer-in-Charge, half of the security deposit is sufficient to meet all the liabilities of the contractor under this contract, half of the security deposit will be refundable after **6 months** and the remaining half after **12 months** of the issue of the said certificate of completion or till the final bill has been prepared and passed whichever is later. Performance Security shall be refunded to the contractor after completion of the work and recording the completion certificate.

In case of maintenance and operation of E&M services, the security deposit deducted from contractors may at the considered opinion of the EIC, which shall be final and binding be refunded within one month from the date of final payment or within one month from the date of completion of the maintenance contract, whichever is earlier

CLAUSE 18 : CONTRACTOR TO SUPPLY TOOLS & PLANTS ETC. :

The contractor shall provide at his own cost all materials (except such special materials, if any, as may in accordance with the contract be supplied from the Engineer-in-Charge's stores), machinery, tools & plants as specified in Schedule 'F'. In addition to this, appliances, implements, other plants, ladders, cordage, tackle, scaffoldings and temporary works required for the proper execution of the work, whether original, altered or substituted and whether included in the specifications or other documents forming part of the contract or referred to in these conditions or not, or which may be necessary for the purpose of satisfying or complying with the requirements of the Engineer-in-Charge as to any matter as to which under these conditions he is entitled to be satisfied, or which he is entitled to require together with carriage therefore to and from the work. The contractor shall also supply without charge the requisite number of persons with the means and materials, necessary for the purpose of setting out works, and counting, weighing and assisting in the measurement or examination at any time and from time to time of the work or materials. Failing his so doing the same may be provided by the Engineer-in-Charge at the expense of the contractor and the expenses may be deducted, from any money due to the contractor, under the contract and/or from his security deposit or the proceeds of sale thereof, or of a sufficient portions thereof.

CLAUSE 18A : RECOVERY OF COMPENSATION PAID TO WORKMAN : In every case in which by virtue of the provisions Sub-Section (1) of Section 12 of the Workmen's Compensation Act, 1923, Government is obliged to pay compensation to a workman employed by the contractor, in execution of the works, Government will recover from the contractor the amount of the compensation so paid; and, without prejudice to the rights of the Government under, sub-section (2) of Section 12 of the said Act, Government shall be at liberty to recover such amount or any part thereof by deducting it from the security deposit or from any sum due by Government to the contractor whether under this contract or otherwise. Government shall not be bound to contest any claim made against it under Sub-Section (1) of Section 12, of the said Act, except on the written request of the contractor and upon his giving to Government full security for all costs for which Government might become liable in consequence of contesting such claim.

CLAUSE 18B: ENSURING PAYMENT AND AMENITIES TO WORKERS IF CONTRACTOR FAILS TO DO SO :

In every case in which by virtue of the provisions of the Contract Labour (Regulation and Abolition) Act, 1970 and of the contract labour (Regulation and Abolition) Central Rules, 1971, Government is obliged to pay any amounts of wages to a workman employed by the contractor in execution of the works, or to incur any expenditure in providing welfare and health amenities required to be provided under the above said Act and the Rules, under Clause 19 H or under the DAE Contractor's Labour Regulations, or under the rules framed by Government from time to time for the protection of health and sanitary arrangements for workers employed by Department of Atomic Energy contractors, Government will recover from the contractor the amount of wages so paid or the amount of expenditure so incurred; and without prejudice to the rights of the Government under Sub-Section (2) of Section 20, and Sub-Section (4) of Section 21, of the contract labour (Regulation and Abolition) Act, 1970, Government shall be at liberty to recover such amount or any part thereof by deducting it from the security deposit or from any sum due by Government to the contractor whether under this agreement or otherwise. Government shall not be bound to contest any claim made against it under Sub-Section (1) of Section 20, and Sub-Section (4) of section 21, of the said Act, except on the written request of the contractor and upon his giving to the Government full security for all costs for which Government might become liable in contesting such claim.

CLAUSE 18C: The contractor shall indemnify the President, represented by Director, BARC from any loss, responsibility, legal, moral, or otherwise for and in the unwelcome event of any accident that is caused by criminal negligence and or any unsafe working condition which in the opinion of the EIC could have been caused by and for any reason attributable to the contractor for even force majeure, causing loss of life, incapacitation, grievous injury to ant workmen, supervisor or any other person and the indemnity so executed separately on a non judicious stamp paper shall be in force during the execution of the contract and shall remain co- terminus with Clause-17 ibid.

CLAUSE 19 : LABOUR LAWS TO BE COMPLIED BY THE CONTRACTOR :

The contractor shall obtain a valid license under the Contract Labour (R & A) Act, 1970 and the Contract Labour (Regulation and Abolition) Central Rules, 1971, before the commencement of the work, and continue to have a valid license until the completion of the work. The contractor shall also abide by the provisions of the Child Labour (Prohibition & Regulation) Act-1998.

The contractor shall also comply with the provisions of the building and other Construction Workers (Regulation of Employment & Conditions of Service) Act, 1996 and the building and other Construction Workers Welfare Cess Act, 1986.

Any failure to fulfill this requirements shall attract the penal provisions of this contract arising out of the resultant non-execution of the work.

CLAUSE 19A: NO LABOUR BELOW 14 YEARS : No labour below the age of 14 (fourteen) years shall be employed on the work.

CLAUSE 19B : FAIR WAGE CLAUSE : (PAYMENT OF WAGES) :

i) The contractor shall pay to labour employed by him either directly or through sub contractors, wages not less than fair wages as defined in the DAE, Contractor's Labour Regulations or as per the provisions of the Contract Labour (Regulation and Abolition) Act, 1970 and the Contract Labour (Regulation and Abolition) Central Rules, 1971, wherever applicable.

ii) The contractor shall, notwithstanding the provisions of any contract to the contrary, cause to be paid fair wage to labour indirectly engaged on the work, including any labour engaged by his sub-contractors in connection with the said work, as if the labour had been immediately employed by him.

iii) In respect of all labour directly or indirectly employed in the works for performance of the contractor's part of this contracts, the contractor shall comply with or cause to be complied with the DAE Contractor Labour Regulations made by Government from time to time in regard to payment of wages, wage period, deductions from wages, recovery of wages not paid and deductions unauthorisedly made, maintenance of wage books or wage slips, publication of scale of wages and other terms of employment, inspection and submission of periodical returns and all other matters of the like nature or as per the provisions of the Contract Labour (Regulation and Abolition) Act, 1970 and the Contract Labour (Regulation and Abolition) Central Rules 1971, wherever applicable.

iv-a) The Engineer-in-Charge concerned shall have the right to deduct from the moneys due to the contractor any sum required or estimated to be required for making good the loss suffered by a worker or workers by reasons of non-fulfillment of the conditions of the contract for the benefit of the workers, non-payment of wages or of deduction made from his or their wages which are not justified by their terms of the contract or non-observance of the regulations.

iv-b) Under the provisions of the minimum wages (Central) Rules, 1950, the contractor is bound to allow the labourers directly or indirectly employed in the works one day's rest for six days continuous work and pay wages at the same rate as for duty. In the event of default, the Engineer-in-Charge shall have the right to deduct the sum or sums not paid on account of wages for weekly holidays to any labourers, and pay the same to the persons entitled thereto from any money due to the contractor by the Engineer-in-Charge concerned.

v) The contractor shall comply with the provisions of the payment of wages Act 1936, Minimum Wages Act, 1948, Employees Liability Act, 1938, Workmen's Compensation Act, 1923, Industrial Disputes Act, 1947, Maternity Benefit Act, 1961 and the Contractor's Labour (Regulation and Abolition) Act, 1970 or the modifications thereof or any other laws relating thereto and the rules made thereunder from time to time.

vi) The contractor shall indemnify and keep indemnified Government against payments to be made under and for the observance of the laws aforesaid and the D.A.E. Contractor's Labour Regulations without prejudice to his right to claim indemnity from his sub-contractors.

vii) The laws aforesaid shall be deemed to be a part of this contract and any breach thereof shall be deemed to be a breach of this contract.

viii) Whatever is the minimum wage for the time being, or if the wage payable is higher than such wage, such wage shall be paid by the contractor to the workmen directly without the intervention of Jamadar and that Jamadar shall not be entitled to deduct or recover any amount from the minimum wage payable to the workmen as and by way of commission or otherwise.

ix) The contractor shall ensure that no amount by way of commission or otherwise is deducted or recovered by the Jamadar from the wage of workmen.

CLAUSE - 19C : SAFTY PROVISIONS FOR LABOUR & PENALTY ON DEFAULT : In respect of all labour directly or indirectly employed in the work for the performance of the contractors part of this contract the contractor shall at his own expense arrange for the safety provisions as per DAE safety code framed from time to time and shall at his own expense provide for all facilities in connection therewith. In case the contractor fails to make arrangements and provide necessary facilities as aforesaid, he shall be liable to pay a penalty of Rs. 200/- for each default and in addition the Engineer-in-Charge shall be at liberty to make arrangement and provide facilities as aforesaid and recover the costs incurred in that behalf from the contractor.

CLAUSE 19D : SUBMISSION OF LABOUR CHART BY EVERY FORTNIGHT : The contractor shall submit, by the 4th and 19th of every month, to the Engineer-in-Charge a true statement showing, in respect of the second half of the preceding month and the first half of the current month respectively.

1. The number of labourers employed by him on the work.
2. Their working hours.
3. The wages paid to them.
4. The accidents that occurred during the said fortnight showing the circumstances under which they happened and the extent of damage and injury caused by them, and
5. The number of female workers who have been allowed Maternity Benefit, according to clause 19 F and the amount paid to them.

Failing which the contractor shall be liable to pay to Government a sum not exceeding Rs. 200/- for each default or materially incorrect statement. The decision of the Engineer-in-Charge shall be final in deducting from any bill due to the contractor the amount levied as fine and be binding on the contractor.

CLAUSE 19E : HEALTH AND SANITARY ARRANGEMENTS FOR WORKERS : In respect of all labour directly or indirectly employed in the works for the performance of the contractors part of this contract, the contractor shall comply with or cause to be complied with all the rules framed by Government from time to time for the protection of health and sanitary arrangements for workers employed by the Bhabha Atomic Research Centre and its contractors.

CLAUSE 19F: MATERNITY BENEFIT RULES FOR FEMALE WORKERS EMPLOYED BY CONTRACTORS

Leave and pay during leave shall be regulated as follows :

1) LEAVE :

- i) **In case of delivery :** maternity leave not exceeding 8 weeks, 4 weeks upto and including the day of delivery and 4 weeks following that day.
- ii) **In the case of miscarriage :** upto 3 weeks from the date of miscarriage.

2) PAY :

- i) **In the case of delivery :** leave pay during maternity leave will be at the rate of the women's average daily earnings, calculated on the total wages earned on the days when full time work was done during a period of 3 months immediately preceding the date on which she gives notice that she expects to be confined or at the rate of Rs.1/- only a day whichever is greater.
- ii) **In case of miscarriage :** leave pay at the rate of average daily earnings calculated on the total wages earned on the days when full time work was done during a period of 3 months immediately preceding the date of such miscarriage.

3) **CONDITIONS FOR THE GRANT OF MATERNITY LEAVE :**

No maternity leave benefit shall be admissible to a woman unless she has been employed for a total period of not less than 6 (six) months immediately preceding the date on which she proceeds on leave.

4) The contractor shall maintain a register of maternity (Benefit) in the prescribed form as shown below and the same shall be kept at the place of work.

REGISTER OF MATERNITY BENEFITS
(Clause 19 F of the conditions of contract)

Name and address of the contractor(s) : -----

Name and location of the work : -----

Name of the employee	Father's / Husband's Name	Nature of employment	Period of actual appointment	Date on which notice of confinement given
1	2	3	4	5

Date of delivery / miscarriage	Date on which maternity leave commenced and ended			
	In case of Delivery		In case of Mis-carriage	
	Commenced	Ended	Commenced	Ended
6	7	8	9	10

Leave pay paid to the employee				Remarks
In case of delivery		In case of mis-carriage		
Rate of leave pay	Amount paid	Rate of leave pay	Amount paid	
11	12	13	14	15

SPECIMEN FORM OF THE REGISTER, REGARDING MATERNITY BENEFIT ADMISSIBLE TO THE CONTRACTOR'S LABOUR IN D.A.E. WORKS.

Name and location of the work : -----

Name and address of the contractor :-----

- 1. Name of the woman and her husband's Name :
- 2. Designation :
- 3. Date of appointment :
- 4. Date with months and years in which she is employed :
- 5. Date of discharge/dismissal, if any :
- 6. Date of production of certificates in respect of pregnancy :

7. Date on which the woman informs about the expected delivery :
8. Date of delivery/Miscarriage/death :
9. Date of production of certificate in respect of delivery/miscarriage :
10. Date with the amount of maternity/death benefit paid in advance of expected delivery:
11. Date with the amount of subsequent payment of maternity benefit :
12. Name of the person nominated by the woman to receive the payment of the maternity benefit after her death :
13. If the woman dies, the date of her death, the name of the person to whom maternity benefit amount was paid, the month thereof and the date of payment:
14. Signature of the contractor authenticating entries in the register :
15. Remarks column for the use of Inspecting Officer:

CLAUSE 19G : PENALTY FOR NON COMPLIANCE OF LABOUR REGULATIONS : In the event of the contractor(s) committing a default or breach of any of the provisions of the D.A.E. Contractor's Labour Regulations and Model Rules, for the protection of health and sanitary arrangements for the workers as amended from time to time or furnishing any information or submitting or filing any statement under the provisions of the above Regulations and Rules which is materially incorrect, he/they shall, without prejudice to any other liability, pay to the Government a sum not exceeding Rs. 200/- for every default, breach or furnishing, making, submitting, filling such materially incorrect statements and in the event of the contractor(s) defaulting continuously in this respect, the penalty may be enhanced to Rs. 200/- per day for each day of default subject to a maximum of 5% of the estimated cost of the work put to tender. The decision of the Engineer-in-Charge shall be final and binding on the parties.

Should it appear to the Engineer-in-Charge that the Contractor(s) is/are not properly observing and complying with the provisions of the DAE, Contractor's labour Regulations and the provisions of the Contract Labour (Regulation and Abolition) Act, 1970 and the contract Labour (R&A) Central Rules 1971 for the protection of health and sanitary arrangements for work people employed by the contractor(s) (hereinafter referred as "the said Rules") the Engineer-in-Charge shall have power to give notice in writing to the contractor(s) requiring that the said Rules be complied with and the amenities prescribed therein be provided to the work-people within a reasonable time to be specified in the notice. If the contractor(s) shall fail within the period specified in the notice to comply with and/or observe the said Rules and to provide the amenities to the work-people as aforesaid, the Engineer-in-Charge shall have the power to provide the amenities here-in-before mentioned at the cost of the contractor(s).

The contractor(s) shall erect, make and maintain at his/their own expense to approved standards all necessary huts and sanitary arrangements required for his/their work-people on the site in connection with the execution of the works, and if the same shall not have been erected or constructed, according to approved standards, the Engineer-in-Charge shall have power to give notice in writing to the contractor(s) requiring that the said huts and sanitary arrangements be remodeled and/or reconstructed according to approved standard, and if the contractor(s) shall fail to remodel or reconstruct such huts and sanitary arrangements according to approved standards within the period specified in the notice, the Engineer-in-Charge shall have the power to remodel or reconstruct such huts and sanitary arrangements according to approved standards at the cost of the contractor(s).

CLAUSE 19H: PROVIDING HUTMENTS, W/S, S/I, DRAINAGE, SANITATIONS ETC. FOR WORKERS: The contractor(s) shall at his/their own cost provide his/their labour with a sufficient number of huts (hereinafter referred to as the "camp") of the following specifications on a suitable plot of land to be approved by the Engineer-in-Charge.

1. a) The minimum height of each hut at the eaves level shall be 2.10 m. (7 ft.) and the floor area to be provided will be at the rate of 2.7 Sq.m. (30 sq.ft.) for each member of the worker's family staying with the labourer.

b) The contractor(s) shall in addition construct suitable cooking places having a minimum area of 1.80 m. x 1.50 m (6' X 5') adjacent to the hut for each family.

c) The contractor(s) shall also construct temporary latrines and urinals for the use of the labourers each on the scale of not less than four per each one hundred of the total strength, separate latrines and urinals being provided for women.

d) The contractor(s) shall construct sufficient number of bathing and washing places, one unit for every 25 persons residing in the camp. These bathing and washing places shall be suitably screened.

2. a) All the huts shall have walls of sun-dried or burnt-bricks laid in mud mortar or other suitable local materials as may be approved by the Engineer-in-Charge. In case of sun dried bricks, the walls should be plastered with mud gobi on both sides. The floor may be katcha but plastered with mud gobi and shall be at least 15 cm. (6") above the surrounding ground. The roofs shall be laid with thatch or any other materials as may be approved by the Engineer-in-Charge and the contractor shall ensure that throughout the period of their occupation the roofs remain water-tight.

b) The contractor(s) shall provide each hut with proper ventilation.

c) All doors, windows and ventilators shall be provided with suitable leaves for security purposes.

d) There shall be kept an open space of at least 7.2 m (18 yards) between the rows of huts which may be reduced to 6 m (20 ft.) according to the availability of site with approval of the Engineer-in-Charge. Back to back construction will be allowed.

3. **Water Supply :** The contractor(s) shall provide adequate supply of water for the use of labourers. The provision shall not be less than 10 Ltrs. two gallons of pure and wholesome water per head per day for drinking purposes and 15 Ltrs. three gallons of clean water per head per day for bathing and washing purposes. Where piped water supply is available, supply shall be at stand posts and where the supply is from wells or rivers, tanks, which may be of metal or masonry, shall be provided. The contractor(s) shall also at his/their own cost make arrangements for laying pipe lines for water supply to his/their labour camp from the existing mains wherever available, and shall pay all fees and charges therefore.

4. The site selected for the camp shall be high ground, removed from jungle.

5. **Disposal of Excreta :** The contractor(s) shall make necessary arrangements for the disposal of excreta from the latrines by trenching or incineration which shall be according to the requirements laid down by the Local Health Authorities. If trenching or incineration is not allowed, the contractor(s) shall make arrangements for the removal of the excreta through the Municipal Committee/authority and inform it about the number of labourers employed so that arrangements may be made by such committee/authority for the removal of the excreta. All charges on this account shall be borne by the contractor and paid direct by him to the Municipality/authority. The contractor shall provide one sweeper for every 8 seats in case of dry system.

6. **Drainage :** The contractor(s) shall provide efficient arrangements for draining away sullage water so as to keep the camp neat and tidy.

7. The contractor(s) shall make necessary arrangements for keeping the camp area sufficiently lighted to avoid accidents to the workers.

8. **Sanitation :** The contractor(s) shall make arrangements for conservancy and sanitation in the labour camps according to the rules of the Local Public Health and Medical Authorities.

Clause 19 I : REMOVAL OF INCOMPETENT WORKERS

The Engineer-in-Charge may require the contractor to dismiss or remove from the site of the work any person or persons in the contractors' employ upon the work who may be incompetent or misconduct himself and the contractor shall forthwith comply with such requirements. In respect of maintenance / repair or renovation works etc. where the labour have an easy access to the individual houses, the contractor shall issue identity cards to the labourers, whether temporary or permanent and he shall be responsible for any untoward action on the part of such labour. AE / JE will display a list of contractors working in the colony / Blocks on the notice board in the colony and also at the service center, to apprise the residents about the same.

CLAUSE 19J : NO PART OF BUILDING TO BE OCCUPIED- ACTION ON BREACH THEREOF : It shall be the responsibility of the contractors to see that the building under construction is not occupied by anybody unauthorisedly during construction and is handed over to the Engineer-in-Charge with vacant possession of complete building. If such building though completed, is occupied illegally, then the Engineer-in-Charge will have the option to refuse to accept the said building/buildings in that position. Any delay in acceptance on this account will be treated as delay in completion and for such delay, a levy upto 5% of tendered value of work may be imposed by the- Superintending Engineer whose decision shall be final both with regard to the justification and quantum and be binding on the contractor.

However the Superintending Engineer, through a notice may require the contractor through a notice to remove the illegal occupation any time on or before construction and delivery.

CLAUSE 19 K: EMPLOYMENT OF SKILLED/SEMI-SKILLED WORKERS:

The contractor shall, at all stages of work, deploy skilled/semi skilled tradesman who are qualified and possess certificate in particular trade from BARC/DAE Training/Industrial Training Institute/National Institute of construction management & Research (NICMAR)/National Academy of Construction, CIDC or any similar reputed and recognized Institute managed/certified by State/Central Government. The number of such qualified tradesmen shall not be less than 20% of total skilled/semi skilled workers required in each trade at any stage of work. The contractor shall submit number of man days required in respect of each trade, its scheduling and the list of qualified tradesmen along with requisite certificate from recognized Institute to Engineer in charge for approval. Notwithstanding such approval, if the tradesmen are found to have inadequate skill to execute the work of respective trade, the contractor shall substitute such tradesmen within two days of written notice from Engineer in charge. Failure on the part of contractor to obtain approval of Engineer-in-Charge or failure to deploy qualified tradesman will attract a compensation to be paid by the contractor at the rate of Rs. 100/- per such tradesman per day. Decision of Engineer in charge as to whether particular tradesman possesses requisite skill and amount of compensation in case of default shall be final and binding.

Provided always, that the provisions of this clause, shall not be applicable for works with estimated cost put to tender being less than Rs.5 Crores.

CLAUSE 20 : MINIMUM WAGES ACT TO BE COMPILED WITH :

The contractor shall comply with all the provisions of the Minimum Wages Act, 1948, and Contract Labour (Regulation and Abolition) Act, 1970, amended from time to time and rules framed thereunder and other labour laws affecting contract labour that may be brought into force from time to time.

CLAUSE 21 : WORK NOT TO BE SUB-LET / ACTION IN CASE OF INSOLVENCY :

The contract shall not be assigned or sub-let without the written approval of the Engineer-in-Charge. And if the contractor shall assign or sub-let his contract, or attempt so to do, or become insolvent or commence any insolvency proceedings or make any composition with his creditors or attempt so to do, or if any bribe, gratuity, gift, loan, perquisite, reward or advantage pecuniary or otherwise, shall either directly or indirectly, be given, promised or offered by the contractor, or any of his servants or agent to any public officer or person in the employ of Government in any way relating to his office or employment, or if any such officer or person shall become in any way directly or indirectly interested in the contract, the Engineer-in-Charge on behalf of the President of India shall have power to adopt any of the courses specified in Clause 3 here of in the interest of Government and in the event of any such courses being adopted the consequences specified in the said Clause 3 shall ensue.

CLAUSE 22 : SUMS PAYABLE BY WAY OF COMPENSATION :

All sums payable by way of compensation under any of these conditions shall be considered as reasonable compensation to be applied to the use of Government without reference to the actual loss or damage sustained, and whether or not any damage shall have been sustained.

CLAUSE 23 : CHANGES IN FIRM'S CONSTITUTION TO BE INTIMATED :

Where the contractor is a partnership firm, the previous approval in writing of the Engineer-in-Charge shall be obtained before any change is made in the constitution of the firm. Where the contractor is an individual or a Hindu undivided family business concern such approval as aforesaid shall likewise be obtained before the contractor enters into any partnership agreement whereunder the partnership firm would have the right to carry out the works hereby undertaken by the contractor. If previous approval as aforesaid is not obtained, the contract shall be deemed to have been assigned in contravention of Clause 21 hereof and the same action may be taken, and the same consequence shall ensue as provided in the said Clause 21.

CLAUSE 24 : WORKS TO BE UNDER DIRECTION OF ENGINEER-IN-CHARGE :

All works to be executed under the contract shall be executed under the direction and subject to the approval in all respects of the Engineer-in-Charge who shall be entitled to direct at what point or points and in what manner they are to be commenced, and from time to time carried on.

CLAUSE 25 Settlement of Disputes & Arbitration

Except where otherwise provided in the contract, all questions and disputes relating to the meaning of the specifications, design, drawings and instructions here-in before mentioned and as to the quality of workmanship or materials used on the work or as to any other question, claim, right, matter or thing whatsoever in any way arising out of or relating to the contract, designs, drawings, specifications, estimates, instructions, orders or these conditions or otherwise concerning the works or the execution or failure to execute the same whether arising during the progress of the work or after the cancellation, termination, completion or abandonment thereof shall be dealt with as mentioned hereinafter :

i) If the contractor considers any work demanded of him to be outside the requirements of the contract, or disputes any drawings, record or decision given in writing by the Engineer-in-Charge on any matter in connection with or arising out of the contract or carrying out of the work, to be unacceptable, he shall promptly within 15 days request the Superintending Engineer in writing for written instruction or decision. Thereupon, the Superintending Engineer shall give his written instructions or decision within a period of one month from the receipt of the contractor's letter.

If the Superintending Engineer fails to give his instructions or decision in writing within the aforesaid period or if the contractor is dissatisfied with the instructions or decision of the Superintending Engineer, the contractor may, within 15 days of the receipt of Superintending Engineer's decision, appeal to the Chief Engineer who shall afford an opportunity to the contractor to be heard, if the latter so desires, and to offer evidence in support of his appeal. The Chief Engineer shall give his decision within 30 days of receipt of contractor's appeal. If the contractor is dissatisfied with this decision, the contractor shall within a period of 30 days from receipt of the decision, give notice to the Chief Engineer for appointment of arbitrator on prescribed performa as per Appendix XV, as given below : failing which the said decision shall be final binding and conclusive and not referable to adjudication by the arbitrator.

Notice for appointment of Arbitrator
[Refer Clause 25]

To
The Chief Engineer
Architecture & Civil Engineering Division
BARC, Trombay,
Mumbai 400 085

Dear Sir,

In terms of clause 25 of the agreement, particulars of which are given below, I / We hereby give notice to you to appoint an arbitrator for settlement of disputes mentioned below:

1. Name of applicant
2. Whether applicant is Individual / Prop. Firm / Partnership firm / Ltd. Co.
3. Full address of the applicant
4. Name of the work and contract number in which arbitration sought
5. Name of Division which entered into contract
6. Contract amount in the work
7. Date of contract
8. Date of initiation of work
9. Stipulated date of completion of work
10. Actual date of completion of work (if completed)
11. Total number of claims made
12. Total amount claimed
13. Date of intimation of final bill (if work is completed)
14. Date of payment of final bill (if work is completed)
15. Amount of final bill (if work is completed)
16. Date of request made to SE for decision
17. Date of receipt of SE's decision
18. Date of appeal to you
19. Date of receipt of your decision

Specimen signatures of the applicant
(only the person / authority who signed
The contract should sign)

I / We certify that the information given above is true to the best of knowledge. I / We enclose following documents.

1. Statement of claims with amount of claims
- 2.
- 3.

Yours faithfully,

(Signatures)

Copy in duplicate to:

1. The Project Engineer
Arch. & Civil Engg. Divn., BARC
2. The Superintending Engineer
Arch. & Civil Engg. Divn., BARC

ii) Except where the decision has become final, binding and conclusive in terms of Sub Para (i) above, disputes or difference shall be referred for adjudication through arbitration by a sole arbitrator appointed by Director, BARC, in respect of the contract entered in to by any subordinate authority under him. However, if the contract is entered into by Director BARC, the arbitrator shall be appointed by the Department of Atomic Energy.. If the arbitrator so appointed is unable or unwilling to act or resigns his appointment or vacates his office due to any reason whatsoever, another sole arbitrator shall be appointed in the manner aforesaid. Such person shall be entitled to proceed with the reference from the stage at which it was left by his predecessor.

It is a term of the contract that the party invoking arbitration shall give a list of disputes with amounts claimed in respect of each such dispute alongwith the notice for appointment of arbitrator and giving reference to the rejection by the Chief Engineer of the appeal.

It is also a term of this contract that no person other than a person appointed as aforesaid, should act as arbitrator and if for any reason that is not possible, the matter shall not be referred to arbitration at all.

It is also a terms of the contract that if the contractor does not make any demand for appointment of arbitrator in respect of any claims in writing as aforesaid within 120 days of receiving the intimation from the Engineer-in-Charge that the final bill is ready for payment , the claim of the contractor shall be deemed to have been waived and absolutely barred and the Government shall be discharged and released of all liabilities under the contract in respect of these claims.

The arbitration shall be conducted in accordance with the provisions of the Arbitration and Conciliation Act, 1996, (26 of 1996) or any statutory modifications or re-enactment thereof and the rules made thereunder and for the time being in force shall apply to the arbitration proceeding under this clause.

It is also a term of this contract that the arbitrator shall adjudicate on only such disputes as are referred to him by the appointing authority and give separate award against each dispute and claim referred to him and in all cases where the total amount of the claims by any party exceeds Rs.1,00,000/- the arbitrator shall give reasons for the award.

It is also a term of the contract that if any fees are payable to the arbitrator, these shall be paid equally by both the parties.

It is also a term of the contract that the arbitrator shall be deemed to have entered on the reference on the date he issues notice to both the parties calling them to submit their statement of claims and counter statement of claims. The venue of the arbitration shall be such place as may be fixed by the arbitrator in his sole discretion. The fees, if any, of the arbitrator shall, if required to be paid before the award is made and published, be paid half and half by each of the parties. The cost of the reference and of the award (including the fees, if any, of the arbitrator) shall be in the discretion of the arbitrator who may direct to any by whom and in what manner, such costs or any part thereof shall be paid and fix or settle the amount of costs to be so paid.

CLAUSE 25A : DELETED.

CLAUSE 26 : CONTRACTOR TO INDEMNIFY GOVT. AGAINST PATENT RIGHTS:

The contractor shall fully indemnify and keep indemnified the President of India against any action, claim or proceeding relating to infringement or use of any patent or design or any alleged patent or design rights and shall pay any royalties which may be payable in respect of any article or part thereof included in the contract. In the event of any claims made under or action brought against Government in respect of any such matters as aforesaid, the contractor shall be immediately notified thereof and the contractor shall be at liberty, at his own expense, to settle any dispute or to conduct any litigation that may arise therefrom. Provided that the contractor shall not be liable to indemnify the President of India in if the infringement of the patent or design or any alleged patent or design right is the direct result of an order passed by the Engineer-in-Charge in this behalf.

CLAUSE 27: LUMP SUM PROVISIONS IN TENDER:

When the estimate on which a tender is made includes lump sums in respect of parts of the work the contractor shall be entitled to payment in respect of the items of work involved or the part of the work in question at the same rates, as are payable under this contract for such item, or if the part of the work in question is not, in the opinion of the Engineer-in-charge payable of measurement, the Engineer-in-Charge may at his discretion pay the lump sum amount entered in the estimate, and the certificate in writing of the Engineer-in-Charge shall be final and conclusive against the contractor with regard to any sum or sums payable to him under the provisions of the clause.

CLAUSE 28 : ACTION WHERE NO SPECIFICATIONS ARE SPECIFIED :

In the case of any class of work for which there is no such specifications as referred to in Clause 11, such work shall be carried out in accordance with the Bureau of Indian Standards Specifications. In case there are no such specifications in Bureau of Indian Standards, the work shall be carried out as per manufacturer's specifications, if not available then as per District Specifications. In case there are no such specifications as required above the work shall be carried out in all respects in accordance with the instructions and requirements of the Engineer-in-Charge.

CLAUSE 29 : WITH HOLDING AND LIEN IN RESPECT OF SUMS DUE FROM CONTRACTOR :

1) Whenever any claim or claims for payment of a sum of money arises out of or under the contract or against the contractor, the Engineer-in-Charge or the Government shall be entitled to withhold and also have a lien to retain such sum or sums in whole or in part from the security, if any deposited by the contractor and for the purpose aforesaid, the Engineer-in-Charge or the Government shall be entitled to withhold the security deposit, if any, furnished as the case may be and also have a lien over the same pending finalisation or adjudication of any such claim. In the event of the security being insufficient to cover the claimed amount or amounts or if no security has been taken from the contractor, the Engineer-in-Charge or the Government shall be entitled to withhold and have a lien to retain to the extent of such claimed amount or amounts referred to above, from any sum or sums found payable or which at any time thereafter may become payable to the contractor under the same contract or any other contract with the Engineer-in-Charge or the Government or any contracting person through the Engineer-in-Charge pending finalization or adjudication of any such claim.

It is an agreed term of the contract that the sum of money or moneys so withheld or retained under the lien referred to above, by the Engineer-in-Charge or Government will be kept withheld or retained as such by the Engineer-in-Charge or Government till the claim arising out of or under the contract is determined by the Arbitrator, (if the contract is governed by the arbitration clause) by the competent court, as the case may be, and that the contractor will have no claim for interest or damages whatsoever on any account in respect of such withholding or retention under the lien referred to above and duly notified as such to the contractor. For the purpose of this clause, where the contractor is a partnership firm or a limited company, the Engineer-in-Charge or the Government shall be entitled to withhold and also have a lien to retain towards such claimed amount or amounts in whole or in part from any sum found payable to any partner/limited company as the case may be, whether in his individual capacity or otherwise.

2) Government shall have the right to cause an audit and technical examination of the works and the final bills of the contractor including all supporting vouchers, abstract, etc. to be made after payment of the final bill and if as a result of such audit and technical examination, any sum found to have been over paid in respect of any work done by the contractor under the contract or any work claimed to have been done by him under the contract and found not to have been executed, the contractor shall be liable to refund the amount of over-payment and it shall be lawful for Government to recover the same from him in the manner prescribed in sub-clause (1) of this clause or in any other manner legally permissible, and if it is found that the contractor was paid less than what was due to him under the contract in respect of any work executed by him under it, the amount of such under-payment shall be duly paid by Government to the contractor, without any interest thereon whatsoever.

Provided that Government shall not be entitled to recover any sum over-paid, nor the contractor shall be entitled to payment of any sum paid short where such payment has been agreed upon between the Superintending Engineer or Executive Engineer on the one hand and the contractor on the other under any terms of the contract permitting payment for work after assessment by the Superintending Engineer or the Executive Engineer

CLAUSE 29A : LIEN IN RESPECT OF CLAIMS IN OTHER CONTRACTS : Any sum of money due and payable to contractor (including the security deposit returnable to him) under the contract may be withheld or retained by way of lien by the Engineer-in-Charge or the Government or any other contracting person or persons through Engineer-in-Charge against any claim of the Engineer-in-Charge or Government or such other person or persons in respect of payment of a sum of money arising out of or under any other contract made by the contractor with the Engineer in-charge or the Government or with such other person or persons.

It is an agreed term of the contract that the sum of money so withheld or retained under this clause by the Engineer-in-Charge or the Government will be kept withheld or retained as such by the Engineer-in-Charge or the Government or till his claim arising out of in the same contract or any other contract is either mutually settled or determined by the arbitration clause or by the competent court, as the case may be, and that the contractor shall have no claim for interest or damage whatsoever on this account or on any other ground in respect of any sum of money withheld or retained under this clause and duly notified as such to the contractor.

CLAUSE 30 : Deleted.

CLAUSE 31 : SUPPLY OF UNFILTERED WATER

The contractor(s) shall make his/their own arrangements for water required for the work and nothing extra will be paid for the same. This will be subject to the following conditions.

- (i) That the water used by the contractor(s) shall be fit for the construction purposes to the satisfaction of the Engineer-In-Charge.
- (ii) The engineer In Charge shall make alternative arrangements for supply of water at the risk and cost of contractor(s) if the arrangements made by the contractor(s) for the procurement of water are in the opinion of the Engineer In Charge, unsatisfactory.

CLAUSE 31A : Departmental water supply, if available.

Water if available may be supplied to the contractor by the department subject to the following conditions:- as per Schedule-A (Schedule of materials to be supplied by the Department).

- (i) The water charges @ 1% shall be recovered on gross amount of the work done.
- (ii) The contractor(s) shall make his/their own arrangement of water connection and laying of pipe lines from existing main of source of supply.
- (iii) The department do not guarantee to maintain uninterrupted supply of water and it will be incumbent on the contractor(s) to make alternative arrangements for water at his/their own cost in the event of any temporary break down in the Government water main so that the progress of his/their work is not held up for want of water. No claim of damage or refund of water charges will be entertained on account of such break down.

CLAUSE 32 : ALTERNATE WATER ARRANGEMENT

- (i) Where there is no piped water supply arrangement and the water is taken by the contractor from the wells or hand pump constructed by the Government, no charge shall be recovered from the contractor on that account. The contractor shall, however, draw water at such hours of the day that it does not interfere with the normal use for which the hand pump and wells are intended. He will also be responsible for all damages and abnormal repairs arising out of his use, the cost of which shall be recoverable from him. The Engineer In Charge shall be the final authority to determine the cost recoverable from the contractor on this account and his decision shall be binding on the contractor.

(ii) The contractor shall be allowed to construct temporary wells in Government land for taking water for construction purposes only after he has got permission of the Engineer In Charge in writing. No charges shall be recovered from the contractor on this account, but the contractor shall be required to provide necessary safety arrangements to avoid any accidents or damages to adjacent buildings, roads and service lines. He shall be responsible for any accidents or damage caused due to the construction and subsequent maintenance of the wells and shall restore the ground to its original condition after the wells are dismantled on completion of work.

CLAUSE 33 : RETURN OF SURPLUS MATERIALS - ACTION TO BE TAKEN :

Notwithstanding anything contained to the contrary in this contract, where any materials for the execution of the contract are procured with the assistance of Government either by issue from Government stocks or purchase made under orders or permits or licenses issued by Government, the contractor shall hold the said materials economically and solely for the purpose of the contract and not dispose of them without the written permission of the Government and return, if required by the Engineer-in-Charge, all surplus or unserviceable materials that may be left with him after the completion of the contract or at its termination for any reason whatsoever on being paid or credited such price as the Engineer-in-Charge shall determine having due regard to the condition of the materials. The price allowed to the contractor however, shall not exceed the amount charged to him excluding the element of storage charges. The decision of the Engineer-in-Charge shall be final and conclusive. In the event of breach of the aforesaid condition the contractor shall in addition to throwing himself open to action for contravention of the terms of the licence or permit and/or for criminal breach of trust, be liable to Government for all moneys, advantages or profits resulting or which in the usual course would have resulted to him by reason of such breach.

CLAUSE 34 : Hire of plant and machinery :

(i) The contractor shall arrange at his own expense all tools, plant, machinery and equipment (hereafter referred to as T&P) required for execution of the work except for the Plant and Machinery listed in Schedule-C and stipulated for issue to the contractor. If the contractor requires any item of T&P on hire from the T&P available with the Government over and above the T&P stipulated for issue, the Government will, if such item is available, hire it to the contractor at rates to be agreed upon between him and the Engineer In Charge. In such a case, all the conditions here under for issue of T&P shall also be applicable to such T&P as is agreed to be issued.

(ii) Plant and Machinery when supplied on hire charges shown in Schedule-C shall be made over and taken back at the departmental equipment yard /shed shown in Schedule-C and the contractor shall bear the cost of carriage from the place of issue to the site of work and back. The contractor shall be responsible to return the plant and machinery with condition in which it was handed over to him, and he shall be responsible for all damage caused to the said plant and machinery at the site of work or elsewhere in operation and otherwise during transit including damage to or loss of plant and for all losses due to his failure to return the same soon after the completion of the work for which it was issued. The Divisional Engineer shall be the sole judge to determine the liability of the contractor and its extent in this regard and his decision shall be final and binding on the contractor.

(iii) The plant and machinery as stipulated above will be issued as and when available and if required by the contractor. The contractor shall arrange his programme of work according to the availability of the plant and machinery and no claim, whatsoever, will be entertained from him for any delay in supply by the department.

(iv) The hire charges shall be recovered at the prescribed rates from and inclusive of the date the plant and machinery made over up to and inclusive of the date of the return in good order even though the same may not have been working for any cause except major break down due to no fault of the contractor or faulty use requiring more than three working days continuously (excluding intervening holidays and Sundays) for bringing the plant in order. The contractor shall immediately intimate in writing to the Engineer In Charge when any plant or machinery gets out of order requiring major repairs as aforesaid. The Engineer In Charge shall record the date and time of receipt of such intimation in the log sheet of the plant or machinery. Based on this if the break down before lunch period or major break down will be computed considering half a day's break down on the day of complaint. If the break down occurs in the post lunch period of major break down will be computed starting from the next working day. In case of any dispute under this clause, the decision of the Superintending Engineer shall be final and binding on the contractor.

(v) The hire charges shown above are for each day of 8 hours (inclusive of the one hour of lunch break) or part thereof.

(vi) Hire charges will include service of the operating staff as required and also supply of lubricating oil and stores for cleaning purposes. Power fuel of approved type, fire wood, kerosene oil etc. for running the plant and machinery and also the full time chowkidar for guarding the plant and machinery against any loss or damage shall be arranged by the contractor who shall be full responsible for the safeguard and security of the plant and machinery. The contractor shall on or before the supply of plant and machinery sign an agreement indemnifying the Department against any loss or damage caused to the plant and machinery either during transit or site of work.

(vii) Ordinarily, no plant and machinery shall work for more than 8 hours a day inclusive of one hour lunch break. In case of an urgent work however, the Engineer In Charge may, at his discretion, allow the plant and machinery to be worked for more than normal period of 8 hours a day. In that case, the hourly hire charges for over time to be borne by the contractors shall be 50% more than the normal proportionate hourly charges (1/8 th of the daily charges) subject to a minimum half day's normal charges on any particular day. For working out hire charges for over time, a period of half an hour and above will be charged as one hour and a period of less than half an hour will be ignored.

(viii) The contractor shall release the plant and machinery every seventh day for periodical servicing and/or wash out which may take about three to four hours or more. Hire charges for full day shall be recovered from the contractor for the day of servicing/ wash out irrespective of the period employed in servicing.

(ix) The plant and machinery once issued to the contractor shall not be returned by him on account of lack of arrangements of labour and materials, etc. on his part, the same will be returned only when they are required for major repairs or when in the opinion of the Engineer-in-Charge, the work or a portion of work for which the same was issued is completed.

(x) Log Book for recording the hours of daily work for each of the plant and machinery supplied to the contractor will be maintained by the Department and will be countersigned by the contractor or his authorized agent daily. In case the contractor contests the correctness of the entries and/or fails to sign the Log Book, the decision of the Engineer-in-Charge shall be final and binding on him. Hire charges will be calculated according to the entries in the Log Book and will be binding on the contractor. Recovery on account of hire charges for road rollers shall be made for the minimum number of days worked out on the assumption that a roller can consolidate per day and maximum quantity of materials or area surfacing as noted against each in the annexed statement (see attached annexure).

(xi) In the case of concrete mixers, the contractors shall arrange to get the hopper cleaned and the drum washed at the close of the work each day or each occasion.

(a) In case rollers for consolidation are employed by the contractor himself, log book for such rollers shall be maintained in the same manner as is done in case of departmental rollers, maximum quantity of any items to be consolidated for each roller-day shall also be same as in Annexure to Clause 34(x). For less use of rollers, recovery for the less roller days shall be made at the stipulated issue rate.

(xii) The contractor shall be responsible to return the plant and machinery in the condition in which it was handed over to him and he shall be responsible for all damage caused to the said plant and machinery at the site of work or elsewhere in operation or otherwise or during transit including damage to or loss of parts, and for all losses due to his failure to return the same soon after the completion of the work for which it was issued. The Divisional Engineer shall be the sole judge to determine the liability of the contractor and its extent in this regard and his decision shall be final and binding on the contractor.

(xiii) The contractor will be exempted from levy of any hire charges for the number of days is called upon in writing by the Engineer In Charge to suspend execution of the work, provided Government plant and machinery in question have, in fact, remain idle with the contractor because of the suspension.

(xiv) In the event of the contractor not requiring any item of plant and machinery issued by Government though not stipulated for issue in Schedule 'C' any time after taking delivery at the place of issue, he may return it after two days written notice or at any time without notice if he agrees to pay hire charges for two additional days without, in anyway, affecting the right of the Engineer-in-Charge to use the said plant and machinery during the said period of two days as he likes including hiring out to a third party.

CLAUSE 35 : Use of asphaltic materials :

(i) The contractor undertakes to make arrangement for the supervision of the work by the firm supplying the tar or bitumen used.

(ii) The contractor shall collect the total quantity of tar or bitumen required for the work as per standard formula, before the process of painting is started and shall hypothecate it to the Engineer-in-Charge. If any bitumen or tar remains unused on completion of the work on account of lesser use of materials in actual execution for reasons other than authorized changes of specifications and abandonment of portion of work, a corresponding deduction equivalent to the cost of unused materials as determined by the Engineer-in-Charge shall be made and the material return to the contractors. Although the materials are hypothecated to Government, the contractor undertakes the responsibility for their proper watch, safe custody and protection against all risks. The materials shall not be removed from site of work without the consent of the Engineer-in-Charge in writing.

(iii) The contractor shall be responsible for rectifying defects noticed within a year from the date of completion of the work and the portion of the security deposit relating to asphaltic work shall be refunded after the expiry of this period.

CLAUSE 36. – Employment of Technical Staff and Employees

Contractors & Superintendence, Supervision, Technical staff & Employees

i) The contractor shall provide all necessary superintendence during execution of the work and all long thereafter as may be necessary for proper fulfilling of the obligations under the contract.

The contractor shall immediately after receiving letter of acceptance of the tender and before commencement of the work, intimate in writing to the Engineer-in-Charge the name(s), qualifications, experience, age, address(s) and other particulars along with certificates, of the principal technical representative to be in charge of the work and other technical representative(s) who will be supervising the work. Minimum requirements of such technical representative(s) and their qualifications and experience shall not be lower than specified in Schedule "F". The Engineer-in-Charge shall within 3 days of receipt of such communication intimate in writing his approval or otherwise of such a representative(s) to the contractor. Any such approval may at any time be withdrawn and in case of such withdrawal, the contractor shall appoint another such representative(s) according to the provisions of this Clause. Decision of the tender accepting authority shall be final and binding on the contractor in this respect. Such a principal technical representative and other technical representative(s) shall be appointed by the contractor soon after receipt of the approval from Engineer-in-Charge and shall be available at site ~~within~~ before start of work.

All the provisions applicable to the principal technical representative under the Clause will also be applicable to other technical representative(s). The principal technical representative and other technical representative(s) shall be present at the site of work for supervision at all times when any construction activity is in progress and also present himself / themselves as required to the engineer-in-charge and / or his designated representative to take instructions. Instructions given to the principal technical representative or other technical representative(s) shall be deemed to have the same force as if these have been given to the contractor. The principal technical representative and other technical representative(s) shall be actually available at site fully during all stages of execution of work, during recording / checking / test checking of measurements of work and whenever so required by the Engineer – in- charge and shall also note down instructions conveyed by Engineer –in-charge or his designated representative(s) in the site order book and shall affix his/their signature in token of noting down the instructions and in token of acceptance of measurements /checked measurement /test checked measurements. The representative(s) shall not look after any other work. Substitutes, duly approved by Engineer-in-Charge of the work in similar manner as aforesaid shall be provided in the event of absence of any of the representative(s) by more than two days.

If the Engineer-in-Charge, whose decision in this respect is final and binding on the contractor, is convinced that no such technical representative(s) is/ are effectively appointed or is/are effectively attending or fulfilling the provision of this clause, a recovery (non-refundable) shall be effected from the contractor as specified in Schedule “F” and the decision of the Engineer-in-Charge as recorded in the site order book and measurement recorded checked /test checked in Measurement Books shall be final and binding on the contractor. Further if the contractor fails to appoint a suitable technical Principal technical representative and /or other technical representative(s) and if such appointed persons are not effectively present or are absent by more than two days without duly approved substitute or do not discharge their responsibilities satisfactorily, the Engineer-in-Charge shall have full powers to suspend the execution of the work until such date as a suitable other technical representative(s) is /are appointed and the contractor shall be held responsible for the delay so caused to the work. The contractor shall submit a certificate of employment of the technical representative(s) alongwith every on account bill / final bill and shall produce evidence if at any time so required by the Engineer-in-Charge.

ii) The contractor shall provide and employ on the site only such technical assistants as are skilled and experienced in their respective fields and such foremen and supervisory staff as are competent to give proper supervision to the work.

The contractor shall provide and employ skilled, semiskilled and unskilled labour as is necessary for proper and timely execution of the work.

The Engineer-in-Charge shall be at liberty to object to and require the contractor to remove from the works any person who in his opinion misconducts himself, or is incompetent or negligent in the performance of his duties or whose employment is otherwise considered by the Engineer-in-Charge to be undesirable. Such person shall not be employed again at works site without the written permission of the Engineer-in-Charge and the persons so removed shall be replaced as soon as possible by competent substitutes.

CLAUSE 37 : LEVY/TAXES PAYABLE BY CONTRACTOR :

Sales Tax / VAT (except Service Tax for which exemption certificate shall be provided by BARC), Building and other Construction Workers Welfare Cess or any other tax or cess in respect of this contract shall be payable by the contractor and Government shall not entertain any claim whatsoever in this respect. However, in respect of service tax, in consultancy contract the same shall be paid by the contractor/consultant to the concerned department on demand and it will be reimbursed to him by the Engineer-in-Charge after satisfying that it has been actually and genuinely paid by the contractor.

ii) The contractor shall deposit royalty and obtain necessary permit for supply of the red bajri, stone, kankar etc. from local authorities.

iii) If pursuant to or under any law, notification or order any royalty, cess or the like becomes payable by the Government of India and does not any time become payable by the contractor to the State Government. Local authorities in respect of any material used by the contractor in the works then in such a case, it shall be lawful to the Government of India and it will have the right and be entitled to recover the amount paid in the circumstances as aforesaid from dues of the contractor.

CLAUSE 38: CONDITIONS FOR REIMBURSEMENT OF LEVY/TAXES IF LEVIED AFTER RECEIPT OF TENDERS

- (i) All tendered rates shall be inclusive of all taxes and levies (except Service Tax) payable under respective statutes. However, if any further tax or levy is imposed by Statute, after the last stipulated date for the receipt of tender including extensions, if any and the contractor thereupon necessarily and properly pays such taxes/levies, the contractor shall be reimbursed the amount so paid, provided such payments, if any, is not, in the opinion of the Superintending Engineer (whose decision shall be final and binding on the contractor) attributable to delay in execution of work within the control of the contractor.
- (ii) The contractor shall keep necessary books of accounts and other documents for the purpose of the condition as may be necessary and shall allow inspection of the same by a duly authorized representative of the Government and/or the Engineer-in-Charge and further shall furnish such other information/document as the Engineer-in-Charge may require from time to time.
- (iii) The contractor shall within a period of 30 days of the imposition of any such further tax or levy or cess give a written notice thereof to the Engineer-in-Charge that the same is given pursuant to this condition, together with all necessary information relating thereto.

CLAUSE 39 : TERMINATION OF CONTRACT ON DEATH OF CONTRACTOR :

Without prejudice to any of the rights or remedies under this contract, if the contractor dies, the Divisional Officer on behalf of the President shall have the option of terminating the contract without compensation to the contractor.

CLAUSE 40 : IF RELATION WORKING IN DAE, THEN CONTRACTOR NOT ALLOWED TO TENDER :

The contractor shall not be permitted to tender for works in the **Bhabha Atomic Research Centre**, (Responsible for award and execution of contracts) in which his near relative is posted as AO/AAO or as an officer in any capacity between the grades of Superintending Engineer to Scientific Assistant (Both inclusive) . He shall also intimate the names of persons who are working with him in any capacity or are subsequently employed by him and who are near relatives to any Gazetted Officer in the Bhabha Atomic Research Centre. Any breach of this condition by the contractor would render him liable to be removed from the approved list of contractors of this Department.

NOTE : By the term ‘near relative’ is meant wife, husband, parents and grandparents, children and grand children, brothers and sisters, uncles, aunts and cousins and their corresponding in-laws.

CLAUSE 41 : NO OFFICER ALLOWED AS A CONTRACTOR TILL 1 YEAR OF RETIREMENT :

No Engineer of gazetted rank or other gazetted officer employed in Engineering or administrative duties in an Engineering Department of the Government of India shall work as a contractor or employee of a contractor for a period of one year after his retirement from Government Service without the previous permission of Government of India in writing. This contract is liable to be cancelled if either the contractor or any of his employee is found at any time to be such a person who had not obtained the permission of Government of India as aforesaid, before submission of the tender or engagement in the contractors service as the case may be.

CLAUSE 42 : RETURN OF MATERIALS AND RECOVERY FOR EXCESS MATERIALS ISSUED :

- (i) After completion of the work and also at any intermediate stage in the event of non reconciliation of materials issued, consumed and in balance – (see Clause 10), theoretical quantity of materials issued by the Government for use in the work shall be calculated on the basis and method given hereunder:-

- (a) Quantity of cement & bitumen shall be calculated on the basis of quantity of cement & bitumen required for different items of work as shown in the Schedule of Rates mentioned in Schedule 'F'. In case any item is executed for which standard constants for the consumption of cement or bitumen are not available in the above mentioned schedule / statement or cannot be derived from the same shall be calculated on the basis of standard formula to be laid down by the Engineer-in-Charge.
 - (b) Theoretical quantity of steel reinforcement or structural steel sections shall be taken as the quantity required as per design or as authorized by Engineer-in-Charge, including authorized lappings, chairs, etc. plus 3% wastage due to cutting into pieces, such theoretical quantity being determined and compared with the actual issues each diameter wise, section wise and category wise separately.
 - (c) Theoretical quantity of G.I. & C.I. or other pipes, conduits, wires and cables, pig lead and G.I. / M.S. sheets shall be taken as quantity actually required and measured plus 5% for wastage due to cutting into pieces (except in the case of G.I./ M.S. sheets it shall be 10%), such determination & comparison being made diameterwise & categoriwise.
 - (d) For any other materials as per actual requirements.
- (ii) Over the theoretical quantities of materials so computed a variation shall be allowed as specified in Schedule 'F'. The difference in the net quantities of material actually issued to the contractor and the theoretical quantities including such authorized variation, if not returned by the contractor or if not fully reconciled to the satisfaction of the Engineer-in-Charge within fifteen days of the issue of written notice by the Engineer-in-Charge to this effect shall be recovered at the rates specified in Schedule 'F', without prejudice to the provision of the relevant conditions regarding return of materials governing the contract. Decision of Engineer-in-Charge in regard to theoretical quantities of materials, which should have been actually used as per the Annexure of the standard schedule of rates and recovery at rates specified in Schedule 'F', shall be final & binding on the contractor.
- For non scheduled items, the decision of the Superintending Engineer regarding theoretical quantities of materials which should have been actually used, shall be final and binding on the contractor.
- (iii) The said action under this clause is without prejudice to the right of the Government to take action against the contractor under any other conditions of contract for not doing the work according to the prescribed specifications.

CLAUSE 43 : COMPENSATION FOR DAMAGE TO WORKS DURING WAR LIKE SITUATIONS :

The work (whether fully constructed or not) and all materials, machines, tools and plants, scaffolding, temporary buildings and other things connected therewith shall be at the risk of the contractor until the work has been delivered to the Engineer-in-Charge and a certificate from him to that effect obtained. In the event of the work or any materials properly brought to the site for incorporation in the work being damaged or destroyed in consequence of hostilities or war like operations, the contractor shall, when ordered in writing by the Engineer-in-Charge, remove any debris from the site, collect and properly stack (or remove) in store all serviceable materials salvaged from the damaged work and shall be paid at the contract rates in accordance with the provision of this agreement for the work of clearing the site of debris, stacking or removal of serviceable materials and for the reconstruction of all works ordered by the Engineer-in-Charge, such payments being in addition to compensation upto the value of the work, originally executed before being damaged or destroyed and not paid for. In case of works damaged or destroyed but not already measured and paid for, the compensation shall be assessed by the Divisional Officer upto Rs. 5,000/- and by the Superintending Engineer for a higher amount. The contractor shall be paid for the damage/destruction suffered and for the restoring the materials at the rate based on the analysis of rates tendered for in accordance with the provisions of this contract. The certificate of the Engineer-in-Charge regarding the quality and quantity of materials and the purpose for which they were collected shall be final and binding on all parties to this contract.

Provided always that no compensation shall be payable for any loss in consequence of hostilities or war-like operations (a) unless the contractor had taken all such precautions against Air Raid as are deemed necessary by the A.R.P. Officers or the Engineer-in-Charge, (b) for any materials etc. not on the site of the work or for any tools and plant, machinery, scaffolding, temporary buildings and other things not intended for the work.

In the event of the contractor having to carry out reconstruction as aforesaid, he shall be allowed such extension of time for its completion as is considered reasonable by the Divisional Officer.

CLAUSE 44 : APPRENTICES ACT - PROVISIONS TO BE COMPLIED WITH :

The contractor shall comply with the provisions of the Apprentices Act, 1961 and the rules and orders issued thereunder from time to time. If he fails to do so, his failure will be a breach of the contract and the Superintending Engineer may, in his discretion, cancel the contract. The contractor shall also be liable for any pecuniary liability arising on account of any violation by him of the provisions of the said Act.

CLAUSE 45 : REFUND OF SECURITY DEPOSIT AFTER LABOUR CLEARANCE.Security Deposit of the work shall not be refunded till the contractor produces a clearance certificate from the Labour Officer. As soon as as the work is virtually complete the contractor shall apply for the clearance certificate to the Labour Officer under intimation to the Engineer – in – charge. Engineer – in – charge on receipt of the said communication, shall write to the Labour Officer to intimate any complaint is pending against the contractor in respect of the work if no complaint is pending, on record till after 3 months after completion of the work and/or no communication is received from the Labour Officer to this effect till six months after the date of completion, it will deemed to have received the clearance certificate and the Security Deposit will be released if otherwise due.

SECTION - 3(ii) - SAFETY CODE :

Refer Construction Safety Manual available at www.tenderwizard.com/DAE or www.barc.gov.in website in addition to followings:

1. Suitable scaffolds should be provided for workmen for all works that cannot safely be done from the ground, or from solid construction except such short period work as can be done safely from ladders. When a ladder is used an extra mazdoor shall be engaged for holding the ladder and if the ladder is used for carrying materials as well, suitable footholds and handholds shall be provided on the ladder and the ladder shall be given an inclination not steeper than 1/4 to 1 (1/4 horizontal and 1 vertical).
2. Scaffolding or staging more than 3.6 m. (12 feet) above the ground or floor, swung or suspended from an over head support or erected with stationary support shall have a guard rail properly attached, bolted, braced and otherwise secured atleast 90 cm. (3 feet) high above the floor or platform of such scaffolding or staging and extending along the entire length of the out side and ends thereof with only such opening as may be necessary for the delivery of materials. Such scaffolding or staging shall be so fastened as to prevent it from swaying from the building or structure.
3. Working platform, gangways, and stairways should be so constructed that they should not sag unduly or unequally, and if the height of the platform or the gangway or the stairway is more than 3.6 m. (12 feet) above ground level or floor level, they should be closely boarded, should have adequate width and should be suitably fastened as described in (ii) above.
4. Every opening in the floor of a building or in a working platform be provided with suitable means to prevent the fall of persons or materials by providing suitable fencing or railing whose minimum height shall be 90 cm. (3 feet).
5. Safe means of access shall be provided to all working platforms and other working places. Every ladder shall be securely fixed. No portable single ladder shall be over 9 m. (30 feet) in length while the width between side rails in rung ladder shall in no case be less than 29 cm. (11 1/2") for ladder up to and including 3 m. (10 feet) in length. For longer ladders this width should be increased at least 1/4" for each additional 30 cm. (1 foot) of length. Uniform step spacing shall not exceed 30 cm. (12"). Adequate precautions shall be taken to prevent danger from electrical equipment. No materials on any of the sites of work shall be so stacked or placed as to cause danger or inconvenience to any person or the public. The contractor shall provide all necessary fencing and lights to protect the public from accident, and shall be bound to bear the expenses of defense of every suit, action or other proceedings at law that may be brought by any persons for injury sustained owing to neglect of the above precautions and to pay any damages and cost which may be awarded in any such suit, action or proceedings to any such persons or which may, with the consent of the contractor, be paid to compensate any claim by any such person.
6. **Excavation and trenching :** All trenches, 1.2 m. (4 feet) or more in depth, shall at all times be supplied with atleast one ladder for each 30 m. (100 feet) in length or fraction thereof. Ladder shall be extended from bottom of the trench to at least 90 cm. (3 feet) above the surface of the ground. The side of the trenches which are 1.5 m. (5 feet) or more in the depth shall be stepped back to give suitable slope or securely held by timber bracing, so as to avoid the danger of sides to collapsing. The excavated materials shall not be placed within 1.5 m. (5 feet) of the edges of the trench or half of the depth of the trench whichever is more. Cutting shall be done from top to bottom. Under no circumstances undermining or under cutting shall be done.
7. **Demolition :** Before any demolition work is commenced and also during the process of the work:—
 - i) All roads and open areas adjacent to the work site shall either be closed or suitably protected.
 - ii) No electric cable or apparatus which is liable to be a source of danger over a cable or apparatus used by the operator shall remain electrically charged
 - iii) All practical steps shall be taken to prevent danger to persons employed from risk of fire or explosion or flooding. No floor, roof or other part of the building shall be so overloaded with debris or materials as to render it unsafe.

8. All necessary personal safety equipment as considered adequate by the Engineer-in-Charge should be kept available for the use of the person employed on the site and maintained in a condition suitable for immediate use, and the contractor should take adequate steps to ensure proper use of equipment by those concerned:- The following safety equipments shall be invariably be provided:

- i) Workers employed on mixing asphaltic materials, cement and lime mortars shall be provided with protective footwear and protective goggles.
- ii) Those engaged in white washing and mixing or stacking of cement bags or any material which is injurious to the eyes shall be provided with protective goggles.
- iii) Those engaged in welding works shall be provided with welders protective eye shields.
- iv) Stone breakers shall be provided with protective goggles and protective clothing and seated at sufficiently safe intervals.
- v) When workers are employed in sewers and manholes, which are in active use, the contractors shall ensure that the manhole covers are opened and are ventilated at least for an hour before the workers are allowed to get into the manholes, and the manholes so opened shall be cordoned off with suitable railing and provided with warning signals or boards to prevent accident to the public. In addition, the contractor shall ensure that the following safety measures are adhered to:-
 - a) Entry for workers into the line shall not be allowed except under supervision of the JE or any other higher officer.
 - b) At least 5 to 6 manholes upstream and downstream should be kept open for at least 2 to 3 hours before any man is allowed to enter into the manhole for working inside.
 - c) Before entry, presence of toxic gases should be tested by inserting wet lead acetate paper which changes colour in the presence of such gases and given indication of their presence.
 - d) Presence of oxygen should be verified by lowering a detector lamp into the manhole. In case, no oxygen is found inside the sewer line, workers should be sent only with oxygen kit.
 - e) Safety belt with rope should be provided to the workers. While working inside the manholes, such rope should be handled by two men standing outside to enable him to be pulled out during emergency.
 - f) The area should be barricaded or cordoned off by suitable means to avoid mishaps of any kind. Proper warning signs should be displayed for the safety of the public whenever cleaning works are undertaken during night or day.
 - g) No smoking or open flames shall be allowed near the blocked manhole being cleaned.
 - h) The malba obtained on account of cleaning of blocked manholes and sewer lines should be immediately removed to avoid accidents on account of slippery nature of the malba.
 - i) Workers should not be allowed to work inside the manhole continuously. He should be given rest intermittently. The Engineer-in-Charge may decide the time up to which a worker may be allowed to work continuously inside the manhole.
 - j) Gas masks with oxygen cylinder should be kept at site for use in emergency.
 - k) Air-blowers should be used for flow of fresh air through the manholes. Whenever called for, portable air blowers are recommended for ventilating the manholes. The motors for these shall be vapor proof and of totally enclosed type. Non sparking gas engines also could be used but they

should be placed at least 2 metres away from the opening and on the leeward side protected from wind so that they will not be a source of friction on any inflammable gas that might be present.

- l) The workers engaged for cleaning the manholes / sewers should be properly trained before allowing to work in the manhole.
 - m) The workers shall be provided with Gumboots or non sparking shoes bump helmets and gloves non sparking tools safety lights and gas masks and portable air blowers (when necessary). They must be supplied with barrier cream for anointing the limbs before working inside the sewer lines.
 - n) Workmen descending a manhole shall try each ladder stop or rung carefully before putting his full weight on it to guard against insecure fastening due to corrosion of the rung fixed to manhole well.
 - o) If a man has received a physical injury, he should be brought out of the sewer immediately and adequate medical aid should be provided to him.
 - p) The extent to which these precautions are to be taken depend on individual situation but the decision of the Engineer-in-Charge regarding the steps to be taken in this regard in an individual case will be final.
- vi) The contractor shall not employ men below the age of 18 years and women on the work of painting with products containing lead in any form. Wherever men above the age of 18 are employed on the work of lead painting, the following precautions should be taken :—
- a) No paint containing lead or lead products shall be used except in the form of paste or ready made paint.
 - b). Suitable face masks should be supplied for use by the workers when paint is applied in the form of spray or a surface having lead paint dry rubbed and scrapped.
 - c) Overalls shall be supplied by the contractors to the workmen and adequate facilities shall be provided to enable the working painters to wash during and on cessation of work.
9. The contractor shall not employ women and men below the age of 18 on the work of painting with product containing lead in any form, wherever man above the age of 18 are employed on the work of lead painting the following principle must be observed for such use:
- i) White lead, sulphate of lead, or product containing these pigment, shall not be used in painting operation, except in the form of paste or of paint ready for use.
 - ii) Measures shall be taken, wherever required in order to prevent danger arising from the application of paint in the form of spray.
 - iii) Measures shall be taken, wherever practicable to prevent danger arising out from dust caused by dry rubbing down and scrapping.
 - iv) Adequate facilities shall be provided to enable working painters to wash during and on cessation of work.
 - v) Overalls shall be worn by working painters during the whole of the working period.
 - vi) Suitable arrangements shall be made to prevent clothing put off during working hours, being soiled by painting materials.
 - vii) Cases of lead poisoning and suspected lead poisoning shall be notified and shall be subsequently verified by a medical man appointed by the competent authority of the Department.
 - viii) The Department of Atomic Energy may require, when necessary, medical examination of workers.
 - ix) Instruction with regard to special hygienic precautions to be taken in the painting trade shall be distributed to working painters.

10. When the work is done near any place where there is risk of drowning, all necessary equipments should be provided and kept ready for use and all necessary steps taken for prompt rescue of any person in danger and adequate provision should be made for prompt first-aid treatment of all injuries likely to be obtained during the course of the work.
11. Use of hoisting machines and tackle including their attachments, anchorage and supports shall conform to the following standards or conditions:
- i) a) These shall be of good mechanical construction, sound material and adequate strength and free from patent defects and shall be kept in good repair and in good working order.
 - b) Every rope used in hoisting or lowering materials or as a means of suspension shall be of durable quality and adequate strength, and free from patent defects.
 - ii) Every crane driver or hoisting appliance operator shall be properly qualified and no person under the age of 21 years should be in charge of any hoisting machine including any scaffolding winch or give signals to operator.
 - iii) In case of every hoisting machine and of every chain ring hook, shackle swivel and pulley block used in hoisting or as means of suspension the safe working load shall be ascertained by adequate means. Every hoisting machine and all gear referred to above shall be plainly marked with the safe working load. In case of a hoisting machine having a variable safe working load, each safe working load and the conditions under which it is applicable shall be clearly indicated. No part of any machine or any gear referred to above in this paragraph shall be loaded beyond the safe working load except for the purpose of testing.
 - iv). In case of departmental machines, the safe working load shall be notified by the Electrical Engineer-in-Charge. As regards contractors machines the contractors shall notify the safe working load of the machine to the Engineer-in-Charge whenever he brings any machinery to site of work and get it verified by the Electrical Engineer concerned.
12. Motors, gearing, transmission, electrical wiring and other dangerous parts of hoisting appliances should be provided with efficient safe-guards. Hoisting appliances should be provided with such means as will reduce to the minimum the risk of accidental descent of the load. Adequate precautions should be taken to reduce to the minimum the risk of any part of a suspended load becoming accidentally displaced. When workers employed on electrical installations which are already energised, insulating mats, wearing apparel, such as gloves, sleeves and boots as may be necessary should be provided. The workers should not wear any rings, watches and carry keys or other materials which are the good conductors of electricity.
13. All scaffolds, ladders and other safety devices mentioned or described herein shall be maintained in safe condition and no scaffold, ladder or equipment shall be altered or removed while it is in use. Adequate washing facilities should be provided at or near places of work.
14. These safety provisions should be brought to the notice of all concerned by display on a notice board at a prominent place at work spot. The person responsible for compliance of the safety code shall be named therein by the contractor.
15. To ensure effective enforcement of the rules and regulations relating to safety precautions the arrangements made by the contractor shall be open to inspection by the Labour Officer, Engineer-in-Charge of the Department or their representatives.
16. Notwithstanding the above clauses from (1) to (15) there is nothing in these to exempt the contractor from the operations of any other Act or Rule in force in the Republic of India.

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SAFTY WITH SCAOLDINGS

INTRODUCTION:

1. This bulletin deals with safety regulations and precautions to be followed in the construction use, maintenances etc. of scaffolds. This will serve as a guide to users of scaffolds in the construction and maintenance operations.
2. Suitable scaffolds are used for performing work that cannot be done from the ground, part of a permanent structure, a ladder or other available means of support.
3. Scaffolds are used in many construction and maintenance operations. Fall of person is the most common hazard accompanying the use of scaffolds because of the height usually involved.

1. GENERAL:

1.1 Every scaffolds and its supporting members should be designed to support given load, with a safety factor of at least four. No alterations should be made that might impair the strength of such structures, no improvised, make-shift or substandard scaffold should be permitted even for the most temporary use.

1.2 All work in connection with such structures, including construction, alteration and removal should be carefully done under the direction and supervision of persons who have had experience in such works.

2. MATERIALS OF CONSTRUCTION:

2.1 Every scaffold and every part thereof, including supports, should be of good construction, sound material, of adequate strength for the purpose which it is meant to be used and should be properly maintained.

Planks should be laid flat with an overlap lengthwise, of at least 30cm. with the centre of the overlap directly over a bearer. Boards and planks used for the floors should be of uniform thickness, closely laid and securely fastened in place.

2.2 All member used in the construction of scaffolds, should be sound straight grained free from cross grains, shakes and loose or dead knots. It should also be free from dry rot, large checks, worm holes, or other defects impairing its strength or durability.

2.3 All nails used in the construction of scaffolds, staging and supports should be of ample size and used in sufficient quantities at each connection to develop the designed strength of scaffold. Nails should penetrate to the holding piece to a depth of at least 12 times the diameter of nail.

2.4 Barrels boxes, loose tiles blocks, loose piles of bricks or other unstable objects should not be used to support planks used as working platforms.

3. PLATFORMS, RAILINGS AND TOE-BOARDS:

3.1 The minimum uniformly distributed design load per sq.m. of platforms should be 250 kg. Any concentrated load at any point in the span should not exceed the designed uniformly distributed load. Planks should not be less than 50mm thick.

3.2 The rear of outer side of every scaffolding, platform and ramp more than 2M above the surrounding ground or solid construction, or adjacent to deep holes, excavations, railroad tracks, high tension electrical wires, should be provided with a substantial guard rail of standard construction consisting of top and intermediate rails, and toe-boards all supported by posts and securely connected at scaffold at intervals of not more than 2.4 M.

3.3 The width of the scaffolds should be such as to provide a clear walkway 50 cm. wide. If path of the width of scaffold is to be used for keeping materials such as brick, mortar or lumber, the scaffold should be made wider so as to provide a walkway of the required width.

3.4 Where scaffolds are erected over side walks or over areas in which persons must work or pass, the space between the railing and toe-board should be fitted with side screens.

3.5 There should be a screen or other protection suspended from the scaffold to catch materials that may fall from above. Screens should extend beyond the edge of the scaffold to catch any materials that may fall over the edges.

4. MEANS OF ACCESS:

4.1 A safe and convenient means of access should be provided to the platform scaffold. This requirement does not apply to swinging scaffolds or those with convenient access from adjacent floors.

Means of access may be portable ladder, fixed ladder, ramp or it may be a stairway. The use of cross braces or framework as means of access to the working surface should not be permitted.

4.2 If scaffolds are to be used to a great extent or for a long period of time, a regular plank stairway, wide enough to allow two persons to pass, should be erected. Such stairways should have handrails on both sides.

4.2.1 No stairway or run of slope exceeding 2 in 3 should be used.

4.2.2 Where the slope of a stairway or run renders additional foot hold necessary, and in every case where the slope is more than 1 in 4, there should be provided proper stepping laths which should:

- a) have a minimum section of 50 x 30 mm and be placed at maximum interval of 45 cm and
- b) be of length to cover the full width of the stairway of run except that they may be interrupted over a width not more than 10cm to facilitate the movement of barrows.

5. OVERBEAD PROTECTION:

5.1 Overhead protection should be provided on the scaffold whenever persons are working at higher places. This protection should be not more than 3m above the scaffold floor and should be of planks or other suitable materials.

6. USE OF SCAFFOLDS:

6.1 Good housekeeping should be maintained at all times upon scaffolding, platforms and ramps. Excessive storage of materials thereon should be avoided and care must be taken to avoid accumulation of small object, such as boards, tools, pieces of reinforcing steel, waste concrete which may easily be disturbed or knocked off. Hand rails should be kept in good repair and securely nailed or otherwise fastened down. Scaffold should be cleared of all tools, materials and rubbish at the end of each working day / shift.

6.2 Persons should not be permitted on scaffolds when the platform or guard rails are slippery. Persons should not be permitted on work on scaffolds during storm or strong winds.

6.3 Suspended scaffolds should never be used for the storage of stone or heavy materials. Two or more swinging scaffolds should not at any time be combined into one by bridging the distance between them with planks or any other form of connection. Life line securely fastened from above should be provided for each person working on a swinging scaffold. Safety belts should be tied to the life lines.

7. **INSPECTION:**

7.1 As scaffolds have to remain in position normally for many weeks they must be inspected at least once a week to make sure that nothing has gone wrong since erection. In addition, they must always be inspected after a spell of bad weather which might have affected their stability.

7.2 The inspections must be carried out by some one who knows the faults to look for and how they may be put right. It is important to know that the work of inspection has been completed and what faults have been found, the results of each inspection must, therefore, be recorded. Any scaffold damaged or weakened from any cause should be immediately repaired and persons should not be allowed to use it until repairs have been completed.

8. **DISMANTLING:**

8.1 The dismantling of scaffold should be carefully done under experienced supervision. Care should be taken not to drop small, loose objects when removing scaffold planks. All nails should be promptly removed from scaffold planks and the planks safely piled.

9. **PRECAUTIONS AGAINST PARTICULARS HAZARDS:**

9.1 Care should be taken to see that no uninsulated electric wire exists within 3M. of the working platform, stairway etc. of the scaffold.

9.2 While carrying bars, rods or pipes of any conducting materials of length greater than 3M in the vicinity of electric wires, special care should be taken that these bars do not touch the electric wires.

9.3 Care should be taken against any possibility of wooden scaffold catching fire. In suspended scaffolds, if a blow torch or other flame is used for removing paints, only wire ropes not less than 10mm in diameter should be used.

9.4 Care should be taken to see that no part of a scaffold is struck by a truck or other heavy moving equipment and no material should be dumped against it.

9.5 Scaffolds on through fare should be provided with light.

9.6 Access to cable tunnels, hydrants etc. should remain free at all times.

9.7 Care should be taken from damaging under ground cables and equipment. This is specially important when parts of scaffolds for other fasteners have to be driven in the ground.

SECTION - 3 (iii) : MODEL RULES FOR THE PROTECTION OF HEALTH AND SANITARY ARRANGEMENTS FOR WORKERS EMPLOYED BY BARC OR ITS CONTRACTORS :

1. **APPLICATION :** These rules shall apply to all building and construction works in charge of BARC, Department of Atomic Energy in which twenty or more workers are ordinarily employed or are proposed to be employed on any day during the period during which the contract work is in progress.

2. **DEFINITION :** Work place means a place where twenty or more workers are ordinarily employed or are proposed to be employed in connection with construction work on any day during the period during which the contract work is in progress.

3. **FIRST-AID FACILITIES :**

(1) At every work place there shall be provided and maintained, so as to be easily accessible during working hours, first-aid boxes at the rate of not less than one box for 150 contract labour or part thereof ordinarily employed.

(2) The first-aid box shall be distinctly marked with a red cross on white back ground and shall contain the following equipment:—

a) For work places in which the number of contract labour employed does not exceed 50. Each first-aid box shall contain the following equipments:

(i) 6 small sterilised dressings.

(ii) 3 medium size sterilised dressings.

(iii) 3 large size sterilised dressings.

(iv) 3 large sterilised burn dressings.

(v) 1 (30 ml.) bottle containing a two per cent alcoholic solution of iodine.

(vi) 1 (30 ml.) bottle containing salvolatile having the dose and mode of administration indicated on the label.

(vii) 1 snake-bite lancet.

(viii) 1 (30 gms.) bottles of potassium permanganate crystals.

(ix) 1 pair scissors.

(x) 1 copy of the first-aid leaflet issued by the Director General, Factory Advice Service and Labour Institutes, Government of India.

(xi) 1 bottle containing 100 tablets (each of 5 gms.) of aspirin.

(xii) Ointment for burns.

(xiii) A bottle of suitable surgical antiseptic solution.

b) For work places in which the number of contract labour exceeds 50. Each first-aid box shall contain the following equipments:

(i) 12 small sterilised dressings.

(ii) 6 medium size sterilised dressings.

(iii) 6 large size sterilised dressings.

(iv) 6 large size sterilised burn dressings.

(v) 6 (15 gms.) packets sterilised cotton wool.

(vi) 1 (60 ml.) bottle containing a two per cent alcoholic solution of iodine.

(vii) 1 (60 ml.) bottle containing salvolatile having the dose and mode of administration indicated on the label.

(viii) 1 roll of adhesive plaster.

(ix) 1 snake-bite lancet.

(x) 1 (30 gms.) bottle of potassium permanganate crystals.

(xi) 1 pair scissors.

(xii) 1 copy of the First-Aid leaflet issued by the Director General, Factory Advice Service and Labour Institute, Government of India.

(xiii) A bottle containing 100 tablets (each of 5 gms.) of aspirin.

(xiv) Ointment for burns.

(xv) A bottle of suitable surgical antiseptic solution.

(3) Adequate arrangements shall be made for immediate recoupment of the equipment when necessary.

(4) Nothing except the prescribed contents shall be kept in the first aid box.

(5) The First-Aid box shall be kept in charge of a responsible person who shall always be readily available during the working hours of the work place.

(6) A person in charge of the First-Aid box shall be a person trained in First-Aid treatment, in work places where the number of contract labour employed is 150 or more.

(7) In work places where the number of contract labour employed is 500 or more and hospital facilities are not available within easy distance of the works, First-Aid posts shall be established and run by a trained compounder. The compounder shall be on duty and shall be available at all hours when the workers are at work.

(8) Where work places are situated in places which are not towns or cities, a suitable motor transport shall be kept readily available to carry injured person or persons suddenly taken ill to the nearest hospital.

4. DRINKING WATER :

(a) In every work place, there shall be provided and maintained at suitable places, easily accessible to labour, a sufficient supply of cold water fit for drinking.

(b) Where drinking water is obtained from an intermittent public water supply, each work place shall be provided with storage where such drinking water shall be stored.

(c) Every water supply of storage shall be at a distance of not less than 50 feet from any latrine, drain or other source of pollution. Where water has to be drawn from an existing well which is within such proximity of latrine, drain or any other source of pollution, the well shall be properly chlorinated before water is drawn from it for drinking. All such wells shall be entirely closed in and be provided with a trap-door which shall be dust and water proof.

(d) A reliable pump shall be fitted to each covered well, the trap-door shall be kept locked and opened only for cleaning or inspection which shall be done at least once a month.

5. WASHING FACILITIES :

(i). In every work place adequate and suitable facilities for washing shall be provided and maintained for the use of contract labour employed therein.

(ii). Separate and adequate cleaning facilities shall be provided for the use of male and female workers.

(iii). Such facilities shall be conveniently accessible and shall be kept in clean and hygienic condition.

6. LATRINES AND URINALS :

(i). Latrines shall be provided in every work place on the following scale, namely:

- a) Where females are employed, there shall be at least one latrine for every 25 females.
- b) Where males are employed, there shall be at least one latrine for every 25 males.

Provided that where the number of males or females exceeds 100, it shall be sufficient if there is one latrine for 25 males or females, as the case may be, up to the first 100, and one for every 50 thereafter.

(ii) Every latrine shall be under cover and so partitioned off as to secure privacy and shall have a proper door and fastening.

(iii) Construction of latrines : The inside walls shall be constructed of masonry or some suitable heat resisting non-absorbent materials and shall be cement washed inside and outside at least once a year. Latrines shall not be of a standard lower than bore-hole system.

(iv) a) Where workers of both sexes are employed, there shall be displayed out side each block of latrine and urinal, a notice in the language understood by the majority of the workers "For Men only" or "For Women only" as the case may be.

b) The notice shall also bear the figure of a man or of a woman, as the case may be.

(v) There shall be at least one urinal for male workers up to 50 and one for female workers up to 50 employed at a time. Provided that where the number of male or female workmen, as the case may be, exceeds 500, it shall be sufficient if there is one urinal for every 50 males or females up to the first 500 and one for every 100 or part thereof, thereafter.

(vi) a) The latrines and urinals shall be adequately lighted and shall be maintained in a clean and sanitary condition at all times.

b) Latrines and urinals other than those connected with a flush sewerage system shall comply with the requirements of the Public Health Authorities.

(vii) Water shall be provided by means of a tap or otherwise so as to be conveniently accessible in or near the latrines and urinals.

(viii) Disposal of excreta : Unless otherwise arranged for by the local sanitary authority, arrangements for proper disposal of excreta by incineration at the work place shall be made by means of a suitable incinerator. Alternately excreta may be disposed off by putting a layer of night soil at the bottom of a pucca tank prepared for the purpose and covering it with a 15 cm. layer of waste or refuse and then covering it with a layer of earth for a fortnight (when it will turn into manure).

(ix) The contractor shall, at his own expense, carry out all instructions issued to him by the Engineer-in-Charge to effect proper disposal of night soil and other conservancy work in respect of the contractor's workmen or employees on the site. The contractor shall be responsible for payment of any charges which may be levied by Municipal or Cantonment Authority for execution of such work on his behalf.

7. PROVISION OF SHELTER DURING REST : At every place there shall be provided, free of cost, four suitable sheds, two for meal, and the other two for rest separately for the use of men and women labour. The height of each shelter shall not be less than 3 metres (10 feet) from the floor level to the lowest part of the roof. These shall be kept clean and the space provided shall be on the basis of 0.6 Sq.m. per head.

Provided that the Engineer-in-charge may permit to his satisfaction a portion to the building under construction or other alternative accommodation to be used for the purpose.

8. CRECHES :

i) At every work place at which 20 or more women workers are ordinarily employed, there shall be provided two rooms of reasonable dimensions for the use of their children under the age of six years. One room shall be used as a play room for the children and the other as their bed-room. The rooms shall be constructed with specifications as per clause 19 H (ii) a,b & c.

ii) The rooms shall be provided with suitable and sufficient openings for light and ventilation. There shall be adequate provision of sweepers to keep the places clean.

iii) The contractor shall supply adequate number of toys and games in the play rooms and sufficient number of cots and beddings in the bed room.

iv) The contractor shall provide one ayaa to look after the children in the creche when the number of women workers does not exceed 50 and two Dais when the number of women workers exceeds 50.

v) The use of the rooms earmarked as creches shall be restricted to children, their attendants and mothers of the children.

9. CANTEENS :

(i) In every work place where the work regarding the employment of contract labour is likely to continue for six months and wherein contract labour numbering one hundred or more are ordinarily employed, an adequate canteen shall be provided by the contractor for the use of such contract labour.

(ii) The canteen shall be maintained by the contractor in an efficient manner.

(iii) The canteen shall consist of at least a dining hall, kitchen, store room, pantry and washing places separately for workers and utensils.

(iv) The canteen shall be sufficiently lighted at all times when any person has access to it.

(v) The floor shall be made of smooth and impervious material and inside walls shall be lime washed or colour washed at least once in each year:

Provided that the inside walls of the kitchen shall be lime washed every four months.

(vi) The precincts of the canteen shall be maintained in a clean and sanitary condition.

(vii) Waste water shall be carried away in suitable covered drains and shall not be allowed to accumulate so as to cause a nuisance.

(viii) Suitable arrangement shall be made for the collection and disposal of garbage.

(ix) The dining hall shall accommodate at a time 30 per cent of the contractor labour working at a time.

(x) The floor area of the dining hall, excluding the area occupied by the service counter and any furniture except tables and chairs shall not be less than one square metre (10 sqfeet) per diner to be accommodated as prescribed in sub-rule (ix).

(xi) a) A portion of the dining hall and service counter shall be partitioned off and reserved for women workers, in proportion to their number.

b) Washing places for women shall be separate and screened to secure privacy.

(xii) Sufficient tables, stools, chairs or benches shall be available for the number of diners to be accommodated as prescribed in sub-rule (ix).

(xiii) (a) (1) There shall be provided and maintained sufficient utensils, crockery, furniture and any other equipments necessary for the efficient running of the canteen.

(2) The furniture, utensils and other equipments shall be maintained in a clean and hygienic condition.

(b) (1) Suitable clean clothes for the employees serving in the canteen shall be provided and maintained.

(2) A service counter, if provided, shall have top of smooth and impervious material.

(3) Suitable facilities including an adequate supply of hot water shall be provided for the cleaning of utensils and equipments.

(xiv) The food stuffs and other items to be served in the canteen shall be in conformity with the normal habits of the contract labour.

(xv) The charges for food stuffs, beverages, and any other items served in the canteen shall be based on No profit, No loss and shall be conspicuously displayed in the canteen.

(xvi) In arriving at the price of food stuffs and other articles served in the canteen, the following items shall not be taken into consideration as expenditure, namely:—

- (a) The rent of land and buildings;
- (b) The depreciation and maintenance charges for the building and equipments provided for the canteen;
- (c) The cost of purchase, repairs and replacement of equipments including furniture, crockery, cutlery and utensils;
- (d) The water charges and other charges incurred for lighting and ventilation;
- (e) The interest and amounts spent on the provision and maintenance and equipments provided for in the canteen.

(xvii) The accounts pertaining to the canteen shall be audited once every 12 months by registered accountants and auditors.

10. ANTI-MALARIAL PRECAUTIONS : The contractor shall at his own expense, conform to all anti-malarial instructions given to him by the Engineer-in-Charge including the filling up of any borrow pits which may have been dug by him.

11. The above rule shall be incorporated in the contracts and notice inviting tenders and shall form part of the contract.

12. AMENDMENTS : Government may, from time to time, add to or amend these rules and issue such directions as it may consider necessary for the purpose of removing any difficulty which may rise in the administration thereof.

* * * * *

SECTION - 3 (iv) : DEPARTMENT OF ATOMIC ENERGY CONTRACTORS LABOUR REGULATIONS:

1. SHORT TITLE :

These regulations may be called the “Department of Atomic Energy Contractors. Labour Regulations”.

2. DEFINITIONS :

i) **“Workmen”** means any person employed by the Department of Atomic Energy or its Contractor directly or indirectly through a sub-contractor, with or without the knowledge of the Department of Atomic Energy, to do any skilled, semi-skilled or unskilled manual, supervisory, technical or clerical work for hire or reward, whether the terms of employment are expressed or implied but does not include any person—

a) Who is employed mainly in a managerial or administrative capacity; or

b) Who, being employed in a supervisory capacity draws wages exceeding five hundred rupees per mensem or exercise either by the nature of the duties attached to the office or by reason of powers vested in him, functions mainly of managerial nature;

c) Who is an out worker, that is to say, a person to whom any article or materials are given out by or on behalf of the principal employer to be made up, cleaned, washed, altered, ornamental finished, repaired, adopted or otherwise processed for sale for the purposes of the trade or business of the principal employer and the process is to be carried out either in the home of the out worker or in some other premises, not being premises under the Control and management of the principal employer.

ii) **“fair wages”** means wages whether for time or piece work fixed and notified under the provisions of the Minimum Wages Act from time to time.

iii) **“Contractors”** shall include every person who undertakes to produce a given result other than a mere supply of goods or articles of manufacture through contract labour or who supplies contract labour for any work and includes a sub-contractor.

iv) **“Wages”** shall have the same meaning as defined in the payment of wages act.

2(a) Normally working hours of an adult employee should not exceed 9 hours a day and in case of a child 4 1/2 hours a day. The working day shall be so arranged that inclusive of interval for rest, if any, it shall not spread over more than 12 hours on any day.

2(b) When an adult worker is made to work for more than 9 hours on any day or for more than 48 hours in any week he shall be paid over time for the extra hours put in by him at double the ordinary rate of wages.

2(c) (i) Every worker shall be given a weekly holiday normally on a Sunday, in accordance with the provisions of the Minimum Wages (Central) Rules, 1960 as amended from time to time irrespective of whether such worker is governed by the Minimum Wages Act or not.

(ii) Where a Minimum Wages prescribed by the Government under the Minimum Wages Act are not inclusive of the wages for the weekly day of rest, the worker shall be entitled to rest day wages at the rate applicable to the next preceding day, provided he has worked under the same contractor for a continuous period of not less than 6 days.

(iii) Where a contractor is permitted by the Engineer-in-Charge to allow a worker to work on a normal weekly holiday, he shall grant a substituted holiday to him for the whole day on one of the five days immediately before or after the normal weekly holiday and pay wages to such worker for the work performed on the normal weekly holiday at over time rate.

3. (i) Normally working hours of an adult employee should not exceed 9 hours a day. The working day shall be so arranged that inclusive of interval for rest, if any, it shall not spread over more than 12 hours on any day.

(ii) When an adult worker is made to work for more than 9 hours on any day for more than 48 hours in any week, he shall be paid over time for the extra hours put in by him at double the ordinary rate of wages.

(iii) a) Every worker shall be given a weekly holiday normally on a Sunday, in accordance with the provisions of the Minimum Wages (Central) Rules 1960 as amended from time to time irrespective of whether such worker is governed by the Minimum Wages Act or not.

b) Where the minimum wages prescribed by the Government under the Minimum Wages Act are not inclusive of the wages for the weekly day of rest, the worker shall be entitled to rest day wages at the rate applicable to the next preceding day, provided he has worked under the same contractor for a continuous period of not less than 6 days.

c) Where a contractor is permitted by the Engineer-in-Charge to allow a worker to work on a normal weekly holiday, he shall grant a substituted holiday to him for the whole day on one of the five days immediately before or after the normal weekly holiday and pay wages to such worker for the work performed on the normal weekly holiday at overtime rate.

4. DISPLAY OF NOTICE REGARDING WAGES ETC. :

The contractor shall before he commences his work on contract, display and correctly maintain and continue to display and correctly maintain in a clean and legible condition in conspicuous places on the work, notices in English and in the local Indian languages spoken by the majority of the workers, giving the minimum rates of wages fixed under the Minimum Wages Act, the actual wages being paid, the hours of work for which such wages are earned, wage periods, dates of payment of wages and other relevant information as per Annexure 'A'.

5. PAYMENT OF WAGES :

(i) The contractor shall fix wage periods in respect of which wages shall be payable.

(ii) No wage period shall exceed one month.

(iii) The wages of every person employed as contract labour in an establishment or by a contractor where less than one thousand, such persons are employed shall be paid before the expiry of the seventh day and in other cases before the expiry of tenth day after the last day of the wage period in respect of which the wages are payable.

(iv) Where the employment of any worker is terminated by or on behalf of the contractor, the wages earned by him shall be paid before the expiry of the second working day from the date on which his employment is terminated.

(v) All payments of wages shall be made on a working day at the work premises and during the working time and on a date notified in advance and in case the work is completed before the expiry of the wage period, final payment shall be made within 48 hours of the last working day.

(vi) Wages due to every worker shall be paid to him direct or to other person authorised by him in this behalf.

(vii) All wages shall be paid in current coin or currency or in both.

(viii) Wages shall be paid without any deductions of any kind except those specified by the Central Government by general or special order in this behalf or permissible under the payment of Wages Act, 1956.

(ix) A notice showing the wages period and the place and time of disbursement of wages shall be displayed at the place of work and a copy sent by the contractor to the Engineer-in-Charge under acknowledgement.

(x) It shall be the duty of the contractor to ensure the disbursement of wages in the presence of the Engineer-in-Charge or any other authorised representative of the Engineer-in-Charge who will be required to be present at the place and time of disbursement of wages by the contractor to workmen.

(xi) The contractor shall obtain from the Engineer-in-Charge or any other authorised representative of the Engineer-in-Charge as the case may be, a certificate under his signature at the end of the entries in the "Register of wages" or the "Wage-cum-Muster Roll" as the case may be in the following form :

"Certified that the amount shown in column No. _____

has been paid to the workmen concerned in my presence on _____
_____ at _____

6. FINES AND DEDUCTIONS WHICH MAY BE MADE FROM WAGES:

i) The wages of a worker shall be paid to him without any deductions of any kind except the following:

- a) Fines.
- b) Deductions for absence from duty i.e from the place or the places where by the terms of his employment he is required to work. The amount of deduction shall be in proportion to the period for which he was absent.
- c) Deductions for damage to or loss of goods expressly entrusted to the employed person for custody, or for loss of money or any other deduction which he is required to account, where such damage or loss is directly attributable to his neglect or default.
- d) Deduction for recovery of advances or for adjustment of over payment of wages, advances granted shall be entered in a register.
- e) Any other deduction which the Central Government may from time to time allow.

ii) No fines should be imposed on any worker save in respect of such acts and omissions on his part as have been approved of by the Chief Labour Commissioner.

Note: An approved list of acts and omissions for which fines can be imposed is enclosed as Annexure – I.

iii) No fine shall be imposed on a worker and no deduction for damage or loss shall be made from his wages until the worker has been given an opportunity of showing cause against such fines or deductions.

iv) The total amount of fine which may be imposed in any wage period on a worker shall not exceed an amount equal to three paise in a rupee of the total wages, payable to him in respect of that wage period.

v) No fine imposed on any worker shall be recovered from him by installment, or after the expiry of sixty days from the date on which it was imposed.

vi) Every fine shall be deemed to have been imposed on the day of the act or omission in respect of which it was imposed.

7. LABOUR RECORDS:

i) The contractor shall maintain a “**Register of persons employed**” on work on contract in Form XIII of the CL (R & A) Central Rules, 1971 (Annexure B).

ii) The contractor shall maintain “**Muster Roll**” in respect of all workmen employed by him on the work under the contract in form XVI of the CL (R & A) Rules, 1971 (Annexure C).

iii) The contractor shall maintain “**Wage Register**” in respect of all workmen employed by him on the work under the contract in form XVII of the CL (R & A) Rules, 1971 (Annexure D).

iv) **Register of accidents:**

The Contractor shall maintain a register of accident in such form as may be convenient at the work place but the same shall include the following particulars:

- a) Full particulars of the labourers who met with accident.
- b) Rate of wages.
- c) Sex.
- d) Age.
- e) Nature of accident and cause of accident.
- f) Time and date of accident.
- g) Date and time when admitted in Hospital.
- h) Date of discharge from Hospital.
- i) Period of treatment and result of treatment.
- j) Percentage of loss earning capacity and disability as assessed by Medical Officer.
- k) Claim required to be paid under workmen's Compensation Act.
- l) Date of payment of compensation.
- m) Amount paid with details of the person to whom the same was paid.
- n) Authority by whom the compensation was assessed.
- o) Remarks.

v) **Register of Fines:**

The contractor shall maintain a “**Register of Fines**” in the form XII of the CL (R & A) Rules, 1971 (Annexure K).

vi) The contractor shall maintain a “**Register of deductions for damage or loss**” in the form XX of the CL (R & A) Rules, 1971 (Annexure J).

vii) **Register of Advances:**

The contractor shall maintain a “**Register of Advances**” in the form XXI of the CL (R & A) Rules, 1971 (Annexure K).

viii) **Register of overtime:**

The contractor shall maintain a “**Register of Overtime**” in the form XXIII of the CL (R & A) Rules, 1971 (Annexure L).

8. ATTENDANCE CARD-CUM-WAGE SLIP:

i) The contractor shall issue an attendance card-cum-wage slip to each workmen employed by him in the specimen form at (Annexure-E).

ii) The card shall be valid for each wage period.

iii) The contractor shall mark the attendance of each workmen on the card twice each day, once at the commencement of the day and again after the rest interval, before he actually starts work.

iv) The card shall remain in possession of the worker during the wage period under reference.

v) The contractor shall complete the wage slip portion on the reverse of the card at least a day prior to the disbursement of wages in respect of the wage period under reference.

vi) The contractor shall obtain the signature or thumb impression of the worker on the wage slip at the time of disbursement of wages and retain the card himself.

9. EMPLOYMENT CARD :

The contractor shall issue an Employment Card in Form XIV of the CL (R & A) Central Rules, 1971 to each worker within three days of the employment of the worker (Annexure-F).

10. SERVICE CERTIFICATE :

On termination of employment for any reason whatsoever the contractor shall issue to the workman whose services have been terminated, a service certificate in form XV of the CL (R & A) Central Rules, 1971 (Annexure G).

11. PRESERVATION OF LABOUR RECORDS :

All records to be maintained under Regulations Nos. 6 and 7 shall be reserved in original for a period of three years from the date of last entries made in them and shall be made available for inspection by the Engineer-in-Charge, Labour Officer or any other officers authorised by the Department of Works & Housing in this behalf.

12. POWER OF LABOUR OFFICERS TO MAKE INVESTIGATIONS OR ENQUIRY :

The Labour Officer or any other person authorised by Central Government on their behalf shall have power to make enquiries with a view to ascertaining and enforcing due and proper observance of the Fair Wages Clauses and the Provisions of Regulations. He shall investigate into any complaint regarding the default made by the contractor or sub contractor in regard to such provision.

13.. REPORT OF LABOUR OFFICER :

The Labour Officer or other person authorised as aforesaid shall submit a report of result of his investigation or enquiry to the Engineer-in-Charge concerned indicating the extent, if any to which the default has been committed with a note that necessary deductions from the contractor's bill be made and the wages and other dues be paid to the labourers concerned in case an appeal is made by the contractor under Clause 13 of these regulations, actual payment to labourers will be made by the Engineer-in-Charge after the Chief Engineer has given his decision on such appeal.

a) The Engineer-in-Charge shall arrange payments to the labour concerned within 45 days from the receipt of the report from the Labour Officer or the Chief Engineer as the case may be.

14. APPEAL AGAINST THE DECISION OF LABOUR OFFICER :

Any person aggrieved by the decision and recommendations of the Labour Officer or other person so authorised may appeal against such decision to the Chief Engineer concerned within 30 days from the date of decision, forwarding simultaneously a copy of his appeal to the Engineer-in-Charge concerned but subject to such appeal, the decision of the Officer shall be final and binding upon the contractor.

15. PROHIBITION REGARDING REPRESENTATION THROUGH LAWYER :

i) A workman shall be entitled to be represented in any investigation or enquiry under these regulation by:

a) An officer of a registered trade union of which he is a member.

b) An officer of a federation of trade unions referred to in clause (a) is affiliated.

c) Where the employer is not member of any registered trade union, by an officer of a trade union, connected with, or by any other workman employed in the Industry in which the worker is employed.

- ii) An employer shall be entitled to be represented in any investigation or enquiry under these regulations by:
 - a) An officer of an association of employers of which he is a member.
 - b) An officer of a federation of associations of employees to which association referred to in clause (a) is affiliated.
 - c) Where the employer is not a member of any association of employers, by an officer of association of employer, connected with, or by any other employer engaged in the Industry in which the employer is engaged.
- iii) No party shall be entitled to be represented by a legal practitioner in any investigation or enquiry under regulations.

16.. **INSPECTION OF BOOKS AND SLIPS:**

The contractor shall allow inspection of all the prescribed labour records to any of his workers or to his agent at a convenient time and place after due notice is received or to the Labour Officer or any other person, authorised by the Central Government on his behalf.

17. **SUBMISSION OF RETURNS:**

The contractor shall submit periodical returns as may be specified from time to time.

18. **AMENDMENTS:**

The Central Government may from time to time, add to or amend the regulations and any question as to the application, interpretation or effect of these regulations the decision of the Chief Engineer concerned in that behalf shall be final.

ANNEXURE- ‘ A’

LABOUR BOARD

Name of work _____

Name of contractor_____

Address of contractor _____

Name and address of Division _____

Name and address of Labour Officer _____

Name and address of Labour Enforcement Officer _____ Date _____

Sl .No	Category	Minimum wage fixed	Actual wage paid	Number present	Remarks

Weekly holiday _____

Wage period _____

Date of payment of wages _____

Working Hours _____

Rest Interval -----

ANNEXURE – ‘C’

FORM XVI
MUSTER ROLL

Name and address of contractor:

Name and address of establishment in/under which contract is carried on:

Nature and location of work:

Name and address of Principal Employer:

For the month of/fortnight:

Sl. No	Name of workman	Father's/Husband's Name	Sex	Dates	Remarks
1	2	3	4	5	6

ANNEXURE D

FORM XVII
REGISTER OF WAGES

Name and address of contractor:
Name and address of establishment in/under which contract is carried on:
Nature and location of work:
Name and address of Principal employer:

Sl. No	Name of workman	Serial in the register of workmen	Designation/ Nature of work	No. of Days worked	Unit of work done	Daily rate of wages / piece Rate	Basic Wages	Dearness allowance	Over time	Other cash payment (indicate nature)	Total	Deductions if any	Net amount paid	Signature/ Thump impression of workmen	Initials of contrac tor or his represe ntative
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

Wage period:
Monthly/Fortnight ly

ANNEXURE D

ANNEXURE-E WAGE CARD

Wage Card No.:

Name and address of contractor:

Date of issue :

Name of work with location:

Designation :

Name of workman:

Month/Fortnight :

Rate of wages :

Date of issue : _____ Designation _____ Month/Fortnight _____

1.	2.	3.	4.	5	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.	24.	25.	26.	27	28	29.	30.	31

Morning:

Rate:

Evening:

Amount:

Initial:

Received from _____ the sum of Rs. _____ on account of my wages.

The Wage Card is valid for one month from the date of issue.

Signature

**ANNEXURE ‘E’
(Reverse)**

**FORM XIX
WAGE SLIP**

Name and address of contractor: _____
Name and Fathers/Husbands name of workman: _____
Nature and location of work: _____
For the Week/Fortnight/Month ending: _____
1. No. of days worked: _____
2. No. of units worked in case of piece: _____ rate workers
3. Rate of daily wages/piece rate: _____
4. Amount of overtime wages: _____
5. Gross wages payable: _____
6. Deductions, if any: _____
7. Net amount of wages paid : _____

Initials of the contractor or his representative

ANNEXURE-‘ F’

**FORM XIV
EMPLOYMENT CARD**

Name and address of contractor: _____
Name and address of establishment in/under: _____ which contract is carried on
Name of work and location of work: _____
Name and address of Principal employer: _____
1. Name of the workman: _____
2. Sl. No. in the register of workman: _____ employed
3. Nature of employment/designation: _____
4. Wage rate (with particulars of unit in: _____ case of piece work)
5. Wage period: _____
6. Tenure of employment: _____
7. Remarks: _____

Signature of contractor

ANNEXURE G

FORM - XV
SERVICE CERTIFICATE

Name and address of contractor: _____

Name and address of establishment in/under which contract is carried on _____

Name and location of work: _____

Name and address of workman _____

Name and address of principle employer _____

Age or Date of birth _____

Identification marks _____

Father / husband's Name _____

Sl.No	Total period for	Which Employed	Nature of work Done	Rate of wage(with particulars of Unit in case of piece work)	R e m a r k s
	From	To			
1	2	3	4	5	6

ANNEXURE 'I'**LIST OF ACTS AND OMISSIONS FOR WHICH FINES CAN BE IMPOSED :**

In accordance with rule 5 of the Department of Atomic Energy Contractor's Labour Regulations to be displayed prominently at the site of work in both English and local language.

1. Willful insubordination or disobedience, whether alone or in combination with other.
2. Theft, fraud or dishonesty in connection with the contractors beside a business or property of Department of Atomic Energy.
3. Taking or giving bribes or any illegal gratifications.
4. Habitual late attendance.
5. Drunkenness fighting, riotous or disorderly or indifferent behavior.
6. Habitual negligence.
7. Smoking near or around the area where combustible or other materials are locked.
8. Habitual indiscipline.
9. Causing damage to work in the progress or to property of the Department of Atomic Energy or of the contractor.
10. Sleeping on duty.
11. Malingering or slowing down work.
12. Giving of false information regarding name, age, father's name etc.
13. Habitual loss of wage cards supplied by the employers.
14. Unauthorized use of employer's property for manufacture or making of unauthorized articles at the work place.
15. Bad workmanship in construction and maintenance by skilled workers which is not approved by the Department and for which the contractors are compelled to undertake rectifications.
16. Making false complaints and/or misleading statements.
17. Engaging on trade within the premises of the establishments.
18. Any unauthorized divulgence of business affairs of the employees.
19. Collection or canvassing for the collection of any money within the premises of an establishment unless authorized by the employer.
20. Holding meeting inside the premises without previous sanction of the employers.
21. Threatening or intimidating any workman or employee during the working hours within the premises.

ANNEXURE-‘ J’

FORM - XX

REGISTER OF DEDUCTIONS FOR DAMAGE OR LOSS

Name and address of contractor: _____

Name & address of establishment in/under which contract is carried on:

Nature and location of work:

Name and address of Principal Employer:

[illegible]

ANNEXURE- ' L '

FORM - XXIII

REGISTER OF OVERTIME

Name and address of contractor: _____

Name and address of establishment in/under which contract is carried on:

Nature and location of work:

Name and address of Principal Employer: _____

Sl. No	Name of workman	Fathers/Husband's Name	Sex	Designation/nature of- employment	Dates on which Overtime worked	Total over time worked or production in case of piece rated	Normal rate of wages	overtime rate of wages	overtime earnings	Rate on which overtime wages paid	Remarks
1	2	3	4	5	6	7	8	9	10	11	12

ADDITIONAL CONDITIONS

1. MATERIALS OBTAINED FROM DISMANTLEMENT:

The contractor in the course of their work should understand that all materials (e.g. stone and other materials) obtained in the work of dismantling excavation etc. will be considered Government property and issued to the contractor (if they require the same for their own use) at rates approved by the Chief Engineer. If they do not require these materials, they will be disposed off to the best advantage of Government.

2. DELAY IN OBTAINING MATERIALS BY THE DEPARTMENT:

Owing to difficulty in obtaining certain materials in the open market, the Government has undertaken to supply materials as specified in Schedule 'A' here to annexed rates states therein. There may be delay in obtaining the materials by the Department and the contractor is, therefore, required to keep himself in touch with day-to-day position, regarding the supply of materials from the Engineer-in-charge and to so adjust the progress of the work that their labour may not remain idle nor may there be any other claim due to or arising from delay in obtaining the material. It should be clearly understood that no claim whatsoever shall be entertained by the Government on account of delay in supplying materials. In case the materials included in schedule of supply of materials are not supplied by the Department and in case the use of such material is required in the works, the contractor with prior orders of the Engineer, for the use of such materials/ sections etc. from his own stocks or sources, may use of such materials of approved and tested quality. In all such cases the contractor shall produce the details of these materials such as quality, quantities including testing certificates and shall be entitled to claim extra payment for such use. The extra payment/ deduction would be the difference between the actual price (to be supported by vouchers) and the issue price.

3. Any damage to work resulting from rains or from any other cause until the work is taken over by the Department after completion will be made good by the contractor at his own cost.

4. The contractor shall get himself acquainted with the nature and extent of the work and satisfy himself about the availability of quarry and of kiln for collection and conveyance of materials required for the construction. The contractor's quoted rate should take into account all these factors, and will not be allowed any extra lead for collection and conveyance of materials for any reasons whatsoever.

5. The contractor shall deposit royalty and obtain necessary permit for supply of Red Bajri, stone kankar etc. from local authorities

6. Security deposit should not be paid till clearance certificate from Labour Officer is obtained by Contractor.

7. No area shall be allotted by the Department for setting up of labour camp.

8. Labour Camp shall not be erected at the site of the work nor any Labour shall be allowed to live at site.

9. The contractor shall conform to the provision of any Government acts which relate to works and to the regulations and by laws of any local authorities. The contractor shall give all notices required by the said acts or laws etc. and pay all fees payable to such authorities and allow for those contingencies in his tendered rates including fees for encroachments, costs of restorations etc. and all other fees payable to the local authorities.

10. The contractor shall undertake to have site clean free from rubbish to the satisfaction of the Engineer-In-charge. All surplus materials, rubbish etc. will be removed to the place fixed by the Engineer-In-charge and nothing extra will be paid.

11. CONVENIENCE FOR DEPARTMENT'S ACTIVITIES:

The contractor shall not deposit materials on any site which will seriously be inconvenient to any of the Department's activities. The Engineer-In-charge may require the contractor to remove any materials which are considered by him to be of danger or inconvenience to the activities of the department or cause them to be removed at the contractor's cost.

12. EMPLOYMENT OF CERTIFIED PLUMBERS:

Certified plumbers should be employed by the contractor on the work for main sewer filtered and unfiltered main.

13. EMPLOYMENT OF LICENSED ELECTRICAL FOREMAN (for electrical works only)

The contractor should employ a licensed electrical foreman to supervise the electrical works.

14. The contractor shall not employ a woman and man below the age of 18 on the work of painting with products containing lead in any form, where ever men above the age of 18 are employed on the work of lead painting, the following principles must be observed for use.

i)a) White lead, sulphate of lead, products containing these pigments shall not be used in painting operation except in the form of paste or paint ready for use.

b) Measures shall be taken in order to prevent danger arising from the application of paint in the form of spray.

c) Measures shall be taken wherever practicable to prevent danger arising from dust caused by the rubbing down and scrapping.

ii) a) Adequate facilities shall be provided to enable working painters to wash during and on cessation of work.

b) Suitable arrangements shall be made to prevent clothing put off during working hours being spoiled by painting materials.

c) Overalls shall be worn by working painters during the whole of the working period.

iii) a) Case of lead poisoning and of suspected lead poisoning shall be notified, and shall be subsequently verified by a medical man appointed by the Competent authority of BARC.

b) The B.A.R.C. may require, when necessary a medical examination of workers.

c) Instructions with regard to the special hygiene precautions to be taken in the painting trade shall be distributed to working painters.

15. In any section of these specifications where item of material or equipment are specified by brand name, catalogue number or by names of manufacturers, the contractor is required to use the same material / equipment only. Equivalent to the material / equipment shall be acceptable (after reducing/increasing the rate to extent of difference in cost) incase of its non-availability and after confirming the same in writing from the manufacturer only with the written approval of Engineer-in-charge.

16. **SUBSTITUTE OF MATERIALS** : (a) In any section of these specifications where items of material or equipment are specified by brand name, catalogue number or by names of manufacturers the reference is intended to be descriptive and not restrictive and is solely for the purpose of indicating the type or quality of item that will be acceptable. An approved equal shall be acceptable whether so specifically stated or not at the discretion of the Engineer.

(b) The Engineer reserves the right to have certain tests and / or analysis made of any proposed substitute material or equipment to determine its acceptability for the purpose specified.

i) Samples of the proposed substitute material or equipment certified by the manufacturer, shall be submitted to the Engineer for test and / or analysis. The quantities of the items in question required for these tests and / or analysis shall be determined by the Engineer.

ii) During the progress of the work, the Engineer may, should be deem it advisable, take samples of the substitute item for check test or analysis.

iii) All costs of the tests, check tests and / or analysis made shall be borne by the contractor.

iv) No proposed substitute for a specified item shall be used in the work of the contract prior to written authorization by the Engineer, such written authorization to state the amount of the adjustment, if any to be made in favour of the Department.

v) Should the use of authorized substitute materials and / or equipment proposed by the Contractor, require, in the opinion of the Engineer changes or modifications in the design, engineering drawing, specifications or work to be performed under the contract in any way, all of the cost of making such changes or modifications, whether or not considered at the time of the substitute was approved shall be borne by the Contractor. Said costs shall include, but not be limited to the finishing installation by the Contractor of any additional materials or equipment which in the opinion of the Engineer may be deemed necessary to accommodate the substitute materials and / or equipment in the work.

SECTION - IV
SPECIAL INSTRUCTIONS TO
TENDERERS

NAME OF WORK :- _____

SPECIAL INSTRUCTIONS TO TENDERERS

1. The tenderer is requested to visit the site to acquaint himself with the site conditions, working conditions, approaches, availability of materials, facilities for storing construction materials, dumping facilities for his labour force, geological and weather conditions and all other relevant information required for tendering before submitting his tender.

2. LOCATION AND SCOPE OF THE WORK :

Please refer Performa of Schedules.

3. The tenderer should also note that other contractor will be working in the vicinity and this work will have to be carried out in proper co-ordination with them. The tenderers shall also note that they shall have to clear the site of vegetation, debris etc. before commencement of the work and that no extra payment is permissible on account of clearance of site, removal of debris etc. coming in the way of construction work.

4. **STAKING OUT BASE LINES AND LEVELS:**

The contractor shall layout his work from base lines and grade established by the Department and shall be responsible for all measurements in connection therewith. The contractor shall at his own expense furnish all stakes, templates, platforms equipments, ranges and labour that may be required in setting of layout of any part of the work. The contractor shall be held responsible for the proper execution of the work to such lines and grades as may be established or indicated on the drawings and in specifications. The contractor shall take benchmarks, lines and levels. The contractor is to construct and maintain proper benches at the intersections of all main walls, columns, etc. in order that the lines and levels may be accurately checked at all times, theodolite, levels, prismatic compass, chain, steel and metallic tapes and all other surveying instruments found necessary for the work shall be provided by the contractors for use at site in connection with this work.

5. **DRAINAGE IN THE VICINITY OF THE BUILDING:**

The contractor shall be entirely responsible for the provision and maintenance of the efficient drainage arrangements in the work site to lead of all water whatever pumped from the excavation or on account of rains, springs or any other sources whatsoever. Flooding or ponding of water in the work site shall not be permitted under any circumstances whatsoever and the contractor shall take all precautions to prevent the same by providing suitable pump or other dewatering arrangements. The cost of repairing damages, if any, to the work under execution or to any Government property in and around the site shall be entirely borne by the contractor when such damages are due to non-compliance with the above conditions.

6. **TRAFFIC INTERFERENCE & INCONVENIENCE TO THE PUBLIC:**

The contractor shall conduct his operations so as to interfere as little as possible with the traffic. When interference to traffic is inevitable, notice of such interference shall be given to the Engineer-in-charge well in advance (at least 2 days). The contractor shall take all precautionary and other measures, such as providing warning signals, temporary diversions

etc. all as directed by the Engineer-in-charge. The contractor shall exercise full care to ensure that no damage is caused by him or his workmen, during the operations, to the existing water supply and power lines. The cost of any such damage and risks arising out of this shall be entirely borne by the contractor. The contractor shall not deposit materials on any site which will seriously inconvenience the public. The Engineer-in-charge may require the contractor to remove any materials which are considered to be of danger or inconvenient to the public or cause them to be removed at the contractor's cost.

7. COMMENCEMENT AND COMPLETION OF WORK IN PROPER SCHEDULE:

The entire work shall be completed within a period of (as specified in NIT/ Schedule F) months including monsoon period from fifteenth day after the date on which the written order to commence the work is issued.

Time being the essence of the contract, a broad based time schedule showing the important phases of the work has been prepared by the Department for contractor's information and enclosed herewith. It will be necessary for the contractor to adhere to this programme of work and he will have to prepare and submit detailed programme of work and showing the various activities of work taking into consideration the departmental programme. This programme shall be submitted by the contractor within a fortnight of the acceptance of the tender for the approval of the Engineer-in-charge, which will then form part of the contract and the work is to be carried out in all respects as per time schedule.

8. CO-OPERATION WITH OTHER CONTRACTORS:

The contractor shall afford all facilities and give complete co-operation for the execution of various other works, if required to be carried out simultaneously by other agencies while his own work is in progress. The co-ordination will be effected in consultation with the Engineer-in-charge of the work. Other contractors are also likely to be authorised by the owners to work in the same area during the construction stage for work such as (i) Electrical (ii) Air-conditioning (iii) Services and (iv) Public Health and other miscellaneous works.

The contractor shall afford all facilities

- a) For the installation of embedded parts, sleeves with its accessories in slabs, beams or walls by the other agencies, before the reinforcement is placed. Necessary outlets in the Shuttering will have to be provided by the civil contractor for this purpose for which no extra payment will be admissible.
- b) For the installation of various service lines in the walls, floors, slabs ducts etc.
- c) The contractor shall afford all facilities for using scaffolding etc. by the other contractors.

No extra claims on account of facilities provided for carrying out the work mentioned above will be entertained.

9. SPECIFICATIONS AND DRAWING

- a) The drawings furnished to the contractor shall be interpreted by the use of given dimensions and nomenclature only, and the drawings shall not be scaled. Drawings to a large scale shall have precedence over those to a smaller scale.
- b) Prior to the execution of the work the contractor shall check all drawings, specifications and shall immediately report all errors, discrepancies and /or omissions discovered therein to the Engineer-in-charge and obtain appropriate orders in the same. Any adjustments made by the contractor without prior approval of Engineer-in-Charge shall be at his own risk. Each description of item in the schedule of quantities shall be read in conjunction with the relevant drawings and specifications and the contractor's rate shall be

deemed to be such complete work unless otherwise specified by the contractor while tendering.

c) Cost of all shop drawings, fabrication drawing of formwork drawings and details to be furnished by the contractor shall be deemed to be included in his tendered rates for the form work. Approval of shop drawings shall not be construed as authorizing additional work of increased costs to the Department.

d) Prior to submission for approval, the contractor shall be responsible for thoroughly checking all drawings to ensure that they comply with the intent and the requirements of the contract specifications and that they fit in with the overall building layout. Drawings found to be inaccurate or otherwise in error will be returned for correction by the contractor.

e) For all drawings to be submitted by the Contractor for the approval of the Engineer-in-charge, the contractor shall submit 6 (six) copies of each drawings for approval.

f) The approval of the drawings by the Engineer-in-charge shall not be construed as a complete dimensional check, but will indicate only that the general method of construction and detailing is satisfactory. The contractor shall be responsible for the dimensions and design of adequate connection, supports, details & satisfactory construction of the work.

10. CONTRACTOR'S STORES AND SITE OFFICE:

Suitable area near the site of the work shall be allocated to the contractor free of cost for storing his equipment, plant, materials, etc. and for his site office and cement godown. He will, however, be solely responsible for watching or guarding his property and materials issued to him by the owner. Contractor shall cover all materials at site with requisite insurance against theft larceny, decoits, fire tempest and flood. He, however will have to dismantle the sheds and vacate the land after the receipt of due notice from Engineer-in-charge ,if the same is obstructing any work.

11. APPROACH ROADS:

Contractor shall be permitted to use the existing roads in the establishment area for the purpose of transporting labourers and materials etc. The Engineer-in-charge, however, will not undertake to provide any approach roads to the site of work. It shall be entirely the responsibility of the contractor to provide and maintain such temporary approach roads at his own cost for the purpose of movement of men, materials and equipment. Layout of such approach road shall be submitted to Engineer-in-charge for his approval before undertaking the construction of the same. Such approach roads shall be made available to other agencies carrying out the work in the same area in consultation with Engineer-in-charge of the works without any extra cost.

12. TEMPORARY BUILDINGS:

Warehouse, shed, workshop and office facilities as required by the contractor shall be provided by him at his own expenses. Prior approval of the Engineer-in-charge shall be obtained in respect of location layout and details, of these buildings. After the work is over these temporary facilities shall be removed by the contractor at his own expenses to the satisfaction of the Engineer-in-charge within 10 days from the date of completion. No land for erecting temporary huts for housing the contractors Labourers will be made available by the Department. The contractor will have to make his own arrangements for the same.

13. INSPECTION:

The work shall be conducted under the general direction of the Engineer-in-charge and is subject to inspection by his appointed representative to ensure strict compliance with the terms of contract. No failure of the Engineer-in-charge or his designated representative during the progress of work to discover or to reject materials or work not in accordance with

the requirements of this contract shall be deemed an acceptance thereof, or a waiver of defects therein, and payment by the Engineer-in-charge a partial or entire occupancy of the premises shall be construed to be an acceptance of work or materials which are not strictly in accordance with the requirements of this contract. No changes whatsoever to any provision of the specifications shall be made without written authorization from the Engineer-in-charge.

14. WATER:

Only piped water will be made available to the contractor at site at one place on the main line to be determined by the Engineer-in-charge. The contractor shall make his own arrangements for drawing water from the main. He shall bear the cost of making all connections, boosting water, laying all the pipe lines, installing a tested meter of approved make, maintaining all installations and dismantling the same on completion of work and making good any damage due to such piping of work and its removal. The meter shall be provided with masonry chamber, with a lid and locking arrangement.

The contractor shall pay for all the water drawn by him at the rate specified in Schedule 'A'. In case it is observed that the water meter is out of order the consumption of water for the period during which the meter was out of order shall be worked out on the basis of 1 % of the cost of items of construction requiring water, during the said period.

The contractor shall provide at his own cost adequate storage of water required for his work and drinking for the labour to tide over temporary stoppage in the supply of water. No claims for any help of work in this account will be entertained.

15. REQUIREMENT OF ELECTRIC POWER:

The tenderers should submit along with their tenders the total approximate requirement of electric power that may be required by them for the execution of the work.

16. ELECTRICITY:

GUIDELINES FOR TEMPORARY POWER SUPPLY AT SITE AND

GENERAL SAFETY PROCEDURE:

(A) General:

i) Electrical power supply at Medium voltage (415 volt, 3 phase, 4 wires) for constructional purpose and general lighting will be made available at site or near site of work at the discretion of Engineer-in-charge at one point. The distance will not however, exceed 50 meters from the building site. The contractor has to lay the power lines from this point at his own cost in an approved manner as indicated in subsequent clauses. The power supply will be made available subject to following:

ii) The contractor should submit a list of equipments he proposed to connect for constructional and general lighting purposes indicating his power requirements in appropriate form enclosed (Annexure-I) for approval of Engineer-in-charge.

iii) A list of licensed electrical staff he will be posting at site.

iv) The contractor should pay the minimum charges based on his power demands at Current tariff rates prevailing at site as charged by supply authorities and as shown in schedule 'A' (Schedule of Materials to be supplied).

v) Suitably rated KWH meter will be supplied and installed by contractor and test certificates as per ISS from authorised test lab. or manufacturer is submitted.

vi) All extension from this point shall be executed in an approved manner with prior permission of Electrical Engineer. The installation shall conform to Indian Electricity Rules, Indian Electricity Act 1910 & IRE Regulations as per the latest Revisions and got executed by Licensed Electrical Contractors only.

vii) The entire installation shall be subject to the following tests before energisation of installation including portable equipments.

- a) Insulation resistance test
- b) Polarity test of switches
- c) Earth continuity test
- d) Earth electrode resistance

The testing procedure and results shall conform to ISS & Code of practice. The contractor shall provide the necessary skilled and unskilled labour and also instruments for conducting the test. The tests shall be carried out in the presence of Electrical Engineer and submitted in proforma enclosed

(Annexure-II).

viii) Double grounding will be provided for all equipments. Power supply will be effected after completion of above.

(B) After energising the installation continuity of power supply will be subject to the following:

i) The contractor shall submit a test report as per Clause (A) (vii) a,b, c, d for his complete installation every 2 months or after rectifying any faulty section in the specimen test report enclosed (Annexure II). One such test report for the complete installation shall be submitted before onset of monsoon.

ii) The contractor should not connect any additional load without prior permission of Electrical Engineer. For obtaining additional power required, test reports should be submitted.

iii) Where distribution boards are located at different places, the contractor shall submit schematic drawing indicating all details like size of wires, OH or cable feeders, earthings etc.

iv) The supply will be switched off by the Elec. Engineer by prior arrangement with Civil Dept. for normal and preventive maintenance etc., of Departmental equipments once in a month. The duration and time will be intimated to contractor. The availability of power supply will be further subject to shut down due to any emergency break downs or switch off by supply authorities for their maintenance works. Contractor is not eligible for any compensation due to above.

Government will not be liable for any loss or damage to the contractor's equipment as a result of variations in voltage or frequency of interruptions in power supply. In the event of any failure / interruptions /stoppage of power supply for a continuous period not exceeding 24 hours the contractor shall have no claim whatsoever against Government. For any power failure / stoppage resulting in interruptions for a continuous period exceeding 24 hours, the contractor will be eligible only for reasonable extension of time for any compensation in this account.

Government will not be liable for any loss to the contractor arising from failure or interruption or stoppage of works any attendant delays consequent upon such failure, interruption or stoppage of power supply or variations in voltage or frequency.

(C) The following are provided for general guidance of the contractor and should be read as specific requirements, in addition to complying with Indian Electricity Act, Indian Electricity Rules, I.S. Regulations.

- i) The minimum clearance to be maintained for all overhead line shall be 4 meters along roads and 6.1 meters across roads.
- ii) Wherever cables or wires are laid on poles a guard wire of adequate size shall be run along the cables/wires and earthed effectively.
- iii) Metallic poles as general rule should be avoided and if used should be earthed individually.
- iv) All loose hanging of wire and cables should be avoided and should be properly supported and an approved method of fixing shall be adopted.
- v) Installation shall not cause any hindrances to movement of men and materials.
- vi) Reinforcement rods or any metallic part of structures should not be used for supporting wires and cables fixtures, equipments etc.
- vii) All cables and wires should be adequately protected mechanically against damages.
- viii) In case the cable is required to be laid in ground, it should be adequately protected by covering the same with bricks, PCC tile or any other approved means.
- ix) Laying of cables and wires direct on floor shall be avoided but if, required the same shall be taken through G.I. / M.S. pipes etc.

D. i) All the switch boards, equipments etc. should be protected from rain and should not be exposed to weather. The contractor should provide proper enclosure of approved size and shape for protection against rain.

ii) As far as possible, switch fuse units and Distribution Boxes etc. with HRC fuses should be used.

iii) The switch fuse units should be checked for their proper function. As far as possible new equipments should be used. However, the same shall be in a very good condition. ISI marked equipments from reputed manufacturers will be preferred. Switch fuse units of appropriate ratings of fuse be utilised for the required power supply and all terminals in the external supply should, as far as possible, be taken from the bottom of the switch such that rain water or its spray will not enter the switch boards from the top. All switches of the switch boards should have proper gaskets so that no water will enter even if rain water or its spray falls on the switches.

v) All the Distribution Boards, Switch fuse units, Bus bar chambers etc. shall be dust and vermin proof.

The distribution boards, switches etc. shall be so fixed that they should be easily accessible. The position and location of all equipments, switches etc. shall be informed to the Electrical Engineer at the time of energisation. Also, the same should be informed as soon as any change is done.

E. i) Only PVC insulated & PVC sheeted wires or armoured PVC insulated and sheeted cables should be used for external power supply connections of temporary nature. Weather proof rubber wire should not be used for any temporary power supply connections. Taped joints in the wires shall be avoided as far as possible and the connections shall be made in looping system. At the terminal points of the switch boards, an effective PVC Box or alternatively M.S. Box, with proper glands and sealing arrangements, should be provided to ensure that no moisture leaks at the terms of the switches.

ii) All armoured cables shall be properly terminated by using suitable cable glands, standard conductor cables shall be connected by using cable lugs / sockets, Cable lugs should preferably be crimped, cable lugs should be proper size and

should correspond to the current rating and size of the cables. Twisted connections will not be allowed.

iii) All the cables glands shall be properly earthed.

iv) All connections to lighting fixtures, starters or other power supply should be provided with PVC insulated, PVC sheeted twin core wires to have better mechanical protection for preventing possible damage to equipment or injury to personnel. No taped joints will be allowed and the connections may be looping system.

v) All the lighting fixtures and lamp holders shall be of good quality and in good condition. Badly repaired or broken holders etc. will not be allowed for use.

vi) The working areas shall be adequately lighted. The lighting fixtures shall be fixed in such a manner such that sufficient head clearance is provided for general working.

vii) For day to day lighting requirements it is preferred that an extension board is used for three pin plugs should be used for tapping. By using the extension boards any number of light points can be tapped as and when required, without having any joints in wires.

viii) The connection for portable machines shall be taken through 3 pin plugs points, Iron clad industrial type plug outlets are preferred. While taking supply through plug outlet a plug top must be used. The third pin of the plug shall invariably be earthed and 3 core wire shall be used.

ix) Wire guards shall be provided on bulbs as far as possible.

F. (i) Method of earthing, installation and size of earth electrodes and earthing conductors and earth testing results shall conform to relevant I.S. etc.

ii) Generally the contractor shall make his own arrangements for main electrode and taping thereof. The existing earth points available at site can be used at the discretion of the Electrical Engineer with prior permission.

iii) Joints in earthing conductor shall be avoided as far as possible. However in case of a joint it should be properly soldered or jointed in an approved manner. Twisting of wires will not be allowed. Loop earthing of equipment shall not be allowed. However, tappings from on earth bus may be done. Every equipment should be provided with two independent earth connections except for portable equipments.

iv) All three phase equipments shall be provided with duplicate earthing./ All light fixtures and portable equipments should be effectively earthed to main earthing.

G. Power supply to all the machines and lighting fixtures etc. shall be switched off when not in use.

i) Persons having valid wireman's license / competency certificate must be employed for carrying out electrical work and repair of equipments, installation and maintenance at site. A qualified /licensed supervisor may also be employed for supervision.

ii) An electric power failure and/or accident caused due to noncompliance of above mentioned instructions will entirely be the responsibility of the contractor.

iii) On recommendations by the Electrical Engineer the Engineer-in-charge reserve the right to disconnect the power supply to the contractor Without prior intimation. If the above mentioned instructions are not Followed contractor will not be eligible for any compensation due to such disconnections.

SAFETY INSTRUCTIONS: ELECTRICAL OPERATIONS

I Installations:

i) Electrical equipment and installations should be so designed, installed and maintained as to prevent danger from contact with live conductors and / or from electrically originated fire. Only qualified/licensed persons should be permitted to install, adjust, examine or repair electric equipment/circuits.

ii) Materials for all electrical equipment should be selected with regard to working voltage, load and working environment, such equipment should conform to the relevant standards.

iii) Exposed live parts at electrical circuits and equipment operating with alternating current (AC) at 50 volts or more should be generally provided with permanent enclosures / cover.

Crane trolley wires and other conductors, which cannot be completely insulated, should be placed such that they are inaccessible under normal working conditions.

iv) Armouring and sheathing of electric cables, metal circuits and their fittings, metallic fittings and other non-current carrying parts of electrical equipment and apparatus should be effectively grounded.

v) Grounding conductor of wiring system should be copper or other corrosion resistant material. An extra grounding connection should be made in appliances / equipments where chances of electric shock is high.

vi) Electric fuses and / or circuit breakers installed in equipment circuits for short circuit protection should be of proper rating. It is also recommended that high rupturing capacity (HRC) fuses should be used wherever possible in circuits carrying currents more than 15 amps.

vii) Open type distribution boards should be placed only in dry and ventilated rooms, they should not be placed in the vicinity of storage batteries or otherwise exposed to chemicals fumes.

viii) Isolating switches should be provided for disconnecting electrical equipment or conductors from the source of supply when repair or maintenance work has to be done on them.

ix) In front of distribution boards a clear space of 105 cm (3.5') should be maintained in order to have easy access during an emergency.

x) Adequate working space should be provided around electrical equipment which require adjustment or examination during operation.

xi) As far as possible electrical switches should be excluded from a place where there is danger of explosion. All electrical equipments such as motors, switches and lighting installed in work room where there is possibility of explosion hazard should be explosion proof type approved by CMRS, Dhanbad.

xii) After installation of new electric system and/or other extensive alterations to existing installations, an Electrical Engineer before the new system should make thorough inspection or new extension is put in use.

II. OPERATION & MAINTENANCE:

i) A person who works with electrical installation / equipment should be aware of the electrical hazards, use of protective devices and safe operational procedures. They should be given training in fire fighting, first aid and artificial resuscitation techniques.

ii) The supervisor should instruct in the proper procedure, specify and enforce the use of necessary protective equipment such as adequately insulated pliers, screw drivers, fuse pullers and similar hand tools. Only wooden ladders should be used to reach the heights in electrical work.

iii) Before any maintenance work is commenced on electrical installation / equipment the circuits should be de-energised and ascertained to be dead by positive test with an approved voltage testing device. Switches should be tagged or the fuse holders withdrawn before starting the work.

iv) Adequate precautions should be taken in two important aspects

- a) That there shall be no danger from any adjacent live part and
- b) That there shall be no chances of re-energisation of the equipment on which the persons are working.
- v) While working or near a circuit, whenever possible the use of only one hand should be practised even though the circuit is supposed to be dead. The other hand may preferably be kept in pocket.
- vi) When it is necessary to touch electrical equipment (for example when checking for overload or motors) back of the hand may be used. Thus, if accidental shock were to cause muscular contractions, one should not 'freeze' to the conductor.
- vii) Operation of electrical equipment should be avoided when standing on wet floor or when hands are wet.
- viii) Before blown fuses are replaced, the circuit, should be locked out and investigations should be made for the cause of the short-circuit or overload.
- ix) Pliers, screw drivers, testing lights and other tools for the work should be adequately insulated for voltage involved.
- x) When two persons are working within reach of each other, they should never work on different phases of the supply.
- xi) When structural repairs, modification or painting works are undertaken, appropriate measures should be taken for the protection of persons where work may bring them into the proximity of live equipment I circuit.
- xii) Temporary electrical connections should be removed as soon as the stipulated work is over.
- xiii) An insulation resistance test should be carried out every time an equipment is connected back after alterations or repair. Also, insulation resistance tests (meggar tests) should be made periodically and significantly low readings or sudden changes should be carefully investigated. Outside installations which are exposed to weather should be tested more frequently.
- xiv) It should be ensured that no extension boards are over loaded while tapping. Only standard three pin plugs should be used for tapping electricity. Broken sockets I plugs should be replaced immediately with good ones. Joint free cables only should be used for connecting equipment I apparatus.
- xv) Floors should be kept free from trailing electrical cables to avoid tripping hazard.

III. PORTABLE ELECTRICAL EQUIPMENT

- i) Portable electrical equipment should be regularly examined, tested and maintained to ensure that the equipment and its loads are in good order.
- ii) All portable appliances should be provided with a three pin plugs. It should be ensured that the metal part of the equipment should be effectively earthed.
- iii) **BARE WIRE SHOULD NOT BE USED FOR TAPPING ELECTRICITY**
 - a) It should be ensured that the insulation and wire size of extension cords are adequate for the voltage and current to be carried.
 - b) All loose wiring such as trailing and flexible cables for portable lamps, tools and apparatus should be regularly examined.

IV. GENERAL SAFETY PROCEDURE:

- i) It should be ensured that power supply to equipment is disconnected before any repair work is undertaken.
- ii) Insulated tools shall be used for working on electrical equipments.
- iii) At building constructional sites, helmets and safety shoes shall be used. PI
- iv) In case of an accident the security staff on duty shall be informed immediately. Also the Engineer-in-charge, Electrical Engineer, Safety Co-ordinator of the Project. Administrative Officer of the Project and Trombay / Tarapur dispensary shall be informed.
- v) In case of an electrical accident a report should also be sent to the Electrical Inspector, on prescribed proforma, under intimation to the Electrical Engineer and the Engineer-in-charge. Also, resuscitator may be used.
- vi) in case of fire hazard, BARC Fire Brigade (Phone No. 2550 5222 or 2559 2222 or 2559 4222) shall also be informed immediately. For Tarapur works the Security Officer, Tarapur shall be contacted through Assistant Security Officer, PREFRE.
- vii) The contractor shall keep a first aid kit at site. However, in case of accident major/Serious) the victim shall be taken to BARC, Trombay Dispensary before removing from the premises, (Dispensary Phone No. 2550 5149 or 2559 2003 or 2559 2338). For Tarapur works the victim shall be taken to TAPS Hospital at Tarapur.
- viii) In case of working at a high elevation either safety belts shall be used or railing / enclosure shall be provided around the working platform / Cage / ladder etc.
- ix) Ropes, shackles, chains, slings etc. to be used (specially for use of tying the scaffolding etc.) shall be periodically checked for integrity and mechanical soundness and corrected by replacement.
- x) All safety procedures and practices as informed by Department should be followed.

17. REMOVAL OF WORKMEN AND SUPERVISORY STAFF:

The contractor shall employ in or about execution of the work only such persons as are careful, skilled and experienced in their several trades and the Engineer-in-charge, shall be at liberty to object to and require the contractor to remove from the works any persons employed by the contractor in or about the execution of works who in the opinion of the Engineer-in-charge misconduct himself or is incompetent, or negligent in the proper performance of his duties and all such persons shall not again be employed upon the works without the permission of the Engineer-in-charge.

18. SCHEDULE OF QUANTITIES:

A schedule of probable quantities in respect of the work and specification is enclosed. The schedule of probable quantities is liable to alterations by omission, deduction or additions at the discretion of the Engineer-in-charge.

19. TENDER RATES:

The rates quoted by the tenderer in the schedule shall be inclusive of Sales Tax on contract materials, Sales Tax on contract turnover as levied by the local State Govt. authorities, Octroi Duty and or other duties levied by the Government or other public bodies. Unless otherwise stated in the schedule of quantities rates for all items shall be for the complete work including supplying and fixing of all materials etc.

The contractor when called for by the Department, should furnish detailed analysis in support of the rates quoted by him against each item of the tender. The Department reserves the right to utilize the analysis thus supplied in settling any deviations or claims arising on this contract.

In this connection, the tenderers may, however, note that under the provisions of section 1944 (2) of ~ Bombay Municipal Corporation Act, if any articles on which octroi is paid, is imported into the city under a written declaration signed by the importer that such article is being imported into the city for the purpose of supply to Government work, the octroi is admissible for refund on production of certificate from the Government that the article has become the property of Govt. In case of materials incorporated in this work, the necessary certificate will be furnished by the Department to enable the contractor to obtain refund of octroi. This may be taken into consideration by the tenderers when quoting their rates.

20. SUPPLY OF MATERIALS: Materials stated in Schedule 'A' will be issued from the Arch. & Civil Engineering Division Stores at North Site, BARC, Trombay depending upon availability as indicated in Schedule 'A'. In the case of works at Tarapur, Steel and other materials will be issued from Departmental Stores at Railways Siding Boisar as indicated in Schedule 'A'.

The contractor shall bear all incidental charges for cartage, storage and safe custody of materials also. No reimbursement of the expenses will be made by the Department.

The contractor should note that the difference in the quantity of materials actually issued to the contractor and theoretical quantity including its variations, if not required by the contractor, shall be recovered at twice the issue rates including storage charges without prejudice to the provision to the relevant condition regarding the return the materials. And in the event of it being discovered that the quantity of material used is less than the quantity ascertained as herein before provided (allowing variations of minus side) cost of materials not so used shall be recovered from the contractor on the basis of stipulated issue rate including storage charges and cartage to site without prejudice to the right of the Engineer-In-charge to reject such works or to allow him at reduced rates for such items or insist on him to do the same without any extra cost.

Recovery for the supply of M.S. Rounds, high yield strength deformed bars, structural etc. shall be made progressively from the running account bills allowing 10% wastage over the quantity consumed Recovery for cement supplied shall be made based on the actual consumption at site.

M.S. Rounds. High Yield Strength Deformed Bars. M.S. Structural Plates & M.S Sheets etc.:
The materials shall be issued in length as available in the stores. no claim on this account shall be entertained. M.S. Bars shall be issued in straight or in coils as available and nothing extra shall be payable for straightening the bars. The materials shall be stacked properly on wooden sleepers to prevent excessive rusting. Wastage in respect of M.S. materials as indicated below shall be property of the contractor.

- a. For all diameter of M.S. Rounds and high yield strength deformed bars pieces under 2.00 meter length will be reckoned as wastage.
- b. For all structural sections, pieces under 1 meter length shall be reckoned as wastage.
- c. For all M.S. plates and sheets, pieces less than 0.1 sq. metre, will be considered as wastage.

Any pieces of size exceeding those specified above and in good condition will have to be returned by the contractor at his own cost to the owner and adjustment will be made in the final bill by giving a credit at rates indicated in Schedule-A but excluding 1 % storage charges.

Only M.S. Rounds and High Yield strength deformed bars, structural steel items and M.S plates as indicated in the Schedule -A will be supplied to the contractor and the owner does not bind himself to supply other structural steel items for which the contractor will have to make his own arrangement to procure the same.

Cement: The contractor shall construct suitable godowns at site of work for storing approximately tones of cement at his own cost. Cement bags shall be stored in the godown with pucca floor and weather proof roofs and walls. Each godown shall be provided with a single door with two locks. The key of one lock shall remain with Engineer-in-charge, or his representative and that of the other lock with the authorised agent of the contractor at the site of the work so that the cement is removed from the godowns according to the daily requirement with the knowledge of both the parties.

The cement bags shall be stacked on proper floors, consisting of two layers of dry bricks laid on well consolidated earth at a level at least 300 mm (one foot) above ground level. These stacks shall be in rows of 2 and 10 high with a minimum of 600 mm (2'-0") clear space around. The bags should be placed horizontally continuous in each line. The day-to-day receipts and issue accounts of cement shall be maintained by the Engineer-In-charge or his representative and the same shall be signed daily by the contractor or his authorised agent.

It is not envisaged to supply any cement Departmentally Contractor will have to procure the same from reputed manufacturers suppliers. The cement shall be of 43 Grade OPC conforming to IS 8112/89 and shall be of , approved Brand Manufactured by the following manufacturers:-

M/s. Ultratech; M/s. Narmada; M/s. Rajashree; M/s. A.C.C or Other approved equivalent.

The contractor shall furnish necessary Test Certificate for the cement used on the work as per relevant specifications of Bureau of India Standards. The samples of cement shall be taken for such consignment under Departmental supervision and got tested in approved Laboratory Testing Institutions us per relevant standard practice at the contractor's cost.

It shall be ensured by the contractor that minimum of two months requirement shall be procured and kept in stock to maintain uninterrupted it process in the works.

Contractor should note that they will have to render an account of cement procured and actually used on works as compared to theoretical quantity of cement to be used on the works as calculated on the basis of approved design of mixes for concrete and on the basis of standard requirements for other items (As per separate sheet enclosed for guidance of contractors). Variation in these two shall be governed by provision of Clause 42 (ii) of the conditions. It shall be noted by the contractor that the quantity of cement required will be based on 20 Bags making one Metric Tone and any variation in weight of Bags shall be made good at their own cost by ensuring consumption of required quantity of cement. For each consignment of cement brought to site, the same shall be shown to departmental representative and records maintained at site for all future reference.

It should be noted that no reimbursement would be made for the cement used in excess of standard requirement inclusive of permission variation. However, in case, it is revealed that the cement consumed is less than that the standard requirement. As per separate sheet enclosed for guidance of contractors., The recovery will be made for the quantities following short at the rate of market price of latest consignment procured by the contractor. The decision of the Engineer-In-charge in this aspect is binding to the contractor.

Modalities for monitoring the consumption of cement and rendering of accounts etc. shall be worked out by the Engineer and contractor mutually from time to time.

The secured advance toward cement procured by the contractor and brought to site for meeting the requirement of work concerned. (Limited to the requirement for the immediate following two months period) shall be permissible against furnishing of necessary Indenture I Indemnity Bond by the contractor as in the case of similar advances for non-perishable material admissible under Clause 10 (B) of the General Conditions of Contract.

21. WITHDRAWAL OF TENDER: The tender should be valid for a minimum period of 180 days from the date of opening of tenders. Should the tenderer withdraw or modify his tender within this validity period, his earnest money deposit will be liable for forfeiture.

22. MEASUREMENTS: Where mode of measurements is not specified the measurements will be taken at site as per latest LS. Code of practice for measurements.

The contractor or his representative shall accompany the Engineer-in-charge or his representative when required to do and assist in taking measurements and shall agree to the measurements recorded on the spot.

All measuring tapes shall be of steel and scaffolding and ladders that may be required for taking measurements shall be supplied by the contractor.

If the contractor fails to accompany the Engineer or other persons who has been duly authorized by the Engineer-In-charge to take measurements. then he shall be bound by the measurements recorded by the Engineer-In-charge or his representative.

23. SAMPLES: Samples of all the materials to be incorporated in the works shall be submitted to the Engineer-In charge for his approval without any extra cost. The approved samples will be kept with the Engineer-In-charge till the completion of work. Materials not conforming strictly to the samples are liable to be rejected.

24. CONTRACTOR'S STAFF :

The tenderer shall furnish along his tender the list of Engineers and supervisory staff with their qualifications and experience he proposes to employ for execution of the work covered by this contract.

26. ONE COPY OF THE DRAWINGS TO BE KEPT AT SITE:

One copy each of the drawings furnished to the contractor shall be kept by the contractor at the site and the same shall at all reasonable times be made available for inspection and used by the Engineer-in-charge and any other persons authorised by the Engineer-in-charge.

27. PROPER DRAWINGS AND INSTRUCTIONS:

The Engineer-in-charge shall have full powers and authority to supply to the contractor from time to time during progress of the work such further drawings and instructions as shall be necessary for the purpose of proper adequate execution and maintenance of the work and the contractor shall carry out the work and be bound by the same.

28. WORK TO THE SATISFACTION OF THE ENGINEER-IN-CHARGE :

Save in so far as it is legally or physically impossible the contractor shall examine and complete and maintain the works in strict accordance with the entire satisfaction of the Engineer-in-charge and shall comply with and adhere strictly to the instructions and directions of Engineer-in-charge on any important matter concerning the work. The contractor shall take instructions and directions only from the Engineer-in-charge or his authorised representative.

29. WATCHING AND LIGHTING:

The contractor shall in connection with the works provide and maintain at is own cost all lights, guards, fencing and watching when and where necessary or as required by the Engineer-in-charge and duly constituted authority for the protection of the workers or for safety and convenience of the public or otherwise.

30. CARE OF WORK:

From the commencement to the completion of works, the contractor shall take responsibility for the care thereof and all temporary works and in case any damage, loss or injury shall happen to the works from any cause whatsoever at his own cost repair and make good the same. so that on completion, the works shall be in good order and condition and in the conformity in every respect with the requirements of the contract and the Engineer-in-charge's instructions.

31. GIVING OF NOTICES AND PAYMENT OF FEES:

a) The contractor shall give notices and pay all fees required to be given or paid by any National / or State Statute Ordinance or other laws or any Regulations of Bye-Laws or any local or other duly constituted authority in relation to the execution of the works or of any temporary works any by the rules and regulation of all public bodies and companies whose property or rights are affected or may be affected in any way of the works or any temporary works. All quarry fees, royalties, octroi duties including town duty and ground rent for stacking materials, if any should be paid by the contractor. If refunds of such payments are however, admissible in respect of Government contracts under the rules of municipal or local authorities the contractor may obtain such refunds by following the prescribed procedures laid down by those quantities. The assistance of Bhabha Atomic Research Centre shall be in such cases, be restricted only to the extent of issue of a certificate that materials so imported have become the property of Government in Bhabha Atomic Research Centre. The contractor shall be entitled to such refunds whatsoever so obtained and should take this into account while quoting his item rate in the tender.

b) The contractor shall confirm in all respect with the provision of such statute, ordinance or law as aforesaid and the Regulations or by laws of any local or other duly constituted authority indemnified against all penalties and liability of every kind of breach of such statute, ordinance or law regulations or bye-laws.

32. ACCESS TO SITES:

The Engineer-in-charge and any persons authorised by him shall at all times have access to the works and to the site and to all workshops and places where is being prepared or where materials, manufactured articles, or a machinery are being obtained for the works and the contractor shall afford every facility for and every assistance in obtaining the right to such access.

33. PLANT ETC. TO BE EXCLUSIVE USE FOR THE WORK:

All painting equipment scaffolding ladders and materials provided by the contractors shall when brought on to site to be deemed to be exclusively/intended for the construction and completion of the works, and the contractor shall not remove the same or any part thereof (save for the purpose of moving it from one part of the site to another) without the consent in writing of the Engineer-in-charge such shall not be unreasonably withheld.

34. DEPARTMENT NOT LIABLE FOR DAMAGES TO PLANT ETC.

- a. The Department shall not at any time be liable for the loss of or injury to any of the said construction plant and temporary work of materials.
- b. If any plant or equipment or machinery purchased out of advances taken from the Department, such plant, equipment or machinery shall have to be issue by the contractor at least to the extent of such advance and pledged in the name of the Department until all such advances shall have been paid to the Department.

35. URGENT REPAIRS:

If by reason of any accident or failure or other event occurring to, in connection with the works or any part thereof either during the period of maintenance any remedial or other work on repair shall in the opinion of the Engineer-in-charge be urgently necessary for security and the contractor is unable or unwilling, Engineer-in-charge at once to do his own or other workmen to such work or repair as may consider necessary. If the work or repair so done is work which in the opinion of the Engineer-in-charge, the contractor was liable to do at his own expenses under the contract, all the costs and charge properly incurred by the Engineer-in-charge in doing so, shall on demand, be paid by contractor or may be deducted from any moneys due to which may become due to the Contractor provided always that the Engineer-in-charge shall be soon after the occurrence of any such emergency as may be reasonably practicable notify the contractor thereof in writing.

36. CONTRACTOR'
MACHINERY. PLANT & EQUIPMENTS:

The tenderer shall furnish with the tender a list of plant and equipment that he proposes to bring to site at his own cost for the execution of the work, to enable Government to assess his mode of execution of work.

37. Supply of construction drawings will be phased by the Department to suit the time schedule exposed hereinafter. In case of delay in supply of drawings, the contractor will be eligible for suitable extension of time only, in the event such a delay has, in the opinion of the Engineer-in-charge, whose decision shall be final, affected the progress.

38. The contractor shall at his own cost, install, run and maintain a weigh batching plant and, if required a refrigeration plant for supplying concrete of the specified quality for different parts of the work covered by this tender.

39. The contractor may be allowed to carry out work in shifts with the prior approval of the Engineer-in-charge.

40. The tenderers are required to note that as specified under Clause 45-19 of Section III-Conditions of Contract, the contractor has to comply with the provisions of the "Contract :Labour" (Regulation and Abolition) Act 1970 and ~~rules~~ contract labour (R&A) central Rules 1971, child labour (Prohibition & Regulation) Act 1986 and with the provisions of to building and other construction workers (Regulation of Employment and conditions of service) Act 1996 and building and othrer construction workers welfare cess Act 1986 orders issued there under from time to time. As per para v(a) under Clause 25 of said act and central rules, it is obligatory on the part of the contractor to pay wages to all. "" the labour employed by him on the work at the same rates of wages as fixed by the Principal Employees (in this case BARC) in respect of labour directly engaged by the Principal Employer in the vicinity. The rates of wages currently notified by the Principal Employer (i.e. BARC) for the said purposes in Greater Bombay and Tarapur areas are as given in Annexure-III.

The wages rates shown are all inclusive rates and include also the wages for the weekly day of rest.

Accordingly wage shall be allowed for 6 days in a week.

The Tenderers may bear this in mind while working out their rates for submitting tenders.

41. MAHARASHTRA VALUE ADDED TAX (MVAT) ON WORKS CONTRACT

The rates quoted by the tenderers shall be inclusive of VAT on all materials, royalty, "MVAT on Works Contract" as levied by Maharashtra State Govt. under provisions of the Maharashtra Value Added Tax Act, 2002 (referred to as MVAT Act), Maharashtra Value Added Tax Rule 2005, Maharashtra Value Added Tax (Second Amendment Rule, 2007) on the transfer of the property in goods involved in the execution of Works Contracts or any other taxes that may be livable under statutory rules from time to time. The Department shall not entertain any claim whatsoever on this account.

42. GOVERNMENT LABOUR ACTS / LAWS:

The contractor has to follow strictly the Government Labour Acts, which are in force at present 'and introduced from time to time, such as, Acts enforced by Regional Provident Fund Commissioner. Directorate of ESIS and Enforcement Officer of Contract Labour Act, and all necessary arrangement for labour, security insurance will have to be made by the Contractor at his own cost.

43. DEDUCTION OF INCOME TAX:

As per Section 194 (C) of Income Tax Act, as amended by letter No. 275/9£,72/9- TJ (Circular No. 86) dated 19/5/1972 received from Ministry of Finance (Department of Revenue and Insurance), New Delhi, the Income Tax @ 2% (two percent only) and surcharge, on income tax as applicable on the gross value of the work done will be recovered from the bills. A certificate for the amount so recovered will be issued by the Department to the contractor.

44. SECURITY REGULATIONS:

The contractor has to follow strictly the security regulations prevailing in BARC area (at Trombay, Vashi-Navi Mumbai, Project at village Chincholi near Kalyan and Tarapur etc.) from time to time especially in regard to working hours, movement of materials and entry permits. The security regulations in vogue are broadly as under:

1. The contractor shall make applications to the Engineer-in-charge everyday for issue of entry permits I photo passes for casual labourers to be deployed on the works.
2. On recommendation by the Engineer-in-charge, the contractor shall collect the required number, of tokens from the security Department and distribute the same among the authorised labour force, He shall also be responsible for accounting and surrendering of tokens issued by the Security department at the end of day's work. The tokens can be used only for short duration in the morning hours. In the event of loss or misplacement of tokens/ vigil passes fee of Rs. 200/-for first instance/ Rs. 500/-for second instance/ Rs. 1000/-for third instance per token or as in vogue at time to time on the basis of police complaint will be levied.
3. The contractor shall make an application for the photo passes to be issued by the Security Department for his regular supervisory staff.
4. No persons other than those holding tokens or photo passes shall be normally be permitted to enter work site. In case, the contractor desires to bring any other personnel to the work site he shall obtain permission of Security Department well in advance through Engineer-in-charge.

5. All materials and articles brought by the contractor to the work site shall have to be declared at the security gate. Similarly no materials shall be taken out from the Department premises without proper gate pass, which will be issued by the Engineer-in-charge to the contractors on written request. It is to be noted that loading of contractors materials in vehicles and trucks shall be done in the presence of Department personnel. The contractor's representative will have to escort the materials till the security check is over.

6. For working on Saturdays, Sundays, Holidays and late hours even through permission will be accorded by the Engineer-in-charge, the contractor will have to make application to the Security Department also and keep them informed well in advance.

Any breach of above security regulations and rules in force from time to time will be viewed seriously.

45. Information regarding accidents:

The contractor is also to promptly report the case(s) of the accident(s) involving injuries to his worker(s) to the local Security Post / Security Officer.

46. The contractor, his employees and agents shall not disclose any information or drawings furnished to him by Government. All drawings, reports and other information prepared by the contractor/by the Government or jointly by both for the execution of the contract shall not be disclosed without the prior approval of the Engineer-in-Charge. No photograph of the works or plant within the premises shall be taken without the prior approval of the Engineer-in-Charge.

47. VERIFICATION OF CREDENTIALS OF CONTRACTOR'S PERSONNEL:

(a) Contractors, their employees, workers and casual labourers :

i) It will be the responsibility of the contractor to produce police clearance certificate for himself and his employees / workers before seeking permission for entry into BARC area.

ii) Police verification certificate submitted with respect to an individual will be treated valid for 3 years from the date of issue and on expiry of 3 years period, a fresh police clearance certificate will have to be produced.

iii) Original police verification certificate should be attached to the initial application for temporary identity card and in case of further renewals within six months a xerox copy of the same can be attached.

iv) The contractor shall employ labourers only after due verification of their credentials and track of past record. They should maintain a register showing the particulars of labourers including their residential address and submit the same to the Project Engineer periodically for verification. The contractor shall ensure that no labourer with criminal record in the past, is employed on BARC works. If any labourer with undesirable antecedents is found to be employed, the contractor shall forthwith remove such labourers from the work site on demand by the Project Engineer. The contractor shall be held solely responsible in the event of any adverse report / enquiry from the law enforcing authorities.

v) It will be mandatory on the part of the Tenderer to obtain Police Verification Certificate for their Engineers, Supervisors and authorised representative,,- who are authorised to draw tokens/passes - for day today works inside BARC Campus. Tenderers are requested to take advance action to obtain Police verification Certificate for their authorised representative who desire to obtain photo passes, so as to avoid delay in commencement of work & also for issue of photo passes.

(b) Representatives of firms:

Representatives of firms who are required to visit BARC for supplying materials will not be issued with identity cards. They will be given entry by issuing entry permission on day to day basis.

48. SECURITY REGULATIONS

a) As a part of keeping Nation-wide vigil on Government Establishments, the Security set up in BARC also has been beefed up and accordingly the following restrictions are in force till further orders.

b) Any motor vehicle with or without any construction related materials will be given an entry permit to BARC premises after convincing the purpose of entry, if and only if it is; accompanied by an authorised departmental employee through out its movement within the premises.

c) The movement of contractor's Vehicle within BARC premises is restricted and normally one specified vehicle will be permitted for his personal movement at the discretion of the Project Engineer during the contract period after a thorough security verification. The contractor has to apply for such vehicle permit to the department through the Project Engineer in the standard proforma, after receiving the Work Order.

d) Each Labourer has to give his/her bio-data in the standard proforma to the Department for obtaining the labour entry pass and normally such an entry pass will be issued only after a thorough verification of the bio-data.

e) The Department will make every possible arrangement to minimise the inconvenience to the contractor from security point of view. However, due to any unforeseen reasons, any delay, inconvenience or loss occurred to the contractor no claim for compensation whatsoever in nature shall be entertained by the Department.

The above additional regulations are indicated only to make aware the contractor about the latest security set up in BARC premises.

49. Confidentiality Clauses: -

I. Confidentiality :

No party shall disclose any information to any Third party' concerning the matters under this contract generally. In particular, any information identified as " Proprietary" in nature by the disclosing party shall be kept strictly confidential by the receiving party and shall not be disclosed to any third party without the prior written consent of the original disclosing party.

This clause shall apply to the sub-contractors, consultants, advisors or the employees engaged by a party with equal force.

II "Restricted information" categories under Section 18 of the Atomic Energy Act, 1962 and "Official Secrets" Under Section 5 of the Official Secrets Act, 1923:-

Any contravention of the above-mentioned provisions by any contractor, sub-contractor, consultant, adviser or the employees of a contractor, will invite penal consequences under the above said legislation.

III. Prohibition against use of BARC's name without permission for publicity purposes

The contractor or Sub-contractor, consultant, adviser or the employees engaged by the contractor shall not use BARC's name for any publicity purpose through any public media like press, Radio, TV or internet without the prior written approval of BARC.

50. Statement of Wages:

Please refer Performa of Schedules.

51. PROVISIONS UNDER CONTRACT LABOUR (REGULATION & ABOLITION) ACT 1970 REQUIRED TO BE FULFILLED BY CONTRACTORS.

- 1) Every Contractor employing 20 or more workmen on any day should obtain license from Asstt. Labour Commissioner, Sion, Mumbai. They should also obtain Registration under BOCW Act if they are engaged in construction activities. (Rule 12).
- 2) Every Civil Contractor employing 10 or more workmen should obtain a Registration under Building and Other Construction Workers Act from Asstt. Labour Commissioner, Sion, Mumbai.
- 3) Notice of commencement of contract work should be given to Labour Enforcement Officer by the Contractor in from VI-A. {Rule ~1 (3)}.
- 4) Notice of completion of contract work should be given to Labour Enforcement Officer by the Contractor in Form VI-A. {Rule 81(3)}.
- 5) Notices showing rates of wages, hours of work, wage periods, date of payment of wages, date of payment of unpaid wages, names and addresses of Inspections in English, Hindi and in local language should be displayed at Work Site. (Rule 81 (i) (i)).
- 6) A copy of the above Notice is to be sent to Labour Enforcement Officer.
- 7) Maintain a Register of workmen in Form XIII. (Rule 74).
- 8) Issue Employment Card to workmen in Form XIV. (Rule 76).
- 9) Issue a Service Certificate to workmen in Form XV on termination of employment for any reason whatsoever. (Rule 77).
- 10) Maintain Muster Roll of Workmen in Form XVI. (Rule 78 (1) (a) (i)).
- 11) Maintain Register of wages in Form XVII. Contractors may maintain a Combined Register of Wag{~s-cum-Muster Roll, if the wage period is a fortnight or less.
- 12) Provide Wage slip to workmen in Form XIX. (Rule 78 (1) (b)).
- 13) Maintain a Register of Deduction for Damage/ Loss in Form XX. (Rule 78 (1) (a) (ii)).
- 14) Maintain a Register of Fines in Form XXI. (Rule 78 (1) (a) (ii)).
- 15) Maintain a Register of Advances in Form XXII. (Rule 78 (1) (a) (ii)).
- 16) Maintain a Register of Overtime in Form XXII. (Rule 78 (1) (a) (iii)).
- 17) Send Half Yearly Return in Form XXIV to ALCILEO . (Rule 82 (1»)).
- 18) A first Aid Box with essential medical items to be maintained. (Rule 58).
- 19) Every contractor should ensure disbursement of wages to his workmen in the presence of authorized representative of BARC . (Rule 72).

- 20) Every contractor shall display an abstract of the Act and Rules in English, Hindi and in the language spoken by the majority of the workers. (Rule 79).

Annexure – I
(Claim A(ii))
(Under Clause 15)

FORM OF REQUISITION FOR SUPPLY OF ENERGY

To

_____.

_____.

Sir,

I/We, require power supply at 415V, 3 Phase 4 wire for our installation at the following location for a period of _____ year/months.

Location of the Project : _____

The installation shall be executed by the following Electricity Contractor :

Name of the Contractor : _____

License No. & Grade “ _____

The details of the proposed layout is as follows :

Description	H.P./KW	Type of Starting	Single Phase or 3 Phase Meters
(i)			
(ii)			
(iii)			

Other Plants.

Lighting Layouts

Lights at office, stores etc.

Ceiling fans.

Heaters :

Socket 54 x 5 ph.

154 x 5 p.h.

Outdoor Lights :

Number and Wattage.

3. We propose to install overhead lines with bare conductors/double P.V.C. insulated wires/underground cables.

Brief details to be given (wires type of pole Brief details to be given (wires type of pole to be used etc. in case of underground cables – Tupe & Number of joints.

We shall be providing the earthing layout as follows :

- (a) Type of each electrode : Plate/pipe coiled earth
- (b) Materials : Copper/G.I.
- (c) No. of electrodes & Location :
- (d) Min. size of earth conductor on OH layout & bearer wires :
- (e) Any other relevant details :

4. Total maximum demand for our layout will not exceed _____KW/KVA.

5. We shall be providing our own KWH meter and test certificate for the KWH meter will be submitted before effecting power supply.

6. We agree to pay towards electricity bill during the calendar months for consumption of energy on unit basis at rates indicated or minimum charges on the connected load whichever is higher.

7. The installation shall be executed conforming to I.S. Code of practice and Indian Electricity Rules with their latest revision.

8. We shall be submitting required test reports in proforma enclosed every month and before on set of monsoon.

9. We shall maintain our installation in good repair and conform to all statutory regulations of Central/State Government and also as per safety regulations that will be intimated by the Department from time to time at our own cost and risk. We have also read the guide lines to temporary supply of Department and agree to abide by them.

Signature of the Contractor

Annexure – II
(Claim A (vii) & B (I))
Under Clause 15.

TEMPORARY POWER SUPPLY

DETAILS AND TEST REPORTS

Ref No. : _____ Date : _____

Name of the contractor : _____

Address: _____

Name of the Licensed

Electrical Contractor/ : _____

Supervisor : _____

I/We hereby certify that the installation detailed below has been installed by me/us and tested and that to the best of my/our knowledge and belief, it complied with Indian Electricity Rules, 1956.

Electrical Installation at _____

Voltage and system of supply _____

1. Particulars of works :

(a) Internal Electrical Installations :

No. of Load Type of system of wiring

(i) Light point

(ii) Fan Point

(iii) Plug point

a) 3 Pin 5 Amp.

b) 3 Pin 15 Amp.

c) Others.

Description	HP/KW	Type of Starting	Single Phase/Three Phase
a) Motors (i)			
	(ii)		
	(iii)		

b) Other plants.

c) If the work involves installation of overhead line and/or underground cables :

- a) i) Type and description of overhead lines.
- ii) Total length and No. of Spans.
- b) i) Total length of underground cable and its size.

- ii) No. joints
- End joint
- Tee joint
- St. through joints.

NOTE : All outdoor lines should be of doubly installed lines and wires should conform to IS 3035.

II. Earthing :

- i) Description of earthing electrode.
- ii) No. of earth electrodes.
- iii) State of main earth load.
- (ii) Main control switch _____mps _____ Vlt. _____PH _____N
- (ii) Energy meter details Sr.No __make_____ph_____wire
- (_____230)
- _____250V
- _____Rev/kwh

Initial reading on the

_____ Meter _____on

(iii) Meter test certificate attached : Yes/No.

(iv) Test results.

a) Insulating Resistance

i) Insulation resistance of the whole system of conductors to earth _____ megaohms.

ii) Insulation resistance between the phase conductor and neutral.

Between Phase R and neutral _____ megaohms

Between Phase Y and neutral _____ megaphms

Between Phase B and neutral _____ megaohms.

iii) Insulation resistance between the phase conductors in case of polyphase supply.

Between phase R and Phase Y _____ megaphms.

Between phase Y and Phase B _____ megaohms.

Between phase B and Phase A _____ megaohms.

iv) Insulation resistance of motor/other plants.

<u>S.No.</u>	<u>Equipment</u>	<u>Capacity</u>	<u>I.A. Test Result</u>

b) Earth continuity test

Maximum resistance between any point in the earth continuity conductor including metal conducts and main earthing lead.

_____ ohms.

c) Earth electrode resistance

Resistance of each earth electrode.

i) _____ ohms.

ii) _____ ohms

iii) _____ ohms

iv) _____ ohms

d) Name and signature of License wireman who will operate and maintain Contractor's installations : _____

License No. _____

Signature of Electrical

Supervisor/Contractor

License No. & Class

Signature of the Contractor

Name & Address :

SECTION - V

SPECIFICATIONS

Please refer BARC documents at Website- www.tenderwizard.com/DAE or www.barc.gov.in

GOVERNMENT OF INDIA
BHABHA ATOMIC RESEARCH CENTRE
Arch & Civil Engineering Division

SECTION - VI

LIST OF DRAWINGS

Uploaded separately(if applicable)

SECTION - VII

SCHEDULE - A

(Schedule of Materials to be supplied by the Department)

Uploaded separately

APPENDIX –‘A’

BID SECURITY (BANK GUARANTEE)
(on Non-judicial stamp paper of value ₹ 100/-)

WHERE AS _____ (Name of Bidder) (herein after called “the Bidder”) has submitted his bid dated _____ (date) for undertaking the work of _____ (Name of work) (hereinafter called “the Bid”).

KNOW ALL PEOPLE by these presents that We _____ (Name of bank) of _____ (Name of country) having our registered office at _____ (hereinafter called “the Bank”) are bound to President of India, acting through Chief Engineer, BARC, Trombay, Mumbai 400 085 for the sum of ₹ _____ (1) for which payment will and truly be made to be said BARC, Trombay, the Bank binds itself, his successors and assigns by these presents.

SEALED with the common seal of the said Bank this _____ day of 2011.

THE CONDITIONS of this obligation are:

- (1) If after Bid opening the Bidder withdraws his Bid during the period of Bid validity specified in the Form of Bid or makes any modification in the terms and conditions of the tender which are not acceptable to BARC, Trombay OR
- (2) If the Bidder having been notified of the acceptance of his Bid by BARC, Trombay during the period of bid validity
 - (a) Fails or refuses to execute the Form of Agreement in accordance with the instructions of Bidders, if required; OR
 - (b) Fails to commence the work specified in the tender document in prescribed time.

We _____ (Name of the Bank & Branch) undertake to pay BARC upto the above amount upon receipt of their first written demand, without BARC, Trombay having to substantiate their demand, provided that in their demand BARC will note that the amount claimed by them is due to them owing to the occurrence of one or any of the above conditions, specifying the occurred condition or conditions.

This Guarantee will remain in force up to and including the date _____ (2). This date may be extended by Chief Engineer, BARC, notice of which extension(s) to the Bank is hereby waived. Any demand in respect of this Guarantee should reach the Bank not later than the above date.

DATE _____ SIGNATURE OF THE BANK _____

WITNESS _____

SEAL _____

(Signature, name and address)

Notes:

1. The Bidder should insert the amount of Guarantee in words and figures denominated in Indian Rupees. This figure should be the same as specified in the tender document.
2. This date should be 45 days after the end of validity period of the Bid, reckoning from the deadline for submission of Bids which is stated in the tender document.

APPENDIX-‘B’

FORM OF BANK GUARANTEE BOND FOR PERFORMANCE SECURITY / SECURITY DEPOSIT

In consideration of the President of India (hereinafter called "The Government") having agreed under the terms and conditions of Agreement No..... dated..... made between and (hereinafter called " the said Contractor{s}") .for the work (hereinafter called " the said Agreement") having agreed to production of a irrevocable bank Guarantee for Rs. (Rupees only), as a security / guarantee from the contractor(s) for compliance of his obligations in accordance with the terms and conditions in the said agreement, we(Indicate the name of the Bank) (hereinafter referred to as "the Bank") hereby undertake to pay to the Government an amount not exceeding Rs. . (Rs.....only) on demand by the Government.

2. We (indicate the name of Bank) do hereby undertake to pay the amounts due and payable under this guarantee without any demur, merely on a demand from the Government stating that the amount claimed is required to meet the recoveries due or likely to be due from the said Contractor(s). Any such demand made on the bank shall be conclusive as regards the amount due and payable by the Bank under this guarantee. However, our liability under this guarantee shall be restricted to an amount not exceeding Rs.....(Rupees.....only).

3. We, the said bank, further undertake to pay to the Government any money so demanded notwithstanding any dispute or disputes raised by the Contractor(s) in any suit or proceeding pending before any Court or Tribunal relating thereto, our liability under this present being absolute and unequivocal.

The payment so made by us under this bond shall be a valid discharge of our liability for payment thereunder and the Contractor(s) shall have no claim against us for making such payment.

4. We..... (indicate the name of Bank) further agree that the guarantee herein contained shall remain in full force and effect during the period that would be taken for the performance of the said Agreement and that it shall continue to be enforceable till all the dues of the Government under or by virtue of the said Agreement have been fully paid and its claims satisfied or discharged or till Engineer-in-charge on behalf of the Government certifies that the terms and conditions of the said Agreement have been fully and properly carried out by the said Contractor(s) and accordingly discharges this guarantee.

5. We (indicate the name of Bank) further agree with the Government that the Government shall have the fullest liberty without our consent and without affecting in any manner our obligations hereunder to vary any of the terms and conditions of the said Agreement or to extend time of performance by the said Contractor(s) from time to time or to postpone for any time or from time to time any of the powers exercisable by the Government against the said Contractor(s) and to forbear or enforce any of the terms and conditions relating to the said Agreement and we shall not be relieved from our liability by reason of any such variation, or extension being granted to the said Contractor(s) or for any forbearance, act of omission on the part of the Government or any indulgence by the Government to the said Contractor(s) or by any such matter or thing whatsoever which under the law relating to sureties would, but for this provision, have effect of so relieving us.

6. This guarantee will not be discharged due to the change in the constitution of the Bank or the Contractor(s).

7. We, ... (indicate the name of Bank) lastly undertake not to revoke this guarantee except with the previous consent of the Government in writing.

8. This guarantee shall be valid up to, unless extended on demand by Government. Notwithstanding anything mentioned above, our liability against this guarantee is restricted to Rs. (Rupees only) and unless a claim in writing is lodged with us within six months of the date of expiry or the extended date of expiry of this guarantee, all our liabilities under this guarantee shall stand discharged.

Signed and sealed

Dated the day of for(indicate the name of Bank)

* * *

APPENDIX 'C'**INDENTURE FOR SECURED ADVANCE**

(For use in cases in which the contract is for finished work and the contractor has entered into an agreement for the execution of a certain specified quantity of work in a given time.)

Government of India**Department of Atomic Energy**

State : Maharashtra

Administration : Department of Atomic Energy

Division : Directorate of Construction, Services and Estate Management

THIS INDENTURE made the.....day of 19.....
BETWEEN (hereinafter called the Contractor which expression shall where the context so admits or implies be deemed to include his executors, administrators and assigns) of the one part and the President (hereinafter called the President which expression shall where the context so admits or implies be deemed to include his successors in office and assigns) of the other part.

WHEREAS by an agreement dated
(hereinafter called the said agreement) the contractor has agreed.

AND WHEREAS the contractor has applied to the President that he may be allowed advance on the security of materials absolutely belonging to him and brought by him to the site of the works, he subject of the said agreement for use in the construction of such of the works as he has undertaken to execute at rates fixed for the finished work (inclusive of the cost of materials and labour and other charges).

AND WHEREAS the President has agreed to advance to the contractor the sum of Rs on the security of materials, the quantities and other particulars of which are detailed in Part-II of a Running Account Bill (B) for the said works signed by the contractor on and the President has reserved to himself the option of making any further advances on the security of other materials brought by the contractor to the site of the said works.

NOW THIS INDENTURE WITNESSETH that in pursuance of the said agreement and in consideration of the sum of Rs. on or before the execution of these presents paid to the contractor by the President (the receipt where of the contractor both hereby acknowledge and of such further advance, if any, as may be made to him as aforesaid the contractor both hereby convenient and agree with the President and declare as follows:

1. That the said sum of Rupees so advanced by the President to the contractor as aforesaid and all or any further sum or sums advanced as aforesaid shall be employed by the contractor in or towards expenditure the execution of the said works and for no other purpose whatsoever.

2. That the materials detailed in the said Running Account Bill (B) which have been offered to and accepted by the President as security are absolutely the contractor's own property and free from encumbrances of any kind and the contractor will not make any application for or receives a further advance on the security of materials which are not absolutely his own property and free from encumbrance of any kind and the contractor indemnifies and president against all claims to any materials in respect of which an advance has been made to him as aforesaid.

3. That the materials detailed in the said Running Account Bill (B) and all other materials on the security of which any further advance or advances may hereafter to be made as aforesaid (hereinafter called the said materials) shall be used by the contractor solely in the execution of the said works in accordance with the directions of the Divisional Officer of the said works, Civil Engineering Division (hereinafter called "the Divisional Officer") and in the terms of the said agreement.

4. That the contractor shall make at his own cost all necessary and adequate arrangements for the proper watch, safe-custody and protections against all risks of the said materials and that until used in construction as aforesaid said materials shall remain at the site of the said works in the contractor's custody and on his own responsibility and shall at all times be open to inspection by the Divisional Officer or any officer authorised by him. In the event of the materials or any part thereof being stolen, destroyed or damaged or becoming deteriorated in a greater degree than is due to reasonable use and wear thereof the contractor will forthwith replace the same with other materials of like quality or repair and make good the same as required by the Divisional Officer.

5. That the said materials shall not on any account be removed from the site of the works except with the written permission of the Divisional Officer or an officer authorised by him on that behalf.

6. That the advance shall be repayable in full when or before contractor receives payment from the President of the price payable to him for the said works under the terms and provisions of the said agreement. Provided that if any intermediate payments are made to the contractor on account of work done thereon the occasion of each such payment the President will be at liberty to make a recovery from the contractor's bill for such payment by deduction there from the value of the said materials than actually used in the construction and in respect of which recovery has not been made previously the value for this purpose being determined in respect of the each description of materials at the rates at which the amounts of the advances made under these presents were calculated.

7. That if the contractor shall at any time make any default in the performance or observance in any respect of any of the terms and provisions of the said agreement or of these presents the total amount of the advance or advances what may still be owing to the President shall immediately on the happening of such default be repayable by the contractor to the President together with interest thereon at twelve percent per annum from the date of respective dates of such advance or advances to the date of repayment and with all costs, charges, damages and expenses incurred by the President in or for the recovery thereof or the enforcement of this security or otherwise by reasons of the default of the contractor and contractor hereby covenants and agrees with the President to repay and pay the same respectively, to him accordingly.

8. That the contractor hereby charges all the said materials with the repayment to the President of India the said sum of Rs. and any further sum or sums advanced as aforesaid and all costs, charges, damages and expenses payable under these presents PROVIDED ALWAYS and it is hereby agreed and declared that notwithstanding anything in the said agreement and without prejudice to the powers contained therein if and whenever the covenant for Payment and repayment herein before contained shall become enforceable and the money owing shall not be paid in accordance there with the President may at any time thereafter adopt all or any of the following courses as he may deemed best.

a) Seize and utilise the said materials or any part thereof in the completion of the said works on behalf of the contractor in accordance with the provisions in that behalf contained in the said agreement debiting the contractor with the actual cost of effecting such completion and the amount due in respect of advances under these present and crediting the contractor with the value of work done as if he had carried it out in accordance with the said agreement and at the rates thereby provided. If the balance is against the contractor he is to pay same to the President on demand.

b) Remove and sell by public auction the seized materials or any part thereof and out of the moneys arising from the sale retain all the sum, aforesaid repayable or payable to the President under these presents and pay over the surplus (if any) to the contractor.

c) Deduct all or any part of the money owing out of the security deposit or any sum due to the contractor under the said agreement.

9. That except in the event of such default on the part of the contractor as aforesaid interest on the said advances shall not be payable.

10. That in the event of any conflict between the provisions of these presents and the said agreement the provisions of these presents shall prevail and the event of any dispute or difference arising over the construction or effect of these presents the settlement of which has not been herein before expressly provided for the same shall be referred to the Chief Engineer, Directorate of Construction, Services and Estate Management, time being in force shall apply to any such reference.

IN WITNESS thereof the said and.....
by the order under the direction of the President have hereinto set their respective hands the
day and year first
above written.

Signed, sealed and delivered by the said contractor in the presence of :

A diagram showing a record structure. On the left, the word "Address" is followed by a long horizontal line. At the end of this line is a vertical line that connects to a large right-facing curly bracket. To the right of this bracket, the words "Signature" and "Name" are stacked vertically, indicating they are part of the same field or group.

Witness

Signed by

by the order and direction of the President in the presence of:

Witness _____ { Signature
 _____ { Name
 _____ { Address

Witness

* * * * *

APPENDIX - 'D'

PROFORMA FOR GUARANTEE TO BE EXECUTED BY THE CONTRACTORS FOR REMOVAL OF DEFECTS AFTER COMPLETION IN RESPECT OF WATERPROOFING WORKS.

Name of work:

Work order No:

Agreement No:

This agreement made this _____ day of _____
two thousand _____ and _____ between

(hereinafter called the Guarantor of the other part)
and the PRESIDENT OF INDIA

(hereinafter called the Government of the one part)

WHEREAS THIS agreement is supplementary to a contract (hereinafter called the Contractor dated and made between the GUARANTOR OF THE ONE PART AND GOVERNMENT of the other part, whereby the Contractor, interalia, undertook to render the buildings and structures in the said contract recited completely water and leakproof.

AND WHERE THE GUARANTOR agreed to give a guarantee to the effect that the saids structures will remain water and leak proof for _____ years from the date of _____.

NOW THE GUARANTOR hereby guarantees that waterproofing treatment given by him will render the structures completely leakproof and the minimum life of such waterproofing treatment shall be 10 years to be reckoned from the date after the maintenance period prescribed in the contract.

Provided that the guarantor will not be responsible for leakage caused by earthquake or structural defects or misuse / alteration of structures and for such purpose:

(a) misuse shall mean operation which will damage treatment, like chopping of firewood and things of the same nature which might cause damage.

(b) Alteration shall mean construction of an additional structure or a part or construction adjoining to existing structure whereby treatment is removed in parts.

(c) the decision of the Chief Engineer with regard to cause of leakage shall be final.

During this period of guarantee the guarantor shall make good all defects and in case of any defect being found render the building waterproof to the satisfaction of the Engineer-in-Charge at his cost and shall commence the work for such rectification within seven days from the date of issue of the notice from the Engineer-in-Charge calling upon him to rectify the defects failing which the work shall be got done by the Department by some other contractor at the guarantor's cost & risk. The decision of the Engineer-in-Charge as to the cost payable by the Guarantor shall be final and binding.

That if the Guarantor fails to execute the waterproofing or commits breach thereunder then the Guarantor will indemnify the Principal and his successors against all loss damage, cost expense or otherwise which may be incurred by him by reason of any default on the part of the Guarantor in performance and observance of this supplemented agreement. As to the amount of loss and/or damage and cost incurred by the Government the decision of Engineer-in-Charge will be final & binding on the parties.

IN WITNESS WHEREOF these presents have been executed by the Obligator (Guarantor)_____and _____ for and on behalf of the President of India on the day, month and year first above written.

SIGNED SEALED AND DELIVERED BY (Obligator / Guarantor) in the presence of:

1.

2.

Signed for and on behalf of the President of India in the presence of

1.

2.

* * *

APPENDIX - 'E'

GUARANTEE BOND FOR ANTITERMITE TREATMENT

(For Guarantee to be executed by contractors for removal of defects after completion of antitermite treatment works)

This agreement made this.....day of ... two thousand hundred and.....between M/s. _____ (hereinafter called "the Guarantor of the one part) and the PRESIDENT OF INDIA (hereinafter called "the Government" of the other part.)

Whereas this agreement is supplementary to a contract (hereinafter called "the Contract) dated.....and made between the Guarantor of the one part and the Government of the other part whereby the Contractor inter-alia undertook to render the buildings and structure completely termite proof.

AND WHEREAS THE GUARANTOR agreed to give a guarantee to the effect that the said structure will remain termite proof for ten years from the date of handing over of the building and or completion date of contract whichever is later.

NOW THE GUARANTOR hereby guarantees that the anti-termite treatment provided by him will render the structures completely termite proof and the minimum life of such anti-termite treatment shall be ten years to be reckoned from the date of handing over of the building and/or completion of the building whichever is later.

Provided that the Guarantor will not responsible for damages caused due to structural defects or misuse of premises/area.

a) Misuse of premises shall mean any operation which will disturb the chemical barrier like excavation under floors, breaking of walls at G.L. disturbing the treatment already carried out.

The decision of the Engineer-in-Charge with regard to cause of damage shall be final.

During this period of guarantee the guarantor shall make all the arrangements to do the post constructional anti-termite treatment in all the buildings in case of any termite nuisance being found in the building, to the satisfaction of the Engineer-in-Charge at the cost of guarantor and shall commence the work for such treatment within seven days from the date of calling upon him to rectify the defects, by the Engineer-in-Charge, failing which the work shall be got done by the Department by some other contractor at the GUARANTOR'S COST and risk. The decision of the Engineer-in-Charge as to the cost payable by the Guarantor shall be final and binding.

That if the Guarantor fails to execute the anti-termite treatment or commits breach thereunder then the Guarantor will indemnify the principal and his successors against all loss, damage, cost, expense or otherwise which may be incurred by the Department by reason of any default on the part of the GUARANTOR in performance and observance of this supplementary agreement. As to the amount of loss and/or damage and/or cost incurred by the Government the decision of the Engineer-in-Charge will be final and binding on the parties.

IN WITNESS WHEREOF these presents have been executed by the Obligator... and by....and for and on behalf of the PRESIDENT OF INDIA on the day, month and year first above written.

SIGNED, sealed and delivered by (OBLIGATOR) in the presence of :

- 1.
- 2.

SIGNED FOR AND ON BEHALF OF THE PRESIDENT OF INDIA BY .

..... in the presence of:

- 1.
- 2.* *

A N N E X U R E - A

Uploaded separately

ANNEXURE - B

LIST OF APPROVED MANUFACTURER OF BUILDING MATERIALS

Sl. No.		Description of materials	List of Manufacturers
1	a	Ordinary Portland Cement of Grade 43	ACC, Birla Rajshree, Ultratech, Narmada
	b	Portland Pozzolana Cement (fly ash based confirming to 28 days strength requirement of OPC 43 grade)	ACC, Birla, Ultratech & Narmada
	c	White Cement	J.K. Cement & Birla White
2	a	HYSD Bars (TMT Bars)	M/s TISCO, SAIL, RINL
	b	HYSD Bars (TMT Bars) if specified other than M/s TISCO, SAIL, RINL	Guru Nanak Metal, Metro Ispat
3		Structural Steel Sections	M/s SAIL, RINL
4		Structural Steel Plates	M/s SAIL, RINL
5		Anti-Termite treatment	M/s PARAGON, PEECOPP Express Pesticides Corporation, Elite Corporation, Pest Control (I) Ltd. & NOCIL Chemicals, Novin Corporation
6		Tiles:	
	a	Terrazzo Tiles	M/s NITCO, BHARAT, G.K. BANSAL, Acme Tiles & Super Tiles
	b	Ceramic Tiles	M/s H.R. Johnson (I) Ltd., Somany, Kajaria
	c	Glazed Tiles	M/s H.R. Johnson (I) Ltd., Somany, Kajaria
	d	Vitrified Floor Tiles	M/s H.R. Johnson, RAK Ceramics, Bell Granito
	e	P V C flooring	M/s Premier Vinyl Flooring Ltd., Royal Cushion Vinyl Product Ltd., Armstrong, Responsive Industries Ltd.
	f	Paver Blocks, Polymer moulded Paver Blocks, Chequered concrete Floor Tiles	Super Tiles
7		Metallic Floor Hardner	Triveni Colour Industries (Floor) Heatly & Gresham (India) Ltd., De Rust Chemical Corporation of India (Fermonite), Cement Research Corporation (stilonite), Ironite India Ltd.
8		Pressed Steel Door Frame	M/s Sen Harvic, TECHOME Nishan Solid Door Frame, Anjali Enterprises, M/s SUNBEAM, Windoors Bharat Steel Industries, Pune, M/s AGEW, Strategic Building Systems
9		Wooden Doors	
	a	Flush Door Shutter	Indian Plywood, Kitply, Sitapur, Kutty Flush Doors, Mysore Plywood, Shreejee, Anand Wood Crafts, Sejpal and others (Anand Doors)
	b	Factory made panel door shutter	Wooden Design – Bangalore, Shankar Ramchandra & Joinery Manufacturer
	c	Masonite Wooden Panel Doors	Kutty flush doors, Sejpal & others
	d	FRP Door Shutter	Advance FRP & House of Doors
	e	Pressed steel doors & fire resistant steel doors	Godrej, Windoors, Strategic Building Systems & Kutty Flush Doors
	f	Steel Windows	M/s Sen Harvic, AGEW, Senital Multiwin, Hope Metal, Godrej, Windoors, Anjali Enterprises & Bharath Steel (Pune)
	g	Mild Steel Rolling Shutters, G.I. Rolling	SWASTIC, Windoors, Dodia,

		Shutters, Stainless steel & aluminium rolling shutters	Trupti, Bharath & Larsen Engineering
	h	Block Board	Wood India – Calcutta, Sejpal & others Pioneer Timber Products, Chandigarh, Northern Door
	i	Ply Wood	Indian Plywood Mfg. Ltd., Kitply, Century Plywood, Nuboard & Nashik Plywood Industries
	j	Pre Laminated & Plain Particle Boards	NOVAPAN, Anchor
	k	Adhesive for wood	Fevicol, Vamicol, Dunlop, Araldite
10		Aluminium Grills	M/s Alumiprofiles, Decogrills
11		Fittings & fixtures	M/s Jayant Metal, Shalimar hardware, Everite, Garnish, Diamond, Navbharat, SAIF Enterprises, Hardwin Traders, Godrej, DE Lock Industries, Explore Engineers, Garg Hinges
12		Aluminium Extruded Sections	Jindal, Indal, Hindalco & Boruka
13		Aluminium Powder Coated Curtain rods	Bilmate, Elite
14		Glass shelf C.P. brackets	Elite, Amit & PPJA
15		Lime	Janatacem, Asian Paint
16		Neeru	More (Peacock), Kamal
17		Cement Based Paint	M/s Snowcem India Ltd. (Super snowcem, Sandex Matt), NITCO (Nitcocom) Paints, Hindustan Colour Chemical, Jayant colour, Surfa coat, Terraco, Berger-Rabiacem, Apporva Buildcare & Decocem
18		Distemper & Paints	M/s Asian Paints, Kansai Nerolac Paints Ltd., ICI Paints, Noble Paints, Berger Paints India Ltd., Jenson Nicholson, Garware Paints Ltd. & Shalimar Paints
19		Integral Waterproofing Compound	M/s Accoproof, CICO, Impermo, Pidilite, roffe, FOSROC
20		Waterproofing Treatment	M/s Modern Waterproofing, M/s Chirag Waterproofing Co. Ms/ Gemini Construction M/s National Waterproofing M/s New Bharat Waterproofing Co. M/s CICO Technologies M/s Nina Industries M/s Structural Waterproofing Company
21		Water stops	M/s Omai Plastics, Basecon Pask, Asian Engineering Products, Caprihans India Ltd., R.C. Enterprises, Kanta Polymers (Kanta flex) & Fixopan
22		Expansion Joint Boards & Tarfelts	M/s Shalitex, S.T.P. Ltd., Lloyd Insulation, Tiki Tar Industries
23		Expansion Joint Filters	M/s Shalitex, S.T.P. Ltd., Lloyd Insulation & BASF Chemicals
24		Glass for Doors / Windows	Modi Guard, Continental, Emirates, Saint Gobain, Asahi & Sejal
25		Plain Glass Mirror	M/s Modi Float Glass, Eagle, Atul, Saint Gobain, Asahi
26		Sanitary Wares	M/s Parryware, Hindustan, Cera, Neycer
27		C.P. Brass Fittings & Fixtures	GEM, Techno, Lalsons KINGSTON, JAGUAR, Metro, ESSCO, MARC
28		C.P. Brass Coupling and Bottle Trap	ESSCO, GEM, Kingston, Jaquar, Metro, Marc
29		C.I. Flushing Cistern	M/s A-1 (J.S.), HJN, JAMCO, Neco, HIF
30		C.P. BRASS Urinal Waste & Flush pipes	Orient, PARKO, Elite, Jaquar & Metro
31		Plastic Sheet & Cover	M/s Commander, Diplomat,

			Admiral, Patel, Champion, Parryware & Hindware
32		S.S. Sink	M/s Diamond, Nirali
33		G.I. Pipes	M/s TATA
34		G.I. Pipes other than TATA make if specified	Zenith, Jindal or ISI mark
35		G.I. Fittings	PEC, MJM, Simal, R-Brand, UNIK, Plumb well and other brands approved by ISI mark
36		G.M. Gate / Globe Valves	Neta, SANT, M/s Leader Valves
37		Coper ball Valve	Techno, M/s GEM, ESSCO, Leader, A-1 JS
38		Air Valve	Leader, Sant, HAWA, M/s Kirloskar
39		Water Meter	Capstan, Keycee, Paramount
40		Sluice Valves	Kirloskar, Minoti, ESSCO & Burn, Hawa
41		C.I. water quality pipes	Electro steel castings, Jindal, Lanco
42		Cast Iron Valves	Kirloskar, Leader, HAWA
43		C.I. Soil Quality pipes	NECO, BC, RIFCO, ASP, A-1, PARAS, HIF, Kajeriwal
44		S.W. Pipes & Gully Trap	Perfect, Kashmira, BURN, RK, ANAND, ISI marked
45		RCC Hume Pipes	M/s Indian Hume Pipes, Pranali, Cement pipe, Ghambir, Kore Cement confirm to ISI
46		HDPE Pipes & HDPE fittings	Prince, Gautam M/s Hastil, Sangir pipes, Supreme
47		RCC frame, covers & SFRC	M/s Pratibha, Bharath, Vikrant
48		Pressure quage	HAWA
49		PIG LEAD	M/s Hindustan Zinc Ltd.
50		C.I. frame & covers	RIFCO, NECO, PARAS, A-1, M/s Ashok Iron, Foundry, HIF
51		CPVC, UPVC, SWR Pipes	Finolex, Prince & Supreme
52		Poly Propylene – R Pipes	Supreme & Sakthi Polymers
53		PVC Plastic High / Low level cistern	Commander, Elite Dual, Champion, Parryware-similine, Hindware
54		PVC Inlet connection & Waste Pipes	Kohinoor, ECCSO, GEM & Elite
55		CP Brass towel rods and accessories	Elite, GEM, Jacquar, ESSCO
56		Concrete Admixtures	Structural waterproofing Co., SIKA, FOSROC Chemicals, BASF, CICO
57		Asbestos Roofing Sheets	Everest, Charminar & Asbestos Cement Ltd.
58		Colour Coated Steel / Zinc-alu alloy roofing sheets	Kirby, Steelfab & Colour Roof India Ltd.

**LIST OF APPROVED MANUFACTURER FOR STRUCTURAL GLAZING, ACP
CLADDING AND GLASS FAÇADE**

Sl. No.		Description of materials	List of Manufacturers
1		Glass: Monolithic, Heat Strengthened, Toughened, Reflective, Tinted, Insulated, Laminated and Tempered Glass	St.Gobain (France/India), Glaverbel (Europe), Pilkington (USA, UK), Asahi (Japan), Viracon (USA), Guardian (USA), Saudi American Glass Factory, Interpane (USA)
2		Aluminium Extrusions	Hindalco Industries, Jindal, Bhoruka or approved equivalent subject to specified tolerance standards.

3		Stainless Steel	Salem Steel or approved equivalent
4		EPDM	AMEE Rubber Industries Pvt. Ltd., OSAKA Rubber Pvt. Ltd. or equivalent approved.
5		Double Glazing Unit Hermatically Sealed	Manufacturers listed above as item 1 and Sejal Arch. Glases
6		Expansion Anchors	HILTI or approved equivalent (with stainless steel 616 bolts, nuts & washers)
7		Chemical Anchors	HILTI or approved equivalent
8		Window Furniture: a) 4 Point Lockset b) S.S. Friction Hinges c) Patch Fittings d) Floor Springs e) Adhesive Film f) SS Handles	GIESSE or approved equivalent COTS WOLD or approved equivalent. DORMA. DORMA. 3 M or approved equivalent. DORMA/KICH
9		Structural Sealant	Dow Corning / GE / Wecker
10		Weather Sealant	Dow Corning /GE / Wecker
11		Foam Spacers and Mounting Tapes	NORTON or approved equivalent
12		PVDF Coatings	VALSPAR Corporation or approved equivalent.
13		Aluminium Composite	ALUCOBOND or REYBOND or Alpolic approved Metal Panels equivalent
14		Baker Rod	Supreme Ind. or approved equivalent
15		Insulation	Glass wool / Rock Wool or approved equivalent
16		Spider System	Dorma or approved equivalent
17		Clear Float Glass	Saint Gobain / Asahi / Modiguard or approved equivalent
18		Glass Processor	Impact Safety / Sejal Glasstech/ GSC / Asahi or approved equivalent.

Date:

Signature of Tenderer
with seal

PROFORMA OF SCHEDULES

Uploaded separately

CONSTRUCTION SAFETY MANUAL FOR WORKS CONTRACT

Prepared by

Kaushik Kayal and B. Srinivas

Architecture & Civil Engineering Division

and

G.L.N. Padmavathi and Praveen Dubey

Industrial Hygiene and Safety Section

Radiation Safety Systems Division

Reviewed by

A.K. Gurjar, A&CED

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GOVERNMENT OF INDIA
ATOMIC ENERGY COMMISSION

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BHABHA ATOMIC RESEARCH CENTRE
MUMBAI, INDIA
2011

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निर्माण कार्य ठेके के लिए निर्माण संरक्षा नियमावली

सारांश

निर्माण उद्योग, संयंत्र स्थल गतिविधियों से संबंधित जोखिमों की ओर अत्यधिक प्रवृत्त है और निर्माण परियोजनाओं में अत्यधिक संख्या में ठेके के कामगार काम करते हैं। ठेके के कामगार विभिन्न व्यवसाय के विशेषकर ग्रामीण क्षेत्रों और कृषि पृष्ठभूमि के होते हैं तथा उन्हें निर्माण संरक्षा से संबंधित उचित प्रशिक्षण प्राप्त नहीं होता है। कार्यस्थल पर कार्य निष्पादन के दौरान, इन कामगारों को निर्माण कार्य में शामिल विभिन्न जोखिमों और अन्य व्यवसाय जनित रोगों तथा स्वास्थ्य संकटों का सामना करना पड़ता है जिससे क्षति एवं बीमारियां होती है, जिसके फलस्वरूप, कार्य समय की हानि और अन्य कानूनी परेशानियों के कारण निर्माण परियोजनाओं में देरी होती है। अतः किसी भी निर्माण परियोजना के लिए आवश्यक है कि संयंत्र स्थल गतिविधियों के लिए कुछ संरक्षा दिशानिर्देश जारी हो जिससे कामगारों, कार्यस्थल पर्यवेक्षकों तथा इंजीनियरों में जागरूकता पैदा की जा सके। निर्माण संरक्षा नियमावली का उद्देश्य, वास्तुविद्या एवं सिविल इंजीनियरी प्रभाग, भाभा परमाणु अनुसंधान केंद्र के अधीन सभी निर्माण कार्य स्थलों को सुरक्षित कार्य स्थिति में रखने के योग्य बनाना है। इस नियमावली में वास्तुविद्या एवं सिविल इंजीनियरी प्रभाग, भाभा परमाणु अनुसंधान केंद्र की संरक्षा नीति, सिद्धांत और उद्देश्य, विभिन्न निर्माण गतिविधियों के लिए सुरक्षित कार्य प्रक्रिया पर सामान्य दिशानिर्देश, इन प्रक्रियाओं के क्रियान्वयन के लिए उत्तरदायी कार्य स्थल स्तर संरक्षा समिति, मानीटरन तथा रिपोर्ट करने की प्रक्रियाएं और प्रशिक्षण तथा जागरूकता निर्माण करनेवाले कार्यक्रम शामिल हैं। इस नियमावली में अनुलग्नक भी शामिल हैं जिनमें सुरक्षित कार्य प्रक्रिया तथा विधिक अनुपालन के क्रियान्वयन के लिए विभिन्न प्रारूप निहित हैं।

Construction Safety Manual for Works Contract

Abstract

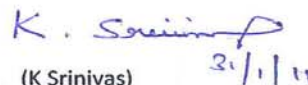
Construction Industry is highly prone to hazards related to site activities and construction projects engage large number of contract workers. Contract workers come from varied trades especially from rural areas and agricultural background and do not have proper training in construction safety. During execution at site, these workers are exposed to various risks involved in construction works and other occupational diseases and health hazards which cause injuries and illnesses. As a result, the construction projects get delayed due to loss of working hours and other legal hassles. Therefore, it is essential for any construction project to have certain safety guidelines for site activities and to create awareness among the workers, site supervisor and engineers. The aim of the Construction Safety Manual is to enable to maintain safe working condition at all construction sites under Architecture and Civil Engineering Division, Bhabha Atomic Research Centre. This manual covers safety policy, principles and objectives of Architecture and Civil Engineering Division, Bhabha Atomic Research Centre, general guidelines on safe working procedures for various construction activities, Site Level Safety Committee responsible for implementation of these procedures, monitoring and reporting procedures and training and awareness building programmes. This manual also includes annexures containing various formats to be followed for implementation of safe working procedure and legal compliance.

PREFACE

Architecture & Civil Engineering Division, Bhabha Atomic Research Centre takes up construction of new facilities and maintenance of existing facilities through public tender. The contractor engages contract workers to execute these works. These workers are mostly from varied background and they may be exposed to the hazardous conditions prevailing at construction sites. A&CED recognizes the responsibility of ensuring safety of these workers at site and therefore it is necessary to formulate the safety guidelines for execution of civil works at site.

This safety manual for works contract is prepared with the objective to ensure a safe working environment at work site, to complete the project in a safe and accident-free manner by creating safety awareness among the workers and staff. This manual is designed to enhance the safety standards presently being followed and to reduce occurrence of near-misses and accidents in construction projects under taken by BARC.

Implementation of the safety guidelines recommended in this manual will help Engineer-in-charges of the projects to strengthen the safety measures at site and to ensure the welfare of all contract workers as well as staff of the contractor and the department.

 31/1/11

(K Srinivas)
Chief Engineer &
Head, Architecture & Civil Engineering Division

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(Smt. A. K. Gurjar)

Superintending Engineer (G), A&CED &
Convener, Sub-Committee for Construction
Safety Manual for Works Contract

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1.0 DEFINITION AND SCOPE:

1.1 Definition:

Construction: Construction is the process of making, building, fabrication and/or erection of structures for some facility to be housed in the same.

Safety: Safety is the state of being safe or free from any kind of hazard.

Contract: A contract is a legally binding mutual agreement between the parties identified in the agreement to fulfil all the terms and conditions outlined in the agreement.

1.2 Scope: The manual covers Civil and Public Health construction safety and the scope of this safety manual shall be for all the construction activities undertaken by Architecture & Civil Engineering Division of Engineering Services Group of Bhabha Atomic Research Centre. This manual may be referred to for any Civil and Public Health construction works for BARC Trombay or any BARC outstation facilities.

2.0 SAFETY PRINCIPLES AND OBJECTIVES:

2.1 Safety Principles:

- 2.1.1 Ensuring safety at construction sites is mandatory requirement as it is directly related to welfare of staffs and contractors' workers.
- 2.1.2 All accidents and occurrences of near-misses can be avoided by proper planning and thorough implementation of safe practices at work place.
- 2.1.3 All types of injuries, fatalities, loss of property and time can be minimized through preventive measures.
- 2.1.4 To increase the safety consciousness of the workforce and the supervisory staffs through continuous training and motivation towards safe practices.
- 2.1.5 Regular monitoring, inspections and safety audits will form an integral part of the safety programmes at the worksite.

2.2 Safety Objectives:

- 2.2.1 To provide a safe working environment to all workers and supervisory staffs.
- 2.2.2 To ensure safety at each and every level of the project as an integral part of the activities.
- 2.2.3 To enhance the safety standards as a continuous effort.
- 2.2.4 To complete project in an incident-free manner, without any damage to health, property and environment.

3.0 SAFETY POLICY:

Architecture and Civil Engineering Division, BARC is committed to ensure the highest standard of occupational health, safety and environment in all construction activities undertaken in order to achieve zero-accident working period in all projects and thereby contributing towards enhancement of the safety performance of the centre.

4.0 SAFETY ORGANIZATION:

Contractor shall form a Site Level Safety Committee (SLSC) comprising employees from all sections and one representative from the department. As per chapter XXI, Rule 208, BOCW Central Rules 1998, SLSC shall be constituted by the contractor (Employer) wherein 500 or more workers are employed. In addition, the corporate office of the contractor shall have a safety and environmental control section to liaise with the Competent Authority and carry out periodic safety audit at site. Contractor shall not be self-complacent with mere compliance with sections and rules of various Acts and Rules applicable to construction safety. He shall promote health, safety and environment practices by identifying the personnel and assigning specific responsibilities to them so that proper safety is implemented at site and a safety culture is created among his all employees and workmen and maintained until completion of the project.

4.1 Site Level Safety Committee: (SLSC)

For a project site having maximum strength of less or equal to 500 numbers of workers, Contractor shall identify a Site Engineer to perform the duty of the Safety Engineer/Officer at site. The numbers of representatives from the contractor and the workers in the Site Level Safety Committee (SLSC) shall be as per chapter XXI, Rule 208, BOCW Central Rules 1998. The committee shall meet at regular intervals, at least once in every month and shall be chaired by the senior most person having over all control of the affairs of the construction site, normally the Project Manager or the authorized signatory (power of attorney holder) of the contractor with Safety Officer as Member Secretary. All section-in-charges including site engineers, electrical, mechanical, QA/QC, Stores, administration section, representatives of the workers and one representative of the department shall be the members of this committee. The duties of the committee are enlisted as under:

The main job of the Site Level Safety Committee is to ensure health and safety of all employees, workers and the neighbourhood and for this the committee shall -

- (a) See that all the provisions of relevant Acts & Rules and conditions referred in contract agreement are conformed to.
- (b) See that a well documented safety programme exists.
- (c) See that a work permit system exists for all construction activities, especially for-
 - (i) Any work at hazardous locations such as at height or at depth;
 - (ii) All hot jobs, fabrication works and electrical repairs & maintenance works;
 - (iii) All concreting works; and
 - (iv) Under high noise and high dust environment.
- (d) See that all employees are informed of the hazards involved in their work and are provided with adequate protective equipments.

- (e) See that the work environment and the neighbourhood is free from debris, muck, insects and any unhygienic conditions at any time and proper access and illumination is ensured at the workplace.
- (f) See that a detailed schedule for periodic calibration and preventive maintenance of all the machinery and equipments is being implemented.
- (g) See that periodic medical examination of all employees and workers are carried out to the extent required as per the work environment.
- (h) Assess the potential hazards and dangerous occurrences at the work place and examine the effectiveness of the safety and control measures.
- (i) See that various processes of construction and disposal of debris and effluents are safe to ensure conformance to the Environmental Protection Act, 1986.
- (j) Discuss accidents and dangerous occurrences at the work place and examine root causes of accidents and suggest to the management necessary improvements.
- (k) Organize safety circles in the site for developing safety culture.
- (l) Investigate complaints received from anybody about the risks or dangers.
- (m) Promote safety and health by organizing accident prevention programs, campaigns and meets on continual basis by organizing safety weeks, safety competitions, safety talks and film shows on safety, displaying posters and other promotional activities to stimulate interest among staff and workers about safety.

The agenda and minutes of the meeting to be circulated to all concerned. The decisions and recommendations of SLSC shall be complied with by the contractor within specified/reasonable time.

4.2 Safety Officer and Safety Steward:

General: Number of Safety Officers and Stewards: The number of Safety Officers and Stewards to be engaged by the contractor shall be as per Chapter XXI, Rule 209 and schedule VIII of BOCW Central Rules, 1998. For a project site having maximum strength of less or equal to 500 numbers of workers, Contractor shall identify a Site Engineer to perform the duty of the Safety Engineer/Officer at site. The above provision does not absolve the concerned Site Engineers / Section-In-Charges of the Contractor from the responsibility of ensuring safe working condition for the workmen deployed at a particular area under their control. The respective Site Engineer stands equally accountable for occurrence of any near-miss and / or any accident at site and the Department reserves the right to take suitable actions, as deemed fit, against the Contractor's personnel responsible for such lapse in ensuring proper safety at site.

4.2.1 Duties of Safety Officer: The duties of Safety Officer shall be to advise and assist the management in the fulfilment of its obligations, statutory or otherwise, concerning Atomic Energy Factory Rules, 1996 and BOCW Act & Central Rules, prevention of personal injuries and maintaining a safe working environment. These duties shall include the following, namely:-

- (a) to advise the concerned departments in planning and organizing measures necessary for creating a safe working environment for all workmen engaged at site and to prevent any kind of personal injuries and damage to property;
- (b) to advise on safety aspects in all job studies, and to carry out detailed job safety studies of selected jobs and to formulate Job Hazard Analysis Report and Safety Manual during initial mobilization stage of the project;
- (c) to check and evaluate the effectiveness of the action taken or proposed to be taken to prevent personal injuries and damage to property;
- (d) to ensure that all Personal Protective Equipment (PPE) provided to workers as required under any of the provisions of the Act or the Rules conform to the relevant Indian Standards and to advise all Site Engineers / Section-In-Charges / Supervisors to ensure proper use of such PPEs by workers at site;
- (e) to provide advice on matters related to carrying out site safety inspections, daily walk-through surveys, etc.;
- (f) to carry out site safety inspections in order to observe the physical conditions of work and the work practices and procedures followed by workers and to render advice on measures to be adopted for removing the unsafe physical conditions and preventing unsafe actions by workers;
- (g) to render advice on matters related to reporting and investigation of industrial accidents and diseases;
- (h) to report and investigate all accidents and near-misses and to recommend the preventive measures so as to ensure non-occurrence of such cases;
- (i) to investigate the cases of industrial diseases contracted and reportable dangerous occurrences.
- (j) to advise on the maintenance of such records as are necessary relating to accidents, dangerous occurrences and industrial diseases;
- (k) to promote setting up of Site Level Safety Committee (SLSC) and to act as adviser and catalyst to such committees;
- (l) to organise in association with the concerned departments, campaigns, competitions, contests and other activities which will create awareness and will develop and maintain the interest of the workers in establishing and maintaining safe conditions of work and procedures; and
- (m) to design and conduct either independently or in collaboration with the training department, suitable training and educational programme for the prevention of personal injuries.

4.2.2 Facilities to be provided to Safety Officers: The Contractor shall provide each Safety Officer with such facilities, equipment and information as are necessary to enable him to discharge his duties effectively. Such typical facilities may include personal computer, testing facility, facilities for storage of PPE, documents and stationery, etc.

4.2.3 Qualifications for Safety Officer:

A person shall not be eligible for appointment as a Safety Officer unless he

- a) possesses- (i) a recognised degree or equivalent in any branch of engineering or technology and has had practical experience of working in a construction project site in supervisory capacity for a period of not less than 2 years; or
- (ii) a recognised diploma or equivalent in any branch of engineering or Technology and has had practical experience of working in a construction project site in supervisory capacity for a period of not less than 5 years;
- (b) possesses a degree or diploma in industrial safety recognized by the Central / State Government in this behalf; and
- (c) has adequate knowledge of the language spoken by majority of the workers in the region in which the construction project site where he is to be appointed is situated.

5.0 GENERAL SAFETY PROVISIONS:

5.1 Work Planning: The contractor shall identify the requirements of good practices at site for fulfilment of legal requirement related to environment, occupational health and safety. The contractor shall enlist all the activities under the contract in advance and their effect on safety, health and environment. The contractor shall establish, implement and maintain procedure to identify and have accesses to applicable legal requirements related to environment, occupational health and safety. The contractor shall maintain register **(Refer Annexure-1)** of applicable legal requirements which shall be kept updated from time to time.

5.2 Job Hazard Analysis Report: Contractor shall analyse job-specific hazards in order to identify the probable causes to these hazards, well in advance, and recommend the remedial measures in Job Hazard Analysis Report **(Refer Annexure-2)**; which shall be submitted to the Department within one month from the issue of work order in the approved format and as per guidelines of the Engineer-In-Charge for approval of the Competent Authority as per regulatory requirement of BARC. Contractor shall implement the recommended remedial measures at site in order to create and maintain an accident-free working condition at site.

5.3 Work Permit: The contractor's Site Engineer shall seek work permit for all new activities to be taken up at site and submit the form duly signed by him in quadruplicate **(Refer Annexure-3)** to Safety Officer before commencement of the work daily. The Safety Officer will inspect the site and give the clearance to the concerned site engineer. One copy of the work permit shall be made available with the contractor's site engineer, site supervisor, safety officer and departmental staff each. No work shall commence at site without approved work permit. In case of renewal of work permit, such noting shall be made on the work permit.

5.4 Safe Working Procedure:

5.4.1 Guidelines for general and enabling works:

The contractor shall submit the layout of proposed location of site office, stores, batching plant & silos, mechanical workshop, electrical panel rooms, water points, first aid centre and safety office and other temporary structures for prior approval of Engineer-in-charge. It shall be ensured that the proposed locations of temporary structures do not hinder the existing permanent structures, roads, drains, services, movement of workers and equipment during construction, etc. and shall be easily accessible. The trial pit location for finding existing underground services shall also be submitted for advance approval.

5.4.2 Demolition:

Before any demolition work is commenced and also during the progress of the work:

- a) All roads and open area adjacent to the work site shall either be closed or suitably protected. Appropriate warning signs shall be displayed for cautioning persons approaching the demolition area. The area shall be cordoned off properly.
- b) Protection of adjacent building, underground service lines should be ensured. Underpinning operations shall not be permitted unless adequate measures against collapse of structure are ensured.
- c) Before demolition operations begin, the Contractor shall ensure that the power on all electric service lines is shut off and the lines are cut or disconnected at or outside the demolition site. If it is necessary to maintain electric power during demolition operation, the required service lines shall be adequately protected against damage.
- d) Persons handling heavy materials /equipments shall wear safety shoes.
- e) No floor, roof or other part of the building shall be overloaded with debris or materials that may render it unsafe.
- f) Entries to the demolition area shall be restricted to authorized persons only.

5.4.3 Piling:

5.4.3.1 Piling rig: The legs of the tripod shall be properly spiked in the ground to prevent accidents due to slipping of the tripod legs when rested on a paved ground or sleepers. The shear legs and bases become thin and fatigued with usage. They should be replaced frequently.

5.4.3.2 Pulley and rope: The pulley and rope shall be checked with reference to the Rule 71 and 72, Section- I of BOCW Central Rules, 1998. In addition to this, the pulley and rope shall be checked before the commencement of day's work, in this respect-

- a) Check for loose strands and wear, deformation, corrosion and breakage of wires.

- b) Check whether the end of the rope has become loose or has slipped wire clips or wire sockets.
- c) Check against slippage of rope from the sleeve during work.
- d) Check if there is any occurrence of torsion in the wire rope while working and if so, unwind it normally at once.
- e) Check if there are any adhesions like mud, earth, etc, on the rope. If so, clean with wire brush or compressed air.
- f) Check if the grease applied on the rope is adequate.
- g) Check for wear and cracks on the lining of the clutches and brake band; and the engine condition.
- h) The pulley shall be checked for any cracks in wheel, etc.

5.4.3.3 Field operation: Contractor shall take following precautions during boring of pile and concreting activity:

- *Centering the Pile* — the workers helping while marking the pile centre shall be protected from possible injury by bailer / chisel.
- *Driving the casing & cap* — workers shall be protected from chances of slippage of driving bar / clutches falling accidentally.
- *Lowering Reinforcement Cages* — the lifting and lowering of re-bar cage shall be done with utmost care since it is very heavy and at the same time flexible enough to buckle. Adequate supporting arrangement shall be ensured. The workers shall be protected from projected parts like binding wire, wire nails, etc. while preparing the pile cages or handling and lowering them.
- *Jammed Casings* — while withdrawing the casing, sometimes the casings may get jammed. During the process of extracting them, the tripod legs shall be secured properly for prevention of toppling / collapse of tripod due to sudden jerks. The withdrawal process of casing shall be executed slowly and with proper care in order to ensure smooth movement of the casing.
- *Grounding the Bailers/Chisels* — workers shall keep safe distance while the bailers and chisels are grounded so as to be safe from any injury due to swing of them. Minimum distance of 5 m shall be maintained.
- *Guarding of flywheels* — the flywheels of the machine of the piling rigs shall be guarded properly.
- *General precautions* — workers shall wear tight fitting clothes and all necessary PPEs. Care shall be taken for nearby permanent structures for vibrations, etc. during piling.

5.4.4 Earthwork in excavation and backfilling: The Contractor shall take all safety precautions during the execution of awarded work and shall maintain and leave the site safe at all times.

5.4.4.1 Excavation:

5.4.4.1.1 All trenches 1.2 m or more in depth shall at all times be provided with at least one ladder at a spacing of 15m or part thereof in case of hazardous work and 30m or part thereof in case of less hazardous works. Ladder shall be extended from bottom of the

trench to at least 1 m above the surface of the ground and the legs of the ladder shall be secured against slipping.

5.4.4.1.2 The sides of the trench which are 1.2 m or more in depth shall be stepped back to give suitable slope (angle of repose depending on the type of the soil) or securely held by steel or suitable shoring, so as to avoid the danger of sides from collapsing. A provision of clear berm of a width not less than one-third of the final depth of excavation is recommended. In areas, where this width of the berm is not feasible due to space constraint, the clear berm width (clear space) not less than 1 m shall be provided. Cutting shall be done from top to bottom. Under no circumstances mining or under-cutting shall be done.

5.4.4.1.3 The Contractor shall ensure the stability and safety of the excavation, adjacent structures, existing services and the works of other agencies.

5.4.4.1.4 Open excavations shall be cordoned off by suitable railing/barricading and photo-luminescent warning signals installed so as to prevent persons slipping or falling into the excavations. Warning signals shall be visible at night also and the area shall be well illuminated during the work.

5.4.4.1.5 All blasting operations, if permitted by Engineer-in-charge, shall be carried out on the basis of procedures approved by Inspector of Explosives. All works in this connection shall be carried out as per I.S Code of Practice. Barricades, photo-luminescent warning signs, etc. shall be placed on the roads/open area. Prior approval of such operation shall be obtained from Safety Officer/Engineer-In-Charge of Works.

5.4.4.1.6.

- a)** For removal of earth from an earth mound work permit shall be obtained from the Engineer In-charge / safety officer of the work.
- b)** As far as practical, earth shall be removed mechanically. Ramp shall be made by the contractor with suitable hard material for movement of trucks / tippers, etc. with proper slope, compaction and drainage so as to ensure safe and easy movement of the above transport vehicles carrying excavated earth.
- c)** Wherever manual removal of earth is involved, earth shall be removed from the top by maintaining the proper slope equal to the angle of repose of the earth.
- d)** Such work shall be constantly supervised by the contractor's responsible person and frequently inspected by the departmental representative to ensure that no under-cutting is done.
- e)** The excavating equipment should be parked at a distance of not less than the depth of the trench.
- f)** For excavation in greater depths, separate access for workers with proper steps/slope and temporary railing arrangement shall be provided apart from ladders. The access shall be maintained in proper condition until backfilling is completed in the excavated area.
- g)** Experienced and qualified supervisors shall be put in charge of the excavation work by the contractor. The supervisor shall brief workers about the working plan before the commencement of work and explain potential hazards to them. He

shall pay attention to existing water pipelines, electric cables below the surface or during excavations of underground structures and arrange for proper protection to them. Contractor shall report the condition of excavated pit to departmental staff/Engineer-in-charge after every rain and accordingly shall take necessary corrective action for safety at site.

h) Contractor shall arrange adequate and efficient mechanical dewatering system as recommended by Engineer-in-charge. These pumps shall be inspected and maintained in proper working condition. The electrically operated pumps shall be connected to ELCB of proper rating for safety of the person operating/shifting them.

i) Contractor shall wash the wheels, of the transport vehicles carrying excavated soil, with water jet before moving out of the site premises so that there is no spill over of soil on the existing roads. In case there is any such spill over on the roads, the same shall be cleaned by the contractor by manual / mechanical means immediately at no extra cost.

5.4.4.2 Backfilling:

5.4.4.2.1 The earth to be used for backfilling shall be taken from approved location or borrow pit if the soil is taken from inside BARC. For outside BARC supply, the source shall be approved by the Department in advance.

5.4.4.2.2 The contractor shall take precautions for earth mounds stacked for backfilling as mentioned above under the head of earthwork in excavation. The soil shall not be pushed indiscriminately by mechanical means into the excavated pit as far as possible. If mechanical dumping / pushing are unavoidable, it has to be done with proper guidance / warning (helper / reverse horn to be provided to all vehicles) and the pits have to be vacated from manpower.

5.4.4.2.3 The final backfilling shall be done in layers and compacted as per technical specification of the tender. Utmost care shall be taken by the contractor for protection of permanent structure or already cast structures during use and movement of mechanical compactors.

5.4.4.2.4 The temporary power supply points or panels are to be protected from water spraying or any other damages during backfilling process.

5.4.5 Reinforcement and Concrete works:

5.4.5.1 Concreting:

a) Manual handling of concrete shall be restricted as far as possible. Proper exhaust ventilation shall be available at the cement store and during casting work in confined places. PPE for protection of workers viz. respirators, hand gloves, gumboots, etc. shall be provided by the contractor to the workers handling cement bags and concrete manually.

b) The contractor shall provide ear-muffs to the operator / worker exposed to continuous high-level of noise and ear-plugs to all workers involved in the concreting work.

- c) The out riggers / wheels of concrete pump / concrete mixer shall be placed on firm ground / platform. Pump accessories shall be checked for its safe working pressure considering maximum pipe line height. A pressure release valve shall be attached to the pump to release the excess pressure.
- d) The pipeline for transporting the concrete shall have the shortest route with minimum bends and shall be installed on firm supports at suitable intervals. Pipeline shall be properly joined with clamps and securely tied to nearby support and checked in advance before starting the concreting. Pipe segments shall be cleaned in advance to avoid choking of concrete during casting.
- e) Length of flexible hose shall be such that it can be easily handled by the workers. The end of flexible hose shall be checked before commencement of concreting and it shall be free from loose wires, concrete lumps, etc. The “swan neck” position of the flexible hose shall be avoided as it results in building up excessive pressure on concrete pump and clogging of concrete.
- f) Ball catcher / Trap to arrest the ball must be provided at the end of the pipe line after the concreting is over and flexible pipe is removed. The supervisor, who is authorized to give clearance for ball passing, shall check that whether the ball catcher / trap is fixed properly before passing the ball. The supervisor shall instruct all workers to keep safe distance during ball passing.
- g) Signalling system - Red and green flags shall be displayed by the supervisors/ designated signalmen, standing in visible locations, for commencement and stopping the flow of concrete. These signalmen shall not be engaged in any other work during concreting activity. They shall be trained along with the concrete pump operator in advance by the contractor for correct signalling. During concreting in night, electric torches fitted with red/green cellophane papers may be used instead of red/green flags.
- h) All mechanical equipment/tools used in concreting activity like batching plant/concrete mixer, concrete pumps, vibrators, etc. shall be operated by trained person only.
- i) Ready Mix Concreting – Loaded transit mixers shall move / park on firm ground as far as possible. The reversal of transit mixers shall be guided by helpers and reverse horn shall be used for reversal. Cleaning/washing of transit mixers shall be done at designated area only.
- j) The concrete mixers used for preparation of concrete may be tilting or non-tilting type, driven by electric motors or by diesel engine depending upon the location of the structure. For electric driven mixers, the wire connecting the mixers shall be in good and sound condition, and the circuit breaker shall be well maintained.
- k) Exhaust gases of a diesel engine if inhaled for long period may cause diseases. They shall be directed away from the operator. All gears and moving parts shall be well guarded. Care shall be taken to display notice “Under Repairs” while cleaning the drum. Wire ropes operating the drum and clutches shall be inspected regularly and replaced, if required.

5.4.5.2 Reinforcement:

- a) Bar bending and cutting yard shall be properly cordoned / barricaded and entry shall be restricted.
- b) Re-bar bending and cutting machines shall be handled by trained operator / skilled workers.
- c) Shifting of cut re-bars shall be done by mechanical means as far as possible. When re-bars are shifted manually, it shall be done with proper care and proper balance shall be maintained. Clear access shall be provided for shifting of re-bars.
- d) Proper support shall be given to the column bars by means of rings / props against undesirable sway.
- e) Free ends of the binding wires shall be bent inside to avoid injuries.
- f) Proper PPE viz. leather / cotton hand gloves, goggles, etc., for the people handling / shifting and cutting / tying of re-bar, shall be used for protection from injury and other occupational diseases.

5.4.5.3 Formwork for concreting:

- a) Shuttering and supporting members viz. props, tie rods, etc. shall be of adequate strength to support the load / pressure of concrete and the formwork scheme shall be approved by Engineer-In-Charge in advance. The procedure approved by Engineer-In-Charge shall be followed for mixing, transporting and pouring of concrete.
- b) The process of stripping of formwork shall be planned in advance and approved by Engineer-in-charge. Stripping shall enable the structural member to behave in desired manner. The area shall be suitably cordoned / barricaded and unauthorized entry shall be restricted by displaying signboards, etc.
- c) While removing formwork from vertical surfaces, the shuttering board shall be adequately supported by props, in order to prevent the same from toppling / slipping, until it is lowered on ground safely. Same support with props shall be provided during erection of formwork too until the plywood is secured in desired place with tie rods.

5.4.6 Scaffolding and Working at Height:

5.4.6.1 General:

- a) All the workers, supervisors and engineers of the contractor, who will work at height, shall have valid height passes issued as per **Annexure-4** by the Safety Officer / Medical Attendant in consultation with the Authority of the Safety Unit, ESG, BARC. Each such individual shall be medically examined by a Medical Practitioner, for blood pressure, vision, hearing, and efficient movement of limbs, epilepsy, vertigo or any other persistent diseases that make him/her medically unfit for working at height. The fit persons shall be issued height passes, which shall be valid for maximum 6 (Six) months, for working at height. After every 6 (Six) months, these persons shall be medically examined in order to find out their fitness for working at height. List of unfit workers shall be submitted to the departmental representative and such persons may be allowed to work at ground level and in no case shall be engaged by the contractor to work at height. The records of

medical checkups / fitness tests certified by the Medical Practitioner shall be maintained at the first aid centre / safety office of the contractor and shall be produced to the departmental representative as and when asked.

b) The scaffold to be erected for working at height shall be designed for the estimated load (load of the RCC structure to be supported, live load and other vibrations load during casting, etc.) and design shall be submitted for approval of the department in advance. The scaffold components shall be designed for at least 4 times of the maximum intended load. The use of Bamboo/Wooden scaffoldings shall not be permitted irrespective of height of work and only steel scaffolding shall be used by the contractor.

c) The erected scaffold shall be inspected and cleared by the safety officer of the contractor. The safety check list (**Refer Annexure-5**) for scaffolding erection shall be submitted by the site engineer of the contractor to the safety officer in triplicate. The standard format of safety check list for scaffolding erection is enclosed as **Annexure- 5**. The safety officer shall physically inspect the erected scaffolding and after his satisfaction, shall give clearance for the use of the scaffold. One copy of safety check list, duly filled in and cleared by safety officer of the contractor, shall be submitted to the departmental representative. Other two copies shall be available with site engineer and safety officer of the contractor respectively.

d) Base of the structure shall be supported on levelled and firm ground as far as possible. In case such firm ground is not available at site then the load of the vertical members of the scaffold shall be distributed with the help of base plates, sole plates or channels, etc. The base of the scaffold shall be away (at least 1.5m) from excavated pits, open drains, manholes, water logged area, etc. Contractor shall ensure that there is no vehicle movement near the erected scaffold and it shall be protected by proper barricading/warning sign, etc.

e) The scaffold shall be checked for its condition i.e. it shall be free from bends, cuts, rust, etc. All vertical members shall be in plumb and correctly spaced. The joints of vertical and horizontal members shall be properly connected with couplers, lock pins, etc. The scaffold shall be securely tied with permanent structure as per the requirement of IS: 3696 – 1991 (Part 1) (Reaffirmed in 2002).

f) The access to the scaffolding shall be free from obstructions, undesirable and slippery materials. Stair tower, monkey ladders, gangway, etc. shall be provided in the scaffolding for movement of the workers.

g) The working platform and the access to the scaffold shall be free from all debris and loose materials.

h) The diagonal face bracing/Zig zag face bracing shall be provided at a spacing of maximum 10 m centre to centre for pipe scaffolding.

i) Safety tag (for 'Unsafe Scaffolding DO NOT USE' in red letters or tag / 'Safe Scaffolding' in yellow letters or tag) shall be displayed on the erected scaffold at ground level. Such safety tag / sign boards shall be written in the language understood by the majority of the workers. Unsafe scaffolds shall be repaired / removed.

j) Contractor shall provide necessary PPEs as per relevant I.S. Codes for the workers working at height viz. full harness safety belt, fall arrestor, kinetic shock absorber, safety helmet, gloves, etc.

5.4.6.2 Working platform:

a) The quality of wooden planks or MS grill plates for decking of working platform shall be made of good quality material and free from any defects, etc. The load carrying capacity of the working platform shall be designed in consultation with Engineer-in-charge. Working platform, gangways and stairways shall be so constructed that they shall not sag unduly or unequally. They shall be closely boarded, shall have adequate width (at least 2 planks/ grill plates wide or 600 mm whichever is more) for easy movement of persons and materials and shall be suitably guarded.

b) The steel walkways or wooden planks used for making working platform shall not project beyond the end supports to a distance of 150 mm. The planks shall be rigidly tied at both ends to prevent sliding and toppling. The thickness of the planks shall be adequate to take load of men and materials and shall conform to IS: 3696-1987 (Part-I) (Reaffirmed 2002) and they shall not collapse.

c) The overlaps of MS grill plates / wooden planks shall not be less than 300 mm.

d) The platform shall extend at least 600 mm beyond the end of wall in order to facilitate the worker to reach end of the wall.

e) All working platforms shall have guard rails at 1.0 m height with middle rails at 0.5 m height from the platform and 15 cm high toe boards securely tied with the vertical posts. The spacing of vertical posts shall not exceed 2.0 m centre to centre.

f) Every opening in the floor of a building or in a working platform shall be provided with fencing or railing and protective cover, to prevent fall of persons or materials, the minimum height of which shall be 1.0 m, along with 15 cm high toe board at floor level along the railing. The removal of such railing / protective cover shall be done only after seeking proper work permit from Safety Officer of the contractor.

g) The contractor shall provide grab rope / life line all around the working platform/level, at height, which will provide tying / anchoring facility for the safety belt / fall arrestor.

h) Contractor shall provide safety net under all working platform/level at height to protect fall of men and materials from above and such safety nets shall conform to IS: 11057-1984.

i) Adequate precautions shall be taken to prevent danger from electrical lines and equipment. Scaffolding, ladder, working platform, gangways, etc. shall not exist within 5m of any un-insulated electric wire. Whenever electric power and lighting cables are required to run through (pass on) the scaffolding or electrical equipments are used, such scaffolding structures shall have minimum two earth connections with earth continuity conforming to relevant IS Code of Practice.

5.4.6.3 Ladder:

- a) Safe means of access shall be provided to all working platforms and other elevated working places with the help of ladders.
- b) Ladder shall be placed in an inclination not steeper than 1 in 4 (1 horizontal and 4 vertical).
- c) Every ladder shall be securely fixed at bottom from sliding/slipping.
- d) No single portable ladder shall be over 9 m in length.
- e) For ladders up to 3m in length, the width between side rails in the ladder shall be a minimum of 300 mm. For longer ladders, this width shall be increased by at least 20 mm for each additional metre of length.
- f) The spacing of rungs shall be uniform and shall not exceed 300 mm.
- g) Ladder shall be of rigid construction having sufficient strength for the intended loads and made either of good quality wood or metal. All ladders shall be maintained well for safe working condition. The rungs shall be tested periodically as per provisions of IS: 3696 -1991 (Part 2) (Reaffirmed in 2002).
- h) Whenever ladder is not securely fixed an extra worker shall be engaged for holding the ladder.
- i) Ladders shall not be used for climbing while carrying materials in hands. While climbing, both the hands shall be free for holding the rails. Contractor shall make alternate safe arrangement for lifting of tools and implements for all his workers working at height.

5.4.7 Construction machinery and Tools:

General: The operation and maintenance of any construction machinery shall be as per manufacturer's guidelines & checklists and by trained personnel only.

5.4.7.1 Earth moving machinery:

General: The contractor shall ensure the stability of the equipment, while working, depending on the load bearing capacity of the ground; which may reduce due to presence of moisture and due to vibration effect. The contractor shall provide bearing plates, packing, etc. to strengthen the ground below outriggers or wheel or crawler of the equipment. All earth moving equipment shall have Roll Over Protective Structures, sound suppressers, seat belts, reverse alarms, warning horns, windshield wipers and easily approachable control and lever for brake system and emergency stop. They shall be checked at the time of delivery and they shall be properly maintained. Contractor shall display warning sign for keeping away from the moving parts of such equipment and the area of operation of such machinery shall be properly cordoned. The shovel / bucket of the earth moving equipment shall be rested on ground when the equipment is not working. Operation of such equipment shall always be carried out by trained operator accompanied by the designated helper.

a) Power shovels: The shovels both mechanical as well as hydraulic / pneumatic type need basic precautions while being operated. The excavators shall not lose their stability while operating. The Contractor shall adhere to the Load Charts for various boom lengths

provided by the manufacturers. For the mechanical shovels, the wire rope shall be changed as per the frequency mentioned in history sheet. For Hydraulic hoses, the connections shall be tight and leak proof. The fire extinguisher of appropriate type confirming to IS: 2190-1992 (Reaffirmed in 2007) shall be made available on the hydraulic excavator.

b) Bulldozers: The blade of Bulldozer shall be inspected at least once in a week. The blade shall not be used as a brake except in emergency. The position of the blade shall be adjusted while travelling up or down the gradient. The Bulldozer shall be parked on levelled ground, by applying hand brakes and by lowering blade.

c) Scrapers: The brakes of the Scraper shall be checked before putting it in operation. The scraper bowl shall be repaired and the cutting blades shall be changed periodically. The bowl shall be locked before carrying out the repairs. The bucket shall be raised while moving the scraper. No vehicle movement shall be allowed within the radius of movement of scraper and the area shall be properly cordoned. The wire ropes shall be checked periodically by visual inspection at least once in a fortnight.

5.4.7.2 Lifting and hoisting machinery: Use of lifting machines and tackles including their attachments, anchorage and supports shall conform to the Rules 55 to 71 of chapter VII of BOCW Central Rules, 1998 and shall also conform to the following conditions.

(a) Lifting machines and tackles shall be of good mechanical construction, sound material and adequate strength and free from any defects and shall be kept in good repair and in good working condition. Every rope used in hoisting or lowering materials or as the means of suspension shall be as per manufacturer's guidelines, of good quality and adequate strength and dimension and free from any defect. Test certificates of such ropes, D-shackles, etc. shall be submitted in advance by the contractor.

(b) Every crane operator or lifting appliance operator shall be properly qualified. No person under the age of 18 years shall be in charge of any hoisting machine or to give signal to operator of such machine.

(c) In case of every lifting machine (and of every chain, ring, hook, D-shackle, swivel and pulley block used in hoisting or as means of suspension) the safe working load shall be ascertained and clearly marked. In case of a lifting machine, having a variable safe working load, each safe working load and the conditions under which it is applicable shall be clearly indicated. No part of any machine or any gear referred to above in this paragraph shall be loaded beyond the safe working load except for the purpose of testing. This shall be approved by the Safety Officer of the contractor.

(d) The Contractor shall notify the safe working load of the machine to the Engineer-in-charge whenever he brings any machinery to site and get it verified by the third party testing, supported by a valid test certificate.

(e) The base of such hoisting equipment shall be kept in perfect horizontal condition since any tilt would reduce the load carrying capacity of the equipment. The foundation shall

be firm enough to support the equipment. The level shall be checked every day before starting the work in case of mobile hoisting equipment.

(f) Thorough inspection and load testing of lifting machines and tackles shall be done by a third party, at least once in every 12 months and the records of such inspection and testing shall be maintained and a copy shall be submitted by the contractor to the departmental representative at site. Motors, transmission, couplings, belts, chain drives and other moving parts of hoisting appliances shall be provided with adequate safeguards. Hoisting appliances shall be provided with such means as it shall minimize the risk of any part of a suspended load becoming accidentally displaced or lowered.

(g) Double sling shall be used for hoisting material. The angle of the sling shall be wide enough for safe hoisting and the sling shall be adjusted as per the centre of gravity of the material to be lifted. A guide rope (manila rope of sufficient length, normally 1.5m long) shall be attached to the end of the material lifted in order to pull the same conveniently during lowering.

(h) The contractor shall maintain a Register of Periodical Tests for Examination of Lifting Appliances and Gears (**Refer Annexure 7A**) at site as per Rule 74, Chapter VII, BOCW Central Rules, 1998 and record the periodic / annual thorough examination of such appliances (viz. winches, derricks, their accessory gears, loose gears, ropes, hooks, shackles, swivels, etc.). This register shall be kept available at site always for examination of the department.

5.4.7.2.1 Tower Cranes: Erection & Commissioning - The type of the tower crane to be used shall be selected based on the load to be lifted, the reach of the boom and the height at which the material is to be shifted. The contractor shall follow all the safety instructions given in the manufacturer's manual for erection, dismantling or extension (jumping) of tower cranes. The contractor shall submit the operation manual, provided by the manufacturer, to the departmental representative before erection of the same at site. For both movable and fixed tower cranes, the adequacy of the counterweight shall be ensured. The base of the tower crane shall be in perfect horizontal level. Base shall be capable of bearing the loads during the operation of tower crane.

The foundation of the tower crane (mainly for static tower crane) shall be properly designed, for at least 25% more than the maximum load carrying capacity of the crane. For erection of mobile tower crane, the contractor shall first level and compact the soil at the place of erection or shall lay PCC / RCC of sufficient thickness if the soil condition is poor. The out riggers / wedge of the mobile tower crane shall be properly secured. The limit switch of the tower crane shall be properly calibrated and checked periodically by the contractor in order to ensure safe load carrying capacity of the same. The load carrying capacity shall be tested, at least once in 12 months, by a third party and a copy of such test shall be submitted by the contractor to the departmental representative at site. The limit switch shall function in such a manner that it immediately cuts off the power supply to the hoisting motor of the crane on overloading. The electrical power supply system of the crane shall be through MCB / ELCB of proper rating which shall be

periodically checked. The height of the tower crane shall be such that it clears all obstruction like column dowels, protruding parts of scaffolds, overhead electric lines, etc. easily while hoisting the loads.

Operation – The crane shall never be used to pick the loads which are out of the crane's reach or to do skew pulls of any sort. The load (to be lifted by the crane) shall be free from any sticky characteristic which may cause sudden jerk while lifting. No worker / person shall be lifted by tower crane. Any kind of swinging of lifted load, to put them out of crane's reach, shall not be tried. The operator shall not reverse the motor in order to achieve quicker stop to save time. He shall execute one operation at a time only and shall never combine horizontal movement of trolley with vertical movement of lifting hook. Tower crane shall be protected from sway due to wind load, etc. during operation. Precautions in high wind load (more than 72 kmph or possibility of storm) shall be taken as per manufacturer's guide. Various components and parts of the tower crane like wire ropes, pulleys, structural members of the tower and boom, etc. shall be periodically checked and properly maintained by the mechanical engineer of the contractor. Proper lighting arrangement with the boom and the tower of the crane shall be provided as safety arrangements for clear visibility during night. The tower crane shall be provided with the siren / horn facility in order to caution the workers in vicinity during operation of the crane. The operator shall take "START" and "HOISTING" signal from the designated helper / supervisor only; however, "STOP" signal can be taken from anyone.

Maintenance - The balancing rope, trolley rope, hoisting rope and erection rope shall be checked as per maintenance guidelines given by the manufacturer and they shall be replaced immediately as and when required. For regular maintenance, the manufacturer's manual shall be followed.

5.4.7.2.2 Mobile Cranes: The contractor shall take care that, the engine of the crane shall be kept running with the gear engaged and maintain a slow speed, while moving down the hill. While travelling uphill or downhill, the boom shall always be kept downhill in order to prevent the boom from falling back. The soil of working area, movement area and parking area of the mobile crane shall be well compacted and shall have proper drainage arrangement. The area shall be dry, levelled and firm enough to hold the load of the mobile crane. In case the soil is soft, the area under the wheels should be made solid with stones, wooden slippers, etc. This also applies to the crawler mounted cranes. The chart for rated load vis-à-vis operation radii for mobile crane shall be referred to before any erection and the same shall be submitted by the contractor to the departmental representative in advance. In no case, the maximum operation radius shall be exceeded. The out- riggers / jacks along with bearing plates shall be used while in operation and no load shall come on the wheels. The lifting hook shall be tied / anchored while the crane is moving or not operational. Before starting operation at the beginning of day's work, the capacity load shall be picked up to 0.3 m above the ground to test the drift, if any, due to faulty brakes. The brakes shall be 'ON' when a rubber tyre crane is operated. The operator shall always avoid any jerky start or a fast swing during operation of the crane since it

increases the risk of overturning of the crane. The pressure in the pneumatic tyre shall be maintained correctly in all wheeled machines. The crane shall be equipped with the following features:

- i) Anemometer to indicate wind pressure
- ii) Anchors for rail mounted cranes
- iii) Load Limiter to prevent failure of ropes
- iv) Safety stops to restrict crane travel
- v) Swinging radius indicator to indicate safe load at given radius
- vi) Heel indicators to control crane heeling
- vii) Electrical/mechanical safe limits to compare the weight actually hoisted and the load admissible at various swing radii

The standard formats for inspection and certificate of testing for crane and hoist are given as per **Annexure 6 and 7**.

5.4.7.2.3 Builder Hoists: The capacities of the builder hoists are limited. The structure of builder hoist shall be supported from permanent structure like column, slab, etc. so that the rails do not rattle while operating the hoist. The structure shall be vertically held in position. Periodic checking and maintenance shall be done by the contractor for the condition of ropes, rails, pulleys, bucket/hopper, locking system, etc. from time to time. There shall not be any obstruction or protruding part on the way of movement of builder hoist. The builder hoist shall never be used for movement of manpower. The openings shall be cordoned by guard rails as per safety provisions under working at height.

5.4.7.3 Transporting Machinery:

a) Trucks, tippers, dumpers used in transportation of excavated earth or other materials; which are loaded with mechanical excavators, shovels / loaders shall have strong canopies over the driver's cabin to protect them from injuries while loading. The driver's cabin for all the vehicles at construction site shall have a system of sound and vibration suppression, seat belts, reverse horn/alarm, rear view mirror, wide windshield, triplex glass, wiper, sun visor, etc. Brakes and control shall be designed so as to get locked when the vehicle is parked. While going down the gradient, the speed of the vehicle should be controlled. Hydraulic retarder shall be used for big dumpers. Persons holding valid driving licenses for heavy motor vehicle shall be engaged as drivers of the respective type of vehicles. Every dumper, tipper, truck, etc. shall be accompanied by helper and driver shall take all signals from his helper only. The access road of such transport vehicle shall be firm and levelled as far as practicable and shall be free from any obstacle.

b) Trucks shall be loaded at places where there is no danger of falling rock or landslide. While loading trucks with mechanical excavators, shovels, etc. suitable distance shall be kept to avoid the shovel touching the truck. Brakes shall be applied when a vehicle is loaded and unloaded. The vehicles shall not be overloaded and the loading shall be even. Stop logs shall be used while loading and transportation so that the back door of the dumper does not open undesirably.

c) For tough riders, the hydraulic system for the bucket shall be checked periodically as per manufacturer's maintenance manual. They shall not be overloaded.

5.4.7.4 Concrete mixers and batching plants: The concrete mixers and batching plants shall be calibrated by the contractor at least once in a month and such records shall be made available to the departmental staff for record.

5.4.7.4.1 Concrete mixers: The mixer shall be placed on levelled and firm ground. The hopper shall rest on ground while loading of aggregates and cement. The hopper shall not be overloaded. The gear, pulley, ropes, etc. shall be checked regularly and replaced as and when required. Concrete mixers shall be operated by trained / skilled operator only. In case of electrically operated mixer machines, the switch boxes shall be properly guarded from rain and dust.

5.4.7.4.2 Batching Plant: The installation, operation, maintenance and decommissioning of batching plant shall be done as per manufacturer's guidelines and manuals. All electrical works and connections shall be done by a licensed electrician under supervision of electrical engineer of the contractor. The DG requirement (in case of power cuts) shall be of at least 150% of the overload capacity. The operations of hopper, scrapper and pan mixer shall be smooth and periodic inspection shall be done as per manufacturer's guidelines. The material bins shall be checked periodically for presence of any boulders, lumps, etc. which may choke in the hopper causing disruption of operation of the batching plant. Proper care shall be taken during feeding cement silo from the bulker for any loose joints in the feeder pipe and pump of the silo. The silo shall have a guarded monkey ladder for access to the top. The person accessing the top of silo shall seek work permit in advance and shall use proper PPE while climbing. The outer surface of the silo shall be properly painted and maintained against weathering effects. The contractor shall make available at least one fire extinguisher near the operator cabin of the batching plant and the same shall be maintained in good condition at all times. The operator cabin and the scrapper cabin shall be well ventilated and dust proof. The underground water tank/Vat of the batching plant shall be covered with suitable protective cover and shall be cordoned all around.

5.4.7.5 Hydraulic machines: Hydraulic operated machines like mechanical excavators, jacks, or any other hydraulically operated parts, etc. shall be handled carefully. The pressure relief valves mounted on the Hydraulic construction equipment shall not be tampered. These machines shall be equipped with the foam based fire extinguisher. These machines shall be maintained at regular intervals as per the manufacturer's manual, to avoid failure of brakes, hydraulic system, etc. Regular checking shall be done for such equipment for any leakage, condition of the hoses and connections, etc. Contractor shall give proper training to the operator, mechanic, etc. before they handle the equipment.

5.4.7.6 Dewatering pumps, Concrete pumps, Boom placer pumps:

5.4.7.6.1 Dewatering pumps: The rotating parts of the dewatering pump shall be well guarded. Only authorized operator / mechanic shall operate the pump on requirement. He shall not wear any loose clothes while operating the pump. The exhaust of the smoke shall be away from the workers working in the surrounding area. The pump shall be operated and maintained as per the manufacturer's guidelines.

For electrically operated dewatering pumps including submersible pumps, special care shall be taken while operating them. Such pumps shall be fitted with ELCB of proper rating. The power shall be put off before shifting or removal of the submersible pumps. Only authorized operator / electrician shall be allowed to operate the same.

5.4.7.6.2 Stationery Concrete Pumps and Boom Placer pumps:

The commissioning, operation and maintenance of concrete pumps (both stationery and boom placer type) shall be done as per manufacturer's guidelines or manual provided along with the equipment. The safety procedure and tips as mentioned in these guidelines shall not be violated. A copy of such manuals shall be submitted to the department before installing the equipment at site. Apart from manufacturer's manual, the following guidelines shall be followed for operation and maintenance of the concrete pumps:

- a) The operation, maintenance and signalling of concrete pumps shall be done by trained and authorized personnel having minimum 18 years of age.
- b) Place of work shall be so selected that the visibility of batching plant operator/transit mixer driver, concrete pump operator, signal man/supervisor and hose man (at the pouring point) is ensured all at a time. In case such visibility between all the above people cannot be ensured, then at least the pump operator shall be able to see the batching plant operator and signal man separately. The pump operator shall play most important role in pouring and he shall be properly trained by the safety officer/site Engineer of the contractor to understand the signalling process properly in order to ensure smooth concreting activity at site.
- c) When the concrete is being placed in the hopper of the pump (either from batching plant chute or transit mixer chute), no person shall climb on the hopper of the pump.
- d) The danger zones (within working area) like hose end position, beneath the placing boom, moving parts of the concrete pump and its hopper, its support legs and the area of the concrete pipe line, etc. shall be identified by the safety officer/ mechanical engineer in advance. Accordingly these areas shall be cordoned and restricted movement shall be ensured as practicable as possible.
- e) The concrete pipeline (delivery system) for stationary pumps shall be checked by the mechanical engineer before he seeks work permit for concreting activity, for proper clamping of the pipe joints, supports for pipe line, etc. The pipe line shall have minimum number of bends and shall be straight as far as possible. In case pipe line needs to change the direction, then there shall be at least 5 m straight portion just after the concrete pump. The bends in the pipe line shall be as smooth as possible.

- f) Inspection interval shall be decided based on manufacturer's guide line, age of the concrete pump, quantity of the operating hours and output of concrete.
- g) Personal protective equipments like helmet, safety shoes, ear defenders (ear muff/ ear plug), protective gloves and goggles, face mask/respiratory protector, etc. shall be arranged by the contractor for all the workers working on concrete pump.
- h) Concrete pump shall have suitable pressure relief valve, set at a predetermined pressure level, in order to ensure safety of the workers as well as the pump.

5.4.7.7 Tools:

5.4.7.7.1 Pneumatic Tools:

The hose of the compressed air shall not be directed towards a person's body. Compressed air shall not be used for cleaning of dust on the clothes of the workers. The compressed air line shall not be bent to stop the flow of air. This may cause building of pressure resulting in bursting of pipe and injury to the person. The operator shall use earmuffs on regular basis. The person cleaning certain area with compressed air shall be given safety goggles, dust respirators and ear plugs. Other workers shall not be present in the area which is being cleaned.

5.4.7.7.2 Abrasive Tools:

All machines, hand tools, etc. shall be test driven and necessary earthing shall be checked before actual use. All moving parts of mills, mixers and disintegrators shall have secure guards to avoid injury to workers. Contractor shall provide protective equipment to workers involving in crushing, grinding or pulverizing operations and all the machines shall be covered overall with hard material to keep them clean.

- a) **Drills:** All the pneumatic drills shall be equipped with the additional lateral handles to avoid accidents wherein the back twisting torque exceeds 15 Nm. Compressed air hoses shall be suitably covered or hung from the ceiling.
- b) **Saws:** The contractor shall ensure that all the built-in safety devices of the pneumatic saws such as adjustable riving knife, guard hood, replaceable blade aperture insert, push stick and start/stop switch shall not be tampered by the workers during operations. The contractor shall provide standard PPEs such as ear plugs or earmuffs as the noise level during operations of saws may exceed 90 dBA.
- c) **Grinding machines:** The contractor shall use correct type of wheel depending on type of material to be ground such as separate wheel for concrete and steel surfaces, etc. The expiry date written on the wheel shall be referred before use. The RPM of the wheel shall match with that of the grinding machine. The wheel may get chipped or cracked in transportation or in storage. In order to check this defect, the wheel shall be held loosely on a finger through the arbor hole and tapped lightly with a wooden hammer. The grinding machine shall have proper earthing, guards, etc. and the operator shall use all necessary PPEs like hand gloves, goggles, ear plugs, dust respirators, etc.
- d) **Pneumatic Tools Safety:** The contractor shall check all the rotating tools with the Tachometer for proper operating speed before accessories are attached. The

contractor shall operate all the grinding wheels under or inside the guards (except cone shaped wheels and small mounted points). The diameter of the wheel arbors shall match that of the grinding wheels. The wheel washer (blotter) and collar shall grip the wheel firmly and the two shall never be of different diameters. The nut which holds the wheel on the arbor and the washer (blotter) against the wheel shall be of ample size and strength. The contractor shall follow the manufacturer's charts about the applications and speed of the various types of the grinding wheels.

e) Hand Tools:

i) Impact Tools: The contractor shall use precision grip for the most commonly used impact tool, hammer for light work. For safe operations, the hammer shall have a straight cylindrical handle of 24 to 40 mm calibre with a maximum length of 600 mm and maximum head weight of 6.5 to 7.5 kg. Hammers shall be maintained such that cracked or weak handles are replaced and heads are in good condition and firmly secured to an undamaged handle.

ii) Cutting Tools: The contractor shall ensure that various cutting tools like axes, chisels and shovels, etc. are made up of material with adequate strength. The contractor shall ensure that wooden handles are to be moist before use during summer. Proper PPEs like hand gloves, ear plugs, goggles, dust respirators, etc. shall be provided to the worker as per the need of the work.

5.4.8 Structural Steel Fabrication:

5.4.8.1 Welding and Gas Cutting: Welding and gas cutting operations shall be done only by qualified and authorized persons and as per IS: 818-1968 (Reaffirmed in 2008). No hot job shall be done without approved work permit.

a) Welding and gas cutting shall not be carried out in places where flammable/any materials such as combustible/flammable chemicals, dyes, hessian cloth, wooden pieces, cylinders, etc. are kept within 10 m from the spot of fabrication or gas cutting.

b) Gas cylinders:

i) General precautions:

- Cylinders together with their valves and other fittings and identification colours shall be maintained in good condition.
- No lubricant shall be used in any fittings of the cylinders.
- No cylinder shall be subjected to any heat treatment or exposed to a high temperature or to the sun or stored with flammable or explosive material.
- Every cylinder containing compressed gas shall have its valve securely closed so as to prevent leakage. Valves fitted to the cylinders containing LPG and highly toxic gases shall be provided with security nut on the outlet to act as a secondary means of safeguard against leakage of gas.

- If the leak in the valve cannot be rectified by tightening the gland-nut or the spindle, the cylinder shall be removed to an open space where it is least dangerous to life and property and the Filler shall be informed.

ii) Handling and use:

- Cylinders shall be adequately supported during handling.
- Trolleys and cradles of adequate strength shall, as far as possible, be used when moving the cylinders.
- The cylinders shall be handled carefully and not be allowed to fall on one another or subjected to any undue shock.
- Sliding, dropping or playing with cylinders is prohibited.
- LPG cylinders and cylinders containing liquefied gas shall always be kept in upright position and be so placed that they cannot be knocked over.
- Cylinders used in horizontal position shall be so secured that they do not roll.
- Open flames, lights, lighting of fires, welding and smoking shall be prohibited in close proximity of any cylinder containing flammable gases except those in use for welding, cutting or heating.

iii) Storage of cylinders:

- Cylinders shall be stored in cool, dry, well ventilated place under cover, away from boilers, open flames, steam pipes or any potential sources of heat and such place shall be easily accessible.
- The storage room or shed shall be of fire-resistant construction.
- Thin-walled cylinders such as LPG and cylinders of dissolved gas shall not be stacked in horizontal position.
- Cylinders containing flammable and toxic gases shall be kept separated from each other and from cylinders containing other types of gases by an adequate distance or by suitable partition wall.
- Cylinders shall not be stored under conditions that will cause them to corrode.
- Cylinders shall not be stored with any combustible materials.
- Empty cylinders shall be segregated from filled ones and care shall be taken that the valves are tightly shut.
- Specificity of gas cylinders: Gas cylinders designed and approved for filling a particular gas should not be used for filling with any other gas without specific approval from the Chief Controller of Explosives.

iv) Transport of cylinders:

- Cylinders filled with any compressed gas shall not be transported by bicycle or any other two-wheeled mechanically propelled vehicle.
- Cylinders shall be so transported as not to project in the horizontal plane beyond the sides or ends of the vehicle by which they are transported.
- Cylinders shall be adequately secured to prevent their falling off the vehicle and being subjected to rough handling, excessive shocks or local stresses.

v) Restrictions on transport of cylinders:

- Cylinders containing flammable gases shall not be transported along with cylinders containing any other type of compressed gas.
- Cylinders containing toxic or corrosive gases shall not be transported along with food-stuff.

vi) Loading and unloading of cylinders for transport: No lifting magnet shall be used in loading or unloading of cylinders filled with compressed gas. When any such operation is carried out by means of a crane or fork lift truck, a proper cradle with chains or wire rope slings shall be used.

vii) Protection of valves: The valves of compressed gas cylinders should be protected against damage during transport.

viii) Notice of accident: Notice of an accident involving compressed gas cylinder should be given to the Chief Controller of Explosives, by an express telegram, followed by a letter within 24 hours giving particulars of the occurrence and to the Officer-in-Charge of the nearest Police Station.

ix) Condemning of Cylinders: Any cylinder which does not pass the periodical test or loses over 5% of its tare weight or found to be defective should be destroyed.

- c) Barrier screens shall be erected to protect other persons from harmful rays and sparks from the work. When welding or gas cutting is carried out in elevated positions, precautions like providing metal sheet, etc. shall be taken to prevent sparks or hot molten metal falling on persons or flammable materials below.
- d) Adequate ventilation shall be provided for easy dispersion of gas while welding, brazing and cutting in confined space.
- e) Suitable type of protective clothing consisting of fire resistant gauntlet gloves, boots and aprons shall be provided to workers to protect from heat and hot molten metal splashes. Welding shields with filter glasses of appropriate shade shall be worn as face protection against UV & IR rays.
- f) Welding and gas cutting shall not be carried out by standing on drums, barrels, tanks or other containers.
- g) Appropriate type fire extinguisher and fire bucket shall be available near the location of welding operations.
- h) Contractor's safety officer shall ensure at least half an hour fire watch after the hot work is over.

5.4.8.2 Electric Arc Welding: For Electric Arc welding the following additional safety precautions shall be taken:

- i) All power connections shall be routed through ELCB of proper rating and machine connections shall be through MCB. Double earthing shall be provided to the welding machine. A provision of a separate return path shall be ensured.
- ii) The cable to be used shall be of adequate capacity corresponding to output of the welding transformer / generator and shall be routed through dry isolated path. Welding cable terminals shall be provided with lugs and connected properly.

Proper insulation of cable with insulation tape of approved quality shall be ensured and only double insulated cable shall be used. Extension of welding cables shall be done using standard connectors.

iii) Pipe lines carrying flammables shall not be used as part of earth conductor, but a separate earth conductor shall be connected to the machine directly from the job. Painting and Dye Penetration testing shall not be done near electric arc welding.

iv) Personal contact with the electrode or other live parts of electric welding equipment shall be avoided. Wires and cables shall not be hung from any metal hook.

v) Accidental contact of electrodes with ground shall be prevented.

vi) The welding cables shall not be allowed to get entangled with power cables. It shall be ensured that the cables are not damaged by movement of materials. Dragging and coiling of cable shall be avoided.

vii) For Dye Penetration test, necessary care shall be taken so that there is no hot job going on nearby. Place of the test shall be well ventilated.

5.4.8.3 Grinding:

i) All portable grinders shall be used only with their wheel guards in position to reduce the danger from flying fragments should the wheel break during the use.

ii) Grinding wheels of specified diameter only shall be used on a grinder portable or pedestal in order not to exceed the prescribed peripheral speed.

iii) Goggles shall be worn during grinding operation.

iv) All safety procedures as mentioned in 5.4.7.7.2 shall also be followed for grinding activity.

v) Safety provisions for grinding activity as per IS:1991-1987(Part 1-10) (Reaffirmed in 2002) shall be followed.

5.4.8.4 Erection: Only trained operators and workers shall be engaged for the erection of structural fabricated members. For erection by mechanical means, the safety procedures as mentioned in 5.4.7.2 and 5.4.7.3 shall be followed in addition to the following guidelines:

a) The heavy materials shall not be manually handled. They shall be handled and shifted by mechanical means like crane, hydra, trolley, etc. of adequate capacity.

b) All mechanical transport devices and erection equipment shall be operated with the assistance of a helper / supervisor exclusively for proper signalling.

c) While erecting fabricated members, suitable guy rope arrangement shall be made to avoid sudden toppling of derrick.

d) Chain pulley block, D-shackles and wire ropes (lifting appliances) shall be of rated capacity at least 2.0 times more than the maximum desired load to be lifted. Hooks, jigs and fixtures used shall be marked with their capacities.

e) Two or more slings shall be used for lifting the loads and they shall be tied as per the centre of gravity of the load to be lifted.

5.4.9 Electrical Safety: Guide lines for providing temporary power supply at the site and general safety procedures for using electricity are given as under. Following safety requirements shall be complied with before the Contractor uses the power supply.

The Contractor shall submit a list of licensed electrical staff to be posted at site. It shall be the responsibility of the Contractor to provide and maintain complete installation on the load side of the supply point with regard to the safety requirements at site. All cabling and installation shall comply with the appropriate statutory requirements given below and shall be subject to approval of the Departmental Engineer-in-charge/ Electrical Engineer.

- a) The Electricity Act, 1910 (as amended in 2003)
- b) Electricity (Supply) Act, 1948
- c) Indian Electricity Rules, 1956 (as amended in 2005)
- d) National Electric Code 1985 (as amended in 2005)
- e) Other relevant rules of Local Bodies and Electricity Boards

5.4.9.1 After installation of the electrical power wiring works by the contractor, form of completion certificate as per IS: 732 – 1989 (Reaffirmed in 2005) (**Form SGCW – 1 – Annexure 11**) shall be submitted by the contractor duly signed by the authorized valid licensed electrical contractor and /or supervisor along with one copy of the contractor's license and/or competency certificate of supervisor issued by the Electricity Board/Government Electricity Organisations as per the enclosure. The power supply shall be regulated as per the terms and conditions of the supply of the respective electricity boards.

- (a) For purposes of electrical load and power planning by the electrical section, the contractor shall furnish along with the tender, the estimated load requirement of electric power for the execution of the contract works in terms of maximum Kilo Watt or KVA demand during various periods/months of the contract period along with the details of the construction electrical equipment/machinery with their individual load details and location/locations of power supply required for availing temporary electric power supply in the standard proforma enclosed (**Form SGCW- 2 – Annexure 12**).
- (b) The electric power supply will be generally made available at one point in the works site of the contractor by the department.
- (c) Where distribution boards are located at different places the Contractor shall submit schematic drawing indicating all details like size of wires, overhead or cable feeders, earthing, etc. The position and location of all equipment and switches shall be given.
- (d) The Contractor shall make his own arrangements for main earth electrode and tapping thereof. The existing earth points available at site can be used at the discretion of the Departmental Electrical Engineer with prior permission. Method of earthing, installation and earth testing results shall conform to relevant IS Specifications [IS: 3043 – 1987 (Reaffirmed in 2001)]. All three phase equipment shall be provided with double earthing. All light fixtures and portable equipment shall be effectively earthed to main earthing.
- (e) All earth terminals shall be visible. No gas pipes and water pipes shall be used for earth connection. Neutral conductor shall not be treated as earth wire.

(f) The Contractor shall not connect any additional load without prior permission of Departmental Electrical Engineer. For obtaining additional power required, test reports of the tests mentioned in (d) of Form SGCW - 1 (**Refer Annexure – 11**) shall be submitted.

(g) Joints in earthing conductors shall be avoided. Loop earthing of equipment shall not be allowed. However tappings from an earth bus may be done.

(h) The entire installation shall be subjected to the following tests before energizing of installation including portable equipment:

- i) Insulation resistance test
- ii) Polarity test of switches
- iii) Earth continuity test
- iv) Earth electrode resistance.

The test procedures and their results shall conform to relevant IS specifications. The Contractor shall submit a test report for his complete installation every 2 months and also every time after rectifying any faulty section. One such test report for the complete installation shall be submitted before onset of monsoon.

The following are provided for general guidance of the Contractor and shall be read as specific requirement, in addition to complying with Indian Electricity Act, Indian Electricity Rules and IS Specifications.

5.4.9.2 Installation:

- a) Only persons having valid wireman's license/competency certificate shall be employed for carrying out electrical work and repair of electrical equipment, installation and maintenance at site. The job shall be supervised by a qualified licensed supervisor.
- b) Electrical equipment and installations shall be installed and maintained as to prevent danger from contact with live conductors and to prevent fires originating from electrical causes like short circuits, overheating, etc. Installation shall not cause any hindrance to movement of men and materials.
- c) Materials for all electrical equipment shall be selected with regard to working voltage, load and working environment. Such equipment shall conform to the relevant standards.
- d) The minimum clearance to be maintained for all overhead lines along roads and across roads shall be 6.10m (minimum) as per the Rules 77-80 of Indian Electricity Rules, 1956 (Amended in 2005).
- e) Grounding conductor of wiring system shall be of copper or other corrosion resistant material. An extra grounding connection shall be made in appliances/equipment where chance of electric shock is high.
- f) Electric fuses and/or circuit breakers installed in equipment circuits for short circuit protection shall be of proper rating. It is also recommended that high rupturing capacity (HRC) fuses shall be used in all circuits. As Earth Leakage Circuit Breaker shall be provided for all 3 Phase supply irrespective of kilo watt rating and for all single phase supply equal to or exceeding 5 Kilo Watt rating.

- g) Wires and cables shall be adequately supported and an approved method of fixing shall be adopted. Loose hanging of wires & cables shall be avoided. Lighting and power circuits shall be kept distinct and separate.
- h) Reinforcement rods or any metallic part of structure shall not be used for supporting wires and cables, fixtures, equipment, earthing, etc.
- i) All cables and wires shall be adequately protected against mechanical damages. In case the cable is required to be laid underground, it shall be adequately protected by covering the same with bricks, Plain Cement Concrete (PCC) tile or any other approved means.
- j) All armoured cables shall be properly terminated by using suitable cable glands. Multi-stranded conductor cables shall be connected by using cable lugs/ sockets. Cable lugs shall preferably be crimped. They shall be of proper size and shall correspond to the current rating and size of the cable. Twisted connections shall not be allowed.
- k) All cable glands, armouring and sheathing of electric cables, metal circuits and their fittings, metallic fittings and other non-current carrying parts of electrical equipment and apparatus shall be effectively grounded.
- l) All the Distribution Boards, Switch Fuse units, Bus bar chambers, ducts, cubicles etc. shall have Mild Steel enclosures and shall be dust, vermin and water proof. The Distribution Boards switches etc. shall be so fixed that they shall be easily accessible. Changes shall be done only after the approval of the Departmental Electrical Engineer.
- m) The Contractor shall provide proper enclosures/covers of approved size and shape for protection of the entire switch board, equipment etc. against rain. Exposed live parts of all electrical circuits and equipment shall be enclosed permanently. Crane trolley wires and other conductors which cannot be completely insulated shall be placed such that they are inaccessible under normal working conditions.
- n) Iron clad industrial type plug outlets are preferred for additional safety.
- o) Open type Distribution Boards (DBs) shall be placed only in dry and ventilated rooms; they shall not be placed in the vicinity of storage batteries or otherwise exposed to chemical fumes.
- p) Isolating switches shall be provided close to equipment for easy disconnection of electrical equipment or conductors from the source of supply when repair or maintenance work has to be done on them.
- q) In front of distribution boards (DBs) a clear space of 1.0 m shall be maintained in order to have easy access during an emergency. Pathway to DBs shall be maintained free from any obstacles. If there are any attachment/base connection at the back side of the switch board, the space, if any behind the switch board shall be either less than 20cm or more than 75cm in width, measured from the farthest outstanding part of any attachment or conductor. If the space behind the switch board exceeds 75cm in width, there shall be a passage way from either end of switch board clear to a height of 180 cm.

- r) As far as possible electrical switches shall be excluded from a place where there is danger of explosion. All electrical equipment such as motors, switches and lighting fittings installed in work room where there is possibility of explosion hazard shall be explosion proof.
- s) All connections to lighting fixtures, starters or other power supplies shall be provided with PVC insulated, PVC sheathed twin/three/four core wires to have better mechanical protection for preventing possible damage to equipment or injury to personnel. Taped joints shall not be allowed and the connections may be made in looping system. Electric starter of motors, switches shall not be mounted on wooden boards. Only sheet steel mounting or iron frame work shall be used.
- t) All the lighting fixtures and lamp holders shall be of good quality and in good condition. Badly repaired or broken holders, etc. shall not be used.
- u) Only PVC insulated and PVC sheathed wires or armoured PVC insulated and sheathed cables shall be used for external power supply connections of temporary nature. Weather proof rubber wires shall not be used for any temporary power supply connections. Taped joints in the wires shall not be used.
- v) Lamps used for illumination and testing purpose shall have cover or guard to protect them from accidental breakages. Only 24 Volt supply system shall be used for hand lamps etc, while working inside metallic tanks or conducting vessels.
- w) After installation of new electric system and or other extensive alterations to existing installations, thorough inspection shall be made by Departmental Electrical Engineer before the new system or new extension is put in use.

5.4.9.3 Operation & Maintenance:

- a) All persons who work with electrical installation/equipment shall be aware of the electrical hazards, use of protective devices and safe operational procedures. At least two persons in a shift shall be given training in fire fighting, first aid and artificial resuscitation techniques. First Aid treatment of electrical shock shall be displayed at First Aid Centre.
- b) The supervisor shall instruct the workers for the proper procedure, specify and enforce the use of necessary protective equipment such as adequately insulated pliers, screw drivers, fuse pullers, testing lamps and similar hand tools. Only wooden ladders shall be used to reach the heights in electrical work.
- c) No material or earth work shall be allowed to be dumped below or in the vicinity of the bare overhead line conductors. Minimum clearance of 6.10m shall be maintained.
- d) Separate work permits shall be issued in accordance with IS: 5216-1982 (Reaffirmed in 2010) working on the same system which shall be returned after the completion of the work to Safety Officer and no system shall be restored without the clearance of Safety Officer.
Before any maintenance work is commenced on electrical installations/equipment, the circuits shall be de-energized and ascertained to be

dead by positive test with an approved voltage testing device. Prior to attempting repairs on the equipment Switch off, Isolate, Discharge and Earth (SIDE) Rule should be strictly followed. Switches shall be tagged or the fuse holders withdrawn before starting the work. During electrical works, minimum two persons shall be available. Adequate precautions shall be taken in two important aspects viz.

- (i) That there shall be no danger from any adjacent live parts and
 - (ii) That there shall be no chances of re-energizing of the equipments on which the persons are working.
- f) While working on or near a circuit, whenever possible the use of one hand may be practiced even though the circuit is supposed to be dead. The other hand may preferably be kept in pocket.
 - g) When it is necessary to touch electrical equipment (for example when checking for overload of motors) back of the hand may be used. Thus, if accidental shock were to cause muscular contractions, one would not 'freeze' to the conductor.
 - h) Operation of electrical equipment shall be avoided when standing on wet floor or when hands are wet.
 - i) Before blown fuses are replaced, the circuit shall be locked out and an investigation shall be made for the cause of the short circuit or overload.
 - j) When two persons are working within reach of each other, they shall never work on different phases of the supply.
 - k) When structural repairs, modification or painting works are to be undertaken, appropriate measures shall be taken for the protection of persons whose work may bring them into the proximity of live equipment/circuit.
 - l) It shall be ensured that the insulation and wire size of extension cords are adequate for the voltage and current rating.
 - m) While tapping electricity from the socket, plug top must be used. It shall be ensured that no extension boards are over loaded while tapping. Only standard three pin plugs shall be used for tapping electricity. Broken sockets/plugs shall be replaced immediately with good ones. Only joint free cables shall be used for connecting equipment/apparatus.
 - n) Floors shall be kept free from trailing electrical cables to avoid tripping hazard.
 - o) Power supply to all the machines and lighting fixtures shall be switched off when not in use.
 - p) Temporary electrical connections shall be removed as soon as the stipulated work is over. After completion of the works, the contractor shall dismantle the distribution boards and the other facilities he may have erected.
 - q) Unauthorized tapping of power by others from distribution boards under the control of the contractor shall be prohibited at all circumstances.
 - r) Safety work permits shall be used for switching off the main feeder and equipment by the contractor.

- s) "MEN ON LINE", "DO NOT SWITCH ON", "DANGER" or "CAUTION" boards as applicable shall be used during maintenance works on the electrical equipment.
- t) Power tapping of electrical equipment shall as near as possible of the equipment.
- u) During maintenance at height, proper access by ladder shall be adopted.

5.4.9.4 Portable Electrical Equipment:

- a) Portable electrical equipment shall be regularly examined, tested and maintained to ensure that the equipment and its leads are in good order. Register shall be maintained for inspection recording the testing dates and results of the equipments. The insulation and winding resistance of the portable electrical equipment shall be checked at least once in a month and report shall be submitted for all such machines. A typical format for testing portable and other electrically operated equipment is enclosed as **Annexure-15**.
- b) All portable appliances shall be provided with three core cables and three pin plugs. The third pin of the plug shall invariably be earthed. It shall be ensured that the metal part of the equipment shall be effectively earthed.
- c) All connections to portable equipment or machines from the panel/distribution board/extension board shall be taken using 3 core double insulated PVC flexible copper wire in one length. No joints shall be allowed in this flexible wire. In case, single length of wire is not sufficient for a particular location then the supply can be tapped by providing another extension board comprising of switch and socket. Isolation switch shall be made available as close as possible to the equipment.
- d) Flexible cables for portable lamps, tools, and apparatus shall be regularly examined, tested periodically and maintained to ensure safety and protected against mechanical damages.

5.4.10 Fire Safety: The contractor shall take all necessary precautions to prevent outbreak of fires at the construction site. Adequate provisions shall be made to extinguish fires should they still break out.

- (a) Quantities of combustible materials like timber, bamboos, coal, paints, etc. shall be the minimum required in order to avoid unnecessary accumulation of combustibles at site.
- (b) Containers of paints, thinners and allied materials shall be stored in a separate room which shall be well ventilated and free from excessive heat, sparks, flame or direct rays of the sun. The containers of paint shall be kept covered or properly fitted with lid and shall not be kept open except while using.
- (c) Fire extinguishers suitable for the different classes of fire such as Class A, B, C & D as per IS: 2190-1992 (Reaffirmed in 2010) shall be made available at the appropriate places in the construction site. The date of last maintenance of fire extinguisher shall be displayed properly on the same by using maintenance tag. The fire extinguishers shall be sent for maintenance/refilling at least once in 6 months or whenever exhausted. The safety officer shall inspect the condition of the plunger, safety pin, switch grip, hose tube, etc. at least once in a month and

report shall be submitted to the departmental representative as per the format enclosed as **Annexure 14**.

- (d) Adequate number of contractor's workmen and supervisors shall be given training in fire fighting and extinguishing methods.
- (e) The safety officer of the contractor shall plan for site evacuation in fire emergency in order to facilitate to easy and safe exits for entire site work force and supervisory staff. He shall identify and train the designated staff or supervisor for specific role in site evacuation plan.
- (f) The telephone number of the nearest fire station shall be displayed at suitable locations (near telephone, main entrance of the site, first aid centre, stores, etc.) in bold distinct font.

5.4.11 Housekeeping:

5.4.11.1 The Contractor shall promote and upkeep the practice of good housekeeping throughout the contract period in order to create a safe and hygienic working environment at site. The contractor shall maintain a separate housekeeping team of workers and supervisors who shall maintain the hygienic conditions at site. He shall at all times, keep his work spot, site office, labour toilets and surroundings and roads clean and tidy from rubbish, scrap, surplus materials and unwanted materials, tools and equipment. The contractor shall follow the recommendation of IS: 4082-1996 (Reaffirmed in 2003) for stacking and storage of construction materials and components at site.

5.4.11.2 Welding and other electrical cables shall be so routed as to allow safe traffic by all concerned. Electrical cables shall not trail on the ground and they shall be raised above ground with the help of posts, etc.

5.4.11.3 The plan of temporary structures shall be such that they do not hamper easy movement of worker and vehicles. No materials on any of the sites of work shall be so stacked or placed as to cause inconvenience to any person or the public. The Engineer-in-charge may require the contractor to remove any materials which are considered to be of danger or cause inconvenience to the public. If necessary, the Engineer-in-charge may cause them to be removed at the contractor's cost.

5.4.11.4 After the completion of the work, the contractor shall have removed from the work premises all scaffoldings, surplus materials, scrap, rubbish and all temporary structures, huts and sanitary arrangements used/installed for his workmen at site. The contractor shall stack all undesirable materials and debris to the designated area at his own cost, as directed by Engineer-in-charge.

5.4.11.5 The Engineer-in-charge has the right to stop work if the Contractor fails to improve upon the housekeeping after having been notified.

5.4.11.6 The contractor shall instruct workmen to keep all accesses clear from any obstruction and unwanted material for free and safe movement of the workers and staffs including departmental staffs. He shall provide tool box and safe means for carrying tools (for working at height) to all his workers so that tools and tackles are kept in proper place.

The working area shall be free from wastes like nails, binding wires, nuts & bolts, used plastics, etc. so that they do not cause injury to others.

5.4.12. Safe access to workplace:

5.4.12.1 Adequate and safe means of access and exit shall be provided for all work places, at all elevations. Ladders shall be always used for approaching high elevations.

5.4.12.2 Suitable scaffolds shall be provided for workmen for all works that cannot safely be done from the ground, or from solid construction except such short duration work as can be done safely from ladders. Safety procedures for ladder shall be as per 5.4.6.3 above.

5.4.12.3 Safety procedures for Scaffolding and working platform shall be as per 5.4.6 above.

5.4.12.4 All access to the work place shall be well guarded viz. stairs, ramps, etc. and shall be well illuminated as per the requirement of clause 15.8 (Illumination Guidelines) of SP: 70-2001. The access shall not have any water logging; they shall be levelled and dry so that people do not slip. Sign boards, written in language understood by majority of the workers, and exit signs shall be displayed at suitable location for easy identification. The steps of the stair shall be periodically cleaned for any accumulation of debris, dust, etc.

5.4.13 Common Hazards:

5.4.13.1 Barricading and Sign Boards: All work areas around excavated pits, trenches, openings, scaffolding, vehicle movement areas, etc. shall be well cordoned / barricaded with the help of railing, safety tapes (photo luminescent), etc. Photo luminescent sign boards and warnings shall be displayed at required locations and they shall be clearly visible from a distance even at low or no illumination.

5.4.13.2 Noise: Suitable ear protection (ear muff) shall be provided to the workers, who are exposed to high noise levels (85dBA and above), e.g. concrete pump operator, vibrator operator, batching plant operator, air compressor operator, grinding machine operator, breaking rocks with pavement breaker, cutting of marble/granite, etc. The exposure duration in case of these workers shall be restricted to the stipulation of Table-1 of Schedule-XI, Rule-88 of AEFR, 1996. Other workers and staff who are in the close vicinity of high noise level such as unskilled worker engaged in concreting works, etc. shall be provided with ear plugs.

5.4.13.3 Area Illumination: Adequate lighting facilities such as flood lights, halogen lamps, hand lights and area lighting shall be provided by the contractor at the site of work, storage area of materials and equipment and temporary access roads within his working area. The area illumination shall be such that it promotes work and safety for all workers at site and creates a pleasing environment at work site. The contractor shall obtain written approval of the Engineer-in-charge to the lighting scheme and place of tapping prior to its installation. The intensity of illumination shall depend on the nature of work and the same shall be planned by the contractor in advance based on the recommendations of Hand Book on Functional Requirements of Industrial Buildings

(Lighting & Ventilation: SP32-1986). However, a minimum illumination as per the task performed shall be maintained at site; which can be augmented based on nature of work from time to time.

5.4.13.4 Dust and fumes: Confined areas like basement, bunkers, etc. shall be under forced ventilation (using blowers) for at least 3-7 air changes per hour depending on presence of dust and fumes generated from grinding, gas cutting, welding, etc. Adequate measure like dust extractor/arresters shall be available for use to prevent spread of dust to nearby areas during open area operations. Workers shall be rested for sufficient time after every one hour of continuous working in dust. The same worker shall not be engaged for grinding for many days continuously and they shall be engaged/kept on job rotation. All necessary PPEs like dust respirators, safety goggles, hand gloves, ear plugs, protective clothes, etc. shall be provided. Any illness due to continuous work in dust or fume shall be immediately reported to the First Aid Centre.

5.5 Personal Protective Equipment:

All necessary personal protective equipment (PPE) shall be provided by the contractor at his own cost, for his workers, supervisors, staffs and visitor/visiting staffs. All PPEs shall conform to relevant IS code / ASTM / BS or any other international code of practice as given under. The contractor shall make available all type of personal protective equipment for use of workers, supervisors and visitors at site as considered necessary by the Engineer-in-charge and they shall be maintained in a condition suitable for immediate use. Also the contractor shall take adequate steps to ensure proper use of equipment by those concerned.

Safety Helmet:	IS: 2925-1984 (Reaffirmed 2000)
Safety Goggles:	IS: 5983-1980 (Reaffirmed 2002) or EN 166:2001
Full body harness safety belt:	IS: 3521-1999
Ear Muff / Ear Plug:	IS: 6996-1973 (Reaffirmed 1998) or EN 352-1:2002 and EN 352-2:2002 or
Face shield:	IS: 8521 (Part II) – 1977 (Reaffirmed 2002) IS: 8521 (Part I) –1994 (Reaffirmed 2002) or EN 175F
Fall arrestor:	EN 353-2:2002
Respirators:	IS: 15321 – 2003, IS: 15322 – 2003
Safety shoes:	IS: 15298 – 2002
Hand gloves:	IS: 4770 – 1991 (Reaffirmed 2001)

(a) All persons employed or supervising at and / or visiting the construction site shall use safety helmets. The colour coding of helmets may be adopted by the contractor as per site requirement. The contractor shall provide safety shoes for all his workers, supervisors, staffs and visitor/visiting staffs.

(b) Workers employed on mixing asphaltic materials, concrete, cement and mortars shall use PPEs such as protective goggles, protective foot wears, respirators and hand gloves, etc.

(c) Persons engaged in welding and gas cutting works shall use appropriate welding face shields, leather hand gloves and protective clothes. The persons who assist the welders shall use appropriate goggles.

(d) Workers breaking rock, grinding and chipping shall use protective goggles, dust respirators, ear muffs/ear plugs, etc. In addition, leather hand gloves shall be used where there is no possibility of entanglement with rotating parts. During work, other workers should maintain the safe distance.

(e) Persons working at height above ground level or floor and exposed to risk of falling down shall use full harness safety belts, kinetic shock absorbers, fall arrestor, life lines, and grab ropes. The working platform and access shall be protected by cages, guard railings, etc. The area beneath shall be protected by safety net of adequate strength (as per IS: 11057 – 1984) fastened to substantial supports.

(f) Wherever two-wheelers are allowed, motorcycle and scooter drivers and their pillion riders shall wear crash helmets inside the Project/Plant sites. Safety helmets shall not be replaced with crash helmets and vice-versa.

(g) When workers are employed in sewers, septic tanks and inside man-holes which are in use, the contractor shall ensure that the manholes are opened and are adequately ventilated. After it has been well-ventilated, the atmosphere inside the space shall be checked for the presence of any explosive mixture, toxic gas or oxygen deficiency. The workers shall be allowed to get into the man-holes under safe working environment only. The man-holes opened shall be cordoned off with suitable railing and provided with warning signals or caution boards to prevent accidents. There shall be proper illumination in the night. All safety measures for working in confined space as given in the Factory Act shall be ensured. In case of forced ventilation, battery backup for ventilation and measures to rescue workers shall be ensured.

5.6 General Health Management at site:

The contractor shall arrange adequate facilities for medical aid and treatment for his staff and workers engaged on the work site and visiting staffs including the first-aid facilities at the project site.

5.6.1 General:

5.6.1.1 **General medical examination:** The contractor shall follow the guidelines of Rule 81 (iv), Schedule VII of BOCW Central Rules, 1998 for periodicity of medical examination of building workers.

5.6.1.2 **High noise level:** The contractor shall arrange for audiometry examination for workers exposed to high noise level as per Chapter IX, Rule 88, Schedule XI, Sub-Rule 3 (f) (ii) of AEFR, 1996.

5.6.1.3 **High dust exposure:** The contractor shall arrange for medical examination for workers exposed to high dust level as per Chapter IX, Rule 88, Schedule IV, Sub-Rule 9 of AEFR, 1996.

5.6.1.4 Eye sight examination for crane operators, etc.: The contractor shall arrange for medical examination for crane operators and other vehicle operators like operators of material transportation/handling equipment, mechanical excavators, etc. as per Chapter IV, Rule 55 of AEFR, 1996.

5.6.2 First Aid Facility:

The contractor shall ensure medical and first aid facility at site as per Rule 223 to 232, Chapter XXIV, BOCW Central Rules, 1998 in order to facilitate immediate relief to the injured person before shifting him to the nearest departmental dispensary or public hospital. All the provisions of the above mentioned rules of BOCW Central Rules, 1998 viz. medical examination of building workers, duties of medical attendant, occupational health centre, ambulance room (first aid centre), ambulance van or safety vehicle, etc. shall be arranged by the contractor at site.

5.6.3 Full-time Medical Attendant:

First aid posts shall be established and be manned by a full-time trained medical attendant. The medical attendant shall have a degree of B.Sc in Nursing or equivalent and a minimum 5 years of working experience in any nursing home or general hospital. The contractor shall submit his/her certificates and credentials to the department in advance for approval before employing him/her at site. The duties of the medical attendant shall be as given below:

- (a) First-aid care including emergency medical treatment
- (b) Immunisation services
- (c) Medical records upkeep and maintenance
- (d) Health education including advisory services on family planning, personal hygiene, environmental sanitation and safety
- (e) Referral services

5.6.4 First-Aid Box, Medicines and Medical Equipment:

a) First-aid box containing bandage, sterilized dressing, ruler bandage, triangular bandage, crape bandage, dry gauge, band aid, antiseptic such as savlon/dettol, cotton wool, plaster, scissors, antiseptic creams shall be arranged by the contractor, at a readily accessible place in work site. The quantities of the listed items shall conform to Schedule III of BOCW Central Rules, 1998 (**Refer Annexure-8**). These shall be maintained in good order under the charge of Full-time Medical Attendant or the Safety Officer or a responsible person in absence of them.

b) The articles for ambulance room or first-aid post with effective communication system shall be arranged by the contractor as per Schedule IV of BOCW Central Rules, 1998. The list is enclosed as per **Annexure 9**. The size of the room shall be adequate for proper treatment of the injured persons and keeping the enlisted articles in an organized manner. The room shall be well ventilated and well illuminated, preferably by natural

means. The contractor shall keep a refrigerator of approx. 150 liters capacity for proper storage of injections and temperature sensitive medicines.

5.7 Hygiene at workplace:

The contractor shall ensure hygiene at work place as well as at the residing place for all his workers and staff. He shall submit the plan of labour colony and labour toilet in advance for approval of the Engineer- in -charge.

a) Labour Toilet and urinal: Latrines and urinals, as the case may be required to be provided, shall be as specified below:

- a. Every latrine shall be under cover and so partitioned off as to secure privacy and shall have a proper door and fastenings.
 - b. i) Where both male and female building workers are employed, there shall be displayed outside each block of latrines or urinals a notice containing therein "For Men Only" or "For Women Only", as the case may be written in the language understood by the majority of such workers.
ii) Such notice also bear the figure of a man or of a woman, as the case may be.
 - c. Where females are employed, there shall be at least one WC for every 25 females. There shall be at least one WC for every 25 males. If the number of males exceeds 100, there shall be one latrine for every 25 males up to the first 100 males, and one for every 50 males thereafter. The W.C shall be cleaned at least once in a week and maintained properly by the contractor throughout the project duration. The privacy of the all workers shall be ensured by providing partitions of suitable heights. Proper disposal of excreta by septic tank and soak pit shall be made by the contractor. In no case, the excreta shall be disposed off in any open drain, nallah, etc. which may cause outbreak of disease or reduce the overall hygiene of the workplace. Urinals shall be provided for the use of male workers and there shall be at least one urinal for every 50 males and where the number of males employed exceeds 50, it shall be sufficient if there is one urinal for every 50 males up to the first 500 employed, and one for every 100 thereafter.
- b) Drinking water:** contractor shall provide adequate number of water taps, water purifiers and water coolers for the potable water supply for the staff and workers at his own cost. However, the water connection will be given by the department based on the contract condition.
- c)** The contractor shall apply pesticides and mosquito repellent at regular interval or whenever required, by fogging machine, etc., in the labour colony and at work site at his own cost.

6.0 MONITORING AND REPORTING:

The contractor shall monitor, measure and regularly evaluate compliance with applicable legal requirements. He shall recognize the importance of monitoring and reporting of

hazards associated with site activities. He shall instruct his safety officer and site engineers to monitor the unsafe conditions and unsafe acts regularly in order to record the observations so that remedial measures can be taken in time. The contractor shall not neglect or underestimate the near-misses occurred at site and shall establish a procedure to record all such near-misses since the lessons learnt from them can prevent recurrence of such incidents in future. The contractor shall report any accident occurred at site as per format of Injury Report for Contract/Casual Worker (**Refer Annexure 13**). He shall make available all the legal documents and records (as mentioned in 6.2 below) related to safety for internal as well as external audits from time to time.

6.1 Walk-through survey: The Safety Officer and site engineers shall carry out a walk through survey every morning at site in order to monitor any unsafe conditions and unsafe acts. This measure reduces the hazards in site activities and creates a safe working environment at site. The safety officer and site engineers shall record any observation of unsafe condition / act in the observation register immediately and the corrective action to be taken along with the name of person responsible for the same. The safety officer shall make a review visit to the place of observation, during next day's walk through survey, to review whether the corrective actions are taken or not and shall inform his higher authorities / departmental staff in case the corrective measures are not taken. The standard format of Observation Register / Complaint Record is enclosed herewith as **Annexure 10**.

6.2 Records: The contractor shall maintain all safety and first aid / medical related records and registers in the safety office / first aid post at site and such records and reports shall be made available during audits and whenever required. These records and reports shall be updated by safety officer and / or medical attendant at site in consultation with their superiors and departmental staff from time to time. A typical list of records under good practices for compliance with legal requirements related to environment, occupational health and safety is given below:

- i. Safety Organization Chart
- ii. Training Records like initial safety induction training, pep-talk, etc.
- iii. Record of site safety inspection, walk through survey and observation register
- iv. Accident investigation report
- v. Record of Accidents, Near-misses / dangerous occurrences
- vi. Record of test and examination of equipment and structures (like scaffold check list, etc.) as per statutes/codes/standards
- vii. Safe Operating procedure for various site activities
- viii. Record of work permits
- ix. Record of monitoring flammable and explosive substances at work place
- x. Records of maintaining and testing of fire fighting equipment

- xi. Medical records of workers and staffs (separate register shall be maintained for injury at work and for general ailments and medical check-up for height passes)
- xii. Site emergency plans
- xiii. Record of waste disposal
- xiv. Housekeeping inspection record
- xv. Minutes of Site Level Safety Committee meetings and monthly safety reports
- xvi. Record of modification carried out in construction equipment
- xvii. Calibration and testing record
- xviii. Record of previous audits
- xix. Records of applicable legal requirements (**Refer Annexure-I**)
- xx. Tree plantation record, if any
- xxi. Environment and hygiene management plan
- xxii. General complaint register

6.3 Inspection and Safety Audit: The contractor shall arrange internal safety inspections by safety organisation, designated for the project, at least once in a month in order to monitor the status of implementation and adherence to the safety procedures. The project shall be subject to external audit by a team / committee headed by Chief Safety Officer, Engineering Services Group, BARC at least once in a year. However, the contractor shall be prepared for surprise inspections and audits by the department or any third party authorised by the department.

7.0 TRAINING AND AWARENESS BUILDING PROGRAMME:

The contractor shall train and build up a general awareness in safety among the workers and staffs as a continuous effort throughout the project duration. He shall develop and nurture a good safety culture among the staff and workers for an incident free completion of the project. The contractor shall arrange for celebration of National Safety Day / Week on 4th March every year and shall plan for conducting various safety events, competitions, etc. during this period. He shall identify good safety performers among different trades of workers and staff and shall reward them for their performance so as to motivate the others.

7.1 Safety Event Calendar:

The Safety Officer shall chalk out a safety event calendar for various safety events, training programmes, mock drills, demonstration, inspections and audit etc. and shall intimate the concerned people in advance. The contractor shall submit a copy of safety event calendar to the department at the onset of the project / in the month of January every year. This calendar shall be displayed at the site safety office / first-aid post and the contractor shall ensure that these events are conducted as per schedule.

7.2 Safety Induction Training:

The contractor shall ensure that each and every new worker attends initial safety induction training before reporting at respective place of work. The workers shall report to the safety officer first for receiving safety induction training and after successful completion of such training they shall report to respective site engineer. The safety officer shall intimate the workers about the probable hazards related to the work and shall explain and demonstrate the importance and use of PPEs to them. The medium of instructions shall be chosen depending on the language understood by the majority of the workers. He shall also explain to the workers the security restrictions to be followed inside BARC premises. The duration of such induction training depends on the type of worker and shall be decided by the Safety Officer in consultation with the department.

7.3 Pep talk, Tool-box training:

Subsequent to the initial safety induction training, the Safety Officer shall also conduct safety pep talks and tool box training for various teams of workers in regular interval at site. He may identify the groups in advance and finalise the topic of pep talk and schedule the pep talk accordingly so that it does not affect the working hours of the group. He shall arrange pep talks / tool box training on work related topics like use of various PPEs and tools, housekeeping, hot job, electrical works, etc. He shall solicit active participation of workers in such tool box training by asking them to share their experience with their fellow workers. Record of such pep talks and tool box training along with a list of people trained shall be kept at safety office and such records shall be submitted along with monthly safety report.

7.4 Signboards, Posters, Displays: The contractor shall display adequate numbers of signboards (written/painted in photo-luminescent paint) at various workplaces, movement area of mechanical equipment, diesel store, scaffoldings, first aid post, etc. in order to warn the workers and staff of probable hazards at work site. Such signboards shall be written in the language understood by majority of the workers. The contractor shall also arrange for display of posters as an awareness building programme. He shall have to maintain these signboards and posters in good condition throughout the contract period and shall have to replace them periodically. Some of the important topics for signboards are given as under for guidance; however, work specific sign boards can be designed and displayed at site.

- a) Use of proper Personal Protective Equipment (PPE) viz. Safety helmet, safety shoes, safety belt, safety goggles, face shield, ear plug / ear muff, gloves, dust respirators, etc.
- b) No Smoking specially near diesel room, stores or near combustible materials
- c) Moving parts of equipment viz. fly wheels of piling rigs, motors of pumps, etc.
- d) Hot job and fabrication works viz. welding, gas cutting, grinding, etc.

- e)** Unsafe Scaffolding (wherever the scaffold is in unsafe condition)
- f)** Open Excavation / Openings in floors (especially near excavated pit, trenches, lift well, stair well, etc.)
- g)** Electrical installations and high voltage equipment viz. welding transformers, meter panels, fuse distribution boards, etc.
- h)** Dismantling / demolition work in progress
- i)** High noise level area especially near concrete pumps, demolition areas, etc.
- j)** Fragile roofs (where sheeting and roofing work is going on)
- k)** Vehicle movement areas, access roads, etc.
- l)** Fire extinguisher (class wise)
- m)** Emergency exit

8.0 REFERENCES:

- AERB Safety Guide for Works Contract
- Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Central Rules, 1998
- Atomic Energy Factories Rules, 1996
- Job Hazard Analysis Report for Construction of Common Facility Building (CFB) Project, at North Site BARC
- Operation and Maintenance Manual of Mobile Tower Crane (MTC-3625 of M/s Action Construction Equipment Ltd.)
- Operation and Maintenance Manual of Batching Plant (CP30 of M/s Schwing Stetter)
- Operation and Maintenance Manual of Concrete Pump (M/s Putzmeister)
- SP32:1986 (Hand Book on Functional Requirements of Industrial Buildings - Lighting & Ventilation)
- SP53:1992 (Hand operated hand tools - Safety code for the use, care and protection)
- SP70:2001 (Handbook on Construction safety practices)
- IS: 732 – 1989 (Reaffirmed 2005) Code of Practice for Electrical Wiring Installations
- IS: 818-1968 (Reaffirmed 2008) Code of Practice for Safety and Health Requirements in Electric and Gas Welding and Cutting Operations.
- IS: 1991 - 1987 (Part 1 to 10) (Reaffirmed 2002) Safety Requirements for the Use, Care and Protection of Abrasive Grinding Wheels
- IS:2190-1992 (Reaffirmed 2007) Selection, Installation and Maintenance of First-aid Fire Extinguishers - Code of Practice
- IS: 3043 – 1987 (Reaffirmed 2001) Code of Practice for Earthing
- IS:3696-1987 (Reaffirmed 2002) Safety Code for Scaffolds and Ladders (Part 1- Scaffolds)
- IS:3696-1991 (Reaffirmed 2002) Safety Code for Scaffolds and Ladders (Part 2- Ladders)
- IS: 4082-1996 (Reaffirmed 2003) Stacking and storage of construction materials and components at site
- IS:4379-1981(Reaffirmed 2007) Identification of the Contents of Industrial Gas Cylinders
- IS: 5216-1982 (Reaffirmed 2010) Recommendations on safety Procedure and Practices in Electrical work; Part – I: General; Part – II: Life Saving Technique
- IS: 10302 – 1982 (Reaffirmed 2005) Unified Nomenclature for Workmen for Civil Engineering
- IS: 11057 – 1984 Specification For Industrial Safety Nets

[illegible]

Annexure 2

FORMAT FOR JOB HAZARD ANALYSIS REPORT

Sl. No.	Activity / Sub-activity	Potential hazards	Causes	Precautions recommended

Annexure 3**FORMAT FOR WORK PERMIT***(To be filled in by contractor in quadruplicate)*

Name of the work: _____

Name of the principal contractor: _____

W.P. No.: _____

Date: _____

Work Permit valid from _____ on _____ to _____ on _____
(time) (date) (time) (date)

Name of the Site Engineer seeking work permit: _____

Name of the Site Safety Officer: _____

Name of site supervisor: _____

Work Permit sought for: _____ *(Please tick in the box)*

☐	Piling	☐	Excavation & backfilling	☐	Formwork at G.L.
☐	Reinforcement work at yard	☐	Hot Jobs	☐	Mechanical handling/shifting/transportation
☐	Formwork/rebar work at height	☐	Concreting	☐	Structural Erection
☐	Electrical Installation	☐	Maintenance/repair	☐	Other works at height
☐	Finishing works	☐	Grinding/chiseling	☐	Demolition
☐	Miscellaneous works (please specify)				
☐	Working on fragile roof	☐		☐	
☐		☐		☐	

Work Description: _____

Location: _____

I confirm that I have been given charge of the above mentioned work and I will take all necessary precautions to avoid danger to the workers engaged at the above site as well as property. I will abide by the recommendations of the Safety Officer and implement them and I will assign jobs to only trained personnel.

(Name and Signature of Site Engineer)

----- (To be filled in by Safety Officer before issuing work permit) -----

Following safety precautions are taken care of:

Sl. No.	Safety Precautions	Yes	No	NA
1.	All concerned personnel are instructed about the nature of work			
2.	Access ladder/crawling ladder to work/roof provided & properly secured			
3.	Safety clearance/check list for scaffold erection obtained/submitted			
4.	All workers have valid height passes			
5.	Safety net provided under the work place			
6.	Life line/Grab rope is provided at height			
7.	Work area is properly cordoned/barricaded			
8.	Work area is properly illuminated			
9.	Proper access to site is ensured			
10.	Openings are properly covered with safety net/steel jalli & barricaded			
11.	Electrical equipments are de-energized (fuses removed)			
12.	Electrical equipments are checked for earthing			
13.	Portable electrical equipments are tested by site maintenance section			
14.	All rotating parts of machine are well guarded			
15.	Whether any inflammable is present in vicinity of the area of hot job			
16.	Fire extinguisher is available at the work site			
17.	Whether fire watch is required			
18.	Half-an-hour fire watch is complied after hot jobs			
19.	Whether cylinders are kept vertically, properly tied and are under shed			
20.	Work area is well ventilated			
21.	"NO SMOKING" board is displayed			
22.	Personal Protective Equipment (strike out whichever is not applicable) Helmet/Shoe/Hand Gloves/Goggles/Ear Muff/Ear Plugs/Safety Belt/Face Shield/Nose Mask/			
23.	Free escape route is available			
24.	Workers are in good health on the day of work			

I have checked the safety precautions taken at site and allowed the work to be carried out.

Special precautions (if any) _____

(Name and Signature of Safety Officer)

- Cc: 1. Safety Officer
2. Site Engineer
3. Site Supervisor
4. Departmental Representative

Annexure - 4

Part - A
Application for Height Pass

Project _____

Group/Section: _____ Contractor: _____

1. Applicant's Name : _____
2. Departmental Address: _____
3. Residential Address : _____
4. Age : _____
5. Sex : _____
6. Height : _____
7. Gate Pass No. : _____
8. Name of contractor/Agency with whom engaged at present : _____
9. Height pass requirement for work at _____ mtr. height.
10. Description of present job : _____
11. Previous experience of working at height: _____

Sl.No.	Name of the Employer	Duration of Employment	Work Experience
1.			
2.			

12. Is the applicant suffering from any of the following ailments (If yes details to be given):

Blood Pressure _____

Seizure disorder (Fits / Epilepsy Convulsion) _____

Flat Foot _____

d) Frequent attacks of headache or reeling sensation _____

e) Mental depression _____

f) Limping gait _____

Acrophobia (Fear of height) _____

Declaration:

I hereby declare that the above information furnished by me is true and correct. I shall always wear the safety belt and tie the life-line whenever working at unguarded heights of 3 mtrs and above. I shall not misuse the height pass issued to me or transfer it to any other person. I shall never come to duty or work at height/depth under the influence of alcohol/drugs.

Date:

Name:

Sign:

(Applicants Name & Signature or Left Thumb Impression (LTI) in case he cannot sign. Incase of LTI; an authorized person shall explain each point/item to the individual and certify on his behalf below the LTI).

I certify that I am satisfied with the above certification of the individual for the application of Height Pass and request for issue of height pass to him.

Name:

Sign:

(Agency Concerned)

Part – B
MEDICAL FITNESS CERTIFICATE

Certified that I, Dr. _____ have examined Shri. _____ aged _____ on (date) _____ of M/s. _____ who has signed below in my presence. General & Physical examinations of Shri. _____ do not reveal any abnormality. He does not suffer from any acute/chronic skin disease or any contagious or infectious disease. His eyesight is normal with/without glasses. In my opinion, _____ Shri _____ is physically and mentally fit for working at height.

Details of examinations:

1. Age: _____

2. General & Systemic Examination:

2.1	Pulse			2.10	Depth of Vision	Normal:	Abnormal:
2.2	B.P.			2.11	Nystagmus :	Present:	Absent:
2.3	Weight			2.12	Rhomberg Sign:	Positive:	Negative:
2.4	Height			2.13	Hearing:	Normal:	Abnormal:
2.5	Pallor	Yes:	No:	2.14	Muscular Co-ordination	Normal:	Abnormal:
2.6	Flat foot	Present:	Absent:	2.15	Cardio Vascular System	Normal:	Abnormal:
2.7	Gait	Normal:	Abnormal:	2.16	Respiratory System	Normal:	Abnormal:
2.8	Vision	Normal:	Abnormal:	2.17	Central Nervous System	Normal:	Abnormal:
2.9	Colour Vision	Normal:	Abnormal:				

3. Previous History of:

3.1	Seizure disorders (Epilepsy)	Yes	No
3.2	Frequent headache or reeling sensation	Yes	No
3.3	Mental depression	Yes	No
3.4	Acrophobia	Yes	No

4. Investigation:

4.1	Urine
	Albumin:
	Sugar:
4.2	Blood
	CBC:
	Random blood sugar (if age is >35 years.)

5. X-ray:

Required / not required : _____

If required – details of report : _____

(Signature of workman)

(Signature & Rubber stamp)
of Medical Practitioner with Reg. No.

Part – C
Height Pass Certificate

(Considering the above medical certificate; the applicant has appeared on the following practical tests conducted by BARC and the results are given below (strike off whichever in-applicable)

a)	Walking freely over a horizontal structure bar at 1 ft. height	:	Pass / Fail
b)	Wearing a safety belt and tying the rope knot	:	Pass / Fail
c)	Walking over a horizontal structure at 10 ft. height wearing a belt.	:	Pass / Fail

Affix
photograph
(3.5cm x
2.5cm)
for contractor
workers only

The above applicant's performance in the above tests has been satisfactory/ unsatisfactory.

I certify issue of this height pass to Shri _____ of _____ M/s. _____ with Registration No. _____ in the height pass register. This is valid for one year from the date of issue i.e. up to _____.

Date : _____
Name : _____
(Safety Supervisor)

Signature : _____

Name : _____
(Safety Officer)

Signature : _____

Annexure - 5

FORMAT FOR SAFETY CHECK LIST FOR HEAVY DUTY TOWER / SCAFFOLDING ERECTION

(To be filled in by contractor in TRIPLICATE)

Name of the work:

Name of the principal contractor:

Ref. No.:

Date:

Location / Block / Grid:

(Please tick in the box)

Sl. No.	Checklist points	Yes	No	Remarks
A.	Check the base of the scaffolding:			
1.	Is the ground below base plate levelled and firm?			
2.	Are the base plates/sole plates provided or are proper supports placed under the structure?			
3.	Is the base away from excavation, drain cover, manhole, etc.?			
4.	Is there any vehicle movement near structure?			
5.	Is the frame supported on any make-shift arrangements like barrels, boxes, concrete blocks, bricks, empty drums, etc.?			
B.	Check the structure:			
1.	Are all members in good condition (free from bends, cuts, rust, etc.)?			
2.	Whether all the vertical members in plumb and correctly spaced?			
3.	Whether the joints of frames/vertical members are properly connected with couplers & spring-lock pins/cuplocks?			
4.	Are all vertical & horizontal bracings provided and are they properly tied with pins/swivel couplers?			
5.	Whether the scaffold structure is securely tied / restrained with permanent structure? (max. vertical height between ties is 4 times of the least base width)			
6.	Is there any electrical cable / wire within 5m above the top most part of the structure?			
C.	Check the working platform:			
1.	Is the working platform at least two boards wide?			
2.	Is there any gap in the working platform?			

3.	Whether the condition of the scaffold boards is good?			
4.	Whether the ends of the scaffold boards / jallis are securely tied at the ends?			
5.	Is the overlap of the boards at least 300 mm?			
6.	Whether the last scaffold board is extended at least 600 mm beyond the end of the wall?			
7.	Are the guard rail and knee rail provided at 1.00 m and 0.50 m height from the working platform?			
8.	Whether toe board of good condition and of min. 150 mm height is provided?			
9.	Whether the working platform is over loaded?			
10.	Whether safety net is provided below the working the platform?			
D.	Check the access:			
1.	Whether stair/monkey ladder/walkway are provided as access?			
2.	Whether the access is properly supported / tied / made?			
3.	Whether the steps / landing of the access have any slip resistance arrangement?			
4.	Whether the access steps / landings are free from any obstacle and undesirable & slippery materials?			
5.	Whether the entry / exit of the access is free from any obstruction			
E.	Housekeeping and maintenance:			
1.	Are all debris / undesirable material removed from the working platform and access?			
2.	Are all the scaffold members maintained from time to time?			
3.	Are all the damaged / weakened parts of the scaffold immediately removed or replaced?			
F.	Safety tag:			
1.	Whether safety tag "unsafe scaffolding" / "safe scaffolding" is displayed in the language understood by majority of the workers?			

(Name & Signature of Site Engineer)

(Name & Signature of Safety Officer)

Annexure - 6**FORMAT OF CERTIFICATE OF TEST AND THOROUGH EXAMINATION OF CRANE BY THIRD PARTY***(To be filled in TRIPLICATE)*

Sl. No.	Description	Details			
1.	Name and address of contractor				
2.	Name and address of manufacturer of the crane				
3.	Type of Crane and nature of power				
4.	a) Date of manufacture of the crane				
	b) Date of first use of the crane				
	c) Date of last examination of the crane				
5.	Identification No.				
	a) Manufacturer's serial number				
	b) Owner's distinguishing mark / number				
6.	Safe Working Load(s)	Length of jib (M)	Radius (M)	Test Load (MT)	Safe Working Load (MT)
		(1)	(2)	(3)	(4)
	In case of a crane with variable operating radius, the safe working load at various radii of the jib, trolley or crab must be given. Test loads at various radii shall be given in column (3) and in the case which has been calculated without the application of a test load, 'NIL' shall be entered in that column.				
7.	In case of a crane with a derricking jib or jibs, the maximum radius at which the jib or jibs may be worked (in m)				
8.	Defects noted and alterations or repairs required before crane is put into service (if none, enter 'NIL')				

I hereby certify that the crane described in this certificate was tested and thoroughly examined by me on (date: ____ / ____ / ____) and that the above particulars are correct.

Date of certification:

(Signature & stamp)

(Qualification)

(Name & address of the Person, Company or Association by whom the person conducting test and examination is employed)

Annexure – 7

FORMAT OF CERTIFICATE OF TEST AND THOROUGH EXAMINATION OF HOIST BY THIRD PARTY

(To be filled in TRIPLICATE)

Sl. No.	Description	
1.	Name and address of contractor	
2.	a) Type of hoist or lift and identification number and description	
	b) Date of manufacture	
	c) Date of last overhauling / substantial alteration	
3.	Design and manufacture: Are all parts of the hoist or lift of good mechanical construction, sound material and adequate strength?	
4.	Maintenance: Are all following parts of the hoist or lift properly maintained and in good working order? If not, state what defects have been found	
	a) Enclosure of hoist way or lift way	
	b) Leading gates and cage gate(s)	
	c) Interlock on the leading gates and cage gate(s)	
	d) Other gate fastenings	
	e) Bucket or cage or platform and fittings, gates, buffers, hoist way	
	f) Over running devices	
	g) Suspension ropes or chains and their attachments	
	h) Safety gear i.e., arrangements for preventing fall of bucket or platform or cage.	
	i) Brakes	
	j) Worm or spur gearings	
	k) Other electrical equipment	
	l) Other parts	
5.	Which parts (if any) were inaccessible?	
6.	Repairs, renewals or alterations required to enable the hoist or lift to be used or to continue to be used with safety:	
	a) Immediately	

	b) Within a specified time, the time is to be stated	
	If no such repairs, renewals or alterations are required, enter 'NIL'	
7.	Specify defects (other than those specified at 5 above) which require attention	
8.	If no defects requiring attentions are found and no repairs, renewals or alterations are required then state that the hoist or lift is in safe working condition.	
9.	Maximum safe working load subject to repairs, renewals or alterations (if any) specified at 5.	
10.	If the hoist is to be used for the carriage of passengers specify the maximum number of passengers that may be carried safely.	
11.	Other observations	

I hereby certify that on (date: ____ / ____ / ____) I thoroughly examined this hoist or lift and the that the foregoing is a correct report of the result.

Date of certification:

(Signature & stamp)

(Qualification)

[Name & address of the Person, Company or Association by whom the person conducting the test and examination is employed]

Annexure 7A**REGISTER OF PERIODICAL TEST – EXAMINATION OF LIFTING APPLIANCE AND GEARS, ETC.**

(As per Form XXVI, BOCW Central Rules, 1998)

PART-I**INITIAL AND PERIODICAL LOAD TEST OF LIFTING APPLIANCES AND THEIR ANNUAL THOROUGH EXAMINATION**

“Thorough examination” means a visual examination, supplemented, if necessary, by other means such as a hammer test, carried out as carefully as the conditions permit, in order to arrive at a reliable conclusion as to the safety of the parts examined, and if necessary, for such examination parts of the lifting appliances and gear shall be dismantled.

(A) Initial and periodical load tests of lifting appliance				
<i>Situation and description of lifting appliances tested with distinguishing number of marks if any</i>	<i>No of certificate of test and examination of competent person</i>	<i>I certify that on the date on which I have appended by signature the lifting appliance shown in column (a) was tested and no defects affecting its safe working condition were found other than those shown in column (5)</i>		<i>Remarks (to be, signed and dated)</i>
		<i>Date and signature with seal</i>	<i>Date and signature with seal</i>	
(1)	(2)	(3)	(4)	(5)
1.				
2.				

(B) Annual thorough examination:

I certify that on the date to which I have appended my signature, the lifting appliance shown in column (1) was thoroughly examined and no defects affecting its safe working conditions were found other than those shown in column (12)

<i>Date and signature with seal</i>	<i>Date and signature with seal</i>	<i>Date and signature with seal</i>	<i>Date and signature with seal</i>	<i>Date and signature with seal</i>	<i>Date and signature with seal</i>	<i>Remarks to be signed and dated</i>
(6)	(7)	(8)	(9)	(10)	(11)	(12)
1.						
2.						

PART II

Initial and periodical load test of loose gars and annual thorough examination:

List of loose gear:

The following classes of loose gears namely-

1. Chains made of malleable cast iron;
2. Plate link chains;
3. Chains, rings, hooks, shackles and swivels made of steel;
4. Pitched chains;
5. Chains, rings, hooks, shackles and swivels permanently attached to pitched chains, pulley blocks, containers, spreaders, trays, slings, baskets etc. and any other similar gear
6. Hooks and swivels having screw threaded parts or ball bearings or other case hardened parts; and
7. Bordeaux connections

Initial Test And Periodical Load Test Of Loose Gears

<i>Distinguishing no. or marks</i>	<i>Description of loose gear tested and examined</i>	<i>No of certificates of test and examination of competent person</i>	<i>I certify that on the date on which I have append my signature the loose gears shown in column (1) and (2) were tested and no defects affecting the safe working condition were found other than those shown in column (6)</i>	
			<i>Date and signature with seal</i>	<i>Date and signature with seal</i>
(1)	(2)	(3)	(4)	(5)
1.				
2.				
3.				
4.				

Annual Thorough Examination Of Loose Gears

<i>Remarks (to be signed and dated)</i>	<i>I certify that on the date to which I have appended my signature the loose gears shown in column (1) and (2) were thoroughly examined by me and no defects affecting their safe working condition were found other than those shown in column (10)</i>			
	<i>Date and signature with seal</i>	<i>Date and signature with seal</i>	<i>Date and signature with seal</i>	<i>Remarks (to be signed and dated)</i>
(6)	(7)	(8)	(9)	(10)
1.				
2.				

PART III

Annealing of chains, Rings, Hooks, Shackles and Swivels (other than those exempted)
(SEE PART II)

12.5 mm and smaller chains, rings, hooks, shackles and swivels in general use. Other chains, rings, hooks, shackles and swivels in general	If used with lifting appliance of driven by power, must be annealed once at least in every six months. If used solely with lifting appliance worked by hand, must be annealed once at least in every twelve months. If used with lifting appliance driven by power, must be annealed once at least in twelve months. If used solely with lifting appliance worked by hand, must be annealed once at least in every two years.

NOTE: It is recommended though not required by rules that annealing should be carried out in a suitable constructed furnace heated to temperature between 1100 degree and 1300 degree Fahrenheit or 600 degree and 700 degree Centigrade, for a period between 30 and 60 minutes

<i>Distinguishing no. and mark</i>	<i>Description of gear annealed</i>	<i>No. of the certificate of test and examination</i>	<i>I certify that on the date to which I have appended my signature, the gear described in cols. 1 & 2 was effectually annealed under my supervision; that after being so annealed every article was carefully inspected and that no defects affecting its safe working condition were found other than those shown in col. 7</i>			<i>Remarks (to be signed and dated</i>
			<i>Date and signature with seal</i>	<i>Date and signature with seal</i>	<i>Date and signature with seal</i>	
(1)	(2)	(3)	(4)	(5)	(6)	(7)

Annexure - 8

CONTENT OF A FIRST AID BOX

(as per Schedule – III, BOCW Central Rules, 1998)

1. A sufficient number of eye wash bottles filled with distilled water or suitable liquid clearly indicated by a distinctive sign which shall be visible at all times.
2. 4 per cent xylocaine eye drops, and boric acid eye drops and soda-bi-carbonate eye drops.
3. Twenty four small sterilised dressings.
4. Twelve medium size sterilised dressings.
5. Twelve large size sterilised dressings.
6. Twelve large size sterilised burn dressings.
7. Twelve (fifteen cm) packets of sterilised cotton wools.
8. Two hundred ml bottle of certimide solution (1 per cent) or suitable antiseptic solution.
9. One (two hundred ml) bottle of mercurochrome (2 per cent) solution in water.
10. One (one hundred twenty ml) bottle of salvolatile having the doses and made of administration indicated in the bottle.
11. One pair of scissors.
12. One roll of adhesive plaster (six cm x one metre)
13. Two rolls of adhesive plaster (two cms x one metre)
14. Twelve pieces of sterilised eye pads in separate sealed packets.
15. A bottle containing hundred tablets (each of three hundred twenty five mg) of aspirin or any other analgesic.
16. Twelve roller bandages five cms wide.
17. Twelve roller bandages ten cms wide.
18. One tourniquet
19. A supply of suitable splints
20. Three packets of safety pins.
21. Kidney tray.
22. A snake bite lancet.
23. One (thirty ml) bottle containing potassium permanganate crystals.
24. One copy of first aid leaflet issued by Director General
25. Six triangular bandages.
26. Two pairs of suitable, sterilized, latex hand gloves.

Tablets for: fever, headache, body ache, stomach ache, loose motion, acidity, cold, upper respiratory tract infection, urinary tract infection, low backache, abdomen pain, minor injuries, Tab. Sorbitrate, Cap. Nefedine, etc.

Annexure 9

Articles for Ambulance Room/First Aid Post
(as per Schedule – IV, BOCW Central Rules, 1998)

1. A glazed sink with hot and cold water always available.
 2. A table with a smooth top at least 180cm x 105 cm.
 3. Means for sterilizing instrument
 4. A couch and three chairs.
 5. Two Stretchers and one examination bed with bed sheet, a pillow and cover
 6. Two buckets or containers with close fitting lids and two rubber hot water bags.
 7. A kettle and spirit stove or other suitable means of boiling water.
 8. Twelve plain wooden splints 900cm x 100cm x 6cm.
 9. Twelve plain wooden splints 350cm x 75cm x 12cm.
 10. Six plain wooden splints 250cm x 50cm x 12cm.
 11. Six wooden blankets.
 12. Three pairs artery forceps.
 13. One bottle of spiritus annemiae arenatuins (120ml).
 14. Smelling salt (60gm)
 15. Two medium size sponges.
 16. Six hand towels.
 17. Four kidney trays.
 18. Four cakes of toilet soap, preferably antiseptic soap.
 19. Two glass tumblers, two wine glasses, two tea spoons and two clinical thermometers.
 20. Two graduated (120ml) measuring glasses.
 21. Two minimum measuring glasses.
 22. One wash bottle (1000cc) for washing eyes.
 23. One bottle (one litre) carbolic lotion 1 in 20.
 24. One screen and one electric hand torch.
 25. Four first-aid boxes or cupboards.
 26. An Adequate supply of tetanus toxide.
 27. Injections- morphia, pethidine, atrophine, adrenaline, coramine, novocaine (6 each).
 28. Cramine liquid (60ml).
 29. Tablets- antithistaminic antispasmodic (25 each).
 30. Syringes with needles-2cc, 5cc, 10cc, and 500cc and needle destoryer
 31. Three surgical scissors
 32. Two needle holders, big and small.
 33. Suturing needles and materials.
 34. Three dissecting forceps, three dressing forceps and three scalpels.
 35. One stethoscope and one Blood Pressure apparatus.
 36. Rubber bandage-pressure bandage.
 37. Oxygen cylinder (min. 330 litres capacity) with necessary attachments and one Ambu bag.
 38. Weighing machine, measuring, near vision chart, distance vision chart, wash basin, high pressure drum for sterile items – one each.
 39. Atropin eye ointment
 40. IV fluids and sets – ten numbers
 41. Suitable, foot operated, covered, refuse containers
 42. Adequate number of sterilized, paired, latex hand gloves
- Injections and other materials: Inj. Dexamethasone, Inj. Hydrocortisone, Inj. Avil, Inj. Dopamine, Inj. Adrenelin, Inj. Deriphyllin, emergency control drug, demulcent drink, etc.

Annexure - 10**FORMAT OF OBSERVATION REGISTER OR COMPLAINT RECORDS**

(To be filled in by Safety officer or Site Engineers)

Sl. No.	Date	Area/ location	Observation/ hazard	Remedial measures recommended	Name of person responsible	Action taken on	Signature of Safety Officer

Annexure - 11**FORM NO. SGCW - 1****FORM FOR COMPLETION CERTIFICATE**

(Prescribed under Cl.1.2 of Annexure of AERB Safety Guide for Works Contract))

I/We certify that the installation detailed below has been installed by me/us and tested and that to the best of my/our knowledge and belief, it complies with Indian Electricity Rules, 1956 as well as IS: 732-1963 code of practice for Electrical Wiring Installations. [System voltage not exceeding 650 Volts (Revised)].

Electric installation at

Voltage and system of supply a)

Particulars of work	Number	Total load	Type of system of wiring
i) Light Points			
ii) Fan points			
iii) Plug points (3 pin)			
iv) Motors			

b) If the work involves installation of overhead lines and/or underground cable

c) Earthing:

Description of earthing electrode, size of earth wire and number of electrodes provided:

d) Test results:

1. Insulation resistance for the whole installation:

i. Between conductors:

ii. Between each conductor and earth:

2. Resistance of earthing electrode or earthing system

3. Maximum earthing resistance of installation

()

Signature of Supervisor

Name and address of Supervisor

()

Signature of Contractor

Name and address of Contractor.

Annexure - 12

FORM NO. SGCW-2

'A' APPLICATION FOR SERVICE CONNECTION BY CONTRACTOR

(Prescribed under Cl.1.3 of Annexure of AERB Safety Guide for Works Contract)

(to be filled in triplicate)

1. Name & Address of Contractor:
2. Reference to Tender & Work Order:
3. Completion period:
4. Connected load details:
(please attach details in a separate sheet)
5. Max. demand anticipated :
6. Nature of service connection required:
(whether single or three phase)
7. Place where service required:
 - a) Works:
 - b) Colony:
8. If supply of electricity is free or chargeable:
(Please enclose extract of conditions from the tender)
9. Details of meter provided:
 - a) If meter required from the Department, whether Security Deposit is paid:
 - b) Details of SD (Security Deposit):
 - c) Whether meter is tested or not, if tested, attach test report, if not, details of testing fee deposited:
10. Name of Supervisor/Electrician in charge of installation and maintenance:
11. Electrical license No. of person mentioned against col. 10:
12. Electrical safety appliances available for use:
13. Fire extinguishers available for use:
14. First Aid facility/box available for use, if any:

(Signature of the Contractor)

Name:

Date:

'B' CERTIFICATE BY THE CONTRACTOR

Certified that my/our installations have been carried out in accordance with I.E. Rules and that I/We have employed competent persons to handle the installations.

I/we am/are agreeable to the bills, in respect of this service connections being raised on the basis the connected load furnished above, in case the actual consumption falls below the one stipulated by the tender conditions.

(Signature of the contractor)

Name:

Address:

Date:

'C' CERTIFICATE BY THE CONTRACT CONTROL ENGINEER

Verified the particulars and forwarded to the Engineer In charge.

(Signature of Contract control Engineer)

Name:

Section: Civil/Electrical/Mechanical.

'D' CERTIFICATE BY THE ENGINEER IN CHARGE

Certified that the particulars furnished by the Contractor are true to the best of my knowledge and belief and that I have satisfied myself as to the safe conditions of electrical installations for which the service connection is applied for.

Signature:

Name:

Date:

Designation with section:

'E' CERTIFICATE BY THE SAFETY ENGINEER

Certified that I have inspected the electrical installations referred herein and after satisfying myself about the safe conditions of the installation, I hereby recommend that the service connection be given to the Contractor.

Signature of Safety Engineer.

Name:

Date:

'F' AUTHORISATION BY THE ELECTRICAL ENGINEER

Service connection may be/may not be given for the reasons noted hereunder.

Date:

Signature of Electrical Engineer.

Name:

Designation:

'G' 'REPORT OF COMPLIANCE'

Service connection is given by me on

a) Meter Nos.

- 1.
- 2.

b) Initial readings:

- 1.
- 2.

c) Locations:

- 1.
- 2.

d) Meter Sealings:

- 1.
- 2.

Signature of Electrical Engineer
(Metering and Billing)

Name:

Designations:

Date:

Note:

1st copy to Contract Control Engineer

2nd copy to Safety Engineer

and 3rd copy to Electrical Engineer

After all the formalities are completed and
Report of Compliance Electrical Engineer after
power supply is given.

1. Name of the injured person:
2. Age: Sex: Male / Female
3. Date and time of the accident:
4. Place where the accident occurred:
5. Name of Project and Contractor:
6. Name of contracting division/section:
7. Name of BARC supervisor:
8. Nature of job:

9. Was this his regular job?:

10. How did the accident occur (please give details):

11. Nature of injuries:

12. Was the patient referred to hospital?

13. If yes, whether admitted:

14. What was wrong with the working method/instructions:

15. What was defective? Any unsafe condition existed?:

16. Was the accident due to fault of any person other than injured?:

17. If yes, who and how?:

18. Did any similar accident occur earlier in the project?:.

19. What safe guards / instructions could have prevented the accident?:

20. What steps will be taken to prevent recurrence of similar accident?:

(Name & Signature of Contractor)

(Name & Signature of Engineer-in-charge)

21. Comments from Head of the contracting Division/Section:

(Head of Contracting Signature Division/Section)

Annexure 14**FORMAT FOR INSPECTION OF FIRE EXTINGUISHERS**

Sl. No.	Fire Extinguisher No.	Type of Fire Extinguisher	Date of monthly inspection	Date of annual inspection	Status	Place of Fire Extinguisher	Signature

Annexure 15

FORMAT FOR TESTING OF PORTABLE AND OTHER ELECTRICALLY OPERATED EQUIPMENT

Sl. No.	Name of Equipment	Capacity (HP)	IR value 1Ph	3 Ph IR Value			Remarks
				R MΩ	Y MΩ	B MΩ	

(Name & Signature of Contractor)

(Name & Signature of Dept. Representative)

ABBREVATIONS

A&CED: Architecture & Civil Engineering Division
AEFR : Atomic Energy Factory Rules
AERB : Atomic Energy Regulatory Board
ASTM : American Society for Testing and Materials
BOCW : Building and Other construction Workers
BS : British Standards
DB : Distribution Board/ Box
DCP : Dry Chemical Powder
DG : Diesel Generator
ESG : Engineering Services Group
ELCB : Earth Leakage Circuit Breaker
HRC : High Rupturing Capacity
IHSS : Industrial Hygiene and Safety Section
IS : Indian Standards
kmph : kilometre per hour
KVA : kilo-volt-ampere
MCB : Miniature Circuit Breaker
MS : Mild Steel
PCC : Plain Cement Concrete
PPE : Personal Protective Equipment
Re-bar : Reinforcement bar
RCC : Reinforced Cement Concrete
RMC : Ready Mix Concrete
RPM : Revolution Per Minute
RSSD : Radiation Safety Systems Division
QA : Quality Assurance
QC : Quality Control
SU : Safety Unit
SLSC : Site Level Safety Committee
SIDE : Switch off, Isolate, Discharge and Earth
UV & IR: Ultra Violet & Infrared Radiation
WC : Water Closet

Government of India
BHABHA ATOMIC RESEARCH CENTRE
Civil Engineering Division

**Corrigendum No. 1 to A&CED Tender Documents
w.e.f. 28.11.2014**

This may be read along with the existing A& CED Tender Documents published on BARC website/tender wizard BARC-DAE. The following are the changes in the existing A& CED Tender Documents:

Sr. No.1: A&CED (Architectural & Civil Engineering Division) has been divided into two Divisions i.e. **CED** (Civil Engineering Division) and **A&SED** (Architectural & structural Engineering Division). So A& CED Tender Documents means “**CED (Civil Engineering Division) Tender Documents**” and “**A& SED (Architectural & structural Engineering Division) Tender Documents**”.

Sr. No.2: SECTION - III - CONDITIONS OF CONTRACT: C L A U S E S O F C O N T R A C T:

CLAUSE 1-A: RECOVERY OF SECURITY DEPOSIT: Under this clause the existing first two para are modified/ replaced with as under:

Para I- Replaced with **New Para as under:**

New Para: The person/persons whose tender(s) may be accepted (hereinafter called the contractor) shall permit Government at the time of making any payment to him for work done under the contract to deduct a sum at the rate of 2.5% of the gross amount of each running and final bill till the sum deducted will amount to security deposit of 2.5% of the tendered value of the work. Such deductions will be made and held by Government by way of Security Deposit unless he/they has/have deposited the amount of Security at the rate mentioned above in cash or in the form of Government Securities or fixed deposit receipts. In case a fixed deposit receipt of any Bank is furnished by the contractor to the Government as part of the security deposit and the Bank is unable to make payment against the said fixed deposit receipt, the loss caused thereby shall fall on the contractor and the contractor shall forthwith on demand furnish additional security to the Government to make good the deficit.

Para II- “The security deposit shall be collected from the running bills of the contractor at the rates mentioned above and the Earnest Money deposited at the time of tenders will be treated a part of the Security Deposit” may be read as “**The security deposit shall be collected from the running bills and the final bill of the contractor at the rates mentioned above**”.

Sr. No.3: CLAUSE 10 (CC):

The last para under this clause “Clause 10 CC to be applicable in contracts with stipulated period of completion exceeding **18 Months.**” may be read as “**Clause 10 CC to be applicable in contracts with stipulated period of completion exceeding 12 Months.**”

Sr. No. 4: PROFORMA OF SCHEDULES**SCHEDULE 'E'**

Under Schedule 'E' the following are the changes:

Estimated cost of work: Rs. _____

(i) Earnest money: Rs. _____

(ii) Performance Guarantee: 5% of tendered value

(iii) Security Deposit: 5% of tendered value

Is replace by:

Estimated cost of work: Rs.

(i) Earnest money: Rs.(to be returned after receiving performance guarantee)

(ii) Performance Guarantee: 5% of tendered value.

(iii) Security Deposit: 2.5% of tendered value.

Sr. No. 5 : A N N E X U R E - B "LIST OF APPROVED MANUFACTURER OF BUILDING MATERIALS" is replaced with new approved list as under:

ANNEXURE – B**LIST OF APPROVED MANUFACTURER OF BUILDING MATERIALS**

The makes have been specified in the tender document based on requirements & desired performance and detailed study of the technical parameters, manufacturing process, quality assurance/control & testing and if any bidder wishes to add any other make / brand equivalent to specified in the tender they shall inform at the time of Pre bid meeting / Technical bid submission, the same would be communicated to all the bidders if approved and would become part of the tender.

Sl.No.		Description of materials	List of Manufacturers
1	a	Ordinary Portland Cement of Grade 43	ACC, Birla Rajshree, Ultratech
	b	Portland Pozzolana Cement (fly ash based confirming to 28 days strength requirement of OPC 43 grade)	ACC, Birla, Ultratech
	c	White Cement	J.K. Cement & Birla White
2	a	HYSD Bars (TMT Bars)	M/s TISCO, SAIL, RINL
	b	HYSD Bars (TMT Bars) if specified other than M/s TISCO, SAIL, RINL	Guru Nanak Metal, Metro Ispat., Metro Alloys & M/s. Bhagwati Steel Cast, JSW Steel, Sham Steel, Ambe Ferro Alloys
3		Structural Steel Sections	M/s SAIL, RINL, TATA
4		Structural Steel Plates	M/s SAIL, RINL, TATA, Essar
5		Agency for Anti-Termite treatment	M/s PARAGON, PEECOPP Express Pesticides Corporation, Pest Control (I) Ltd.
6		Tiles:	
	a	Ceramic Tiles	M/s H.R. Johnson (I) Ltd., Somany, Kajaria, Asian Granito India Ltd.
	b	Glazed Tiles	M/s H.R. Johnson (I) Ltd., Somany, Kajaria, Asian Granito India Ltd.
	c	Vitrified Floor Tiles	M/s H.R. Johnson, RAK Ceramics, Bell Granito, KAJARIA, SOMANY & Asian Granito India Ltd.
	d	P V C flooring Rolls / Tile / Sheets	Wonder Floor, M/s Premier Vinyl Flooring Ltd., Armstrong, Responsive Industries Ltd.
	e	Paver Blocks, Polymer moulded Paver Blocks, Chequered concrete Floor Tiles, Unipaver Blocks	Super Tiles, Shree Precast INDUSTRIES, Pavetech Industries
	f	Concrete Designer wall & Floor tiles	Ultra tile, Eurocon, Duracrete
	g	Acid Proof Tiles	Johnson ENDURA Tiles
	h	Tile Grout	ROFF / BALENDURA / LATICRETE

Sl.No.		Description of materials	List of Manufacturers
7		Flyash Bricks	M/s Shirke bricks, M/s Unicorn, M/s Shri Samarth, M/s A Cube bricks
8		Metallic Floor Hardner	Ironite India Ltd. Triveni Colour Industries (Floor) Heatly & Gresham (India) Ltd., De Rust Chemical Corporation of India (Fermonite), Cement Research Corporation (stilonite), Kironite
9		Pressed Steel Door Frame	M/s SenHarvic, Anjali Enterprises, Windoors, Bharat Steel Industries, Pune, M/s AGEW, M/s Sheth Fabricators
10		Steel flush Doors	Shakthimet Dors, Sheth Fabricators, M/s Ahaladha, M/s Senharvic, M/s Diamond Doors (Item Specific), windors, Anjali Enterprises, AGEW
11		Doors	
	a	Flush Door Shutter	Indian Plywood, Kitply, Anand Wood Crafts, Sejpal and others (Anand Doors), M/s Kalpatharu Doors
	b	Masonite Wooden Panel Doors	Masonite India Ltd.
	c	FRP Door Shutter	Advance FRP & House of Doors, Eccentric Designs Godrej
	d	Pressed steel doors & fire resistant steel doors	M/s. Shakthimet dors, M/s. Ahaladha, Strategic Building Systems. M/s. Sheth Fabricators, M/s. Signum Fire Protection Ltd.
	e	Steel Windows	M/s SenHarvic, AGEW, Windoors, Anjali Enterprises, M/s. Sheth Fabricators, M/s. NCL Seccolor & Bharath Steel (Pune)
	f	Mild Steel Rolling Shutters, G.I. Rolling Shutters, Stainless steel & aluminium rolling shutters	Windoors, Dodia, Bharath, Vijaylakshmi Rolling Shutters & M/s Anjali Enterprises
	g	Block Board	Wood India – Calcutta, Sejpal & others, Pioneer Timber Products, Chandigarh, Anchor
	h	Ply Wood	Indian Plywood Mfg. Ltd., Kitply, Century Plywood, Anchor, Associate Ply
	i	Pre Laminated & Plain Particle Boards	ASIS, ARCHIDPLY, Action TESA
	j	Factory made solid wooden panel doors	Kalpatharu Doors, M/s Jawahar Saw Mills, M/s Sreeji Wood Craft
	k	Fibre Cement boards	Everest-E-Boards / Charminiar –C-Boards & ECOPRO & Shera boards
	l	Textured Fibre Boards	SHERA boards & Everest E-boards

Sl.No.		Description of materials	List of Manufacturers
	m	Adhesive for wood	Fevicol, Vamicol, Dunlop, Araldite
12		Aluminium Grills	M/s Decogrille
13	a)	Hardware Fittings & fixtures	M/s Jayant Metal, Shalimar hardware, Everite, Garnish, Diamond, Navbharat, SAIF Enterprises, Hardwin Traders, Godrej, DE Lock Industries, Explore Engineers, Garg Hinges, Classic
	b)	Brass hardwares	M/s. Chetna, Flora
	c)	Fixtures for Aluminum Windows	Shalimar &EBCO
14		Aluminium Extruded Sections	Jindal, Indal, Hindalco, Boruka, M/s Royale touch
15		Aluminium Powder Coated Curtain rods	Bilmate, Elite
16		Glass shelf C.P. brackets	Elite, Amit & Vijay
17		Lime	Janatacem, Asian Paint More (Peacock)
18		Neeru	More (Peacock), Kamal
19		Cement Based Paint	M/s Snowcem India Ltd. (Super Snowcem, Sandex Matt), Surfa coat, Terraco, Berger-(Rabiacem), Apporva Buildcare
20	a)	Distemper & Paints	M/s Asian Paints, Kansai Nerolac Paints Ltd., ICI Paints, Noble Paints, Berger Paints India Ltd., Jenson Nicholson, Garware Paints Ltd. & Shalimar Paints
	b)	Textured Paint & coatings	Renovo, Durashield, & RUF &TUF of Sherwin Willams [BJN Paints]
21		Integral Waterproofing Compound	M/s Accoproof, CICO, Impermo, Pidilite, Roffe, FOSROC, Dr. Fixit
22		Agencies for Waterproofing Treatment- Cement based	M/s Modern Waterproofing, Ms/ Gemini Construction M/s National Waterproofing M/s New Bharat Waterproofing Co. M/s. Taj Enterprises M/s CICO Technologies M/s Nina Industries M/s Structural Waterproofing Company

Sl.No.		Description of materials	List of Manufacturers
23		Chemical Based Water Proofing	Indofil, FlexiCrete, Fosroc, M/s. STP Ltd (Item Specific) M/s. Bitumet (Item Specific)
24		PVC Water stops	M/s Omai Plastics, Caprihans India Ltd., Kanta Polymers (Kanta flex) & Fixopan
25		Expansion Joint Boards	M/s Shalitex M/s. Supreme-HD-100 Duroboard (Item specific)
26		Tarfelts	M/s. S.T.P. Ltd., Lloyd Insulation, Tiki Tar Industries
27		Expansion Joint Fillers	M/s Shalitex, S.T.P. Ltd., Lloyd Insulation & BASF Chemicals, FOSROC, PIDILITE, Choksey
28		Glass for Doors / Windows	Modi Guard, Emirates, Saint Gobain, Asahi (IAG & AIS), Floatglass
29		Plain Glass Mirror	M/s Modi Float Glass, Eagle, Atul, Saint Gobain, Asahi
30		Sanitary Wares	M/s Parryware, Hindustan, Cera, Neycer
31		Water supply C.P. Brass Fittings & Fixtures	JAGUAR, GEM, Techno, KINGSTON, Metro, ESSCO, Plato
32		C.P. Brass Waste Coupling and Bottle Trap, C.P. Towel Rod & C.P. Extn.	ESSCO, GEM, Kingston, Jaquar, Metro, Plato
33		C.P. BRASS Urinal Waste & Flush pipes	Orient, PARKO, Elite, Jaquar & Metro
34		Plastic Seat & Cover	M/s Commander, Diplomat, Patel, Champion, Parryware & Hindware, CERA
35		S.S. Sink	M/s Diamond, Nirali, Parryware
36		G.I. Pipes	M/s TATA
37		G.I. Pipes other than TATA make if specified	Zenith, Jindal
38		G.I. Fittings	PEC, MJM, R-Brand, UNIK, Plumb well and other brands approved with ISI mark KAS, Kranti
39		G.M. Gate / Globe Valves	M/s Leader Valves, Neta, SANT, Zoloto
40		Air Valve	Leader, Sant, HAWA, M/s Kirloskar
41		Water Meter	Capstan, Keycee, Paramount
42		Sluice Valves	Kirloskar, Leader, Hawa

Sl.No.		Description of materials	List of Manufacturers
43		C.I. water quality pipes	Electro steel castings, Jindal, Lanco (Item Specific)
44		Cast Iron Valves	Kirloskar, Leader, HAWA
45		C.I. Soil Quality pipes	NECO, RIFCO, A-1, PARAS, HIF, Kajeriwal, ASP
46		S.W. Pipes & Gully Trap	Perfect, BURN, RK, ANAND, Bharath (Any ISI marked)
47		RCC Hume Pipes	M/s Indian Hume Pipes, Pranali, Cement pipe, Ghambir Pipes, products - Hindustan Pipes (Confirming to ISI)
48		HDPE Pipes & HDPE fittings	Prince, Sangir pipes, Supreme
49		RCC frame, covers	M/s Pratibha, Bharath, Vikrant
50		Pressure gauge	HAWA
51		PIG LEAD	M/s Hindustan Zinc Ltd.
52	(a)	C.I. frame & covers	NECO, M/s Ashok Iron, Foundry, HIF, Bombay Iron Works
53		Cast Iron Gratings	NECO, KFAI & Bombay Iron works
54		UPVC, SWR Pipes,	Finolex, Prince & Supreme
55		C-PVC pipes	Supreme, Prince & ASTRAL
56		Poly Propylene – R Pipes	Supreme & Sakthi Polymers, PRINCE, KISAN-KSR
57		PVC Plastic High / Low level cistern	Commander, Champion, Elitedual Parryware-slimline, Hindware, Prince
58		PVC Inlet connection & Waste Pipes	Kohinoor, ESSCO, GEM & Elite
59		CP Brass towel rods and accessories	Elite, GEM, Jagquar, ESSCO, HINDWARE, PLATO
60		Stainless Steel Towel rods & bath Accessories	KICH, Jaquar, ESSCO, Johnson
61		PTMT Bath fittings (PVC)	PRAYAG Polymers
62		Concrete Admixtures	Structural waterproofing Co., FOSROC Chemicals, BASF, CICO
63		Asbestos Roofing Sheets	Everest, Charminar & Asbestos Cement Ltd., VIKRANT

Sl.No.		Description of materials	List of Manufacturers
64		Colour Coated Steel / Zinc-alu alloy roofing sheets	Kirby, Steelfab & Colour Roof India Ltd., M/s SAFZIP
65		Aluminium Roofing Sheets	M/s. CRIL, KALZIP, SAFZIP (Item Specific)
66		BITUMEN	HPCL, BPCL & Indian oil Corporation
67		Bitumen Emulsion	IWL, STP, HPCL
68		Ready Mix Plaster	ROOFIT, FAIRMAT & WALPLAST
69		Ready Mix concrete	ACC RMC, Govandi & ULTRATECH readymix, Govandi, RMC India (Ghatkopar, Mahape)
70		PILING - agencies	Simplex Piles, Advance Geotech Solutions, M/s. Pandey Earth work Pvt. Ltd.
71		Automatic Rolling Shutters & Motorized Gates	M/s. Gandhi automation Pvt. Ltd., Vijalakshmi Rolling Shutters
72		Factory made Ready to fix Aluminium Windows	M/s. Geeta Aluminum
73		Epoxy Flooring	HUNTSMAN & Fosroc
74		Epoxy paint	APCODUR- Asian paints, Berger, Shalimar, Amarloe, Huntsmar
75		False Flooring	M/s UNITILE Access Floor, M/s D G False flooring
76		Autoclave Aerated Blocks (AAC)	M/s. Siporex & M/s AEROCON
77		ROCKWOOL	M/s. Rock wool India Ltd.
78		Heavy Density Thermocol (Expanded polystyrene)	M/s. Beard shell
79		Polycarbonate sheet	TUFLITE Polymers, GE
80		PVC water tank	SINTEX
81		FRP water tank	Devi Polymers & BINANI
82		Dry wall portions	M/s. Gypsum India Ltd. (Saint Gobain, M/s. RAMCO HILUX (calcium silicate (ITEM SPECIFIC)
83		Floor Springs & Door Closers	Hardwyn & Everite, Hyper, Garnish
84		Poly Sulphide Sealent	PIDILITE / BASF / DOWCORNING
85		VENETIAN BLINDS / VERTICAL BLINDS	FABER, MARVEL, Max, Vista

Sl.No.		Description of materials	List of Manufacturers
86		WALL PUTTY White Cement based	Birla Walcare / JK Putty
87		System Formwork	DOKA, RMD Quick Form & L&T

**LIST OF APPROVED MANUFACTURER FOR STRUCTURAL GLAZING,
ACP CLADDING AND GLASS FAÇADE**

Sl. No.		Description of materials	List of Manufacturers
1		Glass: Monolithic, Heat Strengthened, Toughened, Reflective, Tinted, Insulated, Laminated and Tempered Glass	St. Gobain (France/India), Glaverbel (Europe), Pilkington (USA, UK), Asahi (Japan), Viracon (USA), Guardian (USA), Saudi American Glass Factory, Interpane (USA)
2		Aluminium Extrusions	Hindalco Industries, Jindal, Bhoruka or approved equivalent subject to specified tolerance standards. Indalco
3		Stainless Steel	Salem Steel or approved equivalent
4		EPDM	AMEE Rubber Industries Pvt. Ltd., OSAKA Rubber Pvt. Ltd. or equivalent approved.
5		Double Glazing Unit Hermatically Sealed	Manufacturers listed above as item 1 and Sejal Arch. Glass/ FG Glass Industries Pvt. Ltd.
6		Expansion Anchors	HILTI or approved equivalent (with stainless steel 616 bolts, nuts & washers)
7		Chemical Anchors	HILTI or approved equivalent
8		Window Furniture: a) 4 Point Lockset b) S.S. Friction Hinges c) Patch Fittings d) Floor Springs e) Adhesive Film f) SS Handles	GIESSE or approved equivalent COTS WOLD or approved equivalent, DORMA / Geetavin/Shalimar DORMA DORMA 3 M or approved equivalent. DORMA/KICH
9		Structural Sealant	Dow Corning / GE / Wecker
10		Weather Sealant	Dow Corning / GE / Wecker
11		Foam Spacers and Mounting Tapes	NORTON or approved equivalent

Sl. No.		Description of materials	List of Manufacturers
12		PVDF Coatings	VALSPAR Corporation or approved equivalent.
13		Aluminium Composite	ALUCOBOND or REYBOND or Alpolic approved Metal Panels equivalent, Eurobond, Durobond
14		Baker Rod	Supreme Ind. or approved equivalent
15		Insulation	Glass wool / Rock Wool or approved equivalent
16		Spider System	Dorma or approved equivalent
17		Glass Processor	Impact Safety / Sejal Glass tech/ GSC / Asahi & FG Glass Industries Pvt. Ltd.
18			

Sd/-28-11-2014
Chief Engineer

Government of India
BHABHA ATOMIC RESEARCH CENTRE
Civil Engineering Division

Corrigendum No. 2 to Tender Documents
w.e.f. 09.09.2015

This may be read along with the existing Tender Documents published on BARC website/tender wizard BARC-DAE. The following are the changes in the existing Tender Documents:

Sr. No.1: SECTION - III - CONDITIONS OF CONTRACT: C L A U S E S O F C O N T R A C T:

CLAUSE 37 : LEVY/TAXES PAYABLE BY CONTRACTOR : Under this clause the existing **first para** is modified/ replaced with as under:

Para I- Replaced with **New Para as under:**

New Para: Sales Tax/VAT (except Service Tax), Building and other Construction Workers Welfare Cess or any other tax or Cess in respect of this contract shall be payable by the contractor and Government shall not entertain any claim whatsoever in this respect. However, in respect of service tax, same shall be paid by the contractor to the concerned department on demand and it will be reimbursed to him by the Engineer-in-Charge after satisfying that it has been actually and genuinely paid by the contractor **and the contractor shall give an undertaking that any refund allowed by the assessing authority will be passed on to BARC.**

Sr. No.2 : SECTION - III - CONDITIONS OF CONTRACT: C L A U S E S O F C O N T R A C T:

CLAUSE 19 : Under this clause **New Sub Clause** is added:

CLAUSE 19L : Contribution of EPF and ESI

The ESI and EPF contributions on the part of employer in respect of this contract shall be paid by the contractor. These contributions on the part of the employer paid by the contractor shall be reimbursed by the Engineer-in-charge to the contractor on actual basis.

Sr. No.3: A N N E X U R E – B is Modified / Revised as under:

ANNEXURE - B**LIST OF APPROVED MANUFACTURER OF BUILDING MATERIALS**

The makes have been specified in the tender document based on requirements & desired performance and detailed study of the technical parameters, manufacturing process, quality assurance/control & testing and if any bidder wishes to add any other make / brand equivalent to specified in the tender they shall inform at the time of Pre bid meeting / Technical bid submission, the same would be communicated to all the bidders if approved and would become part of the tender.

Sl. No.		Description of materials	List of Manufacturers
1	a	Ordinary Portland Cement 43 Grade	ACC, Birla Rajshree, Ultratech.
	b	Portland Pozzolana Cement (fly ash based confirming to 28 days strength requirement of OPC 43 grade)	ACC, Birla Rajshree, Ultratech,
	c	White Cement	J.K. Cement & Birla White
2		HYSD Bars (TMT Bars) confirming IS-1786	M/s SAIL, RINL, TATA, JSPL, JSW Steel, Sham Steel, Guru Nanak Metal, Metro Ispat., Metro Alloys, M/s. Bhagwati Ferro alloys, Ambe Ferro Alloys
3	a	Structural Steel Sections confirming to IS-2062	M/s. SAIL, RINL, TATA, JSPL, JSW, any other manufacturers confirming to IS-2062
	b	Structural Steel Plates confirming to IS-2062	M/s. SAIL, RINL, TATA, ESSAR, JSPL, JSW, any other manufacturers confirming to IS-2062
4	a	Flyash Bricks	M/s Shirke bricks, M/s Unicorn, M/s Shri Samarth, M/s A Cube bricks, LANVIN Infrastructure Pvt. Ltd., any other approved manufacturers.
	b	Autoclave Aerated Blocks (AAC)	M/s. Siporex , M/s AEROCON
5		Agency for Anti-Termite treatment	M/s PARAGON, PEECOPP, Express Pesticides Corporation, Pest Control (I) Ltd.
6		Tiles:	
	a	Ceramic Tiles	M/s H.R. Johnson (I) Ltd., Somany, Kajaria, Asian Granito India Ltd, Bell graneto
	b	Digital Glazed Vitrified Tiles	M/s H.R. Johnson (I) Ltd., Somany, Kajaria, Asian Granito India Ltd, Bell graneto
	c	Glazed Floor Tiles	M/s H.R. Johnson, RAK Ceramics, Bell Granito, KAJARIA, SOMANY & Asian Granito India Ltd.
	d	P V C flooring Rolls / Tile / Sheets	Premier Poly Vinyl, RMG Poly Vinyl India Ltd., (wonder floor), Armstrong, Responsive Industries Ltd., Royal Cushion Vinyl
	e	Paver Blocks, Polymer moulded Paver Blocks, Chequered concrete Floor Tiles, Unipaver Blocks	Super Tiles, Shree Precast INDUSTRIES, Pavetech Industries, Ultra Tile Pvt. Ltd., Intex Designer Tiles Pvt. Ltd. (Duracrete); Choice Mosaic Tiles.
	f	Concrete Designer wall & Floor tiles	Ultra tile, Eurocon, Duracrete

Sl. No.		Description of materials	List of Manufacturers
6	g	Acid Proof Tiles	Johnson ENDURA Tiles
	h	Tile Grout	ROFF / BALENDURA / LATICRETE
	i	Non shrink Grout	FOSROC/PIDILITE/BASF/SIKA
	j	Mossaic Tiles / Terrazo	As approved
	k	Metallic Floor Hardner	Ironite India Ltd. Triveni Colour Industries (Floor) Heatly & Gresham (India) Ltd., De Rust Chemical Corporation of India (Fermonite), Cement Research Corporation (stilonite), Kironite
	l	Metal False Flooring	M/s UNITILE Access Floor
7		Ready Mix Plaster	ROOFIT, FAIRMAT, WALPLAST
8		White Cement based wall putty	Birla Walcare / JK Putty
9		Lime, Neeru	Janatacem, Asian Paint More (Peacock), Kamal
10		Ready Mix concrete	ACC RMC, Govandi, ULTRATECH Readymix, Govandi, RMC India (Ghatkopar, Mahape) and other approved plants.
11		Concrete Admixtures	Structural waterproofing Co., FOSROC Chemicals, BASF, CICO
12		Integral Waterproofing Compound	M/s Accoproof, CICO, Impermo, Pidilite, Roffe, FOSROC, Dr. Fixit, Sunanda Chemicals
13		Agencies for Waterproofing Treatment- Cement based	M/s Modern Waterproofing, Ms/ Gemini Construction M/s National Waterproofing M/s New Bharat Waterproofing Co. M/s. Taj Enterprises M/s CICO Technologies M/s Nina Industries M/s Structural Waterproofing Company
14		PVC Water stops	M/s Omai Plastics, Caprihans India Ltd., Kanta Polymers (Kanta flex) & Fixopan
15	a	Expansion Joint Boards	M/s Shalitex, M/s. Supreme-HD-100, Duroboard (Item specific)
	b	Expansion Joint Fillers	M/s Shalitex, S.T.P. Ltd., Lloyd Insulation & BASF Chemicals, FOSROC, PIDILITE, Choksey
	c	Heavy Density Thermocol (Expanded polystyrene)	As approved
	d	Poly Sulphide Sealent	PIDILITE / BASF / DOWCORNING, Choksey
16		Doors, Windows, Partitions, Rolling Shutters, Fittings & Fixtures	
	a	Pressed Steel Door Frame	Ms SenHarvic, Anjali Enterprises, Windoors, Bharat Steel Industries Pune, M/s AGEW, M/s Sheth Fabricators, Shakti Hurmann
	b	Steel flush Doors / Hollow metal Flush Doors	Shakthimet Doors, Sheth Fabricators, M/s Ahaladha, M/s Senharvic, M/s Diamond Doors (Item Specific); Windoors, Strategic Buiding Systems, Signum Fire Protection Ltd., Anjali Enterprises, AGEW
	c	Pressed steel doors & fire resistant steel doors	Ms Shakthimet Doors, M/s Ahaladha, Strategic Building Systems, M/s. Sheth Fabricators, M/s Signum Fire Protection Ltd.
	d	Flush Door Shutter	Indian Plywood, Kitply, Anand Wood Crafts,

Sl. No.		Description of materials	List of Manufacturers
			Sejpal and others (Anand Doors), M/s Kalpatharu Doors
16	e	Masonite Wooden Panel Doors	Masonite India Ltd.
	f	FRP Door Shutter	Advance FRP & House of Doors, Eccentric Designs
	g	Steel Windows	M/s SenHarvic, AGEW, Windoors, Anjali Enterprises, M/s. Sheth Fabricators, M/s. NCL Seccolor & Bharath Steel (Pune)
	h	Mild Steel Rolling Shutters, G.I. Rolling Shutters, Stainless steel & aluminium rolling shutters	Windoors, Dodia, Bharath, Vijaylakshmi Rolling Shutters & M/s Anjali Enterprises
	i	Motorized Rolling Shutters & Motorized Gates	M/s. Gandhi automation Pvt. Ltd., Vijalakshmi Rolling Shutters
	j	Block Board	Wood India – Calcutta, Sejpal & others, Pioneer Timber Products, Chandigarh, Balaji Action Build well (Action Tesa)
	k	Ply Wood	Indian Plywood Mfg. Ltd. (Anchor), Kitply, Century Plywood, Associate Ply
	l	Pre Laminated & Plain Particle Boards	ASIS, ARCHIDPLY, Action TESA
	m	Factory made solid wooden panel doors	Kalpatharu Doors, M/s Jawahar Saw Mills, M/s Sreeji Wood Craft
	n	Fibre Cement boards	Everest-E-Boards / Charminiar –C-Boards & ECOPRO & Shera boards
	o	Textured Fibre Boards	SHERA boards & Everest E-boards
	p	Aluminium Flush door shutters	Alufins
	q	Adhesive for wood	Fevicol, Vamicol, Dunlop, Araldite
	r	Aluminium Grills	M/s Decogrille
	s	Hardware Fittings & fixtures	M/s Jayant Metal, Shalimar hardware, Everite, Garnish, Diamond, Navbharat, SAIF Enterprises, Hardwin Traders, Godrej, DE Lock Industries, Explore Engineers, Garg, Classic, EBCO, Kich
	t	Aluminium Extruded Sections	Jindal, Indal, Hindalco, Bhoruka, M/s Royale Touche, Geetavin
	u	Aluminium Powder Coated Curtain rods	As approved
	v	Factory made Ready to fix Aluminium Windows	M/s. Geeta Aluminum
	w	Dry wall partitions	M/s. Gypsum India Ltd. (Saint Gobain, M/s. RAMCO HILUX (calcium silicate (ITEM SPECIFIC)
	x	Floor Springs & Door Closers	Hardwyn, Everite, Hyper, Garnish
	y	VENETIAN BLINDS / VERTICAL BLINDS	FABER, MARVEL, Max, Vista
17		Cement Based Paint	M/s Snowcem India Ltd. (Super snowcem, Sandex Matt), Berger-(Rabiacem), Apoorva Buildcare
18		Distemper & Paints Acrylic Emulsion, Enamel, Luster coat	M/s Asian Paints, Kansai Nerolac Paints Ltd., ICI Paints, AKzo NOBLE Paints, Berger Paints India Ltd., Jenson Nicholson, Garware Paints Ltd. & Shalimar Paints

Sl. No.		Description of materials	List of Manufacturers
19		Elastomeric Paints	Apoorva Buildcare
20		Polyurethane Paints	MRFL – Metal Coats
21		Textured Plaster / Paint	Renovo, Durashield, RUF & TUF of Sherwin Williams [BJN Paints]
22		Anti-fungal paint	Artilin Paints, weather shield AKZO NOBLE Paints, Royal Shyne of Asian Paints
23	a	Epoxy paint	Asian paints, Berger, Shalimar, Amorloc, Huntsman
23	b	Epoxy Flooring	HUNTSMAN, Fosroc
24	a	Tar felts	M/s. S.T.P. Ltd., Lloyd Insulation, Tiki Tar Industries
	b	Chemical Based Water Proofing	Indofil, Flexicrete of Polyflex Industries, Fosroc, M/s. STP Ltd (Item Specific) M/s. Bitumet (Item Specific)
25		Glass wool slabs	M/s. Rock wool India Ltd.
26		Glass for Doors / Windows	Modi Guard, Emirates, Saint Gobain, Asahi (IAG & AIS), Floatglass
27		Plain Glass Mirror	M/s Modi Float Glass, Eagle, Atul, Saint Gobain, Asahi (IAG)
28		Sanitary Wares	M/s Parryware, Cera, Neycer, Hindustan Sanitary ware (Hindware)
29		PH C.P. Brass Fittings & Fixtures – All PH fittings	Jaquar, GEM, Techno, KINGSTON, Metro, ESSCO, Plato
30		C.P. BRASS Urinal Waste & Flush pipes	As approved
31		Plastic Seat & Cover for EWC	M/s Commander, Diplomat, Patel, Champion, Parryware, Hindware, CERA
32		S.S. Sink	M/s Diamond, Nirali, Parryware
33		G.I. Pipes	M/s TATA
34		G.I. Pipes other than TATA make if specified	Zenith, Jindal ,
35		G.I. Fittings	As approved
36		G.M. Gate / Globe Valves	M/s Leader Valves, Neta, SANT, Zoloto, Hawa
37		Air Valve	Leader, Sant, HAWA, M/s Kirloskar
38		Water Meter	Capstan, Keycee, Paramount
39		Sluice Valves	Kirloskar, Leader, Hawa
40		Stainless Steel Towel rods & bath Accessories	KICH, Jaquar, ESSCO, Johnson
41		Cast Iron Valves	Kirloskar, Leader, HAWA
42		C.I. Soil Quality pipes, Rain water pipes	NECO, RIFCO, A-1, PARAS, HIF
43		S.W. Pipes & Gully Trap	As approved
44		RCC Hume Pipes	M/s Indian Hume Pipes, Pranali, Cement pipe, Ghambir Pipes and products , Hindustan Pipes (Confirming to ISI)
45		HDPE Pipes & HDPE fittings	Prince, Sangir pipes, Supreme
46		RCC frame, covers	M/s Pratibha, Bharath, Vikrant
47		C.I. frame & covers; CI Gratings	NECO, M/s Ashok Iron, Foundry, HIF, Bombay Iron Works, KFAI
48		UPVC, SWR Pipes, C-PVC Pipes	Finolex, Prince, Supreme, ASTRAL

Sl. No.		Description of materials	List of Manufacturers
49		PPR Pipes	Supreme, Sakthi Polymers, PRINCE, KISAN-KSR
50		PVC Plastic High / Low level cistern	Commander, Champion, Elitedual Parryware-slimline, Hindware, Prince
51		PVC Inlet connection & Waste Pipes	Kohinoor, ESSCO, GEM & Elite
52		Concertina Coil	As approved
53		Polycarbonate sheet	TUFLITE Polymers, GE
54		Asbestos Roofing Sheets	Everest, Charminar, Asbestos Cement Ltd., VIKRANT
55		Colour Coated Steel / Zinc-alu alloy roofing sheets	Kirby, Steelfab & Colour Roof India Ltd., M/s SAFZIP
56		Aluminium Roofing Sheets	M/s. CRIL, KALZIP, SAFZIP (Item Specific)
57		BITUMEN	HPCL, BPCL & Indian oil Corporation
58		Bitumen Emulsion	IWL, STP, HPCL
69		PVC water tank	SINTEX
60		FRP water tank	Devi Polymers, BINANI
61		Polymers (Styrene Butadine Rubber)	BASF, Pidilite & ROFFE, BASF

LIST OF APPROVED MANUFACTURER FOR STRUCTURAL GLAZING, ACP CLADDING AND GLASS
FAÇADE

Sl. No.		Description of materials	List of Manufacturers
1		Glass: Monolithic, Heat Strengthened, Toughened, Reflective, Tinted, Insulated, Laminated and Tempered Glass	St. Gobain (France/India), Glaverbel (Europe), Pilkington (USA, UK), Asahi (Japan), Viracon (USA), Guardian (USA), Saudi American Glass Factory, Interpane (USA)
2		Aluminium Extrusions	Hindalco Industries, Jindal, Bhoruka or approved equivalent subject to specified tolerance standards. Indalco
3		Stainless Steel	Salem Steel or approved equivalent
4		EPDM	AMEE Rubber Industries Pvt. Ltd., OSAKA Rubber Pvt. Ltd. or equivalent approved.
5		Double Glazing Unit Hermatically Sealed	Manufacturers listed above as item 1 and Sejal Arch. Glass/ FG Glass Industries Pvt. Ltd.
6		Expansion Anchors	HILTI or approved equivalent (with stainless steel 616 bolts, nuts & washers)
7		Chemical Anchors	HILTI or approved equivalent
8		Window Furniture: a) 4 Point Lockset b) S.S. Friction Hinges c) Patch Fittings d) Floor Springs e) Adhesive Film f) SS Handles	GIESSE or approved equivalent COTS WOLD or approved equivalent, DORMA / Geetavin/Shalimar DORMA DORMA 3 M or approved equivalent. DORMA/KICH
9		Structural Sealant	Dow Corning / GE / Wecker
10		Weather Sealant	Dow Corning / GE / Wecker
11		Foam Spacers and Mounting Tapes	NORTON or approved equivalent
12		PVDF Coatings	VALSPAR Corporation or approved equivalent.
13		Aluminium Composite	ALUCOBOND or REYBOND or Alpolic approved Metal Panels equivalent, Eurobond, Durobond
14		Baker Rod	Supreme Ind. or approved equivalent

Sl. No.		Description of materials	List of Manufacturers
15		Insulation	Glass wool / Rock Wool or approved equivalent
16		Spider System	Dorma or approved equivalent
17		Glass Processor	Impact Safety / Sejal Glass tech/ GSC / Asahi & FG Glass Industries Pvt. Ltd.
18			

Government of India
BHABHA ATOMIC RESEARCH CENTRE
Civil Engineering Division

Corrigendum No. 3 to Tender Documents
w.e.f. 19.02.2016

This may be read along with the existing Tender Documents published on BARC website/tender wizard BARC-DAE. The following are the changes in the existing Tender Documents:

ANNEXURE – B is Modified (new brands have been added at Sr.No.2, 7, 16k and at 42 in the existing list)/ Revised as under:

ANNEXURE - B**LIST OF APPROVED MANUFACTURER OF BUILDING MATERIALS**

The makes have been specified in the tender document based on requirements & desired performance and detailed study of the technical parameters, manufacturing process, quality assurance/control & testing and if any bidder wishes to add any other make / brand equivalent to specified in the tender they shall inform at the time of Pre bid meeting / Technical bid submission, the same would be communicated to all the bidders if approved and would become part of the tender.

Sl. No.		Description of materials	List of Manufacturers
1	a	Ordinary Portland Cement 43 Grade	ACC, Birla Rajshree, Ultratech.
	b	Portland Pozzolana Cement (fly ash based confirming to 28 days strength requirement of OPC 43 grade)	ACC, Birla Rajshree, Ultratech,
	c	White Cement	J.K. Cement & Birla White
2		HYSD Bars (TMT Bars) confirming IS-1786	M/s SAIL, RINL, TATA, JSPL, JSW Steel, Sham Steel, Guru Nanak Metal, Metro Ispat., Metro Alloys, M/s. Bhagwati Ferro alloys, Ambe Ferro Alloys, M/s Electrosteel Steels Ltd.
3	a	Structural Steel Sections confirming to IS-2062	M/s. SAIL, RINL, TATA, JSPL, JSW, any other manufacturers confirming to IS-2062
	b	Structural Steel Plates confirming to IS-2062	M/s. SAIL, RINL, TATA, ESSAR, JSPL, JSW, any other manufacturers confirming to IS-2062
4	a	Flyash Bricks	M/s Shirke bricks, M/s Unicorn, M/s Shri Samarth, M/s A Cube bricks, LANVIN Infrastructure Pvt. Ltd., any other approved manufacturers.
	b	Autoclave Aerated Blocks (AAC)	M/s. Siporex , M/s AEROCON
5		Agency for Anti-Termite treatment	M/s PARAGON, PEECOPP, Express Pesticides Corporation, Pest Control (I) Ltd.
6		Tiles:	
	a	Ceramic Tiles	M/s H.R. Johnson (I) Ltd., Somany, Kajaria, Asian Granito India Ltd, Bell graneto
	b	Digital Glazed Vitrified Tiles	M/s H.R. Johnson (I) Ltd., Somany, Kajaria, Asian Granito India Ltd, Bell graneto
	c	Glazed Floor Tiles	M/s H.R. Johnson, RAK Ceramics, Bell Granito, KAJARIA, SOMANY & Asian Granito India Ltd.
	d	P V C flooring Rolls / Tile / Sheets	Premier Poly Vinyl, RMG Poly Vinyl India Ltd., (wonder floor), Armstrong, Responsive Industries Ltd., Royal Cushion Vinyl
	e	Paver Blocks, Polymer moulded Paver Blocks, Chequered concrete Floor Tiles, Unipaver Blocks	Super Tiles, Shree Precast INDUSTRIES, Pavetech Industries, Ultra Tile Pvt. Ltd., Intex Designer Tiles Pvt. Ltd. (Duracrete); Choice Mosaic Tiles.
	f	Concrete Designer wall & Floor tiles	Ultra tile, Eurocon, Duracrete

Sl. No.		Description of materials	List of Manufacturers
6	g	Acid Proof Tiles	Johnson ENDURA Tiles
	h	Tile Grout	ROFF / BALENDURA / LATICRETE
	i	Non shrink Grout	FOSROC/PIDILITE/BASF/SIKA
	j	Mosaic Tiles / Terrazo	As approved
	k	Metallic Floor Hardner	Ironite India Ltd. Triveni Colour Industries (Floor) Heatly & Gresham (India) Ltd., De Rust Chemical Corporation of India (Fermonite), Cement Research Corporation (stilonite), Kironite
	l	Metal False Flooring	M/s UNITILE Access Floor
7		Ready Mix Plaster	ROOFIT, FAIRMAT, WALPLAST, ULTRATECH
8		White Cement based wall putty	Birla Walcare / JK Putty
9		Lime, Neeru	Janatacem, Asian Paint More (Peacock), Kamal
10		Ready Mix concrete	ACC RMC, Govandi, ULTRATECH Readymix, Govandi, RMC India (Ghatkopar, Mahape) and other approved plants.
11		Concrete Admixtures	Structural waterproofing Co., FOSROC Chemicals, BASF, CICO
12		Integral Waterproofing Compound	M/s Accoproof, CICO, Impermo, Pidilite, Roffe, FOSROC, Dr. Fixit, Sunanda Chemicals
13		Agencies for Waterproofing Treatment- Cement based	M/s Modern Waterproofing, Ms/ Gemini Construction M/s National Waterproofing M/s New Bharat Waterproofing Co. M/s. Taj Enterprises M/s CICO Technologies M/s Nina Industries M/s Structural Waterproofing Company
14		PVC Water stops	M/s Omai Plastics, Caprihans India Ltd., Kanta Polymers (Kanta flex) & Fixopan
15	a	Expansion Joint Boards	M/s Shalitek, M/s. Supreme-HD-100, Duroboard (Item specific)
	b	Expansion Joint Fillers	M/s Shalitek, S.T.P. Ltd., Lloyd Insulation & BASF Chemicals, FOSROC, PIDILITE, Choksey
	c	Heavy Density Thermocol (Expanded polystyrene)	As approved
	d	Poly Sulphide Sealent	PIDILITE / BASF / DOWCORNING, Choksey
16		<u>Doors, Windows, Partitions, Rolling Shutters, Fittings & Fixtures</u>	
	a	Pressed Steel Door Frame	Ms SenHarvic, Anjali Enterprises, Windoors, Bharat Steel Industries Pune, M/s AGEW, M/s Sheth Fabricators, Shakti Hurmann
	b	Steel flush Doors / Hollow metal Flush Doors	Shakthimet Doors, Sheth Fabricators, M/s Ahaladha, M/s Senharvic, M/s Diamond Doors (Item Specific); Windoors, Strategic Buiding Systems, Signum Fire Protection Ltd., Anjali Enterprises, AGEW
	c	Pressed steel doors & fire resistant steel doors	Ms Shakthimet Doors, M/s Ahaladha, Strategic Building Systems, M/s. Sheth Fabricators, M/s Signum Fire Protection Ltd.
	d	Flush Door Shutter	Indian Plywood, Kitply, Anand Wood Crafts, Sejpal and others (Anand Doors), M/s Kalpatharu Doors

Sl. No.		Description of materials	List of Manufacturers
16	e	Masonite Wooden Panel Doors	Masonite India Ltd.
	f	FRP Door Shutter	Advance FRP & House of Doors, Eccentric Designs
	g	Steel Windows	M/s SenHarvic, AGEW, Windoors, Anjali Enterprises, M/s. Sheth Fabricators, M/s. NCL Seccolor & Bharath Steel (Pune)
	h	Mild Steel Rolling Shutters, G.I. Rolling Shutters, Stainless steel & aluminium rolling shutters	Windoors, Dodia, Bharath, Vijaylakshmi Rolling Shutters & M/s Anjali Enterprises
	i	Motorized Rolling Shutters & Motorized Gates	M/s. Gandhi automation Pvt. Ltd., Vijalakshmi Rolling Shutters
	j	Block Board	Wood India – Calcutta, Sejpal & others, Pioneer Timber Products, Chandigarh, Balaji Action Build well (Action Tesa)
	k	Ply Wood	a) For permanent use in buildings: Indian Plywood Mfg. Ltd. (Anchor), Kitply, Century Plywood, Associate Ply b) For Formwork : MAGNUS DENSIFIED FILMFACED PLY WOOD, Anchor brand, Assoiciate Lumories
	l	Pre Laminated & Plain Particle Boards	ASIS, ARCHIDPLY, Action TESA
	m	Factory made solid wooden panel doors	Kalpatharu Doors, M/s Jawahar Saw Mills, M/s Sreeji Wood Craft
	n	Fibre Cement boards	Everest-E-Boards / Charminiar –C-Boards & ECOPRO & Shera boards
	o	Textured Fibre Boards	SHERA boards & Everest E-boards
	p	Aluminium Flush door shutters	Alufins
	q	Adhesive for wood	Fevicol, Vamicol, Dunlop, Araldite
	r	Aluminium Grills	M/s Decogrille
	s	Hardware Fittings & fixtures	M/s Jayant Metal, Shalimar hardware, Everite, Garnish, Diamond, Navbharat, SAIF Enterprises, Hardwin Traders, Godrej, DE Lock Industries, Explore Engineers, Garg, Classic, EBCO, Kich
	t	Aluminium Extruded Sections	Jindal, Indal, Hindalco, Bhoruka, M/s Royale Touche, Geetavin
	u	Aluminium Powder Coated Curtain rods	As approved
	v	Factory made Ready to fix Aluminium Windows	M/s. Geeta Aluminum
	w	Dry wall partitions	M/s. Gypsum India Ltd. (Saint Gobain, M/s. RAMCO HILUX (calcium silicate (ITEM SPECIFIC)
	x	Floor Springs & Door Closers	Hardwyn, Everite, Hyper, Garnish
	y	VENETIAN BLINDS / VERTICAL BLINDS	FABER, MARVEL, Max, Vista
17		Cement Based Paint	M/s Snowcem India Ltd. (Super snowcem, Sandex Matt), Berger-(Rabiacem), Apoorva Buildcare
18		Distemper & Paints Acrylic Emulsion, Enamel, Luster coat	M/s Asian Paints, Kansai Nerolac Paints Ltd., ICI Paints, AKzo NOBLE Paints, Berger Paints India Ltd., Jenson Nicholson, Garware Paints Ltd. & Shalimar Paints

Sl. No.		Description of materials	List of Manufacturers
19		Elastomeric Paints	Apoorva Buildcare
20		Polyurethane Paints	MRFL – Metal Coats
21		Textured Plaster / Paint	Renovo, Durashield, RUF & TUF of Sherwin Williams [BJN Paints]
22		Anti-fungal paint	Artilin Paints, weather shield AKZO NOBLE Paints, Royal Shyne of Asian Paints
23	a	Epoxy paint	Asian paints, Berger, Shalimar, Amorloc, Huntsman
23	b	Epoxy Flooring	HUNTSMAN, Fosroc
24	a	Tar felts	M/s. S.T.P. Ltd., Lloyd Insulation, Tiki Tar Industries
	b	Chemical Based Water Proofing	Indofil, Flexicrete of Polyflex Industries, Fosroc, M/s. STP Ltd (Item Specific) M/s. Bitumet (Item Specific)
25		Glass wool slabs	M/s. Rock wool India Ltd.
26		Glass for Doors / Windows	Modi Guard, Emirates, Saint Gobain, Asahi (IAG & AIS), Floatglass
27		Plain Glass Mirror	M/s Modi Float Glass, Eagle, Atul, Saint Gobain, Asahi (IAG)
28		Sanitary Wares	M/s Parryware, Cera, Neycer, Hindustan Sanitary ware (Hindware)
29		PH C.P. Brass Fittings & Fixtures – All PH fittings	Jaquar, GEM, Techno, KINGSTON, Metro, ESSCO, Plato
30		C.P. BRASS Urinal Waste & Flush pipes	As approved
31		Plastic Seat & Cover for EWC	M/s Commander, Diplomat, Patel, Champion, Parryware, Hindware, CERA
32		S.S. Sink	M/s Diamond, Nirali, Parryware
33		G.I. Pipes	M/s TATA
34		G.I. Pipes other than TATA make if specified	Zenith, Jindal ,
35		G.I. Fittings	As approved
36		G.M. Gate / Globe Valves	M/s Leader Valves, Neta, SANT, Zoloto, Hawa
37		Air Valve	Leader, Sant, HAWA, M/s Kirloskar
38		Water Meter	Capstan, Keycee, Paramount
39		Sluice Valves	Kirloskar, Leader, Hawa
40		Stainless Steel Towel rods & bath Accessories	KICH, Jaquar, ESSCO, Johnson
41		Cast Iron Valves	Kirloskar, Leader, HAWA
42		C.I. Soil Quality pipes, Rain water pipes	NECO, RIFCO, A-1, PARAS, HIF , SKF by M/s Singhal Iron Foundry (Pvt.) Ltd.
43		S.W. Pipes & Gully Trap	As approved
44		RCC Hume Pipes	M/s Indian Hume Pipes, Pranali, Cement pipe, Ghambir Pipes and products , Hindustan Pipes (Confirming to ISI)
45		HDPE Pipes & HDPE fittings	Prince, Sangir pipes, Supreme
46		RCC frame, covers	M/s Pratibha, Bharath, Vikrant
47		C.I. frame & covers; CI Gratings	NECO, M/s Ashok Iron, Foundry, HIF, Bombay Iron Works, KFAI
48		UPVC, SWR Pipes, C-PVC Pipes	Finolex, Prince, Supreme, ASTRAL

Sl. No.		Description of materials	List of Manufacturers
49		PPR Pipes	Supreme, Sakthi Polymers, PRINCE, KISAN-KSR
50		PVC Plastic High / Low level cistern	Commander, Champion, Elitedual Parryware-slimline, Hindware, Prince
51		PVC Inlet connection & Waste Pipes	Kohinoor, ESSCO, GEM & Elite
52		Concertina Coil	As approved
53		Polycarbonate sheet	TUFLITE Polymers, GE
54		Asbestos Roofing Sheets	Everest, Charminar, Asbestos Cement Ltd., VIKRANT
55		Colour Coated Steel / Zinc-alu alloy roofing sheets	Kirby, Steelfab & Colour Roof India Ltd., M/s SAFZIP
56		Aluminium Roofing Sheets	M/s. CRIL, KALZIP, SAFZIP (Item Specific)
57		BITUMEN	HPCL, BPCL & Indian oil Corporation
58		Bitumen Emulsion	IWL, STP, HPCL
69		PVC water tank	SINTEX
60		FRP water tank	Devi Polymers, BINANI
61		Polymers (Styrene Butadine Rubber)	BASF, Pidilite & ROFFE, BASF

LIST OF APPROVED MANUFACTURER FOR STRUCTURAL GLAZING, ACP CLADDING AND GLASS**FAÇADE**

Sl. No.		Description of materials	List of Manufacturers
1		Glass: Monolithic, Heat Strengthened, Toughened, Reflective, Tinted, Insulated, Laminated and Tempered Glass	St. Gobain (France/India), Glaverbel (Europe), Pilkington (USA, UK), Asahi (Japan), Viracon (USA), Guardian (USA), Saudi American Glass Factory, Interpane (USA)
2		Aluminium Extrusions	Hindalco Industries, Jindal, Bhoruka or approved equivalent subject to specified tolerance standards. Indalco
3		Stainless Steel	Salem Steel or approved equivalent
4		EPDM	AMEE Rubber Industries Pvt. Ltd., OSAKA Rubber Pvt. Ltd. or equivalent approved.
5		Double Glazing Unit Hermatically Sealed	Manufacturers listed above as item 1 and Sejal Arch. Glass/ FG Glass Industries Pvt. Ltd.
6		Expansion Anchors	HILTI or approved equivalent (with stainless steel 616 bolts, nuts & washers)
7		Chemical Anchors	HILTI or approved equivalent
8		Window Furniture: a) 4 Point Lockset b) S.S. Friction Hinges c) Patch Fittings d) Floor Springs e) Adhesive Film f) SS Handles	GIESSE or approved equivalent COTS WOLD or approved equivalent, DORMA / Geetavin/Shalimar DORMA DORMA 3 M or approved equivalent. DORMA/KICH
9		Structural Sealant	Dow Corning / GE / Wecker
10		Weather Sealant	Dow Corning / GE / Wecker
11		Foam Spacers and Mounting Tapes	NORTON or approved equivalent
12		PVDF Coatings	VALSPAR Corporation or approved equivalent.
13		Aluminium Composite	ALUCOBOND or REYBOND or Alpolic approved Metal Panels equivalent, Eurobond, Durobond
14		Baker Rod	Supreme Ind. or approved equivalent

Sl. No.		Description of materials	List of Manufacturers
15		Insulation	Glass wool / Rock Wool or approved equivalent
16		Spider System	Dorma or approved equivalent
17		Glass Processor	Impact Safety / Sejal Glass tech/ GSC / Asahi & FG Glass Industries Pvt. Ltd.
18			

Government of India
BHABHA ATOMIC RESEARCH CENTRE
Civil Engineering Division

Corrigendum No. 4 to Tender Documents
w.e.f. 29.07.2016

This may be read along with the existing Tender Documents published on BARC website/tender wizard BARC-DAE. The following are the changes in the existing Tender Documents:

ANNEXURE – B is Modified (new brands have been added at Sr.No. 4(b) , 6(h), 6(m) and at Sr. No. 7 in the existing list) / Revised as under:

ANNEXURE - B**LIST OF APPROVED MANUFACTURER OF BUILDING MATERIALS**

The makes have been specified in the tender document based on requirements & desired performance and detailed study of the technical parameters, manufacturing process, quality assurance/control & testing and if any bidder wishes to add any other make / brand equivalent to specified in the tender they shall inform at the time of Pre bid meeting / Technical bid submission, the same would be communicated to all the bidders if approved and would become part of the tender.

Sl. No.		Description of materials	List of Manufacturers
1	a	Ordinary Portland Cement 43 Grade	ACC, Birla Rajshree, Ultratech.
	b	Portland Pozzolana Cement (fly ash based confirming to 28 days strength requirement of OPC 43 grade)	ACC, Birla Rajshree, Ultratech,
	c	White Cement	J.K. Cement & Birla White
2		HYSD Bars (TMT Bars) confirming IS-1786	M/s SAIL, RINL, TATA, JSPL, JSW Steel, Sham Steel, Guru Nanak Metal, Metro Ispat., Metro Alloys, M/s. Bhagwati Ferro alloys, Ambe Ferro Alloys, M/s Electrosteel Steels Ltd.
3	a	Structural Steel Sections confirming to IS-2062	M/s. SAIL, RINL, TATA, JSPL, JSW, any other manufacturers confirming to IS-2062
	b	Structural Steel Plates confirming to IS-2062	M/s. SAIL, RINL, TATA, ESSAR, JSPL, JSW, any other manufacturers confirming to IS-2062
4	a	Flyash Bricks	M/s Shirke bricks, M/s Unicorn, M/s Shri Samarth, M/s A Cube bricks, LANVIN Infrastructure Pvt. Ltd., any other approved manufacturers.
	b	Autoclave Aerated Blocks (AAC)	M/s. Siporex , M/s AEROCON, XTRALITE of M/s UltraTech Cement Ltd. ,
5		Agency for Anti-Termite treatment	M/s PARAGON, PEECOPP, Express Pesticides Corporation, Pest Control (I) Ltd.
6		Tiles:	
	a	Ceramic Tiles	M/s H.R. Johnson (I) Ltd., Somany, Kajaria, Asian Granito India Ltd, Bell graneto
	b	Digital Glazed Vitrified Tiles	M/s H.R. Johnson (I) Ltd., Somany, Kajaria, Asian Granito India Ltd, Bell graneto
	c	Glazed Floor Tiles	M/s H.R. Johnson, RAK Ceramics, Bell Granito, KAJARIA, SOMANY & Asian Granito India Ltd.
	d	P V C flooring Rolls / Tile / Sheets	Premier Poly Vinyl , RMG Poly Vinyl India Ltd. , (wonder floor), Armstrong , Responsive Industries Ltd. , Royal Cushion Vinyl
	e	Paver Blocks, Polymer moulded Paver Blocks, Chequered concrete Floor Tiles, Unipaver Blocks	Super Tiles , Shree Precast INDUSTRIES , Pavetech Industries , Ultra Tile Pvt. Ltd. , Intex Designer Tiles Pvt. Ltd. (Duracrete) ; Choice Mosaic Tiles .
	f	Concrete Designer wall & Floor tiles	Ultra tile, Eurocon, Duracrete

Sl. No.		Description of materials	List of Manufacturers
6	g	Acid Proof Tiles	Johnson ENDURA Tiles
	h	Tile Grout	ROFF / BALENDURA / LATICRETE / TILEFIXO of M/s UltraTech Cement Ltd., FIXOTILE of ACC Ltd.
	i	Non shrink Grout	FOSROC/PIDILITE/BASF/SIKA/ ACCOGGOUT of ACC Ltd.
	j	Mossaic Tiles / Terrazo	As approved
	k	Metallic Floor Hardner	Ironite India Ltd. Triveni Colour Industries (Floor) Heatly & Gresham (India) Ltd., De Rust Chemical Corporation of India (Fermonite), Cement Research Corporation (stilonite), Kironite
	l	Metal False Flooring	M/s UNITILE Access Floor
	m	Thin Jointing Mortar	FIXOBLOCK of M/s UltraTech Cement Ltd., ACCOFIX of ACC Ltd.
7		Ready Mix Plaster	ROOFIT, FAIRMAT, WALPLAST, READIPLAST of ULTRATECH Cement Ltd., ACCOPlast of ACC Ltd.
8		White Cement based wall putty	Birla Walcare / JK Putty
9		Lime, Neeru	Janatacem, AsianPaintMore (Peacock), Kamal
10		Ready Mix concrete	ACC RMC, Govandi, ULTRATECH Readymix, Govandi, RMC India (Ghatkopar, Mahape) and other approved plants.
11		Concrete Admixtures	Structural waterproofing Co., FOSROC Chemicals, BASF, CICO
12		Integral Waterproofing Compound	M/s Accoproof, CICO, Impermo, Pidilite, Roffe, FOSROC, Dr. Fixit, Sunanda Chemicals
13		Agencies for Waterproofing Treatment- Cement based	M/s Modern Waterproofing, Ms/ Gemini Construction M/s National Waterproofing M/s New Bharat Waterproofing Co. M/s. Taj Enterprises M/s CICO Technologies M/s Nina Industries M/s Structural Waterproofing Company
14		PVC Water stops	M/s Omai Plastics, Caprihans India Ltd., Kanta Polymers (Kanta flex) & Fixopan
15	a	Expansion Joint Boards	M/s Shalitek, M/s. Supreme-HD-100, Duroboard (Item specific)
	b	Expansion Joint Fillers	M/s Shalitek, S.T.P. Ltd., Lloyd Insulation & BASF Chemicals, FOSROC, PIDILITE, Choksey
	c	Heavy Density Thermocol (Expanded polystyrene)	As approved
	d	Poly Sulphide Sealent	PIDILITE / BASF / DOWCORNING, Choksey
16		Doors, Windows, Partitions, Rolling Shutters, Fittings & Fixtures	
	a	Pressed Steel Door Frame	Ms SenHarvic, Anjali Enterprises, Windoors, Bharat Steel Industries Pune, M/s AGEW, M/s Sheth Fabricators, Shakti Hurmann
	b	Steel flush Doors / Hollow metal Flush Doors	Shakthimet Doors, Sheth Fabricators, M/s Ahaladha, M/s Senharvic, M/s Diamond Doors (Item Specific); Windoors, Strategic Buiding Systems, Signum Fire Protection Ltd., Anjali Enterprises, AGEW
	c	Pressed steel doors & fire resistant steel doors	Ms Shakthimet Doors, M/s Ahaladha, Strategic Building Systems, M/s. Sheth Fabricators, M/s Signum Fire Protection Ltd.

Sl. No.		Description of materials	List of Manufacturers
16	d	Flush Door Shutter	Indian Plywood, Kitply, Anand Wood Crafts, Sejpal and others (Anand Doors), M/s Kalpatharu Doors
	e	Masonite Wooden Panel Doors	Masonite India Ltd.
	f	FRP Door Shutter	Advance FRP & House of Doors, Eccentric Designs
	g	Steel Windows	M/s SenHarvic, AGEW, Windoors, Anjali Enterprises, M/s. Sheth Fabricators, M/s. NCL Seccolor & Bharath Steel (Pune)
	h	Mild Steel Rolling Shutters, G.I. Rolling Shutters, Stainless steel & aluminium rolling shutters	Windoors, Dodia, Bharath, Vijaylakshmi Rolling Shutters & M/s Anjali Enterprises
	i	Motorized Rolling Shutters & Motorized Gates	M/s. Gandhi automation Pvt. Ltd., Vijalakshmi Rolling Shutters
	j	Block Board	Wood India – Calcutta, Sejpal & others, Pioneer Timber Products, Chandigarh, Balaji Action Build well (Action Tesa)
	k	Ply Wood	a) For permanent use in buildings: Indian Plywood Mfg. Ltd. (Anchor), Kitply, Century Plywood, Associate Ply b) For Formwork : MAGNUS DENSIFIED FILMFACED PLY WOOD, Anchor brand, Associate Lumories
	l	Pre Laminated & Plain Particle Boards	ASIS, ARCHIDPLY, Action TESA
	m	Factory made solid wooden panel doors	Kalpatharu Doors, M/s Jawahar Saw Mills, M/s Sreeji Wood Craft
	n	Fibre Cement boards	Everest-E-Boards / Charminiar –C-Boards & ECOPRO & Shera boards
	o	Textured Fibre Boards	SHERA boards & Everest E-boards
	p	Aluminium Flush door shutters	Alufins
	q	Adhesive for wood	Fevicol, Vamicol, Dunlop, Araldite
	r	Aluminium Grills	M/s Decogrille
	s	Hardware Fittings & fixtures	M/s Jayant Metal, Shalimar hardware, Everite, Garnish, Diamond, Navbharat, SAIF Enterprises, Hardwin Traders, Godrej, DE Lock Industries, Explore Engineers, Garg, Classic, EBCO, Kich
	t	Aluminium Extruded Sections	Jindal, Indal, Hindalco, Bhoruka, M/s Royale Touche, Geetavin
	u	Aluminium Powder Coated Curtain rods	As approved
	v	Factory made Ready to fix Aluminium Windows	M/s. Geeta Aluminum
	w	Dry wall partitions	M/s. Gypsum India Ltd. (Saint Gobain, M/s. RAMCO HILUX (calcium silicate (ITEM SPECIFIC)
	x	Floor Springs & Door Closers	Hardwyn, Everite, Hyper, Garnish
	y	VENETIAN BLINDS / VERTICAL BLINDS	FABER, MARVEL, Max, Vista
17		Cement Based Paint	M/s Snowcem India Ltd. (Super snowcem, Sandex Matt), Berger-(Rabiaceem), Apoorva Buildcare
18		Distemper & Paints Acrylic Emulsion, Enamel, Luster coat	M/s Asian Paints, Kansai Nerolac Paints Ltd., ICI Paints, AKzo NOBLE Paints, Berger Paints India Ltd., Jenson Nicholson, Garware Paints Ltd. & Shalimar Paint

Sl. No.		Description of materials	List of Manufacturers
19		Elastomeric Paints	Apoorva Buildcare
20		Polyurethane Paints	MRFL – Metal Coats
21		Textured Plaster / Paint	Renovo, Durashield, RUF & TUF of Sherwin Williams [BJN Paints]
22		Anti-fungal paint	Artilin Paints, weather shield AKZO NOBLE Paints, Royal Shyne of Asian Paints
23	a	Epoxy paint	Asian paints, Berger, Shalimar, Amorloc, Huntsman
23	b	Epoxy Flooring	HUNTSMAN, Fosroc
24	a	Tar felts	M/s. S.T.P. Ltd., Lloyd Insulation, Tiki Tar Industries
	b	Chemical Based Water Proofing	Indofil, Flexicrete of Polyflex Industries, Fosroc, M/s. STP Ltd (Item Specific) M/s. Bitumet (Item Specific)
25		Glass wool slabs	M/s. Rock wool India Ltd.
26		Glass for Doors / Windows	Modi Guard, Emirates, Saint Gobain, Asahi (IAG & AIS), Floatglass
27		Plain Glass Mirror	M/s Modi Float Glass, Eagle, Atul, Saint Gobain, Asahi (IAG)
28		Sanitary Wares	M/s Parryware, Cera, Neycer, Hindustan Sanitary ware (Hindware)
29		PH C.P. Brass Fittings & Fixtures – All PH fittings	Jaquar, GEM, Techno, KINGSTON, Metro, ESSCO, Plato
30		C.P. BRASS Urinal Waste & Flush pipes	As approved
31		Plastic Seat & Cover for EWC	M/s Commander, Diplomat, Patel, Champion, Parryware, Hindware, CERA
32		S.S. Sink	M/s Diamond, Nirali, Parryware
33		G.I. Pipes	M/s TATA
34		G.I. Pipes other than TATA make if specified	Zenith, Jindal ,
35		G.I. Fittings	As approved
36		G.M. Gate / Globe Valves	M/s Leader Valves, Neta, SANT, Zoloto, Hawa
37		Air Valve	Leader, Sant, HAWA, M/s Kirloskar
38		Water Meter	Capstan, Keycee, Paramount
39		Sluice Valves	Kirloskar, Leader, Hawa
40		Stainless Steel Towel rods & bath Accessories	KICH, Jaquar, ESSCO, Johnson
41		Cast Iron Valves	Kirloskar, Leader, HAWA
42		C.I. Soil Quality pipes, Rain water pipes	NECO, RIFCO, A-1, PARAS, HIF , SKF by M/s Singhal Iron Foundry (Pvt.) Ltd.
43		S.W. Pipes & Gully Trap	As approved
44		RCC Hume Pipes	M/s Indian Hume Pipes, Pranali, Cement pipe, Ghambir Pipes and products , Hindustan Pipes (Confirming to ISI)
45		HDPE Pipes & HDPE fittings	Prince, Sangir pipes, Supreme
46		RCC frame, covers	M/s Pratibha, Bharath, Vikrant
47		C.I. frame & covers; CI Gratings	NECO, M/s Ashok Iron, Foundry, HIF, Bombay Iron Works, KFAI
48		UPVC, SWR Pipes, C-PVC Pipes	Finolex, Prince, Supreme, ASTRAL

Sl. No.		Description of materials	List of Manufacturers
49		PPR Pipes	Supreme, Sakthi Polymers, PRINCE, KISAN-KSR
50		PVC Plastic High / Low level cistern	Commander, Champion, Elitedual Parryware-slimline, Hindware, Prince
51		PVC Inlet connection & Waste Pipes	Kohinoor, ESSCO, GEM & Elite
52		Concertina Coil	As approved
53		Polycarbonate sheet	TUFLITE Polymers, GE
54		Asbestos Roofing Sheets	Everest, Charminar, Asbestos Cement Ltd., VIKRANT
55		Colour Coated Steel / Zinc-alu alloy roofing sheets	Kirby, Steelfab & Colour Roof India Ltd., M/s SAFZIP
56		Aluminium Roofing Sheets	M/s. CRIL, KALZIP, SAFZIP (Item Specific)
57		BITUMEN	HPCL, BPCL & Indian oil Corporation
58		Bitumen Emulsion	IWL, STP, HPCL
69		PVC water tank	SINTEX
60		FRP water tank	Devi Polymers, BINANI
61		Polymers (Styrene Butadine Rubber)	BASF, Pidilite & ROFFE, BASF

LIST OF APPROVED MANUFACTURER FOR STRUCTURAL GLAZING, ACP CLADDING AND GLASS**FAÇADE**

Sl. No.		Description of materials	List of Manufacturers
1		Glass: Monolithic, Heat Strengthened, Toughened, Reflective, Tinted, Insulated, Laminated and Tempered Glass	St. Gobain (France/India), Glaverbel (Europe), Pilkington (USA, UK), Asahi (Japan), Viracon (USA), Guardian (USA), Saudi American Glass Factory, Interpane (USA)
2		Aluminium Extrusions	Hindalco Industries, Jindal, Bhoruka or approved equivalent subject to specified tolerance standards. Indalco
3		Stainless Steel	Salem Steel or approved equivalent
4		EPDM	AMEE Rubber Industries Pvt. Ltd., OSAKA Rubber Pvt. Ltd. or equivalent approved.
5		Double Glazing Unit Hermatically Sealed	Manufacturers listed above as item 1 and Sejal Arch. Glass/ FG Glass Industries Pvt. Ltd.
6		Expansion Anchors	HILTI or approved equivalent (with stainless steel 616 bolts, nuts & washers)
7		Chemical Anchors	HILTI or approved equivalent
8		Window Furniture: a) 4 Point Lockset b) S.S. Friction Hinges c) Patch Fittings d) Floor Springs e) Adhesive Film f) SS Handles	GIESSE or approved equivalent COTS WOLD or approved equivalent, DORMA / Geetavin/Shalimar DORMA DORMA 3 M or approved equivalent. DORMA/KICH
9		Structural Sealant	Dow Corning / GE / Wecker
10		Weather Sealant	Dow Corning / GE / Wecker
11		Foam Spacers and Mounting Tapes	NORTON or approved equivalent
12		PVDF Coatings	VALSPAR Corporation or approved equivalent.
13		Aluminium Composite	ALUCOBOND or REYBOND or Alpolic approved Metal Panels equivalent, Eurobond, Durobond
14		Baker Rod	Supreme Ind. or approved equivalent

Sl. No.		Description of materials	List of Manufacturers
15		Insulation	Glass wool / Rock Wool or approved equivalent
16		Spider System	Dorma or approved equivalent
17		Glass Processor	Impact Safety / Sejal Glass tech/ GSC / Asahi & FG Glass Industries Pvt. Ltd.
18			

Government of India
BHABHA ATOMIC RESEARCH CENTRE
Civil Engineering Division

Corrigendum No. 5 to Tender Documents
w.e.f. 09.03.2018

This may be read along with the existing Tender Documents published on BARC website/tender wizard BARC-DAE. The following are the changes in the existing Tender Documents:

Sr. No.1: Tender SECTION - II -GENERAL RULES AND DIRECTIONS:

Clause No.15:

Existing at present:

(i) Sales Tax/VAT (except Service Tax for which BARC will provide certificate) Purchase Tax, Turnover tax or any other tax applicable in respect of this contract shall be payable by the contractor and government will not entertain any claim whatsoever in respect of the same.

Now Replaced with New Para as under:

(i) **GST** or any other tax applicable in respect of **inputs procured by the contractor** for this contract shall be payable by the Contractor and Government will not entertain any claim whatsoever in respect of the same. However, **component of GST at time of supply of service (as provided in CGST Act 2017) provided by the contract shall be varied if different from that applicable on the last date of receipt of tender including extension if any.**

Sr. No.2: Tender Section III: CONDITIONS OF CONTRACT:

DEFINITIONS:

Para 2 (xvi):

At present: No provision

Under this clause New Sub Clause is added as under:

2(xvi) GST shall mean Goods and Service Tax – Central, State and Inter State.

Sr. No.3: Tender Section III: CONDITIONS OF CONTRACT:

CLAUSES OF CONTRACT

Clause No. 37 :

Existing at present: (i) Sales Tax / VAT (except Service Tax for which exemption certificate shall be provided by BARC), Building and other Construction Workers Welfare Cess or any other tax or cess in respect of this contract shall be payable by the contractor and Government shall not entertain any claim whatsoever in this respect. However, in respect of service tax, in consultancy contract the same shall be paid by the contractor/consultant to the concerned department on demand and it will be reimbursed to him by the Engineer-in-Charge after satisfying that it has been actually and genuinely paid by the contractor.

Now Replaced with New Para as under:

(i) **GST**, Building and other Construction Workers **Welfare** Cess or any other tax, **levy** or Cess in respect of **input for or output by** this contract shall be payable by the Contractor and Government shall not entertain any claim whatsoever in this respect **except as provided under Clause 38.**

Sr. No.4: Tender Section III: CONDITIONS OF CONTRACT:

CLAUSES OF CONTRACT

Clause No. 38 :

Existing at present: (i) All tendered rates shall be inclusive of all taxes and levies (except Service Tax) payable under respective statutes. However, if any further tax or levy is imposed by Statute, after the last stipulated date for the receipt of tender including extensions, if any and the contractor thereupon necessarily and properly pays such taxes/levies, the contractor shall be reimbursed the amount so paid, provided such payments, if any, is not, in the opinion of the Superintending Engineer (whose decision shall be final and binding on the contractor) attributable to delay in execution of work within the control of the contractor.

Now Replaced with New Para as under:

(i) All tendered rates shall be inclusive of any tax, levy or cess applicable on last stipulated date of receipt of tender including extension if any. No adjustment i.e. increase or decrease shall be made for any variation in the rate of GST, Building and other Construction Workers Cess or any tax, levy or cess applicable on inputs. However, effect of variation in rates of GST or Building and other Construction Workers Cess or imposition or repeal of any other tax, levy or cess applicable on output of the works contract shall be adjusted on either side, increase or decrease. Provided for Building and other Construction Workers Cess or any tax (other than GST), levy or cess varied or imposed after the last date of receipt of tender including extension if any, any increase shall be reimbursed to the contractor only if the contractor necessarily and properly pays such increased amount of taxes/levies/cess. Provided further that such adjustment GST shall not be made in the extended period of contract for which the contractor alone is responsible for delay as determined by authority for extension of time under Clause 5 in Schedule F.

**Sr. No.5 : A N N E X U R E – B is modified/ replaced with Revised ANNEXURE-B
(new materials/brands have been added at Sr.No. 6 a, b, c, d, g, n, o, p, 7, 13, 16 h, w, z, 22 a, b, 23 c, d, 61, 62, 63 and at Sr. No. 64 in the existing list} as under:**

ANNEXURE - B

LIST OF APPROVED MANUFACTURER OF BUILDING MATERIALS

The makes have been specified in the tender document based on requirements & desired performance and detailed study of the technical parameters, manufacturing process, quality assurance/control & testing and if any bidder wishes to add any other make / brand equivalent to specified in the tender they shall inform at the time of Pre bid meeting / Technical bid submission, the same would be communicated to all the bidders if approved and would become part of the tender.

Sl. No.		Description of materials	List of Manufacturers
1	a	Ordinary Portland Cement 43 Grade	ACC, Birla Rajshree, Ultratech.
	b	Portland Pozzolana Cement (fly ash based confirming to 28 days strength requirement of OPC 43 grade)	ACC, Birla Rajshree, Ultratech,
	c	White Cement	J.K. Cement & Birla White
2		HYSD Bars (TMT Bars) confirming IS-1786	M/s SAIL, RINL, TATA, JSPL, JSW Steel, Sham Steel, Guru Nanak Metal, Metro Ispat., Metro Alloys, M/s. Bhagwati Ferro alloys, Ambe Ferro Alloys, M/s Electrosteel Steels Ltd.
3	a	Structural Steel Sections confirming to IS-2062	M/s. SAIL, RINL, TATA, JSPL, JSW, any other manufacturers confirming to IS-2062
	b	Structural Steel Plates confirming to IS-2062	M/s. SAIL, RINL, TATA, ESSAR, JSPL, JSW, any other manufacturers confirming to IS-2062
4	a	Flyash Bricks	M/s Shirke bricks, M/s Unicorn, M/s Shri Samarth, M/s A Cube bricks, LANVIN Infrastructure Pvt. Ltd., any other approved manufacturers.
	b	Autoclave Aerated Blocks (AAC)	M/s. Siporex , M/s AEROCON, XTRALITE of M/s UltraTech Cement Ltd.,
5		Agency for Anti-Termite treatment	M/s PARAGON, PEECOPP, Express Pesticides Corporation, Pest Control (I) Ltd.
6		Tiles:	
	a	Ceramic Tiles	M/s H.R. Johnson (I) Ltd., Somany, Kajaria, Asian Granito India Ltd, Bell graneto, NITCO LTD. , Orient Bell Limited (After Bell Ceramics acquired by Orient)
	b	Digital Glazed Vitrified Tiles	M/s H.R. Johnson (I) Ltd., Somany, Kajaria, Asian Granito India Ltd, Bell graneto, NITCO LTD. , Orient Bell Limited (After Bell Ceramics acquired by Orient)

Sl. No.		Description of materials	List of Manufacturers
6	c	Glazed Floor Tiles	M/s H.R. Johnson, RAK Ceramics, Bell Granito, KAJARIA, SOMANY & Asian Granito India Ltd., NITCO LTD., Orient Bell Limited (After Bell Ceramics acquired by Orient)
	d	P V C flooring Rolls / Tile / Sheets	Premier Poly Vinyl, RMG Poly Vinyl India Ltd., (wonder floor), Armstrong, Responsive Industries Ltd., Royal Cushion Vinyl
	e	Paver Blocks, Polymer moulded Paver Blocks, Chequered concrete Floor Tiles, Unipaver Blocks	Super Tiles, Shree Precast INDUSTRIES, Pavetech Industries, Ultra Tile Pvt. Ltd., Intex Designer Tiles Pvt. Ltd. (Duracrete); Choice Mosaic Tiles.
	f	Concrete Designer wall & Floor tiles	Ultra tile, Eurocon, Duracrete
	g	Acid Alkali Proof Tiles (Heavy Duty Tiles/Pavers)	Johnson ENDURA Tiles, Orient Bell Limited (After Bell Ceramics acquired by Orient)
	h	Tile Grout	ROFF / BALENDURA / LATICRETE / TILEFIXO of M/s UltraTech Cement Ltd., FIXOTILE of ACC Ltd., Shalimar Tar Products (STP) Ltd.
	i	Non shrink Grout	FOSROC/PIDILITE/BASF/SIKA/ACCOGGOUT of ACC Ltd., Shalimar Tar Products (STP) Ltd.
	j	Mossaic Tiles / Terrazo	NITCO LTD., Or As approved
	k	Metallic Floor Hardner	Ironite India Ltd. Triveni Colour Industries (Floor) Heatly & Gresham (India) Ltd., De Rust Chemical Corporation of India (Fermonite), Cement Research Corporation (stilonite), Kironite, Shalimar Tar Products (STP) Ltd.
	l	Metal False Flooring	M/s UNITILE Access Floor
	m	Thin Jointing Mortar	FIXOBLOCK of M/s UltraTech Cement Ltd., ACCOFIX of ACC Ltd., Shalimar Tar Products (STP) Ltd., SILICOfix of M/S Precise Conchem Pvt. Ltd.
	n	Non Metallic Floor Hardner	Shalimar Tar Products (STP) Ltd.
	o	Marble Tiles	NITCO LTD.
	p	Germ Free Tiles	Orient Bell Limited (After Bell Ceramics acquired by Orient)
7		Ready Mix Plaster	ROOFIT, FAIRMAT, WALPLAST, READIPLAST of ULTRATECH Cement Ltd., ACCOPlast of ACC Ltd., SILICOplast of M/S Precise Conchem Pvt. Ltd.
8		White Cement based wall putty	Birla Walcare / JK Putty
9		Lime, Neeru	Janatacem, AsianPaintMore(Peacock), Kamal
10		Ready Mix concrete	ACC RMC, Govandi, ULTRATECH Readymix, Govandi, RMC India (Ghatkopar, Mahape) and other approved plants.
11		Concrete Admixtures	Structural waterproofing Co., FOSROC Chemicals, BASF, CICO

Sl. No.		Description of materials	List of Manufacturers
12		Integral Waterproofing Compound	M/s Accoproof, CICO, Impermo, Pidilite, Roffe, FOSROC, Dr. Fixit, Sunanda Chemicals
13		Agencies for Waterproofing Treatment- Cement based	M/s Modern Waterproofing, Ms/ Gemini Construction M/s National Waterproofing M/s New Bharat Waterproofing Co. M/s. Taj Enterprises M/s CICO Technologies M/s Nina Industries M/s Structural Waterproofing Company M/s Raj Waterproofing Co., Chembur-Mumbai
14		PVC Water stops	M/s Omai Plastics, Caprihans India Ltd., Kanta Polymers (Kanta flex) & Fixopan
15	a	Expansion Joint Boards	M/s Shalitex, M/s. Supreme-HD-100, Duroboard (Item specific)
	b	Expansion Joint Fillers	M/s Shalitex, S.T.P. Ltd., Lloyd Insulation & BASF Chemicals, FOSROC, PIDILITE, Choksey
	c	Heavy Density Thermocol (Expanded polystyrene)	As approved
	d	Poly Sulphide Sealent	PIDILITE / BASF / DOWCORNING, Choksey
16		Doors, Windows, Partitions, Rolling Shutters, Fittings & Fixtures	
	a	Pressed Steel Door Frame	Ms SenHarvic, Anjali Enterprises, Windoors, Bharat Steel Industries Pune, M/s AGEW, M/s Sheth Fabricators, Shakti Hurmann
	b	Steel flush Doors / Hollow metal Flush Doors	Shakthimet Doors, Sheth Fabricators, M/s Ahaladha, M/s Senharvic, M/s Diamond Doors (Item Specific); Windoors, Strategic Buiding Systems, Signum Fire Protection Ltd., Anjali Enterprises, AGEW
	c	Pressed steel doors & fire resistant steel doors	Ms Shakthimet Doors, M/s Ahaladha, Strategic Building Systems, M/s. Sheth Fabricators, M/s Signum Fire Protection Ltd.
	d	Flush Door Shutter	Indian Plywood, Kitply, Anand Wood Crafts, Sejpal and others (Anand Doors), M/s Kalpatharu Doors
	e	Masonite Wooden Panel Doors	Masonite India Ltd.
	f	FRP Door Shutter	Advance FRP & House of Doors, Eccentric Designs
	g	Steel Windows	M/s SenHarvic, AGEW, Windoors, Anjali Enterprises, M/s. Sheth Fabricators, M/s. NCL Seccolor & Bharath Steel (Pune)
	h	Mild Steel Rolling Shutters, G.I. Rolling Shutters, Stainless steel & aluminium rolling shutters	Windoors, Dodia, Bharath, Vijaylakshmi Rolling Shutters , M/s Anjali Enterprises, M/s Azad Rolling Shutter & Construction, Kota, Shri Ambika Manufacturing Co. Chembur Mumbai,

Sl. No.		Description of materials	List of Manufacturers
16	i	Motorized Rolling Shutters & Motorized Gates	M/s. Gandhi automation Pvt. Ltd., Vijalakshmi Rolling Shutters
	j	Block Board	Wood India – Calcutta, Sejpal & others, Pioneer Timber Products, Chandigarh, Balaji Action Build well (Action Tesa)
	k	Ply Wood	a) For permanent use in buildings: Indian Plywood Mfg. Ltd. (Anchor), Kitply, Century Plywood, Associate Ply b) For Formwork : MAGNUS DENSIFIED FILMFACED PLY WOOD, Anchor brand, Associate Lumories
	l	Pre Laminated & Plain Particle Boards	ASIS, ARCHIDPLY, Action TESA
	m	Factory made solid wooden panel doors	Kalpatharu Doors, M/s Jawahar Saw Mills, M/s Sreeji Wood Craft
	n	Fibre Cement boards	Everest-E-Boards / Charminiar –C-Boards & ECOPRO & Shera boards
	o	Textured Fibre Boards	SHERA boards & Everest E-boards
	p	Aluminium Flush door shutters	Alufins
	q	Adhesive for wood	Fevicol, Vamicol, Dunlop, Araldite
	r	Aluminium Grills	M/s Decogrille
	s	Hardware Fittings & fixtures	M/s Jayant Metal, Shalimar hardware, Everite, Garnish, Diamond, Navbharat, SAIF Enterprises, Hardwin Traders, Godrej, DE Lock Industries, Explore Engineers, Garg, Classic, EBCO, Kich
	t	Aluminium Extruded Sections	Jindal, Indal, Hindalco, Bhoruka, M/s Royale Touche, Geetavin
	u	Aluminium Powder Coated Curtain rods	As approved
	v	Factory made Ready to fix Aluminium Windows	M/s. Geeta Aluminum
	w	Dry wall partitions	M/s. Gypsum India Ltd. (Saint Gobain, M/s. RAMCO HILUX (calcium silicate (ITEM SPECIFIC), Everest Industries Ltd.
	x	Floor Springs & Door Closers	Hardwyn, Everite, Hyper, Garnish
	y	VENETIAN BLINDS / VERTICAL BLINDS	FABER, MARVEL, Max, Vista
	z	PEB Structures/Metal Roofing	Everest Industries Ltd.
17		Cement Based Paint	M/s Snowcem India Ltd. (Super snowcem, Sandex Matt), Berger-(Rabiace), Apoorva Buildcare, , New World Paints
18		Distemper & Paints Acrylic Emulsion, Enamel, Luster coat	M/s Asian Paints, Kansai Nerolac Paints Ltd., ICI Paints, AKzo NOBLE Paints, Berger Paints India Ltd., Jenson Nicholson, Garware Paints Ltd. & Shalimar Paint
19		Elastomeric Paints	Apurva India Pvt. Ltd., New World Paints
20		Polyurethane Paints	MRFL – Metal Coats,

Sl. No.		Description of materials	List of Manufacturers
21		Textured Plaster / Paint	Renovo, Durashield, RUF & TUF of Sherwin Williams [BJN Paints] , New World Paints
22	a	Anti-fungal paint	Kremosoi of Artilin Paints, weather shield AKZO NOBLE Paints, Royal Shyne of Asian Paints, , New World Paints, Wall Guard II of M/s Apurva India Pvt. Ltd.
	b	Biowash	Artibose of Artilin Paints, Berger Paints India Ltd., Snowcem India Ltd.
23	a	Epoxy paint	Asian paints, Berger, Shalimar, Amorloc, Huntsman
	b	Epoxy Flooring	HUNTSMAN, Fosroc, Shalimar Tar Products (STP) Ltd.
	c	Polyurethane Flooring	Shalimar Tar Products (STP) Ltd.
	d	High Build Epoxy	Shalimar Tar Products (STP) Ltd.
24	a	Tar felts	M/s. S.T.P. Ltd., Lloyd Insulation, Tiki Tar Industries
	b	Chemical Based Water Proofing	Indofil, Flexicrete of Polyflex Industries, Fosroc, M/s. STP Ltd (Item Specific) M/s. Bitumet (Item Specific)
25		Glass wool slabs	M/s. Rock wool India Ltd.
26		Glass for Doors / Windows	Modi Guard, Emirates, Saint Gobain, Asahi (IAG & AIS), Floatglass
27		Plain Glass Mirror	M/s Modi Float Glass, Eagle, Atul, Saint Gobain, Asahi (IAG)
28		Sanitary Wares	M/s Parryware, Cera, Neycer, Hindustan Sanitary ware (Hindware)
29		PH C.P. Brass Fittings & Fixtures – All PH fittings	Jaquar, GEM, Techno, KINGSTON, Metro, ESSCO, Plato
30		C.P. BRASS Urinal Waste & Flush pipes	As approved
31		Plastic Seat & Cover for EWC	M/s Commander, Diplomat, Patel, Champion, Parryware, Hindware, CERA
32		S.S. Sink	M/s Diamond, Nirali, Parryware
33		G.I. Pipes	M/s TATA
34		G.I. Pipes other than TATA make if specified	Zenith, Jindal ,
35		G.I. Fittings	As approved
36		G.M. Gate / Globe Valves	M/s Leader Valves, Neta, SANT, Zoloto, Hawa
37		Air Valve	Leader, Sant, HAWA, M/s Kirloskar
38		Water Meter	Capstan, Keycee, Paramount
39		Sluice Valves	Kirloskar, Leader, Hawa
40		Stainless Steel Towel rods & bath Accessories	KICH, Jaquar, ESSCO, Johnson
41		Cast Iron Valves	Kirloskar, Leader, HAWA
42		C.I. Soil Quality pipes, Rain water pipes	NECO, RIFCO, A-1, PARAS, HIF , SKF by M/s Singhal Iron Foundry (Pvt.) Ltd.
43		S.W. Pipes & Gully Trap	As approved

Sl. No.	Description of materials	List of Manufacturers
44	RCC Hume Pipes	M/s Indian Hume Pipes, Pranali, Cement pipe, Ghambir Pipes and products , Hindustan Pipes (Confirming to ISI)
45	HDPE Pipes & HDPE fittings	Prince, Sangir pipes, Supreme
46	RCC frame, covers	M/s Pratibha, Bharath, Vikrant
47	C.I. frame & covers; CI Gratings	NECO, M/s Ashok Iron, Foundry, HIF, Bombay Iron Works, KFAI
48	UPVC, SWR Pipes, C-PVC Pipes	Finolex, Prince, Supreme, ASTRAL
49	PPR Pipes	Supreme, Sakthi Polymers, PRINCE, KISAN-KSR
50	PVC Plastic High / Low level cistern	Commander, Champion, Elitedual Parryware-slimline, Hindware, Prince
51	PVC Inlet connection & Waste Pipes	Kohinoor, ESSCO, GEM & Elite
52	Concertina Coil	As approved
53	Polycarbonate sheet	TUFLITE Polymers, GE
54	Asbestos Roofing Sheets	Everest, Charminar, Asbestos Cement Ltd., VIKRANT
55	Colour Coated Steel / Zinc-alu alloy roofing sheets	Kirby, Steelfab & Colour Roof India Ltd., M/s SAFZIP
56	Aluminium Roofing Sheets	M/s. CRIL, KALZIP, SAFZIP (Item Specific)
57	BITUMEN	HPCL, BPCL & Indian oil Corporation
58	Bitumen Emulsion	IWL, STP, HPCL
69	PVC water tank	SINTEX
60	FRP water tank	Devi Polymers, BINANI
61	Polymers (Styrene Butadine Rubber)	BASF, Pidilite & ROFFE, BASF, Flexicrete Acrylic Co-Polymer of M/s Apoorva Buildcare
62	Under water Repair Products	Shali Damit of Shalimar Tar Products (STP) Ltd.
63	Instant Under water Road Repair Products	Shali Patch of of Shalimar Tar Products (STP) Ltd.
64	Parallel Threaded mechanical splices	Dextra India Pvt. Ltd., M/s. Spplisetek India Pvt. Ltd.,

**LIST OF APPROVED MANUFACTURER FOR STRUCTURAL GLAZING, ACP CLADDING AND
GLASS FAÇADE**

Sl. No.		Description of materials	List of Manufacturers
1		Glass: Monolithic, Heat Strengthened, Toughened, Reflective, Tinted, Insulated, Laminated and Tempered Glass	St. Gobain (France/India), Glaverbel (Europe), Pilkington (USA, UK), Asahi (Japan), Viracon (USA), Guardian (USA), Saudi American Glass Factory, Interpane (USA)
2		Aluminium Extrusions	Hindalco Industries, Jindal, Bhoruka or approved equivalent subject to specified tolerance standards. Indalco
3		Stainless Steel	Salem Steel or approved equivalent
4		EPDM	AMEE Rubber Industries Pvt. Ltd., OSAKA Rubber Pvt. Ltd. or equivalent approved.
5		Double Glazing Unit Hermatically Sealed	Manufacturers listed above as item 1 and Sejal Arch. Glass/ FG Glass Industries Pvt. Ltd.
6		Expansion Anchors	HILTI or approved equivalent (with stainless steel 616 bolts, nuts & washers)
7		Chemical Anchors	HILTI or approved equivalent
8		Window Furniture: a) 4 Point Lockset b) S.S. Friction Hinges c) Patch Fittings d) Floor Springs e) Adhesive Film f) SS Handles	GIESSE or approved equivalent COTS WOLD or approved equivalent, DORMA / Geetavin/Shalimar DORMA DORMA 3 M or approved equivalent. DORMA/KICH
9		Structural Sealant	Dow Corning / GE / Wecker
10		Weather Sealant	Dow Corning / GE / Wecker
11		Foam Spacers and Mounting Tapes	NORTON or approved equivalent
12		PVDF Coatings	VALSPAR Corporation or approved equivalent.
13		Aluminium Composite	ALUCOBOND or REYBOND or

			Alpolic approved Metal Panels equivalent, Eurobond, Durobond
Sl. No.		Description of materials	List of Manufacturers
14		Baker Rod	Supreme Ind. or approved equivalent
15		Insulation	Glass wool / Rock Wool or approved equivalent
16		Spider System	Dorma or approved equivalent
17		Glass Processor	Impact Safety / Sejal Glass tech/ GSC / Asahi & FG Glass Industries Pvt. Ltd.
18			

Sd/-09.03.2018
Chief Engineer

**Government of India
BHABHA ATOMIC RESEARCH CENTRE
Civil Engineering Division**

Corrigendum No. 6 to Tender Documents w.e.f. 06.05.2020

This may be read along with the existing Tender Documents published on BARC website/tender wizard BARC-DAE. The following are the changes in the existing Tender Documents:

ANNEXURE – B is Modified (New brands have been added at Sr. No. 2, 6-q, 10, 16-f2, 24-c, 42 and at 48 in the existing list) / Revised as under :

ANNEXURE - B

LIST OF APPROVED MANUFACTURER OF BUILDING MATERIALS

The makes have been specified in the tender document based on requirements & desired performance and detailed study of the technical parameters, manufacturing process, quality assurance/control & testing and if any bidder wishes to add any other make / brand equivalent to specified in the tender they shall inform at the time of Pre bid meeting / Technical bid submission, the same would be communicated to all the bidders if approved and would become part of the tender.

Sl. No.		Description of materials	List of Manufacturers
1	a	Ordinary Portland Cement 43 Grade	ACC, Birla Rajshree, Ultratech
	b	Portland Pozzolana Cement (fly ash based confirming to 28 days strength requirement of OPC 43 grade)	ACC, Birla Rajshree, Ultratech
	c	White Cement	J.K. Cement & Birla White
2		HYSD Bars (TMT Bars) confirming IS-1786	M/s SAIL, M/s RINL, M/s TATA, M/s JSPL, M/s JSW Steel, M/s Sham Steel, M/s Guru Nanak Metal, M/s Metro Ispat, M/s Metro Alloys, M/s Bhagwati Ferro alloys, M/s Ambe Ferro Alloys, M/s Electrosteel Steels Ltd. - (V-XEGA- M/s Vedanta Group)
3	a	Structural Steel Sections confirming to IS-2062	M/s. SAIL, M/s RINL, M/s TATA, M/s M/s JSPL, M/s JSW, any other manufacturers confirming to IS-2062
	b	Structural Steel Plates confirming to IS-2062	M/s. SAIL, RINL, TATA, ESSAR, JSPL, JSW, any other manufacturers confirming to IS-2062
4	a	Fly-ash Bricks	M/s Shirke bricks, M/s Unicorn, M/s Shri Samarth, M/s A Cube bricks, LANVIN Infrastructure Pvt. Ltd., any other approved manufacturers.

Sl. No.		Description of materials	List of Manufacturers
	b	Autoclave Aerated Blocks (AAC)	M/s Siporex, M/s AEROCON, XTRALITE of M/s UltraTech Cement Ltd.
5		Agency for Anti-Termite treatment	M/s PARAGON, PEECOPP, Express Pesticides Corporation, Pest Control (I) Ltd.
6		Tiles:	
	a	Ceramic Tiles	M/s H.R. Johnson (I) Ltd., M/s Somany, M/s Kajaria, M/s Asian Granito India Ltd, M/s Bell graneto, M/s NITCO LTD., M/s Orient Bell Limited (After Bell Ceramics acquired by Orient)
	b	Digital Glazed Vitrified Tiles	M/s H.R. Johnson (I) Ltd., M/s Somany, M/s Kajaria, M/s Asian Granito India Ltd, M/s Bell graneto, NITCO LTD., M/s Orient Bell Limited (After Bell Ceramics acquired by Orient)
	c	Glazed Floor Tiles	M/s H.R. Johnson, RAK Ceramics, Bell Granito, KAJARIA, SOMANY & Asian Granito India Ltd., NITCO LTD., Orient Bell Limited (After Bell Ceramics acquired by Orient)
	d	P V C flooring Rolls / Tile / Sheets	Premier Poly Vinyl, RMG Poly Vinyl India Ltd., (wonder floor), Armstrong, Responsive Industries Ltd., Royal Cushion Vinyl
	e	Paver Blocks, Polymer moulded Paver Blocks, Chequered concrete Floor Tiles, Unipaver Blocks	Super Tiles, Shree Precast INDUSTRIES, Pavetech Industries, Ultra Tile Pvt. Ltd., Intex Designer Tiles Pvt. Ltd. (Duracrete); Choice Mosaic Tiles.
	f	Concrete Designer wall & Floor tiles	Ultra tile, Eurocon, Duracrete
	g	Acid Alkali Proof Tiles (Heavy Duty Tiles/Pavers)	Johnson ENDURA Tiles, Orient Bell Limited (After Bell Ceramics acquired by Orient)

Sl. No.		Description of materials	List of Manufacturers
	h	Tile Grout	ROFF / BALENDURA / LATICRETE /TILEFIXO of M/s UltraTech Cement Ltd., FIXOTILE of ACC Ltd., Shalimar Tar Products (STP) Ltd.
	i	Non shrink Grout	FOSROC / PIDILITE / BASF / SIKA / ACCOGGOUT of ACC Ltd., Shalimar Tar Products (STP) Ltd.,
	j	Mossaic Tiles / Terrazo	NITCO LTD., Or As approved
	k	Metallic Floor Hardner	Ironite India Ltd. Triveni Colour Industries (Floor) Heatly & Gresham (India) Ltd., De Rust Chemical Corporation of India (Fermonite), Cement Research Corporation (stilonite), Kironite, Shalimar Tar Products (STP) Ltd.
	l	Metal False Flooring	M/s UNITILE Access Floor
	m	Thin Jointing Mortar	FIXOBLOCK of M/s UltraTech Cement Ltd., ACCOFIX of ACC Ltd., Shalimar Tar Products (STP) Ltd., SILICOfix of M/S Precise Conchem Pvt. Ltd.
	n	Non Metallic Floor Hardner	Shalimar Tar Products (STP) Ltd.
	o	Marble Tiles	NITCO LTD.
	p	Germ Free Tiles	Orient Bell Limited (After Bell Ceramics acquired by Orient)
	q	Non shrink / Non expanding Power Grout	M/s UltraTech
7		Ready Mix Plaster	ROOFIT, FAIRMAT, WALPLAST, READIPLAST of ULTRATECH Cement Ltd., ACCOPlast of ACC Ltd., SILICOplast of M/S Precise Conchem Pvt. Ltd.
8		White Cement based wall putty	Birla Walcare / JK Putty
9		Lime, Neeru	Janatacem,AsianPaintMore(Peacock), Kamal

Sl. No.		Description of materials	List of Manufacturers
10		Ready Mix concrete	ACC RMC, Govandi, ULTRATECH Readymix, Govandi, RMC India (Ghatkopar, Mahape), M/s StarCrete LLP, Mahape (M/s Ashwini Infradevelopment Pvt. Ltd.), M/s Concretech India, Tubhe & MIDC-Pawane M/s Swastik Infra-logic (I) Pvt. Ltd., M/s TNA Readymix India Private Ltd. and other approved plants.
11		Concrete Admixtures	Structural waterproofing Co., FOSROC Chemicals, BASF, CICO
12		Integral Waterproofing Compound	M/s Accoproof, CICO, Impermo, Pidilite, Roffe, FOSROC, Dr. Fixit, Sunanda Chemicals
13		Agencies for Waterproofing Treatment- Cement based	M/s Modern Waterproofing, Ms/ Gemini Construction M/s National Waterproofing M/s New Bharat Waterproofing Co. M/s. Taj Enterprises M/s CICO Technologies M/s Nina Industries M/s Structural Waterproofing Company M/s Raj Waterproofing Co., Chembur-Mumbai
14		PVC Water stops	M/s Omai Plastics, Caprihans India Ltd., Kanta Polymers (Kanta flex) & Fixopan
15	a	Expansion Joint Boards	M/s Shalitex, M/s. Supreme-HD-100, Duroboard (Item specific)
	b	Expansion Joint Fillers	M/s Shalitex, S.T.P. Ltd., Lloyd Insulation & BASF Chemicals, FOSROC, PIDILITE, Choksey
	c	Heavy Density Thermocol (Expanded polystyrene)	As approved

Sl. No.		Description of materials	List of Manufacturers
	d	Poly Sulphide Sealant	PIDILITE / BASF / DOWCORNING, Choksey
16		Doors, Windows, Partitions, Rolling Shutters, Fittings & Fixtures	
	a	Pressed Steel Door Frame	M/s SenHarvic, Anjali Enterprises, Windoors, Bharat Steel Industries Pune, M/s AGEW, M/s Sheth Fabricators, Shakti Hurmann
	b	Steel flush Doors / Hollow metal Flush Doors	Shakthimet Doors, Sheth Fabricators, M/s Ahaladha, M/s Senharvic, M/s Diamond Doors (Item Specific); Windoors, Strategic Buiding Systems, Signum Fire Protection Ltd., Anjali Enterprises, AGEW
	c	Pressed steel doors & fire resistant steel doors	Ms Shakthimet Doors, M/s Ahaladha, Strategic Building Systems, M/s. Sheth Fabricators, M/s Signum Fire Protection Ltd.
	d	Flush Door Shutter	Indian Plywood, Kitply, Anand Wood Crafts, Sejpal and others (Anand Doors), M/s Kalpatharu Doors
	e	Masonite Wooden Panel Doors	Masonite India Ltd.
	f1	FRP Door Shutter	Advance FRP & House of Doors, Eccentric Designs
	f2	PVC Doors & window shutters, false ceiling, walls & partition panels	M/s. Jain Irrigation Systems Ltd.
	g	Steel Windows	M/s SenHarvic, AGEW, Windoors, Anjali Enterprises, M/s. Sheth Fabricators, M/s. NCL Seccolor & Bharath Steel (Pune)

Sl. No.		Description of materials	List of Manufacturers
	h	Mild Steel Rolling Shutters, G.I. Rolling Shutters, Stainless steel & aluminium rolling shutters	Windoors, Dodia, Bharath, Vijaylakshmi Rolling Shutters, M/s Anjali Enterprises, M/s Azad Rolling Shutter & Construction, Kota, Shri Ambika Manufacturing Co. Chembur Mumbai,
	i	Motorized Rolling Shutters & Motorized Gates	M/s. Gandhi automation Pvt. Ltd., Vijalakshmi Rolling Shutters
	j	Block Board	Wood India – Calcutta, Sejpal & others, Pioneer Timber Products, Chandigarh, Balaji Action Build well (Action Tesa)
	k	Ply Wood	a) For permanent use in buildings: Indian Plywood Mfg. Ltd. (Anchor), Kitply, Century Plywood, Associate Ply b) For Formwork : MAGNUS DENSIFIED FILMFACED PLY WOOD, Anchor brand, Associate Lumories
	l	Pre Laminated & Plain Particle Boards	ASIS, ARCHIDPLY, Action TESA
	m	Factory made solid wooden panel doors	Kalpatharu Doors, M/s Jawahar Saw Mills, M/s Sreeji Wood Craft
	n	Fibre Cement boards	Everest-E-Boards / Charminar –C-Boards & ECOPRO & Shera boards
	o	Textured Fibre Boards	SHERA boards & Everest E-boards
	p	Aluminium Flush door shutters	Alufins
	q	Adhesive for wood	Fevicol, Vamicol, Dunlop, Araldite
	r	Aluminium Grills	M/s Decogrille
	s	Hardware Fittings & fixtures	M/s Jayant Metal, Shalimar hardware, Everite, Garnish, Diamond, Navbharat, SAIF Enterprises, Hardwin Traders, Godrej, DE Lock Industries, Explore Engineers, Garg, Classic, EBCO, Kich

Sl. No.		Description of materials	List of Manufacturers
	t	Aluminium Extruded Sections	Jindal, Indal, Hindalco, Bhoruka, M/s Royale Touche, Geetavin
	u	Aluminium Powder Coated Curtain rods	As approved
	v	Factory made Ready to fix Aluminium Windows	M/s. Geeta Aluminum
	w	Dry wall partitions	M/s. Gypsum India Ltd. (Saint Gobain, M/s. RAMCO HILux (calcium silicate (ITEM SPECIFIC), Everest Industries Ltd.
	x	Floor Springs & Door Closers	Hardwyn, Everite, Hyper, Garnish
	y	VENETIAN BLINDS / VERTICAL BLINDS	FABER, MARVEL, Max, Vista
	Z	PEB Structures/Metal Roofing	Everest Industries Ltd.
17		Cement Based Paint	M/s Snowcem India Ltd. (Super snowcem, Sandex Matt), Berger-(Rabiacem), Apoorva Buildcare, New World Paints
18		Distemper & Paints Acrylic Emulsion, Enamel, Luster coat	M/s Asian Paints, Kansai Nerolac Paints Ltd., ICI Paints, AKZO NOBLE Paints, Berger Paints India Ltd., Jenson Nicholson, Garware Paints Ltd. & Shalimar Paint
19		Elastomeric Paints	Apurva India Pvt. Ltd., New World Paints
20		Polyurethane Paints	MRFL – Metal Coats,
21		Textured Plaster / Paint	Renovo, Durashield, RUF & TUF of Sherwin Willams [BJN Paints] , New World Paints
22	a	Anti-fungal paint	Kremosoi of Artilin Paints, weather shield AKZO NOBLE Paints, Royal Shyne of Asian Paints, , New World Paints, Wall Guard II of M/s Apurva India Pvt. Ltd.
	b	Biowash	Artibose of Artilin Paints, Berger Paints India Ltd., Snowcem India Ltd.

Sl. No.		Description of materials	List of Manufacturers
23	a	Epoxy paint	Asian paints, Berger, Shalimar, Amorloc, Huntsman
	b	Epoxy Flooring	HUNTSMAN, Fosroc, Shalimar Tar Products (STP) Ltd.
	c	Polyurethane Flooring	Shalimar Tar Products (STP) Ltd.
	d	High Build Epoxy	Shalimar Tar Products (STP) Ltd.
24	a	Tarfelts	M/s. S.T.P. Ltd., Lloyd Insulation, Tiki Tar Industries
	b	Chemical Based Water Proofing	Indofil, Flexicrete of Polyflex Industries, Fosroc, M/s. STP Ltd (Item Specific) M/s. Bitumet (Item Specific)
	c	APP waterproofing Membrane	Sika, Tikidan
25		Glass wool slabs	M/s. Rock wool India Ltd.
26		Glass for Doors / Windows	Modi Guard, Emirates, Saint Gobain, Asahi (IAG & AIS), Floatglass
27		Plain Glass Mirror	M/s Modi Float Glass, Eagle, Atul, Saint Gobain, Asahi (IAG)
28		Sanitary Wares	M/s Parryware, Cera, Neycer, Hindustan Sanitary ware (Hindware)
29		PH C.P. Brass Fittings & Fixtures – All PH fittings	Jaquar, GEM, Techno, KINGSTON, Metro, ESSCO, Plato
30		C. P. BRASS Urinal Waste & Flush pipes	As approved
31		Plastic Seat & Cover for EWC	M/s Commander, Diplomat, Patel, Champion, Parryware, Hindware, CERA
32		S.S. Sink	M/s Diamond, Nirali, Parryware
33		G.I. Pipes	M/s TATA
34		G.I. Pipes other than TATA make if specified	Zenith, Jindal
35		G.I. Fittings	As approved
36		G.M. Gate / Globe Valves	M/s Leader Valves, Neta, SANT, Zoloto, Hawa

Sl. No.		Description of materials	List of Manufacturers
37		Air Valve	Leader, Sant, HAWA, M/s Kirloskar
38		Water Meter	Capstan, Keycee, Paramount
39		Sluice Valves	Kirloskar, Leader, Hawa
40		Stainless Steel Towel rods & bath Accessories	KICH, Jaquar, ESSCO, Johnson
41		Cast Iron Valves	Kirloskar, Leader, HAWA
42		C.I. Soil Quality pipes, Rain water pipes	NECO, RIFCO, A-1, PARAS, HIF, SKF by M/s Singhal Iron Foundry (Pvt.) Ltd., HEPCO
43		S.W. Pipes & Gully Trap	As approved
44		RCC Hume Pipes	M/s Indian Hume Pipes, Pranali, Cement pipe, Ghambir Pipes and products , Hindustan Pipes (Confirming to ISI)
45		HDPE Pipes & HDPE fittings	Prince, Sangir pipes, Supreme
46		RCC frame, covers	M/s Pratibha, Bharath, Vikrant
47		C.I. frame & covers; CI Gratings	NECO, M/s Ashok Iron, Foundry, HIF, Bombay Iron Works, KFAI
48		UPVC, SWR Pipes, C-PVC Pipes	Finolex, Prince, Supreme, ASTRAL, Jain Irrigation Systems Ltd.
49		PPR Pipes	Supreme, Sakthi Polymers, PRINCE, KISAN-KSR
50		PVC Plastic High / Low level cistern	Commander, Champion, Elitedual Parryware-slimline, Hindware, Prince
51		PVC Inlet connection & Waste Pipes	Kohinoor, ESSCO, GEM & Elite
52		Concertina Coil	As approved
53		Polycarbonate sheet	TUFLITE Polymers, GE
54		Asbestos Roofing Sheets	Everest, Charminar, Asbestos Cement Ltd., VIKRANT
55		Colour Coated Steel / Zinc-alu alloy roofing sheets	Kirby, Steelfab & Colour Roof India Ltd., M/s SAFZIP
56		Aluminium Roofing Sheets	M/s. CRIL, KALZIP, SAFZIP (Item Specific)

Sl. No.		Description of materials	List of Manufacturers
57		BITUMEN	HPCL, BPCL & Indian oil Corporation
58		Bitumen Emulsion	IWL, STP, HPCL
69		PVC water tank	SINTEX
60		FRP water tank	Devi Polymers, BINANI
61		Polymers (Styrene Butadine Rubber)	BASF, Pidilite & ROFFE, BASF, Flexicrete Acrilic Co-Polymer of M/s Apoorva Buildcare
62		Under water Repair Products	Shali Damit of Shalimar Tar Products (STP) Ltd.
63		Instant Under water Road Repair Products	Shali Patch of of Shalimar Tar Products (STP) Ltd.
64		Parallel Threaded mechanical splices	Dextra India Pvt. Ltd., M/s. Spplisetek India Pvt. Ltd.,

**LIST OF APPROVED MANUFACTURER FOR STRUCTURAL GLAZING, ACP
CLADDING AND GLASS FAÇADE**

Sl. No.	Description of materials	List of Manufacturers
1	Glass: Monolithic, Heat Strengthened, Toughened, Reflective, Tinted, Insulated, Laminated and Tempered Glass	St. Gobain (France/India), Glaverbel (Europe), Pilkington (USA, UK), Asahi (Japan), Viracon (USA), Guardian (USA), Saudi American Glass Factory, Interpane (USA)
2	Aluminium Extrusions	Hindalco Industries, Jindal, Bhoruka or approved equivalent subject to specified tolerance standards. Indalco
3	Stainless Steel	Salem Steel or approved equivalent
4	EPDM	AMEE Rubber Industries Pvt. Ltd., OSAKA Rubber Pvt. Ltd. or equivalent approved.
5	Double Glazing Unit Hermatically Sealed	Manufacturers listed above as item 1 and Sejal Arch. Glass/ FG Glass Industries Pvt. Ltd.
6	Expansion Anchors	HILTI or approved equivalent (with stainless steel 616 bolts, nuts & washers)
7	Chemical Anchors	HILTI or approved equivalent
8	Window Furniture: a) 4 Point Lockset b) S.S. Friction Hinges c) Patch Fittings d) Floor Springs e) Adhesive Film f) SS Handles	GIESSE or approved equivalent COTS WOLD or approved equivalent, DORMA / Geetavin /Shalimar DORMA DORMA 3 M or approved equivalent. DORMA/KICH
9	Structural Sealant	Dow Corning / GE / Wecker
10	Weather Sealant	Dow Corning / GE / Wecker

Sl. No.	Description of materials	List of Manufacturers
11	Foam Spacers and Mounting Tapes	NORTON or approved equivalent
12	PVDF Coatings	VALSPAR Corporation or approved equivalent.
13	Aluminium Composite	ALUCOBOND or REYBOND or Alpollic approved Metal Panels equivalent, Eurobond, Durobond
14	Baker Rod	Supreme Ind. or approved equivalent
15	Insulation	Glass wool / Rock Wool or approved equivalent
16	Spider System	Dorma or approved equivalent
17	Glass Processor	Impact Safety / Sejal Glass tech/ GSC / Asahi & FG Glass Industries Pvt. Ltd.

-Sd- 06-05-2020
Chief Engineer

**Government of India
BHABHA ATOMIC RESEARCH CENTRE
Civil Engineering Division**

Corrigendum No. 7 to Tender Documents w.e.f. 04.10.2021

This may be read along with the existing Tender Documents published on BARC website. The following are the changes in the existing Tender Documents:

ANNEXURE – B is Modified (First Para is modified) / Revised as under:

LIST OF TENTATIVE MANUFACTURER OF BUILDING MATERIALS

The tentative makes have been specified in the tender document based on requirements & desired performance and detailed study of the technical parameters, manufacturing process, quality assurance/control & testing. The list is merely for guidance and bidders can prefer any other make which is meeting technical specifications given under Section-V and Schedule of Quantities given under Section-VIII of Tender document ACED and shall confirm to the relevant BIS codes and other relevant codes. The bidder may suggest any make/ brand meeting technical parameters during pre-bid stage and before technical bid submission.

ANNEXURE - B

Sl. No.		Description of materials	List of Manufacturers
1	a	Ordinary Portland Cement 43/ 53 Grade	ACC, Birla Rajshree, Ultratech
	b	Portland Pozzolana Cement (fly ash based confirming to 28 days strength requirement of OPC 43 grade)	ACC, Birla Rajshree, Ultratech
	c	White Cement	J. K. Cement & Birla White
2		HYSD Bars (TMT Bars) confirming IS-1786	M/s SAIL, M/s RINL, M/s TATA, M/s JSPL, M/s JSW Steel, M/s Sham Steel, M/s Guru Nanak Metal, M/s Metro Ispat, M/s Metro Alloys, M/s Bhagwati Ferro alloys, M/s Ambe Ferro Alloys, M/s Electrosteel Steels Ltd. - (V-XEGA- M/s Vedanta Group)
3	a	Structural Steel Sections confirming to IS-2062	M/s. SAIL, M/s RINL, M/s TATA, M/s M/s JSPL, M/s JSW, any other manufacturers confirming to IS-2062
	b	Structural Steel Plates confirming to IS-2062	M/s. SAIL, RINL, TATA, ESSAR, JSPL, JSW, any other manufacturers confirming to IS-2062
4	a	Fly-ash Bricks	M/s Shirke bricks, M/s Unicorn, M/s Shri Samarth, M/s A Cube bricks, LANVIN Infrastructure Pvt. Ltd., any other approved manufacturers.

Sl. No.		Description of materials	List of Manufacturers
	b	Autoclave Aerated Blocks (AAC)	M/s Siporex, M/s AEROCON, XTRALITE of M/s UltraTech Cement Ltd.
5		Agency for Anti-Termite treatment	M/s PARAGON, PEECOPP, Express Pesticides Corporation, Pest Control (I) Ltd.
6		Tiles:	
	a	Ceramic Tiles	M/s H.R. Johnson (I) Ltd., M/s Somany, M/s Kajaria, M/s Asian Granito India Ltd, M/s Bell graneto, M/s NITCO LTD., M/s Orient Bell Limited (After Bell Ceramics acquired by Orient)
	b	Digital Glazed Vitrified Tiles	M/s H.R. Johnson (I) Ltd., M/s Somany, M/s Kajaria, M/s Asian Granito India Ltd, M/s Bell graneto, NITCO LTD., M/s Orient Bell Limited (After Bell Ceramics acquired by Orient)
	c	Glazed Floor Tiles	M/s H.R. Johnson, RAK Ceramics, Bell Granito, KAJARIA, SOMANY & Asian Granito India Ltd., NITCO LTD., Orient Bell Limited (After Bell Ceramics acquired by Orient)
	d	P V C flooring Rolls / Tile / Sheets	Premier Poly Vinyl, RMG Poly Vinyl India Ltd., (wonder floor), Armstrong, Responsive Industries Ltd., Royal Cushion Vinyl
	e	Paver Blocks, Polymer moulded Paver Blocks, Chequered concrete Floor Tiles, Unipaver Blocks	Super Tiles, Shree Precast INDUSTRIES, Pavetech Industries, Ultra Tile Pvt. Ltd., Intex Designer Tiles Pvt. Ltd. (Duracrete); Choice Mosaic Tiles.
	f	Concrete Designer wall & Floor tiles	Ultra tile, Eurocon, Duracrete
	g	Acid Alkali Proof Tiles (Heavy Duty Tiles/Pavers)	Johnson ENDURA Tiles, Orient Bell Limited (After Bell Ceramics acquired by Orient)

Sl. No.		Description of materials	List of Manufacturers
	h	Tile Grout	ROFF / BALENDURA / LATICRETE /TILEFIXO of M/s UltraTech Cement Ltd., FIXOTILE of ACC Ltd., Shalimar Tar Products (STP) Ltd.
	i	Non shrink Grout	FOSROC / PIDILITE / BASF / SIKA / ACCOGGOUT of ACC Ltd., Shalimar Tar Products (STP) Ltd.,
	j	Mossaic Tiles / Terrazo	NITCO LTD., Or As approved
	k	Metallic Floor Hardner	Ironite India Ltd. Triveni Colour Industries (Floor) Heatly & Gresham (India) Ltd., De Rust Chemical Corporation of India (Fermonite), Cement Research Corporation (stilonite), Kironite, Shalimar Tar Products (STP) Ltd.
	l	Metal False Flooring	M/s UNITILE Access Floor
	m	Thin Jointing Mortar	FIXOBLOCK of M/s UltraTech Cement Ltd., ACCOFIX of ACC Ltd., Shalimar Tar Products (STP) Ltd., SILICOfix of M/S Precise Conchem Pvt. Ltd.
	n	Non Metallic Floor Hardner	Shalimar Tar Products (STP) Ltd.
	o	Marble Tiles	NITCO LTD.
	p	Germ Free Tiles	Orient Bell Limited (After Bell Ceramics acquired by Orient)
	q	Non shrink / Non expanding Power Grout	M/s UltraTech
7		Ready Mix Plaster	ROOFIT, FAIRMAT, WALPLAST, READIPLAST of ULTRATECH Cement Ltd., ACCOPlast of ACC Ltd., SILICOplast of M/S Precise Conchem Pvt. Ltd.
8		White Cement based wall putty	Birla Walcare / JK Putty
9		Lime, Neeru	Janatacem, Asian Paint More(Peacock), Kamal

Sl. No.		Description of materials	List of Manufacturers
10		Ready Mix concrete	ACC RMC, Govandi, ULTRATECH Readymix, Govandi, RMC India (Ghatkopar, Mahape), M/s StarCrete LLP, Mahape (M/s Ashwini Infradevelopment Pvt. Ltd.), M/s Concretech India, Tubhe & MIDC-Pawane M/s Swastik Infra-logic (I) Pvt. Ltd., M/s TNA Readymix India Private Ltd. and other approved plants.
11		Concrete Admixtures	Structural waterproofing Co., FOSROC Chemicals, BASF, CICO
12		Integral Waterproofing Compound	M/s Accoproof, CICO, Impermo, Pidilite, Roffe, FOSROC, Dr. Fixit, Sunanda Chemicals
13		Agencies for Waterproofing Treatment- Cement based	M/s Modern Waterproofing, Ms/ Gemini Construction M/s National Waterproofing M/s New Bharat Waterproofing Co. M/s. Taj Enterprises M/s CICO Technologies M/s Nina Industries M/s Structural Waterproofing Company M/s Raj Waterproofing Co., Chembur-Mumbai
14		PVC Water stops	M/s Omai Plastics, Caprihans India Ltd., Kanta Polymers (Kanta flex) & Fixopan
15	a	Expansion Joint Boards	M/s Shalitex, M/s. Supreme-HD-100, Duroboard (Item specific)
	b	Expansion Joint Fillers	M/s Shalitex, S.T.P. Ltd., Lloyd Insulation & BASF Chemicals, FOSROC, PIDILITE, Choksey
	c	Heavy Density Thermocol (Expanded polystyrene)	As approved

Sl. No.		Description of materials	List of Manufacturers
	d	Poly Sulphide Sealant	PIDILITE / BASF / DOWCORNING, Choksey
16		Doors, Windows, Partitions, Rolling Shutters, Fittings & Fixtures	
	a	Pressed Steel Door Frame	M/s SenHarvic, Anjali Enterprises, Windoors, Bharat Steel Industries Pune, M/s AGEW, M/s Sheth Fabricators, Shakti Hurmann
	b	Steel flush Doors / Hollow metal Flush Doors	Shakthimet Doors, Sheth Fabricators, M/s Ahaladha, M/s Senharvic, M/s Diamond Doors (Item Specific); Windoors, Strategic Buiding Systems, Signum Fire Protection Ltd., Anjali Enterprises, AGEW
	c	Pressed steel doors & fire resistant steel doors	Ms Shakthimet Doors, M/s Ahaladha, Strategic Building Systems, M/s. Sheth Fabricators, M/s Signum Fire Protection Ltd.
	d	Flush Door Shutter	Indian Plywood, Kitply, Anand Wood Crafts, Sejpal and others (Anand Doors), M/s Kalpatharu Doors
	e	Masonite Wooden Panel Doors	Masonite India Ltd.
	f1	FRP Door Shutter	Advance FRP & House of Doors, Eccentric Designs
	f2	PVC Doors & window shutters, false ceiling, walls & partition panels	M/s. Jain Irrigation Systems Ltd.
	g	Steel Windows	M/s SenHarvic, AGEW, Windoors, Anjali Enterprises, M/s. Sheth Fabricators, M/s. NCL Seccolor & Bharath Steel (Pune)

Sl. No.		Description of materials	List of Manufacturers
	h	Mild Steel Rolling Shutters, G.I. Rolling Shutters, Stainless steel & aluminium rolling shutters	Windoors, Dodia, Bharath, Vijaylakshmi Rolling Shutters, M/s Anjali Enterprises, M/s Azad Rolling Shutter & Construction, Kota, Shri Ambika Manufacturing Co. Chembur Mumbai,
	i	Motorized Rolling Shutters & Motorized Gates	M/s. Gandhi automation Pvt. Ltd., Vijalakshmi Rolling Shutters
	j	Block Board	Wood India – Calcutta, Sejpal & others, Pioneer Timber Products, Chandigarh, Balaji Action Build well (Action Tesa)
	k	Ply Wood	a) For permanent use in buildings: Indian Plywood Mfg. Ltd. (Anchor), Kitply, Century Plywood, Associate Ply b) For Formwork : MAGNUS DENSIFIED FILMFACED PLY WOOD, Anchor brand, Associate Lumories
	l	Pre Laminated & Plain Particle Boards	ASIS, ARCHIDPLY, Action TESA
	m	Factory made solid wooden panel doors	Kalpatharu Doors, M/s Jawahar Saw Mills, M/s Sreeji Wood Craft
	n	Fibre Cement boards	Everest-E-Boards / Charminar –C-Boards & ECOPRO & Shera boards
	o	Textured Fibre Boards	SHERA boards & Everest E-boards
	p	Aluminium Flush door shutters	Alufins
	q	Adhesive for wood	Fevicol, Vamicol, Dunlop, Araldite
	r	Aluminium Grills	M/s Decogrille
	s	Hardware Fittings & fixtures	M/s Jayant Metal, Shalimar hardware, Everite, Garnish, Diamond, Navbharat, SAIF Enterprises, Hardwin Traders, Godrej, DE Lock Industries, Explore Engineers, Garg, Classic, EBCO, Kich

Sl. No.		Description of materials	List of Manufacturers
	t	Aluminium Extruded Sections	Jindal, Indal, Hindalco, Bhorka, M/s Royale Touche, Geetavin
	u	Aluminium Powder Coated Curtain rods	As approved
	v	Factory made Ready to fix Aluminium Windows	M/s. Geeta Aluminum
	w	Dry wall partitions	M/s. Gypsum India Ltd. (Saint Gobain, M/s. RAMCO HILUX (calcium silicate (ITEM SPECIFIC), Everest Industries Ltd.
	x	Floor Springs & Door Closers	Hardwyn, Everite, Hyper, Garnish
	y	VENETIAN BLINDS / VERTICAL BLINDS	FABER, MARVEL, Max, Vista
	Z	PEB Structures/Metal Roofing	Everest Industries Ltd.
17		Cement Based Paint	M/s Snowcem India Ltd. (Super snowcem, Sandex Matt), Berger-(Rabiacem), Apoorva Buildcare, New World Paints
18		Distemper & Paints Acrylic Emulsion, Enamel, Luster coat	M/s Asian Paints, Kansai Nerolac Paints Ltd., ICI Paints, AKZO NOBLE Paints, Berger Paints India Ltd., Jenson Nicholson, Garware Paints Ltd. & Shalimar Paint
19		Elastomeric Paints	Apurva India Pvt. Ltd., New World Paints
20		Polyurethane Paints	MRFL – Metal Coats,
21		Textured Plaster / Paint	Renovo, Durashield, RUF & TUF of Sherwin Williams [BJN Paints], New World Paints
22	a	Anti-fungal paint	Kremosoi of Artilin Paints, weather shield AKZO NOBLE Paints, Royal Shyne of Asian Paints, New World Paints, Wall Guard II of M/s Apurva India Pvt. Ltd.
	b	Biowash	Artibose of Artilin Paints, Berger Paints India Ltd., Snowcem India Ltd.

Sl. No.		Description of materials	List of Manufacturers
23	a	Epoxy paint	Asian paints, Berger, Shalimar, Amorloc, Huntsman
	b	Epoxy Flooring	HUNTSMAN, Fosroc, Shalimar Tar Products (STP) Ltd.
	c	Polyurethane Flooring	Shalimar Tar Products (STP) Ltd.
	d	High Build Epoxy	Shalimar Tar Products (STP) Ltd.
24	a	Tarfelts	M/s. S.T.P. Ltd., Lloyd Insulation, Tiki Tar Industries
	b	Chemical Based Water Proofing	Indofil, Flexicrete of Polyflex Industries, Fosroc, M/s. STP Ltd (Item Specific) M/s. Bitumet (Item Specific)
	c	APP waterproofing Membrane	Sika, Tikidan
25		Glass wool slabs	M/s. Rock wool India Ltd.
26		Glass for Doors / Windows	Modi Guard, Emirates, Saint Gobain, Asahi (IAG & AIS), Floatglass
27		Plain Glass Mirror	M/s Modi Float Glass, Eagle, Atul, Saint Gobain, Asahi (IAG)
28		Sanitary Wares	M/s Parryware, Cera, Neycer, Hindustan Sanitary ware (Hindware)
29		PH C.P. Brass Fittings & Fixtures – All PH fittings	Jaquar, GEM, Techno, KINGSTON, Metro, ESSCO, Plato
30		C. P. BRASS Urinal Waste & Flush pipes	As approved
31		Plastic Seat & Cover for EWC	M/s Commander, Diplomat, Patel, Champion, Parryware, Hindware, CERA
32		S.S. Sink	M/s Diamond, Nirali, Parryware
33		G.I. Pipes	M/s TATA
34		G.I. Pipes other than TATA make if specified	Zenith, Jindal
35		G.I. Fittings	As approved
36		G.M. Gate / Globe Valves	M/s Leader Valves, Neta, SANT, Zoloto, Hawa

Sl. No.		Description of materials	List of Manufacturers
37		Air Valve	Leader, Sant, HAWA, M/s Kirloskar
38		Water Meter	Capstan, Keycee, Paramount
39		Sluice Valves	Kirloskar, Leader, Hawa
40		Stainless Steel Towel rods & bath Accessories	KICH, Jaquar, ESSCO, Johnson
41		Cast Iron Valves	Kirloskar, Leader, HAWA
42		C.I. Soil Quality pipes, Rain water pipes	NECO, RIFCO, A-1, PARAS, HIF, SKF by M/s Singhal Iron Foundry (Pvt.) Ltd., HEPCO
43		S.W. Pipes & Gully Trap	As approved
44		RCC Hume Pipes	M/s Indian Hume Pipes, Pranali, Cement pipe, Ghambir Pipes and products, Hindustan Pipes (Confirming to ISI)
45		HDPE Pipes & HDPE fittings	Prince, Sangir pipes, Supreme
46		RCC frame, covers	M/s Pratibha, Bharath, Vikrant
47		C.I. frame & covers; CI Gratings	NECO, M/s Ashok Iron, Foundry, HIF, Bombay Iron Works, KFAI
48		UPVC, SWR Pipes, C-PVC Pipes	Finolex, Prince, Supreme, ASTRAL, Jain Irrigation Systems Ltd.
49		PPR Pipes	Supreme, Sakthi Polymers, PRINCE, KISAN-KSR
50		PVC Plastic High / Low level cistern	Commander, Champion, Elitedual Parryware-slimline, Hindware, Prince
51		PVC Inlet connection & Waste Pipes	Kohinoor, ESSCO, GEM & Elite
52		Concertina Coil	As approved
53		Polycarbonate sheet	TUFLITE Polymers, GE
54		Asbestos Roofing Sheets	Everest, Charminar, Asbestos Cement Ltd., VIKRANT
55		Colour Coated Steel / Zinc-alu alloy roofing sheets	Kirby, Steelfab & Colour Roof India Ltd., M/s SAFZIP
56		Aluminium Roofing Sheets	M/s. CRIL, KALZIP, SAFZIP (Item Specific)

Sl. No.		Description of materials	List of Manufacturers
57		BITUMEN	HPCL, BPCL & Indian oil Corporation
58		Bitumen Emulsion	IWL, STP, HPCL
69		PVC water tank	SINTEX
60		FRP water tank	Devi Polymers, BINANI
61		Polymers (Styrene Butadine Rubber)	BASF, Pidilite & ROFFE, BASF, Flexicrete Acrilic Co-Polymer of M/s Apoorva Buildcare
62		Under water Repair Products	Shali Damit of Shalimar Tar Products (STP) Ltd.
63		Instant Under water Road Repair Products	Shali Patch of of Shalimar Tar Products (STP) Ltd.
64		Parallel Threaded mechanical splices	Dextra India Pvt. Ltd., M/s. Spplcetek India Pvt. Ltd.,

**LIST OF APPROVED MANUFACTURER FOR STRUCTURAL GLAZING, ACP
CLADDING AND GLASS FAÇADE**

Sl. No.	Description of materials	List of Manufacturers
1	Glass: Monolithic, Heat Strengthened, Toughened, Reflective, Tinted, Insulated, Laminated and Tempered Glass	St. Gobain (France/India), Glaverbel (Europe), Pilkington (USA, UK), Asahi (Japan), Viracon (USA), Guardian (USA), Saudi American Glass Factory, Interpane (USA)
2	Aluminium Extrusions	Hindalco Industries, Jindal, Bhorka or approved equivalent subject to specified tolerance standards. Indalco
3	Stainless Steel	Salem Steel or approved equivalent
4	EPDM	AMEE Rubber Industries Pvt. Ltd., OSAKA Rubber Pvt. Ltd. Or equivalent approved.
5	Double Glazing Unit Hermatically Sealed	Manufacturers listed above as item 1 and Sejal Arch. Glass/ FG Glass Industries Pvt. Ltd.
6	Expansion Anchors	HILTI or approved equivalent (with stainless steel 616 bolts, nuts & washers)
7	Chemical Anchors	HILTI or approved equivalent
8	Window Furniture: a) 4 Point Lockset b) S.S. Friction Hinges c) Patch Fittings d) Floor Springs e) Adhesive Film f) SS Handles	GIESSE or approved equivalent COTS WOLD or approved equivalent, DORMA / Geetavin /Shalimar DORMA DORMA 3 M or approved equivalent. DORMA/KICH
9	Structural Sealant	Dow Corning / GE / Wecker
10	Weather Sealant	Dow Corning / GE / Wecker

Sl. No.	Description of materials	List of Manufacturers
11	Foam Spacers and Mounting Tapes	NORTON or approved equivalent
12	PVDF Coatings	VALSPAR Corporation or approved equivalent.
13	Aluminium Composite	ALUCOBOND or REYBOND or Alpolic approved Metal Panels equivalent, Eurobond, Durobond
14	Baker Rod	Supreme Ind. or approved equivalent
15	Insulation	Glass wool / Rock Wool or approved equivalent
16	Spider System	Dorma or approved equivalent
17	Glass Processor	Impact Safety / Sejal Glass tech/ GSC / Asahi & FG Glass Industries Pvt. Ltd.

Government of India
BHABHA ATOMIC RESEARCH CENTRE
Civil Engineering Division

Corrigendum No. 8 to Tender Documents w.e.f. 04.10.2021

This may be read along with the existing Tender Documents published on BARC website. The following are the changes in existing Section-VIII of Tender ACED:

ANNEXURE – F is added as under:

APPENDIX - F

FORM OF CERTIFICATE FOR ELIGIBLE SOURCE COUNTRIES

(To be submitted on Bidder's Letter head)

I/We, ... (Name of the Bidder), have read the **NIT clauses** regarding restrictions on procurement from a Bidder of a country which shares a land border with India, and I/we am/are not from such a country'' or, from such a country (indicate country.....), have been registered with Competent Authority and submit a certificate herewith as an evidence of valid registration by the Competent Authority''.

I/We hereby certify that I/We am/are fulfilling all requirements in this regard and eligible to be considered, in accordance to **NIT clauses**.

I/We acknowledge the right of the Employer that absence of such a certificate in the bid, if the Bidder belongs to such country stated above, shall disqualify the Bidder.

I/We acknowledge the right of the Employer to terminate the Bidder for false declaration or certificate, along with such other actions as may be permissible under law.

Signature of the Bidder

**Government of India
BHABHA ATOMIC RESEARCH CENTRE
Civil Engineering Division**

Corrigendum No. 9 to Tender Documents w.e.f. 23.05.2022

This may be read along with the existing Tender Documents published on BARC website. The following are the changes in the existing Tender Documents:

ANNEXURE – B is Modified (New brands have been added at Sr. No. 65, 66, 67 and at 13 in the existing list) / Revised as under

ANNEXURE – B

LIST OF TENTATIVE MANUFACTURER OF BUILDING MATERIALS

The tentative makes have been specified in the tender document based on requirements & desired performance and detailed study of the technical parameters, manufacturing process, quality assurance/control & testing. The list is merely for guidance and bidders can prefer any other make which is meeting technical specifications given under Section-V and Schedule of Quantities given under Section-VIII of Tender document ACED and shall confirm to the relevant BIS codes and other relevant codes. The bidder may suggest any make/ brand meeting technical parameters during pre-bid stage and before technical bid submission.

Sl. No.		Description of materials	List of Manufacturers
1	a	Ordinary Portland Cement 43/ 53 Grade	ACC, Birla Rajshree, Ultratech
	b	Portland Pozzolana Cement (fly ash based confirming to 28 days strength requirement of OPC 43 grade)	ACC, Birla Rajshree, Ultratech
	c	White Cement	J. K. Cement & Birla White

Sl. No.		Description of materials	List of Manufacturers
2		HYSD Bars (TMT Bars) confirming IS-1786	M/s SAIL, M/s RINL, M/s TATA, M/s JSPL, M/s JSW Steel, M/s Sham Steel, M/s Guru Nanak Metal, M/s Metro Ispat, M/s Metro Alloys, M/s Bhagwati Ferro alloys, M/s Ambe Ferro Alloys, M/s Electrosteel Steels Ltd. - (V-XEGA- M/s Vedanta Group)
3	a	Structural Steel Sections confirming to IS-2062	M/s. SAIL, M/s RINL, M/s TATA, M/s JSPL, M/s JSW, any other manufacturers confirming to IS-2062
	b	Structural Steel Plates confirming to IS-2062	M/s. SAIL, RINL, TATA, ESSAR, JSPL, JSW, any other manufacturers confirming to IS-2062
4	a	Fly-ash Bricks	M/s Shirke bricks, M/s Unicorn, M/s Shri Samarth, M/s A Cube bricks, LANVIN Infrastructure Pvt. Ltd., any other approved manufacturers.
	b	Autoclave Aerated Blocks (AAC)	M/s Siporex, M/s AEROCON, XTRALITE of M/s UltraTech Cement Ltd.
5		Agency for Anti-Termite treatment	M/s PARAGON, PEECOPP, Express Pesticides Corporation, Pest Control (I) Ltd.
6		Tiles:	
	a	Ceramic Tiles	M/s H.R. Johnson (I) Ltd., M/s Somany, M/s Kajaria, M/s Asian Granito India Ltd, M/s Bell graneto, M/s NITCO LTD., M/s Orient Bell Limited (After Bell Ceramics acquired by Orient)
	b	Digital Glazed Vitrified Tiles	M/s H.R. Johnson (I) Ltd., M/s Somany, M/s Kajaria, M/s Asian Granito India Ltd, M/s Bell graneto, NITCO LTD., M/s Orient Bell Limited (After Bell Ceramics acquired by Orient)

Sl. No.		Description of materials	List of Manufacturers
	c	Glazed Floor Tiles	M/s H.R. Johnson, RAK Ceramics, Bell Granito, KAJARIA, SOMANY & Asian Granito India Ltd., NITCO LTD., Orient Bell Limited (After Bell Ceramics acquired by Orient)
	d	P V C flooring Rolls / Tile / Sheets	Premier Poly Vinyl, RMG Poly Vinyl India Ltd., (wonder floor), Armstrong, Responsive Industries Ltd., Royal Cushion Vinyl
	e	Paver Blocks, Polymer moulded Paver Blocks, Chequered concrete Floor Tiles, Unipaver Blocks	Super Tiles, Shree Precast INDUSTRIES, Pavetech Industries, Ultra Tile Pvt. Ltd., Intex Designer Tiles Pvt. Ltd. (Duracrete); Choice Mosaic Tiles.
	f	Concrete Designer wall & Floor tiles	Ultra tile, Eurocon, Duracrete
	g	Acid Alkali Proof Tiles (Heavy Duty Tiles/Pavers)	Johnson ENDURA Tiles, Orient Bell Limited (After Bell Ceramics acquired by Orient)
	h	Tile Grout	ROFF / BALENDURA / LATICRETE /TILEFIXO of M/s UltraTech Cement Ltd., FIXOTILE of ACC Ltd., Shalimar Tar Products (STP) Ltd.
	i	Non shrink Grout	FOSROC / PIDILITE / BASF / SIKA / ACCOGGOUT of ACC Ltd., Shalimar Tar Products (STP) Ltd.,
	j	Mosaic Tiles / Terrazo	NITCO LTD., Or As approved
	k	Metallic Floor Hardner	Ironite India Ltd. Triveni Colour Industries (Floor) Heatly & Gresham (India) Ltd., De Rust Chemical Corporation of India (Fermonite), Cement Research Corporation (stilonite), Kironite, Shalimar Tar Products (STP) Ltd.
	l	Metal False Flooring	M/s UNITILE Access Floor

Sl. No.		Description of materials	List of Manufacturers
	m	Thin Jointing Mortar	FIXOBLOCK of M/s UltraTech Cement Ltd., ACCOFIX of ACC Ltd., Shalimar Tar Products (STP) Ltd., SILICOfix of M/S Precise Conchem Pvt. Ltd.
	n	Non Metallic Floor Hardner	Shalimar Tar Products (STP) Ltd.
	o	Marble Tiles	NITCO LTD.
	p	Germ Free Tiles	Orient Bell Limited (After Bell Ceramics acquired by Orient)
	q	Non shrink / Non expanding Power Grout	M/s UltraTech
7		Ready Mix Plaster	ROOFIT, FAIRMAT, WALPLAST, READIPLAST of ULTRATECH Cement Ltd., ACCOPlast of ACC Ltd., SILICOplast of M/S Precise Conchem Pvt. Ltd.
8		White Cement based wall putty	Birla Walcare / JK Putty
9		Lime, Neeru	Janatacem, Asian Paint More(Peacock), Kamal
10		Ready Mix concrete	ACC RMC, Govandi, ULTRATECH Readymix, Govandi, RMC India (Ghatkopar, Mahape), M/s StarCrete LLP, Mahape (M/s Ashwini Infradevelopment Pvt. Ltd.), M/s Concrettech India, Tubhe & MIDC-Pawane M/s Swastik Infra-logic (I) Pvt. Ltd., M/s TNA Readymix India Private Ltd. and other approved plants.
11		Concrete Admixtures	Structural waterproofing Co., FOSROC Chemicals, BASF, CICO
12		Integral Waterproofing Compound	M/s Accoproof, CICO, Impermo, Pidilite, Roffe, FOSROC, Dr. Fixit, Sunanda Chemicals

Sl. No.		Description of materials	List of Manufacturers
13		Agencies for Waterproofing Treatment- Cement based	M/s Modern Waterproofing, Ms/ Gemini Construction M/s National Waterproofing M/s New Bharat Waterproofing Co. M/s. Taj Enterprises M/s CICO Technologies M/s Nina Industries M/s Structural Waterproofing Company M/s Raj Waterproofing Co., Chembur-Mumbai
14		PVC Water stops	M/s Omai Plastics, Caprihans India Ltd., Kanta Polymers (Kanta flex) & Fixopan
15	a	Expansion Joint Boards	M/s Shalitex, M/s. Supreme-HD-100, Duroboard (Item specific)
	b	Expansion Joint Fillers	M/s Shalitex, S.T.P. Ltd., Lloyd Insulation & BASF Chemicals, FOSROC, PIDILITE, Choksey
	c	Heavy Density Thermocol (Expanded polystyrene)	As approved
	d	Poly Sulphide Sealant	PIDILITE / BASF / DOWCORNING, Choksey
16		Doors, Windows, Partitions, Rolling Shutters, Fittings & Fixtures	
	a	Pressed Steel Door Frame	M/s SenHarvic, Anjali Enterprises, Windoors, Bharat Steel Industries Pune, M/s AGEW, M/s Sheth Fabricators, Shakti Humann
	b	Steel flush Doors / Hollow metal Flush Doors	Shakthimet Doors, Sheth Fabricators, M/s Ahaladha, M/s Senharvic, M/s Diamond Doors (Item Specific); Windoors, Strategic Buiding Systems, Signum Fire Protection Ltd., Anjali Enterprises, AGEW

Sl. No.		Description of materials	List of Manufacturers
	c	Pressed steel doors & fire resistant steel doors	Ms Shakthimet Doors, M/s Ahaladha, Strategic Building Systems, M/s. Sheth Fabricators, M/s Signum Fire Protection Ltd.
	d	Flush Door Shutter	Indian Plywood, Kitply, Anand Wood Crafts, Sejpal and others (Anand Doors), M/s Kalpatharu Doors
	e	Masonite Wooden Panel Doors	Masonite India Ltd.
	f1	FRP Door Shutter	Advance FRP & House of Doors, Eccentric Designs
	f2	PVC Doors & window shutters, false ceiling, walls & partition panels	M/s. Jain Irrigation Systems Ltd.
	g	Steel Windows	M/s SenHarvic, AGEW, Windoors, Anjali Enterprises, M/s. Sheth Fabricators, M/s. NCL Seccolor & Bharath Steel (Pune)
	h	Mild Steel Rolling Shutters, G.I. Rolling Shutters, Stainless steel & aluminium rolling shutters	Windoors, Dodia, Bharath, Vijaylakshmi Rolling Shutters, M/s Anjali Enterprises, M/s Azad Rolling Shutter & Construction, Kota, Shri Ambika Manufacturing Co. Chembur Mumbai,
	i	Motorized Rolling Shutters & Motorized Gates	M/s. Gandhi automation Pvt. Ltd., Vijaylakshmi Rolling Shutters
	j	Block Board	Wood India – Calcutta, Sejpal & others, Pioneer Timber Products, Chandigarh, Balaji Action Build well (Action Tesa)
	k	Ply Wood	a) For permanent use in buildings: Indian Plywood Mfg. Ltd. (Anchor), Kitply, Century Plywood, Associate Ply b) For Formwork : MAGNUS DENSIFIED FILMFACED PLY WOOD, Anchor brand, Associate Lumories

Sl. No.		Description of materials	List of Manufacturers
	l	Pre Laminated & Plain Particle Boards	ASIS, ARCHIDPLY, Action TESA
	m	Factory made solid wooden panel doors	Kalpatharu Doors, M/s Jawahar Saw Mills, M/s Sreeji Wood Craft
	n	Fibre Cement boards	Everest-E-Boards / Charminar –C-Boards & ECOPRO & Shera boards
	o	Textured Fibre Boards	SHERA boards & Everest E-boards
	p	Aluminium Flush door shutters	Alufins
	q	Adhesive for wood	Fevicol, Vamicol, Dunlop, Araldite
	r	Aluminium Grills	M/s Decogril
	s	Hardware Fittings & fixtures	M/s Jayant Metal, Shalimar hardware, Everite, Garnish, Diamond, Navbharat, SAIF Enterprises, Hardwin Traders, Godrej, DE Lock Industries, Explore Engineers, Garg, Classic, EBCO, Kich
	t	Aluminium Extruded Sections	Jindal, Indal, Hindalco, Bhorka, M/s Royale Touche, Geetavin
	u	Aluminium Powder Coated Curtain rods	As approved
	v	Factory made Ready to fix Aluminium Windows	M/s. Geeta Aluminum
	w	Dry wall partitions	M/s. Gypsum India Ltd. (Saint Gobain, M/s. RAMCO HILUX (calcium silicate (ITEM SPECIFIC), Everest Industries Ltd.
	x	Floor Springs & Door Closers	Hardwyn, Everite, Hyper, Garnish
	y	VENETIAN BLINDS / VERTICAL BLINDS	FABER, MARVEL, Max, Vista
	Z	PEB Structures/Metal Roofing	Everest Industries Ltd.
17		Cement Based Paint	M/s Snowcem India Ltd. (Super snowcem, Sandex Matt), Berger-(Rabiacem), Apoorva Buildcare, New World Paints

Sl. No.		Description of materials	List of Manufacturers
18		Distemper & Paints Acrylic Emulsion, Enamel, Luster coat	M/s Asian Paints, Kansai Nerolac Paints Ltd., ICI Paints, AKzo NOBLE Paints, Berger Paints India Ltd., Jenson Nicholson, Garware Paints Ltd. & Shalimar Paint
19		Elastomeric Paints	Apurva India Pvt. Ltd., New World Paints
20		Polyurethane Paints	MRFL – Metal Coats,
21		Textured Plaster / Paint	Renovo, Durashield, RUF & TUF of Sherwin Williams [BJN Paints], New World Paints
22	a	Anti-fungal paint	Kremosoi of Artilin Paints, weather shield AKZO NOBLE Paints, Royal Shyne of Asian Paints, New World Paints, Wall Guard II of M/s Apurva India Pvt. Ltd.
	b	Biowash	Artibose of Artilin Paints, Berger Paints India Ltd., Snowcem India Ltd.
23	a	Epoxy paint	Asian paints, Berger, Shalimar, Amorloc, Huntsman
	b	Epoxy Flooring	HUNTSMAN, Fosroc, Shalimar Tar Products (STP) Ltd.
	c	Polyurethane Flooring	Shalimar Tar Products (STP) Ltd.
	d	High Build Epoxy	Shalimar Tar Products (STP) Ltd.
24	a	Tarfelts	M/s. S.T.P. Ltd., Lloyd Insulation, Tiki Tar Industries
	b	Chemical Based Water Proofing	Indofil, Flexicrete of Polyflex Industries, Fosroc, M/s. STP Ltd (Item Specific) M/s. Bitumet (Item Specific)
	c	APP waterproofing Membrane	Sika, Tikidan
25		Glass wool slabs	M/s. Rock wool India Ltd.
26		Glass for Doors / Windows	Modi Guard, Emirates, Saint Gobain, Asahi (IAG & AIS), Floatglass
27		Plain Glass Mirror	M/s Modi Float Glass, Eagle, Atul, Saint Gobain, Asahi (IAG)

Sl. No.		Description of materials	List of Manufacturers
28		Sanitary Wares	M/s Parryware, Cera, Neycer, Hindustan Sanitary ware (Hindware)
29		PH C.P. Brass Fittings & Fixtures – All PH fittings	Jaquar, GEM, Techno, KINGSTON, Metro, ESSCO, Plato
30		C. P. BRASS Urinal Waste & Flush pipes	As approved
31		Plastic Seat & Cover for EWC	M/s Commander, Diplomat, Patel, Champion, Parryware, Hindware, CERA
32		S.S. Sink	M/s Diamond, Nirali, Parryware
33		G.I. Pipes	M/s TATA
34		G.I. Pipes other than TATA make if specified	Zenith, Jindal
35		G.I. Fittings	As approved
36		G.M. Gate / Globe Valves	M/s Leader Valves, Neta, SANT, Zoloto, Hawa
37		Air Valve	Leader, Sant, HAWA, M/s Kirloskar
38		Water Meter	Capstan, Keycee, Paramount
39		Sluice Valves	Kirloskar, Leader, Hawa
40		Stainless Steel Towel rods & bath Accessories	KICH, Jaquar, ESSCO, Johnson
41		Cast Iron Valves	Kirloskar, Leader, HAWA
42		C.I. Soil Quality pipes, Rain water pipes	NECO, RIFCO, A-1, PARAS, HIF, SKF by M/s Singhal Iron Foundry (Pvt.) Ltd., HEPCO
43		S.W. Pipes & Gully Trap	As approved
44		RCC Hume Pipes	M/s Indian Hume Pipes, Pranali, Cement pipe, Ghambir Pipes and products, Hindustan Pipes (Confirming to ISI)
45		HDPE Pipes & HDPE fittings	Prince, Sangir pipes, Supreme
46		RCC frame, covers	M/s Pratibha, Bharath, Vikrant
47		C.I. frame & covers; CI Gratings	NECO, M/s Ashok Iron, Foundry, HIF, Bombay Iron Works, KFAI

Sl. No.	Description of materials	List of Manufacturers
48	UPVC, SWR Pipes, C-PVC Pipes	Finolex, Prince, Supreme, ASTRAL, Jain Irrigation Systems Ltd.
49	PPR Pipes	Supreme, Sakthi Polymers, PRINCE, KISAN-KSR
50	PVC Plastic High / Low level cistern	Commander, Champion, Elitedual Parryware-slimline, Hindware, Prince
51	PVC Inlet connection & Waste Pipes	Kohinoor, ESSCO, GEM & Elite
52	Concertina Coil	As approved
53	Polycarbonate sheet	TUFLITE Polymers, GE
54	Asbestos Roofing Sheets	Everest, Charminar, Asbestos Cement Ltd., VIKRANT
55	Colour Coated Steel / Zinc-alu alloy roofing sheets	Kirby, Steelfab & Colour Roof India Ltd., M/s SAFZIP
56	Aluminium Roofing Sheets	M/s. CRIL, KALZIP, SAFZIP (Item Specific)
57	BITUMEN	HPCL, BPCL & Indian oil Corporation
58	Bitumen Emulsion	IWL, STP, HPCL
59	PVC water tank	SINTEX
60	FRP water tank	Devi Polymers, BINANI
61	Polymers (Styrene Butadine Rubber)	BASF, Pidilite & ROFFE, BASF, Flexicrete Acrylic Co-Polymer of M/s Apoorva Buildcare
62	Under water Repair Products	Shali Damit of Shalimar Tar Products (STP) Ltd.
63	Instant Under water Road Repair Products	Shali Patch of of Shalimar Tar Products (STP) Ltd.
64	Parallel Threaded mechanical splices	Dextra India Pvt. Ltd., M/s. Spplisetek India Pvt. Ltd.,
65	Cement Bonded Particle Board/ Drywell Panel	NCL Industries Ltd
66	Granulated Blast Furnace Slag	JSW Cement Ltd.
67	Precast RCC storm water drains, chambers, box culverts, retaining & boundary walls, utility ducts	Fuji Silvertex

**LIST OF APPROVED MANUFACTURER FOR STRUCTURAL GLAZING, ACP
CLADDING AND GLASS FAÇADE**

Sl. No.	Description of materials	List of Manufacturers
1	Glass: Monolithic, Heat Strengthened, Toughened, Reflective, Tinted, Insulated, Laminated and Tempered Glass	St. Gobain (France/India), Glaverbel (Europe), Pilkington (USA, UK), Asahi (Japan), Viracon (USA), Guardian (USA), Saudi American Glass Factory, Interpane (USA)
2	Aluminium Extrusions	Hindalco Industries, Jindal, Bhorka or approved equivalent subject to specified tolerance standards. Indalco
3	Stainless Steel	Salem Steel or approved equivalent
4	EPDM	AMEE Rubber Industries Pvt. Ltd., OSAKA Rubber Pvt. Ltd. Or equivalent approved.
5	Double Glazing Unit Hermetically Sealed	Manufacturers listed above as item 1 and Sejal Arch. Glass/ FG Glass Industries Pvt. Ltd.
6	Expansion Anchors	HILTI or approved equivalent (with stainless steel 616 bolts, nuts & washers)
7	Chemical Anchors	HILTI or approved equivalent
8	Window Furniture: a) 4 Point Lockset b) S.S. Friction Hinges c) Patch Fittings d) Floor Springs e) Adhesive Film f) SS Handles	GIESSE or approved equivalent COTS WOLD or approved equivalent, DORMA / Geetavin /Shalimar DORMA DORMA 3 M or approved equivalent. DORMA/KICH
9	Structural Sealant	Dow Corning / GE / Wecker
10	Weather Sealant	Dow Corning / GE / Wecker

Sl. No.	Description of materials	List of Manufacturers
11	Foam Spacers and Mounting Tapes	NORTON or approved equivalent
12	PVDF Coatings	VALSPAR Corporation or approved equivalent.
13	Aluminium Composite	ALUCOBOND or REYBOND or Alpolic approved Metal Panels equivalent, Eurobond, Durobond, Alstrong Enterprises India Pvt. Ltd
14	Baker Rod	Supreme Ind. or approved equivalent
15	Insulation	Glass wool / Rock Wool or approved equivalent
16	Spider System	Dorma or approved equivalent
17	Glass Processor	Impact Safety / Sejal Glass tech/ GSC / Asahi & FG Glass Industries Pvt. Ltd.

Government of India
BHABHA ATOMIC RESEARCH CENTRE
Civil Engineering Division

Corrigendum No. 10 to Tender Documents w.e.f. 26th July 2023

This may be read along with the existing Tender Documents published on BARC website. The following are the changes in the existing Tender Documents:

ANNEXURE – B is Modified (New manufacturers have been added at Sr. No. 16 f 2 & 55; corrections in name made at Sr. No. 2 & 66, upgraded material is added in Sr. No. 42 and list of discontinued manufacturer is added) / Revised as under:

ANNEXURE – B

LIST OF TENTATIVE MANUFACTURER OF BUILDING MATERIALS:

Existing at present:

The tentative makes have been specified in the tender document based on requirements & desired performance and detailed study of the technical parameters, manufacturing process, quality assurance/control & testing. The list is merely for guidance and bidders can prefer any other make which is meeting technical specifications given under Section-V and Schedule of Quantities given under Section-VIII of Tender document ACED and shall conform to the relevant BIS codes and other relevant codes. The bidder may suggest any make/ brand meeting technical parameters during pre-bid stage and before technical bid submission.

Now replaced with New Para as under:

The tentative/suggested makes have been specified in the tender document based on requirements of BARC, desired performance, detailed study of the technical parameters, manufacturing process, quality assurance/control & testing. The list is merely for guidance purpose. However, the bidder(s) can prefer any other make(s) which is/are meeting technical specifications given under Section-V, the Schedule of Quantities (Schedule 'B') given under Section-VIII of A&CED Tender Documents in BARC website and shall conform to the technical parameters/performance of the tentative/suggested makes and/ or shall conform to the relevant BIS codes or other relevant codes. In case of non-approved make(s), the bidder(s) shall suggest such equivalent / alternate make / brand, meeting above-mentioned technical parameters, during pre-bid stage and before submission of bid(s).

Sl. No.		Description of materials	List of Manufacturers (Tentative / Suggested)
1	a	Ordinary Portland Cement 43/ 53 Grade	ACC, Birla Rajshree, Ultratech
	b	Portland Pozzolana Cement (fly ash based confirming to 28 days strength requirement of OPC 43 grade)	ACC, Birla Rajshree, Ultratech
	c	White Cement	J. K. Cement & Birla White
2		HYSD Bars (TMT Bars) confirming IS-1786	M/s SAIL, M/s RINL, M/s TATA, M/s JSPL, M/s JSW Steel, M/s Sham Steel, M/s Guru Nanak Metal, M/s Metro Ispat, M/s Metro Alloys, M/s Bhagwati Ferro Metal Pvt. Ltd., M/s Ambe Ferro Alloys, M/s Electrosteel Steels Ltd. - (V-XEGA- M/s Vedanta Group)
3	a	Structural Steel Sections confirming to IS-2062	M/s. SAIL, M/s RINL, M/s TATA, M/s M/s JSPL, M/s JSW, any other manufacturers confirming to IS-2062
	b	Structural Steel Plates confirming to IS-2062	M/s. SAIL, RINL, TATA, ESSAR, JSPL, JSW, any other manufacturers confirming to IS-2062
4	a	Fly-ash Bricks	M/s Shirke bricks, M/s Unicorn, M/s Shri Samarth, M/s A Cube bricks, LANVIN Infrastructure Pvt. Ltd., any other approved manufacturers.
	b	Autoclave Aerated Blocks (AAC)	M/s Siporex, M/s AEROCON, XTRALITE of M/s UltraTech Cement Ltd.
5		Agency for Anti-Termite treatment	M/s PARAGON, PEECOPP, Express Pesticides Corporation, Pest Control (I) Ltd.
6		Tiles:	
	a	Ceramic Tiles	M/s H.R. Johnson (I) Ltd., M/s Somany, M/s Kajaria, M/s Asian Granito India Ltd, M/s Bell graneto, M/s NITCO LTD., M/s Orient Bell Limited (After Bell Ceramics acquired by Orient)
	b	Digital Glazed Vitrified Tiles	M/s H.R. Johnson (I) Ltd., M/s Somany, M/s Kajaria, M/s Asian Granito India Ltd, M/s Bell

			graneto, NITCO LTD., M/s Orient Bell Limited (After Bell Ceramics acquired by Orient)
	c	Glazed Floor Tiles	M/s H.R. Johnson, RAK Ceramics, Bell Granito, KAJARIA, SOMANY & Asian Granito India Ltd., NITCO LTD., Orient Bell Limited (After Bell Ceramics acquired by Orient)
	d	P V C flooring Rolls / Tile / Sheets	Premier Poly Vinyl, RMG Poly Vinyl India Ltd., (wonder floor), Armstrong, Responsive Industries Ltd., Royal Cushion Vinyl
	e	Paver Blocks, Polymer moulded Paver Blocks, Chequered concrete Floor Tiles, Unipaver Blocks	Super Tiles, Shree Precast INDUSTRIES, Pavetech Industries, Ultra Tile Pvt. Ltd., Intex Designer Tiles Pvt. Ltd. (Duracrete); Choice Mosaic Tiles.
	f	Concrete Designer wall & Floor tiles	Ultra tile, Eurocon, Duracrete
	g	Acid Alkali Proof Tiles (Heavy Duty Tiles/Pavers)	Johnson ENDURA Tiles, Orient Bell Limited (After Bell Ceramics acquired by Orient)
	h	Tile Grout	ROFF / BALENDURA / LATICRETE / TILEFIXO of M/s UltraTech Cement Ltd., FIXOTILE of ACC Ltd., Shalimar Tar Products (STP) Ltd.
	i	Non shrink Grout	FOSROC / PIDILITE / BASF / SIKA / ACCOGGOUT of ACC Ltd., Shalimar Tar Products (STP) Ltd.,
	j	Mossaic Tiles / Terrazo	NITCO LTD., Or As approved
	k	Metallic Floor Hardner	Ironite India Ltd. Triveni Colour Industries (Floor) Heatly & Gresham (India) Ltd., De Rust Chemical Corporation of India (Fermonite), Cement Research Corporation (stilonite), Kironite, Shalimar Tar Products (STP) Ltd.
	l	Metal False Flooring	M/s UNITILE Access Floor
	m	Thin Jointing Mortar	FIXOBLOCK of M/s UltraTech Cement Ltd., ACCOFIX of ACC Ltd., Shalimar Tar Products

			(STP) Ltd., SILICOfix of M/S Precise Conchem Pvt. Ltd.
	n	Non Metallic Floor Hardner	Shalimar Tar Products (STP) Ltd.
	o	Marble Tiles	NITCO LTD.
	p	Germ Free Tiles	Orient Bell Limited (After Bell Ceramics acquired by Orient)
	q	Non shrink / Non expanding Power Grout	M/s UltraTech
7		Ready Mix Plaster	ROOFIT, FAIRMAT, WALPLAST, READIPLAST of ULTRATECH Cement Ltd., ACCOPlast of ACC Ltd., SILICOplast of M/S Precise Conchem Pvt. Ltd.
8		White Cement based wall putty	Birla Walcare / JK Putty
9		Lime, Neeru	Janatacem, Asian Paint More(Peacock), Kamal
10		Ready Mix concrete	ACC RMC, Govandi, ULTRATECH Readymix, Govandi, RMC India (Ghatkopar, Mahape), M/s StarCrete LLP, Mahape (M/s Ashwini Infradevelopment Pvt. Ltd.), M/s Concretech India, Tubhe & MIDC-Pawane M/s Swastik Infra-logic (I) Pvt. Ltd., M/s TNA Readymix India Private Ltd. and other approved plants.
11		Concrete Admixtures	Structural waterproofing Co., FOSROC Chemicals, BASF, CICO
12		Integral Waterproofing Compound	M/s Accoproof, CICO, Impermo, Pidilite, Roffe, FOSROC, Dr. Fixit, Sunanda Chemicals
13		Agencies for Waterproofing Treatment- Cement based	M/s Modern Waterproofing, Ms/ Gemini Construction M/s National Waterproofing M/s New Bharat Waterproofing Co. M/s. Taj Enterprises M/s CICO Technologies M/s Nina Industries

			M/s Structural Waterproofing Company M/s Raj Waterproofing Co., Chembur-Mumbai
14		PVC Water stops	M/s Omai Plastics, Caprihans India Ltd., Kanta Polymers (Kanta flex) & Fixopan
15	a	Expansion Joint Boards	M/s Shalitex, M/s. Supreme-HD-100, Duroboard (Item specific)
	b	Expansion Joint Fillers	M/s Shalitex, S.T.P. Ltd., Lloyd Insulation & BASF Chemicals, FOSROC, PIDILITE, Choksey
	c	Heavy Density Thermocol (Expanded polystyrene)	As approved
	d	Poly Sulphide Sealant	PIDILITE / BASF / DOWCORNING, Choksey
16		Doors, Windows, Partitions, Rolling Shutters, Fittings & Fixtures	
	a	Pressed Steel Door Frame	M/s SenHarvic, Anjali Enterprises, Windoors, Bharat Steel Industries Pune, M/s AGEW, M/s Sheth Fabricators, Shakti Hurmann
	b	Steel flush Doors / Hollow metal Flush Doors	Shakthimet Doors, Sheth Fabricators, M/s Ahaladha, M/s Senharvic, M/s Diamond Doors (Item Specific); Windoors, Strategic Building Systems, Signum Fire Protection Ltd., Anjali Enterprises, AGEW
	c	Pressed steel doors & fire resistant steel doors	Ms Shakthimet Doors, M/s Ahaladha, Strategic Building Systems, M/s. Sheth Fabricators, M/s Signum Fire Protection Ltd.
	d	Flush Door Shutter	Indian Plywood, Kitply, Anand Wood Crafts, Sejpal and others (Anand Doors), M/s Kalpatharu Doors
	e	Masonite Wooden Panel Doors	Masonite India Ltd.
	f1	FRP Door Shutter	Advance FRP & House of Doors, Eccentric Designs
	f2	PVC Doors & window shutters, false ceiling, walls & partition	M/s. Jain Irrigation Systems Ltd. , Rajshri Plastiwood

		panels, PVC Integral Foam sheet, PVC Free Foam sheet	
	g	Steel Windows	M/s SenHarvic, AGEW, Windoors, Anjali Enterprises, M/s. Sheth Fabricators, M/s. NCL Seccolor & Bharath Steel (Pune)
	h	Mild Steel Rolling Shutters, G.I. Rolling Shutters, Stainless steel & aluminium rolling shutters	Windoors, Dodia, Bharath, Vijaylakshmi Rolling Shutters, M/s Anjali Enterprises, M/s Azad Rolling Shutter & Construction, Kota, Shri Ambika Manufacturing Co. Chembur Mumbai,
	i	Motorized Rolling Shutters & Motorized Gates	M/s. Gandhi automation Pvt. Ltd., Vijalakshmi Rolling Shutters
	j	Block Board	Wood India – Calcutta, Sejpal & others, Pioneer Timber Products, Chandigarh, Balaji Action Build well (Action Tesa)
	k	Ply Wood	a) For permanent use in buildings: Indian Plywood Mfg. Ltd. (Anchor), Kitply, Century Plywood, Associate Ply b) For Formwork : MAGNUS DENSIFIED FILMFACED PLY WOOD, Anchor brand, Associate Lumories
	l	Pre Laminated & Plain Particle Boards	ASIS, ARCHIDPLY, Action TESA
	m	Factory made solid wooden panel doors	Kalpatharu Doors, M/s Jawahar Saw Mills, M/s Sreeji Wood Craft
	n	Fibre Cement boards	Everest-E-Boards / Charminar –C-Boards & ECOPRO & Shera boards
	o	Textured Fibre Boards	SHERA boards & Everest E-boards
	p	Aluminium Flush door shutters	Alufins
	q	Adhesive for wood	Fevicol, Vamicol, Dunlop, Araldite
	r	Aluminium Grills	M/s Decogrille
	s	Hardware Fittings & fixtures	M/s Jayant Metal, Shalimar hardware, Everite, Garnish, Diamond, Navbharat,

			SAIF Enterprises, Hardwin Traders, Godrej, DE Lock Industries, Explore Engineers, Garg, Classic, EBCO, Kich
	t	Aluminium Extruded Sections	Jindal, Indal, Hindalco, Bhoruka, M/s Royale Touche, Geetavin
	u	Aluminium Powder Coated Curtain rods	As approved
	v	Factory made Ready to fix Aluminium Windows	M/s. Geeta Aluminum
	w	Dry wall partitions	M/s. Gypsum India Ltd. (Saint Gobain, M/s. RAMCO HILUX (calcium silicate (ITEM SPECIFIC), Everest Industries Ltd.
	x	Floor Springs & Door Closers	Hardwyn, Everite, Hyper, Garnish
	y	VENETIAN BLINDS / VERTICAL BLINDS	FABER, MARVEL, Max, Vista
	Z	PEB Structures/Metal Roofing	Everest Industries Ltd.
17		Cement Based Paint	M/s Snowcem India Ltd. (Super snowcem, Sandex Matt), Berger-(Rabiacem), Apoorva Buildcare, New World Paints
18		Distemper & Paints Acrylic Emulsion, Enamel, Luster coat	M/s Asian Paints, Kansai Nerolac Paints Ltd., ICI Paints, AKZO NOBLE Paints, Berger Paints India Ltd., Jenson Nicholson, Garware Paints Ltd. & Shalimar Paint
19		Elastomeric Paints	Apurva India Pvt. Ltd., New World Paints
20		Polyurethane Paints	MRFL – Metal Coats,
21		Textured Plaster / Paint	Renovo, Durashield, RUF & TUF of Sherwin Williams [BJN Paints], New World Paints
22	a	Anti-fungal paint	Kremosoi of Artilin Paints, weather shield AKZO NOBLE Paints, Royal Shyne of Asian Paints, New World Paints, Wall Guard II of M/s Apurva India Pvt. Ltd.
	b	Biowash	Artibose of Artilin Paints, Berger Paints India Ltd., Snowcem India Ltd.
23	a	Epoxy paint	Asian paints, Berger, Shalimar, Amorloc, Huntsman

	b	Epoxy Flooring	HUNTSMAN, Fosroc, Shalimar Tar Products (STP) Ltd.
	c	Polyurethane Flooring	Shalimar Tar Products (STP) Ltd.
	d	High Build Epoxy	Shalimar Tar Products (STP) Ltd.
24	a	Tarfelts	M/s. S.T.P. Ltd., Lloyd Insulation, Tiki Tar Industries
	b	Chemical Based Water Proofing	Indofil, Flexicrete of Polyflex Industries, Fosroc, M/s. STP Ltd (Item Specific) M/s. Bitumet (Item Specific)
	c	APP waterproofing Membrane	Sika, Tikidan
25		Glass wool slabs	M/s. Rock wool India Ltd.
26		Glass for Doors / Windows	Modi Guard, Emirates, Saint Gobain, Asahi (IAG & AIS), Floatglass
27		Plain Glass Mirror	M/s Modi Float Glass, Eagle, Atul, Saint Gobain, Asahi (IAG)
28		Sanitary Wares	M/s Parryware, Cera, Neycer, Hindustan Sanitary ware (Hindware)
29		PH C.P. Brass Fittings & Fixtures – All PH fittings	Jaquar, GEM, Techno, KINGSTON, Metro, ESSCO, Plato
30		C. P. BRASS Urinal Waste & Flush pipes	As approved
31		Plastic Seat & Cover for EWC	M/s Commander, Diplomat, Patel, Champion, Parryware, Hindware, CERA
32		S.S. Sink	M/s Diamond, Nirali, Parryware
33		G.I. Pipes	M/s TATA
34		G.I. Pipes other than TATA make if specified	Zenith, Jindal
35		G.I. Fittings	As approved
36		G.M. Gate / Globe Valves	M/s Leader Valves, Neta, SANT, Zoloto, Hawa
37		Air Valve	Leader, Sant, HAWA, M/s Kirloskar
38		Water Meter	Capstan, Keycee, Paramount
39		Sluice Valves	Kirloskar, Leader, Hawa

40		Stainless Steel Towel rods & bath Accessories	KICH, Jaquar, ESSCO, Johnson
41		Cast Iron Valves	Kirloskar, Leader, HAWA
42		C.I. Soil Quality pipes / C.I. hubless pipe, Rain water pipes	NECO, RIFCO, A-1, PARAS, HIF, SKF by M/s Singhal Iron Foundry (Pvt.) Ltd., HEPCO
43		S.W. Pipes & Gully Trap	As approved
44		RCC Hume Pipes	M/s Indian Hume Pipes, Pranali, Cement pipe, Ghambir Pipes and products, Hindustan Pipes (Confirming to ISI)
45		HDPE Pipes & HDPE fittings	Prince, Sangir pipes, Supreme
46		RCC frame, covers	M/s Pratibha, Bharath, Vikrant
47		C.I. frame & covers; CI Gratings	NECO, M/s Ashok Iron, Foundry, HIF, Bombay Iron Works, KFAI
48		UPVC, SWR Pipes, C-PVC Pipes	Finolex, Prince, Supreme, ASTRAL, Jain Irrigation Systems Ltd.
49		PPR Pipes	Supreme, Sakthi Polymers, PRINCE, KISAN-KSR
50		PVC Plastic High / Low level cistern	Commander, Champion, Elitedual Parryware-slimline, Hindware, Prince
51		PVC Inlet connection & Waste Pipes	Kohinoor, ESSCO, GEM & Elite
52		Concertina Coil	As approved
53		Polycarbonate sheet	TUFLITE Polymers, GE
54		Asbestos Roofing Sheets	Everest, Charminar, Asbestos Cement Ltd., VIKRANT
55		Colour Coated Steel / Zinc-alu alloy roofing sheets	Kirby, Steelfab, Colour Roof India Ltd., M/s Maxroof Corporation Pvt. Ltd.,
56		Aluminium Roofing Sheets	M/s. CRIL, KALZIP
57		BITUMEN	HPCL, BPCL & Indian oil Corporation
58		Bitumen Emulsion	IWL, STP, HPCL
69		PVC water tank	SINTEX
60		FRP water tank	Devi Polymers, BINANI
61		Polymers (Styrene Butadine Rubber)	BASF, Pidilite & ROFFE, BASF, Flexicrete Acrylic Co-Polymer of M/s Apoorva Buildcare
62		Under water Repair Products	Shali Damit of Shalimar Tar Products (STP) Ltd.

63		Instant Under water Road Repair Products	Shali Patch of of Shalimar Tar Products (STP) Ltd.
64		Parallel Threaded mechanical splices	Dextra India Pvt. Ltd., M/s. Spplcetek India Pvt. Ltd.,
65		Cement Bonded Particle Board/ Drywell Panel	NCL Industries Ltd
66		Granulated Ground Blast Furnace Slag (GGBS)	JSW Cement Ltd.
67		Precast RCC storm water drains, chambers, box culverts, retaining & boundary walls, utility ducts	Fuji Silvertch

LIST OF DISCONTINUED MANUFACTURERS

Sl. No.	Description of materials	List of Manufacturers
1 a)	Colour Coated Steel / Zinc-alu alloy roofing sheets	M/s SAFZIP
b)	Aluminium Roofing Sheets	

LIST OF APPROVED MANUFACTURER FOR STRUCTURAL GLAZING, ACP CLADDING AND GLASS FAÇADE

Sl. No.	Description of materials	List of Manufacturers (Tentative / Suggested)
1	Glass: Monolithic, Heat Strengthened, Toughened, Reflective, Tinted, Insulated, Laminated and Tempered Glass	St. Gobain (France/India), Glaverbel (Europe), Pilkington (USA, UK), Asahi (Japan), Viracon (USA), Guardian (USA), Saudi American Glass Factory, Interpane (USA)
2	Aluminium Extrusions	Hindalco Industries, Jindal, Boruka or approved equivalent subject to specified tolerance standards. Indalco
3	Stainless Steel	Salem Steel or approved equivalent
4	EPDM	AMEE Rubber Industries Pvt.

		Ltd., OSAKA Rubber Pvt. Ltd. Or equivalent approved.
5	Double Glazing Unit Hermatically Sealed	Manufacturers listed above as item 1 and Sejal Arch. Glass/ FG Glass Industries Pvt. Ltd.
6	Expansion Anchors	HILTI or approved equivalent (with stainless steel 616 bolts, nuts & washers)
7	Chemical Anchors	HILTI or approved equivalent
8	Window Furniture: a) 4 Point Lockset b) S.S. Friction Hinges c) Patch Fittings d) Floor Springs e) Adhesive Film f) SS Handles	GIESSE or approved equivalent COTS WOLD or approved equivalent, DORMA / Geetavin /Shalimar DORMA DORMA 3 M or approved equivalent. DORMA/KICH
9	Structural Sealant	Dow Corning / GE / Wecker
10	Weather Sealant	Dow Corning / GE / Wecker
Sl. No.	Description of materials	List of Manufacturers
11	Foam Spacers and Mounting Tapes	NORTON or approved equivalent
12	PVDF Coatings	VALSPAR Corporation or approved equivalent.
13	Aluminium Composite	ALUCOBOND or REYBOND or Alpolic approved Metal Panels equivalent, Eurobond, Durobond, Alstrong Enterprises India Pvt. Ltd
14	Baker Rod	Supreme Ind. or approved equivalent
15	Insulation	Glass wool / Rock Wool or approved equivalent
16	Spider System	Dorma or approved equivalent
17	Glass Processor	Impact Safety / Sejal Glass tech/ GSC / Asahi & FG Glass Industries Pvt. Ltd.

Government of India
BHABHA ATOMIC RESEARCH CENTRE
Civil Engineering Division

Corrigendum No. 11 to Tender Documents **w.e.f. 01.02.2024**

This may be read along with the existing Tender Documents published on BARC website. The following are the changes in the existing Tender Documents **and will be effective on all e-Tenders published on or after 1st February 2024:**

Sr. No. 1: NOTICE INVITING e-TENDER:

Clause 28 / Clause 29: LEVY/TAXES Payable by Contractor:

Existing at present:

- i) Goods & Services Tax (GST) or any other tax applicable in respect of inputs procured by the Contractor for this contract shall be payable by the Contractor and Government will not entertain any claim whatsoever in respect of the same. However, component of GST at time of supply of service (as provided in CGST Act 2017) provided by the contract shall be varied if different from that applicable on the last date of receipt of tender including extension if any.
- ii) All tendered rates shall be inclusive of all taxes, GST, levy or cess applicable on last stipulated date of receipt of tender including extension if any.
- iii) Labour welfare cess @1% of gross value of work done shall be recovered from each bill paid to the contractor.
- iv) Income tax and cess as applicable shall be deducted from each bill paid to the contractor.
- v) Contractor should be registered under EPF & ESIC and shall pay EPF & ESIC of contract workers to concerned Department and it will be reimbursed to him by the Department after satisfying that it has been actually and genuinely paid by the contractor. The bidder should not consider EPF & ESIC in his rates.

Contractors shall comply provisions of the EPF Act, 1952 in respect of all the eligible employees / workers/ labours and submit the documentary proof regularly with every RA Bill. vi) Any other taxes /cess as per Government directives shall be deducted from each bill paid to the contractor, from time to time.

Now Replaced with New Para as under:

- i) Any other taxes applicable in respect of **inputs or outputs procured by the Contractor** for this contract shall be borne by the Contractor and Government will not entertain any claim whatsoever in respect of the same.

ii) All tendered rates shall be inclusive of all taxes, duties, levy or cess, fee, royalty charges etc. levied under any statute but **exclusive of GST (Good and Services Tax)** applicable on last stipulated date of receipt of tender including extension if any.

iii) No tax liability (other than GST) or insurance expenses will be borne by BARC. GST as applicable duly certified by Chartered Accountant on this work contract is reimbursable by BARC subject to production of original documentary proof of GST payment for this work.

iv) An undertaking as per **Annexure-3 of NIT** should be submitted for registration under GST and compliance of GST provisions.

v) The bidders/ tenders should ensure that they are GST compliant and their quoted tax structure /rates are as per GST Law.

vi) Labour welfare cess @1% of gross value of work done shall be recovered from each bill paid to the contractor.

vii) Income tax and cess as applicable shall be deducted from each bill paid to the contractor.

viii) Contractor should be registered under EPF & ESIC and shall pay EPF & ESIC of contract workers to concerned Department and it will be reimbursed to him by the Department after satisfying that it has been actually and genuinely paid by the contractor. The bidder should not consider EPF & ESIC in his rates.

Contractors shall comply provisions of the EPF Act, 1952 in respect of all the eligible employees / workers/ labours and submit the documentary proof regularly with every RA Bill. vi) Any other taxes /cess as per Government directives shall be deducted from each bill paid to the contractor, from time to time.

Sr. No. 2: A&CED Corrigendum No. 5 w.e.f. 09.03.2018 - STANDS DELETED FOR THE NEW NIT PUBLISHED ON CPPP w.e.f 1st February 2024

CED Corrigendum No. 11 w.e.f. 1st February 2024 – Newly added.

Sr. No. 3: Tender SECTION - II -GENERAL RULES AND DIRECTIONS:

Clause No.15:

Existing at present:

(i) Sales Tax/VAT (except Service Tax for which BARC will provide certificate) Purchase Tax, Turnover tax or any other tax applicable in respect of this contracts shall be payable by the contractor and Government will not entertain any claim whatsoever in respect of the same.

Now Replaced with New Para as under:

(i) GST or any other taxes applicable in respect of **inputs procured by the Contractor** for this contract shall be payable by the Contractor and Government will not entertain any claim whatsoever in respect of the same. **However, component of GST at time of supply of services (as provided in CGST Act 2017) provided by the contractor shall be varied if different from that applicable on the last date of receipt of tender including extension if any and shall be reimbursable to the contractor against submission of Chartered Accountant certification and original documentary proof of GST payment for this work.**

Sr. No. 4: Tender Section III: CONDITIONS OF CONTRACT:

DEFINITIONS:

Para 2(xvi):

At present: No provision.

Under this clause, **a new sub-clause is now added** as under:

Para 2 (xvi): GST shall mean Goods and Service Tax — Central, State and Inter State.

Sr. No. 5: Tender Section III: CONDITIONS OF CONTRACT:

Clause No. 37: Levy/Taxes payable of contractor

Existing at present:

(i) Sales Tax /VAT (except Service Tax for which exemption certificate shall be provided by BARC), Building and other Construction Workers Welfare Cess or any other tax or cess in respect of this contract shall be payable by the contractor and Government shall not entertain any claim whatsoever in this respect. However, in respect of service tax, in consultancy contract the same shall be paid by the contractor/consultant to the concerned department on demand and it will be reimbursed to him by the Engineer-in-Charge after satisfying that it has been actually and genuinely paid by the contractor.

Now Replaced with New Para as under:

(i) Building and other Construction Workers Welfare Cess or any other tax, levy or Cess in respect of input for or output by this contract shall be payable by the contractor and Government shall not entertain any claim whatsoever in this respect except as provided under Clause 38.

(ii) The contractor shall deposit royalty and obtain necessary permit for supply of the red bajri, stone, kankar, stone aggregate, earth, sand etc. from local authorities.

(iii) If pursuant to or under any law, notification or order any royalty, cess or the like becomes payable by the Government of India and does not any time become payable by the contractor to the State Government, Local authorities in respect of any material used by the contractor in the works, then in such a case, it shall be lawful to the Government of India and it shall have the right and be entitled to recover the amount paid in the circumstances as aforesaid from dues of the contractor.

Sr. No. 6: Tender Section III: CONDITIONS OF CONTRACT:

Clause No. 38: Conditions for reimbursement of Levy/Taxes if levied after receipt of Tenders

Existing at present: (i) All tendered rates shall be inclusive of all taxes and levies (except Service Tax) payable under respective statutes. However, if any further tax or levy is imposed by Statute, after the last stipulated date for the receipt of tender including extensions, if any and the contractor thereupon necessarily and properly pays such taxes/levies, the contractor shall be reimbursed the amount so paid, provided such payments, if any, is not, in the opinion of the Superintending Engineer (whose decision shall be final and binding on the contractor) attributable to delay in execution of work within the control of the contractor.

Now Replaced with New Para as under:

(i) All tendered rates shall be inclusive of any taxes, duties, levy or cess, fee, royalty charges applicable on last stipulated date of receipt of tender including extension if any. No adjustment i.e. increase or decrease shall be made for any variation in the rate of GST, Building and Other Construction Workers Welfare Cess or any tax, levy or cess applicable **on inputs**.

However, effect of variation in rates of Building and Other Construction Workers Welfare Cess or imposition or repeal of any other taxes, duties, levy or cess, fee, royalty charges applicable **on output of the works contract** shall be adjusted on either side, increase or decrease.

Provided further that for Building and Other Construction Workers Welfare Cess or any tax (**other than GST**), duties, levy or cess, fee, royalty charges varied or imposed after the last date of receipt of tender including extension if any, any increase shall be reimbursed to the contractor only if the contractor necessarily and properly pays such increased amount of taxes/levies/cess.

Provided further that such increase including GST shall not be made in the extended period of contract for which the contractor alone is responsible for delay as determined by authority for extension of time under Clause 5 in Schedule F.

(ii) NO CHANGE

Existing at present:

(iii) The contractor shall within a period of 30 days of the imposition of any such further tax or levy or cess give a written notice thereof to the Engineer-in-Charge that the same is given pursuant to this condition, together with all necessary information relating thereto

Now Replaced with New Para as under:

(iii) The contractor shall, within a period of 30 days of the imposition of any such further taxes, duties, levy or cess, fee, royalty charges, or variation or repeal of such taxes, duties, levy or cess, fee, royalty charges give a written notice thereof to the Engineer-in-charge that the same is given pursuant to this condition, together with all necessary information relating thereto.

ANNEXURE – B is Modified (New brands have been added at Sr. No. 10, 21, 53 and list of discontinued manufacturer is updated) / Revised as under:

The tentative/suggested makes have been specified in the tender document based on requirements of BARC, desired performance, detailed study of the technical parameters, manufacturing process, quality assurance/control & testing. The list is merely for guidance purpose. However, the bidder(s) can prefer any other make(s) which is/are meeting technical specifications given under Section-V, the Schedule of Quantities (Schedule 'B') given under Section-VIII of A&CED Tender Documents in BARC website and shall conform to the technical parameters/performance of the tentative/suggested makes and/ or shall conform to the relevant BIS codes or other relevant codes. In case of non-approved make(s), the bidder(s) shall suggest such equivalent / alternate make / brand, meeting above-mentioned technical parameters, during pre-bid stage and before submission of bid(s).

Sl. No.		Description of materials	List of Manufacturers (Tentative / Suggested)
1	a	Ordinary Portland Cement 43/ 53 Grade	ACC, Birla Rajshree, Ultratech
	b	Portland Pozzolana Cement (fly ash based confirming to 28 days strength requirement of OPC 43 grade)	ACC, Birla Rajshree, Ultratech
	c	White Cement	J. K. Cement & Birla White
2		HYSD Bars (TMT Bars) confirming IS-1786	M/s SAIL, M/s RINL, M/s TATA, M/s JSPL, M/s JSW Steel, M/s Sham Steel, M/s Guru Nanak Metal, M/s Metro Ispat, M/s Metro Alloys, M/s Bhagwati Ferro Metal Pvt. Ltd., M/s Ambe Ferro Alloys, M/s Electrosteel Steels Ltd. - (V-XEGA- M/s Vedanta Group)
3	a	Structural Steel Sections confirming to IS-2062	M/s. SAIL, M/s RINL, M/s TATA, M/s M/s JSPL, M/s JSW, any other manufacturers confirming to IS-2062
	b	Structural Steel Plates confirming to IS-2062	M/s. SAIL, RINL, TATA, ESSAR, JSPL, JSW, any other manufacturers confirming to IS-2062
4	a	Fly-ash Bricks	M/s Shirke bricks, M/s Unicorn, M/s Shri Samarth, M/s A Cube bricks, LANVIN Infrastructure Pvt. Ltd., any other approved manufacturers.

	b	Autoclave Aerated Blocks (AAC)	M/s Siporex, M/s AEROCON, XTRALITE of M/s UltraTech Cement Ltd.
5		Agency for Anti-Termite treatment	M/s PARAGON, PEECOPP, Express Pesticides Corporation, Pest Control (I) Ltd.
6		Tiles:	
	a	Ceramic Tiles	M/s H.R. Johnson (I) Ltd., M/s Somany, M/s Kajaria, M/s Asian Granito India Ltd, M/s Bell graneto, M/s NITCO LTD., M/s Orient Bell Limited (After Bell Ceramics acquired by Orient)
	b	Digital Glazed Vitrified Tiles	M/s H.R. Johnson (I) Ltd., M/s Somany, M/s Kajaria, M/s Asian Granito India Ltd, M/s Bell graneto, NITCO LTD., M/s Orient Bell Limited (After Bell Ceramics acquired by Orient)
	c	Glazed Floor Tiles	M/s H.R. Johnson, RAK Ceramics, Bell Granito, KAJARIA, SOMANY & Asian Granito India Ltd., NITCO LTD., Orient Bell Limited (After Bell Ceramics acquired by Orient)
	d	P V C flooring Rolls / Tile / Sheets	Premier Poly Vinyl, RMG Poly Vinyl India Ltd., (wonder floor), Armstrong, Responsive Industries Ltd., Royal Cushion Vinyl
	e	Paver Blocks, Polymer moulded Paver Blocks, Chequered concrete Floor Tiles, Unipaver Blocks	Super Tiles, Shree Precast INDUSTRIES, Pavetech Industries, Ultra Tile Pvt. Ltd., Intex Designer Tiles Pvt. Ltd. (Duracrete); Choice Mosaic Tiles.
	f	Concrete Designer wall & Floor tiles	Ultra tile, Eurocon, Duracrete
	g	Acid Alkali Proof Tiles (Heavy Duty Tiles/Pavers)	Johnson ENDURA Tiles, Orient Bell Limited (After Bell Ceramics acquired by Orient)
	h	Tile Grout	ROFF / BALENDURA / LATICRETE / TILEFIXO of M/s UltraTech Cement Ltd., FIXOTILE of ACC Ltd., Shalimar Tar Products (STP) Ltd.
	i	Non shrink Grout	FOSROC / PIDILITE / BASF / SIKA / ACCOGGOUT of ACC Ltd., Shalimar Tar Products (STP) Ltd.,

	j	Mosaic Tiles / Terrazo	NITCO LTD., Or As approved
	k	Metallic Floor Hardner	Ironite India Ltd. Triveni Colour Industries (Floor) Heatly & Gresham (India) Ltd., De Rust Chemical Corporation of India (Fermonite), Cement Research Corporation (stilonite), Kironite, Shalimar Tar Products (STP) Ltd.
	l	Metal False Flooring	M/s UNITILE Access Floor
	m	Thin Jointing Mortar	FIXOBLOCK of M/s UltraTech Cement Ltd., ACCOFIX of ACC Ltd., Shalimar Tar Products (STP) Ltd., SILICOfix of M/S Precise Conchem Pvt. Ltd.
	n	Non Metallic Floor Hardner	Shalimar Tar Products (STP) Ltd.
	o	Marble Tiles	NITCO LTD.
	p	Germ Free Tiles	Orient Bell Limited (After Bell Ceramics acquired by Orient)
	q	Non shrink / Non expanding Power Grout	M/s UltraTech
7		Ready Mix Plaster	ROOFIT, FAIRMAT, WALPLAST, READIPLAST of ULTRATECH Cement Ltd., ACCOPlast of ACC Ltd., SILICOplast of M/S Precise Conchem Pvt. Ltd.
8		White Cement based wall putty	Birla Walcare / JK Putty
9		Lime, Neeru	Janatacem, Asian Paint More(Peacock), Kamal
10		Ready Mix concrete	ACC RMC, Govandi, ULTRATECH Readymix, Govandi, RMC India (Ghatkopar, Mahape), M/s StarCrete LLP, Mahape (M/s Ashwini Infradevelopment Pvt. Ltd.), M/s Concretech India, Tubhe & MIDC-Pawane M/s Swastik Infra-logic (I) Pvt. Ltd., M/s TNA Readymix India Private Ltd., Bharat Construction Company (Bombay) and other approved plants.

11		Concrete Admixtures	Structural waterproofing Co., FOSROC Chemicals, BASF, CICO
12		Integral Waterproofing Compound	M/s Accoproof, CICO, Impermo, Pidilite, Roffe, FOSROC, Dr. Fixit, Sunanda Chemicals
13		Agencies for Waterproofing Treatment- Cement based	M/s Modern Waterproofing, Ms/ Gemini Construction M/s National Waterproofing M/s New Bharat Waterproofing Co. M/s. Taj Enterprises M/s CICO Technologies M/s Nina Industries M/s Structural Waterproofing Company M/s Raj Waterproofing Co., Chembur-Mumbai
14		PVC Water stops	M/s Omai Plastics, Caprihans India Ltd., Kanta Polymers (Kanta flex) & Fixopan
15	a	Expansion Joint Boards	M/s Shalitex, M/s. Supreme-HD-100, Duroboard (Item specific)
	b	Expansion Joint Fillers	M/s Shalitex, S.T.P. Ltd., Lloyd Insulation & BASF Chemicals, FOSROC, PIDILITE, Choksey
	c	Heavy Density Thermocol (Expanded polystyrene)	As approved
	d	Poly Sulphide Sealant	PIDILITE / BASF / DOWCORNING, Choksey
16		Doors, Windows, Partitions, Rolling Shutters, Fittings & Fixtures	
	a	Pressed Steel Door Frame	M/s SenHarvic, Anjali Enterprises, Windoors, Bharat Steel Industries Pune, M/s AGEW, M/s Sheth Fabricators, Shakti Hurmann
	b	Steel flush Doors / Hollow metal Flush Doors	Shakthimet Doors, Sheth Fabricators, M/s Ahaladha, M/s Senharvic, M/s Diamond Doors (Item Specific); Windoors, Strategic Buiding Systems, Signum Fire Protection Ltd., Anjali Enterprises, AGEW

c	Pressed steel doors & fire resistant steel doors	Ms Shakthimet Doors, M/s Ahaladha, Strategic Building Systems, M/s. Sheth Fabricators, M/s Signum Fire Protection Ltd.
d	Flush Door Shutter	Indian Plywood, Kitply, Anand Wood Crafts, Sejpal and others (Anand Doors), M/s Kalpatharu Doors
e	Masonite Wooden Panel Doors	Masonite India Ltd.
f1	FRP Door Shutter	Advance FRP & House of Doors, Eccentric Designs
f2	PVC Doors & window shutters, false ceiling, walls & partition panels, PVC Integral Foam sheet, PVC Free Foam sheet	M/s. Jain Irrigation Systems Ltd. , Rajshri Plastiwood
g	Steel Windows	M/s SenHarvic, AGEW, Windoors, Anjali Enterprises, M/s. Sheth Fabricators, M/s. NCL Seccolor & Bharath Steel (Pune)
h	Mild Steel Rolling Shutters, G.I. Rolling Shutters, Stainless steel & aluminium rolling shutters	Windoors, Dodia, Bharath, Vijaylakshmi Rolling Shutters, M/s Anjali Enterprises, M/s Azad Rolling Shutter & Construction, Kota, Shri Ambika Manufacturing Co. Chembur Mumbai,
i	Motorized Rolling Shutters & Motorized Gates	M/s. Gandhi automation Pvt. Ltd., Vijalakshmi Rolling Shutters
j	Block Board	Wood India – Calcutta, Sejpal & others, Pioneer Timber Products, Chandigarh, Balaji Action Build well (Action Tesa)
k	Ply Wood	a) For permanent use in buildings: Indian Plywood Mfg. Ltd. (Anchor), Kitply, Century Plywood, Associate Ply b) For Formwork : MAGNUS DENSIFIED FILMFACED PLY WOOD, Anchor brand, Assoiciate Lumories

	l	Pre Laminated & Plain Particle Boards	ASIS, ARCHIDPLY, Action TESA
	m	Factory made solid wooden panel doors	Kalpatharu Doors, M/s Jawahar Saw Mills, M/s Sreeji Wood Craft
	n	Fibre Cement boards	Everest-E-Boards / Charminar –C-Boards & ECOPRO & Shera boards
	o	Textured Fibre Boards	SHERA boards & Everest E-boards
	p	Aluminium Flush door shutters	Alufins
	q	Adhesive for wood	Fevicol, Vamicol, Dunlop, Araldite
	r	Aluminium Grills	M/s Decogrille
	s	Hardware Fittings & fixtures	M/s Jayant Metal, Shalimar hardware, Everite, Garnish, Diamond, Navbharat, SAIF Enterprises, Hardwin Traders, Godrej, DE Lock Industries, Explore Engineers, Garg, Classic, EBCO, Kich
	t	Aluminium Extruded Sections	Jindal, Indal, Hindalco, Bhoruka, M/s Royale Touche, Geetavin
	u	Aluminium Powder Coated Curtain rods	As approved
	v	Factory made Ready to fix Aluminium Windows	M/s. Geeta Aluminum
	w	Dry wall partitions	M/s. Gypsum India Ltd. (Saint Gobain, M/s. RAMCO HILux (calcium silicate (ITEM SPECIFIC), Everest Industries Ltd.
	x	Floor Springs & Door Closers	Hardwyn, Everite, Hyper, Garnish
	y	VENETIAN BLINDS / VERTICAL BLINDS	FABER, MARVEL, Max, Vista
	Z	PEB Structures/Metal Roofing	Everest Industries Ltd.
17		Cement Based Paint	M/s Snowcem India Ltd. (Super snowcem, Sandex Matt), Berger-(Rabiacem), Apoorva Buildcare, New World Paints
18		Distemper & Paints Acrylic Emulsion, Enamel, Luster coat	M/s Asian Paints, Kansai Nerolac Paints Ltd., ICI Paints, AKzo NOBLE Paints, Berger Paints India Ltd., Jenson Nicholson, Garware Paints Ltd. & Shalimar Paint

19		Elastomeric Paints	Apurva India Pvt. Ltd., New World Paints
20		Polyurethane Paints	MRFL – Metal Coats,
21		Textured Plaster / Paint	Renovo, Durashield, RUF & TUF of Sherwin Williams [BJN Paints], New World Paints, KEMTEX Paints
22	a	Anti-fungal paint	Kremosoi of Artilin Paints, weather shield AKZO NOBLE Paints, Royal Shyne of Asian Paints, New World Paints, Wall Guard II of M/s Apurva India Pvt. Ltd.
	b	Biowash	Artibose of Artilin Paints, Berger Paints India Ltd., Snowcem India Ltd.
23	a	Epoxy paint	Asian paints, Berger, Shalimar, Amorloc, Huntsman
	b	Epoxy Flooring	HUNTSMAN, Fosroc, Shalimar Tar Products (STP) Ltd.
	c	Polyurethane Flooring	Shalimar Tar Products (STP) Ltd.
	d	High Build Epoxy	Shalimar Tar Products (STP) Ltd.
24	a	Tarfelts	M/s. S.T.P. Ltd., Lloyd Insulation, Tiki Tar Industries
	b	Chemical Based Water Proofing	Indofil, Flexicrete of Polyflex Industries, Fosroc, M/s. STP Ltd (Item Specific) M/s. Bitumet (Item Specific)
	c	APP waterproofing Membrane	Sika, Tikidan
25		Glass wool slabs	M/s. Rock wool India Ltd.
26		Glass for Doors / Windows	Modi Guard, Emirates, Saint Gobain, Asahi (IAG & AIS), Floatglass
27		Plain Glass Mirror	M/s Modi Float Glass, Eagle, Atul, Saint Gobain, Asahi (IAG)
28		Sanitary Wares	M/s Parryware, Cera, Neycer, Hindustan Sanitary ware (Hindware)
29		PH C.P. Brass Fittings & Fixtures – All PH fittings	Jaquar, GEM, Techno, KINGSTON, Metro, ESSCO, Plato
30		C. P. BRASS Urinal Waste & Flush pipes	As approved

31		Plastic Seat & Cover for EWC	M/s Commander, Diplomat, Patel, Champion, Parryware, Hindware, CERA
32		S.S. Sink	M/s Diamond, Nirali, Parryware
33		G.I. Pipes	M/s TATA
34		G.I. Pipes other than TATA make if specified	Zenith, Jindal
35		G.I. Fittings	As approved
36		G.M. Gate / Globe Valves	M/s Leader Valves, Neta, SANT, Zoloto, Hawa
37		Air Valve	Leader, Sant, HAWA, M/s Kirloskar
38		Water Meter	Capstan, Keycee, Paramount
39		Sluice Valves	Kirloskar, Leader, Hawa
40		Stainless Steel Towel rods & bath Accessories	KICH, Jaquar, ESSCO, Johnson
41		Cast Iron Valves	Kirloskar, Leader, HAWA
42		C.I. Soil Quality pipes / C.I. hubless pipe, Rain water pipes	NECO, RIFCO, A-1, PARAS, HIF, SKF by M/s Singhal Iron Foundry (Pvt.) Ltd., HEPCO
43		S.W. Pipes & Gully Trap	As approved
44		RCC Hume Pipes	M/s Indian Hume Pipes, Pranali, Cement pipe, Ghambir Pipes and products, Hindustan Pipes (Confirming to ISI)
45		HDPE Pipes & HDPE fittings	Prince, Sangir pipes, Supreme
46		RCC frame, covers	M/s Pratibha, Bharath, Vikrant
47		C.I. frame & covers; CI Gratings	NECO, M/s Ashok Iron, Foundry, HIF, Bombay Iron Works, KFAI
48		UPVC, SWR Pipes, C-PVC Pipes	Finolex, Prince, Supreme, ASTRAL, Jain Irrigation Systems Ltd.
49		PPR Pipes	Supreme, Sakthi Polymers, PRINCE, KISAN-KSR
50		PVC Plastic High / Low level cistern	Commander, Champion, Elitedual Parryware-slimline, Hindware, Prince
51		PVC Inlet connection & Waste Pipes	Kohinoor, ESSCO, GEM & Elite
52		Concertina Coil	As approved

53		Polycarbonate sheet	TUFLITE Polymers, GE, M/s Tilara Polyplast
54		Asbestos Roofing Sheets	Everest, Charminar, Asbestos Cement Ltd., VIKRANT
55		Colour Coated Steel / Zinc-aluminium alloy roofing sheets	Kirby, Steelfab, M/s Maxroof Corporation Pvt. Ltd.,
56		Aluminium Roofing Sheets	M/s. KALZIP
57		BITUMEN	HPCL, BPCL & Indian oil Corporation
58		Bitumen Emulsion	IWL, STP, HPCL
69		PVC water tank	SINTEX
60		FRP water tank	Devi Polymers, BINANI
61		Polymers (Styrene Butadine Rubber)	BASF, Pidilite & ROFFE, BASF, Flexicrete Acrylic Co-Polymer of M/s Apoorva Buildcare
62		Under water Repair Products	Shali Damit of Shalimar Tar Products (STP) Ltd.
63		Instant Under water Road Repair Products	Shali Patch of of Shalimar Tar Products (STP) Ltd.
64		Parallel Threaded mechanical splices	Dextra India Pvt. Ltd., M/s. Spplisetek India Pvt. Ltd.,
65		Cement Bonded Particle Board/ Drywell Panel	NCL Industries Ltd
66		Granulated Ground Blast Furnace Slag (GGBS)	JSW Cement Ltd.
67		Precast RCC storm water drains, chambers, box culverts, retaining & boundary walls, utility ducts	Fuji Silvertch

LIST OF DISCONTINUED MANUFACTURERS

Sl. No.	Description of materials	List of Manufacturers
1 a)	Colour Coated Steel / Zinc-alu alloy roofing sheets	a) M/s SAFZIP, M/s Colour Roof India Ltd.
b)	Aluminium Roofing Sheets	b) M/s SAFZIP, M/s Colour Roof India Ltd.

LIST OF APPROVED MANUFACTURER FOR STRUCTURAL GLAZING, ACP CLADDING AND GLASS FAÇADE

Sl. No.	Description of materials	List of Manufacturers (Tentative / Suggested)
1	Glass: Monolithic, Heat Strengthened, Toughened, Reflective, Tinted, Insulated, Laminated and Tempered Glass	St. Gobain (France/India), Glaverbel (Europe), Pilkington (USA, UK), Asahi (Japan), Viracon (USA), Guardian (USA), Saudi American Glass Factory, Interpane (USA)
2	Aluminium Extrusions	Hindalco Industries, Jindal, Bhorka or approved equivalent subject to specified tolerance standards. Indalco
3	Stainless Steel	Salem Steel or approved equivalent
4	EPDM	AMEE Rubber Industries Pvt. Ltd., OSAKA Rubber Pvt. Ltd. Or equivalent approved.
5	Double Glazing Unit Hermatically Sealed	Manufacturers listed above as item 1 and Sejal Arch. Glass/ FG Glass Industries Pvt. Ltd.
6	Expansion Anchors	HILTI or approved equivalent (with stainless steel 616 bolts, nuts & washers)
7	Chemical Anchors	HILTI or approved equivalent
8	Window Furniture: a) 4 Point Lockset	GIESSE or approved equivalent COTS WOLD or approved equivalent,

	b) S.S. Friction Hinges c) Patch Fittings d) Floor Springs e) Adhesive Film f) SS Handles	DORMA / Geetavin /Shalimar DORMA DORMA 3 M or approved equivalent. DORMA/KICH
9	Structural Sealant	Dow Corning / GE / Wecker
10	Weather Sealant	Dow Corning / GE / Wecker
11	Foam Spacers and Mounting Tapes	NORTON or approved equivalent
12	PVDF Coatings	VALSPAR Corporation or approved equivalent.
13	Aluminium Composite	ALUCOBOND or REYBOND or Alpollic approved Metal Panels equivalent, Eurobond, Durobond, Alstrong Enterprises India Pvt. Ltd
14	Baker Rod	Supreme Ind. or approved equivalent
15	Insulation	Glass wool / Rock Wool or approved equivalent
16	Spider System	Dorma or approved equivalent
17	Glass Processor	Impact Safety / Sejal Glass tech/ GSC / Asahi & FG Glass Industries Pvt. Ltd.

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Government of India
BHABHA ATOMIC RESEARCH CENTRE
Civil Engineering Division

Corrigendum No. 12 to Tender Documents w.e.f. 05.08.2025

This may be read along with the existing Tender Documents published on BARC website. The following are the changes in the existing Tender Documents and will be effective on all e-Tenders published on or after 9th July, 2025:

ANNEXURE – B is Modified (new equivalent tentative/suggested manufacturer have been added at Sr. No. 6-h, i, q, 11, 12, 19, 22-a, 24-b) / Revised as under:

The tentative/suggested makes have been specified in the tender document based on requirements of BARC, desired performance, detailed study of the technical parameters, manufacturing process, quality assurance/control & testing. The list is merely for guidance purpose. However, the bidder(s) can prefer any other make(s) which is/are meeting technical specifications given under Section-V, the Schedule of Quantities (Schedule 'B') given under Section-VIII of A&CED Tender Documents in BARC website and shall conform to the technical parameters/performance of the tentative/suggested makes and/ or shall conform to the relevant BIS codes or other relevant codes. In case of non-approved make(s), the bidder(s) shall suggest such equivalent / alternate make / brand, meeting above-mentioned technical parameters, during pre-bid stage and before submission of bid(s).

Sl. No.		Description of materials	List of Manufacturers (Tentative / Suggested)
1	a	Ordinary Portland Cement 43/ 53 Grade	ACC, Birla Rajshree, Ultratech or any other approved manufacturers confirming to relevant IS code
	b	Portland Pozzolana Cement (fly ash based confirming to 28 days strength requirement of OPC 43 grade)	ACC, Birla Rajshree, Ultratech or any other approved manufacturers confirming to relevant IS code
	c	White Cement	J. K. Cement & Birla White or any other approved manufacturers confirming to relevant IS code

2		HYSD Bars (TMT Bars) confirming IS-1786	M/s SAIL, M/s RINL, M/s TATA, M/s JSPL, M/s JSW Steel, M/s Sham Steel, M/s Guru Nanak Metal, M/s Metro Ispat, M/s Metro Alloys, M/s Bhagwati Ferro Metal Pvt. Ltd., M/s Ambe Ferro Alloys, M/s Electrosteel Steels Ltd. - (V-XEGA- M/s Vedanta Group) or any other manufacturers confirming to IS-1786
3	a	Structural Steel Sections confirming to IS-2062	M/s. SAIL, M/s RINL, M/s TATA, M/s M/s JSPL, M/s JSW or any other manufacturers confirming to IS-2062
	b	Structural Steel Plates confirming to IS-2062	M/s. SAIL, RINL, TATA, ESSAR, JSPL, JSW or any other manufacturers confirming to IS-2062
4	a	Fly-ash Bricks	M/s Shirke bricks, M/s Unicorn, M/s Shri Samarth, M/s A Cube bricks, LANVIN Infrastructure Pvt. Ltd. or any other approved manufacturers.
	b	Autoclave Aerated Blocks (AAC)	M/s Siporex, M/s AEROCON, XTRALITE of M/s UltraTech Cement Ltd. or any other approved manufacturers confirming to relevant IS code
5		Agency for Anti-Termite treatment	M/s PARAGON, PEECOPP, Express Pesticides Corporation, Pest Control (I) Ltd. or any other approved manufacturers confirming to relevant IS code
6		Tiles:	
	a	Ceramic Tiles	M/s H.R. Johnson (I) Ltd., M/s Somany, M/s Kajaria, M/s Asian Granito India Ltd, M/s Bell graneto, M/s NITCO LTD., M/s Orient Bell Limited (After Bell Ceramics acquired by Orient) or any other approved manufacturers confirming to relevant IS code
	b	Digital Glazed Vitrified Tiles	M/s H.R. Johnson (I) Ltd., M/s Somany, M/s Kajaria, M/s Asian Granito India Ltd, M/s Bell graneto, NITCO LTD., M/s Orient Bell Limited (After Bell Ceramics acquired by Orient) or

			any other approved manufacturers confirming to relevant IS code
	c	Glazed Floor Tiles	M/s H.R. Johnson, RAK Ceramics, Bell Granito, KAJARIA, SOMANY & Asian Granito India Ltd., NITCO LTD., Orient Bell Limited (After Bell Ceramics acquired by Orient) or any other approved manufacturers confirming to relevant IS code
	d	PVC flooring Rolls / Tile / Sheets	Premier Poly Vinyl, RMG Poly Vinyl India Ltd., (wonder floor), Armstrong, Responsive Industries Ltd., Royal Cushion Vinyl or any other approved manufacturers confirming to relevant IS code
	e	Paver Blocks, Polymer moulded Paver Blocks, Chequered concrete Floor Tiles, Unipaver Blocks	Super Tiles, Shree Precast INDUSTRIES, Pavetech Industries, Ultra Tile Pvt. Ltd., Intex Designer Tiles Pvt. Ltd. (Duracrete); Choice Mosaic Tiles or any other approved manufacturers confirming to relevant IS code
	f	Concrete Designer wall & Floor tiles	Ultra tile, Eurocon, Duracrete or any other approved manufacturers confirming to relevant IS code
	g	Acid Alkali Proof Tiles (Heavy Duty Tiles/Pavers)	Johnson ENDURA Tiles, Orient Bell Limited (After Bell Ceramics acquired by Orient) or any other approved manufacturers confirming to relevant IS code
	h	Tile Grout	ROFF / BALENDURA / LATICRETE /TILEFIXO of M/s UltraTech Cement Ltd., FIXOTILE of ACC Ltd., Shalimar Tar Products (STP) Ltd., M/s Anuvi Chemicals (Resikon Construction Chemicals) or any other approved manufacturers confirming to relevant IS code
	i	Non shrink Grout	FOSROC / PIDILITE / BASF / SIKA / ACCOGGOUT of ACC Ltd., Shalimar Tar

			Products (STP) Ltd., M/s Anuvi Chemicals (Resikon Construction Chemicals) or any other approved manufacturers confirming to relevant IS code
	j	Mosaic Tiles / Terrazo	NITCO LTD., or any other approved manufacturers confirming to relevant IS code
	k	Metallic Floor Hardner	Ironite India Ltd. Triveni Colour Industries (Floor) Heatly & Gresham (India) Ltd., De Rust Chemical Corporation of India (Fermonite), Cement Research Corporation (stilonite), Kironite, Shalimar Tar Products (STP) Ltd. or any other approved manufacturers confirming to relevant IS code
	l	Metal False Flooring	M/s UNITILE Access Floor or any other approved manufacturers confirming to relevant IS code
	m	Thin Jointing Mortar	FIXOBLOCK of M/s UltraTech Cement Ltd., ACCOFIX of ACC Ltd., Shalimar Tar Products (STP) Ltd., SILICOfix of M/S Precise Conchem Pvt. Ltd. or any other approved manufacturers confirming to relevant IS code
	n	Non Metallic Floor Hardener	Shalimar Tar Products (STP) Ltd. or any other approved manufacturers confirming to relevant IS code
	o	Marble Tiles	NITCO LTD. or any other approved manufacturers confirming to relevant IS code
	p	Germ Free Tiles	Orient Bell Limited (After Bell Ceramics acquired by Orient) or any other approved manufacturers confirming to relevant IS code

	q	Non shrink / Non expanding Powder Grout	M/s UltraTech, FOSROC / PIDILITE / BASF / SIKKA / M/s Anuvi Chemicals (Resikon Construction Chemicals) or any other approved manufacturers confirming to relevant IS code
7		Ready Mix Plaster	ROOFIT, FAIRMATE, WALPLAST, READIPLAST of ULTRATECH Cement Ltd., ACCOPlast of ACC Ltd., SILICOplast of M/S Precise Conchem Pvt. Ltd. or any other approved manufacturers confirming to relevant IS code
8		White Cement based wall putty	Birla Walcare / JK Putty or any other approved manufacturers confirming to relevant IS code
9		Lime, Neeru	Janatacem, Asian Paint More(Peacock), Kamal or any other approved manufacturers confirming to relevant IS code
10		Ready Mix concrete	ACC RMC, Govandi, ULTRATECH Readymix, Govandi, RMC India (Ghatkopar, Mahape), M/s StarCrete LLP, Mahape (M/s Ashwini Infradevelopment Pvt. Ltd.), M/s Concretech India, Tubhe & MIDC-Pawane M/s Swastik Infra-logic (I) Pvt. Ltd., M/s TNA Readymix India Private Ltd., Bharat Construction Company (Bombay) and any other approved plants.
11		Concrete Admixtures	Structural waterproofing Co., FOSROC Chemicals, BASF, CICO, M/s Anuvi Chemicals (Resikon Construction Chemicals) or any other approved manufacturers confirming to relevant IS code
12		Integral Waterproofing Compound	M/s Accoproof, CICO, Impermo, Pidilite, Roffe, FOSROC, Dr. Fixit, Sunanda

			Chemicals, M/s Anuvi Chemicals (Resikon Construction Chemicals) or any other approved manufacturers confirming to relevant IS code
13		Agencies for Waterproofing Treatment- Cement based	M/s Modern Waterproofing, M/s Gemini Construction M/s National Waterproofing M/s New Bharat Waterproofing Co. M/s. Taj Enterprises M/s CICO Technologies M/s Nina Industries M/s Structural Waterproofing Company M/s Raj Waterproofing Co., Chembur-Mumbai or any other approved equivalent agency
14		PVC Water stops	M/s Omai Plastics, Caprihans India Ltd., Kanta Polymers (Kanta flex) & Fixopan or any other approved manufacturers confirming to relevant IS code
15	a	Expansion Joint Boards	M/s Shalitex, M/s. Supreme-HD-100, Duroboard (Item specific) or any other approved manufacturers confirming to relevant IS code
	b	Expansion Joint Fillers	M/s Shalitex, S.T.P. Ltd., Lloyd Insulation & BASF Chemicals, FOSROC, PIDILITE, Choksey or any other approved manufacturers confirming to relevant IS code
	c	Heavy Density Thermocol (Expanded polystyrene)	As approved manufacturers confirming to relevant IS code
	d	Poly Sulphide Sealant	PIDILITE / BASF / DOWCORNING, Choksey or any other approved manufacturers confirming to relevant IS code
16		Doors, Windows, Partitions, Rolling Shutters, Fittings & Fixtures	

	a	Pressed Steel Door Frame	M/s SenHarvic, Anjali Enterprises, Windoors, Bharat Steel Industries Pune, M/s AGEW, M/s Sheth Fabricators, Shakti Hormann or any other approved manufacturers confirming to relevant IS code
	b	Steel flush Doors / Hollow metal Flush Doors	M/s. Shakthi Hormann Doors, Sheth Fabricators, M/s Ahaladha, M/s Senharvic, M/s Diamond Doors (Item Specific); Windoors, Strategic Buiding Systems, Signum Fire Protection Ltd., Anjali Enterprises, AGEW or any other approved manufacturers confirming to relevant IS code
	c	Pressed steel doors & fire resistant steel doors	M/s Shakthi Hormann Doors, M/s Ahaladha, Strategic Building Systems, M/s. Sheth Fabricators, M/s Signum Fire Protection Ltd. or any other approved manufacturers confirming to relevant IS code
	d	Flush Door Shutter	Indian Plywood, Kitply, Anand Wood Crafts, Sejpai and others (Anand Doors), M/s Kalpatharu Doors or any other approved manufacturers confirming to relevant IS code
	e	Masonite Wooden Panel Doors	Masonite India Ltd. or any other approved manufacturers confirming to relevant IS code
	f1	FRP Door Shutter	Advance FRP & House of Doors, Eccentric Designs or any other approved manufacturers confirming to relevant IS code
	f2	PVC Doors & window shutters, false ceiling, walls & partition panels, PVC Integral Foam sheet, PVC Free Foam sheet	M/s. Jain Irrigation Systems Ltd., M/s Rajshri Plastiwood or any other approved manufacturers confirming to relevant IS code

	g	Steel Windows	M/s SenHarvic, AGEW, Windoors, Anjali Enterprises, M/s. Sheth Fabricators, M/s. NCL Seccolor & Bharath Steel (Pune) or any other approved manufacturers confirming to relevant IS code
	h	Mild Steel Rolling Shutters, G.I. Rolling Shutters, Stainless steel & aluminium rolling shutters	Windoors, Dodia, Bharath, Vijaylakshmi Rolling Shutters, M/s Anjali Enterprises, M/s Azad Rolling Shutter & Construction, Kota, Shri Ambika Manufacturing Co. Chembur Mumbai or any other approved manufacturers confirming to relevant IS code
	i	Motorized Rolling Shutters & Motorized Gates	M/s. Gandhi automation Pvt. Ltd., Vijalakshmi Rolling Shutters or any other approved manufacturers confirming to relevant IS code
	j	Block Board	Wood India – Calcutta, Sejpal & others, Pioneer Timber Products, Chandigarh, Balaji Action Build well (Action Tesa) or any other approved manufacturers confirming to relevant IS code
	k	Ply Wood	a) For permanent use in buildings: Indian Plywood Mfg. Ltd. (Anchor), Kitply, Century Plywood, Associate Ply or any other approved manufacturers confirming to relevant IS code b) For Formwork : MAGNUS DENSIFIED FILMFACED PLY WOOD, Anchor brand, Associate Lumories or any other approved manufacturers confirming to relevant IS code
	l	Pre Laminated & Plain Particle Boards	ASIS, ARCHIDPLY, Action TESA or any other approved manufacturers confirming to relevant IS code

	m	Factory made solid wooden panel doors	Kalpaltharu Doors, M/s Jawahar Saw Mills, M/s Sreeji Wood Craft or any other approved manufacturers confirming to relevant IS code
	n	Fibre Cement boards	Everest-E-Boards / Charminar –C-Boards & ECOPRO & Shera boards or any other approved manufacturers confirming to relevant IS code
	o	Textured Fibre Boards	SHERA boards & Everest E-boards or any other approved manufacturers confirming to relevant IS code
	p	Aluminium Flush door shutters	Alufins or any other approved manufacturers confirming to relevant IS code
	q	Adhesive for wood	Fevicol, Vamicol, Dunlop, Araldite or any other approved manufacturers confirming to relevant IS code
	r	Aluminium Grills	M/s Decogrille or any other approved manufacturers confirming to relevant IS code
	s	Hardware Fittings & fixtures	M/s Jayant Metal, Shalimar hardware, Everite, Garnish, Diamond, Navbharat, SAIF Enterprises, Hardwin Traders, Godrej, DE Lock Industries, Explore Engineers, Garg, Classic, EBCO, Kich or any other approved manufacturers confirming to relevant IS code
	†	Aluminium Extruded Sections	Jindal, Indal, Hindalco, Bhoruka, M/s Royale Touche, Geetavin or any other approved manufacturers confirming to relevant IS code
	u	Aluminium Powder Coated Curtain rods	As approved manufacturers confirming to relevant IS code

	v	Factory made Ready to fix Aluminium Windows	M/s. Geeta Aluminum or any other approved manufacturers confirming to relevant IS code
	w	Dry wall partitions	M/s. Gypsum India Ltd. (Saint Gobain, M/s. RAMCO HILUX (calcium silicate (ITEM SPECIFIC), Everest Industries Ltd. or any other approved manufacturers confirming to relevant IS code
	x	Floor Springs & Door Closers	Hardwyn, Everite, Hyper, Garnish or any other approved manufacturers confirming to relevant IS code
	y	VENETIAN BLINDS / VERTICAL BLINDS	FABER, MARVEL, Max, Vista or any other approved manufacturers confirming to relevant IS code
	Z	PEB Structures/Metal Roofing	Everest Industries Ltd. or any other approved manufacturers confirming to relevant IS code
17		Cement Based Paint	M/s Snowcem India Ltd. (Super snowcem, Sandex Matt), Berger-(Rabiacem), Apoorva Buildcare, New World Paints or any other approved manufacturers confirming to relevant IS code
18		Distemper & Paints Acrylic Emulsion, Enamel, Luster coat	M/s Asian Paints, Kansai Nerolac Paints Ltd., ICI Paints, AKzo NOBLE Paints, Berger Paints India Ltd., Jenson Nicholson, Garware Paints Ltd. & Shalimar Paint or any other approved manufacturers confirming to relevant IS code
19		Elastomeric Paints	Apurva India Pvt. Ltd., New World Paints, M/s Anuvi Chemicals (Resikon Construction Chemicals) or any other approved manufacturers confirming to relevant IS code

20		Polyurethane Paints	MRFL – Metal Coats, or any other approved manufacturers confirming to relevant IS code
21		Textured Plaster / Paint	Renovo, Durashield, RUF & TUF of Sherwin Williams [BJN Paints], New World Paints, KEMTEX Paints or any other approved manufacturers confirming to relevant IS code
22	a	Anti-fungal paint	weather shield AKZO NOBLE Paints, Royal Shyne of Asian Paints, New World Paints, Wall Guard II of M/s Apurva India Pvt. Ltd., M/s Anuvi Chemicals (Resikon Construction Chemicals) or any other approved manufacturers confirming to relevant IS code
	b	Anti-fungal Treatment	Berger Paints India Ltd., Snowcem India Ltd., or any other approved manufacturers confirming to relevant IS code
23	a	Epoxy paint	Asian paints, Berger, Shalimar, Amorloc, Huntsman or any other approved manufacturers confirming to relevant IS code
	b	Epoxy Flooring	HUNTSMAN, Fosroc, Shalimar Tar Products (STP) Ltd. or any other approved manufacturers confirming to relevant IS code
	c	Polyurethane Flooring	Shalimar Tar Products (STP) Ltd. or any other approved manufacturers confirming to relevant IS code
	d	High Build Epoxy	Shalimar Tar Products (STP) Ltd. or any other approved manufacturers confirming to relevant IS code
24	a	Tarfelts	M/s. S.T.P. Ltd., Lloyd Insulation,

			Tiki Tar Industries or any other approved manufacturers confirming to relevant IS code
	b	Chemical Based Water Proofing	Indofil, Flexicrete of Polyflex Industries, Fosroc, M/s. STP Ltd (Item Specific) M/s. Bitumet (Item Specific), M/s Anuvi Chemicals (Resikon Construction Chemicals) or any other approved manufacturers confirming to relevant IS code
	c	APP waterproofing Membrane	Sika, Tikidan or any other approved manufacturers confirming to relevant IS code
25		Glass wool slabs	M/s. Rock wool India Ltd. or any other approved manufacturers confirming to relevant IS code
26		Glass for Doors / Windows	Modi Guard, Emirates, Saint Gobain, Asahi (IAG & AIS), Floatglass or any other approved manufacturers confirming to relevant IS code
27		Plain Glass Mirror	M/s Modi Float Glass, Eagle, Atul, Saint Gobain, Asahi (IAG) or any other approved manufacturers confirming to relevant IS code
28		Sanitary Wares	M/s Parryware, Cera, Neycer, Hindustan Sanitary ware (Hindware) or any other approved manufacturers confirming to relevant IS code
29		PH C.P. Brass Fittings & Fixtures – All PH fittings	Jaquar, GEM, Techno, KINGSTON, Metro, ESSCO, Plato or any other approved manufacturers confirming to relevant IS code
30		C. P. BRASS Urinal Waste & Flush pipes	As approved manufacturers confirming to relevant IS code

31		Plastic Seat & Cover for EWC	M/s Commander, Diplomat, Patel, Champion, Parryware, Hindware, CERA or any other approved manufacturers confirming to relevant IS code
32		S.S. Sink	M/s Diamond, Nirali, Parryware or any other approved manufacturers confirming to relevant IS code
33		G.I. Pipes	M/s TATA or any other approved manufacturers confirming to relevant IS code
34		G.I. Pipes other than TATA make if specified	Zenith, Jindal or any other approved manufacturers confirming to relevant IS code
35		G.I. Fittings	As approved manufacturers confirming to relevant IS code
36		G.M. Gate / Globe Valves	M/s Leader Valves, Neta, SANT, Zoloto, Hawa or any other approved manufacturers confirming to relevant IS code
37		Air Valve	Leader, Sant, HAWA, M/s Kirloskar or any other approved manufacturers confirming to relevant IS code
38		Water Meter	Capstan, Keycee, Paramount or any other approved manufacturers confirming to relevant IS code
39		Sluice Valves	Kirloskar, Leader, Hawa or any other approved manufacturers confirming to relevant IS code
40		Stainless Steel Towel rods & bath Accessories	KICH, Jaquar, ESSCO, Johnson or any other approved manufacturers confirming to relevant IS code
41		Cast Iron Valves	Kirloskar, Leader, HAWA or any other approved manufacturers confirming to relevant IS code

42	C.I. Soil Quality pipes / C.I. hubless pipe, Rain water pipes	NECO, RIFCO, A-1, PARAS, HIF, SKF by M/s Singhal Iron Foundry (Pvt.) Ltd., HEPCO or any other approved manufacturers confirming to relevant IS code
43	S.W. Pipes & Gully Trap	As approved manufacturers confirming to relevant IS code
44	RCC Hume Pipes	M/s Indian Hume Pipes, Prandli, Cement pipe, Ghambir Pipes and products, Hindustan Pipes (Confirming to ISI) or any other approved manufacturers confirming to relevant IS code
45	HDPE Pipes & HDPE fittings	Prince, Sangir pipes, Supreme or any other approved manufacturers confirming to relevant IS code
46	RCC frame, covers	M/s Pratibha, Bharath, Vikrant or any other approved manufacturers confirming to relevant IS code
47	C.I. frame & covers; CI Gratings	NECO, M/s Ashok Iron, Foundry, HIF, Bombay Iron Works, KFAI or any other approved manufacturers confirming to relevant IS code
48	UPVC, SWR Pipes, C-PVC Pipes	Finolex, Prince, Supreme, ASTRAL, Jain Irrigation Systems Ltd. or any other approved manufacturers confirming to relevant IS code
49	PPR Pipes	Supreme, Sakthi Polymers, PRINCE, KISAN-KSR or any other approved manufacturers confirming to relevant IS code
50	PVC Plastic High / Low level cistern	Commander, Champion, Elitedual Parryware-slimline, Hindware, Prince or any other approved manufacturers confirming to relevant IS code
51	PVC Inlet connection & Waste Pipes	Kohinoor, ESSCO, GEM & Elite or any other approved manufacturers confirming to relevant IS code
52	Concertina Coil	As approved manufacturers confirming to relevant IS code

53		Polycarbonate sheet	TUFLITE Polymers, GE, M/s Tilara Polyplast or any other approved manufacturers confirming to relevant IS code
54		Asbestos Roofing Sheets	Everest, Charminar, Asbestos Cement Ltd., VIKRANT or any other approved manufacturers confirming to relevant IS code
55		Colour Coated Steel / Zinc-aluminium alloy roofing sheets	Kirby, Steelfab, M/s Maxroof Corporation Pvt. Ltd., or any other approved manufacturers confirming to relevant IS code
56		Aluminium Roofing Sheets	M/s. KALZIP or any other approved manufacturers confirming to relevant IS code
57		BITUMEN	HPCL, BPCL & Indian oil Corporation or any other approved manufacturers confirming to relevant IS code
58		Bitumen Emulsion	IWL, STP, HPCL or any other approved manufacturers confirming to relevant IS code
69		PVC water tank	SINTEX or any other approved manufacturers confirming to relevant IS code
60		FRP water tank	Devi Polymers, BINANI or any other approved manufacturers confirming to relevant IS code
61		Polymers (Styrene Butadine Rubber)	BASF, Pidilite & ROFFE, BASF, Flexicrete Acrylic Co-Polymer of M/s Apoorva Buildcare or any other approved manufacturers confirming to relevant IS code
62		Under water Repair Products	Shali Damit of Shalimar Tar Products (STP) Ltd. or any other approved manufacturers confirming to relevant IS code
63		Instant Under water Road Repair Products	Shali Patch of of Shalimar Tar Products (STP) Ltd. or any other approved manufacturers confirming to relevant IS code

64		Parallel Threaded mechanical splices	Dextra India Pvt. Ltd., M/s. Spplisetek India Pvt. Ltd., or any other approved manufacturers confirming to relevant IS code
65		Cement Bonded Particle Board/ Drywell Panel	NCL Industries Ltd. or any other approved manufacturers confirming to relevant IS code
66		Granulated Ground Blast Furnace Slag (GGBS)	JSW Cement Ltd. or any other approved manufacturers confirming to relevant IS code
67		Precast RCC storm water drains, chambers, box culverts, retaining & boundary walls, utility ducts	Fuji Silvertex or any other approved manufacturers confirming to relevant IS code

LIST OF DISCONTINUED MANUFACTURERS

Sl. No.	Description of materials	List of Manufacturers
22 a)	Anti-fungal paint	Kremosoi of M/s. Artilin Paints
b)	Anti-fungal Treatment	Artibose of M/s. Artilin Paints

LIST OF APPROVED MANUFACTURER FOR STRUCTURAL GLAZING, ACP CLADDING AND GLASS FAÇADE

Sl. No.	Description of materials	List of Manufacturers (Tentative / Suggested)
1	Glass: Monolithic, Heat Strengthened, Toughened, Reflective, Tinted, Insulated, Laminated and Tempered Glass	St. Gobain (France/India), Glaverbel (Europe), Pilkington (USA, UK), Asahi (Japan), Viracon (USA), Guardian (USA), Saudi American Glass Factory, Interpane (USA) or any other approved manufacturers confirming to relevant IS code
2	Aluminium Extrusions	Hindalco Industries, Jindal, Bhorka or approved equivalent subject to specified tolerance standards.

		Indalco or any other approved manufacturers confirming to relevant IS code
3	Stainless Steel	Salem Steel or or any other approved manufacturers confirming to relevant IS code
4	EPDM	AMEE Rubber Industries Pvt. Ltd., OSAKA Rubber Pvt. Ltd. or any other approved manufacturers confirming to relevant IS code
5	Double Glazing Unit Hermatically Sealed	Manufacturers listed above as item 1 and Sejal Arch. Glass/ FG Glass Industries Pvt. Ltd or any other approved manufacturers confirming to relevant IS code.
6	Expansion Anchors	HILTI or approved equivalent (with stainless steel 616 bolts, nuts & washers) or any other approved manufacturers confirming to relevant IS code
7	Chemical Anchors	HILTI or any other approved manufacturers confirming to relevant IS code
8	Window Furniture: a) 4 Point Lockset b) S.S. Friction Hinges c) Patch Fittings d) Floor Springs e) Adhesive Film f) SS Handles	GIESSE or approved equivalent COTS WOLD or approved equivalent, DORMA / Geetavin /Shalimar DORMA DORMA 3 M or approved equivalent. DORMA/KICH or any other approved manufacturers confirming to relevant IS code
9	Structural Sealant	Dow Corning / GE / Wecker or any other approved manufacturers confirming to relevant IS code

10	Weather Sealant	Dow Corning / GE / Wecker or any other approved manufacturers confirming to relevant IS code
11	Foam Spacers and Mounting Tapes	NORTON or any other approved manufacturers confirming to relevant IS code
12	PVDF Coatings	VALSPAR Corporation or any other approved manufacturers confirming to relevant IS code
13	Aluminium Composite	ALUCOBOND or REYBOND or Alpolic approved Metal Panels equivalent, Eurobond, Durobond, Alstrong Enterprises India Pvt. Ltd. or any other approved manufacturers confirming to relevant IS code
14	Baker Rod	Supreme Ind. or any other approved manufacturers confirming to relevant IS code
15	Insulation	Glass wool / Rock Wool or any other approved manufacturers confirming to relevant IS code
16	Spider System	Dorma or any other approved manufacturers confirming to relevant IS code
17	Glass Processor	Impact Safety / Sejal Glass tech/ GSC / Asahi & FG Glass Industries Pvt. Ltd. or any other approved manufacturers confirming to relevant IS code

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SECTION-V
TECHNICAL SPECIFICATIONS

SECTION V (i)
GENERAL SPECIFICATIONS

SECTION V (i)

GENERAL SPECIFICATIONS

1. Project Site Information

1.1. Location of Work:

1.1.1. The work site is located at Special Materials Facility, BARC, DoddUllarthi Kaval, Challakere, Chitradurga district, Karnataka - 577537.

1.1.2. The Latitude and Longitude of the site are 14°23'27" N and 76°43'26" E respectively.

1.2. Access to project site:

1.2.1. Road: The site is well connected to the different cities of Karnataka. The nearest town is Challakere. The facility is approximately 13 km (Thirteen) from Challakere town.

1.2.2. Rail: Nearest railway station is Challakere. The nearest major railway stations are Davangere and Bengaluru.

1.2.3. Air: The nearest airport is Bengaluru.

1.2.4. Sea Port: The nearest seaport is Mangalore.

1.3. Terrain

1.3.1. The average ground level is about 560 m above Mean Sea Level (MSL). The terrain is by and large flat and sloping from South side towards North Side. The maximum and minimum elevations of the site are 574 m and 547 m above MSL respectively.

2. Scope of work is as follows:

2.1. Civil Works (Part-I of SOQ) and Pre-Engineered Building Works (Part-II of SOQ)

2.1.1. Architectural and Structural design activities:

2.1.1.1. Architectural designs and development of detailed drawings consisting of the following: a) development of detailed Architectural drawings, b) Working Drawings, all floor Plans, all Elevations, Sections through both the directions (X&Y), Door & Window Drawings including window grill drawings, detailed toilet drawings, Staircase drawings with railing details, Reflective ceiling plans/ false ceiling plans, Flooring pattern drawings, signages. c) detailed 3D Views indicating elevational details from all sides of

buildings including colour schemes, walk through videos. d) Generation of drawings for all connected building elements & services such as structural, Civil finishes, plumbing, sanitary, Electrical installations, and HVAC e) Support in obtaining all necessary statutory clearances from BARC authorities for construction clearance related to architectural aspects, along with documentation work and the supply of six sets (sizes not less than A-1) of all Good for Construction drawings (Please refer SOQ for facility wise work description).

2.1.1.2. Structural Analysis & Design consisting of the following: a) Detailed Structural Analysis & Design including seismic analysis b) Preparation of detailed structural & Fabrication drawings. c) Obtaining approval for all the analysis & designs documents, drawings from any IIT/ NIT/ IISC/Approved Govt. Engg. College. All the documents/ drawing shall be signed by a person not below the rank of a professor. d) Support in obtaining all necessary statutory clearances from BARC authorities for construction clearance related to structural aspects, along with documentation work and the supply of six sets (sizes not less than A-1) of all Good for Construction structural drawings (Please refer SOQ for facility wise work description).

2.1.1.3. For the following facilities:

2.1.1.3.1. Fire Station (RCC framed structure with only Ground floor, having ≈ 1100 m² Built-up Area) & Drill tower (RCC framed structure with Ground+3 floors, having ≈ 100 m² Built-up Area)

2.1.1.3.2. Tank farm areas (Chemical Storage area with foundations for tanks and underground sumps; ≈ 1740 m² Built-up Area)

2.1.1.3.3. Vehicle Parking sheds (≈ 8 no's of vehicles & 1 no of fire tender, ≈ 480 m² Built-up Area)

2.1.1.3.4. Boiler House (Pre-Engineered Building with only Ground floor, having ≈ 330 m² Built-up Area)

2.1.2. Geotechnical investigation works for Fire Station, Drill Tower and Boiler house as per Schedule of Quantities, specifications, and terms & conditions of the tender document.

2.1.3. Construction of Fire Station & Drill Tower as per the approved drawings, specifications, and terms & conditions of the tender document, for the successful and satisfactory completion.

- 2.1.4. Construction of Boiler House work as per approved drawings, specifications, and terms & conditions of the tender document, for the successful and satisfactory completion.
- 2.1.5. Construction of civil works of Tank Farm Areas as per the approved drawings, specifications, and terms & conditions of the tender document, for the successful and satisfactory completion.
- 2.1.6. Construction of Vehicle Parking sheds (≈ 8 no's of vehicles & 1 no of fire tender near FMF) as per the approved drawings, specifications, and terms & conditions of the tender document, for the successful and satisfactory completion.
- 2.1.7. Construction of foundations for all equipment/systems, piping racks etc. for Fiber Manufacturing Facility as per the drawings issued by the Engineer-in-Charge.
- 2.1.8. Construction of Entry booth ($\approx 4\text{m} \times 5\text{m}$) and Panel Room ($\approx 4\text{m} \times 5\text{m}$), for Fiber Manufacturing Facility (FMF) as per the drawings issued by the Engineer-in-Charge.
- 2.1.9. Completion of balance works for existing 5 blocks of FMF as per SOQ items, directions of Engineer-in-Charge.
- 2.2. Electrical Works (Part-III of SOQ): The scope of work includes the layout design for internal electrification, engineering, submission of GTP/drawings, technical documents, arrangement of factory inspections as applicable, loading, safe transportation, unloading, erection, pre-commissioning testing, and commissioning of various electrical systems. These systems include: LT Power Distribution Panels, Indoor and Outdoor Illumination Systems, UPS Systems, Lightning Protection Systems, Earthing Systems, Cable Trays and Cable Tray Management Systems, Conduiting, Wiring, Switches, Sockets, and MCB Distribution Boards (DBs), along with other associated equipment as per the approved design, SOQ, and Technical Specifications. The work also includes tapping power supply from the existing LT substation feeder and distributing it to the facilities as per the approved design. Refer Section-V (iv) for detailed scope of work.
- 2.3. Material Handling & Ventilation Works (Part-IV of SOQ):
 - 2.3.1. Supply, installation, testing, and commissioning of two monorails for the Boiler House with electrical hoists, each with a 2-ton capacity, complete with all mechanical, electrical, control components, and related standard accessories.

- 2.3.2. Supply, installation, testing, and commissioning of wall-mounted exhaust fans, grills, dampers, supply inlet louvers, etc., along with all required fixing accessories and electrical work for the Boiler House.
- 2.3.3. Refer Section-V (v) for detailed scope of work
- 2.4. Note: The built-up areas mentioned above are approximate areas, the final areas may slightly vary.
3. Following Technical specifications are attached with this document:
- 3.1. Section-V (ii) Technical Specifications for Civil Works (Part-I of SOQ)
- 3.2. Section-V (iii) Pre-Engineered Building Works (Part-II of SOQ)
- 3.3. Section-V (iv) Electrical Works (Part-III of SOQ)
- 3.4. Section-V (v) Material Handling & Ventilation Works (Part-IV of SOQ)
4. The Technical Specifications shall be the guidance for proper execution of work to the required standards. The above Specifications are intended for the general description of quality, workmanship etc. desired for various items of work under the Contract. The specifications are not, however, intended to cover minutest details and all work shall be executed according to the spirit of the specifications. The Technical Specifications shall be read in conjunction Schedule of Quantity (Price Schedule/ Schedule 'B')/ BOQ, drawings and other Tender documents.
5. **Payment terms:**
- 5.1. For Part - I - Civil Works, the mode of measurement & payment shall be as per SOQ/ Conditions of Contract/ Specifications.
- 5.2. Part - II - Pre-Engineered Building works:
- 5.2.1. Against approval of architectural drawings from BARC: 1% of the Tendered value for Part - II -Pre-Engineered Building works.
- 5.2.2. Against approval of structural drawings, DBR, DR, GA drawings etc. (Including civil foundations & Pre-Engineered Building portion). This should also include third party vetting from IIT/NIT/IISc/ Approved Govt. Engg. College. as per specifications: 3% of the Tendered value for Part - II - Pre-Engineered Building works.
- 5.2.3. Against submission of Good For Construction Drawings, submission of As-Built drawings.: 1% of the Tendered value for Part - II - Pre-Engineered Building works.

- 5.2.4. On delivery of structural steel members, bracings, sag rods, coldform structural members like purlins & wall girths etc. at construction site and acceptance by BARC: 25% of the Tendered value for Part - II - Pre-Engineered Building works.
- 5.2.5. After supply of rockwool panels, flashings, cage ladder, rainwater pipes and other items required for completion of building as per tender document and acceptance at site by BARC: 15% of the Tendered value for Part - II - Pre-Engineered Building works.
- 5.2.6. After completion of erection of structural steel members, (viz., columns, beams, bracings, tie rods, rafters etc.): 20% of the Tendered value for Part - II - Pre-Engineered Building works.
- 5.2.7. After completion of erection of rockwool panels flashings, cage ladder: 20% of the Tendered value for Part - II - Pre-Engineered Building works.
- 5.2.8. On completion of fittings of architectural items like, facia, rainwater pipes, rolling shutter, windows, corner beads, fits and finishes of all panels etc. including commission of the building: 15% of the Tendered value for Part - II - Pre-Engineered Building works.
- 5.3. For Part - III - Electrical works, Part - IV -Material Handling & Ventilation Works; the payment terms shall be as follows:
- 5.3.1. 70% of the SOQ item rate will be paid on pro-rata basis on receipt of materials at site in good condition and against submission of following documents: Contractor Invoice, packing list, Test certificate, Pre-dispatch inspection certificate / waiver of inspection, Warranty certificate, Dispatch clearance certificate issued by BARC (if applicable).
- 5.3.2. 20% of the SOQ item rate be will be paid on pro-rata basis on after successful installation and test commissioning of the item and acceptance of the same by BARC.
- 5.3.3. 10% of the SOQ item rate be will be paid on pro-rata basis after successful completion and final acceptance of the respective SOQ Part (i.e. Part-III/IV) by BARC.

6. Sub-Contracting:

- 6.1. With the approval of the Engineer-in-Charge, contractor may subcontract the following portions of the work:

- 6.1.1. Design Activities, i.e. Item No. 1 of Part I – Civil Works
- 6.1.2. Geo-technical Works, i.e. Item No. 2 to 7 of Part I – Civil Works
- 6.1.3. Part II – Pre-Engineered Building Works
- 6.1.4. Part III – Electrical Works
- 6.1.5. Part IV – Material Handling & Ventilation Works
- 6.2. Contractor shall be permitted to subcontract up to 25% of the total tendered value for the portions mentioned above, subject to approval by the Engineer-in-Charge.
- 6.3. The subcontractor must have successfully completed at least one work of similar nature, with a value not less than 40% of the portion to be subcontracted. Additionally, for Part III – Electrical Works, the sub-contractor should have Electrical Class-I License/ Electrical Super Grade Contractor license or license issued by any government/ Aided officials in India, suitable for execution of the electrical works of the tender.
- 6.4. The contractor shall not be allowed to sub-contract works to any contractor from a country which shares a land border with India unless such contractor is registered with the competent authority. (Refer orders issued by Public Procurement Division, Department of Expenditure, ministry of Finance, Government of India their amendments/addendum from time to time.).
- 6.5. The details of subcontracts shall be submitted to BARC for approval within 15 days from the date of issue of work order.
- 6.6. BARC shall give approval or shall refuse approval in writing within 15 days of receipt of request along with all supporting details. Contractor shall have alternate arrangement in case BARC rejects sub-contractors listed by the contractor.
- 6.7. The sub-contractor approved by BARC shall not be changed by the contractor during execution of the work. However, if change is warranted the contractor may do so, with permission of Engineer-in- charge.
- 6.8. The approval extended by the BARC to Subcontractors recommended by the contractor shall not discharge the contractor from the Contract obligations. The contractor shall remain solely liable for any action, deficiency, and/or negligence on the part of his Subcontractors. The primary responsibility for completion of work is of the Contractor.

6.9. Payments for the portions where the sub-contracting is allowed shall be paid directly to contractor

6.10. In no event shall the BARC be deemed to have any Contract obligations whatsoever in respect of contractor's Subcontractors and/or title-holders of any sub-orders placed by him.

6.11. It shall be the responsibility of contractor to sort out any dispute / litigation with the Subcontractors without any time & cost overrun to the BARC. The contractor shall be solely responsible for settling any dispute / litigation arising out of his agreement with the Subcontractors. The contractor shall ensure that the work shall not suffer on account of litigation/ dispute between him and the Subcontractors. No claim of hindrance in the work shall be entertained from the Contractor on this account. No extension of time shall be granted and no claim what so ever, of any kind, shall be entertained from the Contractor on account of delay attributable to the selection/rejection of the Subcontractors or any dispute amongst them.

7. Quality Assurance Plan (QAP):

7.1. Contractor shall submit Quality Assurance Plan for entire work within 15 days from stipulate start date of the contract.

1.1. The Tentative Quality Assurance Plan for Civil Works (Part-I of SOQ) and Pre-Engineered Building Works (Part-II of SOQ) is enclosed along with the specifications.

1.2. Contractor can either establish a complete field testing laboratory or shall tie up with an NABL accredited laboratory (Lab shall be approved by Engineer-in-Charge) for sample collection and testing as per the approved Quality Assurance Plan.

1.3. All test charges are to be borne by the contractor and no reimbursement will be made by the Engineer-in-Charge absolutely whatsoever irrespective of the fact that the materials tested have passed or failed.

8. Working Hours: The normal working hours will be from 0900 Hrs. to 1730 Hrs. on normal working days from Monday through Saturday and excluding Sundays and holidays. Depending upon the requirement, time schedule and the targets set to complete the job in time, the works may have to continue beyond normal working hours to the extent of round the clock and Holidays also, for which no extra claim shall be entertained. Permission for working beyond 1730 Hrs. on normal working days from Monday through Saturday and for working on Sundays & Holidays may be permitted by BARC based on

written request by contractor, provided contractor complied with all statutory, safety requirements and applicable labour laws. Any permission to be obtained for the same is in the scope of contractor. It is therefore imperative that the contractor mobilizes sufficient manpower and tools & tackles to complete the work within 0900 Hrs. to 1730 Hrs. from Monday through Saturday only excluding Sundays & holidays.

9. The makes and brands suggested in the specifications are general recommendation and for guidance of bidders to match performance parameters and tender specifications. The list is merely for guidance purpose. However, the bidder(s) can prefer any other alternate or equivalent makes and brands which is/are meeting the performance parameters and tender specifications by submitting technical details to substantiate their claims. To ensure equal opportunity, fair treatment for all bidders, and to avoid delays during execution of work, the pre-bid clarification stage is the appropriate time to propose alternate or equivalent makes and brands. The department will review these proposals and recognize them in the pre-bid clarification document after verifying the submitted technical details. Any delays after the award of work due to the time taken to convey acceptance or rejection of alternate or equivalent makes and brands suggested by the contractor (if any) will be the contractor's responsibility. Additionally, any extra costs resulting from superior specifications or performance of items or materials will not be payable. Only make and brands that meet the minimum local content as per the Public Procurement (Preference to Make in India) Order 2017 shall be considered for approval.

10. Drawings

- 10.1. The drawings are provided Section – VI of this tender document.
- 10.2. Aforesaid drawings are preliminary for Tender purpose only and are not complete.

11. Land, Water, and Electricity for both construction activities and Labour Colony:

- 11.1. As mentioned in Schedule 'A'; under Proforma of schedules, Department provides land, water, and electricity at the rates mentioned therein. However, the contractor holds primary responsibility for arranging these utilities for both construction activities and the labour colony. The department shall not be held liable for any non-availability of land, water, or electricity during the contract period. In case of unavailability, the contractor must make alternative arrangements on their own.

- 11.2. The contractor shall barricade the labour colony with a 3-meter-high GI sheet providing sufficient illumination around the periphery, and having single entry/ exit gate.
- 11.3. The contractor shall provide round-the-clock security, with one Security personnel assigned for each 8-hour shift.
- 11.4. The facilities in the labour colony shall be provided by the contractor in accordance with the conditions mentioned in "Model Rules for the Protection of Health & Sanitary Arrangements for workers" and the "Safety code" of the Tender Document.
- 11.5. The contractor shall deploy a supervisor at all times in the labour colony to assist the department for security related issues.
- 11.6. Consumption of liquor and smoking are strictly prohibited in the construction site and labour colony. The contractor shall submit an undertaking to ensure compliance with this policy.
- 11.7. The Contractor will have to dismantle the labour colony, Temporary office, vacate the land after the receipt of due notice from Engineer-in-Charge., if the same is obstructing any work.
- 11.8. The contractor must immediately dismantle the labour colony, temporary office, vacate the land, and demobilize upon completion of the work.
12. The Existing water supply pipelines and Electricity cables shall not be disturbed by the contractor during execution of the work.

13. Construction Schedule:

- 13.1. Contractor shall submit a detailed Construction Schedule/Time and Progress Chart (PERT/Bar Chart) within 7 days from the placement of Work order.
- 13.2. The tentative Construction Schedule (Time and Progress Chart /Bar Chart) is shown below. The Construction Schedule submitted by the contractor shall be in line with the milestones specified in the Schedule-F/ Clause-5 and tentative construction schedule shown below.

Tentative Construction Schedule (Bar Chart)																								
SL. No.	Activity	Construction period: 730 Calendar days including monsoon period. (24 Months)																						
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1	Preliminary Works : Site mobilization, Finalising sub-contractors	■																						
2	Geo-Technical works	■	■	■	■	■	■																	
3	Design Activities	■	■	■	■	■	■																	
4	Construction clearance by BARC authorities				■	■	■																	
5	Sub-Structure works							■	■	■	■	■	■	■	■	■								
6	RCC Work in Super structure works										■	■	■	■	■	■	■	■						
7	Brick Work, Door frames.											■	■	■	■	■	■	■						
8	Plastering & water proofing												■	■	■	■	■	■	■	■	■	■		
9	Flooring works													■	■	■	■	■	■	■	■	■	■	
10	Doors, windows, Aluminium fitting etc.														■	■	■	■	■	■	■	■	■	
11	PII Works															■	■	■	■	■	■	■	■	
12	Electrical works																■	■	■	■	■	■	■	
13	Painting																	■	■	■	■	■	■	
14	Miscellaneous works																						■	
15	Final touch up & Handing over																							■

Note: (a) The details of sub-contractors shall be submitted to BARC for approval within 15 days from the date of issue of work order. (b) Geo-technical activities shall be completed within 6 months from the stipulated start date of the contract. (c) All design activities shall be completed within 6 months from the stipulated start date of the contract. The facility-wise timeline for submission of design activities, as well as the duration for the issuance of clearances/comments by the statutory authority and Engineer-in-Charge (EIC), are provided in the specifications. (d) The Boiler House, in all aspects, shall be handed over to BARC within 365 days from the stipulated start date of the contract. (e) Independent activities such as: (i) Balance works for the existing 5 blocks of FMF, (ii) Construction of foundations for all equipment/systems, piping racks, etc., for FMF, (iii) Construction of Entry booth and Panel Room for FMF, shall be undertaken immediately after placement of the contract.

*****End of General Specifications *****

SECTION-V(ii)

TECHNICAL SPECIFICATIONS

CIVIL WORKS

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C-01: GEO TECHNICAL INVESTIGATION

1.0 SCOPE

This specification covers the complete soil exploration work including carrying out field tests and laboratory tests to evaluate static parameters of soil/rock and preparation of detailed report including the recommendations regarding founding level, type of foundation for different kinds of structures/machines and methods of deep excavation.

2.0 GENERAL

The contractor shall perform all work under the purview of this specification along with all incidental and related work including setting out, staging, approach to test locations, contractor's office, stores and protection of adjacent buildings, structures or services / facilities. No separate payments shall be made on such accounts. The tenderer should therefore take into account all such relevant items while quoting his unit rates against the schedule of items.

2.1 Work to be provided for the contractor

The work to be provided by the contractor, unless specified otherwise shall include but not be limited to the following.

- a) Furnish necessary plant and equipment, tools and tackles, instruments, necessary power, fuel, water, labour, supervisions by qualified and experienced Engineers and supervisors specialized in the type of investigation, transport of materials, men and equipment etc., services, full insurance and all other incidental items as may be necessary for entire and successful completion of the work as per tender terms, drawings, specifications and instruction of the Engineer-in-Charge.
- b) Locate in the field and in layout drawing all boreholes and other field investigation items.
- c) Furnish progressively and periodically field bore logs, investigation observations, test results with relevant data and features in triplicate. The contractor shall also keep in continuous communication with the Engineer-in-Charge regarding further field investigation, particularly if modifications in the earlier test program become necessary on the basis of the test results.
- d) Prepare and submit draft (in duplicate) and five copies of final (after incorporating comments, if any) sub soil investigation report

as per specification, schedule of items and instructions of the Engineer-in-Charge.

2.2 Work to be provided by others

No work under this specification will be provided by any agency other than the contractor unless specifically mentioned elsewhere in the contract.

2.3 Location and Levels

Location of all boreholes and field test points and levels of the existing ground at such locations shall be established by the contractor at his own cost from two reference grids and one bench mark given by the Engineer-in-Charge and these shall be subsequently plotted in the layout plan, bore logs and other relevant field test data sheets / tables to be incorporated in the report by the contractor.

Making bench mark pillar(s) and reference line pillars (whatever are required for the work) and maintaining them upto the completion of the work shall be the responsibility of the contractor and no extra payment shall be paid.

2.4 Codes and Standards

The following is the general list of IS Codes to be used for the soil investigation work and preparation of report. In all cases latest revision along with amendments, if any, shall be referred to.

IS:1080	-	Code of Practice for Design and construction of Simple Spread Foundations
IS:1498	-	Classification and identification of soils for General Engineering purposes.
IS:1888	-	Method of load tests on soils
IS:1892	-	Subsurface investigation for foundation
IS:1904	-	Structural safety of buildings: shallow foundations
IS:2131	-	Method for standard penetration test for soils
IS:2132	-	Code of Practice for thin walled tube sampling of soils
IS:2720	-	Methods of tests for soils
IS:2809	-	Glossary of terms and symbols relating to Soil Engineering.

	IS:2810	-	Glossary of terms relating to soil dynamics
	IS:3025	-	Methods of sampling and testing for water used in industry
	IS:3043	-	Code of Practice for earthing
	IS:4078	-	Indexing and storage of drill cores
	IS:4434	-	Code of Practice for insitu vane shear test for soils
	IS:4453	-	Code of Practice for exploration by pits, trenches, drifts and shafts
	IS:4464	-	Presentation of drilling information and core description in foundation investigation
	IS:4968 (Part-II)	-	Dynamic Cone Penetration Test.
	IS:4968 (Part-III)	-	Static Cone Penetration Test.
	IS:5249	-	Method of test for determination of dynamic properties of soil.
	IS:5313	-	Guide for core drilling observations
	IS:5529 (Part I)	-	In situ permeability tests - tests in over-burden
	IS:5529 (Part II)	-	In situ permeability tests - tests in bed rock
	IS:6403	-	Determination of allowable bearing pressure on shallow foundations.
	IS:6926	-	Diamond core drilling for site investigation for river valley projects.
boreholes	IS:6935	-	Method of determination of water level in
	IS:7746	-	In situ shear test on rock
	IS:8009	-	Calculation of settlement of foundations -

(Part-I)		Shallow foundations subjected to symmetrical static vertical loads
(Part-II)		Deep foundations subjected to symmetrical static vertical loading.
IS:8763	-	Guide for undisturbed sampling of sands
IS:8764	-	Method for determination of point load strength index of rocks
IS:9143	-	Method for the determination of unconfined compressive strength of rock materials
IS:9179	-	Method for preparation of rock specimen for laboratory testing
IS:9214	-	Method of determination of modulus of subgrade reaction (k-value) of soils in field
IS:9221	-	Method for determination of modulus of elasticity and poisson's ratio of rock materials in uniaxial compression.
IS:9259	-	Liquid limit apparatus for soils
IS:9640	-	Specification for split spoon sampler
IS:10108	-	Sampling of soils by thin wall samples with stationary piston
IS:10589	-	Equipment for subsurface sounding of soils
IS:10837	-	Specification of moulds for determination of relative density and its accessories
IS:11229	-	Specification for shear box testing of soils
IS:11315 (Part II)	-	Description of discontinuities in rock mass - core recovery and rock quality

3.0 **SOIL EXPLORATION**

3.1 **Test Boring**

Test Boring through different layers of soil shall be carried out by the contractor at the locations marked in the drawing (to be furnished by Engineer-in-Charge-in-Charge after award of Contract) and/or at such other locations as directed by the Engineer-in-Charge in a manner described below.

Various methods of boring as described in IS:1892 may be adopted. The tenderer shall furnish in his tender the complete details of the equipment and the method he proposes to follow. Minimum diameter of boring shall be 150 mm.

During the boring operations if rock strata is not encountered, the boring shall be continued upto 30 m depth for two bore holes and upto 20m depth for the remaining boreholes unless stated otherwise. In case rock strata is encountered within the above depths, boring operations shall be discontinued and drilling operation as enumerated in clause 3.03.00 below shall be resorted to. If the present formation level is above the natural ground with filled-up soil, the depth of boring mentioned above shall exclude such filled-up soil.

The contractor shall describe in detail the equipment and method of boring he proposes to use. In the absence of dry boring equipment, wash boring at the discretion of the Engineer-in-Charge may be allowed, but the particular way of cleaning the casing by washing has to be approved by the Engineer-in-Charge. However, if the Engineer-in-Charge, at any time, feels that the washing process is disturbing the samples to be taken, he may stop the work and the contractor shall have no claim whatsoever on this score. If the contractor can, however, improve the method to the satisfaction of the Engineer-in-Charge, he may be allowed to resume the wash boring work.

When boring cannot be advanced due to presence of hard material, it should be checked whether there are continuous strata of hard material below before resorting to drilling methods. If only a local boulder is present it should be chopped using suitable chopping bits and the debris removed and normal boring continued.

Ground water level for each bore hole shall be checked during boring operation and shall be recorded in bore log. Sub-soil water samples shall also be collected from each borehole and recorded.

The boreholes shall be backfilled by the contractor as per SOQ item.

3.2 Stabilization of Boreholes

Boreholes shall be stabilized, whenever required, against caving of the sides of the drill hole and heaving of the bottom of the hole. especially in cases where the hole is carried below the ground water level, by use of drive pipe or casing or by means of drilling fluids (water or mixtures of water and colloidal, gel forming thixotropic clays such as bentonite) or grouting (in rack or other suitable methods).

3.3 Open Trial Pits

The location of open trial pits shall be as indicated in approved drawing and/or at such other locations as directed by the Engineer-in-Charge. If the present formation level is above the natural ground level with filled-up soil, the depth of trial pits shall be upto a depth of 3.5m below natural ground level or not below the ground water table or as directed by the Engineer-in-Charge. In no case, the depth shall be extended over 5m. The size of pits shall be 3.0m x 3.0m or as directed by the Engineer-in-Charge. Samples of undisturbed soil shall be obtained preferably at every 1.5m or where a change in strata is noticed.

The contractor shall provide a suitable access to the bottom of the pits. Sampling in trial pits shall be done as directed by the Engineer-in-Charge.

The contractor shall be paid at contract unit price for each trial pit which will include all costs for earthwork in excavation with necessary side slope and backfilling and shoring/ sheeting for side protection, if required. If the pits exceed over 3.5m in depth, the contractor shall be paid at unit price for the extra depths of excavation.

After completion of the test, sampling and visual examination, the pit shall be suitably backfilled as directed by the Engineer-in-Charge. Unless otherwise specified, excavated soil shall be used for this purpose.

3.4 Rock Drilling

During boring operation, once rock strata is encountered, the normal method of boring operation as described under clause 3.01.00 earlier shall have to be stopped and drilling operation will be resorted to for determining depth and nature of rock strata, in a manner as described below.

Rotary core drilling technique with continuous core recovery should be adopted for drilling through rock. The tenderer shall indicate in his tender the type of coring bit he proposes to use. The behaviour of rock mass is governed more significantly by the nature of fractures in the rock than by the type and hardness of the material composing the rock itself. Hence, good drilling technique should be adopted to obtain an intact sample truly representative of the in-situ material and for achieving highest percentage of recovery possible. Variations in the speed of rotation, the downward pressure on the core barrel, the pressure at which the drilling fluid is introduced into the hole and the length of hole drilled (run length) prior to removal of the core are major items which must be controlled by the driller. In general, coring should be initiated with short runs both because the upper portions of rock masses are commonly highly fractured and also because the elevations at which core losses occur can be more accurately determined. If conditions indicate that it is possible, the length of the runs may be determined by the length of the core barrel.

In zones which are highly fractured or where the barrel continuously becomes blocked it is essential that short runs be used even though this means removal of the entire string of drilling tools every 300 mm or less. Reduced bit pressure should be resorted to when rod vibration or chatter occurs. The pressure under which the drilling fluid should be introduced into the hole will be the minimum to be consistent with adequate removal of cuttings from the hole and proper cooling of the bit. To minimise the erosive action of the drilling fluid on the core and thereby to improve core recovery, double tube core barrels should be used. The casing and core barrel to be used shall be NX only.

During the drilling operation for each bore-hole the contractor shall record the rate of sinking of drill rods, ground water table elevations, if any, nature, type and sequence of rock drilled. All cores shall be collected, serially numbered and placed properly in anti-termite treated core-boxes, appropriately labeled and numbered. From the recovered cores the contractor shall determine nature of fractures and degree of weathering of rock for each bore hole. The contractor shall also note and record any appreciable loss of drilling fluid throughout the entire drilling operations for each bore hole. The contractor shall also determine the percentage recovery ratio and rock quality designation from the recovered cores for each stage of core advance and for all the bore-holes. Rock quality designation is defined as the ratio of cumulative lengths of intact pieces of core greater than 10 cm to the length of core advance.

The contractor shall furnish all the information mentioned above fully verified and signed by the Engineer-in-Charge at site and submit them in triplicate to the Engineer-in-Charge.

In addition to the above mentioned points the contractor shall also take into consideration the provisions of the latest revisions of the following Codes of Practice:

- a) IS:6926 - Code of practice for diamond core drilling for site investigation for river valley projects (optional).
- b) IS:4078 - Code of Practice for indexing and storage of drill cores.
- c) IS:4464 - Code of Practice for presentation of drilling information and core description in foundation investigation.

3.5 Adits and Test shafts

An exploratory adit is a horizontal or near horizontal excavation made by mining methods in rock. The term "test shaft" is used to refer to a vertical excavation generally in rock and very deep test pits. These are

used for in-situ examination of the nature of the rock and its structural features such as joints, fractures, faults and shear zones. Adits may also be used for insitu tests to determine the modulus of deformation of rock.

3.6 Sampling

Bored spoil shall be collected continuously during boring to note any change of strata. Samples of undisturbed soil shall be obtained preferably at every 1.5 m or where a change in strata is indicated by the slurry flowing out. In no case shall the depth between successive sampling be more than 3.0 m and a sample shall be obtained on the average for every 1.5 m depth of boring, since it is intended to ascertain the characteristics of the soil at various depths. If, however, there is fair uniformity in the characteristics of the soil for certain depths the Engineer-in-Charge may limit the number of samples stipulated above.

3.6.1 Tube Sampling

For obtaining undisturbed samples in its simplest form, an open drive thin wall tube sampler shall be attached to a rod and shall be lowered to the bottom after completely cleaning the borehole bottom by washing. The samplers to be used should have area ratio preferably less than 10 percent. The head should have check valve and ports to permit easy escape of drilling fluid or air from the sample tube as the sample enters it.

Sampling will be accomplished by jacking or driving the tube depending on the type of soil to be sampled. Upon completion of the sampling operation the sampler shall be withdrawn from the borehole and the sample of soil carefully taken out. Approximately one inch length of soil is to be removed from each end for identification. If there is any surface water on the sample, this shall be wiped off with soaking paper, all sludge or cuttings from advancement of borehole removed and the sample immediately packed in an airtight, close fitting container marked with respective test bore numbers, elevation at which the sample was taken and other relevant information as per IS:1892. The size of soil test samples shall preferably be 65 mm dia x 200 mm high, but not less than 50 mm dia. x 150 mm high.

Representative / disturbed samples shall also be taken in different strata for visual classification, water content, grain size analysis, Atterberg limits, determination of specific gravity and compaction tests.

3.6.2 Chunk Samples

In cohesive soils, undisturbed samples of regular shapes shall be collected. The samples shall be cut and trimmed to a suitable size (0.3 x 0.3 x 0.3 m). A square area (0.35 x 0.35 m) shall be marked at the

centre of the leveled surface at the bottom of the pit. Without disturbing the soil inside the marked area, the soil around this marking shall be carefully removed up to a depth of 0.35 m. The four vertical faces of the soil block protruding at the centre shall be trimmed slowly so that its size reduced to 0.3 x 0.3 m. Wax paper cut to suitable size shall be wrapped uniformly and covered with two layers of thin cloth over all the 5 exposed surfaces of the soil block and sealed properly using molten wax. A firmly constructed wooden box of size 0.35m x 0.35m (internal dimensions) with the top and bottom open shall be placed around the soil block and held in such a manner that its top edge protrudes just above the surface of the block. The space between the soil block and the box shall be filled uniformly and tightly with moist saw dust. The top surface shall also be covered with saw dust before nailing the wooden lid to cover the box firmly taking care that the soil block is not disturbed. The area of contact between the bottom portion of the block and the ground shall be reduced slowly by removing soil in small quantities using small rods, so that the block can be separated from the ground slowly without disturbance. After inverting the wooden box along with the soil block, the bottom portion shall be trimmed and covered with wax paper, cloth and sealed with molten wax. A wooden lid shall be nailed to the box after providing proper saw dust cushion below it. An arrow mark shall be made on the vertical face of the wooden box to indicate the top surface along with the coordinates and depth of sampling.

3.6.3 Sampling in rock

Sampling in rock shall be accomplished during the drilling process by employing double tube core barrels for continuous core recovery. The drilling procedure to be followed should be the one which brings about the highest percent recovery and the exact procedure must be determined in the field to the satisfaction of Engineer-in-Charge.

3.7 Record of Boring

Detailed chronological record of drilling and sampling operations shall be maintained in the field log and should be submitted to the Engineer-in-Charge after completion of individual borehole at site. The final log showing pertinent subsurface information and results of field and laboratory testing should be submitted with the soil report.

The field log should contain at least the following information:

- a) Reference information like project number, title and location, exploration number and location by coordinates, inclination of the boring and if inclined the bearing or azimuth of the dip of the hole, reference level and datum.
- b) Personnel information - name of drilling contractor, driller and inspecting Engineer-in-Charge.

- c) Equipment data - manufacturer's name and model designation.
- d) Sampling and coring information :
 - i) General : Sample type and number, sampler dimension, depth at start and completion of sampling, length of sample, recovery ratio and complete visual description of each sample in "as retrieved" state.
 - ii) Drive samplers : weight and height of drop of hammer and number of blows for each 150 mm penetration.
 - iii) Push samplers : hydraulic pressure and rate of penetration.
 - iv) Soil or rock coring : average rotational speed, down-ward hydraulic pressure and rate of penetration .
 - v) Rock coring : Rock quality designation (R Q D)
- e) Description of material penetrated but not sampled.
- f) Casing information - size, depth at which required, length and depth of bottom of casing; weight and height of drop of hammer and number of blows for each 300 mm of penetration for driven casing, and average rotational speed and downward pressure on casing and average rate of penetration for drilled casing.
- g) Seepage pressure test information-depth and duration of test.
- h) Groundwater information - depth to water surface recorded daily and continued till water level has stabilized.
- i) Artesian pressure information - depth at which encountered, measured head and time at which each measurement is made.
- j) Elevation of top and bottom of hole and top of rock
- k) Date and time of all operations and delays with reasons.
- l) Miscellaneous information to aid interpretation of sub-surface conditions.
- m) Additional pertinent information.

The final log shall be a condensation of the field log refined on the basis of field and laboratory tests. The final log should present a clear,

concise and accurate picture of subsurface conditions to be utilized by the Engineer-in-Charge.

4.0 PENETRATION TESTS

Penetration tests using various types of equipment as specified shall be conducted to measure the resistance of soil to penetration.

4.1 Standard Penetration Test

Standard penetration test (SPT) shall be carried out in accordance with IS:2131 at every change in strata or at 1.5 m intervals or as directed by the Engineer-in-Charge. The first test shall generally begin at 0.5 to 1.5 M depth, unless UDS is collected at the depth. Generally, SPT and UDS shall be conducted alternatively at 1.5 M intervals, unless some other tests specified by the Engineer Incharge (EIC) at that location. If UDS cannot be collected this shall be replaced by the SPT. For conducting the test, the bottom of borehole shall be cleaned properly and the spoon shall be properly and centrally seated position in the borehole. The contractor shall record the number of blows for each 150 mm penetration of the standard split spoon sampler over a depth of 450 mm. The number of blows for the first 150 mm of penetration shall not be considered in evaluating the penetration resistance. Rammer used for driving the sampler rod shall be 65 kg and drops of 750 mm shall be maintained. Records of the test including depth at which driving is initiated and the number of blows for each 150 mm penetrating shall be shown in the field log, the final log shall indicate the actual SPT value (sum of number of blows for last 300 mm of penetration) at appropriate depths. The SPT value obtained need to be corrected and corrected – SPT value need to be submitted along with final report. Damaged SPT shoe shall be replaced. Irrespective of the condition of the SPT shoe, the shoe shall be replaced after every SPT test in hard rock.

5.0 GROUND WATER INVESTIGATION

Groundwater investigation shall comprise determination of groundwater levels and pressures and chemical analysis of water samples, including sulphates as SO₃, chlorides, pH, turbidity, organic content and soluble salt content etc., as per procedure given in relevant IS standards.

5.1 Ground water level observation

The contractor shall make necessary arrangements to prepare the boreholes for ground water observation. Completed boreholes should be capped and a G.I. pipe inserted in order to preserve them for future ground water observation. These observations will be taken by the contractor during the period of investigation. At the end of the site

investigation work, these boreholes shall be handed over to the Engineer-in-Charge in such a condition that further observations can be taken by the Engineer-in-Charge for a period of at least a year.

Piezometers will have to be installed in boreholes as directed by the Engineer-in-Charge. A piezometer consisting of either a simple standpipe of PVC tubing with a slotted end and surrounded by granular filter of plastic fabrics shall be used for granular soils or permeable rocks. In impermeable soils, hydraulic piezometer consisting of a porous element connected by twin small-bore plastic tubing to a remote reading station will be used.

6.0 FIELD TESTS

In situ tests shall be performed as desired by the Engineer-in-Charge to measure properties of soil during the field investigation work.

6.1 Direct Load Tests on Soils

After deciding the foundation level, plate load tests shall be carried out as per the location plan and the proposed level of foundation to determine the SBC of foundation strata. Plate load tests shall also be carried out at top of back-filling at locations identified by the engineer-in-charge.

Vertical load test shall be conducted either on a plate or on concrete foundation block as specified. These tests shall be conducted at locations and at depths as indicated on the drawing or as directed by the Engineer Incharge (EIC). The test procedure shall be in accordance with IS: 1888 unless noted otherwise elsewhere in this document.

For a plate bearing test, the test plate shall be of mild steel and shall be square or circular. The test plate shall be 600 mm width/diameter unless noted otherwise, in "Schedule of Quantities". The test plate shall be plane and level and in no case less than 25 mm thick. A series of concentrically placed smaller plates of 450 mm and 300 mm width/diameter (for 600 mm test plate) and each of 25 mm thickness shall be used to reduce the upward deflection of the free edges of the plate resting on the soil.

Unless specified otherwise elsewhere in this document, the test pit at test level shall be at least five times the width of the test plate. The pit shall be logged at all four corners as it is excavated and freshly cut surfaces shall be examined. If cohesive soil is encountered, pocket penetrometer tests shall be generously conducted and values (with test location within the pit) recorded. If necessary or if so directed by the ENGINEER INCHARGE (EIC), sides of the test pits shall be

adequately shored. The shoring shall be arranged in such a manner that working of the test is not hampered.

Initially, the pit shall be excavated to a depth of 300 mm above the proposed test level. Thereafter, the kentledge and all other accessories outside the pit pertaining to and necessary for conducting the test shall be set up. On completion of such set up, the final 300 mm shall be excavated from within the pit, taking adequate care so as not to disturb the kentledge.

An easy access to the bottom of the pit shall be provided and the ground

under test shall be protected from rain and sun both during excavation and testing. The bottom of pit at test level shall be undisturbed, planar and free from any crumbs of fine, loose debris. The test plate shall be set on a suitable bedding material approved by the Engineer Incharge (EIC) which shall normally consist of cement mortar or plaster of Paris.

If the test level is below the ground water level, the test may be conducted with water level in the pit at ground water level or the CONTRACTOR may be required to lower the water level in the pit to test level or to a depth at least three times the width/diameter of the test plate measured from the test level and maintain it throughout the duration of the test. The actual option to be adopted shall be as decided by the Engineer Incharge. For test below ground water level, even if the test is to be conducted with water level in the pit at ground water level, the pit shall be dewatered to its bottom, unless specified otherwise, while seating the plate. Any dewatering involved for the test will be considered as per of the test and the CONTRACTOR shall not be separately paid for the same.

The test load shall be so applied that it reaches the soil in a static manner. The loading may be applied directly by kentledge or jacking against a reaction system provided by means of kentledge, tension piles or ground anchors. Where kentledge is used it shall be supported on a properly designed frame or gantry such that there is no possibility of the load tilting or collapsing. The foundations for this frame or gantry should be sufficiently far away from the test plate so as not to affect its behavior to any significant extent. Where tension piles or ground anchors are used, they shall be located a minimum distance of three times the plate width/diameter from the center of the plate to the center of

the pile/anchor. The displacement of the plate shall be related to a fixed datum. This may consist of a reference beam (datum bar) supported by two foundations positioned outside the zones of influence of either the loaded area or the reaction support area. The deflection measuring equipment must be set up in such a way that any tilting of the plate will not cause errors in the measurements. Dial gauges may be used. The least count of the dial gauges shall be at least 0.02 mm. At least two

but preferably four dial gauges shall be used and shall be placed at diagonally opposite corners.

The reference bars for the strain gauges shall be adequately rigid and on

firm supports. The supports for the reference bars shall be so located that they are beyond the zone of influence of the loaded plate (600 mm from plate edge for a 600 mm size square plate) and the zone of influence of kentledge supports. The bars shall be adequately stiffened and placed on supports in a manner such that any effect due to ambient temperature variations are minimized. The reference bars and strain gauges shall not be exposed to direct sun and the pit shall be protected by tarpaulin sheets while the test is in progress.

The maximum load for the test shall correspond to settlement of test plate not less than 40 mm or shear failure in sub soil or four times the design intensity of loading whichever is earlier. Final load shall be reached in not less than ten equal increments. Unloading may, however, be in higher decrements with total number not less than four. At each load increment settlement shall be observed accurate to 0.02 mm at an interval of 1, 5, 10, 15, 25, 35, 50 and 60 minutes and there after at hourly intervals. In case of clayey soils, the time settlement curve shall be plotted at each load stage and load increased to the next stage either when the curve indicates that the settlement has exceeded 90 percent of the probable ultimate settlement at that stage or at the end of the 24 hour period. For soils other than clayey soils, each load increment shall be kept for not less than one hour or upto a time when the rate of settlement gets appreciably reduced (to a value of 0.02 mm/min). The next increment of load shall then be applied and the observations repeated. As noted earlier unloading shall done in equal decrements with total number not less than four and with time gap not less than half hour in between decrement.

If a load test on a concrete block is specified, it shall be conducted similar to plate bearing test. However, loading on the block shall commence only 21 days after the block is cast. The block shall be adequately reinforced.

6.2

Determination of Dry-Density of Soils

In place dry density of soil is required for assessment of bearing capacity of soils, analysis for stability of natural slopes and in settlement calculations for estimating overburden pressure at different depths. The following methods depending on the scope of application in different types of soils shall be adopted as directed by the Engineer-in-Charge for determination of in-place dry density of soils.

6.2.1

Sand Replacement Method

This method is suitable for fine, medium and coarse grained soils. Small sand pouring cylinder should be used when the soil consists of fine to medium size grains while for soils containing stones where difficulties would be encountered with this method, a large sand pouring cylinder should be used. The sand used for filling shall be clean, uniformly graded natural sand; passing 1.00 mm IS sieve and retained on 600 micron IS sieve. It shall be free from organic matter, oven dried and stored for suitable period to allow its water content to reach equilibrium with atmospheric humidity.

Equipment and accessories, test procedure, observations and reporting of results shall conform to IS:2720 (Part XXVIII)

6.2.2 **Core-cutter Method**

The specification for this test shall be as per IS:2720 (Part XXIX). The method should be applied for fine grained soil, free from aggregates. Fine grained soils for the purpose of application of this method is defined as soil with not less than 90 percent passing 4.75 mm IS sieve.

6.3 **Test for Measurement of soil Resistivity**

For designing the earthing system for the project it is necessary to find out the electric resistivity of the soil at some representative locations of the project site.

Soil resistivity is determined in Ohmmeter by using "WENNER's FOUR ELECTRODE METHOD". The principle of the above method is generally as under :

Four electrodes are driven into the earth along a straight line at equal intervals of 'S'. This distance 'S' can be varied and different readings taken for electrode spacing S = 5, 10, 15, 20 metres etc. to detect the vertical variations of resistivity at a certain location. A current I is passed through the two outer electrodes and the earth. The voltage difference, V, between the two inner electrodes is measured. The current I flowing into the earth produces an electric field proportional to its density and to the resistivity of the soil. The voltage V measured between the inner electrodes is, therefore, proportional to this field. Consequently, the resistivity will be proportional to the ratio of voltage to current.

If the depth of burial of electrodes in the ground is negligible compared to the spacing between the electrodes, then the soil resistivity.

$$= 2 \times 3.14 \times S \cdot V / I$$

Where , Resistivity of soil in Ohm-meter

S = Spacing between electrodes in metre

V = Voltage difference between two inner electrodes in volts.

I = Current flowing through two outer electrodes in amp.

Earth testers normally used for the above purpose comprise the current source and meters in a single instrument and directly read the resistance. Such an instrument is known as four terminal meggar. Using such meggar for measurement, above formula becomes

$$R = \frac{2 \times 3.14 \times S \times R}{\pi}$$

where R is meggar reading in Ohms.

Depth of burial of electrodes shall not be more than 1/20 of the spacing between the electrodes.

Correction of the test results should be done, if necessary, using the method outlined in IS:3043.

The location and number of the test points are shown in the plant layout . The number shall be increased if the test results obtained in different locations show a significant difference .

7.0 **LABORATORY TESTS ON SOIL SAMPLES/ROCK CORES**

The contractor shall carry out the tests as listed out in the Schedule of Quantities, and/or as decided by the Engineer-in-Charge, in laboratory. He shall furnish the name/s of laboratories where he proposes to have the tests carried out and have them approved by the Engineer-in-Charge.

The Engineer-in-Charge shall have the right of access to contractor's laboratory and/or any other laboratory where tests have been arranged to be carried out during the progress of this investigation.

Adequate volume of test samples of soil/rock cores shall have to be collected from site and stored, labelled and transported carefully to the approved laboratory for carrying out the tests. The method and procedure of testing to be followed shall be as per the relevant Indian Standard Codes of Practice. The results of the tests shall be submitted to the Engineer-in-Charge in sextuplicate duly signed by the laboratory- in-charge. In tests for rock cores $L/D = 1.0$ of samples must be maintained.

8.0 **REPORT ON SUB-SOIL INVESTIGATION**

8.1 **General**

- a) On completion of all the field and laboratory work, the contractor shall submit a formal report containing geological information of the region, procedure adopted for investigation, field observations, summarised test data, conclusion and recommendations. The report shall include detailed borelogs, subsoil sections, field test results, laboratory observations and test results both in tabular as well as graphical form, practical and theoretical considerations for the interpretation of test results, the supporting calculation for the conclusions drawn etc. Initially, the contractor shall submit two copies of the report in draft form for the owner's review.
- b) The contractor's qualified geotechnical Engineer shall visit the Engineer-in-Charge office for a detailed discussion on the owner's comments on his draft report. During the discussions, it shall be decided as to the modifications that need to be done in the draft report. Thereafter the contractor shall incorporate in his report the agreed modifications and after getting the amended draft report approved, five copies of the detailed final report shall be submitted alongwith a soft copy of the same in th CD/DVD and one set of reproducible of the graphs, tables, etc.
- c) The detailed final report based on field observations, in-situ and laboratory tests shall encompass theoretical as well as practical considerations for foundations for different type of structures envisaged in the area under investigations. The contractor shall acquaint himself about the type of structures, foundations loads and other information required from the Engineer-in-Charge.

8.2 **Data to be furnished**

The report shall include the enlisted items but not be limited to them.

- a) Purpose and scope of investigation
- b) Authorization enabling the contractor to carry out the work at the site.
- c) Project description including proposed facilities and construction materials required for the works.
- d) Description of the site which shall include:
 - i) Location of the site and existing facilities.
 - ii) Topography of the site
 - iii) Drainage Characteristics

- e) A plot plan showing the locations and reduced levels of all field tests e.g., boreholes, trial pits, static cone penetration tests, dynamic cone penetration tests, plate load tests etc., properly drawn to scale and dimensioned with reference to the established grid lines.
- f) A true cross section of all individual bore holes and trial pits with reduced levels and coordinates showing the classification and thickness of individual stratum, position of ground water table, various in-situ tests conducted and samples collected at different depths and the rock stratum, if met with.
- g) A set of longitudinal and transverse profiles connecting various boreholes shall be presented in order to give a clear picture of the site, how soil/rock strata are varying vertically and horizontally.
- h) **Geological information**
 - i) Regional geology - geologic province, topographic position of site, processes of formation of subsurface materials at site.
 - ii) Description of overburden and bedrock at the site (if applicable for the site)
 - iii) Comments on texture and structure of rock, joints, bedding planes, fissures, weathering condition etc (of applicable for the site)
 - iv) Effect of geologic features on design.
- i) Past observations and historical data, if available, for the area or for other areas with similar profile or for similar structures in the nearby area.
- j) Bore hole & trial pit logs on standard proforma showing the depths, extent of various soil strata etc.
- k) Plot of SPT (N) value (both uncorrected and corrected) with depth.
- l) Procedure of investigations employed - field tests and laboratory investigation.
- m) Results of all laboratory test summarised (i) for each sample as well as (ii) for each layer along with all the relevant charts, tables, graphs, figures, supporting calculations, conclusions and photographs of representative rock cores.

furnished : o) For all consolidation tests, the following curves shall be

- e vs. $\log p$
- e vs. p and
- Compression vs $\log t$ or
- Compression vs square root of t (depending upon the shape of the plot for proper determination of co-efficient of consolidation).

The point showing the initial conditions (e, P) of the soil shall be marked on the curves.

- p) The procedure adopted for calculating the compression index from the field curve and settlement of soil strata shall be clearly specified. The time required for 50% and 90% primary consolidation along with secondary settlements, if significant, shall also be calculated.

8.3. **Recommendations**

Recommendations shall be given area wise duly considering the type of soil, structure and foundation in the area. The recommendations shall include but not be limited to the following:

- a) Type of foundations to be adopted for various structures, duly considering the sub soil characteristics, water table, total settlements permissible for structures and equipment. Minimum depth and width of foundation shall also be recommended. The provision in relevant IS codes indicated in clause 2.04.00 shall be considered.
- b) For shallow foundations, the following shall be indicated with comprehensive supporting calculations:
 - i) Net safe allowable bearing pressure for isolated square and continuous strip footings of different sizes at different founding depths below ground level considering both shear failure and settlement criteria, giving reasons for type of shear failure adopted in the calculation.
 - ii) Net safe allowable bearing pressure for mat foundations at different founding depths below ground level considering both shear failure and settlement criteria.
 - iii) Rate and magnitude of settlement expected of the

structure.

- iv) Modulus of subgrade reaction, modulus of elasticity, deformation modulus from plate load test results along with time-settlement and load-settlement curves for the various footing sizes at different founding levels indicated above. The recommended values shall include the effect of size, shape and depth of foundation.
- c) If piling is envisaged, the following shall be indicated with comprehensive supporting calculations :
 - i) Type of pile and reasons for recommending the same considering soil characteristics.
 - ii) Suitable founding strata for pile.
 - iii) Estimated length and diameter of pile for various values of pile capacities. End bearing and frictional resistance shall be indicated separately.
 - iv) Magnitude of negative skin friction, if any, to be considered in pile design.
- d) Recommendations on foundations for special structures like tanks, transformers, sub-station structures, conveyor trestles, silo/stack like structures, etc.
- e) Recommendations regarding bases of roads and pavements.

8.4.00 **Additional Recommendations**

- a) Settlement analysis for different footing sizes based on SPT.
- b) Electricity resistivity of sub-soil based on electrical resistivity tests including electrode spacing vs cumulative resistivity curve.
- c) Recommendations regarding method and slope of deep excavations.
- d) Recommendations regarding stability of slopes, during excavations, etc.
- e) Potential of rock slides and methods of stabilisation of slides for very steep cut.

- f) If expansive soil is met with recommendation on removal or retainment of the same under the structures/roads etc. shall be given. In the latter case detailed specification of any special treatment required including specification for materials to be used, construction method, equipment to be deployed etc. shall be furnished.
- g) Susceptibility of sub soil strata to liquefaction in the event of earthquake and recommendation on remedial measures, if necessary.
- h) Information of special significance like dewatering schemes etc. which may have a bearing on design and construction.
- i) Aggressiveness of percolating water through sub-soil/ rock fissures to reinforced concrete foundation/sub- structures and also recommended protective measures, if required.
- j) Recommendation for the type of cement to be used and any treatment to the underground concrete structures based on the chemical composition of soil and sub-soil water.
- k) Recommendation on suitability of the overburden soil as material of construction of earthen embankments and in back filling of excavated pits / trenches.
- l) Recommendation on the use of rock available as construction material.
- m) Recommendation on the availability of material for use as aggregates at the site.
- n) Recommendation for additional investigation beyond the scope of the present work if the contractor considers it necessary.

o) Plates

- i) General plan showing location of site, and areal geology.

- ii) Plan showing existing features, proposed facilities, contours and locations of boring and other investigations.
- iii) Geologic sections and soil profiles.

p) **Appendices**

- i) Logs of subsurface explorations
- ii) Field test results
- iii) Laboratory test results

C-02: EARTHWORK IN EXCAVATION AND BACKFILLING

1.0 SCOPE

- 1.1 This specification covers the general requirements of earthwork in excavation in different materials, site grading, filling in areas as shown in drawing, filling back around foundations and disposal of surplus spoils or stacking them properly as shown on the drawings and as directed by Engineer-In-charge and all operations covered within the intent and purpose of this specification.
- 1.2 For carrying out earth work excavation in different materials, conveyance and disposal of surplus spoils or stacking them properly, contractor shall furnish all tools, plants, instruments, qualified supervisory personnel, labour, materials, any temporary works. Consumables, any and everything necessary, whether or not such items are specifically stated herein for completion of the job in accordance with specification requirements shall be arranged for by the contractor.
- 1.3 Contractor shall carry out the survey of the site before excavation and set properly all lines and establish levels for various works such as earthwork in excavation for grading, basement, foundations, plinth fillings, roads, drains cable trenches, pipelines etc. such survey shall be carried out by taking accurate cross sections of the area perpendicular to established reference/grid lines at a 3 metres intervals or nearer as determined by the Engineer-In-charge based on ground profile. These shall be checked by the Engineer-In-charge and therein after properly recorded.
- 1.4 The excavation shall be done to correct lines and levels. This shall also include, wherever required, proper shoring to maintain excavation and also the furnishing, erecting and maintaining of substantial barricades around excavated areas and warning lamps at night for ensuring safety.
- 1.5 The rates quoted shall also include for dumping of excavated materials in regular heaps, bunds, and riprap with regular slope as directed by the Engineer-In-charge within the lead specified and leveling the same so as to provide natural drainage. Rock/ soil excavated shall be stacked properly as directed by the Engineer-In-charge. As a rule, all softer material shall be laid along the centre of the heaps, the harder and more weather resisting materials forming the casing on the sides and the top. Rock shall be stacked separately.

2.0

APPLICABLE CODES:

2.1

The following Indian Standard Codes, unless otherwise specified herein, shall be applicable. In all cases, the latest revision of the codes shall be referred to.

IS :965 Equivalent metric units for scale, dimensions and quantities in general construction work.

IS :1200 Method of measurement of building work (Earth work) (Part-1).

IS : 2720 Method of test for determination of moisture (Part-2) content.

IS : 2720 Method of test for determination of moisture (Part-7) content dry density relation using light compaction.

IS : 2720 Method of test for determination of moisture (Part-8) content dry density relation using heavy compaction.

IS : 2720 Method of test for determination of consolidation (Part-25) properties.

IS : 2720 Method of test for determination of dry density of (Part-28) soils by the sand replacement method.

IS : 2720 Method of test for determination of dry density of (part-29) soils by the core cutter method.

IS : 3385 Code of practice for measurement of Civil Engineering works.

IS : 3764 Safety code for excavation work.

IS : 4081 Safety code for blasting and related drilling operations.

IS : 4082 Recommendations of stacking and storage of construction materials at site.

IS: 9759 Guide lines for dewatering during construction.

IS: 10379 Code of practice for field control of moisture and compaction of soils for embankment and sub grade.
Indian Explosives Act 1940 as updated.

3.0 DRAWING:

- 3.1 Engineer-In-charge will furnish drawings wherever in his opinion such drawings are required to show areas to be excavated/ filled, sequence of priorities etc. Contractor shall strictly follow such drawings.

4.0 SITE CLEARANCE:

- 4.1 The area to be excavated/ filled shall be cleared of fences, trees, plants, logs, stumps, bush, vegetation, rubbish, slush, etc. and other objectionable matter. If any roots or stumps of trees are met during excavation, they shall also be removed. The material so removed shall be burnt or disposed off as directed by the Engineer-In-charge. Where earth fills is intended, the area shall be stripped of all loose/ soft patches, top soil containing objectionable matter/ materials before fill commence.

5.0. PRECIOUS OBJECTS, RELICS, OBJECTS OF ANTEQUITY, ETC.:

- 5.1 All gold, silver, oil, minerals, archaeological and other findings of importance, trees cut or other materials of any description and all precious stones, coins, treasures, relics, antiquities and other similar things which may be found in or upon the site shall be the property of the department and the contractor shall duly preserve the same to the satisfaction of the department and from time to time deliver the same to such person or persons as the department may from time to time authorize or appoint to receive the same.

6.0 CLASSIFICATION OF EARTH WORK:

- 6.1 All materials to be excavated shall be classified by the Engineer-In-charge, into one of the following classes and shall be paid for at the rate tendered for that particular class of material. No distinction shall be made whether the material is dry, moist or wet. The decision of the Engineer-In-charge regarding the classification of the material shall be final and binding on contractor and not be a subject matter of appeal or arbitration.
- 6.2 The earth work will be classified under any of the following categories.

6.2.1 ORDINARY & HARD SOILS

6.2.1.1 These shall include all kinds of soils containing kankar, sand, silt, murrum and/ or shingle, gravel, clay, loam, peat, ash, shale, etc., which can generally be excavated by spade, pick axes and shovel and which is not classified under “soft and decomposed rock” and “hard rock” defined below. This shall also include embedded rock boulders not longer than one metre in any direction and not more than 200 mm in any one of the other two directions.

6.2.2 SOFT AND DECOMPOSED ROCK:

6.2.2.1 This shall include rock, boulders, slag, chalk, slate, hard mica schist, laterite and all other materials which in the opinion of the Engineer-In- charge is rock, but does not need blasting and could be removed with picks, hammer, crow bars, wedges and pneumatic breaking equipment. The mere fact that contractor resorts to blasting for reasons of his own shall not qualify for classification under ‘hard rock’.

6.2.2.2 This shall also include excavation in macadam and tarred roads, pavements and rock boulders not longer than one metre in any direction and not more than 500 m in any one of the other two directions.

6.2.3 HARD ROCK:

6.2.3.1 This shall include all rock occurring in large continuous masses, which cannot be removed except by blasting for loosening it. Harder varieties of rock with or without veins and secondary minerals, which in the opinion of the Engineer-In-charge required blasting, shall be considered as hard rock. Boulders of rock occurring in such sizes and not classified under 6.2.1 and 6.2.2 above shall also be classified as hard rock.

7.0 EXCAVATION:

7.1 All excavation work shall be carried out by mechanical equipment unless in the opinion of the Engineer-In-charge, the work involved and time schedule permit manual work.

7.2 Excavation for permanent work shall be carried out strictly to the dimensions given in the drawing or as specified by the Engineer-In- charge. Rough excavation shall be carried out to a

depth 300 to 150 mm above the final excavation level. The balance shall be excavated with special care. Soft pockets shall be removed even below the final level and extra excavation filled up as directed by the Engineer-In-charge. The final excavation if so instructed by the Engineer-In-charge should be carried out just prior to laying the mudmat.

7.3 The contractor may excavate outside the lines shown on the drawing or as directed by the Engineer-In-charge for facility of work or similar other reasons and also backfill later at his own cost if so approved by the Engineer-In-charge. Should any excavation be taken below the specified elevations, the contractor shall fill it up with concrete of the same grade as in the foundation resting thereon upto the required elevation. No extra shall be claimed by the contractor on this account.

7.4 All excavations shall be done to the minimum dimensions as required for safety and working facility. Prior approval of the Engineer-In-charge shall be obtained by the contractor in each individual case for the method he proposes to adopt for the excavation, including dimensions, side slopes, dewatering, disposal, etc. However, this approval shall not in any way relieve the contractor of his responsibility for any consequent loss or damage. The excavation must be carried out in the most expeditious and efficient manner. Side slopes shall be as steep as will stand safely for the actual soil conditions encountered. Every precaution shall be taken to prevent slips. Should slips occur, the slipped material shall be removed and the slope dressed to a modified stable slope. Removal of the slipped earth will not be paid for, if the slips are due to the negligence of the contractor.

7.5 Excavation shall be carried out with such tools, tackles and equipment as described herein before. Blasting or other methods may be resorted to in the case of hard rock, however not without the specific permission of the Engineer-In-charge.

7.6 A **Dealing with Surface Water**

All working areas shall be kept free of surface water as far as reasonably practicable. Works in the vicinity of cut areas shall be controlled to prevent the ingress of surface water.

No works shall commence until surface water streams have been properly intercepted, redirected or otherwise dealt with.

Where works are undertaken in the monsoon period, the Contractor may need to construct temporary drainage systems at his own cost to drain surface water from working areas.

7.6 DEWATERING:

Unless specifically provided for as a separate item in the schedule of quantities, rate shall also include bailing or pumping out all water which may accumulate in the excavation during the progress of further works such as mud mat concrete, R.C. footings, shuttering, trench works for pipes, cables etc. either due to seepage, springs, rain or any other cause and diverting surface flow by bunds or other means. Care shall be taken to ensure that the water is discharged sufficiently away from the foundations to keep it free from nuisance to other works in the neighborhood.

- 7.7 The Engineer-In-charge may also direct that in some extreme cases the rock may be excavated by heating and sudden quenching for splitting the rock. Firewood shall be used for burning and payment shall be made for such work as called for in the schedule of quantities.

7.8 STRIPPING LOOSE ROCK:

- 7.8.1 All loose boulders, semi detached rocks (along with earthy stuff which might move therewith) not directly in the excavation but so close to the area to be excavated as to be liable in the opinion of the Engineer-In- charge to fall or otherwise endanger the workmen, equipment, or the work, etc. shall be stripped off and removed away from the area of the excavation. The method used shall be such as not to shatter or render unstable or unsafe the portion which was originally sound and safe.

7.9 EXCAVATION IN HARD ROCK:

- 7.9.1 Chiselling / Wedging

Where ever Blasting is prohibited excavation shall be carried out by chiselling, wedging or any other approved method. The decision of the Engineer In charge in this regard shall be final and binding on Contractor.

8.0 EXCAVATION BELOW GROUND WATER TABLE

- 8.1 Wherever ground water table is met with during excavation, the Contractor shall immediately report this fact to the Engineer Incharge who shall arrange to record the exact level of the water table before start of dewatering operation. The decision of the Engineer Incharge regarding sub-soil water level shall be final and binding on the Contractor. Ground Water Table for the purpose of this clause shall be taken as the level of standing water observed

during the process of excavation. Capillary action of water in the surrounding soil mass shall not be considered for the above purpose.

- 8.2 The Contractor shall dewater and maintain dry working conditions by maintaining the water table below the bottom of the excavation level by well-point dewatering or deep well dewatering or any other method approved by the Engineer Incharge. He shall continue doing so till excavation, concreting, curing, and all other operation included in the scope of work, which require dry condition in the area are completed.

9.0 **FILL AND BACK FILLING**

- 9.1 All fill material will be subjected to the approval of Engineer-In-charge. If any material is rejected by the Engineer-In-charge, the contractor shall remove the same forthwith from the site at no extra cost to the owner. Surplus fill material shall be deposited /disposed of as directed by the Engineer-Incharge after the fill work is complete.
- 9.2 No earth fill shall commence until surface water discharges and streams have been properly intercepted or otherwise dealt with as directed by the Engineer-In-charge.
- 9.3 To the extent available selected surplus spoils from excavated materials shall be used as backfill. Fill material shall be free from clods, salts, sulphates, organic or other foreign material. All clods of earth shall be broken or removed. Where excavated material is mostly rock, the boulders shall be broken into pieces not larger than 150 mm size, mixed with properly graded fine material consisting of murrum or earth to fill up the mixture used for filling.
- 9.4 If any selected fill material is required to be borrowed, contractor shall make arrangements for bringing such material from outside borrow pits. The material and source shall be subject to prior approval of the Engineer-In-charge. The approved borrow pit area shall be cleared of all bushes, roots of trees, plants, rubbish etc. Top soil containing salts/ sulphates and other foreign material shall be removed. The materials so removed shall be burnt or disposed off as directed by the Engineer-In-charge. The contractor shall make necessary access roads to borrow areas and maintain the same at his own cost if such access road does not exist.
- 9.5 As soon as the work in foundations has been accepted and measured, the spaces around the foundations, structures, pits, trenches etc. shall be cleared of all debris and filled with selected/ approved earth in layers not exceeding 250 mm each layer being watered, rammed and properly consolidated before the

succeeding one is laid. Each layer shall be consolidated to the full satisfaction of the Engineer-In-charge. Filled earth shall be rammed with approved compaction method. Usually no manual compaction shall be allowed unless the Engineer-In-charge is satisfied that in some cases, manual compaction by tampers cannot be avoided. The final back-fill surfaces shall be trimmed and leveled to proper profile as directed by the Engineer-In-charge of indicated on the drawings.

- 9.6 Filling in trenches for pipes and drains shall be commenced as soon as the joints of pipes and drains have been tested and approved by the Engineer-In-charge. The backfilling material shall be properly consolidated by watering and ramming taking due care that no damage is caused to the pipes.
- 9.7 Where the trenches are excavated in soil, the filling from the bottom of the trench to the level of the centre line of the pipe shall be done by hand compaction with selected approved earth in layers not exceeding 80mm. Backfilling above the level of the centre line of the pipe shall be done with selected earth by hand compaction or other approved means in layers not exceeding 250 mm.
- 9.8 In case of excavation of trenches in rock, the filling upto a level 300 mm above the top of the pipe shall be done with fine materials such as earth, murrum etc. The filling upto the level of the centre line of the pipe shall be done by hand compaction in layers not exceeding 80 mm whereas the filling above the centre line of the pipe shall be done by hand compaction or approved means in layers not exceeding 250 mm. The filling from a level 300 mm above the top of the pipe to the top of the trench shall be done by hand or other approved mechanical methods with broken rock filling of size not exceeding 250 mm mixed with fine material as available to fill up the voids.
- 9.9 The filling in the trenches shall be carried out simultaneously on the sides of the pipe to avoid unequal pressure on the pipes.
- 9.10 Plinth filling shall be carried out with approved material as described herein before in layers not exceeding 250 mm watered and compacted mechanically. The Engineer-In-charge may however permit manual compaction by hand tampers, in case he is satisfied that mechanical compaction is not possible. When filling reaches the finished level, the surface shall be flooded with water for at least 24 hours unless otherwise directed by the Engineer-In-charge. The surfaces shall then be allowed to dry and again compacted as specified above to avoid settlements at the later stage. The finished level of the filling shall be trimmed to the specified level, slope etc.

- 9.11 Site grading shall be carried out as indicated in the drawings and as directed by the Engineer-In-charge. Any excavation / filling for site grading shall be carried out as specified in the specifications given above unless otherwise indicated below:
- 9.11.1 If no compaction is called for, the fill may be deposited to the full height in one operation and leveled. If the fill has to be compacted, it shall be placed in layers not exceeding 250 mm and leveled uniformly and compacted as indicated in the specifications given above before the next layer is deposited.
- 9.11.2 To ensure that the fill has been compacted as specified, if required field and laboratory tests shall be carried out by the contractor.
- 9.11.3 Field compaction test shall be carried out at different stages of filling and also after the fill to the entire height has been completed. This shall hold good for embankment as well.
- 9.11.4 The contractor shall protect the earth fill from being washed away by rain or damaged in any other way. If any slip occurs the contractor shall remove the affected material and make good the slip at his own cost.
- 9.11.5 The fill shall be carried out to such dimensions and levels as indicated on the drawings after the stipulated compaction. The fill will be considered as incomplete if the desired compaction has not been obtained.
- 9.11.6 If specifically permitted by the Engineer-In-charge, compaction can be obtained by allowing loaded trucks conveying fill or other material to ply over the fill area. Even if such a method is permitted, it will be for the contractor to demonstrate that the desired / specified compaction has been obtained. In order that the fill may be reasonably uniform throughout, the material should be dumped in place in approximately uniform layers. Traffic over the fill shall then be so routed to compact the area uniformly throughout.
- 9.11.7 If so specified, the rock as obtained from excavation may be used for filling and leveling to indicated grades without further breaking. In such an event, filling shall be done in layers not exceeding 250 mm approximately. After rock filling to the approximate required level, the void in the rocks shall be filled with finer material such as earth, broken stone etc. and area flooded so that be taken to ensure that the finer fill material does not get washed out. Over the layer so filled, a 100 mm thick mixed layer of broken material and earth shall be laid and consolidated to the full satisfaction the Engineer-In-charge.

9.11.8 Where excavated material is mostly rock, the boulders shall be broken into pieces not more than 40 mm size in any direction with suitable crushers, mixed with approved soil / earth obtained from borrow pits to a ratio of 1:1 by volume and the mixtures used shall be for filling.

9.11.9 **Plinth Filling**

The plinth shall be filled with earth in layers not exceeding 250 mm in loose thickness, watered and compacted as stated above with approved compaction machine or manually, if specifically permitted by the Engineer-in-Charge. When the filling reaches the finished level, the surface shall be flooded with water for at least 24 hours, allowed to dry and then rammed and compacted, in order to avoid any settlement at a later stage. The finished level of the filling shall be trimmed to the slope intended to be given to the floor.

9.12.0 **Filling in Disposal Area**

Surplus material from excavation which is not required for backfilling will be disposed of in designated disposal areas as directed by the Engineer-in-Charge. The soft and decomposed rocks and hard rock shall be crushed to a size not more than 100 mm in any direction. The spoils and crushed rock shall not be dumped haphazardly but should be spread in layers approximately 250 mm thick when loose and compacted with the help of compacting equipment to the satisfaction of the Engineer-in-Charge. All clods shall be broken before placing the fill. Earthmoving machinery including dumpers, dozers and trucks shall be allowed to ply over the fill to permit compaction to take place.

In wide areas, rollers will be employed and compaction done to the satisfaction of the Engineer-in-Charge. No payment for compaction shall be made for such nominal compaction.

In certain cases the Engineer-in-Charge may direct disposal without compaction which can be done by tipping the spoils from a high bench neatly maintaining always a proper level and grade of the bench.

The rates quoted shall also include for dumping of excavated materials in regular heaps, bunds, and riprap with regular slope as directed by the Engineer-in-Charge within the lead specified and levelling the same so as to provide natural drainage. Rock/soil excavated shall be stacked properly as directed by the Engineer-in-Charge. As a rule, all softer materials shall be laid along the centre of the heaps, the harder and more weather resisting materials forming the casing on the sides and the top. Rock shall be stacked separately.

10.0 **SAND FILLING:**

10.1 At some of the places, backfilling may have to be carried with local sand/M Sand, if directed by the Engineer-In-charge. The sand used shall be clean, medium grained and free from impurities. The filled in and sand shall be kept flooded with water for 24 hours to ensure maximum consolidation. Any temporary work required to contain sand under flooded condition shall be to the contractor's account. The surface of the consolidated sand shall be dressed to required level or slope.

10.2 Construction of floors or other structures on sand fill shall not be started until the Engineer-In-charge has instructed and approved the fill.

11.0 **FILL DENSITY:**

11.1 The compaction only where so called for in the schedule of quantities/ items shall comply with the specified (proctor/ modified proctor) density. Contractor shall demonstrate adequately by field and laboratory tests that the specified density has been obtained.

11.2 **LEAD**

11.2.1 Lead for deposition/ disposal of excavated material shall be as specified in the respective item of work. For the purpose of measurement of lead, the area to be excavated or filled or area on which excavated material is to be deposited/ disposed off shall be divided into suitable blocks and each of the blocks the distance between the centre lines shall be taken as the lead which shall be measured by the point to point straight line distance in plan and not the actual route taken by the contractor. No extra compensation is admissible on the ground that the lead including that for borrowed material had to be transported over marshy or 'Katcha' land / route.

12.0 **Quality Control**

The Contractor shall establish and maintain quality control for the various aspects of the work, method, materials and equipment used. The quality control operation shall include but not be limited to the following items of work :

- a) Lines, Levels and Grades :
 - i) Periodic surveys
 - ii) Establishment of markers, boards etc.

- b) Back-filling:
 - i) Checking the quality of fill material
 - ii) Checking moisture content of the backfill
 - iii) Checking the degree of compaction

13.0 **EXECUTION**

13.1.0 **Setting Out**

Within 15 days of award of Contract, the Contractor shall prepare and submit to the Engineer-in-Charge, detailed drawings of the excavation work as proposed to be executed by him showing the dimensions as per drawings and specification adding his proposals of slopes, shorings, approaches, dewatering sumps, berms, etc. On receiving the approval from the Engineer-in-Charge with modifications and corrections, if necessary, the Contractor will set out the work from the control points furnished by the Engineer-in-Charge and fix permanent points and markers for ease of future checking. These permanent points and markers will be fixed at intervals prescribed by the Engineer-in-Charge and checked by the Engineer-in-Charge and certified by him after which the Contractor will proceed with the work. Engineer-in-Charge shall be provided with necessary men, material and instructions for such checking. It should be noted that this checking by the Engineer-in-Charge prior to start of the work will in no way absolve the Contractor of his responsibility of carrying out the work to true lines and levels and grades as per drawing and subsequent corrections, if necessary, free of cost to the Owner in case any errors are noticed in the Contractor's work at any stage.

13.2.0 **Initial Levels**

Initial levels of the ground either in a definite grid pattern or as directed by the Engineer-in-Charge will be taken by the Contractor jointly with the Engineer-in-Charge over the original ground prior to starting actual excavation work and after setting out. These initial levels will be used for preparing cross-sections for volume measurement or for cross-checking the depths obtained from tape measurements.

All records of levels, measurements etc. and also any drawing, cross section etc. made therefrom, shall be jointly signed by the authorised representative of the contractor and the Engineer-in-Charge before the commencement of work and they shall form the basis of all payments in future.

14.0 **Blasting**

No heavy blasting is permitted; only controlled blasting by muffling arrangements will be permitted as specified in the BOQ/ at the discretion of Engineer-in-Charge- In –charge.

14.1

General

Excavation shall be continued in hard rock to such widths, lengths, depths and profiles as are shown on the drawings or such other lines and grades as may be specified by the Engineer-in-Charge-in-Charge. As far as possible all blasting shall be completed prior to commencement of construction. At all stages of excavation, precautions shall be taken to preserve the rock below and beyond the lines for the excavation, in the soundest possible condition. The quantity and strength of explosive used, shall be such as will neither damage nor crack the rock outside the limits of excavation. All precautions, as directed by Engineer-in-Charge shall be taken during the blasting operations and care shall be taken that no damage is caused to adjoining buildings or structure as a result of blasting operations. In case of damage to permanent or temporary structures, Contractor shall repair the same to the satisfaction of Engineer-in-Charge at his own cost. As excavation approaches its final lines and levels, the depth of the charge holes and amount of explosives used shall be progressively and suitably reduced.

Unless otherwise stated herein, I.S. Specification IS:4081 "Safety Code for Blasting & Related Drilling Operation" shall be followed.

Specific written permission of BARC Engineer-in-Charge will have to be taken by Contractor for blasting rock and Contractor shall also obtain a valid Blasting licence & other statutory clearances from the authorities concerned.

Contractor shall obtain necessary licence for storage of explosives, fuses and detonators arranged by him, from the authorities dealing with explosives.

The fees, if any, required for obtaining such licence, shall be borne by Contractor. Contractor shall have to make necessary storage facilities for the explosives etc. as per rules of local, State and Central Government Authorities and statutory bodies/ regulations.

In no case shall blasting be allowed closer than 200 meters to any structure or to locations where concrete has just been placed. In the latter case the concrete must be at least 7 days old.

Contractor shall employ a competent experienced supervisor and licensed blaster in-charge of each set of operation, who shall be held personally responsible to ensure that all safety regulations are carried out.

Before any blasting is carried out, Contractor shall intimate Engineer-in-Charge and obtain his approval in writing for resorting to such operations. He shall intimate the hours of firing charges, the nature of explosive to be used and the precautions taken for ensuring safety.

The blasting of rock shall be done under cover and Contractor has to make all such necessary muffling arrangements. Covering shall be done by M.S. plates with adequate dead weight over them. Blasting shall be done with small charges and where directed by Engineer-in-Charge, a trench shall have to be cut by chiselling prior to the blasting operation separating the area under blasting from the existing structures.

When excavation has almost reached the desired level, hand trimming shall have to be done for dressing the surface to the desired level. Any rock excavation beyond an over break limit of 75 mm shall be filled up as instructed by Engineer-in-Charge, with concrete of strength not less than M 100. The cost of filling such excess depth shall be borne by Contractor and the excavation carried out beyond the limit specified above will not be paid for. Stepping in rock excavation shall be done by hand trimming.

Contractor shall be responsible for any accident to workmen, public or BARC's property due to blasting operations. Contractor shall also be responsible for strict observance of rules, laid by Inspector of Explosives, or any other authority duly constituted under the State and/or Union Government.

Storage, handling and use of explosives shall be governed by the current explosive rules laid down by the Central and the State Governments. The Contractor shall ensure that these rules are strictly adhered to.

No child under the age of Sixteen (16) and no person who is in a state of intoxication shall be allowed to enter the premises where explosives are stored nor they shall be allowed to handle the explosives.

Major safety measures to be taken during blasting are:

- i. The blaster should be a qualified and competent person for carrying out blasting work. He should know about the dangers involved.
- ii. Blasting in the open site shall only be carried out during the fixed hours every day / fixed day in the week. Workers & residence of adjacent property been informed about the blasting so they will not be unnecessarily disturbed by it.
- iii. No loose material such as tools, drilling implements etc. shall be left on the rock surface to be blasted.

- iv. Explosives and blasting equipment should be stored only in "Magazine" of clean, dry, well-ventilated, substantially constructed bullet and fire resistance and securely locked. Stock book should be kept accurate and maintained. Licence should be obtained for storage of explosive as per Explosive Act, 1984.
- v. Blasting caps, electric blasting caps or primers should not be stored in the same box, container or room with other explosives. Precautions against lightening shall be provided in accordance with Indian Electricity Act, Rules and Regulations.
- vi. The grit blaster should wear facial respirator with clean air supply to avoid inhalation of free silica.

The explosives should be transported in specially designed vehicles bearing a special sign or inscription entitled "DANGER EXPLOSIVES" and also detonators separated from other explosive should be transported in separate compartment.

Controlled Blasting and muffling arrangements:

Blasting shall be carefully controlled so that rock pieces do not fly out of the pits and thus endanger the installations around. Contractor shall follow the detailed procedure as given below and carefully watch the blasting operations. Based on observations he should set his norms for quantities of charge, depth of holes etc. in consultation with the Engineer-in-Charge within the limits specified below.

Material for the charge shall be either gun powder or gelatine. The ingredients of the gun powder shall be of best available quality. The composition shall be as per manufacturer's specification meant specifically for rock blasting. The same shall be best make and approved by the Engineer-in-Charge before actual use.

Quantity of charge :

Initially 75 to 80 mm of charge fill shall be used an observations made whether blasting is under full control. If necessary, charge may be gradually increased to 150 mm.

Depth of hole : 1500 to 1650 mm.

Diameter of hole : 30 to 40 mm.

Embedment of fuse inside charge : Fuse end shall be embedded to a depth of 1/2 to 2/3 of the depth of the charge.

Distance of firing end of the Fuse from the charge: 15 to 30 mtrs

Time of the blast after firing the fuse : 120 to 150 seconds.

Disposition of hole : 1.20 to 1.80 metre apart both ways.

Inclination : Inclination of the hole to be pointed towards the non-developed side of the site.

Number of holes to be taken : Minimum 8 Numbers

Upper blast : Maximum 20 Numbers.

Protective Measures :

- (i) The holes are to be covered with 3.0 mm thick square steel plate of minimum area from 0.60 m² to 1.00 m².
- (ii) A steel mesh made out of reinforcement rods of not less than 20 mm diameter @ 150 mm centres both ways shall be placed over the steel plates.
- (iii) Six to eight layers of sand filled bags shall be placed over the mesh suitably covering the whole region under blasting operations.
- (iv) The steel mesh shall be inspected after every operation and all twist shall be removed before reuse to the satisfaction of the Engineer-in-Charge.

Feeding the Charge:

- (a) At the bottom of the hole 50 to 75 mm depth shall be filled with dry powder.
- (b) Then the gun powder shall be fed into the hole to the desired length and lightly tamped with a rod.
- (c) The fuse wire shall then be inserted to a depth of $\frac{1}{2}$ to $\frac{2}{3}$ of the charge.
- (d) The rest of the hole shall then be filled with dry brick powder or dry moorum.
- (e) Precautions to be taken when the water table is encountered:
- (f) When the drilled hole encounters water, the charge shall be fed into a steel tube or a plastic tube and inserted to the bottom of the hole.
- (g) In case the contractor prefers to use gelatine for blasting wherever water table is encountered, the method of blasting, the quantity of charge shall be got approved from the Engineer-in-Charge before proceeding with the work.

Storage of explosives shall be governed by the current Explosive Rules, Explosives shall be stored in a clean, dry, well ventilated magazine to be specially built for the purpose. Under no circumstances should a magazine be erected within 400 m of the actual work site or any source of fire. A space surrounding the magazine shall be fenced in. The ground inside the fence shall be kept clear and free from trees, bushes etc. The admission to this fenced space shall be by one gate only and no person shall be allowed inside this fence without permission of the Officer-in-charge. The clear space between the fence and the magazine shall not be less than 90m. The magazine shall be perfectly well drained.

Two lightning conductors shall be provided to the magazine, one at each end. The lightning conductors shall be tested once in every year.

Fuses and detonators shall be stored in separate magazines. However, detonators can be kept in an annexe adjoining the magazine provided that their number does not exceed 25,000 and that the annexe is so constructed that not less than 60 cm masonry and 100 cm of air space shall intervene between any detonators in such annexe and the interior of the main magazine. Cases containing explosives are not to be opened in a magazine. Explosive in open cases are not to be received into a magazine. Explosives which appear to be in a damaged or dangerous condition are not to be kept in any magazine, but must be removed without delay to a safe distance and destroyed.

Artificial light is not to be allowed in any magazine. No smoking shall be allowed within 100 m of a magazine.

Magazine shoes without nails shall be used while entering the magazine.

The mallets, levers, wedges etc. for opening barrels or cases are to be of wood. Inside a magazine the cases of explosives are to be carried by hand and shall not be rolled or dragged. Explosives which have been issued and returned to the magazine are to be issued first; otherwise those which have been longest in store are to be issued first.

Cases of explosives must be kept clear of the walls and floors for free circulation of air on all sides, special care is to be taken to keep the floor free from grains of powder or portions of explosive matter fallen on the floors due to leakage of cases etc.

The magazine shall not be opened during any dust storm or thunderstorm nor shall any person be allowed in the vicinity of the magazine.

All magazines shall be officially inspected at definite intervals and a record kept of the results of such inspections.

14.3

Carriage of Explosives

Detonators and explosives shall be transported separately to the blast site. Explosives shall be kept dry and away from the direct rays of the sun, naked lights, steam pipes or heated metal and other sources of heat. Before explosives are removed, each cage or package is to be carefully examined to ascertain that it is properly closed and shows no sign of leakage.

No person except the driver shall be allowed to travel on a vehicle conveying explosives. No carriage or vessel shall be used for transporting explosives unless all iron or steel therein with which a package containing any explosive is likely to come in contact is effectually covered with lead, leather, wood, cloth or other suitable material. No lights shall be carried on the vehicle carrying explosives.

No operation connected with the loading, unloading and handling of explosives shall be conducted after sunset.

Other points regarding carriage of explosives shall strictly be followed as per provisions of IS: 4081.

14.4

Use of Explosives

The Contractor shall appoint an agent who shall personally superintend the firing and all operations connected therewith. The contractor shall satisfy himself that the person so appointed is fully acquainted with the responsibilities imposed on him.

Holes for charging explosives shall be drilled with Pneumatic drills, the drilling pattern being so planned that the rock pieces after blasting will be suitable for handling.

The hole diameter shall be of such a size that cartridges can easily pass down them and undue force is not required during charging. Charging operations shall be carried out by or under the personal supervision of the shotfirer. Wrappings shall never be removed from explosive cartridges. Only wooden rods shall be used for loading and stemming shotholes. Only one cartridge at a time shall be inserted and gently passed home with the wooden tamping rod.

Only such quantities of explosives as are required for the particular amount of work to be done shall be brought to the works. Should any surplus remain when all the holes have been charged, it shall be carefully removed to a point at least 300 m from the firing point.

The explosives shall be fired by means of an electric detonator placed inside the cartridge. For simultaneous firing of a number of charges the electric detonators shall be connected with the exploder through the shotfiring cable in a simple series circuit. Due precautions shall be

taken to keep the firing circuit insulated from the ground, bare wires, rails, pipes or any other path of stray current and to keep the lead wires short circuited until ready to fire. Any Kinks in detonator leading wire shall be avoided.

For simultaneous firing of a large number of shotholes, use of cordtex may be done. Cordtex shall be initiated by an electric detonator attached to its side with adhesive tape, connecting wire or string.

All connections shall be made by the authorised shotfirer himself. The shotfiring cable shall not be dragged along the ground to avoid possible damage to the insulation. The shotfiring cable shall be tested for continuity and possible short circuiting before it is used each time.

The shotfirer shall always carry the exploder handle on his person until he is ready to fire shots. The number of shots fired at a time shall not exceed the permissible limits.

Blasting shall only be carried out at certain specified times to be agreed jointly by the contractor and the Engineer-in-Charge.

Before any blasting is carried out, it shall be ensured that all workmen, vehicles and equipment on the site are cleared from an area of minimum 300 metres radius from the firing point, or as required by statutory regulations, at least ten minutes before the time of firing by sounding a warning siren. The area shall be encircled by red flags.

At least five minutes after the blast has been fired in case of electric firing or as stipulated in the regulations the authorised shotfirer shall return to the blast area and inspect carefully the work and satisfy himself that all charged holes have exploded. Cases of misfired unexploded charges shall be exploded by drilling a parallel fresh hole not less than 600 mm from the misfired hole and by exploding a new charge. The authorised shotfirer shall be present during removal of the debris liable to contain unexploded explosives near the misfired hole. The workmen shall not return to the site of firing until atleast half an hour after firing.

When blasting is conducted in the neighbourhood of roads, structures, buildings etc., controlled blasting has to be carried out by drilling shallow shotholes and filling the same with light charge of explosives.

Adequate safety precautions as per building bye-laws, safety code, statutory regulations etc. shall be taken during blasting operations.

15.0

Disposal

The excavated spoils will be disposed of at designated locations in any or all the following manners or as directed by the Engineer-in-Charge:-

- a) By using it for backfilling straightway.
- b) By stacking it temporarily for use in backfilling at a later date during execution of the Contract.
- c)
 - i) By either spreading, Or
 - ii) spreading and compacting at designated filling areas and / or disposal areas.
- d) By selecting the useful material and stacking it neatly in areas designated by the Engineer-in-Charge for use in backfilling by some other agency.

16.0 Disposal of Surplus

All surplus material from excavation shall be carried away from the excavation site to designated disposal area selected by the Engineer-in-Charge.

All good and sound rock excavated from the pits and all assorted materials of dismantled structures shall be the property of the Owner and if the Contractor wants to use it, he shall have to obtain it from the Engineer-in-Charge at a mutually agreed rate for the same.

All sound rock and other assorted materials like excavated bricks, etc. shall be stacked separately and shall be measured in stacks deducting 30% volumetric measure for voids.

17.0 Protection

The Engineer-in-Charge shall be notified by the Contractor as soon as the excavation is expected to be completed within a day so that it may be inspected by him at the earliest. Immediately after approval of the Engineer-in-Charge, the excavation must be covered up in the shortest possible time. But, in no case the excavation shall be covered up or worked on before approval and measurement by the Engineer-in-Charge. Excavated material shall be placed beyond 1.5 metres from the edge of the pit or trench or half the depth of the pit or trench whichever is more or further away if directed by the Engineer-in-Charge.

Excavation shall not be carried out below the foundation level of structure close by until required precautions have been taken.

Adequate fencing is to be made enclosing the excavation.

The Contractor shall protect all under-ground services exposed by excavation. The Contractor shall also divert all surface drains, etc. affected by the excavation to maintain the working area neat and clean.

18.0 Timber Shoring

Timber Shoring made out of approved quality of timber shall be 'close' or 'open' type, depending on the nature of soil and the depth of pit or trench and the type of timbering shall be determined by the Engineer-in-Charge. It shall be the responsibility of the Contractor to take all necessary steps to prevent the sides of trenches and pits from collapsing.

18.1 Close Timbering

Close timbering shall be done by completely covering the sides of the trenches and pits generally with short, upright members called 'polling boards'. These shall be of minimum 250 x 40 mm sections as directed by the Engineer-in-Charge. The boards shall generally be placed in position vertically in pairs, one board on each side of cutting, and shall be kept apart by horizontal walers of strong wood at maximum 1.2 metres spacings, cross strutted with ballies or as directed by the Engineer-in-Charge. The length of the bally struts shall depend on the width of the trench or pit.

In case where the soil is very soft and loose, the boards shall be placed horizontally against the sides of the excavation and supported by vertical walers, which shall be strutted to similar timber pieces on the opposite face of the trench or pit. The lowest board supporting the sides shall be taken into the ground. No portion of the vertical side of the trench or pit shall remain exposed, so that the earth is not liable to slip out.

The withdrawal of the timber shall be done very carefully to prevent the collapse of the pit or trench. It shall be started at one end and proceeded systematically to the other end. Concrete or masonry shall not be damaged during the removal of the timber. No claim shall be entertained for any timber which cannot be withdrawn and is lost or buried.

18.2 Open Timbering

In the case of open timbering, the entire surface of the side of trench pit is not required to be covered. The vertical board of minimum 250 mm width and minimum 40 mm depth shall be spaced sufficiently apart to leave unsupported strips of maximum 500 mm average width. The detailed arrangement, sizes of the timber and the distances apart shall be subject to the approval of the Engineer-in-Charge. In all other respects, specification for close timbering shall apply to open timbering.

18.3 Treatment of Slips

The Contractor will take all precaution to avoid high surcharges and provide proper surface drainage to prevent flow of water over the sides. These precautions along with proper slopes, berms, shoring and control of ground water should cause no slips to occur. If slips do occur due to any causes, the same shall be rectified by the contractor at his own expenses.

19.0 Lighting

Full scale area lighting is to be provided if night work is permitted or directed by the Engineer-in-Charge. Even if no night work is in progress, red warning lights should be provided at the top in edges of the excavated area and the edges of the fill, unless otherwise permitted by the Engineer-in-Charge.

20.0.0 TESTING AND ACCEPTANCE CRITERIA

20.1.0 Soil Testing

The following tests shall be undertaken by the Contractor and results and reports shall be submitted to the Engineer-in-Charge for approval. Test failures are to be immediately notified to the Engineer-in-Charge, otherwise results to be submitted within Twenty Four (24) hours of testing. Each layer of material shall be tested for compaction.

Each layer is to be tested in a manner that is representative of its full depth. The Engineer-in-Charge may at his discretion instruct the Contractor to increase or decrease the frequency of testing.

- a) Minimum One (1) test per 300 cu-m of soil coming out of the borrow pits for determination of natural moisture content in order to evaluate how far the natural moisture content tallies with the optimum value and whether further addition or reduction of water content would be necessary. Test is to be done in accordance with IS : 2720 (Part-II).
- b) Minimum Two (2) sets of laboratory tests per 2000 cu-m of soil coming out of the borrow pits for determination of dry density at optimum moisture content. Test is to be done in accordance with IS : 2720 (Part-VII, XIV, XXVII, XXIV), as applicable.
- c) Minimum Two (2) sets of test per 300 cu-m of loose fill for determination of moisture content just prior to compaction of

backfilling soil. Test is to be done in accordance with IS : 2720 (Part-II).

- d) For each compacted layer, minimum One (1) test per 1000 sq-m of compacted area for determination of moisture content and dry density.
- e) Minimum Two (2) tests per 2000 cu-m of soil for determination of soil classification. Test is to be done in accordance with IS : 2720 (part-IV).
- f) Minimum Ten (10) density measurements shall be plotted to establish moisture content-dry density relationship.
- g) Note: the above minimum test numbers may change depending on the directions of EIC/as per QAP.

20.2.0 **Acceptance Criteria**

20.2.1 **Excavation**

On completion of excavation, the dimensions of the pits will be checked as per the drawings after the pits are completely dewatered.

The work will be accepted after all undercuts have been set right and all over- excavations filled back to required lines, levels and grades by placing ordinary concrete of 1:4:8 proportion and/or richer and/or by compacted earth, as directed by the Engineer-in-Charge, at the Contractor's cost. The choice of grade of concrete will be a matter of unfettered discretion of the Engineer-in-Charge.

Over-excavation of the sides will be made good free of cost by the Contractor while carrying out the back-filling. The excavation work will be accepted after the above requirements are fulfilled and all temporary approaches encroaching inside the required dimension of the excavation have been removed.

20.2.2 **Back-filling**

The degree of compaction shall be sufficient to achieve a dry density of not less than 95% of proctor's dry density at optimum moisture content as per IS-2720 (Part - vii). The work of back-filling will be accepted after the Engineer-in-Charge is satisfied with the degree of compaction achieved.

21.0 **MODE OF MEASUREMENT:**

- 21.1 Excavation in all stratas in different components of the schedule of quantities shall be measured net and by levels. Dimensions for the purpose of payment shall be reckoned on the horizontal area of the concrete at the base for foundations of the walls, column, footings, tanks, rafts, or other foundations/ structures to be

built multiplied by the mean depth measured from the surface of the original ground level (in filling areas) and from Terraced level (in cutting areas) in accordance with drawings or as per actual whichever is minimum.

- 21.2 In case of excavation exceeding 1.5 meter depth, then 3V : 1H in side slopes or as specified in the drawing shall be considered by the contractor. In addition, contractor shall consider working space around the foundation. The contractor may make such allowance in his rates to provide for excavation in side slopes keeping in mind the nature of the soil and safety of excavation. Safety of the excavation work shall be the responsibility of the contractor. No extra payment shall be paid to the contractor in this regard.
- 21.3 No extra payment shall be paid to the contractor for providing approach ramps to facilitate carrying out the excavation work and transporting the excavated earth at the various levels.
- 21.4 Reasonable working space not exceeding 600 mm beyond the line of PCC or actual excavation carried out whichever is less for waterproofing of basement structure wherever considered necessary in the opinion of the Engineer-In-charge will be allowed in excavation and considered for payment. However, if concreting is proposed against the sides of excavation to place the water proofing treatment earlier to casting of foundation member over break in rock up to 225 mm beyond the theoretical line of water proofing treatment only will be permitted and paid for.
- 21.5 Over break in hard rock at bottom to the extent of 225 mm in depth or actual whichever is less will be measured and paid for. If, however, the excavation in hard rock at bottom is done more than the required limits the same will have to be made good by filling with concrete of mix 1:3:6 at the contractor's cost. For the rock excavation beyond the required profile over break in rock only will be limited to 225 mm beyond the theoretical line or actual whichever is less.
- 21.6 In case of rock strata intermixed with soil the excavated rock will be properly stacked as directed by the Engineer-In-charge and the volume of rock calculated on the basis of stack measurement after deducting voids @ 50% of the volume,
- 21.7 Unless otherwise specified the unit rates quoted for excavation in different types of materials shall also account for the basic lead as specified in the item of the work. Only leads beyond the basic lead as specified will be considered as extra lead and paid for at rates quoted in the schedule.

- 21.8 The rates for excavation in soft and hard rock shall include carting away the excavated rock to the required lead as indicated in the items of work and properly stacking the same as directed by the Engineer-In-charge after deducting voids @ 50% of the volume,
- 21.9 Backfilling as per specifications in the sides of foundations, columns, footings, structures, walls, tanks, rafts, trenches etc. with selected excavated material will not be paid for separately. It shall be clearly understood that the rate quoted for excavation shall include stacking of excavated material as directed and carting it back and backfilling around the foundations as specified above. Generally the material to be backfilled may be stacked temporarily upto basic lead of 120 meters unless otherwise directed by the Engineer-In-charge.
- 21.10 Payment for fill inside trenches, plinth or similar filling with selected excavated material will be made only after compaction as specified /directed. Cost of all other operations shall be deemed to have been covered in the rate quoted for excavation. Payment for this work will be made based on the measurement of plinth/ trench dimensions filled. If no compaction is specified / desired such filling will not be separately paid for. In such an event the fill shall be leveled / finished to the profiles as directed at no extra cost.
- 21.11 Filling under floors with approved murrum which may have to be brought from outside sources shall be paid for at rates quoted. The quoted rate shall include all operations such as clearing, excavation, lead and transportation, fill, compaction etc. as specified. Actual quantity of consolidated filling limited to the dimension considered for payment for excavation only shall be measured and paid for in cubic metres.
- 21.12 Actual quantity of consolidated sand filling shall be measured and paid in cubic metres.
- 21.13 Lead to be measured to the respective point of disposal by shortest motorable route.
- 21.14 For lead items, 20% for both soil & soft rock, 30% for debris and 50% for hard rock towards voids shall be deducted from the truck/stack measurements (hard rock) or as specified in the item.

C-03: SPECIFICATION FOR ANTI-TERMITE TREATMENT

1.0 SCOPE:

- 1.1 The work of pre-constructional anti-termite treatment covered under this specification consists of the soil treatment with approved chemicals in water emulsion in foundation trenches for columns, in beams, brick wall, lift pits, steps, ramps, apron etc. and in top surface of plinth filling, at junction of walls and floors, in expansion joints etc. in stages as detailed in this specification and drawing.

2.0 APPLICABLE CODES & SPECIFICATIONS:

- 2.1 The relevant I.S specifications, standards and codes given below are made a part of this specification. All standards, specifications, code of practices referred to herein shall be the latest edition including all applicable amendments, revisions and additional publications.

List of Indian Standards:

No.	I.S. No.	I.S. Particulars.
1	IS: 6313 (Part I)	Code of Practice for Anti-termite Measures in Buildings Constructional Measures
2	IS: 1200 (Part I)	Method of measurement of buildings and civil engineering works.
3	IS:6313 (Part II)	Pre-constructional Chemical Treatment Measures
4	IS: 8944	Specification for Chloropyrifos Emulsifiable Concentrates
5	IS: 4015 (Part I)	Guide for Handling cases of Pesticide Poisoning First Aid Measures
6	IS: 4015 (Part II)	Symptoms, Diagnosis and Treatment

3.0 GENERAL:

- 3.1 Pre-constructional anti-termite treatment is a process in which soil treatment is applied to a building in early stages of its construction. The purpose of anti-termite treatment is to provide the building with a chemical barrier against the subterranean termites.

3.2 Anti-termite treatment being a specialized job, calls for thorough knowledge of the chemicals, soils, termite to be dealt with and the environmental conditions. In order to give effective treatment and lasting protection to the properly underground treatment. It is, therefore, imperative that the works of anti-termite treatment should be got executed through specialized agencies only. The specialized agency should be preferably a member of the Indian Pest Control Association and shall have sufficient experience of carrying out similar works of magnitude envisaged in this tender.

3.3 The pre-constructional soil treatment is required to be applied during the construction stages of the sub-structure up to plinth level. The contractor has to be watchful of the various stages of sub-structure works and arrange to carry out the soil treatment in time after proper co-ordination with department and other contractors if any, working at site.

3.4 Unless otherwise stipulated, the anti-termite treatment will be carried out as per I.S. 6313 (Part-II) and / or as per direction of the Engineer- in-Charge. The contractor should produce voucher (s) for the chemical purchased and should get verified the sealed container(s) of the specified chemical from the Engineer Incharge before preparing the emulsion / use for the treatment.

4.0 **SITE PREPARATION:**

4.1 In order to ensure uniform distribution of the chemical emulsion and to assist penetration, the following site preparation shall be carried out:

4.1.1 Remove all trees, stumps, logs or roots from the building site.

4.1.2 Remove all concrete formwork if left anywhere, leveling pegs, timber off cuts and other building debris from the area to be treated.

4.1.3 If the soil is to be treated is sandy or porous, preliminary moistening will be required to fill capillary spaces in and in order to prevent the loss of emulsion through piping or excess percolations.

4.1.4 In the event of water logging of foundation, the water shall be pumped out before application of chemical emulsion and it should be applied only when the soil is absorbent.

4.1.5 On clays and other heavy soil where penetration is likely to be slow and on sloping sites, where runoff of the treating solution is likely to occur, the surface of the soil should be scarified to at least a depth of 25mm.

- 4.1.6 All sub-floor leveling and grading should be completed, all cutting, trenches and excavation should be completed with backfilling in place. Borrowed fill must be free from organic debris and shall be well compacted. If this is not done, supplementary treatments should be made to complete the barrier.

5.0 **CHEMICAL TO BE USED:**

- 5.1 The effectiveness of chemical depends upon the choice of the chemical, the dosage adopted and the thoroughness of application. The chemical solutions or emulsions are required to be spread uniformly in the soil and to the required strength so as to form an effective chemical barrier that is lethal and repellent to termites.

6.0 **MOUND TREATMENT:**

- 6.1 For a mound volume of about one cubic metre, four litres of an emulsion in water with the following may be used:

- 6.1.1 0.50 percent Chloropyrifos.

7.0 **SOIL TREATMENT:**

- 7.1.1 Any one of the following chemicals in water emulsion is effective when applied uniformly over the area:

Sl.No.	Chemical	Concentration By weight
1.	Chlorpyriphos emulsifiable concentrates (IS: 8944)	1.0 %

8.0 **MODE AND RATE OF APPLICATION:**

- 8.1 The chemical emulsion as stated above will be applied uniformly by spraying at the prescribed rates as detailed below in all the states of the treatment:

- 8.1.1 Treatment in Foundation Trenches:

- 8.1.1.1 In case of normal wall load bearing structure, column pits, wall trenches and basement, the treatment shall be @ 5 (five) litres per square metre of surface area of the bottom and sides to a height of at least 300 mm. After the foundation works, the sides shall be treated @ 15 (fifteen) litres per square metre at vertical surface of sub-structure on each side.

- 8.1.1.2 After the earth filling is done, treatment shall be done by rodding the earth at 150 mm center to center close to wall surface and spraying the chemical with the above dose i.e., 15 (fifteen) litres per square metre. In case of framed structure, the treatment shall start at a depth of 500 mm below ground level. From this depth, the backfill around the columns, beams and R.C.C basement walls shall be treated @ 15 (fifteen) litres per square metre of the vertical surface and @ 5 (five) litres per square metre for the horizontal surface at the bottom in the trenches/pits.
- 8.1.2 Treatment on Top Surfaces of Plinth Filling:
- 8.1.2.1 The top surface of the filled earth within plinth walls shall be treated with chemical emulsion at the rate of 5 (five) litres/square metre of the surface area before sub-base to floor is laid. If filled earth has been well rammed and the surface does not allow the emulsion to seep through; holes up to 50 mm to 75 mm deep 150mm centre to centre both ways shall be made with crowbars on the surface to facilitate saturation of the soil with the emulsion.
- 8.1.3 Treatment at Junction of Walls and Floors:
- 8.1.3.1 Special care shall be taken to establish continuity of the vertical chemical barrier on the inner wall surfaces from the finished ground level (or from level where the treatment had stopped) up to the level of the filled earth surface, To achieve this a small channel 30 x 30 mm shall be made at all the junctions of wall / column with floor (before laying sub-grade) and rod holes made in the channel up to the finished ground level at 150 mm apart and the iron rod moved backward to forward to break the earth and chemical emulsion poured along the channel @ 15 (fifteen) litres (or as recommended quantity) per square metre of the vertical wall / column surfaces so as to soak the soil right up to the bottom. The soil shall be tamped back into place after this operation.
- 8.1.4 Treatment for Expansion Joints:
- 8.1.4.1 The soil beneath the expansion joints shall receive special attention when the treatment under 8.1.1 above is in progress. This treatment shall be supplemented by treating through the expansion joint after sub-grade has been laid at the rate of 2 (two) litres per metre length of expansion joint.

9.0 PRECAUTIONS DURING TREATMENT:

- 9.1 Utmost care shall be taken to see that the chemical barrier is complete and continuous. Each part of the area shall receive the prescribed dosage of chemical emulsion.
- 9.2 The treatment should not be carried out when it is raining or when the soil is wet with rain or sub-soil water.
- 9.3 Once formed, the treated soil barrier shall not be disturbed. If by chance, treated soil barriers are disturbed, immediate steps shall be taken to restore the continuity and completeness of the barrier system.

10.0 PRECAUTIONS FOR HEALTH HAZARDS AND SAFETY MEASURES:

- 10.1 All the chemicals mentioned above are poisonous and hazardous to health. These chemicals can have an adverse effect upon health when absorbed through the skin, inhaled as vapors or spray mist or swallowed. Persons handling or using these chemicals should be warned of these dangers and advised that absorption through the skin is the most likely source of accidental poisoning. They should be cautioned to observe carefully the safety precautions given below particularly when handling these chemicals in the form of concentrates.
- 10.2 These chemicals are usually brought to the site in the form of emulsifiable concentrates. The containers should be clearly labeled and should be stored carefully so that children and pets cannot get at them. They should be kept securely closed.
- 10.3 Particular care should be taken to prevent skin contact with concentrates. Prolonged exposure to dilute emulsions should also be avoided. Workers should wear clean clothing and should wash thoroughly with soap and water especially before eating and smoking. In the event of severe contamination, clothing should be removed at once and the skin washed with soap and water. If chemicals splash into the eyes, they shall be flushed with plenty of soap and water and immediate medical attention should be sought.
- 10.4 The concentrates are oil solutions and present a fire hazard owing to the use of petroleum solvents. Flames should not be allowed during mixing.
- 10.5 Care should be taken in the application of soil toxicants to see that they are not allowed to contaminate wells or springs, which serve as sources of drinking water.

11.0 **GUARANTEE:**

11.1 The contractor has to furnish the guarantee for 10 (ten) years from the date of completion of work stating that in case of re-appearance of termites within the building area due to defective materials or workmanship or due to any other reasons, the contractor will carry out the necessary post constructional treatment to keep the entire area free from termite once again, without any extra cost to the department during the guarantee period.

12.0 **MODE OF MEASUREMENT:**

12.1 The payment will be made on the basis of plinth area measurements at ground floor only for all the stages of treatment in square metre rounded off to two places of decimals.

12.2 Rate includes the cost of materials, labour and all tools, consumables, spares for complete operation.

C-04: Plain & Reinforced Cement Concrete including Allied Works

1.00.00 SCOPE

1.01.00 General

This specification covers all the requirements, described hereinafter for general use of Plain and Reinforced Cement Concrete work in Structures and locations, cast-in-situ or precast, and shall include all incidental items of work not shown or specified but reasonably implied or necessary for the completion of the work.

1.02.00 This specification shall also apply to the extent it has been referred to or applicable with the special requirements of structures covered in SCOPE of IS:456.

1.03.00 IS:456 shall form a part of this specification and shall be complied with unless permitted otherwise. For any particular aspect not covered by this Code, appropriate IS Code, specifications and/or replacement by any International Code of practice as may be specified by the Engineer-in-Charge shall be followed. All codes and Standards shall conform to its latest revisions. A list of IS codes and Standards is enclosed hereinafter for reference.

2.00.00 GENERAL

2.01.00 Work to be provided for by the Contractor

The work to be provided by the Contractor, unless otherwise specified shall include but not be limited to the following:

- a) Furnish all labour, supervision, services including facilities as may be required under statutory labour regulations, materials, forms, templates, supports, scaffolds, approaches, aids, construction equipment, tools and plants, transportations, etc. required for the work.
- b) Contractor shall prepare progressively and submit for approval of detailed drawings and Bar Bending Schedules for reinforcement bars showing the positions and details of spacers, supports, chairs, hangers etc.
- c) Design and prepare working drawings of formworks, scaffolds, supports, etc. and submit for approval.
- d) Submit for approval of shop drawings for various inserts, anchors, anchor bolts, pipe sleeves, embedments, hangers, openings, frames etc.

- e) Submit for approval of detailed drawings of supports, templates, hangers, etc. required for installation of various embedments like inserts, anchor bolts, pipe sleeves, frames, joint seals, frames, openings etc.
- f) Submit for approval of detailed schemes of all operations required for executing the work, e.g. Material handling, Concrete mixing, Placement of concrete, Compaction, curing, services, Approaches, etc.
- g) Design and submit for approval of concrete mix designs required to be adopted on the job.
- h) Furnish samples and submit for approval of results of tests of various properties of the following:
 - i) The various ingredients of concrete
 - ii) Concrete
 - iii) Embedments
 - iv) Joint seals
- i) Provide all incidental items not shown or specified in particular but reasonably implied or necessary for successful completion of the work in accordance with the drawings, specifications and Schedule of Items.
- j) For supply of certain materials normally manufactured by specialist firms, the Contractor may have to produce, if directed by the Engineer-in-Charge, a guarantee in approved proforma for satisfactory performance for a reasonable period as may be specified, binding both the manufacturers and the Contractor, jointly and severally.

2.02.00 **Work by Others**

No work under this specification will be provided by any agency other than the Contractor unless specifically mentioned elsewhere in the contract.

2.03.00 **Information to be submitted by the Tenderer**

2.03.01 **After Award**

The following information and data including samples, where necessary, shall be submitted by the Contractor progressively during execution of the contract.

a) **Programme of Execution and Requirement of Materials**

Detailed day to day programme of every month is to be submitted by the Contractor before the end of the previous month.

b) **Samples**

Samples of the following materials and any other materials, proposed to be used, shall be submitted as directed by the Engineer-in-Charge, in sufficient quantities free of cost, for approval. The cost of required tests for approval has to be borne by the contractor. Approved samples will be preserved by the Engineer-in-Charge for future reference. The approval of the Engineer-in-Charge shall not, in any way, relieve the Contractor of his responsibility of supplying materials of specified qualities:

- i) Coarse and fine aggregates.
- ii) Admixtures.
- iii) Plywood for Formwork.
- iv) Embedded and anchorage materials as may be desired by the Engineer-in-Charge.
- v) Joint sealing strips and other waterproofing materials.
- vi) Joint filling compounds.
- vii) Foundation quality Rubber Pads.
- Xi) Cement

c) **Design Mix**

Design mix as per relevant Clauses of this specification giving proportions of the ingredients, sources of aggregates and cement, along with accompanying test results of trial mixes as per relevant I.S. Codes, is to be submitted to the Engineer-in-Charge for his approval before it can be used on the works.

d) **Detail Drawings and Bar Bending Schedules**

Detailed working drawings and Bar Bending Schedules in accordance with relevant Clauses of this specification.

e) **Detailed Drawings and Designs of Formworks to be used**

Detailed design data and drawings of formworks to be used as per relevant Clauses

f) **Detailed Drawings for Templates & Temporary Supports for Embedments**

As per relevant Clauses.

g) **Mill Test Reports for Cement & Reinforcing Steel**

Mill Test Reports/ MTC from manufacturer for Cement and Reinforcing Steel in case these materials are supplied by the Contractor.

h) **Inspection Reports**

Inspection Reports in respect of Formwork and Reinforcement and any other item of work as may be desired by the Engineer-in-Charge in accordance with relevant Clauses of this specification.

i) **Test Reports**

Reports of tests of various materials and concrete as required under Clause 4.00.00 : SAMPLING & TESTING of this specification.

j) Any other data which may be required as per this specification.

2.04.00 **Conformity with Design**

The Contractor shall prepare check lists in approved proforma which will be called 'Pour Cards'. These Pour Cards will list out all items of work involved. The Contractor will inform the Engineer-in-Charge, sufficiently in advance, whenever any particular pour is ready for concreting. He shall accord all necessary help and assistance to the Engineer-in-Charge for all checking required in the pour. On satisfying himself that all details are in accordance to the drawings and specifications, the Engineer-in-Charge will give written permission on the same 'Pour Card' allowing the Contractor to commence placement of concrete. Details of all instructions issued by the Engineer-in-Charge and the records of compliance by the Contractor, deviations allowed by the Engineer-in-Charge and any other relevant information will be

written on accompanying sheets attached to the Pour Cards. These sheets, termed as 'Progress Cards', will be prepared by the Contractor on approved proforma. The Pour Cards along with accompaniments will be handed over to the Engineer-in-Charge before starting placement of concrete. One of the mix designs developed by the Contractor as per the I.S. Specifications and established to the satisfaction of the Engineer-in-Charge by trial mixes shall be permitted to be used by the Engineer-in-Charge, the choice being dictated by the requirements of designs and workability. The methods of mixing, conveyance, placement, vibration, finishing, curing, protection and testing of concrete will be as approved or directed by the Engineer-in-Charge.

2.05.00 Materials to be used

2.05.01 General Requirement

All materials whether to be incorporated in the work or used temporarily for the construction shall conform to the relevant IS Specifications unless stated otherwise and be of best approved quality.

2.05.02 Cement

Unless otherwise specified or called for by the Engineer-In-Charge cement shall be Ordinary Portland Cement of 43 grade in 50 kg bags. The use of bulk cement will be permitted only with the approval of the Engineer-In-Charge. Changing of brand or type of cement within the same structure will not be permitted. In case it is required to change the brand of cement in the same structure, prior permission shall be obtained from the Engineer-In-Charge.

If demanded, a certified report attesting to the conformity of the cement to IS. specifications by the cement manufacturer's chemist shall be furnished to the Engineer-In-Charge.

The contractor will have to make his own arrangements for the storage of adequate quantity of cement. Cement in bulk may be stored in bins or silos, which will provide complete protection from dampness, contamination and minimize cracking and false set. Cement bags shall be stored in dry enclosed shed (storage under tarpaulins will not be permitted), well away from the outer walls and insulated from the floor to avoid contact with moisture from ground and so arranged as to provide ready access. Damaged or reclaimed or partly set cement will not be permitted to use and shall be removed from site. The storage bins and storage arrangements shall be such that there is no dead storage. Not more than 12 bags shall be stacked in any tier. The storage arrangement shall be approved by the EIC.

Consignment of cement shall be stored as received and shall be consumed in the order of their delivery.

Cement held storage for a period of Ninety (90) days or longer shall be tested before use in work. Should at any time the Engineer-In-Charge have reason to consider that any cement is defective, then irrespective of its origin and / or manufacturer's test certificate, such a cement shall be tested immediately at a National Test Laboratory / Departmental Laboratory or such approved laboratory and until the result of such test are found satisfactory, it shall not be used in any work.

2.05.03 **Aggregates**

Aggregates shall be natural or crushed gravel or crushed rock and free from deleterious materials. It shall comply with the requirements of IS-383. All fine and coarse aggregate shall be tested for susceptibility to Alkali Silicate reaction in a laboratory approved by the Engineer-in-Charge.

a) **Coarse Aggregate**

Aggregate of sizes ranging between 4.75 mm and 150 mm will be termed as Coarse Aggregate. Only Coarse Aggregate from approved quarries and conforming to IS: 383 will be allowed to be used on the works. Aggregates shall be washed to make it free from deleterious materials, if necessary.

The grading of coarse aggregates by sieve analysis shall be as per IS: 383.

b) **Fine Aggregate**

Aggregate smaller than 4.75 mm and within the grading limits and other requirements set in IS: 383 will be termed as Fine Aggregate or Sand. Only Fine Aggregate from approved sources and conforming to the above IS Specification will be allowed to be used on works.

In certain cases there may be two types of sand, one very fine and the other very coarse. In such cases, the two types shall be combined to meet the requirements of a particular zone of IS: 383. In most cases, the preferred zone is Zone - II.

In certain cases crushed stone sand may be added to natural sand in order to achieve the required grading.

Crushed stone sand alone may be used only with the approval of the Engineer-in-Charge.

c) **Specific Gravity:**

Aggregate having a specific gravity below 2.60 (saturated surface dry basis) shall not be used without special permission of the Engineer- In- Charge.

d) **Storage of Aggregates:**

All coarse and fine aggregates shall be stacked separately in stock piles in the material yard near the work site in bins properly constructed to avoid inter mixing of different aggregates. Contamination with the foreign materials and earth during storage and while heaping the materials shall be avoided. The aggregate must be of specified quality not only at the time of receiving at site but more so at the time of loading into the mixer. Rakers shall be used for lifting the coarse aggregates from the bins or stock piles. Coarse aggregate shall be piled in layers not exceeding 1.20 metres in height to prevent coning or segregation. Each layer shall cover the entire area of the stock pile before succeeding layers are started. Aggregates that have become segregated shall be rejected.

2.05.04 Water

Water for use in Concrete shall be clear and free from injurious oils, acids, alkalis, organic matter, salt, silts or other impurities. Normally potable water is found to be suitable. Generally, IS: 3550 will be followed for routine tests. Acceptance test for water shall be as per IS: 3025, and Table - 1 of IS: 456.

In case of doubt regarding development of strength, the suitability of water for making concrete shall be ascertained by compressive strength and initial setting time tests as per method of tests in accordance with the requirements of IS: 516 & IS: 4031 respectively. The PH value of water shall generally be not less than 6.

2.05.05 Admixture

Only admixture of approved quality will be used when directed or permitted by the Engineer-in-Charge. The different types of admixtures which may be necessary to satisfy the concrete mix and the design requirement shall be as per the following I.S. Standards:

IS: 2645 - Integral cement water proofing compound

IS: 9103 - Indian standard specification for Admixtures for Concrete

Or equivalent American Codes (ASTM C494 and ASTM C260) or British Codes (BS 5075, Part 1 to 3) and may be one of the following:

a) **Accelerating admixtures**

- Set accelerating admixtures like "Sigunit Powder" or "Sigunit LN10" or approved equivalent.

b) **Retarding admixtures**

- Modified lignosulphonate based set retarding concrete admixture like "Plastiment R" or approved equivalent.

c) **Water reducing admixtures**

- Modified sulphonated melamine formaldehyde based water reducing concrete admixture like "Sikament" or approved equivalent.

d) **Air entraining admixtures**

- Modified lignosulphonate based air entraining concrete admixture like "FLOMO AEP " or surface active agents like "Sika AER" or approved equivalent.

e) **Water proofing admixtures**

- Modified lignosulphonate based waterproofing admixture like "Plastocrete Super" or approved equivalent.

However, the Contractor shall furnish following technical information about the admixtures (along with the manufacturer's Catalogue) which he is planning to use in different areas within the scope of work for the approval of the Engineer-in-Charge:

- i) Type of admixture
- ii) Mix proportion & mode of application in concrete/mortar
- iii) Manufacturer's specification & necessary quality assurance certificates (mainly on chloride & sulphate content, PH value, infra red analysis & solid content).

2.05.06 **Reinforcement**

Reinforcement shall be as per relevant IS Specification as mentioned in the Contract/ Drawing/ Instructions. All bars shall be of tested quality.

2.06.00 **Storage of Materials**

2.06.01 **General**

All materials shall be so stored as to prevent deterioration or intrusion of foreign matter and to ensure the preservation of their quality and fitness for the work. Any material, which has deteriorated or has been damaged or is otherwise considered defective by the Engineer-in-Charge, shall not be used for concrete and shall be removed from site immediately, failing which, the Engineer-in-Charge shall be at liberty to get the materials removed and the cost incurred thereof shall be realised from the Contractor's dues. The Contractor shall maintain up-to-date accounts of receipt, issue and balance (stack-wise) of all materials. Storage of materials shall conform to IS: 4082.

2.06.02 **Cement**

Sufficient space for storage, with open passages between stacks, shall be arranged by the Contractor to the satisfaction of the Engineer-in-Charge.

Cement shall be stored off the ground in dry, leak proof, well ventilated ware-houses at the works in such a manner as to prevent deterioration due to moisture or intrusion of foreign matter.

Cement shall be stored in easily countable stacks with consignment identification marks. Consignments shall be used in the order of their receipts at site. Sub-standard or partly set cement shall not be used and shall be removed from the site, with the knowledge of the Engineer-in-Charge, as soon as it is detected.

Different types of cement shall be clearly marked with the type & different types of cement shall not be intermixed.

2.06.03 **Aggregates**

Aggregates shall be stored on planks or steel plates or on concrete or masonry surface. Each size shall be kept separated with wooden or steel or concrete or masonry bulk- heads or in separate stacks and sufficient care shall be taken to prevent the material at the edges of the stock piles from getting intermixed. Stacks of fine and coarse aggregates shall be kept sufficiently apart with proper arrangement of drainage. The aggregates shall be stored in easily measurable stacks of suitable depths as may be directed by the Engineer-in-Charge.

2.06.04 **Reinforcement**

Reinforcing steel shall be stored consignment wise and size wise off the ground and under cover, if desired by the Engineer-in-Charge. It shall be protected from rusting, oil, grease and distortions. If necessary, the reinforcing steel may be coated with cement wash before stacking to prevent scale and rust at no extra cost to the Owner. The stacks

shall be easily measurable. Steel needed for immediate use shall only be removed from storage.

2.07.00 **Quality Control**

Contractor shall establish and maintain quality control for different items of work and materials as may be directed by the Engineer-in-Charge to assure compliance with contract requirements and maintain and submit to the Engineer-in-Charge records of the same. The quality control operation shall include but not be limited to the following items of work:

- a) Admixture : Type, quantity, physical and chemical properties that affect strength, workability and durability of concrete

For air entraining admixtures, dosage to be adjusted to maintain air contents within desirable limits
- b) Aggregate : Physical, chemical and mineralogical qualities. Tests for grading, moisture content and impurities.
- c) Water : Impurities tests.
- d) Cement : Tests to satisfy relevant IS Specifications (If Contractor's supply).
- e) Formwork : Material, shapes, dimensions, lines, elevations, surface finish, adequacy of form, ties, bracing and shoring and coating.
- f) Reinforcement: Shapes, dimensions, length of splices, clearances, ties and supports. Quality and requirement of welded splices.

Material tests or certificates to satisfy relevant IS Specification (If Contractor's supply).
- g) Grades of : Usage and mix design, testing of all properties.
concrete
- h) Batching & : Types and capacity of plant, concrete mixers
Mixing and transportation equipment.
- i) Joints : Locations of joints, water stops and filler materials. Dimension of joints, quality and shape of joint material and splices.
- j) Embedded & : Material, shape, location, setting.

Anchorage Items

- k) Placing : Preparation, rate of pouring, their limitations, time intervals between mixing and placing and between two successive lifts, covering over dry or wet surfaces, cleaning and preparation of surfaces on which concrete is to be placed, application of mortar/slurry for proper bond, prevention of cold joint, types of chutes or conveyors.
- l) Compaction: Number of vibrators, their prime mover, frequency and amplitude of vibration, diameter and weight of vibrators, duration of vibration, hand-spreading, rodding and tamping.
- m) Setting of base: Lines, elevations and bedding mortar.
& Beaming plates
- n) Concrete : Repairs of surface defects, screening, floating,
steel
Finishes trowelling and brooming, special finishes.
- o) Curing : Methods and length of time.

Copies of records and tests for the items noted above, as well as, records of corrective action taken shall be submitted to the Engineer-in-Charge for approval as may be desired.

3.00.00 **INSTALLATION**

All installation requirements shall be in accordance with IS: 456 and as supplemented or modified herein or by other best possible standards where the specific requirements mentioned in this section of the specification do not cover all the aspects to the full satisfaction of the Engineer-in-Charge.

3.01.00 **Washing and Screening of Aggregates**

Washing and Screening of coarse aggregate shall be carried out to remove fines, dirt or other deleterious materials.

Washing of fine aggregate shall not be allowed, Fine aggregates shall be screened only to remove dirt or other deleterious materials.

However, all washing & screening of aggregates shall be carried out by approved means as approved by the Engineer-in-Charge to ensure compliance with the aggregate specification.

3.02.00 **Admixture**

All concrete shall be designed for normal rate of setting and hardening at normal temperature. Variations in temperature and humidity under different climatic conditions will affect the rate of setting and hardening, which will, in turn, affect the workability and quality of the concrete. Admixtures may be permitted to be used in accordance with IS: 456 to modify the rate of hardening, to improve workability or as an aid to control concrete quality. The Engineer-in-Charge reserves the right to require laboratory test or use test data, or other satisfactory reference before granting approval. The admixture shall be used strictly in accordance with manufacturer's directions and/or as directed by the Engineer-in-Charge.

3.03.00 Grades of Concrete

Concrete shall be in any of the grades designated in IS: 456. Grade of concrete to be used in different parts of work shall be as shown on the drawing or as per the Engineer-in-Charge's instructions. In case of liquid retaining structures, IS: 3370 will be followed.

3.04.00 Proportioning and Works Control

3.04.01 General

Proportioning of ingredients of concrete shall be made by any of the two following methods as directed by the Engineer-in-Charge.

- a) With preliminary tests by designing the concrete mix. Such concrete shall be called 'Design Mix Concrete'.
- b) Without preliminary tests adopting nominal concrete mix. Such concrete shall be called 'Nominal Mix Concrete'.

As far as possible, design mix concrete shall be used on all concrete works. Nominal mix concrete, in grades permitted in accordance with IS: 456 may be used if shown on drawings or approved by the Engineer-in-Charge. In all cases the proportioning of ingredients and works control shall be in accordance with IS: 456 and shall be adopted for use after the Engineer-in-Charge is satisfied regarding its adequacy and after obtaining his approval in writing.

3.04.02 Mix Design Criteria

Concrete mixes will be designed by the Contractor to achieve the strength, durability and workability necessary for the job, by the most economical use of the various ingredients. In general, the design will keep in view the following considerations:

- a) Consistent with the various other requirements of the mix, the quantity of water should be kept at the lowest possible level.

- b) The nominal maximum size of coarse aggregate shall be as large as possible within the limits specified.
- c) The various fractions of coarse and fine aggregates should be mixed in such a proportion as to produce the best possible combined internal grading giving the densest and most workable mix.
- d) Chemical admixtures may be used to modify the rate of hardening, to improve workability (maintaining low water - cement ratio) or as an aid to control concrete quality.
- e) The finished concrete should have adequate durability in all conditions, to withstand satisfactorily the weather and other destructive agencies which it is expected to be subjected to in actual service.

The requirement of adequate structural strength is catered for by the choice of proper grade of concrete adopted in design and specified on drawings by the Engineer-in-Charge. The Contractor will strictly abide by the same in his design of concrete mix installation.

Notwithstanding anything mentioned in various tables given in IS: 456 giving specific values and degrees of workability for different condition of concrete placing, minimum cement content and maximum water-cement ratio for concrete exposed to sulphate attack and for concrete to ensure durability under different condition of exposure, strength requirement for different grades of concrete, proportion for nominal mix concrete, the following tables are included in the specification. For identical condition if values given in the tables shown herein below are different from those mentioned in IS: 456, the values as indicated in the table shown herein below shall prevail.

Various trials shall be given by the contractor with specific cement content on each trial. In some cases, plasticizers and other admixtures may be necessary to achieve the desired results.

Whenever there is a change in the type and source of materials, mix design has to be revised and get approval from the Engineer-in-Charge.

TABLE – I
STRENGTH REQUIREMENT OF CONCRETE

Grade Designation	Specified strength of 150 mm Cube at 28 days	Characteristic	Compressive

(All values in N/Sq.mm)

M 10	10
M 15	15
M 20	20
M 25	25
M 30	30
M 35	35
M 40	40

Note - 1 : Nominal mix concrete of proportions M7.5 or M10 may be used as lean concrete for simple foundations for masonry walls, below the reinforced concrete foundations and mass filling.

Note - 2 : Grades of concrete lower than M20 shall not be used in reinforced concrete.

TABLE - II
MIX PROPORTIONS (BY WEIGHT) EXPECTED TO GIVE
DIFFERENT DEGREES OF WORKABILITY WITH DIFFERENT
VALUES OF WATER - CEMENT RATIO
(FOR GUIDANCE)
CEMENT/TOTAL AGGREGATE RATIOS

WORKABILITY	WATER/ CEMENT RATIO	RATIO BY WEIGHT OF CEMENT TO GRAVEL AGGREGATE		RATIO BY WEIGHT OF CEMENT TO CRUSHED STONE AGGREGATE	
		20 mm Size	38 mm size	20 mm size	38 mm size
Very low Slump 0-25 mm	0.4	1:4.8	1:5.3	1:4.5	1:5.0
	0.5	1:7.2	1:7.7	1:6.5	1:7.4
	0.6	1:9.4	1:10	1:7.8	1:9.6
	0.7	1:10	1:12	1:8.7	1:10.6
Low Slump 25-50 mm	0.4	1:3.9	1:4.5	1:3.5	1:4.0
	0.5	1:5.5	1:6.7	1:5.0	1:5.5
	0.6	1:6.8	1:7.4	1:6.3	1:7.0
	0.7	1:8.0	1:8.5	1:7.4	1:8.0
Medium Slump 50-100 mm	0.4	1:3.5	1:3.8	1:3.1	1:3.6
	0.5	1:4.8	1:5.7	1:4.2	1:5.0
	0.6	1:6.0	1:7.3	1:5.2	1:6.2
High Slump	0.4	1:3.2	1:3.5	1:2.9	1:3.3

100-150 mm	0.5	1:4.4	1:5.2	1:3.9	1:4.6
	0.6	1:5.4	1:6.7	1:4.7	1:5.7
	0.7	1:6.2	1:7.4	1:5.5	1:6.5

Note - 1: Notwithstanding anything mentioned above, the cement/Total aggregate ratio is not to be increased beyond 1:9.0 without specific permission of the Engineer-in-Charge.

Note - 2 : It should be noted that such high aggregate cement ratios will be required or concretes of very low slump and high water-cement ratios which may be required to be used in mass concrete work only.

Note - 3: The above figures are for guidance only, the actual cement/aggregate ratios are to be worked out from the specific gravities of coarse aggregates and sand being used and from trial mixes.

3.05.00 **Strength Requirements**

The strength requirements of both design mix and nominal mix concrete where Ordinary Portland Cement or Portland Slag Cement is used shall be as per Table-2 of IS: 456. All other relevant clauses of IS: 456 shall also apply.

3.06.00 **Minimum Cement Content**

The minimum cement content recommended for each grade of concrete will be as shown below.

TABLE - III

**MINIMUM CEMENT CONTENT SPECIFIED
FOR DIFFERENT GRADES OF CONCRETE**

Grade of Concrete	Minimum Cement Content/Cu.M of Finished Concrete
M 15	Kg 240
M 20	Kg 300
M 25	Kg 330
M 30	Kg 350
M 35	Kg 360
M 40	Kg 380

The minimum cement contents mentioned above are for average conditions and for 20 mm size aggregate. For 40 mm size aggregate the cement content may be reduced (Refer Table 6 of IS: 456).

In case the cement content can be reduced due to continuous and consistent favourable conditions, on account of better quality of cement or by the addition of suitable plasticizer / super plasticizers, then the Engineer-in-Charge may instruct lower cement content, and the Contractor shall abide by the stipulations laid down hereunder:

- a) The Contractor shall design the mixes for 10% (Ten per cent) higher strength over and above those specified in Table - I under Clause 3.4, for the various grades of concrete and different slump requirements.
- b) Sufficient number of trial mixes (to be decided by the Engineer-in-Charge) will be taken at the laboratory for the various designs and graphs of w/c ratio Vs crushing strengths at various ages will be plotted.
- c) All tests will be done in presence of the Engineer-in-Charge who shall be the final authority to decide upon the adoption of any revised minimum cement content. The Contractor will always be responsible to produce quality concrete of the required grade as per the acceptance criteria of IS: 456.
- d) The Engineer-in-Charge will always have the unquestionable right to revise the minimum cement content as decided above, if, in his opinion, there is any chance of deterioration of quality on account of use of lower cement content or any other reason.

In case there is a downward revision of the minimum cement content from that specified in the contract, the particular unit rate of concrete will be reduced by an amount equal to the cost of cement saved, calculated at the issue rate. The relevant cost of wastage and handling on the cement saved, which is inherent in the total cost of structure, will not be deducted from the unit rate and will thus pass on to the Contractor.

3.07.00 Water Cement Ratio

The choice of water cement ratio in designing a concrete mix will depend on

- a) The requirement of strength.
- b) The requirement of durability.

3.07.01 Strength Requirement

In case of 'Design Mix Concrete', the water-cement ratio of such value as to give acceptable test results as per IS: 456 will be selected by trial and error. The values of water- cement ratios for different grade and mix designs will have to be established after conducting sufficiently large number of preliminary tests in the laboratory to the satisfaction of the Engineer-in-Charge. Frequent checks on test will have to be carried out and the water-cement ratios will be revised if the tests produce unsatisfactory results. Notwithstanding anything stated above the Contractor's responsibility to produce satisfactory test results and to bear all the consequences in case of default remains unaltered.

In case of nominal mix concrete, the maximum water-cement ratio for different grades of concrete is specified in Table-9 of IS: 456. The acceptance test criteria for nominal mix concrete shall be as per IS: 456.

3.07.02 **Durability Requirement**

Tables 3, 4 & 5 of IS: 456 give the maximum water-cement ratio permissible from the point of view of durability of concrete subjected to adverse exposure to weather, sulphate attacks, and contact with harmful chemicals. Impermeability may also be an important consideration.

Whenever the water-cement ratio dictated by durability consideration is lower than that required from strength criterion, the former shall be adopted.

The water cement ratio between 0.4 and 0.45 is generally found desirable to satisfy the durability requirement and from the consideration of impermeability of concrete. The contractor may propose lower water cement ratio as mentioned above by addition of a suitable plasticizer / super- plasticizer. However the contractor has to propose specifically along with field trials in the event of lower cement content if found suitable along with a plasticizer. It will be preferable to use Melamine based plasticizer.

3.08.00 **Workability**

The degree of workability necessary to allow the concrete to be well consolidated and to be worked into the corners of formwork and around the reinforcement and embedments and to give the required surface finish shall depend on the type and nature of structure and shall be based on experience and tests. The usual limits of consistency for various types of structures are given below:

TABLE - IV
LIMITS OF CONSISTENCY

Degree of Workability	Slump in mm with Standard Cone as per IS: 1199		Use for which concrete is suitable
	Min.	Max.	
Very low	0	25	Large Mass concrete structure with heavy compaction equipments, roads and like
Low	25	50	Uncongested wide and shallow R.C.C. structures
Medium	50	100	Deep but wide R.C.C. structures with congestion of reinforcement and inserts
High	100	150	Very narrow and deep R.C.C. structures with congestion due to reinforcement and inserts.

NOTE: Notwithstanding anything mentioned above, the slump to be obtained for work in progress shall be as per direction of the Engineer-in-Charge.

With the permission of the Engineer-in-Charge, for any grade of concrete, if the water has to be increased in special cases, cement shall also be increased proportionately to keep the ratio of water to cement same as adopted in trial mix design for each grade of concrete. No extra payment will be made for this additional cement.

The workability of concrete shall be checked at frequent intervals by slump tests. Alternatively where facilities exist or if required by the Engineer-in-Charge, the compacting factor test in accordance with IS: 1199 and Clause 7 of IS: 456 shall be carried out.

3.09.00 **Size of Coarse Aggregates**

The maximum size of coarse aggregates for different locations shall be as follows unless otherwise directed by the Engineer-in-Charge:

Very narrow space	-	12 mm
Reinforced concrete except foundation	-	20 mm

Ordinary Plain concrete and Reinforced concrete foundations	-	40 mm
Mass concrete	-	80 mm
Mass concrete in very large structure	-	150 mm

Grading of coarse aggregates for a particular size shall conform to relevant I.S. Codes and shall also be such as to produce a dense concrete of the specified proportions, strength and consistency that will work readily into position without segregation.

Coarse aggregate will normally be separated into the following sizes and stacked separately in properly designed stockpiles:

150 mm to 80 mm, 80 mm to 40 mm, 40 mm to 20 mm and 20 mm to 5 mm. In certain cases it may be necessary to further split the 20 mm to 5 mm fraction into 20 mm to 10 mm and 10 mm to 5 mm fractions.

This separation of aggregates in different size fractions is necessary so that they may be remixed in the desired proportion to arrive at a correct internal grading to produce the best mix.

3.10.00 **Mixing of Concrete**

Concrete shall always be mixed in mechanical mixer unless specifically approved by the Engineer-in-Charge for concrete to be used in unimportant out of the way locations in small quantities. Water shall not normally be charged into the drum of the mixer until all the cement and aggregates constituting the batch are already in the drum and mixed for at least one minute. Mixing of each batch shall be continued until there is a uniform distribution of the materials and the mass is uniform in colour and consistency, but in no case shall mixing be done for less than 2 (two) minutes and at least 40 (forty) revolutions after all the materials and water are in the drum. When absorbent aggregates are used or when the mix is very dry, the mixing time shall be extended as may be directed by the Engineer-in-Charge. Mixers shall not be loaded above their rated capacity as this prevents thorough mixing.

The entire contents of the drum shall be discharged before the ingredients for the next batch are fed into the drum. No partly set or remixed or excessively wet concrete shall be used. Such concrete shall be immediately removed from site. Each time the work stops, the mixer shall be thoroughly cleaned & when the next mixing commences, the first batch shall have 10% additional cement at no extra cost to the Owner to allow for loss in the drum.

Regular checks on mixer efficiency shall be carried out as directed by the Engineer-in-Charge as per IS: 4634 on all mixers employed at site.

Only those mixers whose efficiencies are within the tolerances specified in IS: 1791 will be allowed to be employed.

Ingredients for design mix concrete shall be measured by weight. For small jobs portable swing weigh Batchers conforming to IS: 2722 may be used.

Batching plant conforming to IS: 4925 shall be used for large jobs. The accuracy of the measuring equipment shall be within $\pm 1\%$ of the quantity of Cement, water or total aggregates being measured and within $\pm 3\%$ of the quantity of any admixture being used. The batching equipment shall be fitted with an accurate mechanism for weighing separately the cement, fine aggregate and coarse aggregate. Water may be measured by volume or by weight. All measuring equipment should be maintained in a clean serviceable condition, and their accuracy shall be checked periodically.

Mechanical / electrical control shall be provided on the mixing equipment to ensure the batch cannot be discharged until approved mixing time has elapsed and the entire batch shall be discharged before the mixer is recharged.

Where admixtures are employed, separate containers & measuring devices shall be used.

For minor concreting works, batching by volume according to specific weight may be permitted by the Engineer-in-Charge. In that case the whole bags of cement shall be used and gauge boxes used for measuring aggregates.

When hand mixing is permitted by the Engineer-in-Charge, it shall be carried out on a water-tight platform and care shall be taken to ensure that mixing is continued until the mass is uniform in colour and consistency. In case of hand-mixing, 10% extra cement shall be added to each batch at no extra cost to the Owner.

3.11.00 Conveying Concrete

Concrete shall be handled and conveyed from the place of mixing to the place of laying as rapidly as practicable by approved means and placed and compacted in the final position before the initial setting of the cement starts. Concrete should be conveyed in such a way as will prevent segregation or loss of any of the ingredients. For long distance haulage, agitator cars of approved design will be used. If, in spite of all precautions, segregation does occur during transport, the concrete shall be properly re-mixed before placement. During very hot or cold weather, if directed by the Engineer-in-Charge, concrete shall be transported in deep containers which will reduce the rate of loss of water by evaporation or loss of heat. If necessary, the container may have to be covered and insulated. Conveying equipments for concrete

shall be well maintained and thoroughly cleaned before commencement of concrete mixing. Such equipments shall be kept free from set concrete.

3.12.00 **Placing and Compacting Concrete**

Where specifically covered, the relevant I.S. Code will be followed for the procedure of surface preparation, placement, consolidation, curing, finishes, repairs and maintenance of concrete. If, however, there is no specific provision in the relevant I.S. Code for any particular aspect of work, any other standard Code of practice, as may be specified by the Engineer-in-Charge, will be adopted. Concrete may have to be placed against the following types of surfaces:

- a) Earth foundation
- b) Rock foundation
- c) Formwork
- d) Construction joint in concrete or masonry

The surface on or against which concrete is to be placed has to be cleaned thoroughly. Rock or old construction joint has to be roughened by wire brushing, chipping, sand blasting or any other approved means for proper bond. All cuttings, dirt, oil, foreign and deleterious material, laitance, etc. are to be removed by air water jetting or water at high pressure. All excavated areas for foundations, ring beams, plinths, pile caps etc. shall be rammed & consolidated properly before blinding with nominal mix plain concrete, as per drawing and / or direction of the Engineer-in-Charge and shall be allowed to cure prior to setting out, steel fixing, shuttering and concrete pouring for the main structural element.

Concrete has to be placed at temperature of 28°C, to achieve this ice flakes etc., may be used with approval from Engineer-in-Charge.

Formwork, reinforcement, preparation of surface, embedments, joint seals etc., shall be approved in writing by the Engineer-in-Charge before concrete is placed. As far as possible, concrete shall be placed in the formwork by means approved by the Engineer-in-Charge and shall not be dropped from a height or handled in a manner which may cause segregation. Any drop over 1500 mm shall have to be approved by the Engineer-in-Charge.

Rock foundation or construction joint will be kept moist for at least Seventy Two (72) hours prior to placement. Concrete will be placed always against moist surface but never on pools of water. In case the foundation cannot be dewatered completely, special procedure and

precaution, as directed by the Engineer-in-Charge will have to be adopted.

Formwork will be cleaned thoroughly and smeared lightly with form oil or grease of approved quality just prior to placement.

A layer of mortar of thickness 12 mm of the same or less w/c ratio and the same proportion as that of the concrete being placed and cement slurry will be spread thoroughly on the rock foundation or construction joint just prior to placement of concrete. The cost of application of such cement slurry and mortar will be deemed to be included in the unit rate of concrete.

After concrete has been placed, it shall be spread, if necessary and thoroughly compacted by approved mechanical vibration to maximum subsidence without segregation and thoroughly worked around shape. Vibrators shall not be used for pushing concrete into adjoining areas. Vibrators must be operated by experienced workmen and the work carried out as per relevant IS Code of Practice. In thin members with heavy congestion of reinforcement or other embedments, where effective use of internal vibrator is, in the opinion of the Engineer-in-Charge, doubtful, in addition to immersion vibrators the contractor may have to employ form vibrators conforming to IS: 4656. For slabs and other similar structures, the contractor will additionally employ screed vibrator as per IS: 2506. Hand tamping may be allowed in rare cases, subject to the approval of the Engineer-in-Charge. Care must be taken to ensure that the inserts, fixtures, reinforcement and formwork are not displaced or distorted during placing and consolidation of concrete.

The temperature of concrete shall not exceed 40 deg Centigrade measured at discharge into the works. However, for temperature controlled concrete (for heavy rotating equipments etc) the temperature at discharge point of concrete shall not exceed 28 degree Centigrade or as per the instruction of the Engineer-in-Charge.

The maximum allowable temperature differential between any two points in the same element is 15 degree Centigrade. Additional temperature control measures during construction (such as use of insulated formwork) shall be required. Contractor shall prepare a process control chart and method statement verifying measures to achieve these requirements.

The temperature monitoring of concrete work is required where:

- a) the minimum dimension of any casting is 0.8m or more, or
- b) where otherwise instructed by the Engineer-in-Charge

The rate of placement of concrete shall be such that no cold joint is formed and fresh concrete is placed always against green concrete

which is still plastic and workable. No concrete shall be placed in open, during rains. During rainy season, no placement in the open is to be attempted unless sufficient tarpaulins or other similar protective arrangement for completely covering the still green concrete from rain is kept at the site of placement. If there has been any sign of washing of cement and sand, the entire affected concrete shall be removed immediately. Suitable precautions shall be taken in advance to guard against rains before leaving the fresh concrete unattended. No accumulation of water shall be permitted on or around freshly laid concrete.

The size of the concrete pours must be carefully considered prior to commencement to ensure the structural elements are poured in on continuous shift to avoid cold joints.

Slabs, beams and similar members shall be poured in one operation, unless otherwise instructed by the Engineer-in-Charge. Moulding, throating, drip course, etc., shall be poured as shown on the drawings or as directed by the Engineer-in-Charge. Holes shall be provided and bolts, sleeves, anchors, fastenings or other fixtures shall be embedded in concrete as shown on the drawings or as directed by the Engineer-in-Charge. Any deviation therefrom shall be set right by the Contractor at his own expense as instructed by the Engineer-in-Charge.

In case the forms or supports get displaced during or immediately after the placement and bring the concrete surface out of alignment beyond tolerance limits, the Engineer-in-Charge may direct to remove the portion and reconstruct or repair the same at the Contractor's expense.

The Engineer-in-Charge shall decide upon the time interval between two placements of concrete of different ages coming in contact with each other, taking in consideration the degree of maturity of the older concrete, shrinkage, heat dissipation and the ability of the older concrete to withstand the load imposed upon it by the fresh placement.

Once the concrete is deposited, consolidated and finished in its final position, it shall not be distributed.

3.13.00 Construction Joints and Cold Joints

3.13.01 Construction Joints

It is always desirable to complete any concrete structure by continuous pouring in one operation. However, due to practical limitation of methods and equipment and certain design considerations, construction joints are formed by discontinuing concrete at certain predetermined stages. These joints will be formed in a manner specified in the drawings/Instruction. Vertical construction joints will be made with rigid stop-board forms having slots for allowing passage of reinforcement rods and any other embedments and fixtures that may

be shown. Next stage concrete shall be placed against construction joint as per clause 3.12. For water retaining structures and leak-proof buildings suitable approved water bars will be installed at the construction joints as specified in schedule of quantities.

Where the locations of the joints are not specified, it will be in accordance with the following:

- a) In a column, the joint shall be formed 75 mm below the lowest soffit of the beam framing into it.
- b) Concrete in a beam shall preferably be placed without a joint, but if provision of a joint is unavoidable, the joint shall be vertical and within the middle third of the span.
- c) A joint in a suspended floor slab shall be vertical and within the middle third of the span and at right angles to the principal reinforcement.
- d) Feather-edges in concrete shall be avoided while forming a joint.
- e) A construction joint should preferably be placed in a low-stress zone and at right angles to the direction of the principal stress.
- f) In case the Contractor proposes to have a construction joint anywhere to facilitate his work, the proposal should be submitted well in advance to the Engineer-in-Charge for study and approval without which no construction joint will be allowed.

3.13.02 Cold Joint

An advancing face of a concrete pour, which could not be covered by fresh concrete before expiry of initial setting time (due to an unscheduled stoppage or delay on account of breakdown in plant, inclement weather, low rate of placement or any other reason), is called a cold joint. The Contractor should always remain vigilant to avoid cold joints.

If, however, a cold joint is formed due to unavoidable reasons, the following procedure shall be adopted for treating it:

- a) If the concrete is so green that it can be removed manually and if vibrators can penetrate the surface without much effort, fresh concrete can be placed directly against the old surface. The old concrete should be covered by fresh concrete as quickly as possible and the joint thoroughly and systematically vibrated.
- b) In case concrete has hardened a bit more than (a) but can still be easily removed by a light hand pick, the surface will be raked thoroughly and the loose concrete removed completely without

disturbing the rest of the concrete in depth. A rich mortar layer 12 mm in thickness will be placed on the cold joint, fresh concrete shall be placed on the mortar layer and the joint will be thoroughly and systematically vibrated penetrating the vibrator deep into the old layer of concrete.

- c) In case the concrete at the joint has become so stiff that it cannot be remoulded and mortar or slurry does not rise inspite of extensive vibration, the joint will be left to harden for at least 12 - 24 hrs. It will then be treated as a regular construction joint, after cutting the concrete to required shape and preparing the surface as described under clause 3.12.

3.14.00 Repairs, Finishes and Treatment of Concrete surfaces

- 3.14.01 Adequate and sound concrete surfaces, whether formed or unformed, can be obtained by employing a concrete mix of proper design, competent formwork, appropriate methods of handling, placing and consolidation by experienced workmen.

Unsound concrete resulting from improper mix design, incompetent methods, equipment and formwork, poor workmanship and protection will not be accepted and will have to be dismantled, removed and replaced by sound concrete at the Contractor's cost. The Engineer-in-Charge may, at his sole discretion, allow to retain concrete with minor defects provided the Contractor is able to repair it by approved methods at no extra cost to the Owner. All concrete work shall be inspected by the Contractor immediately after the forms are removed and he will promptly report occurrence of any defects to the Engineer-in-Charge. All repair works will be carried out as per the instructions and in the presence of the Engineer-in-Charge or his representative. Generally, repair work will consist of any or all of the following operations:

- a) Sack rubbing with mortar and stoning with carborundum stone.
- b) Cutting away the defective concrete to the required depth and shape.
- c) Cleaning of reinforcement and embedments. It may be necessary to provide an anticorrosive coating on the enforcement.
- d) Roughening by sand blasting or chipping.
- e) Installing additional reinforcement/welded mesh fabric.
- f) Dry packing with stiff mortar.
- g) Plastering, guniting, shotcreting etc.

- h) Placing and compacting concrete in the void left by cutting out defective concrete.
- i) Grouting with cement sand slurry of 1:1 mix.
- j) Repairing with a suitable mortar either cement or resin modified mortar.
- k) Polymer modified patching and adhesive repair mortar for beams & columns.

3.14.02 **Finishing Unformed Surface**

The Contractor is to include in his quoted rate for concrete, the provision of normal finishes in unformed surfaces which can be achieved by screeding, floating, trowelling etc., as and where required by the Engineer-in-Charge without any extra cost to the Owner. A few typical and common cases of treatment of concrete surface are cited below:

a) **Floor**

Whenever a non-integral floor finish is indicated, the surface of reinforcement concrete slab shall be struck off at the specified levels and slopes and shall be finished with a wooden float fairly smooth removing all laitance. No overtrowelling, to obtain a very smooth surface, shall be done as it will prevent adequate bond with the subsequent finish. If desired by the Engineer-in-Charge, the surface shall be scored and marked without any extra cost to the Owner to provide better bond.

Where monolithic finish is specified or required, concrete shall be compacted and struck off at the specified levels and slopes with a screed, preferably a vibrating type and then floated with a wooden float. Steel trowelling by hand or by rotary power float is then started after the moisture film and shine have disappeared from the surface and after the concrete has hardened enough to prevent excess of fines and water to rise to the surface but not hard enough to prevent proper finishing of aberrations. Steel trowelling properly done will flatten and smoothen sandy surface left by wooden floats and produce a dense surface free from blemishes, ripples and trowel marks. A fine textured surface that is not slick and can be used where there is likelihood of spillage of oil or water can be obtained by trowelling the surface lightly with a circular motion after initial trowelling keeping the steel trowel flat on the surface.

To provide a better grip the Engineer-in-Charge may instruct marking the floor in a regular geometric pattern after initial trowelling.

b) Beams, Columns & Walls

If on such or any other concrete structure it is intended to apply plaster or such concrete surfaces against which brickwork or other allied works are to be built, the Contractor shall hack the surface adequately as soon as the form is stripped off so that proper bond can develop. Pattern, adequacy and details of such hacking shall meet with the approval of the Engineer-in-Charge, who shall be informed to inspect such surfaces before they are covered up.

3.15.00 Protection and Curing of concrete

Newly placed concrete shall be protected by approved means from rain, sun and wind. Concrete placed below the ground level shall be protected against contamination from falling earth during and after placing. Concrete placed in ground containing deleterious substances, shall be protected from contact with such ground, or with water draining from such ground, during placing of concrete and for a period of at least three days or as otherwise instructed by the Engineer-in-Charge. The ground water around newly poured concrete shall be kept to an approved level by pumping out or other adequate means of drainage to prevent floatation or flooding. Steps, as approved by the Engineer-in-Charge, shall be taken to protect immature concrete from damage by debris, excessive loadings, vibration, abrasion, mixing with earth or other deleterious materials, etc. that may impair the strength and durability of the concrete.

As soon as the concrete has hardened sufficiently, it shall be covered either with sand, polythene sheet, hessian, canvas or similar materials & kept continuously wet for at least 14 (fourteen) days after final setting. Curing by continuous sprinkling of water will be allowed if the Engineer-in-Charge is satisfied with the adequacy of the arrangements made by the Contractor.

If permitted by the Engineer-in-Charge, curing compound like "ANTISOLE (WP)" or approved equivalent may be used for prevention of premature water loss in concrete and thereby effecting curing of concrete. This type of curing compound shall be sprayed on newly laid concrete surfaces to form thin film barrier against premature water loss without disturbances to normal setting action. The curing compound shall comply with ASTM requirements for acceptance.

The curing compound shall be applied following the final finishing operation and immediately after disappearance of water sheen from

concrete surface. It is important not to apply the curing compound when standing water is still present on concrete.

The contractor shall arrange for the manufacturer's supervision at no extra cost to the owner.

The Contractor shall remain extremely vigilant and employ proper equipment and workmen under able supervision for curing. The Engineer-in-Charge's decision regarding the adequacy of curing is final. In case any lapse on the part of the Contractor is noticed by the Engineer-in-Charge, he will inform the Contractor or his supervisor verbally or in writing to correct the deficiency in curing. If no satisfactory action is taken by the Contractor within 3 (three) hours of issuance of such instruction, the Engineer-in-Charge will be at liberty either to employ sufficient means through any agency to make good the deficiency and recover the cost thereof from the Contractor, or pay for the part where adequate curing was not noticed at a reduced rate, entirely at the discretion of the Engineer-in-Charge.

3.16.00 Deleted

3.17.00 **Cold Weather Concreting**

When conditions are such that any operation of concreting may be expected to be done at 5 Deg.C atmospheric temperature or below the work shall conform to the requirement of Clause 14 of IS: 456 and IS: 7861(Part II).

3.18.00 **Hot Weather Concreting**

When depositing concrete in very hot weather, the Contractor shall take all precautions as per IS:7861 (Part-I) and stagger the work to the cooler parts of the day to ensure that the temperature of wet concrete used in structures does not exceed 28 Deg.C while placing. Positive temperature control by precooling, postcooling or any other method, if required, will be specified and paid for separately.

3.19.00 **Concreting under water**

When it is necessary to deposit concrete under water it shall be done in accordance with the requirements of clause 14.2 of IS: 456.

3.20.00 Deleted

3.21.00 **Opening, Chases, Grooves, Rebates, Blockouts etc.**

The Contractor shall leave all openings, grooves, chases, etc. in concrete work as shown on the drawings or as specified by the Engineer-in-Charge.

3.22.00 Anchor Bolts, Anchors, Sleeves, Inserts, Hangers, Conduits, Pipes and other Miscellaneous Embedded Fixtures

The Contractor shall build into concrete work all the items noted below and shall embed them partly or fully as directed and secure the same as may be required. The materials, if required to be supplied by the Contractor, shall be as specified and be of best quality available according to relevant Indian Standards of approved manufacture and to the satisfaction of the Engineer-in-Charge. Exposed surfaces of embedded materials are to be painted with one coat of approved anti-corrosive paint and/or bituminous paint without any extra cost to the Owner. If welding is to be done subsequently on the exposed surface of embedded material the paint shall be cleaned off the member to a minimum length of 50 mm beyond each side of the weld line.

Necessary templates, jigs, fixtures, supports etc. shall be used as may be required or directed by the Engineer-in-Charge, free of cost to the Owner.

Items to be embedded

- a) Inserts, hangers, anchors, frames around openings, manhole covers, frames, floor clips, sleeves conduits and pipes.
- b) Anchor bolts and plates for machinery, equipment and for structural steel work.
- c) Steel structures to be left embedded for future extension, special connection etc.
- d) Lugs or plugs for door and window frames occurring in concrete work.
- e) Flashing and jointing in concrete work.
- f) Any misc. embedments and fixture as may be required.

Correct location and alignment, as per drawings/instruction of all these embedded items shall be entirely the responsibility of the Contractor.

3.23.00 Deleted

3.24.00 Grouting under Machinery or Structural Steel Bases

If required, grouting under base plates of machines or structural steel etc. shall be carried out by the Contractor. In general, the mix shall be 1 (one) part cement and 1 (one) part sand and just enough water to make it flow as required. The areas to be grouted shall be cleaned thoroughly with compressed air jet and/or with water in locations where accumulated surplus water can be removed. Where directed by the Engineer-in-Charge, 12 mm down stone chips may have to be used in the mix. Surface to be grouted shall be kept moist for at least 24 hours in advance. The grout shall be placed under expert supervision, so that there is no locked up air. Edges shall be finished properly. Finished grout shall be cured to ensure proper strength. If desired by the Engineer-in-Charge, admixtures like Aluminium powder, 'Ironite' etc. may have to be added with the grout in proportions to be decided by the Engineer-in-Charge. Admixture, if directed to be added, without any extra cost to the owner.

Alternatively, non-shrink, free flow, cementitious grout like "Conbextra GP2, or approved equivalent specifically selected for the type of equipment to be located (vibrating, static etc.) may also be used for grouting as per manufacturer's specification with necessary approval of the Engineer-in-Charge.

3.25.00 Concrete for Special Work

3.25.01 Precast Concrete

The Specification for precast concrete will be similar as for the cast-in-place concrete described herein and as supplemented in this section. All precast work shall be carried out in a yard made for the purpose.

This yard shall be dry, properly leveled and having a hard and even as well as well drained surface to prevent excessive uneven settlement due to softening of soil during casting & curing. If the ground is to be used as a soffit former of the units, it shall be paved with concrete or masonry and provided with a layer of plaster (1:2 proportions) with smooth neat cement finish or a layer of M.S. sheeting. Where directed by the Engineer-in-Charge, casting will have to be done on suitable vibrating table. The yard, lifting equipment, curing tank, finished material storage space etc. shall be designed such that the units are not lifted from the mould before 10 (Ten) days of curing and can be removed for erection after 28 (twenty eight) days of curing. The moulds shall preferably be of steel or of timber lined with G.I. sheet metal and must be rigid enough to prevent distortion during placing and compaction of the concrete.

Other than normal curing by applying water through spray nozzles or perforated hose curing by high pressure steam, steam vapour or other accepted processes may also be employed to accelerate the hardening of the concrete and to reduce the curing time.

Lifting hooks, where necessary or as directed by the Engineer-in-Charge, shall be embedded in correct position of the units to facilitate erection, even though they may not be shown on the drawings, and shall be burnt off and finished after erection.

All members shall be indelibly marked with a unique identification mark on a surface which will not be permanently exposed to show on which production line they were manufactured, their type, the class of concrete, the data of casting and if they are of a symmetrical section the face which will be uppermost when the member is in its correct position after erection.

Precast concrete units, when ready, shall be transported to site by suitable means approved by the Engineer-in-Charge. Care shall be taken to ensure that no damage occurs during transportation. All adjustments, leveling and plumbing shall be done as per instructions of the Engineer-in-Charge. The Contractor shall render all help with instruments, materials and men to the Engineer-in-Charge for checking the proper erection of the precast units.

After erection and alignment, the joints shall be filled with grout or concrete as directed by the Engineer-in-Charge. If centering have to be used for supporting the precast units, they shall not be removed until the joints have attained sufficient strength and in no case before 14 (fourteen) days. The joint between precast roof planks shall be pointed with 1:2 cement : sand mortar where called for in the drawings.

3.25.02 Construction by Slip/Jump/Climb form Method

Slip/Jump/Climb form method of construction when considered by the contractor, type of process proposed for formwork should be submitted along with sketches, drawings and construction methods statement as explained hereinafter. Number, type and capacities of jacks, the control system and achievable rate of progress (in case of slip form) in mm/hour should also be indicated. The chosen scheme shall be of a past proven design. A certified performance record of the scheme should be submitted with the offer to guarantee workability of the scheme both from execution time and safety point of view.

The contractor should furnish a brief but comprehensive report indicating the planning and method of work to be followed. This report shall include the following items:

Type and description of (Slip/Jump/Climb) form work proposed along with Equipment and its accessories.

- i) Design of scaffolding and staging.

- ii) Description of materials including admixtures to be used for construction.
- iii) Manpower planning, construction spaces required and stand by arrangement.
- iv) Temporary Lightning arrestor arrangement.
- v) Rate of Slip-forming/average rate of Jumps/Climbs per week.
- vi) Proposed workability requirement of concrete and type of cement & admixture to be used.
- vii) Quality and safety assurance programme.
- viii) Method of Transportation of material
- ix) Planned interruption, if proposed and activities during planned interruption.
- x) Treatment of construction joints.
- xi) Contingency solution for unplanned interruptions.
- xii) Time of completion.

Notwithstanding what have been specified in earlier clauses, following guidelines are being presented which should be kept in view by contractor for Slip/Jump/Climb form method of construction:

1. Care to be taken to prevent dragging of concrete alongwith upward movement or removal of the shuttering. For this purpose following steps are advisable:
 - a) Shutter plates have to be smooth and should be thoroughly clean.
 - b) In areas where concrete thickness is 750 mm or more rate of pouring should be such that the minimum slipping rate of slip form is 100 mm per hour.
 - c) Mix design should be so done that it will be self-lubricant at the contact face of shutter and concrete and thus reduce friction. Suitable cement of approved manufacturer (conforming to relevant I.S. Specification) may be used for the purpose. An optimum ratio of coarse/fine aggregate should be established to suit the purpose depending on the type of aggregates used.

- d) Mix design also should be so done that it has as lump of minimum 50 mm at the point where concrete is placed under the ambient temperature conditions. This will also keep the required vibration by needle vibrators to minimum. Slump should not drop down to zero in less than 45 minutes. Suitable retarding agent and plasticizer of approved manufacture may be added in the mix to achieve this purpose. These admixtures to be properly identified by preliminary tests both for performance and for compatibility with particular type of cement and aggregates proposed to be used. The admixtures shall be used strictly as per the manufacturer's Specification.

Additional steps like spraying of water over the shutters and keeping down the temperature of coarse aggregates by continuous spraying of water over those may be resorted to if ambient temperature is higher than 40 Deg.C.

- 2. Care must be taken to prevent twist, which predominantly occurs in the initial stages because of low slipping rate, in the horizontal plane of Slip-form assembly. A thorough check on this aspect must be kept at every 15 minutes interval. One person should exclusively be assigned this work together with rectifying any defect.
- 3. Every endeavor has to be made to eliminate any tilt in the shutter assembly. To achieve this following steps need be taken:
 - a) Performance of jacks has to be closely observed and any defective one needs immediate replacement. Difference in levels of opposite jacks at any in start of time should not exceed 5 mm.
 - b) Loading on Slip-form truss/yokes or A-Frame and hoist has to be fairly equal.
 - c) Sleeves, through which the jacking rod passes for slip form shuttering, has to be of sufficient length so that the latter gets a uniform clearance and does not get any chance to tilt. Sleeves should have a minimum wall thickness of 3.25 mm and should be such that jacking rod gets a maximum clearance of 1 mm to 1.5 mm around.
- 4. In designing the mix following aspects should be borne in mind:
 - a) Cement used should have an initial setting time of not less than 50 minutes and preferably should have a specific surface around 3700 Sq.Cm./gramme.

- b) Coarse and fine aggregates should be well graded and rounded aggregates offer better performance in Slip-form technique. These help to keep down water/cement ratio and also offer better lubrication between concrete and shutter surface. 40 mm down size of coarse aggregates should preferably be used unless reinforcement detailing calls for lesser size aggregates.
 - c) From the point of view of creep, shrinkage as well as initial setting property of concrete, cement content should not preferably be more than 400 Kg. per Cu.M of concrete.
 - d) Minimum compressive strength (after 4 to 6 hours of mixing) of concrete immediately below the shutter as slip form proceeds should not be less than 0.1 MPa.
 - e) It is advisable to use cement from a single source during the entire operation of shell casting using slip form techniques since once the operation starts, there might not be any time left for conducting further trial for design mixes if the source of procurement of cement changes.
5. Large dia meter vibrator needles should not be used for vibrating concrete. Sizes of these needles should preferably be restricted to 25 mm diameter. 40mm diameter may be used only in exceptional cases. Sufficient numbers (atleast two) of standby vibrant to run its should always be maintained on top of working deck at all times during the entire period of shell casting operation.
6. Proper arrangement has to be made for adequate supply of curing water for continuous spraying on both inside and outside surfaces with spraying equipment. Necessary length of pipelines and pumps of adequate capacity and head to serve the purpose shall be made available with Stand-by arrangements.
- Membrane curing compounds may be allowed on fresh surfaces emerging out of shutter panels for curing. The applied compound has to be removed suitably before further surface treatment. If curing compound is to be used then the compound to be applied should be such that it may be removed easily without leaving any stain on the concrete surfaces.
7. Exact number and capacity of jacks as well as spacing of yoke frames are to be determined taking into account various loadings including self weight of the system, dead and live loads on working and other platforms, horizontal load on form work, wind load etc.

It is desirable that the jacking system, based on which the slip/climbing form system works, should consist of jacks 3Tonne to 6Tonne capacity and hydraulic pump with necessary pipe connections.

Spacing of yoke legs should preferably be kept within 2 metres to prevent over loading on jacks and consequent failure resulting in twist of the formwork.

Jacking rods should be of 25 mm diameter for 3Tonne Jacks and 32 mm diameter for 6TonneJacks.

8. At least 30% spare jacks and jacking rods should be kept ready during the entire operation. It is obligatory to maintain spare hydraulic pump alongwith a set of loose pipes in perfect working condition on top of working deck.
9. In sections where thickness is 500 mm or more it is prudent to go in for two nos.of jacks for each slip form yoke.
10. For effective utility of this technique following areas need careful attentions at the very conceptual stage:
 - a) Detailed quality assurance programme.
 - b) Advance Planning and preparations.
 - c) Arrangement for on-site supervision and adequate access facilities.
11. Construction methods including description and types of different equipment proposed to be used, structural arrangement and analysis of the system, description and type of different materials, planned interruptions, description and frequency of various checks and tests for Slip form/climbing technique as well as for material, method of preparing, transporting and pouring of concrete, solution for probable defects during slipping, sequence of operations during planned interruptions etc. should be prepared beforehand by executing agency and to be approved by Engineer-in-Charge before starting the actual work.
12. Placing and binding of reinforcement is also a very critical item and needs special attention. From practical considerations not more than two or three layers of horizontal steel can be tied at a time and this causes a definite limitation in placement of reinforcement.

Vertical reinforcements should be kept vertical by providing suitable holders within the formwork system.

13. For Slip form process, in particular, it is desirable to have a planned break of at least one day for every two weeks of continuous operation. Such break should be utilized for various maintenance activities, removal of jack rods etc.
14. Numbers and locations of hoists for lifting concrete, reinforcement and other materials have to be planned well in advance. Capacity of hoists should be such as to match with hourly requirement of concrete and reinforcement. If felt necessary one hoist may be exclusively earmarked for transporting concrete. For movement of personnel supervising the work a separate hoist must be arranged for.
15. If concrete is to be placed using concrete pumps then the complete operation such as mix design, transportation and placing of concrete, availability of sufficient equipment such as truck mixers, concrete pumps, placer booms etc. should be well planned and ensured before the concreting activities commence.
16. The slip form system being operative round the clock it is obligatory to have adequate lighting arrangement both on various platform levels as well as on ground below. Arrangement has to be made for facilitating continuous upward movement of the entire system alongwith slip form.
17. The vertical alignment must be checked constantly using laser equipment. Further manual checks should be performed using plumb bobs, the oddities or other means.
18. In case of interruption in the course of slipping of formwork following measures should be taken:
 - a) Provision of a key and additional reinforcement at the junction of new and old concrete.
 - b) Form work system should be brought up freely to have a minimum overlap of 100 mm or so over previously cast concrete.
 - c) Washing of old concrete surface with compressed air and water jet and there after pouring a layer of neat cement grout.

- d) Clearing of shuttering panels of loose materials, concrete etc. by compressed air and applying a coat of epoxy paint, if felt necessary by Engineer-in-Charge.
 - e) Neatly finishing the interface of old and new concrete as soon as it comes out of shutter panel.
19. It is preferable to suspend the construction work under highwind condition and high lightning frequency.
20. It is of utmost importance that for effective implementation of this system an Engineer-in-Charge fully conversant with Slip/Jump/Climb form technique with enough experience in planning and control of form work should be in overall command of the site and he should be ably supported by well-trained mid-level supervisory staff, skilled workers and operators.
21. Operation of slip/Jump/Climb form method of construction is practically a continuous/continual operation and demands continuous and intermittent in section of accuracies in line, level, dimensions and position and immediate rectification of any noticed deviation. All these ask for personnel of high quality having constant vigilance over the construction activity.
22. While all the activities in effective implementation of the work needs utmost care keeping safety of men and material in mind it is obligatory that all activities should be carried out under the guidance of a qualified and trained safety Engineer-in-Charge.

Safety measures as listed below must be adhered to but should not be limited to only these:

- a) Safety helmets and belts to be provided to a supervising staff and workers.
- b) Safety nets to be provided below both inside and outside platforms as instructed by Engineer-in-Charge.
- c) Hand railing & toe guard to be provided around all openings & platforms.
- d) Regular maintenance of equipment, checking of hoists, scaffoldings etc.
- e) Passenger hoist must have multiple ropes.
- f) Emergency lights, coloured lamps to be provided in accordance with relevant Indian Standards and as supplemented in the Specification and to be operative in

case of sudden power failure Emergency standby generator must be kept ready during the entire period of slip form method of construction.

- g) Emergency vehicles, first aid facilities must be kept ready during the entire period of work.

23. Permissible construction tolerances should be limited to the following: Variation in wall thickness:(-) 5mm,(+) 25mm

Variation from Design Diameter : (+_)12.5 mm per 3 m dia .but in no case more than (+_) 75 mm.

Out of Plumb in General:1 in 1000 of height subject to a maximum of 200 mm.

3.26.00 **Waterproofing of Concrete Structure**

3.26.01 **General**

Waterproofing of concrete structures shall be done by either suitable extraneous treatments like applying waterproofing paints like “Sikatop Seal” or approved equivalent, fixing bitumen felts etc. or internally by suitable design of the concrete mix, addition of suitable admixtures conforming to IS: 2645 and equivalent American or British codes in the concrete or mortar at the time of mixing and/or installing water bars at the joints.

The design, material and workmanship shall conform to the relevant I.S. Codes where applicable. The Engineer-in-Charge’s approval of the materials shall be obtained by the Contractor before procurement. If desired by the Engineer-in-Charge, test certificates for the materials and samples shall be submitted by the Contractor free of charge. The materials shall be of best quality available indigenously, fresh clean and suitable for the duties called upon.

3.26.02 **Water Bar/Seal/Special Treatment of Construction Joint**

Water bearing structures and underground structures may have water bar/seals installed at the joints. They may be rubber or P.V.C. The materials and installation will be as described under Clause 3.23.3. Construction joint should be provided as per clause 3.13.1 with or without water bar / Seal as shown on the drawing. In case of water bars being used at the construction Joint, fixing of the same has to be done carefully so that the water bar is not disturbed during concreting. The construction joint shall also be treated by any one of the following methods:

Method 1: A surface retarder in the form of a thixotropic gel shall be applied on the joint surface of the previous pour in case of joint on the

wall and in case of floor the same shall be applied on the formwork against which previous pour of concreting shall be done. The retarder may be liquid or paste form depending on the type of formwork. The formwork shall be removed within 24 hours after concreting. Within 2 hours of striking of the formwork the retarder shall be washed off with strong water jet to make surface rough and clean. Then a rich cement mortar using cement, sand and aggregates (maximum size 8 mm) along with synthetic rubber emulsion type water resistant bonding agent shall be applied for a depth of 50 mm just before pouring the next stage of concreting in case of walls. The above bonding agent will be mixed with water which will be used for making the cement mortar. The proportion of mixing of this bonding agent with water shall be as per manufacturer's specification. In case of floor joint, however, after washing of retarder a solvent free two component epoxy resin bonding agent will be used at the joint before the next pour of concrete. The above bonding agent shall have the following properties after 28 days:

Compressive strength	- 55 to 60 N / Sq. mm
Flexural Strength	- 25 to 30 N / Sq. mm
Tensile strength	- 15 N / Sq. mm (approx)
Bonding strength to concrete	- 3 N / Sq. mm (approx)
Bonding strength to steel	- 20 N / Sq. mm (approx)

The whole operation shall be done as per manufacturer's specification. The contractor shall provide manufacturer's supervision at no extra cost to owner.

Method 2 : One row of threaded nozzles at regular intervals not exceeding 1.5 m centre to centre shall be placed in concrete along the construction joint during casting. Injection of cement water together with a suitable waterproof expanding grouting admixture of approved quality shall be done through the nozzles after the construction joint in walls and slabs. The injection shall be done under pressure of approximately 2 to 4 Kg/Sq cm. The nozzles shall be sealed off with suitable admixture after the injection is over. The whole operation shall be carried out as per manufacturer's specification and supervision. The cost of such manufacturer's supervision shall be borne by the contractor.

3.26.03 **Waterproofing Admixtures**

The waterproofing admixture for concrete and cement mortar / plaster shall conform to relevant IS code. The admixture shall not cause decrease of strength of concrete / plaster at any stage and it is free from chlorides and sulphates. The admixture shall not affect the setting time by more than 5 %.

The maximum permissible dosage of admixture will be 3 % (three percent) by weight of cement but a lower dosage will always be preferred.

The product shall be stored in strong moisture proof packings.

However, in case of important structures where M25 or higher grade concrete is specified, the use of melamine based, high range water resistant concrete admixture shall be used as per manufacturer's specification to provide a waterproof concrete.

a) In concrete : The approved admixture shall be based on modified lignosulphonate like "Plastocrete – N/Super" or approved equivalent. The method of application and other details shall conform to the manufacturer's specification and/or as instructed by the Engineer-in-Charge. The Contractor shall have the services of the manufacturer's supervisor at no extra cost to the Owner to supervise the work, if desired by the Engineer-in-Charge.

b) In Plaster : The concrete surface, to be plastered, shall be hacked to Engineer-in-Charge's satisfaction, cleaned thoroughly and kept wetted for 24 hours. The plaster shall be in cement sand mortar mixed in proportion varying from 1:1 to 1:4 by volume along with the approved waterproofing admixture like "No leek CP/ Sika Latex" or approved equivalent and laid in appropriate thickness and in layers not exceeding 15 mm/layer or as per manufacturer's specification. The additive shall be of quality and type approved by Engineer-in-Charge. If desired by the Engineer-in-Charge, the Contractor shall have the work supervised by the manufacturer's supervisor at no extra cost to the Owner. On completion, the plastered surface shall be cured continuously for a minimum period of 14 days like concrete.

3.26.04 Bituminous or Tar Coating on External Surface

The surface to be waterproofed shall be rendered absolutely dry, clean and dust free. The surface shall be sand papered, cleaned and completely coated with hot coal tar pitch of approved manufacturer and quality as per IS: 216 (not heated above 375 Deg.F) using not less than 0.2 Kg. per Sq.M. or with hot asphalt i.e., bitumen according to IS:73 (not heated above 400 Deg.F) using not less than 0.15 kg. per Sq.M. When the first coat has completely dried up and approved by the Engineer-in-Charge, the second coat shall be applied in the same

manner using not less than 0.125 Kg. per Sq.M. in case of coal tar and 0.1 Kg. per Sq.M. in case of asphalt. Immediately after application of the second coat and before it is dried up, sand shall be spread on the surface to cover it completely. Sufficient time shall be allowed after spreading of sand before backfilling is done in order to allow the final coat to dry up completely. In place of hot application by coal tar / asphalt the coating of the outside surfaces of walls may be carried out using a ready to use liquid, bituminous emulsion/ rubber protective coating of approved manufacturer.

3.26.05 Protective Coating on Inside Surface

Two coats of cement based two-components polymer modified flexible protective and waterproofing slurry having 1 mm thickness for each coat shall be applied on the walls/ floor after proper surface preparation as per manufacturer's specification. The slurry shall be applied by brush.

3.26.06 Bitumen Felt : Application for Tanking

This specification shall cover laying the waterproof course on the outside and inside of the walls and bases of structures.

The materials shall conform to IS: 1322, and the workmanship to IS: 1609. The bitumen felt shall be hessian base and/or fibre base as specified in Drawing/Schedule of Items. If required by the Engineer-in-Charge, tests as specified in relevant IS Codes shall be arranged by the Contractor without charging any extra to the Owner.

The Contractor shall execute this work in direct collaboration with one of the well-known specialised firm approved by the Engineer-in-Charge.

Cleaning the surface, keeping it dry, providing necessary corner fillets and cement rendering and cutting chases, etc. shall be included in the rate for this item. If any protective brickwork on/against concrete sub-bases or walls is required, these will be paid extra under suitable items in the contract. A 10 (ten) years' guarantee for satisfactory performances shall be given by the Contractor as well as his specialist sub-contractor jointly and severally, for this item of work. Free rectification of any defects noted in the work within this guarantee period will be carried out by the Contractor even if it is beyond the specified maintenance period of the contract as a whole.

3.26.07 Polyethylene Films : Application in Walls or Base of Structures

Waterproof treatment shall be applied as outlined and as per sequence given hereunder:

- i) the concrete surface shall be made smooth with 12 mm cement plaster 1:6

- ii) apply hot bitumen 80/100 grade (IS:73-1961) @ of 1.0 Kg/Sq.m minimum
- iii) lay black polyethylene film 250 micron (IS:2508-1977) with cut back bitumen adhesive in overlaps over hot bitumen surface, gently pressed, taking care not to puncture the film.

Alternatively, the overlaps shall be heat sealed by an electric iron having three parallel sealing bars. A long piece of plywood is to be placed below the polyethylene film to be heat sealed. On the plywood a rubber gasket is to be laid to provide a cushion for better welding of the film. On the rubber padding, a cellophane tape is to be spread and on this the LDPE film, with 100 mm overlap, is to be stretched. On the overlapped film another cellophane tape is to be placed to prevent the heat sealer from sticking to the LDPE film. After this, the electric iron is to be pressed on the overlap joint for sufficient time so as to allow perfect welding. The operation is to be repeated for subsequent lengths of joints. After heat sealing, the cellophane tape is to be removed and the joints are to be tested for leaks.

- iv) Lay 100 gm brown craft paper laminated with a layer of straight run bitumen
- v) Lay hot bitumen 80/100 grade (IS:73-1961) at 1.0 Kg/Sq.m minimum.
- vi) Lay 250 micron polyethylene film as second layer similar to (iii) above.
- vii) Lay second layer of 100 gm. Brown craft paper laminated as (iv) above.
- viii) Apply hot bitumen (straight run grade) to IS:73-1961 at 1.0 Kg/Sq.m dusted with fine sand.
- ix) Protecting with a layer of 75 mm plain cement concrete M10 or a layer of brick laid in cement mortar 1:6. In case of wall apply a 12 mm thick plaster as shown on the drawing or a protective brick wall in 1:6 cement mortar as shown on the drawing.

3.27.00 **Protective coating on Concrete Surface**

3.27.01 **On Foundation**

The outside faces of foundation of important structures will be protected from adverse effect of soil/ underground water, if shown on drawing or instructed by the Engineer-in-Charge, by using rubber / bitumen emulsion protective coating of approved manufacturer.

3.28.00 **Waterproofing by Pressure / Chemical Grouting**

Where required, waterproofing for underground concrete structure shall be done by injecting high polymer based non- shrink waterproof grouting compound or expanding epoxy grouting or as specified through nozzle under pressure as per manufacturer's recommendation. The pressure during injection shall not be less than 2.5 kg/Sq.m and the thickness of epoxy resinous emulsion waterproof paint (to be applied on the external surface of walls/ slabs) shall not be less than 700 microns.

3.29.00 Polyester / Polypropelene Fibres

Polyester / Polypropelene fibres may be used in concrete work to reduce shrinkage crack and reduce water permeability. The details and dosage of the fibres shall be as per manufacturer's specification. Minimum 125 grams of fibre shall be used per 50 kg of cement. The properties of fibres shall be as follows :

- a) Material :- Modified Polyester
- b) Specific Gravity :- 1.34 to 1.40
- c) Length :- 12 mm
- d) Dia :- 10 to 40 Micron (Effective Dia)
- e) Melting Point :- 240 - 260 Degree C

4.00.00 SAMPLING AND TESTING

4.01.00 General

The Contractor shall carry out all sampling and testing in accordance with the relevant Indian Standards and as supplemented herein for the following items at his own cost unless otherwise specified in this specification. The Contractor shall get the specimens tested in a laboratory approved by the Engineer-in-Charge and submit to the Engineer-in-Charge the test results in triplicate within 3 (three) days after completion of the test.

4.02.00 Cement

Representative samples will be taken from each consignment of cement received from the manufacturer/supplier for carrying out the tests for fineness (by hand sieving), setting time and compressive strengths. Soundness Tests may also be required to be carried out if required by the Engineer-in-Charge. The tests shall be carried out free of charge by the contractor. In case the Contractor is directed to arrange for the supply of cement as per the terms and conditions of the Contract the tests shall be carried out by him without any expense to the owner. In case due to any circumstances, the agency of supply is changed in the middle of the Contract, the party who bore the original

contractual obligation will carry on with the test, free of charge to the other, till the end of the job. No cement from a particular consignment/batch will be used on the works unless satisfactory 3 (three) days and 7 (seven) days test results for compressive strength are known. The Owner, Engineer-in-Charge and Contractor will jointly associate themselves with the tests irrespective of whether they are carried out by the Owner or the Contractor. These tests are of great importance as their results will have a bearing on the acceptance of concrete or otherwise as per the terms and conditions of the Contract.

4.03.00 **Aggregates**

The Contractor shall carry out any or all the tests for aggregates as may be required by the Engineer-in-Charge in accordance with IS: 2386 PARTS-I to VIII. The acceptance criteria of the samples tested shall be in accordance with the requirements of the relevant Indian Standards.

4.04.00 **Water**

Sampling and Testing of water being used for concrete works as per IS: 3550 will be carried out by the Contractor at regular intervals and whenever directed by the Engineer-in-Charge. The final acceptance criteria in case of doubt will be as per IS: 3025 & IS: 456.

4.05.00 **Admixture**

4.05.01 **Air Entraining Agents (A.E.A)**

Initially, before starting to use A.E.A., relationship between the percentage of air entrained and the cube crushing strength vis-à-vis quantity of A.E.A. used for all types of concrete will be established by the Contractor free of charge by carrying out sufficiently large number of tests. Thereafter, the tests shall be carried out at regular intervals and whenever directed by the Engineer-in-Charge, the Contractor will check up free of charge, the actual percentages of air entrained and corresponding crushing strengths to correlate with the earlier test results.

4.05.02 **Other Admixtures**

Tests for establishing the various properties of any other admixtures which may be required to be added shall be carried out by the Contractor free of charge to the Owner.

4.06.00 **Concrete**

The sampling of concrete, making the test specimens, curing and testing procedure etc. shall be in accordance with IS: 516 and IS: 1199 the size of specimen being 15 cm cubes. Normally, only compression

tests shall be performed but under special circumstances the Engineer-in-Charge may require other tests to be performed in accordance with IS: 516.

Sampling procedure, frequency of sampling and test specimen shall conform to Clause 15 of IS: 456.

To control the consistency of concrete from every mixing plant, slump tests and/or compacting factor tests in accordance with IS: 1199 shall be carried out by the Contractor every two hours or as directed by the Engineer-in-Charge. Slumps corresponding to the test specimens shall be recorded for reference.

The acceptance criteria of concrete shall be in accordance with Clause 16 of IS: 456.

Concrete work found unsuitable for acceptance shall have to be dismantled and replacement is to be done as per specification by the Contractor without any extra cost to the owner. No payment for the dismantled concrete, the relevant formwork and reinforcement, embedded fixtures, etc. wasted in the dismantled portion shall be made. In the course of dismantling, if any damage is done to the embedded items or adjacent structures, the same shall be made good, free of charge by the Contractor, to the satisfaction of the Engineer-in-Charge.

5.00.00 ACCEPTANCE CRITERIA

5.01.00 Standard Deviation

Standard deviation shall be based on test results and determination of Standard deviation shall conform to clause 9.2.4 of IS: 456.

5.02.00 Acceptance Criteria

The strength requirements and acceptance criteria shall conform to Clause 16 of IS: 456.

5.03.00 Inspection and Core Tests

Inspection of concrete work immediately after stripping the formwork and Core Test, Non-destructive Tests of structures shall conform to Clause 17 of IS: 456.

5.04.00 Load Test

Load tests of structural members may be required by the Engineer-in-Charge, when the strength of test specimen results fall below the required strength, as per 'Load Tests for flexural members', Clause 17.6 of IS: 456. If load testing is decided by the Engineer-in-Charge, the member under consideration shall be subjected to a test load equal to full dead load of the structure plus 1.25 (one and a quarter) times the specified live load used for design and this load shall be maintained for a period of 24 (twenty four) hours before removal. The detailed procedure of the test is to be decided by the Engineer-in-Charge. Load tests shall not be made until the structure is at least 28 days old.

If the member shows evident failure, such changes as are necessary to make the structure adequately strong shall be made by the Contractor free of cost to the Owner. Alternatively, if permitted under Statutory Regulations and at the discretion of the Engineer-in-Charge, the structure under test or a portion thereof may be retained as such without any modification by derating its load bearing capacity, provided the design criteria allows such derating.

A reinforced concrete beam, floor or roof shall be deemed to have passed the test if the maximum deflection at the end of 24 hours does not exceed the deflection given in Clause 17.6 of IS: 456.

The entire cost of load testing shall be borne by the Contractor. If a portion of the structure is found to be unacceptable, it shall be dismantled and replaced by a new structure as per the specification. The entire cost of dismantling and replacement and restoration of the site shall be borne by the Contractor.

If, in the course of dismantling, any damage is done to the embedded items and or other adjacent structures, the same will be made good, free of charge by the Contractor to the satisfaction of the Engineer-in-Charge.

6.00.00 LIST OF IS CODES AND STANDARDS FOR REFERENCE

All work under this specification shall, unless specified otherwise, conform to the latest revisions and/or replacements of the following or any other Indian Standard Specifications and Codes of Practice. In case any particular aspect of work is not specifically covered by Indian Standard Specifications, any other standard practice, as may be specified by the Engineer-in-Charge, shall be followed:

IS: 73	-	Indian Standard Specification for Paving Bitumen
IS: 216	-	Indian Standard Specification for Coal Tar Pitch
IS: 383	-	Indian Standard Specification for Coarse and Fine Aggregates from Natural Sources for Concrete

IS: 432	-	Indian Standard Specification for Mild Steel and Medium Tensile Steel Bars and Hard Drawn Steel Wire for concrete Reinforcement - Part 1 & 2
IS: 455	-	Indian Standard Specification for Portland Slag Cement
IS: 456	-	Indian Standard Code of Practice for Plain and Reinforced Concrete
IS: 457	-	Indian Standard Code of Practice for General Construction of Plain and Reinforced Concrete for Dams and other Massive Structures
IS: 513	-	Indian Standard Code of Practice for Cold Reduced Low Carbon Steel Sheet and Strip
IS: 516	-	Indian Standard Specification for Methods of Test for Strength of Concrete
IS: 737	-	Indian Standard Specification for Wrought Aluminium and Aluminium Alloy sheet and strip for general Engineer-in-Chargeing purpose
IS: 1199	-	Indian Standard Specification for Methods of Sampling and Analysis of Concrete
IS: 1200 (Part-II)	-	Indian Standard Specification for Method of Measurement Cement Concrete Works
IS: 1200 (Part-V)	-	Indian Standard Specification for Method of Measurement of Formwork
IS: 1322	-	Indian Standard Specification for Bitumen Felts for Waterproofing and Damp-proofing
IS: 1489	-	Indian Standard Specification for Portland- Pozzolona Cement - Part 1 & 2
IS: 1566	-	Indian Standard Specification for hard drawn steel wire fabric for concrete reinforcement
IS: 1609	-	Code of Practice for Laying Damp-proof Treatment using Bitumen Felts
IS: 1786	-	Indian Standard Specification for high strength deformed Bars & wires for Concrete Reinforcement

IS: 1791	-	Indian Standard Specification for Batch Type Concrete Mixers
IS: 1834	-	Indian standard specification for hot applied sealing compound for joint in concrete.
IS: 1838	-	Indian standard specification for Preformed Fillers for Expansion Joint in Concrete Pavement and Structures (Non Extruding and Resilient Type)
IS: 2062	-	Steel for general structural purpose.
IS: 2185	-	Indian Standard Specification for Hollow and solid/ solid light wt. Cement Concrete Blocks - Part - 1 & 2
IS: 2210	-	Indian Standard Specification for Design of Reinforced Concrete Shell Structures and Folded Plates
IS: 2386	-	Indian Standard Specification for Methods of Test for Aggregates for Concrete - Part-I to VIII
IS: 2430	-	Indian standard specification for method of sampling of Aggregate for concrete.
IS: 2502	-	Indian Standard Code of Practice for Bending and Fixing of Bars for Concrete Reinforcement
IS: 2505	-	Indian Standard Specification for Concrete Vibrators Immersion Type
IS: 2506	-	Indian Standard Specification for Screed Board Concrete Vibrators
IS: 2508	-	Indian Standard Specification for Low Density Polyethylene Films
IS: 2514	-	Indian Standard Specification for Concrete Vibrating tables
IS: 2645	-	Integral Cement water proofing compound
IS: 2722	-	Indian Standard Specification for Portable Swing Weigh Batchers for Concrete (Single and Double Bucket type)
IS: 2751	-	Code of Practice for Welding of Mild Steel Bars used for Reinforced Concrete Construction

IS: 2770	-	Indian Standard Specification for Method of Testing Bond in Reinforced Concrete. Part - 1: Pull out Test
IS: 3025	-	Indian Standard Specification for Methods of Sampling and Test (Physical and Chemical) for Water & waste water - part - 1 to 37
IS: 3201	-	Indian Standard Specification for Design and Construction of Precast Concrete Trusses and purlins.
IS: 3370	-	Indian Standard Specification for Code of Practice for Concrete Structures for Storage of Liquids Part 1 to 4
IS: 3384	-	Indian standard specification for / Bitumen primer for use in waterproofing and Damp proofing
IS: 3414	-	Code of practice for Design and Installation of joints in Buildings
IS: 3550	-	Indian Standard Specification for Method of Test for Routine Control for Water used in Industry
IS: 3558	-	Code of Practice for use of Immersion Vibrators for Consolidating Concrete
IS: 3618	-	Indian Standard Specification for Phosphate Treatment of Iron and Steel for Protection against Corrosion
IS: 3696	-	Safety Code for Part-1: Scaffolding and Part 2: Ladders
IS: 3812	-	Indian Standard Specification for Fly Ash for Use as Pozzolana & Admixture
IS: 4031	-	Indian Standard Specification for Method of Tests for Hydraulic Cement - Part - 1 to 14
IS: 4082	-	Indian Standard Specification for Recommendation on Stacking and Storage of Construction Materials at site
IS: 4090	-	Indian Standard Specification for Design of Reinforced Concrete Arches

IS: 4634	-	Indian Standard Specification for Method of Testing Performance of Batch-type Concrete Mixers
IS: 4656	-	Indian Standard Specification for Form Vibrators for Concrete
IS: 4925	-	Indian Standard Specification for Concrete Batching and Mixing Plant
IS: 4926	-	Indian Standard Specification for Ready Mixed Concrete
IS: 4990	-	Indian Standard Specification for Plywood for Concrete Shuttering work
IS: 4991	-	Indian Standard Specification for Blast Resistant Design of Structure for Explosion above ground
IS: 4995 (Part-I&II)	-	Indian Standard Specification for Design of Reinforced Concrete Bins for the Storage of Granular and Powder Materials
IS: 4998 (Part - I)	-	Indian Standard Specification for Design of Reinforced Concrete Chimneys
IS: 5512	-	Indian Standard Specification for Flow Table for use in Tests of Hydraulic Cement and Pozzolanitic Materials
IS: 5513	-	Indian Standard Specification for Vicat Apparatus
IS: 5515	-	Indian Standard Specification for Compaction Factor Apparatus
IS: 5751	-	Indian Standard Specification for Precast Concrete Coping Blocks
IS: 5816	-	Indian Standard Specification for Method of Test for Splitting Tensile Strength of Concrete Cylinders
IS: 5891	-	Indian Standard Specification for Hand Operated Concrete Mixers
IS: 6452	-	Indian Standard Specification for High Alumina Cement for Structural Use

IS: 6909	-	Indian Standard Specification for Supersulphated Cement
IS: 6923	-	Indian Standard Specification for Method of Test for performance of Screed Board Concrete Vibrators
IS: 6925	-	Indian Standard Specification for Method of Test for Determination of Water Soluble Chloride in Concrete Admixtures
IS: 7242	-	Indian Standard Specification for Concrete Spreaders
IS: 7246	-	Indian Standard Specification for Table Vibrators for Consolidating Concrete
IS: 7251	-	Indian Standard Specification for Concrete Finishers
IS: 7320	-	Indian Standard Specification for Concrete Slump Test Apparatus
IS: 7861 (Part-I&II)	-	Indian Standard Specification for Recommended Practice for hot and cold Weather Concreting
IS: 7969	-	Safety Code for Storage and Handling of Building Materials
IS: 8041	-	Indian Standard Specification for Rapid Hardening Portland cement
IS: 8043	-	Indian standard specification for hydrophobic cement
IS: 8112	-	Indian Standard Specification for 43 grade Ordinary Portland Cement
IS: 8142	-	Indian Standard Specification for Determining Setting time of Concrete by Penetration Resistance
IS: 8989	-	Safety Code for Erection of Concrete Framed Structures
IS: 9013	-	Indian Standard Specification for Method of Making, Curing and Determining Compressive Strength of Accelerated - cured Concrete Test Specimens
IS: 9077	-	Code of Practice for Corrosion Protection of Steel Rails in RB and RCC Construction

IS: 9103	-	Indian Standard Specification for Admixtures for Concrete.
IS: 9417	-	Recommendation for welding cold worked bars for reinforced concrete construction
IS: 10262	-	Recommended Guideline for concrete Mix Design
IS: 12269	-	Indian standard specification for 53 grade ordinary Portland cement
IS: 12330	-	Indian standard specification for sulphate resisting Portland cement
IS: 12600	-	Indian standard specification for low heat Portland cement
IS: 14687	-	Indian Standard Guidelines for Falseworks for Concrete Structures

7.0.0

RATES

PCC/RCC: The rate for P.C.C/ R.C.C. shall include the cost of all materials, labour, transport, tools and plants and all the operations mentioned hitherto, including or excluding the cost of form work and/ or reinforcement as mentioned in the schedule of quantities. The rates also shall include the cost of testing materials, mix design, cube test and allied incidental expenses.

8.0.0

MEASUREMENTS

Concrete: Concrete works shall be measured as per IS 1200 (part2) latest edition apart from that is mentioned in SOQ.

C-05: SPECIFICATION FOR FORM WORK

1.0 SCOPE:

1.1 The formwork shall consists of shores, bracings, side of beams, foundations and columns, bottom of slabs, etc. including ties, anchors, hangars, inserts, etc. complete which shall be properly designed and planned for the works.

1.2 The formwork shall be so constructed that up and down vertical adjustments can be made smoothly. Wedges may be used at top or bottom of shores, but not at both the ends to facilitate vertical adjustment for dismantling of the formwork.

2.0 CODES & STANDARDS

2.1 The relevant IS specification, standards and codes given below are made a part of this specification. All standards, specifications, code of practices referred to herein shall be the latest edition including all applicable amendments, revisions and additional publications.

No.	IS. No.	I.S. Particulars
1	IS: 303	Plywood for general purpose
2	IS : 1200 (Part V)	Method of Measurement of building and civil engineering work (Form work)
3	IS : 2750	Specification for steel scaffolding
4	IS : 3696	Safety code for scaffolds and ladders
5	IS : 4014 (Part I)	Code of Practice for steel tubular scaffolding
6	IS : 4014 (Part II)	Code of Practice for steel tubular scaffolding
7	IS : 4990	Specification for plywood for concrete shuttering work

3.0 DESIGN OF FORMWORK:

3.1 The design and engineering of the formwork as well as its construction shall be the responsibility of the contractor. The drawings and calculations for the design of the formwork shall be submitted well in advance to the Engineer-in-charge for approval before proceeding with the work at no extra cost to the department. Engineer- in-charge's approval shall not relieve the contractor of the full responsibility for the design and construction of the formwork.

3.2 The design shall take into account all the loads vertical as well as lateral that the forms will be carrying including live load and vibration loads.

3.3 Depending upon the height of the staging suitable vertical and horizontal cross bracings shall be provided to the satisfaction of EIC.

3.4 The contractor shall note that no concrete work of floor, beam, slab including roof slab will be permitted unless the staging work is inspected and the approval in writing for its soundness is given to the Engineer-in-charge prior to commencement of concrete work.

4.0 **TYPE OF FORMWORK:**

4.1 Formwork may be of timber, plywood or metal (as specified in the BOQ). For special finishes the formwork may be lined with plywood, steel sheets, oil tempered hard board, etc. sliding forms and slip forms may be used with the approval of engineer-in-charge. The system of formwork used shall be such that it is rigid, easy to assemble, dismantle and quickly re-assemble in parts. It is recommended that contractor shall use DOKA or equivalent type of shuttering system for the works.

4.2 Contractor is free to use modules of formwork which can be lifted in place and transported to the next place upon de-shuttering for structures like folded plates and grid slabs. The scheme of usage shall be approved by Engineer In-charge.

5.0 **FORMWORK REQUIREMENTS:**

5.1 Forms shall conform to the shapes, lines, grades and dimensions including camber of the concrete as called for on the drawings. Ample studs, wailer braces, ties, straps, shores, etc. shall be used to hold the forms in proper position without any distortion whatsoever until the concrete has set sufficiently to permit removal of forms. Form shall be strong enough to permit the use of immersion vibrators; in special case form vibrators may also be used. Joints shall be sufficiently tight to prevent loss of water and fine material from concrete.

5.2 Plywood shall be used for exposed concrete surface where called for. Inside faces of forms for concrete surface, which are to be rubbed finished shall be planed to remove irregularities or unevenness in the face. Formwork with lining will be permitted.

- 5.3 All new and used formwork shall be maintained in a good condition with respect to shape, strength, rigidity, water tightness, smoothness and cleanliness of surfaces. Formwork unsatisfactory in any respect shall not be used and if rejected by the Engineer-in-charge shall be removed from the site.
- 5.4 Shores supporting successive stories shall be placed directly over those below or be so designed and placed that the load will be transmitted directly on them. Trussed supports shall be provided for shores that can be secured on adequate foundation.
- 5.5 Form work during any stage of construction showing signs of distortion or disturbed to such a degree that the intended concrete work will not conform to the exact contours indicated on the drawings shall be re-positioned and strengthened. Poured concrete affected by faulty formwork shall be removed entirely and the formwork shall be corrected prior to placing new concrete.
- 5.6 Excessive construction camber to compensate for shrinkage settlement etc. that may impair the structural strength of the members will not be permitted.
- 5.6.1 Forms for substructure concrete may be omitted in case, in the opinion of the Engineer-in-charge the open excavation is firm enough to act as the form. Such excavation shall be slightly larger than that required by drawings to compensate for irregularities in excavation and to ensure the design requirement.
- 5.7 Forms shall be designed and constructed that so they can be stripped in order required and their removal does not damage the concrete. Face form work shall provide true vertical and horizontal joints conforming to the architectural features of the structure as to the location of joints and be as directed by the Engineer-in-charge.
- 5.8 Where exposed smooth or rubbed concrete finishes are required, the forms shall be constructed with special care so that the desired concrete surfaces could be obtained which require a minimum finish.
- 6.0 **BRACINGS, STRUTS AND PROPS:**
- 6.1 Shuttering shall be braced, strutted, propped and so supported that it shall not deform under weight and pressure of the concrete and also due to the movement of men and other materials.

- 6.2 The shuttering for beams and slabs shall be so erected that the shuttering on the sides of the beams and under the soffit of slab can be removed without disturbing the beam bottoms.
- 6.3 Re-propping of the beams shall not be done except when the props have to be reinstalled to take care of construction loads anticipated being in excess of the design load. Vertical props shall be supported on wedges or other measures shall be taken whereby the props can be gently lowered vertically while striking the shuttering.
- 6.4 If the shuttering for a column is erected for the full height of the column, one side shall be left open and built upon sections as placing of concrete proceeds or windows may be left for pouring concrete from sides to limit the drop of concrete to two metres or as directed by the engineer-in-charge.

7.0 **FORM OIL:**

- 7.1 Use of the form oil shall not be permitted on the surface that requires painting. If the contractor desires to use form oil on the inside of form work of the other concrete surfaces, a non staining mineral oil or other approved oil 'CEMOL-35' of M/s Hindustan Petroleum Co. Ltd. or equivalent may be used provided it is applied before placing of reinforcing steel and embedded parts.
- 7.2 All excess oil on the form surfaces and any oil on metal or other parts to be embedded in the concrete shall be carefully removed. Before treatment with oil, forms shall be thoroughly cleared of dried splatter of concrete from placement of previous lift.

8.0 **WALL TIES:**

- 8.1 Wall ties and through bolts passing through the walls shall be used with the permission of Engineer In-charge.

For fixing of formwork, alternate arrangements such as coil nuts may be adopted at the contractor's cost.

9.0 **REUSE OF FORMS:**

- 9.1 Before reuse all forms shall be thoroughly scraped, cleaned, nails removed, holes that may leak suitably plugged and joints examined and when necessary repaired and the inside retreated to prevent adhesion to the satisfaction of Engineer-in-charge. Warped formwork shall be resized. Contractor shall equip himself with enough shuttering to complete the job in the stipulated time.

10.0 REMOVAL OF FORMS:

- 10.1 Contractor shall record in the drawings or a special register the date upon which the concrete is placed in each part of the work and the date on which the shuttering is removed there from.
- 10.2 In no circumstances shall form be struck until the concrete reaches a strength of at least twice the stress due to self weight and any construction/erection loading to which the concrete may be subjected to at the time of striking of formwork. The strength referred to shall be that of concrete using the same cement and aggregates and admixture, if any, with the same proportions and cured under conditions of temperature and moisture similar to those existing on the work.
- 10.3 In normal circumstances where the ambient temperature does not fall below 15°C and where Ordinary Portland Cement is used and adequate curing is done, the stripping time is to be followed as specified in IS: 456-2000 (clause 11.3).
- 10.4 Striking shall be done slowly with utmost care to avoid damage to arise and projections and without shock or vibration by gently easing the wedges. If after removing the formwork, it is found that formwork has been embedded in the concrete, it shall be removed and made good as specified earlier.
- 10.5 Reinforced temporary openings shall be provided as directed by the Engineer in-charge to facilitate removal of formwork which otherwise may be inaccessible.
- 10.6 Tie rods, clamps, form bolts, etc. which must be entirely removed from walls or similar structure shall be loosened not sooner than 16 hours and not later than 24 hours after the concrete has been deposited. Ties except those required to hold the forms in place may be removed at the same time. Ties withdrawn from walls and grade beams shall be pulled towards the inside face. Cutting ties back from the faces of forms and grade beams will not be permitted. Work damaged due to premature or careless removal of forms, any undulation in exposed concrete surface due to sag / settlement or movement of supports found after removal of shuttering shall be reconstructed or rectified to the satisfaction of the Engineer-in-charge by the contractor at his own risk and cost. Abrupt changes in surface of concrete, mortar fins at formwork

joints shall be made even by chipping, grinding and finishing with cement mortar, curing, etc. as directed by Engineer-in-charge at his own cost.

11.0 MODE OF MEASUREMENT:

11.1 The net area of exposed surfaces of concrete members as shown in the drawings coming in contact with form work shall be measured under item of form work in square meter.

11.2 The dimensions of the formwork shall be measured correct to a centimeter.

11.3 No deductions shall be made from the shuttering for openings / obstructions up to an area of 0.10 m^2 and nothing extra shall be paid of forming such opening.

11.4 For the purpose of measurements for formwork, IS: 1200 (Part V) shall be referred.

12.0 SPECIFICATION FOR STAGING WORK:

12.1 The contractor shall note that only steel tubular staging (acrow type or equivalent) shall be used for all RCC beams, slabs, etc. at all floor levels where it is not possible to use DOKA type shuttering and the same shall be designed by him and the detailed drawings and the design calculations shall be submitted for the approval of Engineer-in-charge at least two weeks in advance of the scheduled date of its erection at site. Depending upon the height of the staging, suitable vertical and horizontal cross bracings shall be provided. The contractor shall note that no concreting of floor beams, stairs and slabs including roof slab will be permitted unless the staging work is inspected and approval in writing for its soundness by the Engineer-in-charge is given prior to the commencement of concreting.

C- 06: SPECIFICATIONS FOR STEEL REINFORCEMENT

1.0 GENERAL:

1.1 Steel reinforcement bars shall be either plain round mild steel bars grade-I or Thermo-mechanically treated (TMT) bars - high yield strength deformed bars as per IS: 1786: 2008 as shown, specified in the drawings; shall be manufactured by M/s SAIL or TISCO or RINL only and shall be rolled from their own plants and from virgin material. Steel shall be of grade Fe 500 D TMT bars with strength requirements conforming to IS 1786 – 2008 having elongation more than 14.5% and ultimate tensile strength / yield strength ratio > 1.18 for Fe 500 D. Materials manufactured by their authorized conversion agents and re-rollers shall not be accepted. Documentary evidence of purchasing steel produced from these manufacturers and their manufacturing test certificate shall be submitted. The third party test shall be carried out as per QAP and cost of which shall be included in the item rate and no separate payment shall be made on account of this. Contractor shall make provision for a decoiler at site so that reinforcement supplied in coils can be straightened and used at site.

1.2 Wire mesh or fabric shall be in accordance with IS: 1566.

1.3 Substitution of reinforcement will not be permitted except upon written approval from Engineer-In-Charge.

2.0 SCOPE:

2.1 This specification covers the general requirements for quality, storage, bending and fixing of reinforcement.

3.0 APPLICABLE CODES AND SPECIFICATIONS:

The relevant IS specification, standards and codes given below are made a part of this specification. All standards, specifications, code of practices refer to herein shall be the latest edition including all applicable amendments, revisions and additional publications.

Sl. No.	IS Code	IS Particulars
1.	IS: 432 (Part I)	Mild Steel and Medium Tensile Steel bars and Hard drawn Steel Wires for concrete reinforcement

2.	IS: 432 (Part II)	Mild Steel and Medium Tensile Steel bars and Hard drawn steel wires for concrete reinforcement
3.	IS: 1139	Specification for Hot Rolled Mild steel, Medium steel and HYSD bars for concrete reinforcement
4.	IS: 1200 (Part VIII)	Method of Measurement of Building and Civil Engineering work (Steel and Iron works)
5.	IS: 1566	Hard drawn Steel Wire fabric for concrete reinforcement
6.	IS: 1599	Method for Bend Test
7.	IS: 1608	Method of Tensile Testing of Steel Products
8.	IS: 1786	High Strength Deformed Steel and Wires for concrete reinforcement
9.	IS: 2502	Code of Practice for Bending and Fixing of Bars for concrete reinforcement

4.0 **STORAGE:**

- 4.1 The reinforcement shall not be kept in direct contact with the ground but stacked on top of an arrangement of timber slippers or the like. Fabricated reinforcement shall be carefully stored to prevent damage, distortion, corrosion and deterioration.

5.0 **QUALITY:**

- 5.1 All steel shall be of grade-I quality unless specifically permitted by the Engineer-In-Charge. No re-rolled material will be accepted. Contractor shall submit the manufacturer's test certificate for steel.
- 5.2 Random test on steel supplied by the contractor may be performed by owner as per QAP. All cost incidental to such tests shall be at the contractor's expenses. Steel not conforming to the specifications shall be rejected.
- 5.3 All reinforcement shall be clean, free from grease, oil, paint, dirt, loose mill scale, loose rust, dust, bituminous material or any other substance that will destroy or reduce the bond. All rods shall be thoroughly cleaned before being fabricated.
- 5.4 Pitted and defective rods shall not be used. All bars shall be rigidly held in position before concreting. No welding of rods to obtain

continuity shall be allowed unless approved by the Engineer-in-charge. If welding is approved, the work shall be carried out as per IS: 2751, according to best modern practices and as directed by the Engineer-in-charge.

5.5 In all cases of important connections, test shall be made to prove that the joints are of the full strength of the bar welded. Special precautions as specified by the Engineer in-charge shall be taken in the welding of cold work reinforcing bars and bars other than mild steel.

6.0 **LAPS:**

6.1.1 Laps and splices for reinforcement shall be as shown on the drawings/as per EIC. Splices and adjacent bars shall be staggered and the location of all splices except those specified on the drawings shall be approved by the Engineer-in-charge. The bars shall not be lapped unless the length required exceeds the maximum available length required of bars at site.

7.0 Bending and placing

7.1 Bending shall be as under:

- a) All bars shall be accurately bent according to the size and shape shown on the detail working drawings / bar bending schedule. They shall be gradually bent by machine or approved means.
- b) Reinforcing bars supplied bent or in coils, shall be straightened before these are cut to size. Straightening of bars shall be done in cold and without damaging the bars. This is to be considered as a part of reinforcement bending and fabrication work.
- c) Unless otherwise specified, reinforcing steel shall be bent in accordance with procedure specified in IS:2502 and/or as approved by the EIC. Bends and shapes shall comply strictly with the dimensions shown on the approved bar bending schedules and they shall be rechecked by the Contractor before bending and he shall be entirely responsible for their correctness. Bars correctly bent, shall only be used. Unless specified otherwise or directed by the EIC, the detailing of reinforcement shall be in accordance with IS:5525, IS 13920 and SP:34.

- d) Bending of longitudinal bars for laps shall be done with 1:6 slopes. The ends of column bars at the top of columns shall be bent horizontally at the just below the beam bars permitting full development length of beam bars. The beam column junction reinforcement shall be tied by U- stirrups to develop full moment connection with good confined concrete.
- e) No reinforcement shall be bent when in position in the work without approval of the EIC, whether or not it is partially embedded in concrete. Where reinforcement bars are bent aside, at construction joints and afterwards bent back into their original positions, care shall be taken to ensure that, at no time, the radius of the bend is less than 4 times the bar diameters for plain mild steel or 6 times the bar diameters for deformed bars. Care shall also be taken while bending back bars, to ensure that the concrete around the bar is not damaged.
- f) Welding of bars to obtain continuity shall not be allowed, particularly for cold twisted bars, unless specifically approved by the EIC. If welding is approved, the work shall be carried out as per IS:2751 and IS:9417, according to the best practice and as directed by the EIC.

7.2 Placing in Position shall be as under:

- a) Spacing of bars shall be as indicated in the drawings. Minimum distance between reinforcing bars shall be in accordance with clause 26.3.2 of IS:456.
- b) All reinforcement shall be accurately fixed and maintained in position as shown on the drawings by such approved means as steel chairs, and/or concrete spacer blocks as per IS:2502. Bars intended to be in contact at crossing points, shall be securely bound together at all such points by two numbers annealed steel wire of 0.9 mm to 1.6 mm size conforming to IS:280 in such a manner that they do not slip over each other at the time of fixing & concreting. The tying of bars shall be in criss-cross manner.
- c) Binders shall tightly embrace the bars with which these are intended to be in contact and shall be securely held. The vertical distance between successive layers of bars shall be maintained by provision of spacer bars. These shall be so spaced that the main bars do not sag perceptively between adjacent spacers. Bundled bars shall be provided wherever shown on the drawing to facilitate concreting. Location of laps and development lengths shall be as indicated on the drawings or as directed by EIC.

- d) The placing of reinforcement shall be completed well in advance of concrete pouring. The reinforcement shall be checked by the EIC, for accuracy of placement and cleanliness. Necessary corrections, as directed by the EIC shall be carried out. Care shall be taken to ensure that projecting ends of ties and other embedded metal do not encroach into the concrete cover. Where concrete blocks are used for ensuring the cover and positioning of reinforcement, these shall be made of mortar 1:2 (1 cement:2 sand) by volume and cured for at least seven days. The sizes and locations of the concrete blocks shall be approved by the EIC. The 28 days crushing strength of cover blocks shall be at least equal to the specified strength of concrete in which the blocks will be embedded.
- e) Laps and anchorage length of reinforcing bars shall be in accordance with IS:456, unless otherwise specified. If the bars in a lap are not of the same diameter, the smaller diameter will guide the lap length. Laps shall be staggered as far as practicable and as directed by the EIC and not more than 50% of bars shall be lapped at a particular section. Mechanical connections, for splicing reinforcement bars in congested locations may be used by the Contractor, only if approved by the EIC. Reinforcement bars shall not be lapped unless the length required exceeds the maximum available lengths of bars at site.
- f) Unless otherwise specified by the EIC-, reinforcement shall be placed within the following tolerances:

Tolerance in spacing	
For effective depth 200 mm or less	± 10 mm
For effective depth more than 200 mm.	± 15 mm

8.0 COVER TO REINFORCEMENT:

- 8.1 Unless indicated otherwise on the drawing, clear concrete cover for reinforcement (exclusive of plaster or decorative finish) shall be as per the provisions of IS: 456.

9.0 INSPECTION:

- 9.1 Erected and secured reinforcement shall be inspected and approved by the Engineer-in-charge prior to placement of concrete.

10.0 MODE OF MEASUREMENT:

- 10.1 The actual quantity of reinforcement bars embedded in concrete as specified in the drawing and as approved by the Engineer-in-charge irrespective of the level or height at which the reinforcement bars are placed shall be measured for payment.
- 10.2 The reinforcement bars shall be measured in length nearest to a centimeter for different diameters and their weight shall be calculated based on the standard weights as per Indian Standard.
- 10.3 Wastage, unauthorized overlap and annealed steel binding wires shall not be measured for payment.
- 10.4 Pins, chairs and spacers wherever required shall be provided as directed by the Engineer-in-charge and measured separately and paid for.
- 10.5 The rate for reinforcement item shall include the cost of labour and materials required for all operations described above including transportation, cleaning, straightening, cutting, bending, placing in position and binding of reinforcement bars and wastage, etc.
- 11.0 **Embedded parts**
- 11.1 Steel for light structural work and for preparation of inserts and embedments shall conform to IS:2062.
- 11.2 Bolts to be embedded in concrete shall, unless otherwise detailed in drawings, conform to IS:5624. Material for bolts, shall, unless otherwise mentioned in drawings or the schedule of items, be corrosive resistant/coated steel conforming to IS:2062.
- 11.3 Nuts and locknuts shall conform to IS:1363 (Part 1 to 3) for diameters 6 to 39 and IS 3138 for Hexagon Bolts and Nuts (M-42 to M-150)".
- 11.4 Plain washers shall conform to IS:2016 and spring washers shall conform to IS:3063.
- 11.5 Steel pipe sleeves shall conform to Medium class of IS: 1161.
- 11.6 Embedded parts shall be measured in Kgs.

C-07: SPECIFICATION FOR STRUCTURAL STEEL WORKS

1.0 DESCRIPTION OF THE WORK.

1.1 Steel structural works shall include:

1.1.1 The preparation and supply of design calculations and structural design drawings, material indents, arrangement drawings, detailed fabrication drawings, erection drawings, material lists, site bolt lists and dispatch documents for the steel structures.

1.1.2 The supply, fabrication, erection, painting, transportation, delivery and storage and handling of all steel structures including bolts, nuts, washers, electrodes, etc. complete in all respects.

1.1.3 Erection (including tools, tackles, cranes and any staging, or false work, required for erection) handling, transport and rectification of damaged structures, fixing, bolting and welding, aligning, levelling etc. of all steel structures complete in all respects.

1.1.4 Painting of steel structures after erection.

2.0 LIST OF STEEL STRUCTURES

2.1 Steel Structures shall include essentially, (but not necessarily limited to) the following:

- Platform structures, Cross Overs, Brackets, Staircase ,Ladders , Hand rails etc.,
- Chequered Plates / Gratings
- Pipe support structures etc

3.0 METHOD OF CONSTRUCTION

The mode of construction shall be either welded and / or bolted to suit the following but limiting the site work to minimum possible:

- Method of design
- Process requirements
- Transportation
- Effective erection considerations
- The most effective modern mode of fabrication and design.

Steel tubes for structural purposes shall conform to IS:1161 1979 (Grade YST-240).

All black hexagonal bolts, nuts and locknuts shall conform to IS:1363-1984 and IS:1364-1983 (for precision and semi-

precision hexagonal bolts). Washers shall conform to IS: 1148-1982.

Covered electrodes for arc welding shall conform to IS:814-1991. Coding of electrodes shall be as follows: -

a) ER 421 'C' x for mild steel of Grade A and Grade-B as per
IS:206
2-
1992.

b) EB 542 'C' x H3X for "C" is the value of current as recommended by the electrode manufacturer.

4.0 FABRICATION

4.1 Fabrication of all steel structures shall conform to the best practices and relevant standards.

4.2 Welding shall be in accordance with the standard codes fulfilling the

Requirements of electrodes and flux combination, current characteristics, preheat and post weld heat treatments. Established practices shall be followed to ensure that the weldment and the heat affected zone metal properties are not inferior to the parent metal properties.

4.3 Elements shall be machined / finished as the case may be as per line
and
levels in the shop and assembled suitable for transport / shipment.

4.4 Fabrication tolerances shall be within permissible limits as per applicable standards / codes of practices.

4.5 Structures shall be fabricated to meet transport requirements.

4.6 Subject to fulfillment of transport requirements structures shall be fabricated in sizes so as to minimize site work.

4.7 Important structures to be connected together shall be control assembled in shop so as to avoid mismatch of components during erection at site.

5.0 INSPECTION AND TESTS

Inspection of structures shall generally be in accordance with relevant standards and codes and shall include non destructive testing by ultrasonic tests.

-100 % butt welds shall be subjected to ultrasonic testing.

6.0 PAINTING

6.1 General

All surfaces to be painted, shall be thoroughly cleaned of all dirt, grease, rust and mill scales. Paints shall be applied not later than 3-4 h after cleaning of surface. The surface shall be perfectly dry before painting. Painting shall not be done in frosty or foggy weather or when humidity is such as to cause condensation on the surface to be painted (relative humidity 80% or above) or ambient temperature less than 40 degrees F. Machined/planed surfaces shall be coated with white lead and tallow, before despatch or before being put out in open air and covered with gunny cloth. General compatibility between primer and finishing paints shall be certified by the paint manufacturers supplying these paints. For a selected primer, suggestions of paint manufacturer for surface treatment best suitable for that primer shall be obtained and followed.

6.2 Surface preparation for painting

The steel surface which is to be painted shall be cleaned of dirt and grease and the heavier layers of rust shall be removed by grinding prior to actual surface preparation to a specified grade.

6.3 Manual/power tool cleaning

Manual/power tool cleaning shall be done as per grade St-2 of Swedish Standard Institution SIS 055900.

Grade St-2: Thorough scraping and wire brushing, machine brushing, grinding etc. This grade of preparation shall remove loose mill scale, rust and foreign matter. Finally the surface is to be cleaned with a vacuum cleaner or with clean compressed air or with clean brush. After preparation, the surface should have a faint metallic sheen. The appearance shall correspond to the prints designated St-2.

6.4 Painting System:

Surface preparation St-2 according to Swedish Standard SIS 055900. Primer coat: Epoxy resin based zinc rich primer of 35 micron DFT in each coat (total DFT of primer coats shall be 70 mm). Finish coat and Final finish Coat: Epoxy based paint of 40 micron DFT each.

7.0 ERECTION

- 7.1 The erection of structural steelwork shall be done in accordance with the relevant standards and in the proper sequence.
- 7.2 The number of washers on permanent bolts shall not be less than two. One for the bolt and one for the nut.
- 7.3 All site welds shall be uniform and shall be free from any slags, cracks and blow holes.
- 7.4 Undercutting of the parent metal shall be avoided.
- 7.5 During site assembly by welding, suitable jigs and fixtures must be used to avoid distortion of members after welding.
- 7.6 All welding shall be carried out by qualified welders.
- 7.7 Erection tolerances shall be as per the relevant Indian standards or as per, or special technological requirements, whichever is more stringent.

C -08: SPECIFICATION FOR P.V.C. WATER STOPS

1.0 GENERAL:

- 1.1 The corrugated PVC water stops with centre bulb of specified width, shall be of approved manufacture and conform to the requirements of IS 12200: 2001, satisfy all the normal tests such as tensile strength, elongation etc. The water stop should be fabricated from a plastic compound, the basic resin of which shall be polyvinyl chloride. The compound shall contain additional resins, plasticisers, inhibitors and other materials such that when the material is compounded, it shall meet the requirements of IS 15058:2001.

Water-stop is to be used in all construction joints of foundations, walls, slabs, slabs-on-grade, pre-cast wall panels, box culverts, potable water tanks, basement walls, retaining walls etc as per drawings/ Directions of EIC.

Water-stops shall have following properties:

- It shall provide active protection.
- It shall be simple for application & jointing.
- This, being a flexible strip, shall be place able without any complex shuttering and shall take over any profile..
- Expansion rate shall be such that it does not cause any damage to freshly placed concrete during curing.
- It shall be able to retain its original shape after repeated expansions and contractions.
- It shall provide effective seal in wet conditions.

2.0 SAMPLE:

- 2.1 A sample of Rubber/PVC water stops shall be got approved from the Engineer-in-charge before procurement of bulk quantity.

3.0 PLACING IN POSITION:

- 3.1 The water stops shall be provided in available maximum length and far as possible, jointing shall be avoided. All the joints when unavoidable, shall be field jointed for water tightness as per manufacturers specifications.
- 3.2 The water-stops shall be positioned with suitable temporary supports so as to render adequate rigidity to the water stops while

concreting. The exposed surfaces of water stops revealed after first concreting shall be cleaned thoroughly of all the droppings, mortar splashing, timber scantlings sticking etc. before the next pour of concrete is taken up in hand. Any damage caused to water stops shall be made good by the contractor at his own cost.

4.0 **MODE OF MEASUREMENT:**

4.1 The mode of measurements shall be in running meter, of water stop actually laid without any allowance for laps, wastage etc., measured correct to one centimeter.

4.2 Rate shall include supply, transport, fixing, welding, supporting arrangements, cleaning etc. all as described above.

C-09: SPECIFICATION FOR MASONRY AND ALLIED WORKS

1.0 SCOPE

This section of the specification covers, furnishing, installation including handling, transporting, batching, mixing, laying, scaffolding, centering, shuttering, finishing, curing, protection and repairing till handing over of brick masonry and allied works including DPC and plinth protection.

2.0 GENERAL REQUIREMENTS

- 2.1 The Contractor shall furnish all skilled and unskilled labour, plant, equipment, scaffolding, materials, etc. required for complete execution of the work in accordance with the drawings and as described herein and/or as directed by the EIC.
- 2.2 All workmanship shall be in accordance with the latest standards and best possible practice. Masonry work shall be true to line & level as shown on drawings. All such masonry shall be tightly built against structural members and bonded with dowels, anchors, inserts, etc. as shown on the drawings.
- 2.3 The Contractor shall carryout all works for setting out the building lines, locating the co-ordinates and establishing the reduced levels (RL's) on the basis of reference grid lines and bench mark, which shall be furnished by the EIC, at one or more locations.
- 2.4 Any approval, instructions permission, checking, review, etc. whatsoever by the EIC shall not relieve the Contractor of his responsibility and obligation regarding adequacy, correctness, completeness, safety, strength, quality, workmanship, etc.

3.0 CODES AND STANDARDS

- 3.1 All applicable standards, acts and codes of practice referred to shall be the latest editions including all applicable official amendments and revisions. A complete set of all these documents shall generally be available at site, with the Contractor.
- 3.2 In case of conflict between this specification and those (IS Standards, Codes etc.) referred to in clause 3.3 the former shall prevail.
- 3.3 Some of the applicable Indian standards, Codes, etc. are referred to here below:

IS: 516	1959	Method of strength test for concrete
IS: 702	1988	Specification for industrial bitumen
IS: 1077	1992	Specification for Common burnt clay bricks
IS: 1200 (Part 3)	1976	Method of measurement of building and civil Engineering works - Brickwork
IS: 1200 (Part 4)	1976	Method of measurement of building and civil Engineering works – Stone masonry
IS: 1200 (Part 8)	1974	Method of measurement of building and civil Engineering works – Demolition & dismantling
IS 1597 :Part 1	1992	Construction of Stone Masonry – Code of Practice – Part1 : Rubble Stone Masonry
IS 1597 :Part 2	1992	Code of Practice for construction of Stone Masonry – Part2 : Ashlar Masonry
IS : 2116	1980	Specification for sand for masonry mortars
IS:2212	1991	Code of practice for brick work
IS:2250	1981	Code of practice for preparation and use of masonry mortar
IS: 2386 (Part 1)	1963	Methods of test for aggregate for concrete – Particle size & shape
IS: 2386 (Part 2)	1963	Methods of test for aggregate for concrete – Estimation of deleterious materials and organic impurities
IS: 2691	1988	Specification for burnt clay facing work
IS 3025 (Part 15)	1984	Methods of sampling and test (physical & chemical) for water & waste water – Total residue (totals solids dissolved and suspended)
IS:3414	1968	Design and installation of joint in buildings

IS: 3495 (Part 1)	1992	Method of tests for burnt clay building bricks – Determination of compressive strength
IS: 3495 (Part 2)	1992	Method of tests for burnt clay building bricks – Determination of water absorption
IS: 3495 (Part 3)	1992	Method of tests for burnt clay building bricks – Determination of efflorescence
IS: 3495 (Part 4)	1992	Method of tests for burnt clay building bricks – Determination of warpage
IS:3696 (Part 1)	1987	Safety code for scaffolds and ladders - Scaffolding
IS:3696 (Part 2)	1991	Safety code for scaffolds and ladders - Ladders
IS: 4031 (Part 5)	1998	Methods of physical tests for hydraulic cements - Determination of initial and final setting time
IS: 4031 (Part 7)	1998	Methods of physical tests for hydraulic cements - Determination of compressive strength of masonry cement
IS:4130	1991	Safety code during demolition of buildings
IS:4326	1993	Code of practice for earth quake resistant design and construction of buildings
SP : 20	1991	Hand book on masonry design & construction
SP: 25	1984	Handbook on causes and prevention of cracks in buildings

4.0

BRICKWORK:

4.1

Brick shall be table moulded of uniform size, shape and colour, must be well burnt so as to give a clear ringing sound when struck. They shall be clean, whole and free from flaws, cracks, stones or lumps of any kind, especially lime. They shall have sharp edges, shapes and even surface and shall be sound & hard to resist compression. They shall be from a source

to be approved by the Engineer-in-charge and the quality of the brick should be such that they shall not absorb water more than the percentages mentioned in clause 7.2 of IS 1077-1992 after immersion in water for 24 hours and shall have a minimum compressive strength of 5.0 N/mm² (for normal brickwork) / 7.5 N/mm² (for wire cut bricks) as per IS: 1077-1992 and schedule of items and subject to the provisions mentioned in Table 1 of IS 2212:1991.

- 4.2 All bricks shall be thoroughly saturated with water before use. They should be soaked for about 12 hours for this purpose. No broken bricks shall be used except as closers. The course shall be laid flush in mortar and every course shall be thoroughly grouted, joints shall be broken vertically and they shall not exceed 10 mm in thickness. The horizontal joints shall not be more than 10 mm in thickness. The work shall not be raised more than 12 courses per day. It shall be kept constantly wet for at least 10 days and twice a day for a month. Date of laying the brickwork shall have to be marked, as directed by the Engineer-in-charge, on the wall so as to ensure easy monitoring of the curing period.
- 4.3 Before starting the brick masonry, the concrete surfaces e.g., plinth beams, columns, slabs, Chajjes, etc. shall be thoroughly hacked and washed to remove all mud, dirt, loose particles, etc. No holes for supporting scaffolding arrangement shall be allowed especially at the junction of concrete surfaces and the brickwork. However, these holes may be allowed elsewhere and are to be made good after the scaffolding is removed in such a manner so as to ensure complete water tightness. When the fresh brickwork is to be started on the old brick masonry, the surface should be thoroughly cleaned and washed to remove all moss deposit, loose mortar, mud and dirt, etc.
- 4.4 String courses and mouldings shall be set straight and true by projecting brickwork with properly cut and shaped bricks wherever necessary with as fine joints as possible.
- 4.5 The walls shall be carried up regularly in all cases when the nature of the work will admit of it, not leaving any part 1.0 M lower than another, when circumstances render it necessary to carry out on the same section of a building in uneven course. The brick shall be raked back so as to maintain uniform and effectual bond.
- 4.6 In brick arched and other circular work, the brick shall be shaped to have joints indicating correctly to the center from the front to back of walls with thickness not more than 10 mm. The face brick shall be of uniform colour and with sharp surfaces.

- 4.7 Where pointing or plastering is specified, the joints in all brickwork shall be raked out on both the faces of the wall as the work proceeds.
- 4.8 The size of the brick shall be 230 (9") x 115 (4-1/2") x 75 mm (3") (or 190 x 90 x 90 mm). 230mm (9") and 115 mm (4-1/2") thick walls will be built fair on one side only. All walls of greater thickness shall be built without exception with fair face.
- 4.9 Half brick or 115 mm thick brickwork in CM 1:4 with bricks of designation 5.0 / 7.5 shall be carried out in panels and with horizontal stiffeners of 115 x 75 mm at every fourth course with two MS bars of 6 mm diameter and spacers of 6 mm diameter and vertical stiffeners of 115 x 75 mm with two MS bars of 6 mm diameter and spacers of 6 mm diameter at 2M center to center laid in 1:2:4 concrete property fill including formwork, consolidation, curing, etc. The RCC work shall not be measured separately but will be included in the brickwork. The MS reinforcement however will be measured separately or as specified in the BOQ.
- 4.10 The contractor shall provide all necessary openings doors, windows or such other services and shall embed electrical fittings and fixtures; sleeves supplied by the other agency if required at no extra cost. Also shaping of the bricks for the exhaust fan, circular openings shall also be carried at no extra cost. All these openings shall be closed and gaps to be filled in 1:2:4 concrete and finished neatly with chicken mesh after the installation of all these services at no extra cost.
- 4.11 The rate for brickwork for 345 mm , 230 mm and 115 mm thick walls shall include all single or double scaffolding, tools and plants, quoins and jambs, hacking, cutting and wastage of bricks for splayed joints, watering, etc. deductions shall be made for all the openings, lintels, sills, columns, etc. The unit for measurement of 345 mm, 230 mm brick masonry and above will be in cubic meter and for 115 mm thick masonry in square meter. The rates for brickwork shall also include the cost of the following
- 4.12 Making good all holes (also ensuring the water tightness of the holes left out in external walls for supporting the scaffoldings), chases to any depth due to conduit pipes, holdfast, switches, plug box, exhaust fan openings and other openings, etc.
- 5.0 **MORTAR:**
- 5.1 Mortar for brick masonry shall be prepared as per IS: 2250. Mix for cement mortar shall be as specified in the respective items of work. Gauge boxes for sand shall be of such dimensions that one complete bag of cement containing of 50 kg of cement forms one unit. The sand shall be free from

clay, shale, loam, alkali and organic matter and shall be of sound, hard, clean and durable particles. Sand shall be approved by Engineer-in-charge.

If so directed by the Engineer-in-charge, sand shall be thoroughly washed till it is free from any contamination.

- 5.2 For preparing cement mortar, the ingredients shall be first mixed thoroughly in dry condition. Water shall then be added and mixing continued to give a uniform mix of required consistency. Cement mortar shall preferably be machine mixed, though hand mixing in a thorough manner may be allowed. The mortar so mixed shall be used within 25 minutes of mixing. Mortar left unused beyond specified period shall be rejected.
- 5.3 The contractor shall arrange for test of mortar sample if so directed by the Engineer-in-charge. Re-tempering of mortar shall not be permitted.
- 5.4 All the brickwork shall be built tightly against column, floor slabs or other structural members.
- 5.5 Raking Out Joints
 - 5.5.1 Joint of brick work shall be raked out to a depth of 12 mm at the time of laying and face of brickwork shall be kept clear of all mortar.
- 5.6 Corbelling, Cornices, String Courses
 - 5.6.1 Corbelling shall be effected by 1/4 brick projection for ordinary work and 1/8 brick projection required from consideration of strength.
- 5.7 Reinforcing Anchorage
 - 5.7.1 For external walls, the anchors in the form of flats or rods from spandrel beams and columns and any other anchoring and reinforcement as shown on drawing shall be adequately embedded in the masonry.
- 5.8 Protection of brick work
 - 5.8.1 The brick work shall be protected and covered with gunny bags or water proof sheets from the effects of inclement weather, rain, frost, etc., during the construction and until the mortar sets.
- 5.9 Curing: All brick works shall be kept moist for 10 days after laying.

- 5.10 Brick-on-edge coping, brick paving and cut brick corner: The top course of all plinths, parapets, steps and tops of walls below R.C.C. slabs, beams and paving etc. shall be laid with brick-on-edge, unless specified otherwise. Care shall be taken that bricks forming the top corners and ends of walls shall be properly radiated and keyed into position as specified in IS:2212.

6.0 STONE MASONRY:

6.1 SCOPE OF WORK:

- 6.1.1 The work covered under this specifications consists of supplying and erecting stone masonry walls, compound walls, below plinth etc. with available best quality of stone in strict compliance with this specifications and applicable drawings.

6.2 RANDOM RUBBLE MASONRY (BROUGHT TO COURSES TYPE):

- 6.2.1 This form of stone masonry shall be used in substructure works unless otherwise specified in the drawings.

- 6.2.2 **Material:** The rubble shall be of the best quality gneiss/granite/basalt stones obtained from the approved quarry. The sample of the stone, to be used shall be got approved from the Engineer-in-Charge. All stones shall, generally, be freshly quarried and shall be sound, dense, hard, free from segregation, cracks, weathered portions and other structural defects or imperfections, tending to off set soundness and strength. The percentage of water absorption shall generally not exceed 5% by weight. All stones shall be wetted before use. Stones shall be neatly worked to requisite sections and forms and shall have fully dressed beds and joints. At least 50% of the stones shall be 0.015 cum. in content when reckoned individually. The length of stones for stone masonry shall not exceed three times the height and the breadth or base shall not be greater than three fourth the thickness of wall, or not less than 15 cm. The height of stone may be up to 30 cm. Stones shall be laid on the natural beds and shall run sufficiently inside the wall thickness. No hollow space shall be left out and inter spaces of stones being filled with mortar and stone chips, driven hard and not with mortar only.

- 6.2.3 All mortar to be used shall be of the type and proportion mentioned in the item. Cement, sand and water to be used shall conform to their relevant specifications as described under cement concrete. The masonry shall be laid to plumb, lines levels, curves, shapes as shown in drawings. All required holes for passage of water or pipes are to be embedded during construction as specified.

6.2.4 All stones shall be wetted before laying in masonry. Concrete surfaces of columns, beams, lintels, chajjas etc. coming in contact with masonry shall be properly chipped, washed and wetted before start of masonry work. The concrete surface coming in contact of masonry shall be given a thick coat of cement slurry as the masonry work progresses in height. Clean chips and spawls carefully selected to fit in the space shall be wedged into the mortar joints and beds wherever necessary to avoid thick beds or joints or mortar. However, proper shaping and dressing of stones shall be done prior to their laying in masonry and hammering shall not be resorted to often after the stones are laid in position. The bond stones shall be used in every square meter area of masonry wall and shall extend from front to back to thin walls having width of 600 mm. and shall overlap by at least 150 mm. in walls having thickness more than 600 mm. when laid from both sides. When the work has to be started on the old or the one completed a long while ago or in the previous working seasons, care shall be taken to roughen and clean old surface satisfactorily without disturbing the masonry before laying the new. It shall be wetted before laying the bedding mortar.

6.2.5 When practicable, the whole masonry in any structure shall be carried out upto a uniform level throughout. But when breaks are unavoidable in carrying the work continuously in uniform level, sufficiently long steps shall be left. All junction of walls shall be formed at the time when walls are being built. Cross walls should be carefully bonded into the main walls. All masonry built in cement mortar shall be kept continuously wet for 10 days from the date of laying. Should the mortar perish i.e. becomes dry, white or powder through neglect of watering and if the masonry shows hollow joints or non-adherence of mortar to the stones or if the work does not conform to drawings and specifications, the work shall be pulled down and rebuilt by the contractor at his own cost and risk. All masonry shall be thoroughly cleaned and washed down on completion and all stains, adhering mortar removed from the surface and raking of joints carried out as the scaffolding is being lowered and removed. Holes left in masonry for supporting scaffolding shall be filled and made good before pointing/ plastering.

6.3 **SQUARED RUBBLE MASONRY (COURSED):**

6.3.1 The specifications for squared rubble masonry (coursed) walling shall be generally used in construction of compound walls, stone masonry walls etc. with first and second sort material.

6.3.2 The coursed walling shall be in courses which may vary in height from 100 mm to 300 mm but the stones in any one course are roughly squared to the same height. The faces of the stones may be pitched to give a rock face appearance or may be dressed smooth. The face of the stones shall

be square/ rectangular in shape and shall be so dressed all-round that those can be set on proper bases and shall render uniform joints.

- 6.3.3 For squared rubble (coursed with first sort), face stones shall be hammer dressed for all beds and joints so as to give them approximately rectangular shape. This shall be square on all joints and beds. The bed joints shall be chisel drafted for at least 80 mm back from the face and for the side joints at least 40 mm. No portion of the dressed surface shall show a depth of gap more than 6 mm from a straight edge placed on it. All courses shall be laid truly, horizontal and all vertical joints shall be truly vertical. Quoin stones shall be laid stretchers and headers alternatively and shall be laid square on their beds, which shall be rough chisel dressed to a depth of at least 100 mm.

For squared rubble (coursed with second sort), all requirements are the same as that for coursed rubble masonry with first sort except that no portion of dressed surface of joints shall show a depth of gap more than 10 mm from a straight edge placed on it and use of chips shall not exceed 15% of the quantity of the stone masonry.

6.4 **MODE OF MEASUREMENT:**

- 6.4.1 All stone masonry shall be measured in cubic metres as actually done. All openings for windows, doors, lintels etc. shall be deducted to get the net quantity of actual work done. Openings or chases required for Public Health and electrical inserts less than 0.1 sqm and bearings of precast concrete members shall not be deducted. The unit rate for masonry shall include cost of stones, dressing, mortar, simultaneous flush pointing (as specified in the BOQ), corner stones, bond stones, scaffolding, labour, curing, forming or leaving holes for fixing or building in hold fasts, forming chases and grooves and at operations including tools & appliances of any sort or kind requisite for the completion of the work. etc.

7.0 **DAMP PROOF COURSE (DPC)**

- 7.1 Damp proof course shall be 50 mm thick (unless specified otherwise) consisting of cement concrete in the proportion 1:2:4 (1 cement, 2 sand, 4 stone chips 10 mm down) with admixture of a water proofing compound as approved by the Engineer Incharge. The percentage of admixture shall be as per manufacturer's specification or as per the direction of EIC.
- 7.2 The surface of the brick work/ stone masonry work shall be leveled and prepared before laying the cement -concrete. Edges of DPC shall be straight and even. The side shuttering shall consist of wooden forms

and shall be strongly and properly fixed so that it does not get disturbed during compaction and mortar does not leak through.

- 7.3 The concrete mix shall be of workable consistency and dense. When the side shuttering is removed the surface should come smooth without any honey combing. The top surface shall be double chequered and cured by ponding for at least 7 days. Cement concrete shall be allowed to dry for 24 hours after curing and hot bitumen of grade 80/100 Conforming to IS: 702 at the rate of 1.7 kg/sqm shall be applied over the dried surface of cement concrete properly cleaned with brushes and finally with a cloth soaked in kerosene oil. The bitumen shall be applied uniformly so that no blank spaces are left anywhere.

8.0 PLINTH PROTECTION

- 8.1 Unless otherwise shown on drawing plinths of all buildings shall be protected with 1000 mm wide plinth protection consisting of 50 mm thick PCC M20 grade with 12 mm maximum size aggregate over 200 mm thick stone soling using 40 mm nominal size rammed consolidated & grouted with fine sand.

- 8.2 For the purpose of stone filling, the ground shall be dressed consolidated by ramming or by light rolling & a 12 mm thick cushion of sand be laid. Over this 75 mm thick layer of stone aggregate, with stone size not more than 40 mm, shall be spread uniformly. This shall be then compacted by light roller (by 1/2 ton roller & 4 to 5 passes) or any other means as approved by Engineer Incharge. After compacting, sand shall be uniformly spread & water shall be sprayed over it to ensure that the voids are filled with sand. Water shall be spread in such a manner that bulking in sand does not take place.

- 8.3 This process shall be repeated till the filling reaches the desired level. When it reaches the finished level, surface shall be flooded with water for 24 hours, allowed to dry & then rammed & consolidated to avoid any settlement at a later stage.

- 8.4 Plinth protection shall be laid with a minimum outward slope of 1:50.

9.0 SAMPLING TESTING AND QUALITY CONTROL

9.1 General

- a) The Contractor shall carry out all sampling and testing in accordance with the relevant Indian Standards and/or International Standards and shall conduct such tests as are called for by the Engineer Incharge. Where no specific testing procedure is mentioned, the tests shall be carried out as per the prevalent accepted Engineering practice to the

directions of the Engineer Incharge. Tests shall be done in the field and at a laboratory approved by the Engineer Incharge and the Contractor shall submit to the Engineer Incharge, the test results in triplicate within three days after completion of a test. The Engineer Incharge may, at his discretion, waive -off some of the stipulations given below, for small and unimportant operations.

- b) Material/work found unsuitable for acceptance, shall be removed and replaced by the Contractor. The works shall be redone as per specification requirements and to the satisfaction of the Engineer In charge.
- c) Frequency of sampling and testing shall be as per QAP.

9.4 All masonry shall be built true and plumb within the tolerances prescribed as below.

- a) Deviation in verticality in total height of any wall of a building more than one storey in height shall not exceed ± 12.5 mm.
- b) Deviation from vertical within a story shall not exceed ± 6 mm per 3 m height.
- c) Deviation from the position shown on the plan of any brickwork more than one storey in height shall not exceed 12.5 mm.
- d) Relative displacement between load bearing walls in adjacent storeys intended to be in vertical alignment shall not exceed 6 mm.
- e) Deviation of bed joint from horizontal in any length upto 12 m shall not exceed 6mm, and in any length over 12m it shall not exceed 12.5 mm total.
- f) Deviation from the specified thickness of bed-joints, cross-joints or perpend shall not exceed ± 3 mm.

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AUTOCLAVED AERATED CONCRETE BLOCKS:

These blocks shall be procured from any one of the following makes, m/s Hyderabad Industries Limited, Charminar, Besser concrete. The blocks to be used shall be as conforming to IS 2185 Part-3. The size of the concrete blocks shall be 600x200x230 mm for 230 mm thick wall and 600x200x100 for 100 mm thick wall or as per BOQ. Raw material used for the manufacturing process should have a good recycle content of around 70%. Compressive strength of the block shall be a minimum of 3 N/mm² with good

thermal insulation and sound insulation. Thermal conductivity shall be a minimum of 0.16 W/m-k and should have reduction in emission of CO₂. Autoclaved aerated blocks used shall have a minimum fire resistance of 4 hours. The other specifications regarding construction, testing etc are as specified above for brick work or as per the EIC.

C-10: SOLING & HARDCORE

1.0 SCOPE

- 1.1 The work covered under this specification includes all type of soling work either by rubble stones laid under floors / hard core under foundations, hand packed, complete as per under mentioned specification and applicable drawings.

2.0 RUBBLE STONE SOLING

- 2.1 The rubble stone shall be of best variety of black trap / granite / basalt or other approved variety of stone available locally. The stone shall be hard, durable, free from defects and of required size and shall be approved by the Engineer in-charge before incorporation in the work.

2.2 Preparation of Surface & laying:

- 2.3 The bed on which rubble soling is to be laid shall be cleared of all loose materials, levelled, watered and compacted and got approved by the Engineer In-charge before laying rubble soling. Cable or pipe trenches if shown in the drawing and as required by the Engineer in-charge shall be got done before the soling is started.
- 2.4 Over the prepared surface, the stone shall be set as closely as possible and well packed and firmly set. The stones shall be of full height and shall be laid so as to have their bases of the largest area resting on the sub-grade. Soling shall be laid in one layer of 230mm or 150mm or other specified thickness and no stones shall be less than 230mm or 150mm depth or specified thickness of soling with a tolerance of 25mm.
- 2.5 After packing the stones properly in position, the interstices between them shall be carefully filled with quarry spoils of stone chips of larger size possible to obtain a hard, compact surface. Spreading of loose spoils or stone chips is prohibited.
- 2.6 The entire surface shall be examined for any protrusions and the same shall be knocked off by a hammer and all interstices shall be filled with approved murrum. Excess murrum if any over the surfaces shall be removed. Unless otherwise specified, the murrum shall be supplied by the contractor at his own cost from the selected areas. The surfaces shall then be watered and consolidated with mechanical or sufficiently heavy wooden tampers and log-rammers as approved by the Engineer in- charge to give the

required slope or level and dense sub-base. After compaction, the surface shall present clean look. Adequate care shall be taken by the contractor while levelling and compacting the rubble soling to see that concrete surfaces in contact with soling are not damaged.

3.0 HARD CORE FOR FOUNDATIONS

- 3.1 Where specifically mentioned in the drawings, hard core layer shall be provided as a preparatory surface to receive blinding concrete/ leveling course.
- 3.2 Hard core layer shall comprise of well graded broken stones 80mm nominal size with the following gradation:

IS Sieve designation	% passing
80 mm	100
63 mm	85-100
40 mm	0-30
20 mm	0-5
10 mm	0-5

- 3.3 The hard broken stones layer shall be directly placed over the compacted layer of under lying soil in layers. The stones shall be hand packed and crevices filled with broken stones.
- 3.4 Each layer shall be covered with clean river sand and thoroughly worked into the crevices with a water jet. Additional layers of sand shall be placed on top and worked into the void spaces. The process shall be repeated until no more sand and water get into the voids.
- 3.5 Earth rammer shall be used to compact each layer if directed by EIC.
- 3.6 The thickness and area covered beyond the blinding concrete shall be as indicated in the drawings or as indicated by EIC.

4.0 MEASUREMENT:

- 4.1 The unit rate measurement shall be cubic metre for the specified thickness of rubble soling.

- 4.2 The linear dimensions shall be measured upto two places of decimals of a metre and are worked out correct to the two places of decimals of a cubic metre.
- 4.3 The rate shall include all the materials, labour, preparation of surfaces, watering, consolidation etc.

C-11: SPECIFICATIONS FOR PLASTERING WORK

1.0 SCOPE:

- 1.1 The work covered under this specification consist of supplying all materials and rendering all types of plaster / pointing finishes strictly in accordance with these specifications and applicable drawings etc.

2.0 APPLICABLE CODES & SPECIFICATIONS:

- 2.1 The relevant I.S. specifications, standards and codes given below are made a part of this specification. All standards, specifications, code of practices referred to herein shall be the latest edition including all applicable amendments, revisions and additional publications.

List of Indian Standards:

No.	IS. No.	I.S. Particulars
1	IS. 712	Specification for building limes
2	I.S. 1200 (Part-XII)	Method of measurement of building and civil engineering works. (Plastering & Pointing)
3	I.S. 1661	Code of practice for application of cement and cement finishes.
4	I.S. 2394	Code of practice for application of lime plaster, finish.
5	I.S 2402	Code of practice for external rendered finishes.
6	I.S. 6278	Code of practice for white washing and colour washing

3.0 CEMENT PLASTER WITH NEERU FINISH:

- 3.1 The specifications for cement, sand and water shall generally conform to their relevant specifications described under 'Reinforced Concrete and Allied Works'.
- 3.2 Neeru shall be prepared from best available hydraulic lime slaked with fresh water and sifted. The lime shall be ground fine in a mortar mill and kept moist until used. A sample of lime to be used for neeru shall be produced by the contractor for the approval of Engineer-In-charge. Samples

of lime may be subjected to tests as per relevant I.S. before final approval. All lime/ neeru to be used on the work shall conform to the approved sample. The thickness of neeru coating shall not be less than 1.5mm and not more than 2.5mm.

- 3.3 All junctions of RCC and brickwork (both horizontal as well as vertical) shall be laced with chicken mesh of gauge 22 with a minimum of 150mm overlap on either side completely covering the junction before taking up the plastering work.
- 3.4 Double scaffolding shall be adopted for all plaster work unless permitted to otherwise by the Engineer-Incharge. No holes shall be made in the masonry for supporting the scaffolding.
- 3.5 The scaffolding members shall not be tied to windows or door frames and other members provided in the walls.
- 3.6 The rate for all plaster work shall also include for making good and completing the plaster after the flooring, skirting or dado tiles are laid either by the same or any other agency.
- 3.7 No extra will be paid for making grooves in the internal plaster work.

4.0 **CEMENT PLASTER WITH CEMENT FINISH:**

- 4.1 The specifications for cement, sand and water shall generally conform to their relevant specifications described under 'Reinforced Concrete and Allied Works'.
- 4.2 Cement and fine screened sand shall be thoroughly mixed dry in the proportion specified.
- 4.3 Only minimum water shall then be added and the mortar mixed thoroughly until homogenous and required consistency is obtained.
- 4.4 No more mortar shall be mixed than cannot be used up in half an hour.
- 4.5 The surface to be plastered shall first be thoroughly cleaned and all joints raked out at least 12 mm deep to serve as keys. The raking shall be done carefully and no chipping of the masonry shall be allowed.
- 4.6 All concrete surfaces shall be hacked to provide necessary bonding for the plaster.

- 4.7 All junctions of RCC and brickwork (both horizontal as well as vertical) shall be laced with chicken mesh of gauge 22 with a minimum of 150mm overlap on either side completely covering the junction before taking up the plastering work.
- 4.8 The rate for plaster should include the hacking of surfaces also. All dirt, soot, oil, paint or any other material that might interfere with satisfactory bond shall be removed.
- 4.9 Soft and crumbling brick and stone work, oil soaked material and timber are not suitable for receiving plaster directly and therefore, the surface shall be brushed and washed with fresh water and maintained in a thoroughly wet condition for 24 hours before commencing plastering.
- 4.10 The plastering shall not be commenced until the preparatory work is approved by the Engineer-In-charge.
- 4.11 The cement mortar for the plaster work shall be as specified in the item of schedule.
- 4.12 The plaster shall be applied with some what more than the required thickness and leveled with a wooden trowel so that the final plaster after trowelling will have the specified thickness for concrete and bricks masonry surfaces.
- 4.13 Before the scratch coat hardens, the surface shall be cross scratched to provide mechanical key for the final coat. The cross scratching shall be horizontal as far as possible to aid curing.
- 4.14 The surface shall be kept continuously damp for at least two days immediately following its applications. It shall then be allowed to dry.
- 4.15 Fine sand of approval quality shall be used for finish coat. The finish coat shall be about 5 mm thick or as specified in BOQ.
- 4.16 There shall be at least 3 days interval between application of the first coat an finish coat. Before applying the finishing coat, dampen the first coat evenly by frog spray wherever possible and the coat shall be applied from top to bottom in one operation eliminating joining marks.
- 4.17 The plaster shall be well pressed into the joints and the surface rubbed smooth after floating it with a coat of pure cement.
- 4.18 The use of dry cement shall not be permitted.

- 4.19 All plaster work shall be kept damp continuously for a minimum period of 10 days after the application of finishing coat.
- 4.20 To prevent excessive evaporation of the sunny or windward sides of buildings in hot dry weather, matting or gunny bags should be hung over the outside of the plaster to keep it moist.
- 4.21 Should the plaster crack through neglect of watering or for any other fault of the contractor, the work shall be removed and redone at the contractor's expenses.
- 4.22 Should the contractor fail to water the work to the satisfaction of the Engineer-In-charge, the latter may engage requisite labour to water the work properly at the cost of the contractor.

5.0 WATER PROOF CEMENT PLASTER:

- 5.1 The same specification as detailed for 'Cement Plaster With Cement Finish' shall apply to this plaster also.
- 5.2 However, plaster shall be finished smooth with neat cement and water proofing compound of approved manufacture shall be added in cement mortar @2% by weight of cement or as per manufactures specification.
- 5.3 The waterproofing compound shall have to be supplied by the contractor. No extra shall be paid or mixing the water proofing compound in the mortars as directed.

6.0 SAND FACED CEMENT PLASTER:

- 6.1 Surface preparation shall be done in the same manner as for 'Cement Plaster With Cement Finish'.
- 6.2 Sand faced plaster shall be done in two coats. Backing coat shall be in cement mortar 1:4 and finishing coat shall be in cement mortar 1:3.
- 6.3 The sand to be used for the finishing coat shall be screened to pass through 2.36 mm mesh sieve and all material passing through 1.18 mm mesh sieve shall be eliminated.
- 6.4 The sand shall be thoroughly washed to remove all dust and silt.
- 6.5 The cement and sand shall be mixed dry until the mixture is homogenous and water shall then be added gradually to the required extent,

the mixture being turned over as often as required to produce a homogenous mass of uniform colour.

- 6.6 Backing coat of 12 mm thick with cement mortar 1:4 shall be applied first. Approved water proofing compound @ 2% by weight of cement mortar @2% by weight of cement or as per manufactures specification shall be added in the backing coat.
- 6.7 No extra shall be paid for mixing the water proofing compound in the cement mortar as directed.
- 6.8 The surface shall be made even and uniform by means of wooden floats and roughened with wire brushes to give a good bond to the finishing coat.
- 6.9 The backing coat should then be thoroughly cured for at least 7 days before the finishing coat is taken in hand.
- 6.10 The finishing coat of 8 mm thick in cement mortar 1:3 should then be applied uniformly with wooden float.
- 6.11 The entire surface should then be rubbed with approved sponges to expose the sand grains uniformly and predominantly.
- 6.12 The surface shall be cured again for at least 10 days.
- 7.0 **GROOVES IN SAND FACED PLASTER:**
- 7.1 The horizontal and vertical grooves shall be exactly to the required depth and width as shown in the drawings.
- 7.2 The grooves shall be neatly finished with extreme care.
- 7.3 All horizontal and vertical grooves shall be in perfect straight lines without any break in the continuity.
- 7.4 Only such grooves as specified in the drawing shall be paid for.
- 7.5 The finished external plastered surface shall be subjected to water jet in order to prove the water tightness of the plaster. Any water seepage seen inside the structure further to the test / rains shall be rectified by the contractor at no extra cost.

7.6 MODE OF MEASUREMENT:

7.6.1 The unit of measurement for all the plaster items shall be square metre.

7.6.2 The measurement shall be taken on plastered surfaces as per the provisions of IS 1200.

8.0 ROUGH CAST PLASTER

8.1 MATERIALS:

8.1.1 All materials shall conform to the standards already specified for plaster described above. The preparation of the surface to receive the rough cast plaster shall be as described under sand face plaster. Rough cast plaster shall be carried out in two coats. First coat shall consist of 1 part of cement to 4 parts of clean sand or as specified otherwise. The finished thickness of the first coat shall be 12mm. and shall be laid by throwing the mortar (By using strong whipping motion) on the prepared surface with a trowel in a uniform layer but shall not be smooth. The second coat consists of 1 part of cement and 3 part of 6 mm. to 10 mm down gravel all as approved by the Engineer-in-Charge. The gravel shall thoroughly be got cleaned with water removing all dirt and other organic materials. All these ingredients shall be mixed into a paste which shall be flung upon the first coat with large trowels to form an even protective coat. The second coat must be applied while the first coat is still soft and unset. The thickness of this coat shall be 13 mm. only. Due care shall be taken to avoid concentration of either large size or small size of gravel in one place. A sample of rough cast plaster shall also be got approved by the Engineer-in-Charge as regards the texture etc. before proceeding further with the work. All subsequent work shall generally conform to the approved sample panel. The finished work shall be cured for a minimum period of seven days.

8.1.2 General workmanship, scaffolding, preparation of surface, curing etc. shall conform to the specification already laid down under sand faced plastering.

8.1.3 The contractor shall take special care at the time of plastering or pointing to keep the M.S/ Aluminium window, door / wallspan etc. fixed by other agency in correct shape, position and to cover the same with required hessian cloth/gunny bags to keep away from sprinkling of plasters/paint etc. The damage caused to the above if any, shall be made good by the contractor at his own cost.

8.2 **MODE OF MEASUREMENT:**

- 8.2.1 Area of plastering will be measured net and shall be paid for. The measurement of length of wall plastering shall be taken between walls or partitions (dimensions before plastering shall be taken) for the length and from top of the floor or skirting or dado as the case may be to the underside of ceiling for the height. The measurement shall be as per IS 1200. The rate shall include the cost of finishing all the edges, corners, cost of all materials, labours, scaffolding, transport, curing etc.
- 8.2.2 The rate shall include the cost of finishing all the edges, corners, cost of all materials, labour, transport, scaffolding, curing etc.
- 8.2.3 Groove, if shown in the drawings shall be paid separately according to the relevant item in the schedule of quantities.
- 8.2.4 The rate for plastering should include the cost of work towards the following items for co-ordination with electrical item:
- 8.2.5 Neat plastering around DBs, junction boxes, M.S. boxes etc. should be done and made matching with the wall finish after installation of electrical equipments.
- 8.2.6 All DBs, service boxes, covers etc. should be covered by a plastic cloth or other suitable covering materials such that water or materials should not splash the same during brick work and plastering work. This is to be done in such a way that electrical equipments as well as painted surfaces are not spoiled.
- 8.2.7 For fixing M.S. boxes, DBs etc. Thiyya should be given such that the required face of the MS. box, DB covers etc inline with final finished plastered surface.
- 8.2.8 The rate for the item shall also include rounding up of corner and angles making sharp corners and angles finishing around ceiling rose and electrical fittings etc. fixed by other agencies, finishing of top of dado and skirting (zad finishing), junctions of roof and wall or beam with the finish as specified in the item. Plastering of brick and concrete cornice and copings and plastering in restricted areas, if any, shall not be measured separately. Architectural bands and narrow widths of plaster over structural as well as non-structural and the line when prepared in the same thickness of plaster shall not be measured separately and shall be covered by respective plaster items.

9.0 SPECIFICATIONS FOR RENOVO SYNTHETIC PLASTER

- 9.1 "Renovo" synthetic plaster is based on Synthetic Fibres and Chemicals having acid and alkali resistant properties and UV resistance properties. It is a water-repellent cladding material that shall be used for plastering on external surfaces as shown in the drawings. This shall have resistance to mildew, moss & growth of fungus. The contractor shall procure approved shades of Renovo plaster from approved manufacturer. Synthetic Plaster is water-repellent & is cured by air. The Renovo synthetic plaster of 3mm thickness shall be done over the cement plastered surface.
- 9.2 Renovo synthetic plaster shall be done according to the manufacturer's specifications.
- 9.3 Unit of measurement shall be square metres and measurement shall be in accordance to the provisions of IS 1200.

10.0 SPECIFICATIONS FOR READY MIX PLASTER

- 10.1 The work shall be done according to the manufacturer's specifications & instructions of EIC. General workmanship, scaffolding, preparation of surface, curing etc. shall conform to the specification already laid down under cement plaster with cement finish/ sand faced plastering as applicable.
- 10.2 The measurement shall be as per IS 1200. The rate shall include the cost of finishing all the edges, corners, cost of all materials, labours, scaffolding, transport, curing etc.

C -12: SPECIFICATIONS FOR FLOORING

- 1.0 This specification covers furnishing, installation, finishing, curing, testing, protection, maintenance till handing over various types of floor finishes and allied items of work.

2.0 GENERAL

- 2.1 **Base:** The base to receive the finish is either by formed concrete sub covered under other relevant specifications.

2.2 Sequence

Commencement, scheduling and sequence of the finishing works shall be planned in detail and must be specifically approved by the Engineer-in-Charge in view the activities of other agencies working in that area. However, the Contractor for the finishing items shall remain fully responsible for all normal precautions and vigilance to prevent any damages whatsoever till handing over.

- 2.3 Only workers specially experienced in particular items of finishing work shall be engaged; where such workers are not readily available, with the EIC permission, experienced supervisors recommended by the manufacturer shall be engaged. In particular case where the EIC so desire, the Contractor shall get the finishing items installed by the manufacturer.

- 2.4 The surface to be treated shall be thoroughly examined by the Contractor. Any rectification necessary shall be brought to the notice of the Engineer-in-Charge and his approval shall be obtained regarding method and extent of such rectification work. For all types of flooring, skirting, dado and similar works, the base to receive the finish shall be adequately roughened by chipping, raking out joints and cleaning thoroughly all dirt, grease etc., with water and hard brush and detergent if required, unless otherwise directed by the manufacturer of any special finishing treatment, the base shall be thoroughly soaked with water and all excess water mopped up. The surface shall be done dry where adhesive are used for fixing the finishes. Prior to commencement of actual finishing the approval of the Engineer-in-Charge shall be taken as to the acceptability of the surface.

2.5 CODES AND STANDARDS

- 2.5.1 All applicable standards, acts and codes of practice referred to shall be the latest editions including all applicable official amendments and revisions. A complete set of all these documents shall generally be available at site, with the Contractor.
- 2.5.2 In case of conflict between this specification and those (IS Standards, Codes etc.) referred to in clause 3.3.0 the former shall prevail.
- 2.5.3 Some of the applicable Indian standards, Codes, etc. are referred to here below:

No.	I.S. No.	I.S. Particulars
1	I.S. 1200 (Part XI)	Method of measurements building and civil engineering work
2	IS 1237	Specification for Cement concrete flooring tiles
3	IS 1443	Code of practice for laying and finishing of cement concrete flooring tiles
4	IS 2114	Code of practice for laying in situ terrazzo floor
5	IS 2571	Code of practice for laying flooring
6	IS 5318	Laying of flexible sheet and tile flooring
7	IS 4441	Code of practice for use of silica type chemical resistant mortar
8	IS 4457	Specification for Ceramic unglazed vitreous acid resistant tiles.
9	IS 13753	Specification for dust pressed ceramic tiles with water absorption of $E > 10\%$ Group (BIII)
10	IS 13753	Specification for dust pressed with water absorption of $6\% < E < 10\%$ Group (B II b)
11	IS 13753	Specification for dust pressed ceramic tiles with water absorption of $3\% < E < 6\%$ Group (B II a)
12	IS 13753	Specification for dust pressed ceramic tiles with low water absorption of $E < 3\%$ Group (B I)
13	IS 1200	Specification for dust pressed ceramic tiles with low water absorption of $E < 3\%$ Group (B I)
14	IS 1130	Specification for marble (Block, slab & tiles)

2.6 **MATERIALS**

2.6.1 Materials required for individual finishing items are specified under respective items. In general, all such materials shall be as per relevant IS Codes where available. In all cases these materials shall be of the best quality available indigenously unless specified otherwise.

2.6.2 The materials for finishing items must be procured from well-reputed specified manufacturers and on the basis of samples approved by the Engineer-in-Charge. The materials shall be ordered, procured and stored well in advance to

avoid compulsion to use substandard items to maintain the construction schedule.

3.0 KOTA STONE FLOORING:

- 3.1 Kota stone shall be of best quality and of thickness specified and obtained from approved sources. Kota stone shall be of sizes stipulated in the items of schedule of quantities.
- 3.2 The stone shall have to be machine cut/ hand cut as specified and double machine polished wherever required as per item. The edges to be pointed shall be true to line and dressed to the depth all around.
- 3.3 The stones shall be hard, sound, free from cracks, veins and other defects and of uniform colour.
- 3.4 The sample of stone shall be submitted for approval of Engineer-In-charge and all the stones incorporated in the work shall conform to the approved samples.
- 3.5 Before laying the flooring, surface to be paved shall be thoroughly hacked, cleaned of all mortar scales, concrete lumps, loose materials etc. Unless and until the surface is approved by the Engineer-In-charge the paving shall not be taken in hand.
- 3.6 If found necessary, the permission shall be given by the Engineer-In-charge to dress the stone at site.
- 3.7 A bedding of average 20 mm to 25 mm thick cement mortar (1:4) with the minimum thickness at any place under the slab not less than 13mm or as per BOQ; shall be laid evenly and to the required slope as directed. The stones shall then be truly and evenly set in a thin paste of neat cement applied to sides, bottom and to the prepared base. The stone shall then be tamped down with wooden mallet until they are exactly in true plane and line with the adjacent stone.
- 3.8 All stones shall be extended up to the masonry wall and under side of the plaster. The stone shall be dose jointed and joints shall be as thin as possible.
- 3.9 The cement that oozes out through the joints to the surface shall be immediately wiped clean. The joints shall then be fitted with matching cement and finished neatly.

3.10 The entire surface of flooring shall be re-polished with machine to the satisfaction of the Engineer-In-charge. The edges of stones wherever exposed shall be machine cut.

3.11 The flooring shall be cured for 7 days.

4.0 **KOTA STONE SKIRTING:**

4.1 They shall be laid against a bedding of cement mortar 1:3 to the full height to a true plane, level and plumb. The workmanship shall be similar to flooring.

4.2 The skirting shall be laid projected beyond the finished plastered surfaces as directed.

4.3 The continuous horizontal grooves at the top of skirting shall be provided if specified in the drawing or as directed by the Engineer-In-charge. No extra will be paid for grooves.

4.4 The skirting surfaces shall be re-polished with hand to satisfaction of the Engineer-In-charge.

4.5 The skirting shall be cured for 7 days.

5.0 **KOTA STONE SILLS AND COPING AND COUNTER TOPS:**

5.1 The stones shall be cut to the required size as approved by the Engineer-In-charge. The stones shall have to be machine cut and double machine polished wherever specified. The edges to be pointed shall be true to line and dressed to the required depth all around.

5.2 All the exposed edges shall be neatly polished to give a neat appearance.

5.3 These items shall be laid on a bedding of 20 mm thick cement mortar 1:4 to a true plane, level or slopes all as per relevant drawings.

5.4 The workmanship shall be similar to Kota stone flooring described above. The sills and copings should project beyond the finished plastered surface as show in drawing.

5.5 Continuous horizontal grooves wherever specified shall be provided as per drawings and quoted rate is deemed to included for the same.

5.6 The surface shall be re polished with hand to entire satisfaction of the Engineering-In-charge. The entire work shall be cured for 7 days.

6.0 KOTA STONE CLADDING:

- 6.1 Only approved quality, size and colour machine cut and machine polished Kota stone 40 mm thick (or as specified in the BOQ) and 100 mm wide shall be used.
- 6.2 Maximum thickness of joints shall be 15 mm thick for horizontal as well as vertical and the joints shall be filled with cement mortar 1:4,
- 6.3 Vertical joints shall be staggered and both vertical and horizontal shall be finished by making 15 mm x 15 mm grooves.
- 6.4 Brass clamps and pins of approved quality size and make shall be provided at the meeting of two horizontal Kota stone slabs both way horizontally and vertically staggered @ one number per square metre.
- 6.5 Curing of the joints shall be done with clean water for a minimum period of 10 days.
- 6.6 The rate shall be inclusive of cost of material, double scaffolding if required, laying, finishing, making grooves, curing and cleaning of spashes on kota stones.

7.0 KOTA STONE TREADS / RISERS:

- 7.1 The specifications mentioned for Kota stone flooring shall be generally applicable for this item.

8.0 MODE OF MEASUREMENT:

- 8.1 Unit of measurement shall be square metre.
- 8.2 Measurement for flooring shall be for the actual area covered from face of skirting.
- 8.3 Deduction will be made for columns, projections, equipment foundations, trenches, openings etc.
- 8.4 Measurement shall be for the actual area of skirting, dado, sills, coping etc. and deduction shall be made for the areas not covered by these.

**9.0 TANDUR STONE/CUDDAPPA STONE/POLISHED SHAHABAD
STONE STONE FLOORING / SKIRTING / DADO:**

The specifications for Tandur, Cudappa and polished Shahabad stone flooring / skirting / dado shall be similar to those respecting specifications for Kota stone flooring / skirting / dado specified herein before in all respects.

**10.0 GRANITE STONE FLOORING. TREADS, RISERS, SILLS,
CLADDING, DADO**

10.1 GRANITE STONE SLABS:

10.1.1 The colour and quality of granite slabs shall be of the kind of granite specified in item/drawings/as directed by the Engineer-in-charge. The granite from which the slabs are made shall be of selected quality, hard, sound, dense and homogenous in texture, free from cracks, decay, weathering and flaws. Before starting the work, the contractor shall get the samples of granite slabs approved by the Engineer-in-charge. All slabs which go into the work shall strictly conform to the samples, failing which the entire materials are likely to be rejected.

10.1.2 The slabs shall be machine polished and machine cut to the dimensions specified in items of schedules of quantities/drawings and as directed by the Engineer-in-charge.

10.3 DRESSING OF SLABS:

10.3.1 Every stone shall be cut to the required size as per the drawings or as directed by the Engineer-in-charge and shape, fine dressed on all sides to the full depth so that a straight edge laid along the side of the stone is full in contact with it. The top surface shall also be fine dressed to remove all waviness. The top surface of slabs shall be machine polished and exposed edges machine cut, or as specified in the item and as directed by the Engineer-in-charge. All visible angles and edges of the slabs shall be true, square or as required, and free from chippings and the surface shall be true and plane.

10.3.2 The thickness of the slabs shall be specified in the description of item. The minimum size of stone to be used for various items shall be as mentioned in the schedule of quantities/drawings of this tender. Granite stones of approved smaller sizes other than mentioned in the schedule of quantities, if required for bands, borders, flooring etc. shall be provided and laid as directed by the Engineer-in-charge.

- 10.3.3 Any opening of required size and shape at any desired place in flooring, bands, borders etc. shall be made in such a way that granite bounded by number of granite stones/slabs. No broken or defaced stone shall be permitted in the work.

10.4 **BEDDING/BACKING MORTAR:**

- 10.4.1 The bedding/backing shall be of cement mortar/lime mortar of mix and thickness as specified in the description of the item.
- 10.4.2 Mixing: The mixing of mortar shall be done in mechanical mixer or hand mixing as specified/as directed by the Engineer-in-Charge.
- 10.4.3 Mixing in Mechanical Mixer : Cement and sand in the specified proportion shall be mixed dry thoroughly in a mixer. Water shall then be added gradually and wet mixing continued for at least one minute. Care shall be taken not to add more water than that which shall bring the mortar to the consistency of stiff paste.
- 10.4.4 General : Mortar shall be used as soon as possible after mixing and before it has begun to set, and in any case within 30 minutes after the water is added to the dry mixture. Mortar unused for more than 30 minutes shall be rejected and removed from the site of work immediately.
- 10.4.5 Mixer shall be cleaned with water each time, before suspending the work.
- 10.4.6 Hand Mixing: If approved by Engineer-in-Charge, hand mixing shall be allowed. The measured quantity of sand shall be levelled on clean masonry platform and cement bags emptied on top. In hand mixing, the quantity of cement shall be increased by 5% over the approved constant, with no extra cost to the owner. The cement and sand shall be thoroughly mixed dry by being turned over and over, backwards and forwards, several times till the mixture gives an uniform colour. The quantity or dry mix which can be used within 30 minutes shall then be mixed on masonry through with just sufficient quantity of water to bring the mortar to the consistency of stiff paste.

10.5 **LAYING - FLOORING:**

- 10.5.1 Before laying the cement mortar bedding/backing, the concrete/brick, floor/wall surfaces shall be thoroughly hacked, cleaned of all mortar scales, concrete lumps etc., brushed, washed with water to remove mud, dirt etc. from the surface and shall be thoroughly wetted. Until and unless the surface is approved by the Engineer-in-Charge, the flooring shall not be started. A

bedding of cement mortar of 20 mm. average thickness with the minimum thickness at any place under the slab not less than 13mm or as per BOQ. shall be laid evenly and to the required slopes as directed / specified. The granite slabs shall be thoroughly washed and cleaned and then be laid on the bedding/ backing with cement floating at the rate of 4.39 kg./sqm. All slabs shall be truly and evenly set in a thick cement slurry or paste like consistency applied to the sides and bottom and over the prepared base. The slabs shall then be tamped down with a wooden mallet until they are exactly in true plane and true with adjacent slabs. All slabs shall be extended upto the unplastered surface of masonry walls/RCC columns/RCC walls. The slabs shall be close jointed in matching cement slurry and the cement slurry coming out through the thin joints shall be immediately wiped clean. The grains of granite stone shall be matched as shown in drawing or as directed by the Engineer-in-Charge. All slabs shall be so laid as to have continuous lines from various rooms to the corridors. No change of lines shall be

permitted at junction between rooms and corridor, if the same flooring is specified in both the places.

10.6 GRANITE SILLS, TREADS ETC.

10.6.1 Granite stone for sills shall be of approved quality. Dressing of stone slab, mortar mix. for bedding/backing, laying etc. shall be similar to as described above as far as applicable. Granite slabs of specified thickness and width shall only be provided. The length of the each slab required for the sill shall be of the pattern which shall coincide with the lines of the mullions of windows where it is laid or as directed by the Engineer-in-Charge. Normally it shall not be less than 1.0 m. length.

10.6.2 GRANITE STONE DADO & CLADDING:

10.6.3 Only machine cut and machine polished granite stone will be used. Brass cramps and brass pins of approved quality, size and make shall be provided. The brass pins shall be provided at the meeting of two granite slabs both ways horizontally and vertically. The brass cramps shall be provided at the places approved by the Engineer-in-Charge. Granite to be used shall be of approved size, colour, type of veins and laid as specified in schedule of quantities or to the pattern shown in drawings or as directed by the Engineer-in-Charge. Laying of granite stone shall be similar as stated above as far as applicable.

10.7 POLISHING AND FINISHING

10.7.1 The polishing and finishing shall be carried out in the similar manner as specified under the chapter "TERRAZZO/CEMENT TILES FLOORING, SKIRTING/DADO ETC." as far as it is applicable.

10.8 MEASUREMENT:

- 10.8.1 Granite stone flooring, sills, treads, risers, dado cladding etc. shall be measured in square metre correct to two places of decimal. The length and breadth shall be measured between the finished faces correct to two places of decimal of metre. No deduction shall be made nor extra paid for any opening of area upto 0.05 sqm. Nothing extra shall be paid for working at different levels.

NOTE : Wastage in granite slab cutting to get the required dimensions, as specified in drawing or as directed by the Engineer-in-Charge shall be deemed to be considered by the contractor while quoting the rate for work. The work shall be measured as above and no extra claim will be entertained on this account.

10.9 RATE

The rate shall include the cost of all materials, transport tools, plants, scaffolding and labour involved in all operations described above.

11.0 TERRAZZO / PLAIN TILE FLOORING, SKIRTING, TREADS & RISERS

11.1 SCOPE

- 11.1.1 The work covered under this specification consists of providing and laying at all levels and floors terrazzo tiles in flooring and skirting in accordance with these specifications and relevant drawings.

11.2 APPLICABLE CODES & SPECIFICATIONS:

- 11.2.1 The relevant IS. Specifications, standards and codes given below are made a part of this specification. All standards, specifications, code of practices referred to herein shall be the latest edition including all applicable amendment, revisions and additional publications.

List of Indian Standards

No.	I.S. No.	I.S. Particulars
1	I.S. 1130	Specification for marble (Block, slab & tiles)
2	I.S. 1200	Method of measurement building and civil

	(Part-XI)	engineering work (paving, floor finish, dado and skirting).
3	IS. 2114	Code of practice for laying in-situ terrazzo floor finish.
4	IS. 1237	Specifications for cement concrete flooring tiles
5	I.S. 1443	Code of practice for laying and finishing of cement concrete flooring tiles

11.3 TERRAZZO TILE FLOORING:

- 11.3.1 Terrazzo tiles shall be of size specified in the item, hydraulically pressed and shall be of best quality obtained from approved manufacturers. The tiles shall be uniform in size, true and square, free from twist, cracks, depressions or any other defects. The wearing surface of the coloured terrazzo tiles shall consist of coloured terrazzo finish of not less than 7 mm thickness using marble chips of best available variety. The tiles shall be perfectly smooth finished and machine polished on the wearing surface and roughened or keyed on the bedding face.
- 11.3.2 The design and shade of the tile shall be as approved by the Engineer- In-charge. Samples of different varieties of tiles shall be first submitted to the Engineer-In charge and got approved by him prior to placing the order for bulk supply. All tiles which go into the work shall strictly conform to the sample approved by the Engineer-In-charge, failing which the entire material is likely to be rejected.
- 11.3.3 Before laying the cement mortar bedding, the concrete floor surface shall be thoroughly hacked, cleaned of all mortar scales and concrete lumps etc. and washed to remove mud, dirt etc. from the surface and shall be thoroughly wetted. Unless and until the surface is approved by the Engineer-In-charge the flooring work shall not be started. A bedding of cement mortar (1:4) and of minimum thickness 30mm or as specified in BOQ shall then be laid evenly and to the required slope as directed. The terrazzo tiles shall then be laid on the bedding with cement floating. All tiles shall be truly and evenly set in a thick slurry of neat cement applied to the sides and bottom and over the prepared base. The tiles shall then be tamped down with a wooden mallet until they are exactly in true plane and line with the adjacent tiles, all tiles shall be extended up to the masonry wall and underside of plaster. The tiles shall be close jointed and the cement slurry oozing out through the thin joints shall be immediately wiped clean. The joints shall then be pointed with matching cement and finished neatly.

- 11.3.4 The flooring shall be kept wet and protected for at least 15 days before starting of polishing. When the flooring is ready for polishing the joints shall be rubbed with carborundum stones so that slight projections or edges rising above the surface are leveled properly. The entire flooring shall be machined polished in 3 stages with different grades of polishing stones in the machine. The finished flooring shall be perfectly smooth, uniform and with luster on the surface. The polishing treatment shall also include a coat of grouting of tiles with matching cement after the first stage of polish. After the final polish oxalic acid crystals ground into powder shall be dusted over the surface at the rate of 32.5 gm/m² sprinkled with water and rubbed hard with a pad of woolen rags by means of polishing machine. The finished floor shall give a uniform shade of tiles and any defective tiles or scratches in tiles etc. are observed the same shall be made good at contractor's own cost.

11.4 **TERRAZZO TILE SKIRTING**

- 11.4.1 Terrazzo tiles in skirting shall be of 15 mm thick and of specified sizes in the item hydraulically pressed and shall be obtained from the same source as for the terrazzo tiles for flooring. The design, shade and tile joints of the skirting tiles shall be exactly similar to that of the flooring tiles. The specifications for materials and workmanship shall be same as for flooring except that the skirting tiles shall be laid against the fresh roughened plaster using tile fixing adhesive of approved make and as per manufacturer's specification. The skirting tiles shall be in true plane, level and plumb. The skirting shall be laid projected beyond the finished plastered surfaces. The continuous horizontal grooves at the top of the skirting shall be provided if required as per drawing or as directed by the Engineer-In-charge. No extra will be paid for such grooves.

- 11.4.2 The skirting shall be cured for 7 days.

- 11.4.3 The skirting shall be polished with hand to attain the same finish as for the flooring.

11.5 **TERRAZZO TILE TREADS & RISERS:**

- 11.5.1 The specifications mentioned for Terrazzo stone flooring shall be generally applicable for this item.

11.6 **MODE OF MEASUREMENT:**

- 11.6.1 Measurement for flooring shall be clear distance between the finished (skirting) surfaces. Deduction shall be made for columns, projections,

equipment foundations, trenches, openings etc. Unit of measurement shall be square metre.

- 11.6.2 The measurement shall be the actual area of skirting, dado etc. and deduction shall be made for the areas not covered by the same. Unit of measurement shall be square metre.

11.7 PLAIN CEMENT TILE FLOORING & SKIRTING

- 11.7.1 The specifications, mode of measurements etc. in respect of terrazzo tiles in flooring and skirting shall be applicable in general to plain cement tiles except that no marble chips & white cement shall be used in tile manufacture.

12.0 CHEQUERED TILES IN STAIR TREADS AND LANDINGS

12.1 SCOPE OF WORK:

The work envisaged under these specifications consists of supplying and laying chequered cement tiles in the treads of staircase steps and over landings.

12.2 MATERIALS:

Chequered Tiles: The size of tiles including nosing shall be as shown in drawing and shall have the thickness not less than 28 mm or as specified.

The nosing edge of the tile shall be rounded and the front portion of the tiles for a minimum length of 75 mm. from and including the nosing shall have grooves running parallel to the nosing and at centres not exceeding 25 mm. Beyond that the nosing tiles shall have normal chequered pattern, centre to centre distance being not less than 25 mm. and not more than 50 mm. The nosing shall have the same wearing layers as the top portion of the tile.

The overall thickness of the tile as mentioned earlier shall not be less than 28 mm, or as specified with the top layer measured from the top of the chequers which shall not be less than 6 mm. The tiles shall be given the first grinding before delivery to site. The tiles shall conform to the specification for terrazzo tiles/cement tiles, in respect of method of manufacture and the mix of the backing and wearing layers, as specified in the item.

12.3 PREPARATION OF SURFACE AND LAYING:

The method of preparation of surface and laying shall generally be similar to as specified herein before under terrazzo tile flooring.

12.4 CURING, POLISHING AND FINISHING:

The specifications shall be the same as specified herein before under terrazzo tile flooring except that polishing of the treads nosing and chequered grooves, after laying shall be done by hand. Special care shall be taken to polish the nosing and the grooves in such a manner as to get a uniform erection for the grooves and the nosing and their finish shall match with the finish of the flat portion of the tiles.

12.5 MODE OF THE MEASUREMENT:

Length shall be measured from finished face of skirting, dado or wall plaster correct to a centimetre and the width shall be measured from the outer edge of the tread to the finished face of riser. In the case of tiles laid over the landing, the mode of measurement shall be as per terrazzo tiles specifications. The area shall be in square metres correct to two places of a decimal. The rate shall include the cost of all materials and labour, transport, scaffolding etc. required in all the operations described above.

13.0 CERAMIC TILE FLOORING AND DADO (INCLUDING ANTI-SKID, VITRIFIED):

13.1 SCOPE

13.1.1 The work covered under this specification consists of providing and laying at all levels and floors ceramic tiles in flooring, skirting and dado in accordance with these specifications and relevant drawings.

13.2 APPLICABLE CODES AND SPECIFICATIONS:

13.2.1 The relevant IS. specifications, standards and codes given below are made a part of this specification. All standards, specifications, code of practices referred to herein shall be latest edition including all applicable amendments, revisions and additional publications.

13.2. The tiles shall conform to the relevant standards in all respects. Samples of tiles shall be got approved from the Engineer-in-charge before bulk procurement for incorporation in the work.

No.	I.S. No.	IS. Particulars
1	I.S. 777	Specification glazed earthen ware wall tiles.

2	I.S. 1200 (Part-XI)	Method of measurement building and civil Specification glazed earthen ware wall tiles.
3	I.S. 13753	Specification glazed earthen ware wall tiles.
4	I.S. 13754	Specification glazed earthen ware wall tiles.
5	I.S. 13755	Specification glazed earthen ware wall tiles.
6	I.S. 13756	Specification glazed earthen ware wall tiles.

13.2.1.

MATERIALS:

Vitrified Tiles: The tiles shall be of approved make like Marbonite / Granamite or equivalent and shall generally conform to the approved standards. They shall be flat and true to shape, free from cracks, crazing spots, chipped edges and corners. Unless otherwise specified, the nominal sizes of tiles shall be as under: The tiles shall be square or rectangular of nominal sizes such as: 600 x 600 mm; 900 x 900 mm or as per tender schedule / drawings or as directed by the Engineer-in-Charge. Thickness shall be as per recommendations of the approved manufacturers.

Technical specifications of the tiles shall be generally conforming to the following standards:

TECHNICAL SPECIFICATIONS FOR VITRIFIED TILES

NO	PROPERTY	EXPECTED STANDARDS
1	Deviation in length	(+/-) 0.6%
2	Straightness of sides	(+/-) 0.5%
3	Rectangularity	(+/-) 0.6%
4	Surface flatness	(+/-) 0.5%
5	Water absorption	< 0.5%
6	Mohrs. hardness	> 6
7	Flexural strength	> 27 N/mm ²
8	Abrasion resistance	< 204 mm ²
9	Skid resistance (friction coefficient)	> 0.4
10	Glossiness	Min 85% reflection

13.3 CERAMIC TILE FLOORING (INCLUDING ANTI-SKID, VITRIFIED):

13.3.1 Ceramic tiles shall be of specified size, best quality and of approved make and colour.

- 13.3.2 All the material shall be obtained from one source only. The tiles shall be sound hard well and evenly glazed, free from twist and with fine and sharp edges.
- 13.3.3 Specified makes of tiles shall be brought for the approval and samples of tiles shall be first got approved by the Engineer-In-charge and all the tiles which shall be used in the work shall strictly conform to the approved sample otherwise all the tiles will be rejected.
- 13.3.4 The surfaces where the tiles are to be laid shall be thoroughly hacked, joints of masonry raked, cleaned of all mortar scales, concrete lumps, loose materials etc. and washed to remove mud, dirt etc. from the surfaces.
- 13.3.5 Unless and until the surface is approved by Engineer-In-charge, laying of tiles in flooring or dado shall not be started.
- 13.3.6 The prepared surface shall be thoroughly drenched with water. The glazed tiles and all specials shall be soaked in water for a minimum period of 6 hours before use.
- 13.3.7 A bedding of cement mortar (1:3) and minimum 35mm thickness or as specified for flooring shall be laid evenly to levels or slope as directed so as to keep the top level flush with adjacent flooring generally.
- 13.3.8 The glazed tiles shall then be laid on the bedding with a backing of thin cement paste as per item. All tiles shall be truly and evenly set and pressed in position to obtain uniform plane surface. The tiles shall be close jointed and all joints shall be uniform and run in perfect straight lines. The joints shall be staggered or continuous as directed.
- 13.3.9 The other specials like corner edges, elephant feet, bull eyes etc. shall be used at the proper place wherever required and as directed.
- 13.3.10 The entire finished surface shall thoroughly be cleaned to remove all cement stains etc.
- 13.3.11 The joints shall be then pointed with a neat cement of matching colour.
- 13.3.12 The flooring shall be kept wet for 7 days.
- 13.3.13 The flooring shall be thoroughly cleaned with suitable hydrochloric acid before handing over.
- 13.4 **DADO:**

- 13.4.1 The prepared surface shall be plastered with cement mortar(1:3) to get a backing of 15mm thick or as specified. The tiles shall be fixed with tile fixing adhesive mixed with cement paste as per the manufacturer's specifications or as per item. The plastered surface shall be even, uniform and true to plumb.
- 13.4.2 The glazed / ceramic tiles shall be fixed in position with a backing of cement paste.
- 13.4.3 The specifications for workmanship regarding joints, specials, cleanings, paintings, curing etc. shall be exactly similar to ceramic tile flooring.

13.5 MODE OF MEASUREMENT:

- 13.5.1 Length and breadth of flooring shall be measured correct to a centimeter before laying skirting, dado or wall plaster.
- 13.5.2 In flooring, wherever coves are used at the junctions, the length and breadth shall be measured between the lower edges of the coves.
- 13.5.3 No deductions shall be made for opening not exceeding 0.2 square metre.
- 13.5.4 Length and height of skirting/ dado shall be measured along the finished face of the skirting/ dado correct to a centimeter.
- 13.5.5 In case of skirting, height shall be measured correct to 5 mm.
- 13.5.6 The area of flooring / skirting / dado shall be calculated in square metre correct to two places of decimal.
- 13.5.7 The rates shall include the cost of all material and labour involved in all the operations described above.

14.0 CEMENT CONCRETE FLOORING (IPS)

14.1 SCOPE

- 14.1.1 The work covered under this specification consists of providing and laying at all levels and floors cement concrete (IPS) flooring in accordance with these specifications and relevant drawings.

14.2 APPLICABLE CODE & SPECIFICATIONS:

- 14.2.1 The relevant I.S. specifications, standards and codes given below are made a part of this specification. All standards, specifications, code of

practices referred to herein shall be the latest edition including all applicable amendment, revisions and additional publications.

14.2.2 List of Indian Standards

No.	I.S. No.	I.S. Particulars
1.	I.S. 1200 (Part XI)	Method of measurement of building and Civil engineering works
2.	I.S. 2571	Code of practice for laying in-situ cement

14.3 **CEMENT CONCRETE FLOORING:**

- 14.3.1 The specifications for cement, sand and aggregate etc. shall be same as stated for reinforced concrete work.
- 14.3.2 The concrete flooring shall be 50 mm thick with plain concrete mix of proportion as specified.
- 14.3.3 The sand shall be screened and thoroughly washed to remove all dust and silt.
- 14.3.4 The coarse aggregate shall be of approved quality, well graded and shall not exceed 16 mm size. The coarse aggregate shall be also washed thoroughly to remove all dust and dirt.
- 14.3.5 The surface to be paved shall be thoroughly hacked, cleaned of all mortar, loose materials etc. and washed to remove the mud and dirt from the surface. Unless and until the surface is approved by the Engineer-In-charge, the paving shall not be started.
- 14.3.6 The surface to be paved shall then be wetted for at least 24 hours before the paving is taken in hand. Before placing the concrete for flooring, neat cement slurry shall be thoroughly brushed into the prepared surface of the base concrete just ahead of the finish.
- 14.3.7 Only minimum quantity of water required for mixing and making concrete workable shall be used and the paving consolidated thoroughly by compacting with heavy wooden battens.
- 14.3.8 The surface shall be trowelled smooth without using any extra cement, either dry or in the form of slurry. The trowelling shall be continued until moisture ceases to exude from the mass.
- 14.3.9 The paving shall be cured for at least 15 days and it shall be protected during this period with hessian or other suitable material / means which will not stain the surface.

- 14.3.10 The laying and finishing shall conform to I.S. 2571 (Bonded floor finish- Clause 5.1.2).
- 14.3.11 The paving shall be laid in alternate bays of size 1.5 x1.5 m with aluminium dividing strips of specified size. The form work required for setting the bays shall not be paid extra.
- 15.0 **MODE OF MEASUREMENT:**
- 15.1 Measurement for flooring shall be for the actual area covered between the faces of skirting.
- 15.2 Deductions will be made for columns, projections, equipment foundation, trenches, opening etc.
- 15.3 Unit of measurement will be square metre.
- 16.0 **IRONITE (OR HARDONATE) FLOORING**
- 16.1 **GENERAL**
- 16.1.1 To withstand heavy wear and tear, concrete flooring with metallic concrete hardening compound such as Ironite/ hardonate shall be laid as wearing layer as detailed below:
- 16.2 **METALLIC CONCRETE HARDENING COMPOUND:**
- 16.2.1 The metallic compound shall be Ironite/ Hardonite of approved quality consisting of uniformly graded iron particles, free from non-ferrous metal particles, oil, grease and soluble alkaline compound.
- 16.3 **CEMENT CONCRETE UNDER LAYER:**
- 16.3.1 Cement concrete flooring of specified thickness and mix shall be laid as specified and generally conforming to specifications laid down for cement concrete flooring. The top surface shall be roughened with brushes while the concrete is still green and the form shall be kept projecting up 12 mm. over the concrete surfaces, to receive the metallic hardening compound topping.
- 16.4 **METALLIC CONCRETE HARDENER TOPPING:**
- 16.4.1 This shall consist of 12mm. thick layer of mix 1:2 (1 part of cement mixed with hardener: 2 parts of stone aggregate of 6 mm. nominal size by volume). The metallic concrete hardener compound being mixed with

cement in the ratio of 1:4 (1 metallic concrete hardener: 4 cement used by weight) or as specified by the manufacturer. Concrete hardener shall be dry mixed thoroughly with cement on a clean dry pucca platform. This dry mixture shall then mixed with stone aggregate 6mm. nominal size or as otherwise specified in the ratio of 1:2 (1 cement mixed with hardener: 2 stone aggregate) by volume, and well turned over. Just enough water shall then be added to this dry mix as required for floor concrete, water cement ratio not exceeding 04.

- 16.4.2 The mixture so obtained shall be laid in 12mm. thickness, on cement concrete floor within 1 to 4 hours of its laying. The topping shall be laid true to provide a uniform and even surface. It shall be firmly pressed into the bottom concrete so as to have good bond with it. Manual compaction will not be permitted unless approved by the Engineer-in charge. After the initial set has started, the surface shall be finished smooth and true to slope with steel floats.

16.5 **CURING, PRECAUTIONS, MEASUREMENTS ETC**

- 16.5.1 Specifications for curing, precautions, quantity measurements etc. shall be same as specified for cement concrete flooring.

17.0 **ACID RESISTANT FLOORING & SKIRTING**

17.1 **MATERIALS:**

- 17.1.1 Acid resistant stones shall be of best quality and obtained from approved sources, all stones shall be of the same shade and uniform colour. The stones shall be of 20 mm thick for flooring and 12 thick for skirting and dado and shall be of size 200 mm X 200 mm for flooring and 200 mm X 200 mm for skirting or as per drawing and schedule. The stones shall have to be machine cut and double machine polished. The edges to be pointed shall be true to line and dressed to the full depth all round. The stones shall be hard, sound free from crooks, veins and other defects and shall withstand dilute 30% and concentrated 60% nitric acid without any pitting of the surface. In case acid resistant stones are available in different shade, the sample shall be submitted for approval of the Engineer-in-Charge.

- 17.1.2 Before laying the flooring and skirting, the surface to be paved shall be thoroughly hacked, cleaned of all mortar scales, concrete lumps, loose materials, dust and dirt etc. The surface shall be entirely dry and rough. Unless and until the surface is approved by the Engineer-in- Charge, the paving shall not be taken in hand. After thorough cleaning with wire brush etc., the entire surface shall be treated with two coats of bitumen of 30/40 grade.

17.1.3 The mix for the under bed and joint filling mortar resistant type conforming to IS: 4441. The laying shall be done by approved specialist agency as per recommendation of manufacturer

17.1.6 **Codes and Standards :**

The tiles shall conform to IS 4457 and the chemical mortar shall conform to IS 4441.

17.2 **MEASUREMENTS:**

17.2.1 Measurements for flooring shall be taken between the finished (plasterd) surface, deductions shall be made for columns projections, equipment foundations, trenches, openings, etc. Unit of measurement shall be on square meter basis.

17.2.2 Acid resistant stones in skirting and dado shall be laid against a bedding of accocid cement mortar (1:1), 20 mm thick to full height of skirting to a true plane level and plumb. These stones shall be set apart to form 5 mm wide joints. These vertical joints shall be raked to a depth for 2 mm only. After the curing (with HCL acid) period is over the top joint between stones and plastered surfaces and all vertical joints shall be sealed with solvent free liquid epoxy as specified above. The skirting / dado area shall be hand polished to make the surface perfectly plane.

17.2.3 Measurement shall be of the actual area of skirting / dado and deductions shall be made for the areas not covered by skirting. Unit of measurement shall be on SQM basis.

17.2.4 The rate for flooring and skirting / dado shall be inclusive of bitumen coating, acid resistant mortar bedding, acid resistant stones, acid curing, filling the joints with liquid epoxy (solvent free) polishing and all labour required etc. complete.

18.0 PVC SHEET / TILES FLOORING

18.1 **GENERAL:**

18.1 P.V.C Flooring material gives a resilient and non-porous surface which can be easily cleaned with a wet cloth as dust and grime do not penetrate the surface. Since a burning cigarette will damage the neat surface of the PVC sheet, special care should be taken to prevent burning cigarette stumps to come in contact with the PVC flooring materials. It shall be laid on a base that is finished even and smooth such as concrete, metal or timber boarding. Unevenness or undulations in the base

will show badly on the surface and are liable to damage the P.V.C sheet / tiles.

18.2 MATERIALS:

- 18.2.1 The PVC flooring material shall be of homogeneous type with minimum 60% PVC content and for other parameters, it shall conform to IS: 3462. It may be in the form of tiles, sheets or rolls as specified. It shall consist of a thoroughly blended composition of thermoplastic binder, filler and pigments. The thermoplastic binder shall consist substantially of one or both of a) Vinyl chloride polymer and b) Vinyl chloride copolymer. The polymetric material shall be compounded with suitable plasticizers and stabilizers.

Thickness: The preferred thickness of PVC tiles for normal floor covering shall be 2.0, 3.0 or 4.0 mm.

- 18.2.2 Thickness of PVC sheets shall be measured with micrometer or Ratchet type or a dial gauge graduated to 0.02 mm. The micrometer shall have flat bearing surfaces of at least 6.5 mm diameter at both contact points. For sheets and rolls, the thickness of the specimen shall be measured at twenty scattered points. For polystyrene wall tiles, the cavity depth of the test specimen shall be measured at five points taken at random on the rear surface of each tile with a suitable depth gauge.

- 18.2.3 The width of flooring sheets and rolling in continuous length shall be 1000, 1500 and 2000 mm. When supplied in rolls the length of the rolls shall not be less than 10 metre. The measurement shall be carried out with a travelling microscope or suitable scale graduated to 0.02 mm. Each tile shall be measured for length and width at the three quarter point in each direction.

- 18.2.4 Tolerances:

(a)	In Thickness	(+/-) 0.15 mm
(b)	In Width: as under:	
i).	300 mm square tiles	(+/-) 0.2 mm
ii).	600 mm square tiles	(+/-) 0.4 mm
iii).	900 mm square tiles	(+/-) 0.6 mm
iv).	Sheets and rolls	(+/-) 0.1 per cent

- 18.2.5 Adhesive: Rubber based adhesives are suitable for fixing PVC flooring over concrete, wooden and metal sub-floors. PVA based adhesives shall be used for concrete and wooden sub floors. PVA based adhesives are not suitable

for metallic surfaces and also for locations where there is constant spillage of water.

18.3 PREPARATION OF SUB-FLOORS:

Before laying PVC sheets / tiles, it is essential to ensure that the base is thoroughly dry and damp proof as evaporation of moisture can not take place once the PVC flooring is laid. Moisture slowly damages the adhesive resulting in PVC sheet / tiles being separated from the base and curled up. In case of new work, a period of 4 to 8 weeks shall be allowed for drying the sub-floor under normal conditions. Concrete sub- floors on the ground floor shall be laid in two layers. The top of the lower layer of concrete shall be painted with two coats of A-90 grade (conforming to IS: 1580) applied at the rate of 1.5 kg/sqm. The top surface of the lower layer shall be finished smooth while laying the concrete so that the bitumen can be applied uniformly. The bitumen shall be applied after the concrete has set and is sufficiently hard. Bitumen felt conforming to IS : 1322 shall be sandwiched in the sub- floor laid in two layers.

In new concrete floor, the smooth finish required shall be produced by using cement slurry spread on fresh concrete floor and finished smooth. If the concrete floor is old and surface not even, the surface should be made smooth by first cleaning it free of all foreign material and then a layer of cement mortar 1:2 of average thickness of 6 mm shall be applied on the surface finishing the surface smooth. The finished surface shall be cured for 7 days and then allowed to dry thoroughly.

Where it is expected that the dampness may find its way from the surrounding walls, the same shall also be effectively damp-proofed up to at least 150 mm above the level of the sub-floor and the damp proof treatment below the floor shall be extended over the walls.

18.4 LAYING AND FIXING:

- 18.4.1 Prior to laying, the flooring tiles / rolls / sheets shall be brought to the temperature of the area in which it is to be laid by stacking in a suitable manner within or near the laying area for a period of about 24 hours.
- 18.4.2 Where air-conditioning is installed, the flooring shall not be laid on the sub-floor until the conditioning units have been in operation for at least seven days. During this period the temperature shall neither fall below 20°C nor exceed 30°C. These conditions shall be maintained during laying and for 48 hours, thereafter.
- 18.4.3 Before commencing the laying operations, the sub-floor shall be examined for evenness and dryness. The sub-floor shall then be cleaned

with a dry cloth. The PVC flooring shall not be laid on a sub-floor unless the sub-floor is perfectly dry. Dryness of the sub-floor shall be tested conforming to relevant IS codes and manufacturers recommendations as directed by the Engineer-in-Charge.

- 18.4.4 The layout of the PVC flooring on the sub-floor to be covered should be marked with guidelines. The PVC flooring shall be first laid for trial, without using the adhesive, according to the required layout.
- 18.4.5 The adhesive shall be applied by using a notched trowel to the sub-floor and to the back side of the PVC sheet tile flooring. When set sufficiently for laying, the adhesive will be sticky to touch, but will not mark the fingers. In general, the adhesive will require about half an hour for setting. It should not be left after setting for too long a period as the adhesive properties will be lost owing to dust films and other causes.
- 18.4.6 Care should be taken while laying the flooring under high humidity conditions so that condensation does not take place of the adhesive. It is preferable to avoid laying under high humidity conditions.
- 19.4.7 The area of adhesive to be spread at one time on the sub-floor depends entirely upon local circumstances. In case of a small room, adhesive may be spread over the entire area but relatively small areas of tiles/sheets flooring should be treated in a larger room.
- 18.4.8 When the adhesive is just tack free, the PVC flooring sheet shall be carefully taken and placed in position from one end onwards slowly so that the air will be completely squeezed out between the sheet and the background surface. After laying the sheet in position, it shall be pressed with suitable roller weighing about 5 kg to develop proper contact with the sub-floor. The next sheet with its back side applied with the adhesive shall be [laid edge to edge] with the sheet already laid and fixed in exactly the same manner as the first sheet was fixed. The sheets shall be laid edge to edge so that there is minimum gap between joints.
- 18.4.9 The alignment should be checked after the laying of each row of sheet is completed. If the alignment is not perfect, the sheets may be trimmed by using a straight edge.
- 18.4.10 The tiles shall be fixed in exactly the same manner as for the sheets. It is preferable to start laying the tiles from the centre of the area. Care should be taken that the tiles are laid close to each other with minimum gap between joints. The tiles should always be lowered in position and pressed firmly on to the adhesive. Care should be taken not to slide them as this may result in adhesive being squeezed up between the joints. PVC tiles after laying shall be rolled with a light wooden roller weighing about 5 kg to ensure full contact

with the under layer. Any undulations noticed on the PVC surface shall be rectified by removing and relaying the tiles after thorough cleaning of the underside of the affected tiles. The adhesives applied earlier in such places shall be thoroughly removed by using proper solvents and the surface shall be cleaned to remove the traces of solvents used. Work should be constantly checked against guidelines in order to ensure that all the four edges of adjacent tiles meet accurately.

- 18.4.11 Any adhesive which may squeeze up between sheets or tiles should be wiped off immediately with a wet cloth before the adhesive hardens. If, by chance, adhesive dries up and hardens on the surface of the sheet or tile, it should be removed with a suitable solvent. A solution of one part of commercial butyleacetate and three parts of turpentine oil is a suitable solvent for the purpose.
- 18.4.12 A minimum period of 24 hours shall be given after laying the flooring for developing proper bond of the adhesive. During this period, the flooring shall not be put to service. It is preferable to lay the PVC flooring after completion of plastering, painting and other decorative finish works so as to avoid any accidental damage to the flooring.
- 18.4.13 When the flooring has been securely fixed, it shall be cleaned with a wet cloth soaked in warm soap solution (two spoons of soap in 5 litres of warm water).
- 18.4.14 When the edges of the PVC sheets or tiles are exposed, as for example, in doorways and on stair treads, it is important to provide protection against damage of flooring materials. Metallic edge strips may be used and should be securely fastened to the sub floor to protect edges of the flooring.

18.5 **PRECAUTION FOR MAINTENANCE:**

- 18.5.1 PVC flooring subject to normal usage may be kept clean by mopping with soap solution using a clean damp cloth. Water shall not be poured on the PVC flooring for cleaning purpose as the water may tend to seep through the joints and cause the adhesive to fail. To maintain a good wearing surface a good appearance, the flooring may be periodically polished. When polish is applied frequently, a thick layer builds up which collects dirt and dust and is tacky to walk on.
- 18.5.2 If the traffic is light, the floor shall be given frequent brushing regular polishing by an application of new polish every 4 to 6 weeks. Under moderate traffic conditions the floor shall be given an occasional wash with a wet mop but no detergents shall be used so that the polish is not removed.

Application of polish may be done every one to three weeks. PVC flooring should not be over waxed. When this condition develops, the coatings should be cleared off with white spirit or paraffin and a light even coat of polish applied. When the PVC flooring has been polished, it will remain bright for a considerable period if dry mop is applied each day. It is this daily 'dry polish' that maintains the glossy surface. After exceptionally heavy traffic PVC flooring should be swept with a hair broom, rubbed with a mop or doth frequently rinsed in clean water and finally rubbed dry.

18.6 MEASUREMENTS:

Length and breadth shall be measured correct to a cm and its area shall be calculated in sqm correct to two places of decimal. No deduction shall be made nor extra paid for voids not exceeding 0.20 sqm. Deductions for ends of dissimilar materials or other articles embedded shall not be made for areas not exceeding 0.10 sqm. Nothing extra shall be paid for providing PVC flooring in borders and margins, irrespective of their width.

18.7 RATE:

The rate shall include the cost of all materials and labour involved in all the operations described above, except those described under "Precaution for Maintenance". The rate does not include the cost of sub floor or damp proof treatment if any. It also does not include the cost of metallic edge strip to protect edge of flooring, wherever provided, it shall be paid separately.

19.0 Interlocking Cement Concrete Paver block

19.1 Precast Concrete Blocks for paving shall be conforming to IS 15658-2006. Factory made precast cement concrete interlocking paver blocks of specified thickness, specified concrete grade are to be used. Paver blocks of approved size, design, and colour are made by block making machine with strong vibratory and pneumatic compaction. Paver block shall be of specified thickness, colour, design and pattern of approved manufacturer. Concrete paver shall conform to the concrete strength as prescribed for the grade specified and shall be free from any defects. The thickness of paver block shall be minimum 80mm and of grade M30.

19.2 Laying

19.2.1 Interlocking paver block to be fixed on the bed 50 mm or specified otherwise thick of coarse sand of approved specification and filling the joints with the sand of approved type and quality or as specified and as directed by Engineer-in-charge.

19.3 Measurement & Rates

Area provided with paver block to be measured in sqm. Correct upto two places of decimal. The rate includes the cost of the material, labour, tools etc. required in all the operations described above.

20.0 ACCESS FLOOR SYSTEM

20.1 SCOPE OF WORK

- 20.1.1 The work covered under these specifications consist of supplying and fixing access floor system of modular construction including floor tiles, supporting frame, pedestals etc. complete in strict accordance with the specifications and relevant detailed drawings.

20.2 GENERAL

- 20.2.1 The work under Access floor system is to be executed by specialised agency with adequate experience.
- 20.2.2 The work shall be executed in accordance with the access floor layout drawings. In the absence of such drawings the work shall be executed as directed by the EIC considering the location and requirements of the electrical panels and cables, erection openings, etc.
- 20.2.3 The scheme of supporting pedestals and stringers shall be planned in such a way that they clear the cables, cable trays, etc. and got approved by the EIC.
- 20.2.4 Contractor's scope of work shall include marking of panel location, cable routing etc.. and obtaining approval of EIC. This shall be done before cutting for openings. No extra shall be payable for re-aligning the same.
- 20.2.5 The access floor system to be installed shall be at a height of 400 to 650 mm from the concrete floor. The system shall be designed to withstand various static load, fire hazards, acoustic requirements, air leakage, humidity and corrosion etc. The system shall be remain fully antistatic on completion of works.

20.3 MATERIALS AND CONSTRUCTION

- 20.3.1 The Access floor system shall consist of two parts viz. Top part and Under structure.

- 20.3.2 The top part is panels shall be factory made of size 600 x 600 mm approx. made up of cold pressed steel profile in filled with light weight cementitious material. Bottom of panel shall be painted with anti corrosive paint. Top surface of the panel shall have factory laminated antistatic HPL having 3mm groove on all the edges and shall have the impact and corrosion resistance. These panels shall fully interchangeable with each other with in the range of a specified layout. Panels shall be simply supported on to the understructure.
- 20.3.3 Under structure shall be Snap-lock stringer construction consist of supporting pedestals and stringers made up of either powder coated or Zinc coated steel members. Pedestals base shall be permanently placed to position on the sub floor by glue and mechanical fastening at 600 c/c in both directions to form a grid of 600 x 600 mm.
- 20.3.4 The pedestal head shall have the adjustable screw to achieve the minimum height and for maintaining uniform level as mentioned in the drawings.
- 20.3.5 Stringers shall be rectangular channels with counter sunk holes at both ends for fixing on to the pedestal head ensuring maximum lateral stability in all directions. The grid formed by the pedestal and stringer shall receive the floor panels.
- 20.4 SPECIFIC REQUIREMENTS FOR ACCESS FLOOR SYSTEM**
- 20.4.1 The system shall be able to withstand a UDL of 1200 kg / sq.m and a point load of 360 kgs or as specified in the BOQ.
- 20.4.2 The system shall be installed to line and level to achieve a tolerance of +/-5 mm in all directions.
- 20.4.3 Surface preparation to be done before installing the pedestals is the scope of the contractor so that any undulations, loose materials are repaired and removed.
- 20.4.4 All fasteners and screws/bolts shall be of corrosive resistant material.
- 20.4.5 Making cutouts in the panels to the required size to accommodate electrical panels / cables and strengthening of pedestals at the cutout locations also in the scope of contractor.
- 20.4.6 Spare tiles and under structures shall be supplied by the contractor as mentioned in the schedule of items.

- 20.4.7 Contractor is responsible for any damage to the panels and sub structures till its final handover.

20.5 INSPECTION AND ACCEPTANCE

- 20.5.1 Contractor shall get the sample approved of make, material and method of construction from the consultant before ordering the system.
- 20.5.2 EIC shall have the liberty to inspect the manufacture of panels in the factory for its quality of materials and workmanship.
- 20.5.3 Acceptance of the erected system by the consultant is subject to the inspection.
- 20.5.4 Measurement for payment shall be the plan dimension of the area.

21.0 INTEGRAL FINISHING TO CONCRETE BASE

- 21.1 While the surface of the concrete laid as per specification for “cast in-situ concrete and allied works” has been fully compacted and levelled but the concrete is still ‘green’, thick slurry made with neat cement shall be applied evenly and worked in with iron floats. When the slurry starts to set, it shall be pressed with iron floats, to have a firm compact smooth surface without any trowel mark or undulations. This finish shall be as thin as possible by using 2.2 Kg of cement per sqm. of area. The surface shall be kept in shade for 24 hours and then cured for at least 7 days continuously by flooding with water. The surface shall not be subjected to any load or abrasion till 21 days after laying. As desired by the EIC, the surface, while still ‘green’ shall be indented by pressing strings. The markings shall be of even depth, in straight lines and the panels shall be of uniform and symmetrical patterns.

C-13: SPECIFICATIONS FOR WOOD WORK

1.0 SCOPE:

The work covered under this specification consist of providing, making and fixing of wooden frames for doors in accordance with these specifications and drawings.

2.0 APPLICABLE CODES & SPECIFICATIONS:

The relevant IS. Specifications, standards and codes given below are made a part of this specification. All standards, specifications, code of practices referred to herein shall be the latest edition including all applicable amendments, revisions and additional publications.

List of Indian Standards

No.	I.S. No.	I.S. Particulars
1.	I.S. 287	Recommendations for maximum permissible moisture content of timber.
2.	I.S. 401	Code of practice for preservation of timber.
3.	I.S. 851	Specification for synthetic resin adhesives for construction work in wood.
4.	I.S. 1141	Code of practice for seasoning of timber.
5.	I.S. 1200 (Part-XXI)	Method of measurement of building and civil
6.	I.S. 1708 (Part-1 to 18)	Method of testing of small clear specimens of timber.
7.	I.S. 7196	Specification for hold fast.

3.0 TEAK WOOD:

Unless otherwise specified all timber shall be of best quality C.P. class teak wood well-seasoned and free from cracks, sap wood, knots, sags, warps etc. and shall have uniform grains of good pattern.

All timber shall be kept dry and well protected from rain and moisture during construction and shall be stored in dry godown approved by the Engineer-In-charge to protect from fungi insects and marine borers.

The timber shall be wrought and brought to correct dimensions as shown in the drawings. All joints shall be true of proper fit and of the kind specified by the Engineer-In-charge.

Timber embedded in or in contact with the masonry or concrete shall be painted with two coats of approved wood preservative as directed.

The rate of wood works shall include the cost of all the labour, tools and materials including wood preservative paint nails, pins, keys, wedges, screws, holdfasts etc. and erecting the same in position and for painting with one coat of approved wood primer all specified.

The rate shall also include for wastage, if any.

4.0 **TEAK WOOD FRAMES:**

Door frames shall be of best quality timber of C.P. teak wood as specified and wrought and put up to section as indicated on the drawings or as directed by the Engineer-In-charge.

They shall be properly framed and mortised and tongued together at right angles and set correctly in the masonry or concrete.

The door frame shall rest on structural slabs and not on finished floor level.

M.S. holdfasts 230 mm long, 40 mm wide and 3 mm thick shall be fixed as shown in drawing or as directed by the Engineer-In-charge to hold the teakwood rough ground frames/ door frames firmly in the masonry.

Where the rough ground/ frames are placed by the side of concrete surface they shall be fixed firmly against the concrete surface by means of teak wood gutties and screws.

All M.S. hold fast shall be fastened to the frame using adequate number of M.S. screws.

The surfaces of frames in contact with masonry or concrete shall be painted with two coat of bituminuous paint.

The frame shall be as per drawing and shall be provided with triangular keys for the plaster if indicated in the drawing.

All frames shall be protected with one coat of approved wood primer as specified. While fixing the frames in position, the vertical members shall be

held rigid temporarily by means of wooden battens to avoid bending or distortion of members and to keep door frame exactly in plumb.

The teakwood beading/ cover mould/ stopper of the specified sizes shall be fixed on to the frame as shown in the drawings and shall be fixed on to the frame as shown in the drawings and shall be free from knots and sap wood.

5.0 TEAK WOOD HAND RAIL:

Teak wood hand railing and M.S. balusters frame work etc. shall be fixed in position to true line, inclination and level in best workmanlike manner as per details shown in the drawing.

M.S. balusters frame work etc. shall be bent to proper shape and embedded in concrete or masonry walls with necessary base plate or hold fast. The embedded length of M. S. bracket/ balusters/ frame work etc.

shall be sufficient enough to give the strength required to the railing.

The M. S. bracket/ blusters/ frame work etc. shall be in one piece bent to proper shape. MS. flat for teak wood rail shall be welded to M.S. bracket/ balusters/ frame work etc. to proper inclination and level.

Grouting of the brackets/ balusters/ frame work etc. shall be done in cement concrete 1:2:4 and finish smooth.

The teak wood hand rail shall be planed to proper shape and fixed to ms. fiat by means of chromium plated screws of suitable size.

The end pieces and corner bends of the railing shall match with the inclined portion of the railing. The minimum number of joints shall be provided in teak wood railing.

All the welds shall be ground flush smooth to match with the surfaces of steel work.

The specifications for teak wood for hand rail shall be similar to teak wood frames mentioned above under para 4.0.

All the steel surfaces shall be painted with one coat of approved steel primer.

6.0 MODE OF MEASUREMENT:

The door frame shall be measured in cubic metre.

The cubic contents for wood work shall be measured for the finished size, limiting to those shown in the drawings or ordered by the Engineer-In-charge.

The cubical content shall be worked out correct up to three places of decimals of a cubic metre.

The cross sectional dimensions shall be measured equivalent to nearest enclosing rectangle (least rectangle/ square) for wrought and planed sizes.

The frames embedded below finished floor shall not be measured. The mode of measurement for teak wood hand rail shall be running metre or as specified.

The rate for teak wood hand rail includes cost of teak wood, M. S. brackets/ balusters /frame work including all labour for fabricating, erecting and fixing in position, painting etc., or as specified.

7.0 FLUSH DOOR SHUTTER

7.1 SCOPE:

The work covered under this specification consist of providing and fixing block flush door shutter in accordance with the specification and drawings.

7.2 APPLICABLE CODES & SPECIFICATIONS:

The relevant IS. Specifications, standards and codes given below are made a part of this specification. All standards, specifications, code of practices referred to herein shall be the latest edition including all applicable amendments, revisions and additional publications.

List of Indian Standards

No.	I.S. No.	I.S. Particulars
1.	I.S. 204 (Part-I)	Specification for tower bolts (ferrous metal)
2.	I.S. 204 (Part-II)	Specification for tower bolt (non ferrous metal)
3.	I.S. 208	Specification for door handles
4.	I..S. 723	Specification for steel countersunk head wire nails.

5.	I.S. 848	Specification for synthetic resin adhesives for plywood.
6.	I.S.1200 (Part-XXI)	Method of measurement of building and civil engineering works. (Wood work and joinery)
7.	IS. 1341	steel butt hinges.
8.	I.S. 1659	Specification for block boards.
9.	I.S. 1708 (Part -1 to 18)	Method of testing of small clear specimens of timber.
10.	I.S. 1734 (Part-1 to 20)	Method of test for plywood.
11.	I.S. 2202 (Part-I &II)	Specification for wooden flush door shutters. (Solid core type).
12.	I.S. 2209	Specification for mortice lock of timber.
13.	I.S. 3564	Specification for door closers.
14.	I.S. 4992	Specification for door handles for mortice lock.
15.	I.S. 6760	Specification for slotted counter sunk head wood screws.

7.3

BLOCK BOARD FLUSH DOOR SHUTTER:

Flush door shutter shall have a solid core and may be of the decorative or nondecorative type as specified conforming to I.S. 2202.

The thickness and type of shutter shall be as specified in item of schedule of quantities.

Width and height of shutter shall be as shown in the drawings or as directed by the Engineer-Incharge. All four edges of shutter shall be square.

The shutter shall be free from twist or warp in its plane. The moisture content in timbers used in the manufacture of flush door shutters shall be not more than 12 percent when tested according to I.S. 1708.

The core of flush door shall be a block board having wooden strips held in a frame constructed of stiles and rails. Each stile and rail shall be a single piece without any joint. The width of the stiles and rails shall not be less than 75 mm and not more than 100 mm. The width of each wooden strip shall not exceed 25 mm. Stiles, rails and wooden strips forming the

core of a shutter shall be of equal and uniform thickness. Wooden strips shall be parallel to the stiles.

End joints of the pieces of wooden strips of small lengths shall be staggered. In a shutter, stiles and rails shall be of one species of timber. Wooden strips shall also be one species only but it may or may not be the same species as that of the stiles and rails.

The face panel shall be formed by gluing by the hot-press process on both faces of the core either plywood or cross-bands and face veneers. The thickness of the cross bands as such or in the plywood shall be between 1.0 mm and 3.0 mm or as specified. The thickness of the face veneers as such or in the plywood shall be between 0.5 mm and 1.5 mm for commercial veneer and between 0.5 and 1.0 mm for decorative veneers or as specified. The direction of the veneer adjacent to the core shall be at right angles to the direction of the wooden strips. Finished faces shall be sanded to smooth even texture.

Lipping where specified, shall be provided internally on all edges of the shutters. Lipping shall be done with battens of first class teakwood or as specified. Joints shall not be permitted in lipping.

The shutters shall be single leaf or double leaves as shown in the drawings or as directed by the Engineer-In-charge. In case of double leaves shutters, the meeting at stiles shall be rebated by one third the thickness of the shutter. The rebating shall be either splayed or square type.

Wherever specified, the opening for glazing of size as shown in drawing or as directed shall be made in the shutter for vision panel and or louver. Opening for glazing shall be lipped internally with teakwood batten of specified size.

Tolerance on width and height shall be ($\pm$) 3 mm and on thickness it shall be ($\pm$) 1.2 mm. The thickness of the door shutter shall be uniform throughout with a permissible variation of not more than 0.8 mm when measured at any two points.

Adhesive used for bonding various components like core, core frame, lipping, cross bands, face veneers, plywood etc. of flush door shutters and for bonding plywood shall be phenol formaldehyde synthetic resin conforming to IS. 848.

Samples of flush door shutters shall be subjected to all tests in accordance with I.S. 2202 (Part I & II):

All the sample shutters when tested shall satisfy the requirements of the tests as laid down in IS. 2202 (Part - I & II). If the number of samples found unsatisfactory or a test is two or more, the entire lot shall be considered unsatisfactory.

7.4 **MODE OF MEASUREMENT:**

Length and width of the shutter shall be measured to the nearest centimeter in closed position covering the rebates of the frames but excluding the gap between the shutters and the frame. Over laps of two shutters will not be measured.

All work shall be measured net as fixed and area calculated in square metre to nearest two places of decimal.

No deduction shall be made for providing openings for vision panel / louvers.

Rate quoted for the items shall cover all the specifications described above and for the complete work as per item of work including all labour and materials.

The work of providing vision/ louver opening and making rebates in double shutter doors shall be measured and paid for under relevant item of schedule of quantities.

7.5 **TEAK WOOD PANELLED SHUTTERS:**

Teak wood door shutter shall generally conform to standard laid in I.S. 1002 or the latest revision for requirements of materials, construction workmanship and shall be of specified thickness and of 1st class C.P. teak wood or as specified of approved design with stiles, top, bottom and lock rail generally as per drawing. Wherever shown, each panel shall be in a single width piece, but when two or more pieces have to be used and are permitted, all of them shall be of equal width and shall be jointed with a tongue and groove joint with chamfered edges glued together and reinforced with metal dowels.

7.6 **TEAK WOOD GLAZED SHUTTERS:**

The specifications for teak wood panelled shutter shall generally apply to glazed shutters for frame, stiles etc.

The sash and beading required for glazing shall be of the best teak wood and shall be fixed as per the design shown in relevant drawing.

Any mouldings, carvings shown shall be worked out from the teak wood member of bigger size.

7.7

GLAZING:

Glazing shall be generally with 6 mm. thick clear float glass/bajra glass unless otherwise mentioned in the schedule of quantities. The detailed specifications for glazing given hereafter shall be followed generally.

7.8

MISCELLANEOUS:

Wherever mentioned in the Schedule of quantities, vision panels, venetians, plastic laminates, push plates etc. shall be provided in all doors.

The vision panels shall be of size mentioned in the drawing and shall be provided with teak wood lipping allround the glass. The glass shall be 4 mm. thick or as specified of best quality free from defects.

Teak wood venetians or louvers shall generally conform to relevant specifications of timber. Necessary grooves and rebate in frames shall be provided as per drawing. Formica or approved equivalent plastic laminate of required design, required shade and colour shall be provided and fixed on flush door to the required size on any side of the shutter as shown in drawing. It shall be fixed with Fevicol or any other approved adhesive. Fixing shall be done in such a way that there shall not be any air gap, warpage or undulations on the surface. Finished surface of Formica or approved equivalent plastic laminate shall be cleaned with wax polish.

The shutters shall be painted on commercial facing side with two coats of synthetic/flat oil paint of approved shade and make over an approved coat of primer. The decorative veneer side of the shutter shall be wax or French polished with two or more coats so as to render a satisfactory surface.

The flush doors shall be single leaf or double leaf type as mentioned in the schedule of quantities. In case of double leaf shutters, the meeting of the stiles shall be rebated 20 mm. and shall be either splayed or square type and the T.W. tipping around the meeting shall not be less than 35 mm. deep. The meeting stiles shall be in single piece.

Any gap between the plastered surface and the frame shall be filled from both sides with mastic / approved silicone sealant as the finish coat. This will be applicable for all internal as well as external doors.

Sufficient care shall be taken to prevent any damage and loss of shape during handling, transporting, stacking, fixing etc. The door shutters shall be handled with utmost care to prevent any surface damage, warping etc.

7.9

MODE OF MEASUREMENT:

The work covered under the respective items in schedule and the above specifications shall be measured as follows:

The cubic contents for wood work shall be measured for the finished size, limiting to those shown in the drawings or ordered by the Engineer-in-charge. The cross sectional dimensions shall be measured equivalent to nearest enclosing rectangle (least rectangle/square) for wrought and planed sizes. The cubical content shall be worked out correct up to three places of decimals of a cubic metre. The frames embedded below finished floor shall not be measured.

The square meter areas for shutters shall be measured for the exposed surfaces of shutter between frames from inside or outside whichever is more. The linear dimensions shall be measured upto two places of decimals of a metre. The area for payment shall be worked out correct upto two places of decimals of a square metre. The rate for shutters shall include:

- i) Cost of supply assembly and erecting in position.
- ii) Cost of polishing, painting, supplying wood preservative, screws, nails, hold fasts etc.
- iii) Cost of labour for making adjustments in frames, if required, shutters and also for fixing required fittings and fixtures.
- iv) In case of flush doors, the rate for individual item mentioned in the schedule of quantities shall include cost of shutters, plastic laminate sheet push plate, teak wood louvers etc., transporting charges and labour for fixing of fixtures and fastenings except fixing of door closers and painting and polishing as specified.

8.0

FACTORY MADE PARTICLE BOARD PANELLED DOOR SHUTTERS

8.1

GENERAL:

Factory made particle board paneled door shutters shall be made of kiln seasoned and chemically treated timber as specified generally with stiles and top rails of 100 mm. in width, bottom rail and lock rails of 150/175 mm width and panels made of 12 mm. thick both side commercial veneered teak wood particle board or as specified in schedule

of quantities, bonded with phenol formaldehyde synthetic resin adhesive and generally conforming to I.S. 3091.

Factory made shutters, as specified shall be obtained from factories to be approved by the Engineer-in-Charge and shall conform to IS 2202 (Part-I). The contractor shall inform well in advance to the Engineer-in-Charge the name and address of the factory from where the contractor intends to get the shutters manufactured. The contractor will place order for manufacture of shutters only after written approval of the Engineer-in-Charge in this regard is given. The contractor is bound to abide by the decision of the Engineer-in-Charge and recommend the name of another factory from the approved list, in case the factory already proposed by the contractor is not found competent to manufacture quality shutters.

The contractor will also arrange stage-wise inspection by the Engineer-in-Charge or his authorized representative of the shutters at factory of the. Contractor will have no claim if the shutters brought at site are rejected by Engineer-in-Charge in part or in full lot due to bad workmanship/quality. Such shutters will not be measured and paid and the contractor shall remove the same from the site of the work within seven days after the written instructions in this regard are issued by Engineer-in-Charge or his authorized representative.

8.2 TIMBER:

The timber to be used in door shutters shall generally conform to relevant IS specifications for materials, moisture content, seasoning, preservation and workmanship.

All timber shall be from the heart of a sound tree of mature growth, entirely free from sapwood. It shall be uniform in texture, straight in fiber and shall be well and properly seasoned. It shall be free from large, loose, dead or cluster knots, soft or spongy spots, hollow pockets, pith or centre heart, waves, injurious open shakes, borer holes, rot, decay date, discoloration and all other defects or any other damages of harmful nature which will affect the strength, durability, appearance of its usefulness for the purpose for which it is required.

8.3 PARTICLE BOARD PANELS:

It shall be of well-seasoned teak timber particles of uniform thickness, bonded with liquid phenol formaldehyde synthetic resin adhesive of the hot press type. The particle board shall be either flat plate on press or extrusion type as approved by the Engineer In charge conforming to the latest I.S.

specifications. Panels shall be embedded into frames to a minimum of 12 mm. with 1.5 mm. air gaps.

8.4 SEASONING AND TREATMENT:

All timber to be used for sills and rails shall be kiln seasoned to the required standards as per I.S.. 1141-1973.

8.5 ADHESIVE:

The adhesive for bonding of stiles, rails etc. shall be of highly water resistant type synthetic resins (liquid type) adhesive conforming to relevant specifications for synthetic resins.

8.6 WORKMANSHIP AND FINISH:

The workmanship shall be of best quality. All members shall be in continuous length. All the faces of the door shutter shall be secured and in true planes. All wrought timber is to be sawn, planed, drilled or otherwise moulded work to the correct size and shapes indicated in drawing or as specified. All joinery work shall fit truly and without wedging or filling. All the faces of the shutters shall be sanded to smooth even texture. The finished sizes and sections shall be as per drawing or as specified. The shutters shall be got approved from the Engineer-in-Charge at factory site before carting the same to the site of work. The shutters damaged during the carriage and if any sub- standard materials or bad workmanship is detected, the contractor, shall forthwith remove them and replace the same at his own cost, all as directed by the Engineer-in-charge.

8.7 PRIMER COAT:

All factory-made panel door shutters with seasoned teak wood/hard wood frame shall be painted with approved Primer coat as per IS. specifications 1003 (Part-I).

8.8 TESTS:

Tests shall be conducted, if required, by the Engineer Incharge at the contractor's cost. All shutters shall have manufacturer's trademarks.

8.9 TOLERANCES:

Tolerances on nominal width and height shall be (+/-) 3 mm. Tolerance on nominal thickness shall be (+/-) 1.5 mm. The thickness of the shutter frame

shall be uniform throughout with a variation not exceeding 1 mm, when measured at two points.

9.0 SAMPLES:

Sample of door shutter shall be got approved before manufacturing on large scale.

9.1 FIXING:

The shutter shall be fixed to teak wood or rolled M.S. door frame (teak wood/rolled steel in door frames paid under relevant items) with necessary fittings as per drawing (cost of fittings and fixtures paid under relevant items). The shutter shall be painted as specified. The shutters of specified thickness and of required sizes as fixed in position as shown in drawing/schedule of quantities shall be measured for payment. The length and width of the shutter fixed in position shall be measured correct up to three places of decimal of a metre and the areas so worked out shall be corrected up to two places of decimal of a square metre. The area of the shutter shall be measured for the exposed surfaces of shutter between frames from inside or outside whichever is more.

Any gap between the plastered surface and the frame shall be filled from both sides with mastic / approved silicone sealant as the finish coat. This will be applicable for all internal as well as external doors.

9.2 RATE TO INCLUDE:

The rate quoted by the contractor shall be

- i) for supplying and fixing in position of finished shutters with necessary fittings and fixtures as per drawings (excluding cost of fittings and fixtures which shall be paid under relevant items or as specified in the BOQ).
- ii) painting/polishing as specified and as directed by the Engineer-in-charge.

C-14: SPECIFICATIONS FOR FITTINGS AND FIXTURES

1.0 SCOPE OF WORK:

The work covered under these specifications consist of supplying different types of fittings and fixtures required for doors, windows, ventilators etc. The supply shall be in accordance with the BOQ, specification, drawings / approved samples. Samples of various fittings and fixtures proposed to be incorporated in the work shall be submitted by the contractor for approval of the Engineer-in-charge before order for bulk supply is placed.

2.0 GENERAL

All fittings and fixtures shall conform to relevant IS code and made of SS, brass, anodised aluminium, iron oxidised (M.S.) or as specified. These shall be well made reasonably smooth and free from sharp edges, corners, flaws and other defects. Screw holes shall be counter sunk to suit the heads of the specified screws. All hinges pins shall be of steel for brass hinges and aluminium alloy NR-6 or steel pins for aluminium hinges with nylon washers or as specified. All riveted heads pertaining to hinge pins shall be well formed. Screws supplied for fittings shall be of the same metal and finish as the fittings. However, brass cadmium plated/chromium plated screws shall be supplied with aluminium fittings. Samples of each fixture / fitting shall be furnished by the contractor for approval of the Engineer-in-Charge. Order for procurement of fittings and fixtures in bulk shall be placed only after approval by the Engineer-in-Charge.

The fittings and fixtures to be incorporated in the work shall be strictly according to the approved sample/Brand. Fittings shall be fixed in proper position as shown in the drawing and as directed by the Engineer-in-Charge. These shall be truly vertical or horizontal as the case may be. Screws shall be driven home with a screwdriver and not hammered in. Recess shall be cut to the exact size and depth for the counter sinking of hinges. The fittings and fixtures shall be fixed in a workman like manner and any damages done either to fittings and fixtures or to the shutter frames etc. should be rectified by the contractor at his own cost.

Mild steel fittings shall be bright satin finish black stone enamelled or copper oxidised (black finish), nickel chromium plated or as specified.

Brass fittings shall be finished bright satin finish or nickel chromium plated or copper oxidised or as specified.

Aluminium fittings shall be anodised to natural matt finish or dyed anodic coating of approved colour, not less than grade AC 15 of IS: 1868

Stainless steel fittings shall be of specified grade non-magnetic, rust & moisture proof, strong & sturdy. Pin of hinges shall also be of stainless steel.

3.0 BUTT HINGES:

Brass and aluminium hinges shall be manufactured from the extruded sections and shall be free from cracks and other defects. MS. butt hinges shall be cranked and manufactured from M.S. sheets. All butt hinges shall generally conform to relevant I.S viz IS 1341 (M.S.) IS: 205 (Cast brass & aluminium), IS : 362 (Parliament hinges); IS : 453 spring hinges, IS : 3818 (Piano hinges) etc. The size of butt hinges shall be taken as the length of the hinge. Width of the hinge shall be measured from the centre line of hinge pin to end of flange.

4.0 PARLIAMENTARY HINGES:

These shall be manufactured from extruded section for brass and aluminium and from M.S. sheets for iron oxidised and shall be free from cracks and other defects. The size of the parliamentary hinges shall be taken as the width between open flanges, while the depth shall be as specified.

5.0 PIANO HINGES:

These shall be generally conformed to I.S. 3818 and shall be made of either brass oxidized, aluminium anodized, iron oxidized (MS.) or as specified. Piano hinges shall be fixed in the entire length of the cupboard shutters in a single piece. No joints shall be allowed.

6.0 TOWER BOLTS:

These shall generally conform to IS 204 (Part II & I). They shall be well made and shall be free from defects.

The tower bolts shall be of the following types:

- i) MS semi barrel tower bolt with ms sheet pressed barrel and G.I. bolt or with MS barrel and MS sheet bolt.
- ii) Oxidised brass barrel tower bolt with brass sheet barrel and rolled or drawn brass bolt.
- iii) Anodised aluminium tower bolt with barrel and bolt of extruded sections of aluminium alloy.
- iv) Stainless steel

In case of M.S. tower bolt plates and straps after assembly shall be firmly riveted or spot welded properly.

The knobs of brass tower bolts shall be cast and the bolt fixed into the knob firmly as per IS specifications. The tower bolt shall be finished to correct shape and pattern so as to have a smooth action. Wherever specified, aluminium barrel tower bolts shall be manufactured from extruded sections of barrel & bolts.

Knobs shall be properly screwed to the bolt and riveted at the back. The size of the tower bolt shall be taken as the length of barrel without top socket.

7.0 DOOR LATCH:

This shall be of MS, cast brass, SS or as specified shall have smooth sliding action. MS Latch shall be copper oxidized (black finish) or as specified. Brass Latch shall be finished bright, CP or oxidized or as specified.

8.0 AL DROPS:

These shall be oxidized brass or anodized aluminium, iron oxidized or as specified and shall be capable of smooth sliding action and shall be as per relevant I.S. Brass sliding door bolt (AL drop) shall be made from rolled brass generally conforming to IS : 2681. M.S. sliding door bolt shall generally conform to I.S: 281. The hasp shall be of cast brass and screwed to the bolt in a workman like manner. Alternatively, the hasp and the bolt may be in one piece. Bolts shall be finished to shape and threaded with worth standard and provided with round brass washers, nuts of square or hexagonal shape. All components shall be smooth and polished. The leading dimensions of AL drop shall be as the length of the bolt and specified diameter.

9.0 DOOR HANDLES- BOW/PLATE HANDLES:

These should generally conform to IS : 208. Unless otherwise specified door handles shall be of 100 mm size & windows handles of 75 mm size. These shall be of cast brass or SS of specified size, shape and pattern as approved by the Engineer-in-charge. All edges and corners shall be finished smooth and correct to shape and dimensions. Brass handles shall be finished bright, chromium plated or oxidized as specified. Anodized aluminium or iron oxidized (M.S) handles shall be of specified size, shape and pattern. The size of the handle is taken as the inside grip of the handle. In case of iron oxidized handles, the same shall be manufactured from M.S. sheet pressed into oval section as per IS.

10.0 **MORTISE LOCK & LATCH:**

This should generally conform to I.S. 2209. Handles shall conform to IS 4992. Mortise lock with latches and a pair of level handles shall be 6 levers, with zinc alloy pressure die cast/brass or as specified body of approved quality, and shall be right or left handed as specified. The pair of handles shall be either brass chromium plated or anodized aluminium of approved shape and pattern or as specified. It shall be of the best Indian make of approved quality. The size of the lock shall be determined by its length. The lock for single leaf door shall have plain face and that for double leaf door a rebated face. Level handles with springs shall be mounted on plates and shall be of approved quality, anodized aluminium or as specified. Each lock shall be supplied with 3 keys and each key shall be with the numbers stamped thereon according to the door numbers, where it is installed.

11.0 **HYDRAULIC DOOR CLOSER:**

This shall be generally conform to IS: 3564. Hydraulic door closer shall be of approved quality and make. The operation of the Hydraulic door closer shall be very smooth.

Speed of the Hydraulic door closer shall be adjustable and latch closing also shall be adjustable type. Suspension and lubrication of door closer shall be in perfect line and level.

12.0 The contractor shall provide for all the incidentals required for fixing these fixtures and fittings such as cadmium plated screws etc. Fittings and fixtures shall be fixed securely in a workman like manner, all as directed by the Engineer-in-charge. Any of the fixtures damaged during the fixing shall be removed and new one fixed in their place and the surface of joinery made good where affected, at his own expense. Mortise plates shall be used over holes where the bolts enter in the wood work. Metal sockets shall be provided to all bolts where the shoot enter brick, stone, concrete etc. The incidental Fixtures like mortise plates, metal sockets, screws etc. shall not be paid for separately.

13.0 **MORTICE NIGHT LATCH:**

This is a mortice lock having a single spring bolt withdrawn from the outside by using the key and from inside by turning the knob and with an arrangement whereby the lock can be prevented from being opened by its key from outside while the night latch is used from inside the room.

This should generally conform to IS: 3847. It shall be cast or sheet brass, cast or sheet aluminium alloy or mild steel as specified and of approved make. These shall be bright finished or copper oxidized (black) finish as

specified. Normal size of the latch shall be denoted by the length of the face over the body in millimetres.

14.0 FLOOR DOOR STOPPER:

The floor door stopper shall conform to IS: 1823. This shall be made of cast brass of overall size as specified and shall have rubber cushion. The shape and pattern of stopper shall be approved by the Engineer-in- Charge. It shall be of brass finished bright, chromium plated or oxidized or as specified. The size of door stopper shall be determined by the length of its plate. The body of the door stopper shall be cast in one piece. All parts of the door stopper shall be of good workmanship and finish and free from surface and casting defects. Aluminium stopper shall have anodic coating of not less than grade AC-10 of IS 1868.

15.0 MODE OF MEASUREMENT:

All the fittings with all the necessary accessories shall be measured in numbers and the rate shall include the cost of all materials including taxes, excise duty, if any, loading, unloading, transporting, cost of screws, bolts and other accessories complete, if the same are not to be paid for separately as per schedule of quantities.

C- 15: SPECIFICATIONS FOR GLASS AND GLAZING

1.0 SCOPE OF WORK:

The work covered by this specification include furnishing and fixing the glass panes to teak wood, steel/aluminium doors and windows, strictly in accordance with these specifications and drawings.

2.0 MATERIALS:

2.1 Glass: The glass shall be from M/s. Saint Gobain / Modiguard or of equivalent manufacture, as specified and it shall be free from bubbles, flaws specks, waves, air holes, distortion, scratches or other defects. The glasses in bulk quantities shall be brought to site in Makers original packings and Makers guarantee shall be produced, if called for by the Engineer-in-charge. The glass shall be of required thickness as mentioned in the items of schedule of quantities and / or drawing or as directed by the Engineer-in-charge. The contractor shall submit the sample of the glass which he proposes to use on the work and only such approved quality of glass shall be used in the works. The glass brought to site shall be protected against damages. Wherever frosted (obscure) glass is mentioned in the item of schedule of quantities and/or shown in drawings, the glass shall be of sand blown pattern and shall also be got approved by the Engineer-in-charge.

2.2 BEADING

The beading shall be of teak wood of superior quality timber in case of teak wood doors and windows and/or required sizes mentioned in the items of schedule of quantities and/or shown in drawing. In case of steel doors and windows, the beading shall be anodized aluminium beading of channel section as per sizes mentioned in the item and/or shown in the drawing. The junction of the beadings shall be mitre jointed.

3.0 WORKMANSHIP:

The glass shall be cut to the required sizes of panels where it is to be fitted, and it shall be so cut that it fits property in the frames without rattling. Pre measurement of each panel prior to the cutting of glass is essential.

The beading shall then be fixed to glass panes and screwed at close intervals of not more than 10 cm from each corner and the intermediate not more than 20 cm apart. When glass panes are fixed with wooden beadings having mitred joints or aluminium beading thin layer of glazier putty shall be applied covering the area in contact between the glass and sash bars and

beadings. In case of louvers, all the exposed edges of the glass shall be ground properly.

4.0 GENERAL:

After the inspection is over and permitted by the Engineer-in-charge, glass panes shall be cleaned off any labels, paints smears and spots and shall be washed from both the sides and all glazing left clear, perfect and free from rattling. The contractor shall provide all the scaffolding, tools and plants for fixing the glass panes at his own cost. In case of steel windows, any hardware if fixed in position, shall be removed temporarily before fixing the glass panes and which shall be re fixed back in position, all at the contractors cost.

5.0 MODE OF MEASUREMENT:

The rate for teak wood door/window shutters and/or steel /aluminium door/window shall normally cover the cost of glass and glazing also, unless otherwise mentioned. In case, the glazing is carried out as a separate item, the measurement shall be taken out to cut size of teak wood/steel/aluminium door/window frames forming the sides of glass panes and area calculated to two places of decimal of a square meter.

The rate shall include the cost of supplying and fixing the glass panes, all materials, labour, transport, scaffolding etc.

C- 16: SPECIFICATIONS FOR ALUMINIUM GLAZED DOORS & WALL SPANS

1.0 SCOPE:

- 1.1 The work covered under this specification consist of fabricating, supplying and installing in position, aluminium glazed doors and wall spans in strict accordance with these specifications and drawings.

1.2 APPLICABLE CODES & SPECIFICATIONS:

- 1.3 The relevant I.S. specifications, standards and codes given below are made a part of this specification. All standards, specifications, code of practices referred to herein shall be the latest edition including all amendments, revisions and additional publications.

1.4 List of Indian Standards

No.	I.S. No.	I.S.. Particulars
1.	I.S. 1081	Code of practice for fixing and glazing of steel and aluminium doors, windows and ventilators.
2.	IS. 1200 (Part VIII)	Method of measurement of building and civil
3.	IS. 1868	Specification for anodic coating on aluminium and its alloys.
4.	I.S. 1948	Specifications for aluminium doors, windows and ventilators.
5.	IS. 2835	Transparent sheet glass for glazing and framing purposes. Alloys
6.	I.S. 5523	Method of testing anodic coating on aluminium and its alloys.

2.0 GENERAL:

- 2.1 The contractor shall submit shop drawings of fabrication and erection for approval of the Engineer-In-charge.
- 2.2 No fabrication work shall be undertaken prior to the approval of the Engineer-In-charge.

- 2.3 The contractor shall submit samples of all materials / aluminium sections to be used for manufacturing of doors and wall spans for approval of the Engineer In-charge before bulk procurement.
- 3.0 **MATERIALS:**
- 3.1 The frames of all the doors and wall spans shall be fabricated from extruded aluminium sections of standard JINDAL or other approved equivalent. Extruded sections shall have a minimum 3 mm wall thickness or as specified by EIC.
- 3.2 Aluminium alloy used in the manufacture for extruded sections for this work shall correspond to I.S 733 and shall be anodized before incorporating in the work. The rate quoted for these items is deemed to include the cost of anodizing also or as specified in the BOQ.
- 3.3 The frame work, style, mullions, beadings, transom and handles etc. shall be of aluminium anodized sections as shown in the detailed drawings.
- 3.4 All sections and hardware shall have minimum anodic film of thickness not less than 15 microns or as specified in the BOQ. Anodizing quality shall be of type B-3, Decorative quality as per IS 1868 or as specified in the BOQ. Sealing shall be done with hydration treatment of anodic oxide coatings to reduce porosity.
- 3.5 Stainless steel or Cadmium plated brass counter sunk screws, nuts, bolts, washers, rivets and other miscellaneous fastening devices shall be of approved brass cadmium plated or stainless steel as specified in the drawing.
- 3.6 Each door leaf shall be prepared to receive glass panel of required Thickness of approved brand as specified in the schedule.
- 3.7 Glazing shall be done with neoprene dry set glazing gasket of best quality and approved make with snap-in beveled white anodized matt aluminium metal glazing stops inside and outside.
- 3.8 All doors shall have offset pivots, double action floor springs (180 degree minimum swing) with oil check of approved manufacture embedded in floor automatic door closer sunk flush.
- 3.9 One concealed mortise lock of 6 lever on one style of each shutter concealed as per manufacturer's design with concealed flush bolt shall be provided.

- 3.10 All doors shall have push plates of design shown in the drawing and as described in item of schedule.
- 3.11 All the doors shall be without thresholds.
- 3.12 All aluminium surfaces in contact with masonry or concrete shall be given a heavy coat of bitumastic paint.
- 3.13 After fabrication, aluminium metal shall be protected from construction hazards that may damage their appearance or finish. Therefore, all exposed surfaces of all aluminium members shall be protected by masking tape during the shipment and erection.

4.0 **FABRICATION:**

- 4.1 The frames shall be square and flat and the corners of the frame shall be fabricated to a true right angle. All the fixed, sliding, opening frames shall be fabricated with sections which have been cut to length, mitred and mechanically fixed at the corners.
- 4.2 In case welded joints are used, anodizing shall be done after fabrication as a whole unit is completed. All welding shall be on unexposed sides in order to prevent pitting, discoloration of other surfaces, imperfection after fixing etc.
- 4.3 Necessary allowances shall be made while manufacturing the door frames and wall spans for receiving plaster.
- 4.4 Thick layer of clear transparent lacquer based on methacrylates or cellulose butyrate shall be applied on the finished sections of the aluminium work by the supplier to protect the surfaces from wet cement, lime, dirt, dust etc. during installation.

4.5 **HARDWARE:**

- 4.5.1 All cut-outs, recesses, mortising or milling operations required for fixing the hardware shall be accurately made reinforced with backing plate as required to ensure adequate strength of the connection.
- 4.5.2 All the hardware, accessories shall be of best approved types and of anodized finish same as for the frames and other sections.
- 4.5.3 The contractor shall guarantee for all hardware that they shall remain free from defects of any kind of material and workmanship for a period of one year from the date of delivery.

- 4.5.4 The contractor shall repair or replace any and all defective work and damage caused thereby at any time or times during that period within **7** days from the written notice. This shall be done without any cost to the department and to the complete satisfaction of the Engineer-In- charge.
- 4.5.5 In case, the same are not replaced immediately after the receipt of the notice, the department shall do so at the cost of the contractors. The cost as certified by the Engineer-In charge shall be final and binding on the contractors.
- 4.5.6 Each lock shall be supplied with 3 keys and each key shall be with the numbers stamped thereon according to the door numbers, where it is installed.
- 4.5.7 All hardware shall be free from defects which may affect appearance and serviceability.
- 4.5.8 All hardware shall be fixed after obtaining the prior approval of the Engineer In charge.
- 4.5.9 Approved samples of hardware shall be kept in the custody of the Engineer In charge. Working and moving parts of lock sets shall be accurately fitted to smooth, close bearings and shall be free from rattle.
- 5.0 **FIXING IN POSITION:**
- 5.1 The frames shall be accurately fixed to the flooring / brick masonry or concrete member.
- 5.2 The fixing of the frame shall be done with stainless steel or cadmium plated brass counter sunk screws driven onto the teak wood rough grounds already fixed to the wall with holdfasts,
- 5.3 The screws, nuts, washers, bolts, rivets and other miscellaneous fastenings, devices shall be of approved brass cadmium plated or stainless steel as specified in the drawings or as directed by the Engineer-In-charge.
- 5.4 No field fabrication of the frame shall be permitted. All aluminium and glazing work shall be fixed in position as per relevant Indian standard specifications and code of practices.
- 5.5 Any gap between the plastered surface and the aluminium frame shall be filled with cement mortar from both sides with and then sealed with approved

silicone sealant as the finish coat. This will be applicable for all internal as well as external doors.

5.6 The joints shall be neatly pointed with matching cement and excess material shall be removed.

5.7 All hardware shall be fixed in workmanship like manner and as directed by the Engineer-Incharge.

6.0 GLAZING WORK:

6.1 The glazing shall be done with approved make of selected quality and of thickness as specified.

6.2 The glazing shall be either transparent or ground or toughened or frosted as specified in the drawing or as directed by Engineer-Incharge.

6.3 All glazing shall be either transparent or ground or figured as specified in the drawing or as directed by Engineer-Incharge.

6.4 The glass shall be cut so as to give a clearance of not more than 1.5 mm all-round the frames.

6.5 All the glass panels shall have properly squared corners and straight edges.

6.6 The glass panels shall be fixed to the frame with approved neoprene dry-set glazing gaskets of best quality and approved make with shap-in beveled white anodized matt finished aluminium metal glazing stops inside and out.

6.7 The glass panels shall be fixed firmly and truly parallel to the plane of frame.

6.8 All damages or breakages during glazing shall be at the contractor's own risk and cost till the work is fully accepted and taken over by the Engineer-Incharge.

6.9 All the doors and wall-spans/ fixed glazing shall be tested for water tightness. It is the responsibility of the contractor to rectify the leakages found during testing without any extra claim.

7.0 AUTOMATIC ALUMINIUM /FULLY GLAZED SLIDING DOOR:

- 7.1 The aluminium sliding door unit including accessories shall be of size specified in item of schedule and as shown in the drawing. The door unit shall be of approved make.
- 7.2 The sliding door unit shall have double leaves of sliding shutter including all accessories as per manufacturer's specifications/BOQ/drawing along with the following essential components.
 - 7.2.1 Automatic sliding door aluminium operator weighing (approximately) 28 kg and suitable for the opening shown in drawing.
 - 7.2.2 Microcomputer control unit extremely smooth, silent and consistent in operation.
 - 7.2.3 Two numbers of micro wave sensors for transmission of the signal of person or object approaching the door to microcomputer.
 - 7.2.4 High power motor unit with protection device against over loading etc.
 - 7.2.5 All other accessories like floor guide, side channels, belt with it's adjuster, door brackets, terminal block, aluminium channel, door adjuster, closing and opening stoppers, driving and idler pulleys, spring etc.
 - 7.2.6 The door unit shall have automatically pilot test facility.
- 7.3 It shall be contractor's full responsibility to get approved the whole fabricated unit by the Engineer-In-charge before it's delivery to work site.
- 7.4 The following door unit shall be guaranteed against manufacturing defects for a period of eighteen months from the date of installation and commissioning.
- 7.5 The contractor shall replace/ repair any defective component or whole unit immediately after receipt of written intimation from the Engineer- In-charge during guarantee period. No extra claim shall be entertained for such replacement or repairs.
- 7.6 The specifications regarding all materials like aluminium sections, glazing etc. and fabrication mentioned above for aluminium glazed door & wall spans shall hold good for aluminium sliding door unit also.

8.0 MODE OF MEASUREMENT:

- 8.1 The unit of measurement for normal aluminium doors (excluding glass) shall be Kg and glass shall be in sqm or as specified in the item for all types of doors and wall spans.
- 8.2 The unit of measurement for automatic aluminium sliding doors shall be in sqm or as specified in the item for all types of doors and wall spans.
- 8.3 The rate of aluminium automatic sliding door unit includes the cost of all materials, accessories, labour for fabrication, packing charges and transportation, installation and commissioning, all types of taxes and levies.

C -17: SPECIFICATIONS FOR ALUMINIUM GLAZED & LOUVERED WINDOWS, VENTILATORS

1.0 SCOPE

- 1.1 The work covered under this specification consist of fabricating, supplying and installing in position aluminium glazed and louvered windows in strict accordance with these specifications and drawings.

2.0 APPLICABLE CODES & SPECIFICATIONS:

- 2.1 The relevant IS specifications, standards and codes given below are made a part of this specification. All standards, specifications, code of practices referred to herein shall be the latest edition including all amendments, revisions and additional publications.

2.2 List of Indian Standards:

No.	I.S.No.	I.S. Particulars
1.	IS. 1081	Code of practice for fixing and glazing of steel and aluminium doors, windows and ventilators.
2.	I.S. 1200 (Part-VIII)	Method of measurement of building and civil engineering works.
3.	I.S. 1868	Specification for anodic coating on aluminium and its alloys.
4.	I.S. 1948	Specifications for aluminium doors, windows and ventilators.
5.	I.S. 2835	Transparent sheet glass for glazing and framing purposes. Alloys.
6.	I.S. 5523	Method of testing anodic coating on aluminium and its alloys.

2.3 GENERAL

- 2.4 The contractor shall submit shop drawings of fabrication and erection for approval of the Engineer-In-charge.
- 2.5 No fabrication work shall be undertaken prior to the approval of the Engineer In-charge.

- 2.6 The contractor shall submit samples of all materials/ aluminium sections to be used for manufacturing of windows and louvers for approval of the Engineer In-charge before bulk procurement.

3.0 **MATERIALS**

- 3.1 The frames of all the windows and louvers shall be fabricated from extruded aluminium sections of standard JINDAL or other approved equivalent sections. Extruded sections shall have a minimum 3 mm wall thickness or as specified by EIC.
- 3.2 Aluminium alloy used in the manufacture for extruded sections for this work shall correspond to IS. 733 and shall be anodized before incorporating in the work. The rate quoted for these items is deemed to include the cost of anodizing also or as specified in the BOQ.
- 3.3 The frame work, mullions, beadings, transom and handles etc. shall be of aluminium anodized sections as shown in the detailed drawings.
- 3.4 All sections and hard ware shall have minimum anodic film (natural matt finish) of thickness not less than 15 microns or as specified in the BOQ.
- 3.5 Stainless steel or Cadmium plated brass counter sunk screws, nuts, bolts, washers rivets and other miscellaneous fastening devices shall be of approved brass cadmium plated or stainless steel as specified in the drawing.
- 3.6 Each window leaf shall be prepared to receive glass panel of required thickness of approved brand and type as specified in the schedule.
- 3.7 Glazing shall be done with neoprene dry set glazing gasket of best quality and approved make with snap-in beveled white anodized matt aluminium metal glazing stops inside and outside.
- 3.8 All aluminium surfaces in contact with masonry or concrete shall be given a heavy coat of bitumastic paint.
- 3.9 After fabrication aluminium metal shall be protected from construction hazards that may damage their appearance or finish. Therefore, all exposed surfaces of all aluminium members shall be protected by masking tape during the shipment and erection.

4.0 **FABRICATION:**

- 4.1 The frames shall be square and flat and the corners of the frame shall be fabricated to a true right angle. All the fixed, sliding, opening frames shall be

fabricated with sections which have been cut to length mitred and mechanically fixed at the corners.

- 4.2 In case welded joints are used, anodizing shall be done after fabrication as a whole unit is completed. All welding shall be on unexposed sides in order to prevent pitting, discoloration of other surfaces, imperfection after fixing etc.
- 4.3 Necessary allowances shall be made while manufacturing the frames of windows and louvers for receiving plaster.
- 4.4 Thick layer of clear transparent lacquer based on methacrylates or cellulose butyrate shall be applied on the finished sections of the aluminium work by the supplier to protect the surfaces from wet cement, lime, dirt, dust etc. during installation.
- 4.5 The frame work for louvered windows shall be of aluminium box sections as specified in the item of work and drawings. The louvered frame shall be rigidly fixed in the masonry or concrete with adequate holdfasts, anchors plates etc. in true plumb, line and level as per drawing.
- 4.6 The aluminium louvers shall be fabricated out of aluminium sheets of specified gauge and pressed to the required shape as shown in the detailed drawing.
- 4.7 The pressed aluminium louvers of required shape shall be fixed to frame work in proper inclination with necessary screws, nuts, bolts, cleats, etc. as shown in drawing or as directed by Engineer-In-charge.

5.0 **HARDWARE**

- 5.1.1 All the hardware, accessories shall be of best approved types and of anodized finish same as for the frames and other sections.
- 5.1.2 The contractor shall guarantee for all hardware that they shall remain free from defects of any kind of material and workmanship for a period of one year from the date of delivery.
- 5.1.3 The contractor shall repair or replace any and all defective work and damage caused thereby at any time or times during that period within 7 days from the written notice. This shall be done without any cost to the department and to the complete satisfaction of the Engineer-In-charge.
- 5.1.4 In case, the same are not replaced immediately after the receipt of the notice, the department shall do so at the cost of the contractors. The cost as

certified by the Engineer-In-charge shall be final and binding on the contractors.

5.1.5 All hardware shall be free from defects which may affect appearance and serviceability.

5.1.6 All hardware shall be fixed after obtaining the prior approval of the Engineer-In-charge.

5.17 Approved samples of hardware shall be kept in the custody of the Engineer-In-charge. Working and moving parts of the windows shall be accurately fitted to smooth, close bearings and shall be free from rattle.

6.0 **FIXING IN POSITION:**

6.1 The frames shall be accurately fixed to the brick masonry or concrete member in accordance with I.S. 1081.

6.2 The fixing of the frame shall be done with cadmium plated brass counter sunk screws driven onto the teak wood rough grounds already fixed to the wall with holdfasts.

6.3 The screws, nuts, washers, bolts, rivets and other miscellaneous fastenings, devices shall be of approved brass cadmium plated or stainless steel as specified in the drawings or as directed by the Engineer-In-charge.

6.4 No field fabrication of the frame shall be permitted. All aluminium and glazing work shall be fixed in position as per relevant Indian standard specifications and code of practices.

6.5 Any gap between the plastered surface and the aluminium frame shall be first filled from both sides with mortar. Then, the edges shall be treated with approved silicone sealant as the finish coat. This will be applicable for all internal as well as external windows.

6.6 The joints shall be neatly pointed with matching cement and excess material shall be removed.

6.7 All hardware shall be fixed in workmanship like manner and as directed by the Engineer-In-charge.

6.8 The protective film of lacquer wherever provided shall be well preserved and the contractor further shall take all precautions to protect the windows from wet cement, time, dirt, mortar, dust etc. by suitably covering them during plastering work.

7.0 GLAZING WORK:

- 7.1 The glazing shall be done with Saint Gobain or other approved equivalent sheet glass of special selected quality and of thickness as specified.
- 7.2 The glazing shall be uniform in appearance and free from flaws, specks, scratches, air bubbles, cracks, strains and other defects.
- 7.3 All glazing shall be either transparent or ground or figured as specified in the drawing or as directed by Engineer-In-charge.
- 7.4 The glass shall be cut so as to give a clearance of not more than 1.5 mm all-round the frames.
- 7.5 All the glass panels shall have properly squared corners and straight edges.
- 7.6 The glass panels shall be fixed to the frame with approved neoprene dry-set glazing gaskets of best quality and approved make with shape-in beveled white anodized matt finished aluminium metal glazing stops inside and out.
- 7.7 The glass panels shall be fixed firmly and truly parallel to the plane of frames.
- 7.8 All damages or breakages during glazing shall be at the contractor's own risk and cost till the work is fully accepted and taken over by the Engineer-In-charge.
- 7.9 All the windows and fixed glazing shall be tested for water tightness. It is the responsibility of the contractor to rectify the leakages found during testing without any extra claim.
- 7.10 The contractor shall also remove PVC cover and clean the windows thoroughly before handing over them to the Engineer-In-charge.

8.0 MODE OF MESUREMENT:

- 8.1 The unit of measurement for aluminium windows, ventilators and louvers (Excluding glass) shall be Kg and glass shall be in sqm.

C-18: SPECIFICATIONS FOR STEEL DOORS, WINDOWS, VENTILATORS, LOUVRES

1.0 SCOPE

- 1.1 The work in general shall consist of supplying, erecting and installing of all metal doors, windows, ventilators, louvers, glazed partitions etc. as stipulated here or elsewhere in these specifications with all materials complete including labour and equipment.

2.0 APPLICABLE CODES & SPECIFICATIONS:

- 2.1 The relevant I.S. Specifications, standards and codes given below are made a part of this specification. All standards, specifications, code of practices referred to herein shall be the latest edition including all amendments, revisions and additional publications.

List of Indian Standards:

No.	I.S. No.	I.S. Particulars
1.	IS. 1038	Ventilators, Steel doors, windows and ventilators
2.	IS. 1081	Code of practice for fixing and glazing of steel and aluminium doors, windows and ventilators.
3.	IS. 1200 (Part VIII)	Method of measurement of building and civil engineering works.
4.	I.S. 4351	Specification for steel door frames.
5	IS 7452	Specifications for Hot rolled steel sections for doors, windows and ventilators
6	IS 1361	Specifications for Steel windows for industrial building
7	IS 1477	Code of practice for painting ferrous metals in buildings

2.2 General

The Contractor shall submit copies of shop, fabrication, erection drawing covering all types of work under this specification before manufacture. The drawing shall show all dimensions, details of construction, installation, relating to adjoining and related work etc.

3.0 PRESSED STEEL DOORS: GENERAL

- 3.1.1 Generally all steel doors shall be standardized flush type or as specified and shall be supplied by the approved steel manufacturers, properly machine welded, adequately stiffened and prepared for all hardware attachments including fixing, fixtures, and fittings as specified in the drawing.
- 3.1.2 The contractor shall submit shop drawings showing (all necessary hardware fittings) for all types of steel doors, for approval of Engineer-In-charge.
- 3.1.3 Fabrication of door shall be commenced only after the drawings are approved.
- 3.1.4 The shop drawing shall indicate all dimensions, details of fabrication, the gauge of the sheets, stiffeners, reinforcing anchorages, installation and other works required for complete installation.
- 3.1.5 The contractor should note that he has to get the fabrication work from some established and good firm and shall inform the name of the firm immediately to Engineer-In-charge for his concurrences.
- 3.1.6 A sample of each type of finished door complete with fittings and fixtures shall be submitted for approval of Engineer-In-charge. Sample shall be the property of the contractor.

3.2 **FABRICATION**

- 3.2.1 The pressed steel frames and shutter shall be fabricated with CRCA steel sheets of different gauges as indicated in relevant drawings and as specified in the item of schedule.
- 3.2.2 The shutter frame and stiffeners shall be fabricated with standard M. S. sections. The rebates in the door frames shall have sharp right angle corners.
- 3.2.3 All the joints shall be continuously reinforced at the back, fitted and continuously welded along the abutting edges.
- 3.2.4 For installing the pressed steel frames against the concrete like R.C.C. columns, lintels, walls etc. the hold fasts shall be welded to reinforcements or anchor plates provided in the concrete members and the pockets shall be grouted with cement concrete of strength specified for the concrete member.
- 3.2.5 The pressed sheet of steel frames for opening wider than one meter shall be properly reinforced to prevent sagging. Necessary reinforcement for attaching different hardwares shall be provided and

frames and shutters shall be cut and suitably stiffened with steel plates to suit the hardware template for securing butts, strikes checks and other hardware.

- 3.2.6 Necessary hardware fittings and fixtures such as butt hinges, mortice lock with handles, tower bolts, etc. shall be supplied by the contractor.
- 3.2.7 All hardware items shall be fixed in a good workmanlike manner with requisite galvanized M. S. counter sunk machine screws or as specified and directed by the Engineer-In-charge.
- 3.2.8 The contractor shall also see properly that the stains, grease, rust etc. is thoroughly removed before application of one coat of steel primer.
- 3.2.9 All the steel doors shall be approved by the Engineer-In-charge before shop painting work is undertaken by the contractor or manufacturer regarding the quality of work.
- 3.2.10 Suitable neoprene linings shall be provided around the frames as well as on intermediate hinge lines and meeting styles as shown in the drawings to make the doors perfectly airtight.

3.3 MODE OF MEASUREMENT:

- 3.3.1 The unit of measurement for pressed steel door frames shall be running metre and that for shutter shall be sqm or as specified in the BOQ.
- 3.3.2 The length and breadth of the doors in complete finished position shall be measured for outside dimensions of the frame.
- 3.3.3 The rate shall include for all materials, labour for fabrication and erection, all fittings and fixtures including locks, neoprene lining, T,W. fillers for the frames and a coat of approved steel primer.
- 3.3.4 Where there are no thresholds the height shall be measured from the finished floor levels.

4.0 STEEL DOORS, WINDOWS, VENTILATORS, LOUVRES:

4.1 Materials

- 4.1.1 Steel sections used for fabrication of doors, windows, etc. shall be standard rolled steel section specified in IS:1038, IS:1361 and IS:4351 or as specified in drawing. The Mild Steel sheets for frames, shutters, louver blades etc.

shall be of approved quality and of gauge mentioned in this specification/BOQ. Hardware and fixtures of the best quality from approved manufacturers shall only be used. All hardware and fixtures shall be able to withstand repeated use.

- 4.1.2 The Tenderer shall submit samples of each type of hardware to the Engineer-in-Charge. The approved samples shall be retained by the Engineer-in-Charge for comparison with bulk supply.

4.2 **Fabrication**

4.2.1 **Door frames**

Frames shall be reinforced for door closers. They shall be mortised, reinforced, drilled and tapped for hinges, lock and bolt strikes. Flush butt welding to form a solid fused joint, so that all frames are square and flat shall be used with sections cut to required length and mitred. Rubber door silencers shall be furnished for the striking jamb. Loose "T" masonry anchors shall be provided. Frames shall finish flush with floor and adjustable floor anchors shall be supplied. Frames shall be brought to site with floor ties/weather bars installed in place.

4.2.2 **Double plate flush door shutters**

Door shutters shall be 45 mm thick, completely flush design and shall comprise of two sheets of 18G steel sheets, rigidly connected and reinforced inside with continuous vertical 20G stiffeners, spot welded in position at not more than 150 mm on centres. Both edges of doors shall be joined and reinforced to full height by steel channels placed immediately inside and welded to the door faces. Top and bottom of doors shall be reinforced horizontally by steel channels running full width of door. Doors shall not have more than 2.5 mm clearance at jambs and head, shall have proper level on lock stiles and rails to operate without binding, and shall be reinforced at corners to prevent sagging or twisting. Pairs or double doors shall have meeting stile edges bevelled or rebated.

Doors shall be mortised, reinforced, drilled and tapped in shop for hinges, locks and bolts. They shall also be reinforced for closer, push-plates and other surface hardware where necessary. Any drilling and tapping required for surface hardware shall be done at site. Wherever required, provision shall be made for fixing glazing, vision panels, louvers etc. Glazing mouldings shall be of 18G mild steel or extruded aluminum sections with

profiles shown in approved shop drawings and suitable for fixing 6 mm glass. Louver blades shall be V or Z shaped and made out of 16G sheets.

4.2.3 **Sliding doors**

Sliding doors shall be either single or double plate construction as required and made out of 18 Gauge steel sheets with adequate stiffeners. The contractor shall specify the weight of the door in his shop drawing and submit the manufacturer's catalogue of the sliding gear he proposes to use. Where shown on the drawings the contractor shall make provisions for openings in the door for monorail beams.

Door shall close positively to exclude rain water from seeping in. Sliding doors shall withstand specified wind loads without buckling or jamming. The door shall slide freely under all ambient conditions.

4.2.4 **Steel windows, sashes, ventilators etc.**

These shall conform in all respects to IS:1038, IS:7452 and IS-1361. The details as called for in the above codes shall be applicable for coupling mullions, transom, weather bars, pivot arrangements for ventilators etc.

4.2.5 **Windows**

Window shutters shall be hung on projecting hinges. One leaf of the hinges shall be welded into a slot in the outer frame and the other leaf of the hinges riveted to the opening shutters. Hinges may be of the friction type in which case the window shall not be fitted with peg stay. In case of non-friction projecting hinges, a brass or bronze three holes peg stays 300 mm long with pegs and brackets, welded or riveted to the frame shall also be provided. Handles shall be of brass or bronze, and shall be mounted on a mild steel handle plate welded to the shutter in such a way that it should be fixed after the shutter is glazed. The handles shall have a two point nose which shall engage with brass, bronze or aluminium alloy as specified, striking plate on the fixed frame so that it can hold the shutters in a slightly openable as well in a fast position.

4.2.6 **Top hung ventilators:** These shall be fixed with plain hinges, riveted to the fixed frames or welded to it after cutting a slot in it. A peg stay 300 mm long of brass or bronze with three holes, as in case of windows shall be provided.

The locking bracket shall either be fitted to the fixed frame or to the ventilators.

4.2.6.1 **Centre Hung Ventilators:** These shall be hung on two pairs of brass of lead/tin/bronze cup pivots, riveted to the inner and outer frame of the ventilator to permit these to swing through an angle of approximately 85 deg. The opening portion of the ventilators shall be so balanced that it remains open at any desired angle under normal weather condition.

4.2.6.2 A bronze or brass spring catch shall be provided at the top centre of the ventilator. A brass cord pulley wheel in a mild steel or malleable iron brackets, shall be fitted with screws or welded at the sill and a cord eye shall be fixed to inner frame of ventilators to facilitate opening of ventilators.

4.2.6.3 All welds shall be flush butt welded to form a solid fused joint so that all frames are square and flat.

4.2.6.4 Where composite unit openings are shown on drawings, the individual window units shall be jointed together with requisite transoms and mullions. All windows shall be inside glazed, fixed with metal glazing beads. All windows, ventilators, sashes shall be fixed with handles, peg stays etc. of approved make and best quality.

4.2.7 **PRESSED STEEL LOUVERS**

The louver blade shall be 'Z' shaped and made out of 18G sheets. The frames shall be of ISMC 100.

4.2.7.1 Fabrication drawings shall be submitted by the contractor which shall also include weights of the materials used and got approved from the Engineer-in-Charge.

4.3 **SHOP COAT OF PAINT**

4.3.1 Unless otherwise specified, the shop paint for steel doors, windows, ventilators, louvers etc. shall be best quality zinc chromate primer paint from approved manufacturer conforming to IS-274. All surface shall be thoroughly cleaned of rust, grease, loose mill scales and foreign matter as per IS:1477 Part-I, and given one coat of shop paint. Portions like mullions, transom etc. which will be inaccessible after assembly of units shall be given an extra coat of paint before assembly.

- 4.3.2 All steel doors, windows, etc. shall have one shop coat and one site coat of zinc chromate paint (Primer) conforming to IS:2074 with a pigment to be specified by the Engineer-in-Charge and two coats of synthetic enamel paint of approved quality and conforming to relevant I.S. Code, unless specified otherwise in these specifications. Wherever required, all steel doors, windows, etc. shall be hot dip galvanized to give a coating weight of 460 gms to 610 gms per sq.m. One coat zinc chromate primer coat shall then be applied as shop paint.

4.4 **HANDLING**

All metal doors, windows, etc. shall be packed and crated properly before despatch, to ensure that there will be no damage to the fabricated materials. Loading into wagons and trucks shall be done with all care to ensure safe arrival of materials at site in undamaged condition. All metal doors, windows etc. shall be stored under cover in a way to prevent damage or distortion.

4.5 **ASSEMBLY AND ERECTION**

- 4.5.1 In general, the fixing of metal doors, windows ventilators, louvers, etc. shall conform to IS 1081. The contractor shall assemble and install all steel doors, windows, sashes, fixed metal louvers, etc. including transoms and mullions for composite units in respective places keeping proper lines and levels, and in approved workmanlike manner, to give trouble free and leak-proof installation. If required by the Engineer-in-Charge, the installation shall have to be carried out under the supervision of the manufacturer's staff. The tenderer shall take every precaution against damage of the components during installation. Necessary holes chases etc. required for fixing shall be made by the contractor and made good again as per original, after installation.
- 4.5.2 After installation of metal doors, windows, etc. all abrasions to shop-coat of paint shall be retouched and made good with the same quality of paint used in shop-coat.
- 4.5.3 All coupling mullions, transoms, frames. etc. in contact with unpainted steel and other members, shall be well embedded in mastic. The contractor shall bring to the site the mastic cement in original sealed containers of manufacturer and shall apply it as per the instructions.

- 4.5.4 Door shutters, partitions, hardware fixtures etc. shall be fixed only after major equipments have been installed in rooms. Wherever required, nylon cords of approved quality shall be supplied along with pivoted sashes and shall be of adequate length to terminate one meter from the floor. Loose ends of cords shall end in metal or plastic pull as approved by the Engineer-in-Charge.

4.6 **ACCEPTANCE CRITERIA**

4.6.1 **FOR FABRICATED ITEMS**

- a) Overall dimension shall be within + 1.5 mm of the size
- b) Mullions, transoms etc. shall be in one length and permissible deviations from straightness shall be limited to 1.5 mm from the axis of the member.
- c) Door and window shutters shall operate without jamming. The clearance at head and jamb for door shutters shall not exceed 1.5 mm. For double leaf doors, the gap at the meeting of stiles shall not be more than 1.5 mm.
- d) Door leaves shall be undercut wherever required.
- e) Doors, windows, frames etc. shall be on a true plane, free from warp or buckle.
- f) All welds shall be dressed flush on exposed and contact surfaces.
- g) Correctness of location and smoothness of operations of all shop installed hardware and fixtures.
- h) Provision for hardware and fixtures to be installed at site.
- i) Glazing clips, fixing devices etc. shall be supplied in adequate numbers
- j) Shop coats shall be properly applied.
- k) Glazing beads shall be cut with mitered corners.

4.6.2 **FOR INSTALLED ITEMS**

- a) Installations shall be at correct location, elevation and in general, on a true vertical plane.
- b) Fixing details shall be strictly as shown on drawings.
- c) Assembly of composite units shall be strictly as per the drawings with mastic caulking at transoms and mullions, gaskets, weather strips etc. complete.

- d) All frames on external walls shall be mastic caulked to prevent leakage through joint between frames and masonry.
- e) All openable sections shall operate smoothly without jamming.
- f) Locks, fasteners etc. shall engage positively. Key shall be non-interchangeable.
- g) Cutting to concrete or masonry shall be made good and all abrasions to shop paint shall be touched up with paint of same quality as shop paint.

4.7 **Mode of measurements**

On area basis or on weight basis as specified in BOQ of steel section used as specified in item of work.

C- 19: SPECIFICATION FOR FIRE RESISTANT DOORS

1.0 SCOPE

The work covered under this specification consist of supplying and installing in position fire resistant doors in strict accordance with these specifications and approved drawings.

The contractor shall submit shop drawings showing (all necessary hardware fittings) for approval of Engineer-In-charge. One sample of door with all necessary hardware fittings shall be fixed at the site before approval as per the directions of Engineer-In-charge. Only after approval the order has to be placed in bulk.

1.1 GENERAL

Fire resistant doors shall be manufactured as per IS: 3614 Part-2 with minimum 2hrs fire rating. 3 Criteria Godrej Make Fire Doors with minimum 2 hours fire rating, conforming to IS 3614 Part II (meeting insulation criteria as per Clause 9.4) at all heights and levels. The doors shall be comprising of box section fully insulated frame and fully insulated shutters faced with CRCA sheets on both sides and shutter fixed to frame with help of SS hinges including painting the steel work with approved anti corrosive fire retardant primer and finishing coats of approved shade and make of Polyurethane paint and provision for door closing and opening mechanism, smoke seals, fire resistant fittings and fixtures, locking arrangement and fixing in position in masonry / concrete with necessary holdfasts, anchor fastener etc. and making good the masonry / concrete generally as per specifications and as indicated in drawings. The work shall be completed in all respects as per approved shop drawings which is to be designed and submitted by the agency for dimensional checking by the Engineer In charge prior to taking up of fabrication work. Payment shall be made for opening sizes only.

Necessary test certificates for these doors from approved laboratory shall be furnished by the contractor. Fire resistant vision panel and all hard ware fittings shall be of approved quality and shall be tested for required fire rating.

1.2 Mode of Measurement: The unit of measurement for fire resistant door frames shall be running metre and that for shutter shall be sqm or as specified in the BOQ.

C-20: SPECIFICATIONS FOR ROLLING SHUTTERS

1.0 SCOPE OF WORK & GENERAL:

- 1.1 Item refers to supplying and fixing rolling shutters of size and type as specified in the description of item and conforming to IS 6248.
- 1.2 The contractor shall submit shop drawings showing (all necessary hardware fittings) for approval of Engineer-In-charge.

2.0 MATERIALS:

- 2.1 Rolling shutters complete with all accessories shall be of approved quality and as specified. These shall be suitable for fixing in position as specified i.e. outside or inside; on or below lintel or between jambs of the opening. Rolling shutter shall be hand/gear operated as specified in the item of schedule of quantities. For hand operated shutters, it shall be push and pull type. For gear operated shutters, it shall be provided with reduction gear operated by mechanical device with chain, crank, shaft and handle. The shutter shall consist of 80 mm. wide M.S. laths 1.25 mm. thick or gauge as specified of best quality mild steel sheet machine rolled. Laths shall be interlocked together throughout their entire length and jointed together at the end with end locks. These shall be mounted on specially designed pipe shaft. The spring shall be of best quality and shall be manufactured from the tested tensile spring steel wire or strip of adequate strength to balance the shutter in all positions. The spring, pipe shaft etc. shall be supported on strong mild steel or malleable cast iron brackets. Both the side guides and bottom rails shall be joint less and of single piece of pressed steel of minimum 16-gauge thickness. The top cover of shaft, spring etc. shall be of the same materials as that of lath. No extra payment shall be made for the hood, brackets etc. to cover the shaft etc. The reduction gear arrangement operated by the mechanical device shall be of the best quality and shall be easy in operation.

3.0 FIXING:

- 3.1 Brackets shall be fixed on the lintel/beam or under the lintel/beam as specified in item with rawl plugs and screws, bolts, washers etc. The shaft along with the spring shall then be fixed on the brackets. The lath portion (shutters) shall be laid on ground and the side guide channels shall be bound with it. The shutter shall then be placed in position. The side guide channels shall be fixed to the wall through the plates welded to the guides. These plates and brackets shall be fixed by means of steel screws, bolts and rawl plugs drilled into the wall. The plates and screws,

bolts shall be concealed in plaster to make their locations invisible. Fixing shall be done accurately in a workman like manner that the operation of the shutter is easy and smooth. All grout holes and damages on the wall while fixing of shutters shall be made good by the contractor at no extra cost to the Department. The contractor shall ensure smooth and easy working of shutters. All the members of the rolling shutter shall be thoroughly cleaned off dust, scales, rust etc. and shall be given approved priming coat of red oxide paint before fixing the shutter in position and then shall be painted with two coats of flat/synthetic enamel paint of approved quality and shade.

4.0 Fire Rated Rolling Shutter

- 4.1 Single skin fire rated rolling shutter FRS120 shall be as per IS3614 Part-1 & BS 476 Part 20 & 22 and tested to BS 476 Part 22. Slats shall be made from galvanized steel 0.8/1.2mm (22/18 gauge) as per IS 277 of size 109mm of approved make. Shutter shall be certified labeled and approved for fire rating for 120minutes, stability and integrity.
- 4.2 Construction of the flats shall be of 0.8/1.2mm thick GI sheet forming to the door height, the bottom edge of the door shall be 100mm bar fabricated from 50mmX50mmX5mm thick Steel angle. The side guides will be 3mm thick single piece GI guide rail for superior stretch. The shutter box shall be Welded standard steel pipe with double flange steel shafts supported by enclosed bearings. Box cover shall be minimum 0.8mm thick steel box casing cover and side guides painted in approved colour.
- 4.3 Motor capacity shall be 1hp for size upto 5000mm x 5000mm, and 3hp for sizes above 5000mm x 5000mm. Connecting volt shall be 220Volt 50Hz 1 phase up to 5000mm x 5000mm, and 415V 50Hz 3 phase for bigger sizes. One unit Push Button Switch (Up, Stop, Down), IP 65. Current rating will be 5 Amp for sizes less than 5000mm x 5000mm, 9 Amp for more than 5000mm x 5000mm size. The fusible link shall be 24V solenoid release. Vendor should supply 16A, 3 pin, and industrial male socket with 1Mtr cable along with controller.
- 4.4 Rolling shutter finish shall be Galvanized and painted in approved colour on both sides. Minimum head room shall be 700mm to 1000mm based on door sizes, including motor side 200mm and bearing side 150mm.

Note: (i) Design/shop drawing has to be submitted for approval.

5.0 MODE OF MEASUREMENT:

- 5.1 The area of rolling shutters shall be measured in square metre correct up to two places of decimal. Width and height shall be taken for net opening correct to a centimeter.

6.0 RATE:

The rate shall include the cost of materials (including all necessary hardware fixtures), labour involved in all the operations described above.

C-21: SPECIFICATIONS FOR GRILLS/RAILINGS

1.0 GENERAL:

- 1.1 The contractor shall submit shop drawing covering all types of work under this specifications before manufacture, based on the scheme drawings. The drawing shall show all dimensions, details of construction, installation relating to the adjoining work.

2.0 MATERIALS:

- 2.1 All structural steel shall conform to IS. 226 sections for grills and shall be free from loose mill scales, rusts, pittings or any other defects affecting its strength and durability.
- 2.2 Stainless steel of specified grade conforming to relevant standards shall be used.

3.0 FABRICATION:

- 3.1 The grill/railings shall be fabricated to the design and pattern shown in the approved shop drawings. All joints shall be made in best workman like manner with slotting and welding as required to the specified size and shape. The edge of the MS. flats shall be suitably mitred before welding to get the desired shape. The joints shall be filled to remove excess stay after welding. Screws, nuts, washers, bolts, rivets and any other miscellaneous fastenings, devices shall be of steel and shall be provided by the contractor.
- 3.2 Manufactured grills/railings then be fixed in between the posts, balusters, M.S. frame work etc. to correct alignment. Any undulations, bends etc. found shall be rectified by the contractor at his own cost. The complete assembly of grill/railing so fixed shall be firm and there shall not be any lateral movements.

4.0 SAMPLES:

- 4.1 Samples of grill and railings shall be submitted for approval of the Engineer-in-Charge and to be got approved before taking up for mass fabrication.

5.0 INSTALLATION:

The approved grills shall be fixed in position where specified and shown in drawings including in masonry walls, teakwood frames, hand railings etc. Any damages to walls, frames etc. caused during fixing the grills/ railings shall be made good by grouting with cement mortar/packing/repairing properly at the contractor's cost.

6.0 **PAINTING:**

6.1 Painting shall be done as per the specifications specified under painting for M.S. grill and railings.

7.0 **MODE OF MEASUREMENT:**

7.1 M.S. grill manufactured and fixed in position shall be measured by weight for payment.

7.2 The rate is to include the cost of all materials, labour, transporting, fabricating, installing, scaffolding if necessary, grouting etc. complete.

8.0 **FINISHING/PAINTING/POLISHING FOR RAILING:**

Teak wood hand rail shall be polished with wax polish/ french polish/solignum with two or more coats over one coat of wood primer or painted with two coats of synthetic enamel paint/flat oil paint of approved make and shade over one coat of approved primer. M.S. grills, balusters etc. also to be painted as per specifications specified under painting/polishing. S.S. Handrails, balusters etc. also to be finished as per specifications in BOQ.

9.0 **MODE OF MEASUREMENTS (HAND RAILS):**

Hand railing shall be measured for payment in running metre or as specified in BOQ. The length shall be measured along the top centre line of the hand rail and shall be measured between ends of balusters, newels, posts as the case may be up to two places of decimals of a metre. Rate shall include fabrication, leaving suitable pockets, grouting the same, providing and fixing suitable teak wood plugs, fixing, all labour, materials, transport, painting/polishing, finishing and scaffolding, if necessary.

C-22: SPECIFICATIONS FOR MS GATE

1.0 MATERIALS:

The contractor shall submit shop drawing covering all types of work under this specifications before manufacture, based on the scheme drawings. The drawing shall show all dimensions, details of construction, installation relating to the adjoining work. They shall generally conform to relevant I.S Specifications. All the materials for the same shall be procured from approved list of manufacturers.

2.0 INSTALLATION:

2.1 For each leaf of the gate, the internal members shall be welded to the internal angle iron frame of required size by means of suitable welding. The internal angle iron frame is then fixed to the outer frame by means of suitable angle iron lugs welded together. Suitable cleats for the locking arrangement are welded at the height as shown in the approved shop drawings. Both the leaves of the gates thus be fixed over suitable hinges provided on the M.S Channel posts of specified sizes. The side post which shall be erected prior to fixing the gates shall be welded with suitable size M.S plates at the bottom. These posts shall be properly embedded in cement concrete foundations of specified sizes and allowed to set properly.

2.2 All the assembly mentioned above shall be properly erected correct to line, level, plumb and render easy and proper movement of shutters.

3.0 SURFACE FINISHING:

The shutters, channels posts and all other steel parts shall be thoroughly cleaned and painted with Zinc Chromate primer of approved make and shade. Final painting with two coats of Synthetic enamel paints of approved shade and make shall be done as directed by Engineer in charge as per specifications or as specified in the BOQ.

4.0 MODE OF MEASUREMENT:

4.1 M.S. Gate manufactured and fixed in position shall be measured by weight for payment.

4.2 The length of the gate shall be measured outside to outside of the extreme M.S. Channel posts and height between the extreme ends of the top and bottom channel members of shutters.

4.3 The rate shall include the cost of all materials mentioned in the drawings viz. M.S sections, guide plates & wheels, channels, hinges, locking arrangements and other accessories as also necessary excavation in pits, embedding posts cement concrete of M-30 grade, painting etc. all complete.

C-23: SPECIFICATIONS FOR M.S. CRIMPNET GATE

1.0 MATERIALS:

All steel work, pipe frame work and crimpnet shall be of sizes and sections as per approved shop drawings. They shall generally conform to relevant I.S. specifications. The G.I. crimpnet shall be unless otherwise stated, 25 x 25 mm. x 8 g. and of approved manufacture.

2.0 INSTALLATION:

2.1 For each leaf of the gate, the crimpnet shall be fixed tightly to internal angle iron frame of required size by means of suitable welding. This internal angle iron frame is then fixed to outer frame of 50 mm. dia. seamless pipes by means of 65 mm. long angle iron lugs welded together. Suitable cleats for the locking arrangement are welded at the height as shown in the approved shop drawings. Both the leaves of the gates thus be fixed over suitable hinges provided on the side M.S. channel posts of specified sizes. The side post which shall be erected prior to fixing the gates shall be welded with MS plates 250 x 150 x 5 mm. at bottom. These posts shall be properly embedded in cement concrete foundations of specified sizes and allowed to set properly.

2.2 All the assembly mentioned above shall be properly erected correct to line, level, plumb and render easy and proper movement of shutters.

3.0 PAINTING:

The shutters, channel posts and all other steel parts shall be thoroughly cleaned and painted with red oxide primer of approved make and shade. Final painting with two coats of flat oil/synthetic enamel paints of approved shade and make shall be done as directed by the Engineer-in-Charge and as per specifications.

4.0 MODE OF MEASUREMENT:

4.1 The length of the gate shall be measured clear in between the side MS channel posts and height between the extreme ends of pipes, correct to half centimeter and area worked out in sqm. correct to two places of decimals.

4.2 The rate shall include the cost of all materials mentioned above viz. crimpnets, M.S., angles, G.I. pipes, guide plates, channels, base plates, hinges, locking arrangement and other accessories as also necessary excavation in pits, embedding cement concrete, painting etc. all complete. The rates shall be valid for areas in variance by about (+/-) 10% in the overall size of the gate.

C-24: SPECIFICATIONS FOR FRP DOORS

1.0 SCOPE

- 1.1 The work covered under this specification consist of fabricating, supplying and installing in position FRP Doors in strict accordance with these specifications and drawings.

2.0 APPLICABLE CODES & SPECIFICATIONS:

- a) **ASTM D 790** – Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
- b) **ASTM D 638** – Tensile Properties of Plastics.
- c) **ASTM D 2583** – Indentation Hardness of Rigid Plastics by Means of Barcol Impressor.
- d) **ASTM D 256** – Determining the Pendulum Impact Resistance of notched Specimens of Plastics.

2.1 GENERAL

- 2.2 The contractor shall submit shop drawings of fabrication and erection for approval of the Engineer-In-charge.
- 2.3 No fabrication work shall be undertaken prior to the approval of the Engineer In-charge.
- 2.4 The contractor shall submit samples of all materials/sections to be used for manufacturing of windows and louvers for approval of the Engineer In-charge before bulk procurement.

3.0 MATERIALS

FRP Door Composite Components: Minimum of 5 ply composite construction to include: Facing: 3.05 mm composite FRP sheet exterior grade, fiber reinforced plastic panel on interior and exterior faces. Colored pigment shall be maximum amount formulated within the resin. FRP face sheets shall be USDA accepted. FRP face sheets to be non-porous. FRP face sheets to have a maximum flame spread rating of 200, and smoke generated maximum of 450 meeting Class C requirements per ASTM E84. Class A FRP face sheets having a minimum flame spread rating of 20, fuel contributed 0, and smoke generated 100, are optionally available.

Core Liner: Foam core of door shall be completely covered on interior and exterior sides of core with full sheets of 0.032-inch (0.81mm) thick aluminum.

Core: Rigid polyurethane poured-in-place foam with an R value of 5. Use of glue or other adhesives to bond aluminum sheet to pre-poured core is not acceptable.

Interior channels to be fabricated from 16-gauge type 304 (316 and 316L available) stainless steel for maximum corrosion resistance and strength. No aluminum extrusions allowed.

Outer Channel Trim: Replaceable perimeter door edge of 14-gauge type 304 (316 and 316L available) stainless steel shall be provided.

Outer channels shall be joined using notched, fitted butt joints for maximum strength and rigidity.

Regulations: All components and agents to meet EPA standards.

Hinges: Standard door prep shall be for a continuous hinge type rated for door weight. Optional 4-1/2" or 5" heavy weight ball bearing hinges available upon request.

4.0 Fabrication

- a) **General:** Install 304 SS corner supports where stiles join rails. Assemble inner channels to aluminum panels using 3M VHB Tape. Inject polyurethane foam before bonding FRP sheets to aluminum panels. Machine FRP face sheets to accept outer channels to provide flush appearance of channels to face.
- b) **Cutouts:** Machine doors for required vision lites or louvers. Factory to install vision lites or louvers if required.
- c) **Hardware Reinforcements:** Factory to mortise, drill and tap doors for all mortise hardware as required by hardware manufacturer's template. All drilling for thru bolted surface mounted hardware to be done in field by installer.
- d) **Electrified Hardware:** When electrified hardware is required, door will be prepped in accordance with electrified hardware manufacturer's recommendations. All electrified hardware installation to be done in field by installer.

5.0 Execution

- a) **Receipt:** Upon receipt of product, all materials shall be thoroughly inspected and all discrepancies, deficiencies and/or damages shall be immediately reported to the supplier in writing.
- b) **Storage:** The doors be stored indoors in a vertical position, clear of the floor, with blocking between the doors to permit air circulation between the doors and prevent damage to the door faces. Rain/water or condensation

must not be allowed to collect or lay between stored doors. Do not wrap in plastic sheeting, as it will promote condensation formation within. Permanent discoloration can result.

6.0 MODE OF MEASUREMENT:

- 6.1 The unit of measurement FRP doors frames shall be Rm; FRP doors shutters shall be Sqm or as specified in the BOQ.

C-25: SPECIFICATIONS FOR WATER PROOFING TREATMENT

1.0 SCOPE

1.1 This work covered under this specification consists of providing and laying water proofing treatment to horizontal and vertical surfaces of various components like underground trenches, tunnel, lift well, roof terraces, chajjas, water tank, drainages, sunken floors of toilets & kitchens etc.

1.2 This specification also covers the guarantee to be given by the executing agency for leak proofness of the treatment for a period of ten years.

2.0 APPLICABLE CODES & SPECIFICATIONS:

2.1 The relevant IS. specifications, standards and codes given below are made a part of this specification. All standards, specifications, code of practices referred to herein shall be the latest edition including all applicable amendments, revisions and additional publications.

2.2 List of Indian Standards

- a) IS:73 : Paving Bitumen
- b) IS:702 : Industrial Bitumen
- c) IS:1203 : Methods of testing tar and bitumen
- d) IS:1322 : Bitumen felts for waterproofing and damp proofing
- e) IS:1346 : Code of Practice for waterproofing of roofs with bitumen felts
- f) IS:3384 : Bitumen primer for use in waterproofing and damp proofing.
- g) IS:2645 : Specification for integral water proofing compounds for cement mortar and concrete.
- h) IS:3144 : Methods of test for mineral wool thermal insulation materials.
- i) IS:4641 : Expanded polystyrene for thermal insulation purpose.
- j) I.S. 1200-IX : Method of measurement of building and civil engineering works, (Roof covering)

3.0 **GENERAL:**

- 3.1 The work of water proofing treatment shall be executed through a specialized agency having sufficient experience in the field specified type of waterproofing.
- 3.2 The contractor shall submit the detailed methodology as per manufactures specification and the agency to be appointed for water proofing works for approval of the Engineer Incharge before commencement of work. Make and composition of all waterproofing materials including ancillary item such as primer, mastic sealant, and protection boards as recommended by the manufacturers shall be clearly mentioned in the methodology being submitted.
- 3.3 The contractor shall provide at site a competent supervisor during execution of waterproofing works over areas and shall ensure the adequacies of the works carried out to be in line with the drawings and specifications.
- 3.4 The most effective method of waterproofing is not to allow water to pond over the surface. Adequate care shall be exercised during the laying of cement screed to ensure that waterproofing compound is added in the measures required and that proper slope is provided for drainage of water.
- 3.5 Construction joints are the most vulnerable from seepage point of view. It shall be ensured that all the construction joints in the RCC slab, beams, gutters etc. shall be injection grouted prior to the start of waterproofing. All efforts shall be put to see that the screed concrete is laid in one go as far as possible without joints. In unavoidable circumstances, utmost care regarding treatment of joints prior to resumption of concreting from the left over joints shall be exercised. The joints shall be chipped off loose materials and coated with chemicals like "NITOBOND" or equivalent to ensure proper adhesion between the joints.
- 3.6 He shall also bring to the notice of the Engineer-In-charge, the protective measures required for the protection of the water proofing for subsequent operations over it.
- 3.7 The performance guarantee bond for all the water proofing works carried out by the water proofing agency will be required to be furnished by them through the contractors.
- 3.8 In addition to the above, the main civil contractor also shall have to submit the performance guarantee bond in the prescribed form for water proofing guarantee as specified.

- 3.9 The proposed waterproofing material shall be suitably resistant to all chemicals with which they are likely to come into contact.
- 4.0 **APP MODIFIED BITUMINOUS MEMBRANES WATER PROOFING TREATMENT OVER THE TERRACE:**
- 4.1 Water proofing treatment shall be as specified in the schedule of items.
- 4.2 The concrete surfaces should be cleaned of all unwanted materials and the same shall be made rough.
- 4.3 The construction joints or cracks, if any, should be inspected and if found necessary, "Damp proof" compound with cement solution as per manufacturer's specifications shall be injected to seal off the cracks as well as any honey-combs and cavities in the slab.
- 4.4 The same shall then be subjected to terrace method of water proofing treatment as per manufacturer's specifications.
- 4.5 The cleaned terrace shall be watered properly and cement screed with water proofing compound shall be laid to provide necessary gradient for easy flow of rain water.
- 4.6 Over the surface, APP modified bituminous polyester reinforced waterproofing membrane manufactured from a rich mixture of bitumen and selected polymers blended together to obtain excellent heat resistance, flexibility & UV resistance shall be used. Modified bitumen then shall be coated onto a dimensionally stable carrier to obtain excellent tensile strength, tear and puncture resistance. The membrane should be lightweight, UV resistant and self protective, weather resistant and flexible enough to resist the movements in cracks. The thickness shall be minimum 4mm and granule surfaced. The reinforcement within shall be of at least 140 gms/sqm polyester mesh.
- 4.7 Surface Preparation: Concrete, mortar surfaces must be clean, free from grease, oil and loosely adhering particles. Steel and iron surfaces must be free from scale, rust, grease and oil. All surfaces must be as true as possible.
- 4.8 Apply bituminous primer to a clean, smooth and dry surface by brush, roller or spray. Unroll and align and re-roll correctly before torching. Overlaps should be minimum 100mm. Use gas burner to heat the substrate and the thermo fusible film on the underside on lower face of membranes. When the thermo fusible film melts after torching, the membrane is ready to stick. Roll forward and press firmly against the substrate to bond. Heat both the overlaps and use the round tipped trowel heating the same to smoothen and

press into seam. All angles and abutments should be sealed with extra care to ensure full bondage. The edges should be sealed well into the grooves.

- 4.9 Membrane will be applied first to the rain water channels and then to the sloped concrete roof. The membrane shall be installed vertically from rain water channel towards the ridge of the roof. End joints shall be laid in a scattered manner so that multiple overlapping of membranes at the same location is avoided.
- 4.10 This treatment shall be continued along the inner sides of parapets or adjoining walls up to a height of 300 mm to 375 mm till the horizontal projection (gundi).
- 4.11 The construction joints shall be taken at ridges and should be made properly watertight and monolithic.
- 4.12 Care shall be taken to finish the rain water inlets etc. properly so that no leakage occurs.
- 4.13 The terrace shall be tested for leak tightness after the treatment is completed and any defects shall be made good.

5.0 **CEMENT BASED WATER PROOFING TREATMENT TO OVERHEAD WATER TANK:**

- 5.1 The tank is to be treated from inside as per 'Injection' and 'Surface' methods which includes the plaster finished smooth with trowel.
- 5.2 Injection to be given to the floor and walls as and when found necessary and thereafter a layer of approved water proofing will be laid on the floor and will be conformed along the side and partition walls to their full height.
- 5.3 The thickness of the treatment on the floor will be about 50 mm and on the wall about 20 mm.
- 5.4 After the treatment is completed the tank shall be filled with water and the water retained for 24 hours. If any leakage is observed the contractor shall rectify the defects and the tank shall be retested for leak tightness.

6.0 **CEMENT BASED WATER PROOFING TREATMENT TO THE BASEMENT:**

- 6.1 The water proofing treatment for underground trenches, walls, raft, lift pit, water tank etc. shall be done of basement type (Box Type).

- 6.2 The PCC surface below raft shall be thoroughly cleaned and a layer of water proofing treatment about 75 mm thick shall be laid.
- 6.3 The RCC raft shall then be cast over these surfaces. The side walls shall be cast afterwards and the water proofing treatment shall be continued on these walls up to the required heights.
- 6.4 The thickness of treatment for vertical surfaces shall be 40 mm to 50 mm.
- 7.0 **WATER PROOFING TREATMENT IN SUNKEN FLOORS OF TOILET AND BATH ROOM:**
- 7.1 Water proofing treatment shall be as specified in the schedule of items over sunken floors of toilets, bath rooms and washing places.
- 7.2 The RCC slab and other surfaces should be cleaned of all foreign materials such as loose mortar, concrete, local humps, bare metal pieces and other unwanted material.
- 7.3 The surface to be treated shall be hacked to remove loose mortar scalings and roughened. The surface should then be rubbed vigorously to remove all dust with the help of wire brush / brooms.
- 7.4 The surface thus prepared shall then be washed with clean potable water before laying the water proofing treatment.
- 7.5 The cracks, honey combing if any should be located and should be treated with injection, grouting etc. to seal off the cracks, air holes, honey comb, etc. to the entire satisfaction of the Engineer-In-charge.
- 7.6 The prepared RCC surface shall be then watered again thoroughly and cement slurry shall be spread over the surface along with water proofing as per manufacturer's specifications.

ALTERNATE - I

- 7.7 A two component acrylic polymer based flexible cementitious coating of heavy duty flexible coating system with excellent waterproofing and shall be used for waterproofing sunken slabs. The product shall be similar to Dr. FIXIT Pidifin 2k or equivalent.

7.7.1 METHODOLOGY:

- 7.7.1.1 Surfaces to be applied upon, must be clean, dry, free from dirt and loose material.
- 7.7.1.2 Over the R.C.C base slab, apply polymer modified cementitious seamless waterproofing membrane at a rate of 2-2.5 square meter per kg to all required areas, at a thickness of 500 – 600 microns and allow to dry for 4-6 hours.
- 7.7.1.3 Apply second coat in the opposite direction at the same rate. After application of second coat it gives the total thickness shall be 1 to 1.2 mm. The treatment is left as it is for 72 hours for air cure.
- 7.7.1.4 The waterproofing shall be carried at least 300 mm-on vertical surfaces, or at least 150mm above the floor finish level.
- 7.7.1.5 After 3 days of air curing, a layer of 10mm Cement/Sand (Ratio 1:4) protective screed, using Integral Waterproofing Compound @ 200ml/50 kg bag of cement, shall be applied on top of the membrane. Care shall be taken whilst laying the protective screed so as not to damage the waterproofing membrane below.

ALTERNATE –II

- 7.8 25 mm thick bedding of cement mortar 1:4 with water proofing compound @ 2% of weight of cement shall be laid on the floor in specialized manner. 18 mm thick cement plaster of cement mortar 1:4 with water proofing compound @ 2% by weight of cement shall then be applied over the vertical surfaces.

Finishing & Curing

- 7.9 The water proofing plaster so laid should be allowed to set for atleast one week and kept under water.
- 7.10 Any seepage/ dampness noticed on the underside of the ceiling should be treated again as detailed above,
- 7.11 Cinder fill as specified in the schedule of items shall be laid over the water proof plaster to fill up the space/ voids of sunken floor areas.
- 7.12 The treatment shall be cured with clean water for a minimum period of 10 ays.

8.0

WATERPROOFING AND THERMAL INSULATING SYSTEM FOR ROOF AREAS: ALTERNATE-1 (Using Screed for Slopes)

Step 1: "INTEGRITANK" Esselac MMA Resin based Cold Spray Applied Elastomeric Primary Waterproof Membrane Layer:-

The waterproofing membrane "INTEGRITANK" manufactured by M/s. Stirling Lloyd Polychem Limited, U.K. , or equivalent and installed by turnkey waterproofing specialist agency NINA Waterproofing Systems. Pvt. LTD, shall be a 2.0 mm thick (minimum), Esselac MMA resin based cold spray applied, elastomeric seamless liquid membrane applied in two coats of contrasting colours of 1 mm DFT each, over one coat of primer. All components of the system shall be suitable for use in permanently buried, submerged conditions as well as exposed locations. The Integritank MMA resin based spray applied membrane shall be a 100% solids based solvent free system and have a valid BBA Certificate for use in Roofing applications. Bitumen based materials or those that include isocyanates or other sensitising materials will not be permitted for use.

Physical Properties:

Tensile Strength > 10 Mpa

Elongation at Break 130%

Tear Strength 70 N/mm

Hardness > 55 (Shore D) (ISO 868:1985)

Dimensional Stability < + 0.25%

(MOAT 27:5.1.6.1 1983)

Tensile Adhesion (BS EN ISO 4624:2003)

Concrete substrate > 0.3 Mpa

Water Vapour Resistance at 25 degree C, 75% RH < 70 MNs/g (BS 3177:1959)

The Top membrane layer should be integrity tested using non-destructive, high voltage

electronic holiday detection equipment operating at a test voltage of 8 kV to ensure a pinhole free surface.

Step - 2: Detailing around Penetration / Base Plate etc:-

Carrying out necessary detailing / flashing at the penetration locations of baseplate / anchor bolts etc., with hand applied INTEGRITANK Esselac MMA resin based cold spray applied solvent free, 100% solids based Waterproofing Membrane to ensure the over all system continuity.

Step -3: Epoxy Bond Coat:-

Providing and applying Dr. Fixit Pidipoxy EP epoxybased bond coat over the entire surfaces alongwith sprinkling of the quartz sand to create a rough key for the subsequent layer.

Step - 4: Spray Applied Polyurethane Foam Insulation Layer:-

Supplying and applying instant setting spray applied avg 80 mm thick, multilayer insulative waterproof, Dr. Fixit Foamshield polyurethane foam, 2 component, self flashing CFC free blown, polymeric M.D.I. based thermal insulation system having thermal conductivity @ 25°C of 0.023 W/MK, to be applied as per the manufacturer's recommendations with 10 years composite warranty against leakages to be provided by the principal manufacturer. Dr. Fixit Foamshield has a core density of 45 - 50 Kg/m³, compressive strength with rise of 4.2 Kg/cm² tensile strength with rise of 5.1 Kg/cm², closed cell content of 96-98%, Fire resistance conforming to Class - B2 as per DIN 4102.

Step - 5: Two component 100% solids solvent free Hybrid Polyurea Polyurethane Spray Applied Elastomeric Seamless Membrane Top Layer:-

Cleaning and making necessary surface preparation, thereafter providing & applying one coat of Dr. Fixit Superseal P-100, or equivalent make, two component solvent free epoxy primer @ 0.15- 0.20 kg/ m², followed by providing & applying Dr. Fixit Superseal 900, or, equivalent, 2 component , solvent free , 100% solids based Hybrid Polyurea polyurethane liquid cold applied elastomeric seamless membrane by airless spray/roller / squeegee with a total consumption of 2.20 to 2.30 kg per Sq.Mt., to form a total system DFT of 2.00 mm thickness, having Tensile strength of > 10 N/mm², Elongation of min 900%, Solids content of 100%, Shore A Hardness of over 50 and crack bridging capability of upto 4 MM, applied on horizontal surfaces and on verticals upto 300mm height above the FFL, ponding with water for 3 days to test the water tightness etc complete. The system must be capable of being installed on surfaces with Moisture content upto 10% to allow application in humid environment and slightly damp surfaces. The system must be capable of being applied by either airless spray or Roller or Squeegee to allow for fast application on large areas as well as to facilitate Manual application on locations requiring minor repairs, touch ups , etc in small areas also as required at site . The system must be cold applied without requiring any heating equipment during application . The system must not be instant setting and must have a pot life of

min 20 mins or more, to remain in a fluid state post application to enable WFT measurement of the applied membrane film on site, to ensure proper QAQC.

Technical Information			
Test Parameter	Test Method/ Conditions	Unit	
Observed Value			
Physical Parameters			Dr. Fixit Superseal 900
Mix Ratio (Part A : Part B) by weight			16.0 : 9.0
Physical Form coloured			Red liquid(after mixing)
Density 0.05	@ 30°C	g/cm ³	1.1 ±
Soild 100		%	
Application Parameters			
Pot life 40	@ 30°C	minutes	~
Performance Parameters @ 30°C			
Tensile strength 12.0	ASTM D 412	N/mm ²	>
Elongation 900	ASTM D 412	%	>
Tear strength 40.0	ASTM D 624	N/mm	>
Shore A Hardness 50.0	ASTM D 2240	–	>
Water absorption 1.0	ISO 62	%	<
Coverage for 1.5 mm thickness - 1.70	-	Kg/sq.mt	1.60
Packing A:16.0Kg: 9.0 kg)	-	-	25 Kg(Part Part B
Bond Strength on Concrete 2.00	ASTM D 7234	N/mm ²	
Recovery > 90	ASTM D 412	%	
Crack bridging displacement > 4.0	ASNZ-4548	mm	

Step - 6: Final Protective Screed:-

Providing and applying final protective screed, over a geo-textile membrane of 200-300gsm thick, of average 50 mm thick with minimum M25 grade concrete using 12 mm down grade aggregates, well compacted to a float finish including providing and mixing Dr. Fixit Pidiproof LW+ or, equivalent make integral waterproofing admixture @ 100 ml per bag of cement, and 100% virgin polypropylene fibers @ 0.9 Kg. per Cu.Mt. of Concrete and thereafter saw cutting the contraction joints to form panel of upto maximum 12 Sq.Mt. size with groove of 5 mm wide and 15 mm deep and finally sealing the groove with Dr. Fixit PU sealant alongwith curing etc. complete.

Step-7: Top UV Resistant Protective Coating: -

Thereafter providing and applying 2 coats of Dr. Fixit Superseal TC, or, equivalent make Aliphatic pure polyurethane based UV resistant top coat all as per manufacturer's

Recommendation etc. complete. Total consumption of Dr. Fixit Superseal TC shall be 300 to 400 grm per Sq.Mt. Dr. Fixit Superseal TC shall be applied in either light grey or, red or, white or, other colours as approved, based on the colour scheme finalised by the Architects/ Clients.

9.0

WATERPROOFING AND THERMAL INSULATING SYSTEM FOR ROOF AREAS: ALTERNATE-2 (Using Light weight AAC blockbat Coba for Slopes)

Step - 1: "INTEGRITANK" Esselac MMA Resin based Cold Spray Applied Elastomeric Primary Waterproof Membrane Layer:-

The waterproofing membrane "INTEGRITANK" manufactured by M/s. Stirling Lloyd Polychem Limited, U.K. , (M/s. GCP Applied Technologies) or equivalent and installed by turnkey waterproofing specialist agency NINA Waterproofing Systems. Pvt. LTD, shall be a 2.0 mm thick (minimum), Esselac MMA resin based cold spray applied, elastomeric seamless liquid membrane applied in two coats of contrasting colours of 1 mm DFT each, over one coat of primer. All components of the system shall be suitable for use in permanently buried, submerged conditions as well as exposed locations. The Integritank MMA resin based spray applied membrane shall be a 100% solids based solvent free system and have a valid BBA Certificate for use in Roofing applications. Bitumen based materials or those that include isocyanates or other sensitising materials will not be permitted for use.

Physical Properties:

Tensile Strength	> 10 Mpa
Elongation at Break	130%
Tear Strength	70 N/mm
Hardness	> 55 (Shore D) (ISO 868:1985)
Dimensional Stability (MOAT 27:5.1.6.1 1983)	< + 0.25%
Tensile Adhesion Concrete substrate	(BS EN ISO 4624:2003) > 0.3 Mpa
Water Vapour Resistance at 25 degree C, 75% RH	< 70 MNs/g (BS 3177:1959)

The Top membrane layer should be integrity tested using non-destructive, high voltage electronic holiday detection equipment operating at a test voltage of 8 kV to ensure a pinhole free surface.

Step - 2: Epoxy Bond Coat:-

Providing and applying Dr. Fixit Pidipoxy EP epoxy based bond coat over the entire surfaces along with sprinkling of the quartz sand to create a rough key for the subsequent layer.

Step - 3: Thermal Insulation with Spray Applied Impervious Polyurethane Foam along with Top Waterproof Hybrid Polyurea Polyurethane liquid membrane.

Supplying and applying instant setting spray applied avg 40 mm thick, multilayer insulative waterproof, Dr. Fixit Foam shield polyurethane foam, 2 component, self flashing CFC free blown, polymeric M.D.I. based thermal insulation system having thermal conductivity @ 25oC of 0.023 W/MK, to be applied as per the manufacturer's recommendations with 10 years composite warranty against leakages to be provided by the principal manufacturer. Dr. Fixit Foamshield has a core density of 45 - 50 Kg/m³, compressive strength with rise of 4.2 Kg/cm² tensile strength with rise of 5.1 Kg/cm², closed cell content of 96-98%, Fire resistance conforming to Class - B2 as per DIN 4102, followed by providing and applying tone coat of Dr. Fixit Superseal P 100 Solvent free two component epoxy primer with a consumption of 0.15-0.20 kg/sqmt followed by top waterproof Sealer coat of Dr. Fixit Superseal 600, two component, 100% solids solvent free Hybrid Polyurea Polyurethane liquid applied waterproofing membrane having tensile strength of over 6 MPa and Elongation capacity of over 600%, to be applied by roller/ squeegee with a total consumption of min 1.4 Kg per Sq.Mt., so as to form an average system DFT of 1.2.

Step - 4: Protective and Slope making layer with Light Weight AAC blockbat coba

Providing and laying light weight AAC blockbat coba of a total average 110 mm thick laid to a slope of 1:80 with minimum thickness of 70 mm at the rain water outlet with IPS finish on the top laid in c.m. (1:4), using broken aerated block pieces, including Dr. Fixit Pridiproof LW+ integral waterproofing admixture @ 100 ml per bag of cement, finishing on top with false square marking of 300 mm x 300 mm including making wattas at the junctions of floor and walls upto 300 mm height including curing and testing for water tightness by ponding with water for 7 days etc. complete.

Step - 5: Providing additional thickness of light weight blockbat coba to create proper slopes

Providing and laying extra thickness of light wiight AAC blockbat coba above average 110 mm for maintaining slope, in cement mortar (1:4) including Dr. Fixit Pridiproof LW+, or equivalent integral waterproofing admixture @ 100 ml per bag of cement, etc. complete.

10.0

Waterproofing and UV Resistant Protective Coating for Vertical Surfaces at Roof Level

Cleaning and making necessary surface preparation by compressed air/ blower/ scarifier to remove any dust and laitance etc. Thereafter and thereafter, providing and applying Dr. Fixit Hydroshield PUD PLUS, or, Equivalent, water based polyurethane liquid applied elastomeric seamless waterproofing membrane (Bitumen free), to be applied in 2 coats with a total consumption of approx. 1.50 Litre per Sq.Mt., over one coat of Dr. Fixit Primeseal, or, equivalent primer, so as to form a total system thickness of approx. 1.0 mm, to be applied by brush / roller/ spray on the entire RCC slab and on the verticals upto 600 mm above F.F.L.

Thereafter carrying out pond test for testing water tightness for a period fo 3 days (pond test to be conducted after self curing period of the membrane is completed), all as per manufacturer's recommendation etc. complete.

Technical Data		
	Physical Properties Test	Unit Result
Weight solids	68%	%
	Flash Point	oC
	Non	Flammable
	DFT (recommended)	mm
	0.8	1.0
	Coverage	Sq.Mt. per Litre
	0.70	0.80

Performance		Properties	
Adhesion	ASTM D 3359	Excellent >	
3.5		N/mm ²	
Water Resistance		ISO 2812-2	Excellent
(No	adhesion		loss/
Blistering)			
Alkali Resistance	SS 5 Part G2	Excellent	
(No		yellowing/Blistering)	
Efflorescence Resistance		SS 500: 2002	
Excellent			
Water vapour permeability		ASTM D 1653	
> 25	g/sq.m	24	hrs.
Tensile Strength (@50mm/min)		ASTM D 412	
> 1.25		N/mm ²	
Elongation at break(@50mm/min)		ASTM D 412	
>		350%	
Shore A Hardness		ASTM 2240	
80	to	83	
Crack bridging ability		AS/NZD 4548.5:1999	
Excellent	-	able	to bridge
cracks	upto	2	mm
Durability (weathering)		ASTM G 154	
Excellent			
Microbial Resistance		SS345: 1990	
Excellent	(>	10	Years)
Dirt pick-up resistance		SS 500: 2002	
Very		good	
Washability		ASTM D 2486	
Excellent (> 10,000 cycle)			

11.0

Waterproofing to internal wet areas, bathrooms, kitchens etc:

Step - 1: One component SBR based liquid applied elastomeric seamless membrane

Cleaning and making necessary surface preparation by high pressure water jet to remove any dust and laitance etc., chasing open the construction joints and sealing the same to form a U shaped groove of approx. 20 mm width and 20 mm depth, using Dr Fixit URP or equivalent polymer modified mortar carrying out injection grouting at the construction joints, honeycombs, etc., by injecting cement slurry grout admixed with Dr. Fixit Pidicrete AM or equivalent expandable grout additive to full saturation wherever necessary.

Thereafter, providing and applying one coat of water based epoxy primer, followed by "Dr.Fixit Eautite", or, equivalent, high performance waterborne, modified, synthetic rubber based, liquid applied waterproofing elastomeric membrane of M/s. Pidilite having over 300% elongation capacity applied in two coats to a total DFT of 700 microns, with a consumption of approx. 1.2 to 1.3 litre per sqm on the floor & walls upto 1.00 mtr height (Shower area upto full height), ponding with water for 3 days etc. complete.

Step - 2: Polymer modified ready to use non shrink mortar protective screed/plaster

Providing and applying Dr. Fixit Pidipoxy EP, or, equivalent, Epoxy based bonding coat @ approx. 0.15 to 0.20 Kg per Sq.Mt., sprinkled with quartz sand over the surface still it is while stacky so as to form a key for installation of plaster / screed.

Step - 3: Polymer modified ready to use Non shrink mortar protective screed/plaster

Providing and applying Hydroblok 300/ Dr. Fixit or equivalent product of M/s. Pidilite Industries Ltd., comprising of polymer modified high strength cementitious mortar with a compressive strength of min 30 Mpa, to be applied as a protective layer for the floor and walls in a thickness of 5-6 mm thick by trowel application all as per manufacturer's recommendation etc., complete.

Step - 4: Sunken Filling with Sand or suitable material

(a) Providing and filling Sunken portion of the toilet and wet areas with sand filling, well compacted, using cleaned and washed graded sand, all as per the direction of the Architects / Engineer-In-Charge. This is to be done by the main civil contractor as per their scope.

(b) Top levelling screed

Providing and laying 50 mm thick M20 grade P.C.C. layer screed including Polypropylene fibers @ 0.9 Kg. per Cu.Mt., including Dr. Fixit Pidiproof LW+, or equivalent, integral waterproofing admixture @ 100 ml per bag of cement, well compacted to a float finish, curing etc. complete.

Step - 5: Top Waterproof Sealer Coat above the Sunken Filling

Providing and applying Dr. Fixit Polyplus Comboflex (I), or, equivalent, two component, flexible and highly elastic polymer modified cementitious coating to be applied in two coats with a total consumption of 2 Kg per Sq.Mt., on the top of the screed above the sunken filling layers, all as per manufacturer's recommendation including embedding fibreglass or polyester reinforcing mesh between the two

coats of the coating and taking the coating on the verticals for an overlaps of minimum 100 mm all around the periphery etc., and thereafter providing and applying Dr. Fixit Pidicrete URP, or, equivalent polymer modified cementitious bond coat, comprising of Dr. Fixit Pidicrete URP mixed with cement in the ratio of (1:1) parts by weight applied by brush and thereafter immediately sprinkling quartz sand over the bond coat to create the protection layer as well as to provide a rough key for the subsequent floor finishing etc. complete.

Technical Information

Color	: Off White
Mixed Density [g/cc]	: 1.4 + 0.02 ASTM D 1475
Pot life @ 30°C (min)	: 45
Tensile Strength [N/mm ²] ASTM D 412	: > 1
Elongation, (%)	: > 250 ASTM D 412
Abrasion resistance	: < 50 gms ASTM D 4060
CO ₂ diffusion resistance NT BUILD 372	: > 50m
Toxicity BS 6920	: Non-toxic
Water permeability Positive @ 7 bar	: Nil
Negative @ 3 bar BS 12390	: Nil
Crack bridging ability [mm]	: >3 ASTM C 836
Adhesion to concrete [N/mm ²]	: >1 ASTM D 4541
Initial cure @ 25°C & 50% RH, [hours]	: 6-8
Full cure @ 25°C & 50% RH. [days]	: 7
Application temperature	: 5°C to 45°C
Service temperature	: 0°C to 70°C

12.0 Waterproof Sealer around downtake pipes

Providing and laying Dr. Fixit Micro concrete, or, equivalent non shrink, free flow, high strength cementitious grout material to seal the annular gap around pipe periphery and core cut in the slab including providing and applying Dr. Fixit Bathseal Tape, which is a two way adhesive tape to be stuck around the pipe periphery within the cutouts section of the slab and prior to laying the Micro concrete, all as per manufacturer's recommendation, followed by providing and applying Dr. Fixit PU Sealant, or equivalent around the pipe periphery joints at the top level etc., complete.

13.0 Waterproofing treatment to internal surfaces of UG Tanks and OH Tanks

Cleaning the surface of the internal concrete surface of the floor as well as walls thoroughly by wire brushing and washing with high pressure water jet, to remove any loose laitance as well as contaminants, thereafter inspecting the concrete surface to identify any honeycombs, crack, voids or defects in the concrete such as cracks, construction joints etc., and sealing all such locations with solvent free epoxy mortar, using epoxy resin and hardener of either Pidilite or, Huntsman all as per manufacturers recommendation. Thereafter providing

and applying “Permare EPW Tropical” containment membrane system of M/s. Stirling Lloyd Polychem Ltd., UK, consisting of combination of epoxy and polysulphide formulation. “Permare EPW” tropical membrane cures to produce a tough, flexible coating system with excellent abrasion and chemical resistance and waterproof properties and consists of 2 component, which shall be applied in 2 coats by way of spray or roller to provide a minimum wet film thickness of 0.25 mm per coat with material consumption of approx. 0.3 Kg per Sq.Mt. per coat, so as to form a total DFT of 0.5 mm, all as per manufacturers recommendation etc. complete. “Permare EPW” tropical membrane shall be applied on the entire horizontal surface as well as on the vertical surface. “Permare EPW” tropical has a tensile strength of 7 Mpa at 23°C as per BS903:A2:1995) and adhesion to substrate of over 1 Mpa, as per BS EN ISO 4624:2003, with hardness (Shore D) of 52 and low temperature flexibility of upto -26°C as per ASTM D3111-88, and is a non toxic system, to be used in drinking water and potable water tanks, tested to BS 6920.

14.0

Waterproofing treatment to internal surfaces of STP tanks

Cleaning the surface of the internal concrete surface of the floor as well as walls thoroughly by wire brushing and washing with high pressure water jet, to remove any loose laitance as well as contaminates, thereafter inspecting the concrete surface to identify any honeycombs, crack, voids or defects in the concrete such as cracks, construction joints etc., and sealing all such locations with solvent free epoxy mortar, using epoxy resin and hardener of either Pidilite or, Huntsman, all as per manufacturers recommendation. as per manufacturers recommendation.

Thereafter providing and applying “Permare EP” containment membrane system of M/s. Stirling Lloyd Polychem Ltd., UK, consisting of combination of epoxy and polysulphide formulation. “Permare EP” membrane cures to produce a tough, flexible coating system with excellent abrasion and chemical resistance and waterproof properties and consists of 2 component, which shall be applied in 2 coats by way of spray or roller to provide a minimum wet film thickness of 0.50 mm per coat with material consumption of approx. 0.6 Kg per Sq.Mt. per coat, so as to form a total DFT of 1 mm, all as per manufacturers recommendation etc. complete. “Permare EP” membrane shall be applied on the entire horizontal surface as well as on the vertical surface. “Permare EP” has a tensile strength of 6 Mpa at 23°C as per BS903:A2:1995) and adhesion to concrete surface of over 1 Mpa, as per BS EN ISO 4624:2003, with hardness (Shore D) of 55 with Zero Petrol Transmission Rate as per ASTM E96-80 and low temperature flexibility of upto -26°C as per ASTM D3111-88, and with elongation at break 35% as per BS906:A2:1995 at 23°C.

15.0 CEMENT BASED WATER PROOFING TREATMENT OVER THE TERRACE:

- 15.1 Water proofing treatment shall be as specified in the schedule of items.
- 15.2 The concrete surfaces should be cleaned of all unwanted materials and the same shall be made rough.
- 15.3 The construction joints or cracks if any should be inspected and if found necessary “Damp proof” compound with cement solution as per manufacturer’s specifications shall be injected to seal off the honey-combs and cavities in the slab.
- 15.4 The same shall then be subjected to terrace method of water proofing treatment as per manufacturer’s specifications.
- 15.5 The cleaned terrace shall be watered properly and cement slurry shall be laid to provide necessary gradient for easy flow of rain water.
- 15.6 The coba shall be laid in a special manner with brick bats partly projected above. Brick bat coba shall be of average thickness of 110 mm or as specified in the drawings or as directed by the Engineer-In-charge.
- 15.7 The brick joints shall be filled in with “Damp Proof” jointless water proof plaster finished smooth with trowel in thin layer of cement and marked false into 300 mm x 300 mm squares or left smooth if directed by the EIC.
- 15.8 This treatment shall be continued along the inner sides of parapets or adjoining walls up to a height of 300 mm to 375 mm in the shape of round vata.
- 15.9 The construction joints shall be taken at ridges and should be made properly watertight and monolithic.
- 15.10 Care shall be taken to finish the rain water inlets etc. properly so that no leakage occurs.
- 15.11 The terrace shall be tested for leak tightness after the treatment is completed and any defects shall be made good.

16.0 Mode of measurements

- 16.1 The measurement shall be for the actual area covered by the treatment.

- 16.2 The length and breadth shall be measured along the walls before the treatment is laid.
- 16.3 The height of cinder fill shall be considered for measurement after deduction of the average thickness of the treatment laid horizontally over the sunken slab and quantity of cinder fill shall be measured in cum.
- 16.4 The areas of all openings, cutouts etc. shall be deducted.
- 16.5 Water proof brick bat coba shall be measured in cubic metre as actually laid.

C-26: SPECIFICATIONS FOR PAINTING

1.0 SCOPE OF WORK:

- 1.1 The work covered under these specifications consist of furnishing the various types of paints and also the workmanship for these items, in strict compliance with these specifications, which are given in detail here-in-after with the item of schedule of quantities.

2.0 MATERIALS:

- 2.1 Paints, oils, varnishes etc.of approved brand and manufacture shall be used. Ready mixed paints as received from the manufacturer without any admixture shall be used.

If for any reason, thinning is necessary in case of ready mixed paint, the brand of thinner recommended by the manufacturer or as instructed by the Engineer-in-Charge shall be used. Approved paints, oils or varnishes shall be brought to the site of work by the contractor in their original containers in sealed condition. The materials shall be brought in at a time in adequate quantities to suffice for the whole work or at least a fortnight's work. The materials shall be kept in the joint custody of the contractor and the Engineer-in-charge. The empties shall not be removed from the site of work, till the relevant item of work has been completed and permission obtained from the Engineer-in-Charge.

- 2.2 The contractor shall associate the chemist of paint manufacturers before commencement of work, during and after the completion of work who shall certify the suitability of the surface to receive painting and the paint before use etc.

3.0 COMMENCING WORK:

- 3.1 Scaffolding: Wherever scaffolding is necessary, it shall be erected on double supports tied together by horizontal bracings, over which scaffolding planks shall be fixed. No ballies, bamboos or planks shall rest on or touch the surface which is being painted.
- 3.2 Where ladders are used, pieces of old gunny bags shall be tied on their tops to avoid damage or scratches to walls.
- 3.3 For painting of the ceiling, proper stage scaffolding shall be erected.

- 3.4 Painting shall not be started until and unless the Engineer-in-Charge has inspected the items of work to be painted, satisfied himself about their proper quality and given his approval to commence the painting work.
- 3.5 Painting, except the priming coat, shall generally be taken in hand after all other builders' work are practically finished.
- 3.6 The rooms should be thoroughly swept out and the entire building cleaned up at least one day in advance of the paint work being started,
- 4.0 **PREPARATION OF SURFACE:**
- 4.1 The surface shall be thoroughly cleaned. All dirt, rust, scales, smoke and grease shall be thoroughly removed before painting is started. Minor patches, if any, in plastered/form finished surfaces shall be repaired and finished in line and level in CM. 1:1 and cracks & crevices shall be filled with approved filler, by the contractor at no extra cost to the Department. The prepared surface shall have received the approval of the Engineer-in-Charge after inspection, before painting is commenced.
- 5.0 **APPLICATION:**
- 5.1 Before pouring into smaller containers for use, the paint shall be stirred thoroughly in its containers. When applying also, the paint shall be continuously stirred in the smaller containers so that consistency is kept uniform.
- 5.2 Painting works on all surfaces shall be carried out as per the schedule of finishes, BOQ and the colour scheme drawings as provided by the Consultant / as directed by the Department. The contractor will make suitable samples at site for Engineer In charge approval before taking up the work in hand and they will be allowed to proceed with the work only after getting Department's / Engineer In charge approval for the same.
- 5.3 The painting works shall be carried out evenly and smoothly by means of crossing and laying off, the later in the direction of the grain in case of wood. The crossing & laying off consists of covering the area with paint, brushing the surface hard for the first time and then brushing / rolling alternately in opposite directions two or three time and then finally brushing lightly in direction at right angles to the same. In this process, no brush / roller marks shall be left after the laying off is finished. The full process of crossing and laying will constitute one coat.
- 5.4 Where so stipulated, the painting shall be done with spraying. Spray machine used may be (a) a high pressure (small air aperture) type or (b) a low pressure (large air gap) type, depending on the nature and location of

work to be carried out. Skilled and experienced workmen shall be employed for this class of work. Paints used shall be brought to the requisite consistency by adding a suitable thinner. Spraying should be done only when dry condition prevails.

- 5.5 Each coat shall be allowed to dry out thoroughly and rubbed smooth before the next coat is applied. This should be facilitated by thorough ventilation.
- 5.6 Each coat except the last coat, shall be lightly rubbed down with sand paper or fine pumice stone and cleaned of dust before the next coat is laid.
- 5.7 No left over paint shall be put back into the stock tins. When not in use, containers shall be kept properly closed.
- 5.8 The final painted surface shall present a uniform appearance and no streaks, blisters, hair marks from the brush or clogging of paint puddles in the corners of panels, angles of moldings etc. shall be left on the work.
- 5.9 In case of cement based paints/primers, the absorbent surfaces shall be evenly damped so as to give even suction. In any weather, freshly painted surfaces shall be kept damp for at least two days.
- 5.10 In painting doors and windows, the putty around the glass panes must also be painted, but care must be taken to see that no paint stains etc. are left on the glass. Tops of shutters and surfaces in similar hidden locations shall not be left out while painting. Covers of electrical switch boxes have to be painted from inside by removing them. Care shall be taken while removing them in position after painting with respective approved paints. In painting steel work, special care shall be taken while painting over bolts, nuts, rivets, overlaps etc.
- 5.11 The additional specifications for primer and other coats of paints shall be as in accordance to the detailed specifications under the respective headings.
- 5.12 Any damage caused during painting work to the existing works/surfaces shall be made good by the contractor at his own cost.

6.0 **BRUSHES AND CONTAINERS:**

- 6.1 After work, the brushes /rollers shall be completely cleaned off paint and linseed oil by rinsing with turpentine. A brush / roller in which paint has dried up is ruined and shall on no account be used for painting work. The containers, when not in use, shall be closed, kept air tight and shall be kept at a place free from dust. When the paint has been used, the containers

shall be washed with turpentine and wiped dry with soft clean cloth, so that they are clean & can be used again.

7.0 MEASUREMENT:

- 7.1 Painting, unless otherwise stated, shall be measured by area in square metre. Length and breadth shall be measured correct up to two places of decimal of a metre.
- 7.2 No deduction shall be made for opening not exceeding 0.05 sqm. and no addition shall be made for painting to the beading, moulding edges, jambs, soffits, sills, architraves etc. of such openings.
- 7.3 In measuring painting, varnishing, oiling etc. of joinery and steel work etc., the co-efficients as in the following table shall be used to obtain the areas payable. The co-efficients shall be applied to the areas measured flat and not girthed in all cases.
- 7.4 In case of painting of door shutter with push plates in plastic laminate, deduction will be made for area of such laminations.
- 7.5 Table of Co-efficients to be applied over areas of different surfaces to get equivalent plain areas.

1)	DESCRIPTION OF WORK	MULTIPLYING CO-EFFICIENTS
I	WOOD WORK: DOORS, WINDOWS ETC.	
1	Panelled or framed and braced doors, windows etc.	1.30 (for each side)
2	Ledged & battened or ledged, battened & braced doors, windows etc.	
3	Flush doors etc	1.20 (for each side)
4	Part panelled and part glazed or gauzed doors, windows etc.	1.00 (for each
5	Fully glazed or gauzed doors, windows etc.	0.80 (for each side)
6	Fully venetioned or louvered doors, windows etc	1.80 (for each side)
7	Trellis (or Jaffri) work one way or two way.	2.00 (For painting all over)
8	Carved or enriched work:	2.00 (for each side)
9	Weather boarding:	1.20 (for each side)

10	Wood shingle roofing:	1.10 (for each side)
11	Boarding with cover fillets and match boarding.	1.05 (for each side)
12	Tile and slate battening:	0.80 (for painting all over)
II	STEEL WORK: DOORS, WINDOWS ETC.	
13	Plain sheeted steel door or windows:	1.10 (for each side)
14	Fully glazed or gauzed steel doors and windows	0.50 (for each side)
15	Partly panelled and partly gauzed or glazed doors and windows.	0.80 (for each side)
16	Corrugated sheeted steel doors or windows.	1.25 (for each side)
17	Collapsible gates	1.50 (for painting all over)
18	Rolling shutters of inter locked laths.	1.10 (for each side)
II	GENERAL WORKS:	
19	Expanded metal, hard drawn steel wire fabric of approved quality, grill work and gratings in guard bars, balusters, railings, partitions and	1.00 (for painting all over)
20	Open palisade fencing and gates including standards, braces, rails, stays etc. in timber or steel.	1.00 (for painting all over)
NOTE: The height shall be taken from the bottom of the lowest rail, if the palisades do not go below it (or from the lower end of palisades, if they project below the lowest rail) upto the top of palisades but not upto the top of standards, if they are higher than the palisades.		
24	Wire gauze shutters including painting of wire gauze.	1.00 (for each side).

8.0 Explanatory notes on the table of Co-efficients.

8.1 Where doors, window etc. are of composite types other than those included in para 7.3, the different portions shall be measured separately with their appropriate co-efficients, the centre line of the common rail being taken as the dividing line between the two portions.

8.2 Measurements for doors, windows etc. shall be taken flat (and not girthed) overall including chowkhats or frames, where provided. Where chowkhats or frames are not provided, the shutter measurements shall be taken.

- 8.3 Collapsible gates shall be measured for width from outside to outside of gate in its expanded position and for height from bottom to top of channel verticals. No separate measurements shall be taken for the top and bottom guide, rails, rollers, fittings etc.
- 8.4 Rolling shutters of interlocked laths shall be measured for the actual shutter width and the height from bottom of opening to the centre of the shaft. No separate measurements shall be taken for painting guides and other exposed features within or outside the shutter area. The painting of top cover or hood shall however be measured separately.
- 8.5. Co-efficients for sliding doors shall be the same as for normal types of doors as mentioned in the table. Measurements shall be taken outside of shutters, and no separate measurements shall be taken for painting guides, rollers, fittings etc.
- 8.6. Measurement of painting of doors, windows, collapsible gates, rolling shutters etc. as above shall be deemed to include painting all iron fittings in the same or different shade for which no extra will be paid.
- 8.7. The measurements as above shall be deemed to include also the painting of edges, blocks, cleats etc. for which no extra will be paid.
- 8.8. The co-efficients for doors and windows shall apply irrespective of the size of frames and shutter members.
- 8.9. When the two faces of a door, window etc. are to be treated with different specified finishes, measurable under separate items, the edges of frames and shutters shall be treated with the one or the other type of finish as ordered by the Engineer-in-Charge, and measurement of this will be deemed to be included in the measurement of the face treated with that finish.
- 8.10. In the case where shutters are fixed on both faces of the frames, the measurements for the door frame and shutter on one face shall be taken in the manner already described, while the additional shutter on the other face will be measured for the shutter area only excluding the frame.
- 8.10.1 Where shutters are provided with clearance at top or/and bottom, such openings shall be deducted from the over all measurements and relevant co-efficients shall be applied to obtain the area payable.
- 8.11 In case of trellis (or jaffri) work, the measurements shall include the painting of the frame member for which no separate measurements

shall be taken. Trellis door or window shutters shall also be measured under trellis work.

- 8.12 Wherever air conditioning grill, lighting, fixtures etc. in false ceiling are painted along with, measurements shall be taken over all without deductions for opening in grills and no extra shall be paid for the grills. If grills, fixtures etc. are not painted, area of fixtures or grills as measured flat (not girthed) shall be deducted when it exceeds 0.05 sqm. individuals. Where walls and ceilings are painted in separate colours, the junctions of two paints shall be brought down on the walls in a straight line by about 6mm.to 12mm. if so desired, if the junctions of walls and ceilings are not even. Nothing extra shall be paid to the contractor on this account. Beading wherever provided shall not be measured separately but shall be deemed to be included in the area of false ceiling etc. measured flat (not girthed).
- 8.13 For painting open palisade, fencing and gates etc, the height shall be measured from the bottom of the lowest rail, if the palisades do not go below it, (or from the lower end of the palisades, if they project below the lowest rail), upto the top of rails or palisades whichever are higher, but not up to the top of standards when the latter are higher than the top rails or palisades.
- 8.14 For trusses, compound girders, stanchions, lattice girder and similar work, actual areas will be measured in sqm. and no extra shall be paid for painting on bolt heads, nuts, washers etc. even when they are picked out in a different tint to the adjacent work.
- 8.15 Painting of rain water, soil, waste, vent and water pipes etc. shall be measured in running metres of the particular diameter of the pipe concerned. Painting of specials such as bends, heads, branches, junctions, shoes etc. shall be included in the length and no separate measurements shall be taken for these or for painting brackets, clamps etc.
- 8.16 Measurements of wall surfaces and wood and other works not referred to already shall be recorded as per actual and opening exceeding 0.05 sqm. shall be deducted to get the net payable area. Length and breadth shall be measured correct up to two places of decimal of a metre and area so worked out shall be correct up to two places of decimal of a square metre.
- 8.17 In case the items of work requiring painting are inclusive of cost of painting, the painting carried out shall not be measured separately.

9.0 **PRECAUTIONS:**

- 9.1 All furnitures, lightings, fixtures, sanitary fittings, glazing, floors etc. shall be protected by covering and stains, smears, splashings, if any shall be

removed and any damage done shall be made good by the contractor at his cost.

10.0 RATES:

10.1 Rates shall include cost of all labour and materials involved on all the operations described above and in the particular specifications given under the several items.

11.0 PAINTING PRIMING COAT ON WOOD, IRON OR PLASTERED SURFACES:

11.1 PRIMER

11.1.1 The primer for wood work, iron work or plastered surface shall be as specified in the description of the item.

Primer for Wood work / Iron & Steel / Plastered / Aluminium surfaces shall be as specified below:

SN	SURFACES	PRIMER TO BE USED
a	Wood work (hard & soft wood);	Pink conforming to I.S. 3536-1966
b	Resinous wood and ply wood	Aluminium primer
c	Iron & steel, Aluminum and galvanized steel work	Zinc chromate primer conforming to I.S. 104-1962
d	Plastered surfaces, cement brick work, for oil bound distemper and paint:	Cement Primer

11.1.3 The primer shall be ready mixed primer of approved brand and manufacture.

11.2 Preparation of surface

11.2.1 Wood work: The wood work to be painted shall be dry and free from moisture.

11.2.1.1 The surface shall be thoroughly cleaned. All unevenness shall be rubbed down smooth with sand paper and shall be well dusted. Knots, if any, shall be covered with preparation of red lead made by grinding red lead in water and mixing with strong glue sized and used hot. Appropriate filler material with same shade as paint shall be used where so desired by the Engineer-in-charge.

- 11.2.1.2 The surface treated for knotting shall be dry before painting is applied. After the priming coat is applied, the holes and indentation on the surface shall be stopped with glaziers putty or wood putty (for specifications for glaziers putty and wood putty- refer as mentioned here-in-before). Stopping shall not be done before the priming coat is applied as the wood will absorb the oil in the stopping and the latter is therefore liable to crack.
- 11.2.2 Iron and Steel Work : All rust and scales shall be removed by scrapping or by brushing with steel wire brushes. Hard skin of oxide formed on the surface of wrought iron during rolling which becomes loose by rusting, shall be removed.
- 11.2.2.1 All dust and dirt shall be thoroughly wiped away from the surface.
- 11.2.2.2 If the surface is wet, it shall be dried before priming coat is undertaken.
- 11.2.3 Plastered Surface :The surface shall ordinarily not be painted until it has dried completely. Trial patches of primer shall be laid at intervals and where drying is satisfactory, painting shall be taken in hand. Before primer is applied, holes and undulations, shall be filled up with plaster of paris and rubbed smooth.
- 11.3 Application : The primer shall be applied with brushes, worked well into the surface and spread even and smooth. The painting shall be done by crossing and laying off as described here-in-before.
- 11.4 Other Details : The specifications for Painting (General) shall hold good so far as it is applicable.
- 12.0 **PAINTING WITH SUPERIOR QUALITY & FLAT OIL READY MIXED PAINTS ON NEW SURFACE:**
- 12.1 Paint : Ready mixed paints shall be of approved brand and manufacture and of the required shades. They shall conform in all respects to the relevant IS specifications.
- 12.2 **Preparation of Surface:**
- 12.2.1 Wood work: The surface shall be cleaned and all unevenness removed as in para 11.2. Knots if visible, shall be covered with a preparation of red lead. Holes and indentations on the surface shall be filled in with glaziers

putty or wood putty and rubbed smooth before painting is done. The surface should be thoroughly dry before painting.

- 12.2.2 Iron and steel work : The primer coat shall have dried up completely before painting is started. Rust and scaling shall be carefully removed by scraping or by brushing with steel wire brushes. All dust and dirt shall be carefully and thoroughly wiped away.
- 12.2.3 Plastered surfaces : The priming coat shall have dried up completely before painting is started. All dust or dirt that has settled on the priming coat shall be thoroughly wiped before painting is started.
- 12.3 Application : The specifications mentioned here-in-before shall hold good as far as applicable.
- 12.4 The number of coats to be applied will be as stipulated in the item. The painted surface shall present a uniform appearance and glossy/semi glossy finish, free from streaks, blisters etc.
- 12.5 Other details : The specifications for Painting (General) specified here- in- before shall hold good in so far as they are applicable.
- 13.0 **PAINTING WITH SYNTHETIC ENAMEL/SEMI GLOSSY PAINT ON NEW WORK:**
- 13.1 Paint: Synthetic enamel/semi glossy paint of approved brand and manufacture and required shade shall be used for the topcoat and an under coat of shade to match the top coat as recommended by the manufacturer shall be used. The paint shall be conforming to IS : 1932-1964.
- 13.2 Preparation of Surface : This shall be as per painting with superior quality ready mixed paint as mentioned here- in- before.
- 13.3 Application: The number of coats including the under coat shall be as stipulated in the item.
- 13.4 Under Coat : One coat of the specified paint of shade suited to the shade of the top coat shall be applied and allowed to dry overnight. It shall be rubbed next day with the finest grade of wet abrasive paper to ensure a smooth and even surface free from brush marks and all loose particles shall be dusted off. All the cracks, crevices, roughness etc. will be filled with approved putty as per manufacturer's recommendations.

- 13.5 Top Coat : Finishing coats of specified paint of the desired colour & shade shall be applied after the under coat is thoroughly dried. Additional finishing coats shall be applied, if found necessary to ensure a proper and uniform semi glossy surface.
- 13.6 Other Details : The specifications for "Painting (General)" mentioned here-in-before shall hold good as far as they are applicable.
- 14.0 **PAINTING WITH ACRYLIC EMULSION/PLASTIC EMULSION PAINT.**
- 14.1 Primer: The primer to be used for the painting with acrylic emulsion on cement concrete surfaces, plastered surfaces, A.C. sheets, timber and metal surfaces, if necessary, shall be of approved base and as per recommendations of the manufacturers.
- 14.2 Putty: Plaster filler to be used for filling up (putting) uneven surfaces, small cracks and holes etc. shall be of approved compound and as per recommendations of the manufacturers. No oil based putty shall be used. The putty should be made from a mixture of whiting and plastic emulsion paint or as per manufacturers recommendations or BOQ.
- 14.3 Finishing coats : All the finishing coats shall be of matt finish or any other finish as required by the Engineer-in-charge. The number of finishing coats shall be as specified in the item.
- 14.5 **MODE OF MEASUREMENT:**
- 14.5.1 All the measurements for payment shall be taken as per the provisions of IS 1200.
- 14.6 **JOB REQUIREMENTS:**
- 14.6.1 Acrylic emulsion paint is required to be provided on plastered and concrete surfaces in portions of the building.
- 14.6.2 All wood surfaces are to be painted with semi glossy synthetic enamel paint with an approved primer.
- 14.6.3 All shades and colours of paints shall be subjected to review and prior approval of Engineer-in-Charge shall be taken before the application.
- 15.0 **DRY DISTEMPERING:**

- 15.1 Distemper : Dry distemper (IS:427-1965) of approved brand and manufacture, colour and required shade shall be used. The dry distemper shall be stirred slowly in clean water using 0.6 litre of water per kg. of distemper or as specified by the manufacturers. Warm water shall preferably be used. It shall be allowed to stand for at least 30 minutes before use. The mixture shall be invariably well stirred before and during use to maintain an even consistency.
- 15.2 Preparation of surface : This shall be as for Painting work mentioned here in-before in so far as it is applicable.
- 15.3 Application : In case of new work, the treatment shall consist of a priming coat followed by the application of two or more coats of distemper till the surface shows an even colour.
- 153.1 Priming coat : Priming coat of whiting shall be applied over the prepared surface. The whiting (ground white chalk) shall be dissolved in sufficient quantity of warm water and thoroughly stirred to form a thin slurry which shall then be screened through a clean coarse cloth. Two kg. of gum and 0.4 kg. of copper sulphate dissolved separately in hot water shall be added for every cum. of the slurry which shall then be diluted with water to the consistency of milk so as to make a wash ready for use. No white washing coat shall be used as a priming coat for distempering.
- 15.3.2 The application of each coat as mentioned in the specifications for painting (General) here-in-before, shall hold good, as far as it is applicable.
- 16.0 **OIL EMULSION (OIL BOUND) DISTEMPERING:**
- 16.1 Oil bound distemper (IS:428-1969) of approved brand and manufacture, colour and required shade shall be used. The primer where used as on new work shall be cement primer or distemper primer as specified in the item. These shall be of the same manufacture as distemper. The distemper shall be diluted with water or any other prescribed thinner in a manner recommended by manufacturer. Only sufficient quantity of distemper required for days work shall be prepared.
- 16.2 Preparation of surfaces: The surface shall be prepared as described herein- before for Painting work in so far as it is applicable and approved putty/filler shall be applied to the entire area to get uniform and smooth surface before application of primer.
- 16.3 Application: The cement primer or distemper primer shall be applied by brushing and not by spraying. Hurried priming work shall be avoided, particularly on absorbent surfaces. New plaster patches in old work before applying oil bound distemper shall be treated with cement primer/distemper

primer. The surface shall be finished as uniformly as possible leaving no brush marks. Priming coat shall be allowed to dry for at least 48 hours before oil bound distemper is applied. Before applying distemper, the surface shall be lightly sand prepared to make it smooth for receiving the oil bound distemper, taking care not to rub out the priming coat. A time interval of at least 24 hours shall be allowed between consecutive coats to permit the proper drying of the preceding coat. Two or more coats of distemper as are found necessary shall be applied over the priming coat to obtain an even shade.

- 16.4 Other details : The specifications for “Painting (General)” mentioned here-in-before shall hold good as far as it is applicable.

17.0 **WATER PROOFING CEMENT BASED PAINT:**

- 17.1 Material: Cement based paint (IS:5410-1969) of approved manufacture, quality, shade and colour only shall be used.

- 17.2 Preparation of surfaces: The surface shall be thoroughly cleaned off all mortar dropping, dirt, dust, algae, grease and other foreign matter by brushing and washing the surfaces. The surface shall be thoroughly wetted with clean water before the water proof cement paint is applied. The prepared surface shall be got approved before painting is commenced.

- 17.3 Treatment with Bio wash : Antifungal treatment on external wall surface shall be provided with concentrated form of Biowash thinned with fresh water to a concentration level of 2% by volume chemical composition of BENZOLKONIUM CHLORIDE and BIPHENYL – 2.01 containing ISOPROPANOL with micro-biological activity. Apply a coat of Biowash and allow the same to soak for 12 to 14 hours. Wash the surface thoroughly with clean water and allow the surface to dry completely prior to painting/repainting works as per manufacturers specification. The prepared surface shall be got approved before painting is commenced.

- 17.3.1 The water proof cement paint shall be mixed in such quantities as can be used up with in an hour of its mixing as otherwise the mixture will set and thicken, affecting flow and finish.

- 17.3.2 Water proof cement paint shall be mixed with water in two stages. The first stage shall comprise of 2 parts of water proof cement paint and one part of water stirred thoroughly and allowed to stand for 5 minutes. Care shall be taken to add the water proof cement paint gradually to the water and not vice versa. The second stage shall comprise of adding further one part of water to the mix and stirring thoroughly to obtain liquid of

workable and uniform consistency. In all cases the manufacturers instruction shall be followed meticulously.

- 17.4 Application: The solution shall be applied on the clean and wetted surface with brushes or spraying machine. The solution shall be kept well stirred during the period of application. To avoid direct heat of the sun during painting, the cement based paint shall be applied on the surface which is on the shady side. Cement based paint shall not be applied on the surfaces already treated with white wash, colour wash, dry or oil bound distemper, varnishes, paints etc. It shall not be applied on gypsum, wood and metal surfaces.
- 17.5 Other details : The specifications for Painting (General) mentioned here-in- before shall hold good as far as they are applicable.
- 17.6 Mode of measurement for dry distemper, oil bound distemper and water proof cement paint : All measurement for payment shall be taken on net surface area actually painted unless otherwise specified and no co- efficient shall be applied for working out areas. Deductions will be made from areas for opening/obstructions not painted, if they are individually more than 0.05 sqm. Length and breadth shall be taken correct up to two places of decimal of a meter and areas shall be worked out correct up to two places of decimal of a square meter. Measurements shall be as per the provisions of IS 1200.
- 17.6.1 The number of coats of each treatment shall be as stated in the schedule of quantities. The whole surface shall be applied with approved putty/filler to get uniform and smooth surface at no extra cost to the Department.
- 17.7 Rates: The rate shall include cost of all materials and labour involved in all the operation described above.
- 18.0 **EXTERIOR EMULSION PAINTING:**
- Material : Weatherproof Exterior Emulsion paint like Apex Ultima from M/s Asian Paints or equivalent which is a water-based 100% acrylic, exterior wall finish shall be used. This shall be a high performance, long-lasting exterior paint specially formulated to withstand extreme tropical conditions of high rainfall, humidity and heat. It should provide excellent resistance against the growth of algae and fungi on the walls. It should also offer excellent protection against alkali and UV degradation.
- 18.1 Preparation of surfaces : The surface shall be thoroughly cleaned off all mortar dropping, dirt, dust, algae, grease and other foreign matter by

brushing and washing the surfaces. The surface shall be thoroughly wetted with clean water.

- 18.2 Treatment with Biowash : Antifungal treatment on external wall surface shall be provided with concentrated form of Biowash thinned with fresh water to a concentration level of 2% by volume chemical composition of BENZOLKONIUM CHLORIDE and BIPHENYL – 2.01 containing ISOPROPANOL with micro-biological activity. Apply a coat of Biowash and allow the same to soak for 12 to 14 hours. Wash the surface thoroughly with clean water and allow the surface to dry completely prior to painting/repainting works as per manufacturers specification. The prepared surface shall be got approved before painting is commenced.
- 18.2.1 The exterior emulsion paint shall be mixed in such quantities as can be used up within an hour of its mixing as otherwise the mixture will set and thicken, affecting flow and finish.
- 18.2.2 In all cases, mixing of the various constituents and application procedure shall be strictly as per the manufacturers.
- 18.3 Application: The solution shall be applied on the clean and wetted surface with brushes or spraying machine. The solution shall be kept well stirred during the period of application. To avoid direct heat of the sun during painting, the exterior emulsion paint shall be applied on the surface which is on the shady side. Exterior emulsion paint shall not be applied on the surfaces already treated with white wash, colour wash, dry or oil bound distemper, varnishes, paints etc. It shall not be applied on gypsum, wood and metal surfaces.
- 18.3 Other details : The specifications for Painting (General) mentioned herein- before shall hold good as far as they are applicable.
- 18.4 Mode of measurement for exterior emulsion paint: All measurement for payment shall be taken on net surface area actually painted unless otherwise specified and no co-efficient shall be applied for working out areas. Deductions will be made from areas for opening/obstructions not painted, if they are individually more than 0.05 sqm. Length and breadth shall be taken correct up to two places of decimal of a meter and areas shall be worked out correct up to two places of decimal of a square meter. Measurements shall be as per the provisions of IS 1200.
- 18.5 Rates: The rate shall include cost of all materials and labour involved in all the operation described above.

- 19.0 **BEES WAXING OR POLISHING WITH READY MADE WAX POLISH: (NEW WORK):**
- 19.1 **Materials:** The polishing shall be done with bees waxing prepared locally or with readymade wax polish of approved brand and manufacture, as stipulated in the description of item.
- a) Where bees waxing is to be prepared locally, the following specifications for the same shall apply:
- Pure bees wax free from paraffin or steaming adulterants shall be used. Its specific gravity shall be 0.965 to 0.969 and melting point shall be 63°C. The polish shall be prepared from a mixture of bees wax, linseed oil, turpentine and varnish in the ratio of 2: 1.5: 1: 0.5 by weight.
- The bees wax and boiled linseed oil shall be heated over a slow fire. When the wax is completely dissolved, the mixture shall be cooled till it is just warm and turpentine and varnish added to it in the required proportions and the entire mixture shall be well stirred.
- 19.2 **Preparation of surface:** Preparation of surface will be as mentioned here-in-under with the exception that knotting, holes and cracks shall be stopped with a mixture of fine saw dust formed of the wood being treated, beaten up with sufficient bees wax to enhance cohesion.
- 19.3 **Application:** The polish shall be applied evenly with a clean soft pad of cotton cloth in such a way that the surface is completely and fully covered. The surface is then rubbed continuously for half an hour.
- When the surface is quite dry, a second coat shall be applied in the same manner and rubbed continuously for one hour or until the surface is dry.
- The final coat shall then be applied and rubbed for two hours (more if necessary) until the surface has assumed a uniform gloss and is dry showing no sign of stickiness. The final polish depends largely on the amount of rubbing which should be continuous and with uniform pressure, with frequent changes in the direction.
- 19.4 **Other details:** The specifications for painting (General) as mentioned here-in before shall hold good as far as they are applicable.

- 20.0 **FRENCH SPIRIT POLISHING: (ON NEW WORK WITH A COAT OF WOOD FILLER):**
- 20.1 Polish: Pure shellac varying from pale orange to lemon yellow colour, free from resin or dirt shall be dissolved in methylated spirit at the rate of 140 gm. of shellac to 1 litre of spirit. Suitable pigment shall be added to get the required shade.
- 20.2 Preparation of surface: The surface shall be cleaned. All unevenness shall be rubbed down smooth with sand paper and well dusted off. Knots if visible shall be covered with a preparation of red lead and glue size laid on while hot. Holes and indentations on the surface shall be stopped with glaziers putty. The surface shall then be given a coat of wood filler made by mixing whiting (ground chalk) in methylated spirit at the rate of 13 kg. of whiting per litre of spirit. The surface shall again be rubbed down perfectly smooth with glass paper and wiped clean.
- 20.3 Application: The number of coats of polish to be applied shall be as described in the item.
- A pad of woolen cloth covered by fine cloth shall be used to apply the polish. The pad shall be moistened with the polish and rubbed hard on the wood, in a series of overlapping circles applying the mixture sparingly but uniformly over the entire area to give an even level surface. A trace of linseed oil on the face of the pad facilitates this operation. The surface shall be allowed to dry and the remaining coats applied in the same way. To finish off, the pad shall be covered with a fresh piece of clean fine cotton cloth, slightly damped with methylated spirit and rubbed lightly and quickly with circular motions. The finished surface shall have a uniform texture and high gloss.
- 20.4 Measurement, Rate and other Details: These shall be as for Painting (General) mentioned here-in-before as far as they are applicable.
- 21.0 **RESIN BASED THERMO PLASTIC PAINT (DECORATIVE AND PROTECTIVE FINISH):**
- 21.1 Materials: Resin based thermo plastic paint such as Sandtex Matt or other equivalent approved manufacture, colour and shade shall only be used.
- 21.2 Preparation of Surface & General: The Specifications for Painting (General) described here in before shall hold good as far as they are applicable.

- 21.3 Protective Coatings: On surfaces such as ferrous metals, brass, copper and phosphor bronze, a protective coating of suitable bituminous compound or chromated red oxide should be given. New wood should be treated with a leafing grade aluminium primer or a water based acrylic emulsion primer.

The surfaces with algae growth shall be thoroughly cleaned down to remove as much growth as possible and effective solution of stabilized house hold bleach (calcium hypochloride) of approved quality with approximate 35% chlorine content @ 2 kgs. Per 50 ltrs. (or as per manufacturers recommendations) should be used to treat the surfaces.

On chalky or friable surfaces, after removing the loose materials by stiff brushing or scraping, the surface should be treated with one coat of advanced solvent based material such as snowsol stabilizing solution or other approved equivalent with white spirit.

- 21.4 Application: The ready mix Sandtex Matt or other equivalent approved resin based thermo plastic paint shall be applied on clean and wetted surfaces by means of brushes or roller. The solution shall be kept well stirred during the period of application. To avoid direct heat of the sun, the paint shall be applied on the side in shade.

On rough and textured surfaces, one under coat of cement based paint such as Snowcem or other equivalent shall be applied before application of undiluted Sandtex Matt finish coat. In case of application of two coats of Sandtex Matt at normal temperatures, the first one shall be diluted by addition of 25% water and the second coat direct. In extremely hot environs, the second coat shall be diluted @ 2.5 ltrs. of water to 20 ltrs, of paint or as directed.

Painting with resin based thermo plastic paint shall be carried out generally as per manufacturers specifications.

- 21.5 Other Details: The specification for Painting (general) mentioned here- in- before shall hold good as far as they are applicable. Snowsol stabilized solution shall not be applied over bitumen. Snowsol stabilized solution treated surfaces shall not be left unpainted for more than 2 (two) days. Gypsum based materials shall not be used for filling of exterior cracks while preparation of surfaces.

- 21.6 Mode of Measurement: The painting unless otherwise mentioned shall be measured by area in sqm. up to two places of decimal. Length and breadth shall be measured correct up to two places of decimal of a meter. Deduction will be made from the areas of fixtures, grills, ventilation, outlets individually more than 0.5 sqm.

The item shall include removing nails, making good holes, cracks, patches etc. not exceeding 0.1 sqm. each with materials similar in composition to the surface to be prepared.

- 21.7 Rate: The rate shall include the cost of all materials and labour involved in all the operations described above.

22.0 CONSUMPTION OF PAINT FOR DIFFERENT PAINTING ITEMS:

Sr. No.	Brief Description of painting work	Consumption per 10 sqm of net area
1	Oil Bound Distemper on plastered surfaces :	
	a) Cement Primer (one coat).	0.91 litres.
	b) Two finishing coats.	1.60 kg.
	c) Three finishing coats.	2.40 kg.
2.	Flat oil paint to plastered surfaces:	
	a) Cement primer (one coat).	0.91 ltr.
	b) Cement primer (two coats).	1.82 ltrs.
	c) Two finishing coats.	1.72 ltrs.
3.	Acrylic Emulsion Paint:	
	a) Cement primer (one coat).	0.91 ltr.
	b) Two finishing coats	0.87 ltr.
	c) Three finishing coats.	1.30 ltrs
4.	Cement Paint (old surfaces):	
	a) Two coats on sand faced plastered surface.	4.10 kg.
	b) Two coats on rough cast plastered surface.	7.70 kg.
5.	Cement Paint (New surfaces).	
	a) Two coats on sand faced plastered surface.	4.50 kg.
	b) Two coats on rough cast plastered surfaces.	8.50 kg
6.	Enamel Paint to wood/steel:	
	a) Wood primer (one coat.)	0.90 ltr.
	b) Steel primer (one coat.)	0.75 ltr.
	c) Two finishing coats on wood.	1.40 ltrs.
	d) Two finishing coats on steel.	1.35 ltrs.
7.	Flat Oil Paint to wood/steel work.	
	a) Wood primer (one coat.)	0.90 ltr.
	b) Steel primer (one coat.)	0.75 ltr.
	c) Two finishing coats on wood.	1.70 ltrs.
	d) Two finishing coats on steel.	1.70 ltrs.
8.	External Painting with flat oil paint:	
	a) Cement primer (one coat.)	1.00 ltr.
	b) Two finishing coats.	1.74 ltrs.
9.	Repainting old painted surfaces.	
	a) Two coats of emulsion paint.	0.86 ltr.
	b) Two coats of flat oil paint.	1.59 ltrs.
	c) Two coats of enamel paint.	1.35 ltrs.

23.0 COVERAGE PER SQM ACHIEVED PER LITRE PAINT:

(Note: Coverage per Kg is mentioned with respective item)

Sr. No.	Name of Paint	Area coverage for one coat (Old work)	Area coverage for two coats (New work)	Area coverage Per addl. coat
1	Synthetic enamel paint	14m ²	8.5m ²	18m ²
2	Plastic emulsion paint	14m ²	8.5m ²	18m ²
3	Oil Bound distemper	10m ²	6.0m ²	12m ²
4	Dry distemper	10m ² per kg	6.5m ² per kg	12m ² per kg
5	Cement based paint	4.5 mL per kg	2 m ² per kg	6 m ² per kg
6	Aluminium paint	20 m ²	12.5 m ²	28 m ²
7	Bitumen paint / Black Japan	14 m ²	14 m ²	28 m ² —
8	Neeru (or lime punning with slacked lime) over plaster	0.5 m ² per kg of slacked lime		
9	Red oxide metal primer	16 m ²		
10	cement primer	12 m ²		
11	Wood primer	13 m ²		
12	French or spirit polish	10.5 m ²		
13	Varnish	14 m ²	8.5 m ²	18 m ²
14	Exterior Emulsion Paint		8 m ² for first coat / Kg and 10 m ² for second coat	
15	Requirement of paint per coat in Structural steel work on tonnage basis ii Truss and Lattice girder work - 43 litres per tonne. Plane Beam/plane girder work - 2.5 litres per tonne			

24.0 EPOXY PAINTING

24.1 Tenderer is advised to inspect the work site and acquaint himself with the existing working conditions as well as the surface conditions of the area to be painted.

24.2 This work includes thorough surface preparation of the concrete structure by chipping the uneven surface defects and offsets like fins in the form work joints, construction joints, etc. and smoothening by grinders with suitable abrasive wheels. All cement wash or patches on the concrete surface shall be scrapped or ground smooth. The surface unevenness remaining after shaping and grinding shall be filled with suitable epoxy mortar composition and concrete surface should also be filled with approved epoxy putty. The corners of the wall and the floor junctions shall be thoroughly free of an adhering mortar, loose concrete etc. and ground smooth and filled with epoxy mortar or putty as required to give a neat and square corner. Similarly, the panel joints in the flooring shall be properly filled with epoxy putty after removing all the loose materials, broken concrete and detached aluminum strips. The edges of panel joints wherever protruding beyond door surface should be ground smooth. The debris resulting from surface preparation shall be cleared and then vacuum cleaner should be used to remove all finer dust particles. The surface shall then be thoroughly mopped with moistened cloth. No painting work shall be taken up in the vicinity of areas, where the surface preparation is being done in order to

avoid dust deposition on wet paint surfaces. Plastered surfaces shall be closely inspected for cracks and cracks if any, shall be widened with sharp edged tools and filled with epoxy mortar/putty. Only double scaffolding will be permitted for painting as well as surface preparation operations and no part of scaffolding shall rest on any areas to be painted

- 24.3 Airless spray painting equipments/brushes to be used in this work shall be suitable for application of high build epoxy paints. No painting shall be taken up until the surface to be painted is inspected and cleared by Engineer-in- Charge.
- 24.4 Only approved coating systems (paints) as specified in the item shall be used in this work. The dry film thickness (DFT) indicated in the item is the minimum acceptable (specified microns in the item) and this should be achieved by required number of coats as specified in the item with high build paints on well prepared surfaces. However, it would be contractor's responsibility to produce a finished painted surface with required smoothness; and gloss and without defects like pin holes; sagging; bubbling; peeling etc. and no extra will be paid, if any extra coat is required in any area to achieve the acceptable surface finish and DFT. The contractor shall bear this in mind while quoting the rates.
- 24.5 All the surfaces after painting work is completed, shall present a smooth finish and uniform colour. The dry film thickness of the completed coating shall be as given in the item. The Contractor shall afford all the testing facilities to ascertain the film thickness on any painted surface at no extra cost to the Department.
- 24.6 The paints to be used on the job shall be of very good quality and shall be procured from approved manufacturers.
- 24.7 Contractor shall submit manufacturer's test certificate along with each supply of paint brought to site.
- 24.8 The Contractor should note that they have to use the complete system of paint from the same manufacturers. Combination of products from different firms will be liable for rejection.
- 24.9 The Contractor shall depute his full time qualified supervisor to look after the work from the commencement to the completion of the entire job. He shall take instructions from the Engineer-in-Charge regarding the work. He shall be thoroughly conversant with the preparation of surfaces and application of paints etc. for the various types of paints at various surfaces.

- 24.10 The contractor shall bear entire responsibility, liability and risk relating to coverage of his work force under different statutory regulations including workmen's compensation Act, Factory Act. The Contract Labour (R&A) Act., Minimum Wage Act and other relevant statutory regulations.
- 24.11 The successful bidder shall ensure that all safety precautions are invariably taken to safeguard accidents and injuries to his workmen. All necessary safety appliances i.e. helmets, goggles and gloves, safety belts; respiratory mask; etc. as per the safety regulation of the job and as directed by the Engineer-in-Charge shall be provided by the Contractor at his own cost.
- 24.12 The tenderers are required to note that it will be obligatory on their part, if required by the department, to paint free of cost a reasonable area (say 10 sq. m.) of plastered /concrete surface as sample to judge the quality of paint to be used and the workmanship and overall performance of the painted area. The quality of material and standard of workmanship of these sample paints shall also form one of the criteria for award of work. The area for sample painting shall be indicated by the Engineer-in-Charge.
- 24.13 In case after completing the specified number of coats, smooth and even finish and required DFT is not obtained, the contractor shall apply extra coat of specified paint to obtain the designed smooth finish and DFT without any extra cost to the department. Contractor shall afford all the facilities for the inspection by Engineer-in-Charge.
- 24.14 The Contractor should note that the colour schemes and shades of paints required will be given in detail drawings during execution and that they should render all assistance by way of submitting sample panels to enable selection of a proper shade at no extra cost to the department. After selection of the colour shades, the contractor shall have to keep these sample panels of the approved shades with the Engineer-in-Charge to compare the same with the shades specified and the finished work at site.
- 24.15 The Contractor should note that all paints, airless spray painting equipment scaffolding, ladders, wire brushes, sand papers, thinners, cleaning material, knifing compounds, trowelling compound etc. required for painting work will have to be provided by them at their own cost. The contractor should note that before commencement of any painting work, all cracks, unevenness, holes etc. shall be filled up with approved filling putty to get an even surface. The rate for such repairs shall be included in the rate for the relevant item of painting.
- 24.16 Contractor are requested to note that they will have to exercise extreme precaution to protect the equipments, pipes, ducts and electrical fixtures etc. already installed in various areas in the buildings.

Adequate masking and coverings should be provided by them at their own cost for all such equipments, floors etc. wherever required by the Engineer-in-Charge. Any patches, stains etc. of the paint left over on the floor, equipment etc. will have to be removed by them at their own cost including masking & coverings.

- 24.17 Contractor should note that time is the essence of the contract and they shall pay proper attention to the relevant clause of the general conditions of the contract pertaining to compensation for delay. They should note that the painting works will have to be carried out without disturbing or hindering the normal operation of the plant process and other erection activities carried out by users/other agencies in the building and for this purpose they should be prepared to organise their painting works in an orderly phased programme to be worked out well in advance. They should also be prepared to concurrence the work and keep it in progress simultaneously in as many areas of the building as feasible for maintaining the phased programme.
- 24.18 In any case, clarification regarding specifications, conditions of contract or schedule of quantities if necessary, the same should be obtained from the office of the Engineer Incharge before submitting their tender. No claim on account of any ambiguity will be entertained after submission of Tender.
- 24.19 Preparing of Surfaces : The different types of surfaces shall be prepared prior to application of the epoxy paint as follows:
- 24.20 Steel surfaces : The steel surfaces shall be freed of all rust, mills, scales, dirt etc. thoroughly by electrical grinder, buffing with wire brush attachment etc. Avoid bright sun as far as possible when using power tools.
- 24.21 The resultant surface obtained after preparation of the surface as per above will be subjected to chemical cleaning by either of the following processes.
- 24.22 Degreasing : The surface should be degreased with 2% solution of Trisodium Phosphate, rinsed with water and allowed to dry.
- 24.23 Solvent Wash : Use aromatic solvent xylot and thoroughly clean the surface with a dry clean cloth before the solvent dries. Surface should be cleaned thoroughly leaving it free of all mill scale, rust, grease, old coating, moisture and other defects viewed through magnifying glass. Rusted or damaged areas shall be wire brushed properly and touched up with the type of primer specified. Inadequate surface preparation is the most frequent cause of coating failure, Steel surfaces which are already having a primer coating of non-epoxy based paint shall be removed thoroughly wherever necessary and rate for painting shall include the cost of thorough removal of this primer coat before painting with epoxy based primer and paint.

- 24.24 Concrete/Plastered Surfaces: All surfaces requiring painting shall be cleaned of oil, grease and other foreign matter as directed by the Engineer-in-Charge.
- 24.25 The plastered ceiling and wall surfaces shall be sand papered, wire brushed and cleaned by water jet or acid etched as per item or as recommended/specified by paint manufacturer.
- 24.26 In concrete surfaces all protruding fins, adhering concrete/mortar shall be chipped off without cutting into general concrete surface and ground smooth with electrical grinder and appropriate abrasive attachments.
- 24.27 All deep cuts, pockets, offsets etc. shall be filled with approved putty and trowelled smooth.
- 24.28 If the surface appears to be oily, it is necessary to apply a detergent wash to the surface. The surface should be de greased with 2% solution of Trisodium Phosphate rinsed with water and allowed to dry. The dried surface shall be free from oil, grease, acid, alkali or loose material clinging to surface. If necessary, the surface shall be tested for the presence of excessive alkalies or moisture. The moisture can be determined either by copper sulphate test or rubber mat test and free alkali could be determined by universal indicator which should not indicate more than 7.5 PH.
- 24.29 The test shall be made by the contractor at no extra cost and the compliance or otherwise of these shall not relieve the contractor of his responsibilities for making good the paint at his own cost in case the paint peels off due to bad preparation of surfaces or due to presence of moisture or alkali or due to any other reason. The surface shall then be acid etched.
- 24.30 It will be most important to prepare the surface before taking out the epoxy painting work. Since the concrete/plaster is sufficiently old, the painting surfaces are perfectly dry. Before taking up the work it will be necessary to examine the surface carefully and any air bubbles, cracks etc. shall be filled with putty made out of silica floor and paint or as instructed by the Engineer-in-Charge and the surface shall be allowed to dry for a day. For getting a proper key to the paint film, it is necessary to remove the glaze and laitance of the surface.
- 24.31 The surfaces to be painted shall be inspected by the Engineer-in-Charge after the surfaces are prepared for painting and the work of painting shall commence only after the approval of the Engineer-in- Charge.
- 24.32 **Paint Applications:** All the concrete and steel surfaces in the sumps, tanks, walls, ceilings at all levels shall be painted with approved epoxy paint as per colour schedule approved by the Engineer Incharge. The dry film

thickness of the paint shall not be less than as specified in the item. Paint shall preferably be applied by airless spray equipment.

- 24.33 It will be entire responsibility of the painting contractor to take number of trials to achieve a proper dry film thickness per coat by adjusting proper viscosity for airless/brush application. The Contractor shall use elcometer to measure the dry film thickness and should carry out sufficient number of tests before commencement and during execution of the painting work to establish the results to the satisfaction of the Engineer-in-Charge. No extra payment will be made for these tests and the contractor should include the same in the quoted rates by him. If the total dry film thickness of any painted area is found less than the specified one, the contractor has to apply an extra coat/coats at his own cost to get the desired film thickness.
- 24.34 No claim for extra payment to the contractor will be accepted in case the film thickness exceeds more than as specified in certain areas depending upon the site conditions.
- 24.35 While applying the last finishing coat, it will be necessary to cover the entire portion of the ceiling (either bay or full) surface or wall of a room/area at one stretch to obtain a uniform appearance of the finished surface. The contractor shall choose and plan the areas, accordingly. No subsequent coat of paint shall be applied unless the previous coat has satisfactorily cured and hardened. The paint shall be cured (i.e. air drying) for minimum period of 7 days after finishing coat and shall be tested in position/place for MIBK or acetone test or as specified/ directed. After the paint film is properly cured, bond test for the paint film will be carried out or as specified.
- 24.36 Cut the paint film into original concrete/steel surface in triangular form as instructed by the Engineer-in-Charge and cover this paint surface with doctors/surgical adhesive tape or as directed by the Engineer-in-Charge. Pull the tape within a fraction of a second after two minutes of sticking. For satisfactory bond, the paint should not come out and show no signs of any loose bond with the surface. Tests for bond shall be repeated in case results are not satisfactory and repairing of the area shall be done as directed by the Engineer-in- Charge without extra cost to the Department.
- 24.37 Paint shall not be applied to any surface which is likely to have a temperature less than 10° C during painting or while the paint is drying. No paint application shall be done under dusty conditions. Paints shall be spread evenly without runs, sags, brush marks or skips. Paint shall be evenly applied on all surfaces, edges and in to all corners when brush application is essential. Each coat shall give complete coverage and must be dry and hard before the succeeding coat is applied. Paint manufacturer's instructions shall be followed.

- 24.38 The painting items will be measured for the actual painting area as per IS 1200 (Latest) and the unit will be in Sq.m., for complete scope of work (Number of coats, surface preparation, application of knifing compound, etc.) as mentioned in relevant items or schedule of quantities. The contractor shall submit a painting procedure for approval.
- 24.39 Before the actual painting work is commenced and the contractor has to prepare a sample panel for the approval of the Engineer-in-Charge. All of finished work shall be of the same quality as per the approved panel.
- 24.40 Safety Measures: It is most important to take all safety measures during the painting work. The following precautions must be taken before starting and during progress of the application of paint.
- 24.41 It is necessary to display the boards (sufficient and wherever necessary) written with the information and instructions such as "SMOKING, WELDING, GAS CUTTING STRICTLY PROHIBITED" in the vicinity of the area where painting is in progress, without any extra cost for this and as directed by the Engineer-in-Charge.
- 24.42 Sufficient air circulation and exhausts must be provided before starting the painting and the air circulation system should be run after completion of the day's work also up to specified time as directed by the Engineer-in-Charge. No extra cost for this purpose shall be entertained and the contractor should consider this while quoting his rates.
- 24.43 If the vapor collection exceeds 5% in the atmosphere in vicinity of the painted area, the painting work should be stopped further until the vapours collected are neutralized.
- 24.44 To measure the vapour percentage in the air, the explosive meter instrument is available in market and it should be provided by the contractor for checking the vapour percentage at site. The quoted rate shall be deemed to be inclusive of using this meter.
- 24.45 The workers or any other supervisory staff should not walk over the newly painted surfaces with shoes, chappals etc. They should walk over the painted surface with naked foot or otherwise foot gloves should be used.
- 24.46 Since the area to be painted is a closed one with other equipments, instruments etc., it is very important to take all precautions for fire hazards. Sufficient fire extinguishers should be provided in the vicinity of the painted area, throughout the period of painting.
- 24.47 The sufficient number of workers must be kept ready while epoxy painting in confined areas to rotate workers to effect continuous painting work. The workers should use masks during such operations.

- 24.48 The surrounding area of painting in progress should be kept clean with vacuum cleaner or other approved measures every day before starting the work.
- 24.49 The light should be adequate in the painting area. In no case, painting will be allowed if the light is not sufficient and satisfactory.
- 24.50 Any electrical wiring etc. done by the contractor shall be of proper order and shall be got approved by the competent authority. Unsafe wiring will not be allowed at site.

C- 27: SPECIFICATION FOR EPOXY FLOORING AND WALL COATING SYSTEM

1.0 EPOXY FLOORING SYSTEM (HORIZONTAL SURFACES)

- 1.1 Epoxy flooring system selected shall be for heavy duty type and shall comprise of three parts, namely the epoxy primer coat, the epoxy screed and finally the epoxy coating. The whole system shall be procured from approved manufacturers and shall be laid strictly as per the manufacturer's specifications. The shade required shall be finalized in consultation with the Engineer In charge before procurement. The Methodology of application shall be submitted for the approval of Engineer In charge.

1.2 Epoxy Primer

- 1.2.1 Epoxy primer shall be two coats of Araldite GY-257 / HY-848 or equivalent in the ratio 100:70, by brush as directed and as per manufacturer's specifications suitable for priming concrete surfaces prior to the application of the epoxy screed. It shall provide excellent adhesion to any concrete or cementitious substrate.
- 1.2.2 **Surface Preparation:** Surface preparation is a must for best results. It should be ensured that the surface on which the primer is going to be applied is rough in nature. For e.g. broom finished sub base floor top. The sub base floor shall be 45mm thick PCC with water proofing compound as per schedule of items or as directed by EIC. It is of prime importance that the substrate shall not suffer from rising dampness or moisture content more than 5%. The relative humidity in the floor concrete should be recorded using thermo hygrometer. In case, the substrate has been penetrated by oil or grease, then use of flame torching to burn off the oil, acid etching etc. shall be done followed by a detergent wash. In cases where the contamination is deep seated, mechanical means should be adopted to clean the substrate upto the extent of penetration. Depending upon the extent of removal, suitable methods of floor reinstatement of the substrate may be adopted.
- 1.2.3 **Mixing :** Add the entire contents of the hardener into the base and mix with a slow speed drill attached to a mixing paddle to get a homogeneous mix.
- 1.2.4 **Application :** The mixed material must be applied by a brush or roller on a prepared surface thoroughly in a thin continuous fill. Another coat must be applied if characteristic dry patches are seen on the substrate due to high porosity of the surface. This ensures good adhesion but also prevents air release from porous substrates which may cause bubbles after laying epoxy topping subsequently. The primer must be left overnight to dry before the application of epoxy screed and should be in a tacky state. The application temperature shall be between 10°C to 40°C. Excess application and puddling shall be avoided. The primer shall be used within 30 minutes of mixing at

30°C. Care shall be exercised to see that the primer is not exposed to naked flame or other source of ignition from safety point of view. Also, while executing, personnel may wear goggles, shoes & gloves. The primer coverage shall be approximately 4-5 Kg/ sqm / Kg for one coat.

1.3 Epoxy Floor Screed System

1.3.1 This shall be made of GY 257 / HY 840 / Quartz mix no. 10 or approved equivalent in the required thickness that forms a chemical and abrasion resistant flooring with a non-slip finish ideally suited for application in all kinds of industries subjected to heavy wear and tear, mechanical and chemical use. The product shall have excellent abrasion and chemical resistance. It shall be seamless, dust free, hygienic and non-slip surface with a perimeter edge coving upto a height of 225mm.

1.3.2 **Surface preparation :** The surface must be sound, dry, free from laitance, grease, oil and any other contamination. This shall be achieved using wire brush or mechanical means or grit blasting.

1.3.3 **Application :** The epoxy screed shall be laid over the primer when it is still tacky. It shall be laid in lanes of 2 to 3 feet width to enable effective leveling and trowelling. Spread it uniformly to the desired thickness on the primed surface using a steel trowel to finish. Use a wooden float to compact fully and finish smoothly and evenly using steel trowel. Use proper templates to maintain the desired compacted thickness at all areas. Epoxy overcoating should be taken up after 24 hours after application of epoxy screed. Expansion joints, if any, in the substrate should continue in the epoxy flooring layer also. While laying protective clothing, goggles, gloves and boots shall be worn.

1.4 Epoxy coatings

1.4.1 This shall be made of GY-257 / HY-840 / silica flour or approved equivalent in the ratio 100 : 50 : 20 parts by weight and shall provide a hard wearing, aesthetic finish with good resistance to chemical attack. It should have good chemical resistance and withstand temperatures upto 80°C. It should also provide a hygienic, dust free and seamless coating. There should be high abrasion resistance.

1.4.2 **Surface preparation :** The epoxy screed surface laid previously shall be free from laitance, grease, oil and any other contamination. If contaminated, it shall be cleaned satisfactorily.

1.4.3 **Mixing:** Thoroughly stir the components first. Then mix the entire hardener with the base and stir thoroughly with a mechanical stirrer attached with a suitable paddle to get a homogeneous mix.

1.4.4 **Application :** Apply the mixed material on top of the epoxy screed already laid by a good quality paint brush or a good quality flat pile lambswool roller, or with an airless spray system. Ensure that a continuous film is achieved. The coating shall be of 500 micron thickness, done in two coats with

each coat being of DFT 250 microns. The second coat should be applied when the first coat is tack free.

2.0 EPOXY COATING (VERTICAL SURFACES)

For epoxy coating on vertical surfaces, steps enumerated in 1.2 and 1.4 above shall be followed in succession. The DFT for vertical surfaces shall be 200 microns. Before taking up en masse work, contractor shall prepare samples and get the same tested from approved laboratories and the results shall be furnished to the Engineer In charge for final approval.

3.0 MODE OF MEASUREMENT: The unit of measurement shall be in square metres.

C- 28: SPECIFICATION FOR POLY URETHENE FLOORING SYSTEM

1.0 Description

This is four component polyurethane concrete flooring system. It is a solvent free, seamless flooring system for use in medium to heavy duty traffic areas. The system provides high impact and abrasion resistance flooring system coupled with resistance to wide spectrum of chemicals.

2.0 Surface Preparation

The surfaces must be sound, clean, dry, and free from cracks, undulations, oil, grease, laitance and loose particles. New concrete surfaces should be minimum 7 days old and should be sound with tensile strength >1.5 mPa. All joints in the substrate should be maintained while laying PU flooring system.

3.0 Surface priming:

Apply epoxy based primer @6 to 8 m²/Kg., on well prepared substrate covering the entire area uniformly. Allow the primer to dry. On very absorbent or porous surface, it is necessary to apply second coat of primer.

4.0 Application

Mixing: This is supplied as pre-weighed four components, ready to use at site. The components of **PU** shall be mixed by taking Resin component in a clean container followed by addition and gradual mixing of Colouring component using slow speed heavy duty electric stirrer to achieve homogeneous and uniform coloured mix. To the coloured mix is then added Hardener component under continuous stirring followed by gradual addition of Filler component under continuous stirring until homogeneous mix is obtained.

Scratch Coat: Prior to application of **PU** flooring system, the prepared mix of **PU chemical** is applied as scratch coat by spreading the mix @ 1mm thickness using toothed trowel to cover imperfections in the substrate. Allow the scratch cot to dry.

Top Coat: The prepared mix of **PU chemical** is spread using toothed trowel and immediately rolled using spike roller to remove air entrapment and avoid pin holes formation, while maintaining minimum thickness of 3mm. Allow the applied system to cure for 24 hours before allowing vehicular traffic. Depending on the requirement, **PU** shall be applied at 3 to 6mm thickness. Ensure that the entire prepared mix of **PU** is used within its pot life (5 to 10 minutes).

APPLICATION DATA

Mix Ratio By Pack Scratch Coat and Top Coat (Resin: Hardener: Filler: Colouring Liquid/Paste)	1:1:1:1
Pot life at 250C	5 to 10 Minute
Curing Schedule Foot Traffic Full Traffic	8 to 10 Hours 24 Hours
Coverage per Pack Scratch Coat @ 1mm Thickness Top Coat @ 3mm Thickness Total System (1mm Scratch Coat+3mm Top Coat)	9 to 10 m2 3 to 3.5m2 2 to 2.5 m2

Minimum Required Properties of Applied Product

Properties	Values	Test Standard
Compressive	>50 mPa	ISO 604
Flexural Strength	>18 mPa	ISO 178
Tensile Strength	>7 mPa	ISO 527
Impact Strength	>8 KJ/m2	ISO 179
Bond Strength	35Kg/cm2 (Concrete Failure)	ASTM D4541
Abrasion Resistance	<0.150 gm	ASTM D4060, CS-17 Wheel
Impact Resistance	>20 Joules	ASTM D2794
Dry Heat Resistance	800C to 1000C	ASTM D2485
Shore D Hardness	> 80	ISO 868

5.0 **MODE OF MEASUREMENT** : The unit of measurement shall be in square metres.

C- 29: SPECIFICATION FOR STRUCTURAL GLAZING

1.0 SCOPE

The work in general shall consist of design, supplying and/or erecting and installing of all structural glazing, glazed partitions, etc. as per approved design/shop drawings with all materials complete. Supplying and/or fixing of all accessories and hardware are also included in the scope. The tests mentioned in the specification below shall be done only on the directions of EIC if required.

2.0 INSTALLATION

2.01 Materials

Aluminium sections used for fabrication of structural glazing, glazed partitions etc. shall be standard extruded sections specified in relevant standards or as specified in approved shop drawing and schedules.

2.02 Fabrication

Aluminium semi unitised vertical Structural glazing system with SGU/DGU and spandrel panel of approved make having main frame of verticals and horizontals made out of specially designed extruded aluminium sections to withstand wind pressure of 175 kg/sq.m at a height of 40m and fabricated, fixed at all levels, elevation and heights to the Masonry / RC walls with necessary clamps, brackets and anchor fasteners. All clamps and brackets shall be Mild Steel Hot dip galvanized minimum 80 microns thick and shall conform to IS: 4759-1996. The extruded aluminium section shall be anodised in approved colour with a anodic coating of minimum 20 microns. Extruded section shall be of 6063 T5 or T6 alloy conforming to ASTM B 221. Any other fastening straps, nuts, bolts, rivets, washers, Fire stops at all floor levels etc. shall be in stainless steel SS 304 grade. All tapes shall be of approved make.

The system shall be designed to withstand a wind pressure of 200 kg/Sqm and shall be fixed to the masonry/RC walls with necessary clamps, brackets and anchor fasteners, clamps and brackets shall be Hot dip galvanized minimum 80 microns thick, all complete as per manufacturer's manual and specifications. The spandrel panel shall have 50mm thick fiber glass insulation of 48 kg/cum density of approved make conforming to IS-8183 and 1.0 mm thick Twiga black tissue conforming to BS 476 Part 7. This insulation shall be enclosed in a GI tray fabricated out of 1mm thk. GI sheet and fixed to the glazing framework with stainless steel fasteners.

The gap between the GI framework and the concrete framework shall be sealed with Aluminium flashing fixed with stainless steel fasteners. All gaps shall be sealed with Silicone sealant of approved brand. Insulation should be provided in

between the Structural glazing aluminium frame work (i.e., behind the spandrel glazed panel) and the structure. Providing 6 mm thick toughened fully tempered hard coated glass of blue/green/blue-green or approved colour having VLT = 35 to 50 %, External reflectance= 6 to 15% ,Internal reflection = 8 to 15%, Solar factor = 0.36 to 0.43, U Factor = 2.8 to 3.0 W/sqm K etc.

2.03

Aluminium Curtain Wall System

General

- 1) Aluminium Curtain Wall System shall be designed for the following effects:
 - a) Permanent Deformation, thermal expansion.
 - b) Wind and seismic load
 - c) Air and water infiltration or leakage.
 - d) Lateral deflection per floor height
- 2) Unless otherwise specified the design of the system shall be prepared by the specialized firm for executing such works and submitted to the EIC / Department for approval after detailed scrutiny and checking design calculations and drawings.
- 3) It will be obligatory on the part of the contractor to execute the work systematically and conduct the necessary mock-up unit tests, before taking up the work to the satisfaction of EIC / Department.

2.04

Specification for Materials used for Curtain Wall

1	Glazing	Glazing work shall be as specified in the description of the item and / or as described under the chapter <u>Glass & Glazing of this book</u>
2	Framing system	Aluminium anodized extruded sections manufactured by reputed approved manufacturers, for all types of members like brackets, mullions, transom etc.
3	Sealant	As specified in the item or silicon sealant
4	Insulation	50 mm thick rock wool of minimum density 48 kg/cum sandwiched with black polythene sheet 100 micron on one side and aluminium foil of 100 micron on the other side or as specified by manufacturer at spandrel area or as per BOQ. The surface after fixing insulation shall be plain without any distortion

5	Heat Reflective Toughened Glass	As specified elsewhere in the specification. Colour of any shade approved by the Engineer-in-Charge-in-Charge.

2.05 **Aluminium Alloy Extruded Sections**

Extruded sections to be used for fabrication of framing system for curtain walls shall be manufactured and supplied by approved reputed companies. In absence of specific extruded section, sections available conforming to BIS specification, manufactured by approved reputed companies, shall be used in the works. Dimensions and weights of the sections shall be as per approved drawings.

2.06 **Scope of Work**

2.06.01 **Preliminary Requirements**

- i) The contractor shall design, test, fabricate, deliver, install and guarantee all construction necessary to provide a complete curtain wall system, all in conformity with the drawings and approval of the Engineer-in-Charge-in-Charge.
- ii) Specification and all relevant construction regulations including providing any measures that may be required to that end, notwithstanding any omissions or inadequacies of the drawings,
- iii) **The curtain wall system shall also include the following activities:**
 - a) Metal frames, glass glazing, spandrels, ventilators, finish hardware, copings, metal closure, windows etc.
 - b) All anchors attachments, reinforcement and steel reinforcing for the systems required for the complete installations.
 - c) All thermal insulation associated with the system. All fire protection associated with the system.
 - d) All copings and closure and metal cladding to complete the system.
 - e) All sealing and flushing including sealing at junctions with other trades to achieve complete water tightness in the system.
 - f) Isolation of dissimilar metals and moving parts,

- g) Anticorrosive treatment on all metals used in the system, (i) Polyester powder coating aluminium sections,
- iv) **The contractor shall also be responsible for providing the following:**
 - a) Shop drawings, Engineer data and structural calculations in connection with the design of the curtain wall system.
 - b) Mock-ups, samples and test units.
 - c) Performance testing of the curtain wall framing and glazing assembly. (d) Co-ordination with the work of other trade.
 - d) Insulation with glass wool 48 kg/cum at spandrels area.
 - e) All final exterior and interior cleaning and finishing of the curtain wall system.
 - f) Protection.
 - g) As built record drawings and photographs.
 - h) Guarantees and warranties.
 - i) All hoisting, scaffolding, staging and temporary services.
 - j) Conceptualising and design of a suitable maintenance system for curtain glazing,
- v) The water tightness and structural stability of the whole curtain wall system shall be the prime responsibility of the contractor. Any defect or leakage found within the guarantee period shall be sealed and made good all at the risk and cost of the contractor.
- vi) The curtain wall system shall be designed to provide for expansion and contraction of components which will be caused by an ambient temperature range without causing buckling, stress on glass, failure of joint sealants, undue stress on structural elements or other detrimental effects, specific details should be designed to accommodate thermal and building movements.

2.06.02 **Design Requirements**

- i) Curtain wall shall comply with all government codes and regulations, building bye-laws, if any.

- ii) All curtain walling, individual aluminium and glass components and all completed work shall be designed and erected to comply with the following requirements.

2.06.03 **Basic requirement**

The basic design and architectural requirements shall consist of the size of window, net glass area, ventilator, configuration of windows and spandrels to be retained. However the contractor may propose alternatives on the construction details for approval of the Engineer-in-Charge-in-Charge, provided that all basic functional and architectural requirements are fulfilled.

2.06.04 **Quality Consideration and other Activities**

- i) The contractor while submitting the detailed design calculations should submit the following information on the quality of materials to be used and other aspects as detailed below:
 - 1) Metal quality, finishes and thickness
 - 2) Glass quality, coating and thickness and proposed manufacturer's brand names.
 - 3) Aluminium extruded sections including mullions and transoms together with structural calculations and proposed manufacturer's brand name and also the name of agency proposed for fabrication work.
 - 4) Arrangement and jointing of components.
 - 5) Field connections especially mullion to mullion and transom to mullion.
 - 6) Fixing and anchorage system of typical wall unit together with structural calculations.
 - 7) Drainage system and provision in respect of water leakage in the curtain wall system.
 - 8) Provisions for thermal movements.
 - 9) Sealant and sealing methods.
 - 10) Glazing Method
 - 11) Wind load and seismic load and any other specific load considered in the design

- ii) Design concept over lighting protection link-up system of the curtain wall for connection and incorporation into the lighting conductor system of the building (Lighting conductor system of the building shall be done by other approved specialized agency).
- iii) The maximum permissible structural tolerances of the building that the system has been designed to accommodate in case these tolerances exceed those specified in the specification.

2.07 **Tolerances:** Any parts of the curtain wall, when completed, shall be within the following tolerances:

- 1) Deviation from plumb level or dimensioned angle must not exceed 3 mm per 3.5 m length of any member, or 6 mm in any total run in any line.
- 2) Deviation from theoretical position on plan or elevation, including deviation from plumb, level or dimensioned angle must not exceed 9mm total at any location.
- 3) Change in deviation must not exceed 3mm for any 3.5 m run in any direction.

2.08 **Samples :** The contractor shall also submit samples of aluminium extruded sections; mullion and transom sections in lengths of 300 mm with the same finish and workmanship as per the tender proposals and 300 mm x 300 mm samples of glass for approval of the EIC. (samples to include exposed screws and other exposed securing devices if any).

2.09 **Ancillary Requirements to be fulfilled by the contractor**

- i) The contractor / approved specialized agency shall submit a maintenance manual for the curtain wall system inclusive of all metal parts, glass and finish etc.
- ii) During detailed design scrutiny and also during the actual execution of the work any additions and extra provisions that will have to be made as per theoretical requirements or site conditions shall be implemented and executed by the contractor at his own cost, without claiming any thing extra under any circumstances.

2.10 **Execution of work**

Performance Testing - General Requirements

- i) Mock-up units shall be constructed by the contractor and tested to determine the structural stability as well as air and water infiltration or

leakage at glazing beads and all other joints designed into the face of the building.

- ii) After the approval of structural calculations and the drawing for construction of the curtain wall, one test unit for performance testing of the curtain wall shall be constructed by the contractor at an independent laboratory or at a laboratory approved by the Engineer-in-Charge-in-Charge.
- iii) Erect mock-up under manufacturer's / Fabricator's direct supervision and employ workmen as they would be employed during the actual erection at the job site.
- iv) The contractor shall submit to the Engineer-in-Charge-in-Charge the test procedures to be adopted, test schedule and location for testing before the work of actual testing is taken up.
- v) Prior to the fabrication of test units, the contractor shall submit shop drawings and design calculations of the test unit for approval of the Engineer-in-Charge-in-Charge.
- vi) The contractor shall not start the work of erection of curtain wall on site till the approval for the successful completion of the mock up test and clear instruction in writing to start the work is received from the Engineer-in-Charge-in-Charge.
- vii) The decision of the Engineer-in-Charge-in-charge in respect of the procedure to be adopted, in conducting the mock-up test and the judgment over the net results, shall be final and binding on the contractor.

Test of Wind Pressure

- i) The equivalent load of wind pressure or wind suction shall be given to the test unit as increasing or decreasing the inside pressure in the "pressure chamber" at which the test unit is fixed.
- ii) The static wind pressure shall be applied up to 1.5 kpa at maximum wind pressure.
- iii) The variation of dynamic pressure shall be of any approximate sine curve line.
- iv) Deflection on each observational points of the test unit shall be observed and recorded under static pressure as described above.

- v) Any damage and harmful permanent deformation on any parts except sealing materials shall not be found at maximum wind pressure.
- vi) The deflection on the main structural parts in this condition shall not exceed :
 - 1) $1/175$ of the span between supports or 20 mm, whichever is less for vertical elements.
 - 2) $1/250$ of the span between supports for horizontal elements.
 - 3) The extent of recovery of deformation, 15 minutes after the removal of the test load, is to be at least 95%.

Test of Lateral Deflection per floor height

- i) Lateral deflection per floor height shall occur on the test unit, when the structural frame which fixes the test unit is deflected horizontally.
- ii) The deflection of every ± 2.5 mm shall be increased up to ± 13 mm on the test unit (static deflection test)
- iii) The dynamic deflection shall be applied up to ± 13 mm.
- iv) The variation of dynamic deflection shall be of an approximate sine curve line, one period of 3 seconds.
- v) The dimensions of the deflection on each observational point of the test unit shall be measured under the condition as described above and the damage shall be observed.
- vi) Any damage and harmful permanent deformation shall not be found in any parts of the curtain wall except the damage to sealant at maximum deflection.

Water-tightness Test

- i) Water shall be sprinkled to the Test Unit' under wind pressure.
- ii) Pressure shall not be applied to the test unit.
- iii) The volume of the sprinkling water in one minute shall be 5 litres per sqm minimum.
- iv) All water leakage and drainage system at the joint and the open able sash of the curtain wall system shall be observed from the outside of the chamber.

- v) Hold the test two times, in sequence as described below, conforming to the above mentioned conditions.
- vi) Water leakage shall not be observed inside at all parts of the test unit during first water-tightness test.
 - 1) Install the test unit.
 - 2) Hold first water-tightness test.
 - 3) Hold test of wind pressure as described above.
 - 4) Hold second water-tightness test.
 - 5) Lateral deflection test.

2.11 **Test Report:** The contractor shall submit five copies of test report to the Engineer-in-Charge-in-charge.

2.12 **Cost of Performance Test**

- i) The contractor shall allow in his tender for the cost of the performance testing and fabrication, erection, corrections to and demolition of the test units including any special provision required in the testing laboratory for the tests mentioned above.
- ii) The contractor shall allow for amendments and adjustments to the mock-up unit as instructed and required by the Engineer-in-Charge-in-Charge / Architect or the consultant.
- iii) If the mock-up test unit fails to pass the initial testing, the contractor shall make the necessary corrections to the test unit and shall get the test unit retested by the testing laboratory until it passes the test.
- iv) Cost of corrections to the test unit and the cost of retesting shall be borne by the contractor.
- v) The contractor shall be allowed six calendar months time after the work is awarded to set up the test unit and conduct the required test as described above to the satisfaction of the Engineer-in-Charge-in-charge.
- vi) In case the contractor fails to conduct the necessary tests as described above or fails to meet the required test results, without any genuine cause within the allotted period of six months, the Engineer-in-Charge-in-charge shall be free to rescind the contract with all costs including

the forfeiture of E.M.D. and any other securities deposited by the contractor under the condition of contract.

2.13 **Record of Test and Drawings**

- i) The testing laboratory shall keep the approved copy of the shop drawing and calculations of the test unit at testing laboratory during testing of test unit.
- ii) The testing laboratory shall accurately and nearly record on the above mentioned shop drawings all changes, revisions, modifications etc. made to test unit, which shall become the record drawing.
- iii) On completion of testing and after approval of the test reports the testing laboratory shall submit the final record drawings to the Engineer-in-Charge-in-charge.

2.14 **Fabrication and Erection**

- i) Frames shall be square and flat, both the fixed and openable frames shall be constructed of sections, which have been cut to length, mitred and mechanically jointed at the corners, Sub-dividing bar of units shall be tenoned and riveted into frames.

All frames shall have corners welded to true right angles. For jointing hollow sections flash butt welding, argon arc welding or mechanical jointing by inserts shall be used. (Gas welding or brazing shall not be done). Concealed screws shall be used for joining the sub-units.
- ii) The grid for the curtain wall system shall be fabricated carefully with aluminium extruded sections like mullions and transom in the exactly same pattern as per the final drawings with amendments if any received from the laboratory after conducting the mock-up unit test.
- iii) The sizes of different members of the curtain wall system shall be exactly as adopted for the mock-up unit tests and the grid shall be fixed to the building member as shown in the drawing, received after conducting the mock-up unit test.
- iv) Care should be taken to see that any gap between the frame and support and the frame **itself is sealed with silicon sealant.**
- v) Finish of grid frame shall be either anodized, organic coating, backed enamel finish or as specified in the item of work, no visual variation in anodizing / colour shall be accepted.

- vi) Care shall be taken to see that the curtain wall system is not deformed, damaged during erection and it shall be protected from direct contact with wet or intermittent wet cement concrete mortar etc.

2.15

Measurements

- i) The breadth and the height of the finished work including the openable windows shall be measured in metres and cm and the net quantity for payment shall be calculated in sqm up to two places of decimal or as specified in the BOQ.
- ii) The area to be considered for measurement shall be the net area of the exterior face of the curtain wall as fixed including the openable windows, if any, as part of the curtain wall or as specified in the BOQ.

2.16

Rate

The rate shall include the cost of all operations described above including the cost of materials, labour, design, shop drawings, erection and testing, mock-up test units, fabrication, erection, finishing, scaffolding, undertaking performance guarantee etc. No other claims of any kind pertaining to this work shall be entertained.

C -30: SPECIFICATION FOR FALSE CEILING

1.0 SCOPE OF WORK

- 1.1 The work contemplated under these specifications refers to false ceiling with various types of materials as mentioned in the schedule of quantities. The work shall include the supply and insulation of suspended ceiling using insulation / acoustic boards, plaster of paris boards, calcium silicate boards, metal boards etc. together with the suspension system as shown on drawing or specified in Schedule/manufacture with all materials labour and equipment. The work shall also include providing of openings in the ceiling for lighting, air conditioning diffusers etc. as shown on drawings or instructed by the Engineer-in-Charge.

2.0 GENERAL

- 2.1 The work under false ceiling work is to be executed by specialized agency with adequate experience. The contractor shall submit the credentials of the agency executing the work for the approval of EIC.
- 2.2 The work shall be executed in accordance with the false ceiling drawings. In the absence of false ceiling drawings, the work shall be executed as directed by the EIC considering the location and requirements of the light fittings, grills, erection openings, etc.
- 2.3 The scheme of suspenders and direction of intermediate channel shall be planned in such a way that they clear the ducting, cable trays, etc. and got approved by the EIC.
- 2.4 Contractor's scope of work shall include marking of light fitting location, Ac grills or Trap doors and obtaining approval of EIC. This shall be done before cutting for openings. No extra shall be payable for re-aligning the same.
- 2.5 All members of the suspension system shall be of sufficient strength and rigidity to carry the ceiling boards or sheets in a true and level plane without exceeding a deflection of 1/360th of their span. All joints in ceiling panels shall run straight and cross joint shall be securely fixed to walls. All drillings of structural concrete or welding to steel for installation of the suspension system shall be included in the rate. All M S sections used for supports etc. shall be given one coat of synthetic enamel paint over a coat of red lead primer. All wood supports shall be painted with two coats of "Solignum" or other approved wood preservative before erection.

3.0

CODES AND STANDARDS:

The relevant Indian Code for False ceiling works is given below:

IS 2095 (Part – I)	1996	Specification for Gypsum Plaster Boards- Plain gypsum plaster boards
IS 2095 (Part – II)	2001	Specification for Gypsum Plaster Boards- coated or laminated Gypsum
IS 2095 (Part –III)	1996	Specification for Gypsum Plaster Boards- reinforced gypsum plaster boards

4.0

SEAMLESS SUSPENDED CEILING

- 4.1 The suspended false ceiling system shall made from suspender channels, intermediate channels and ceiling channels. All the framework shall be from standard available GI sheet sections.
- 4.2 The suspender shall be of angle 25 mm x 10 mm x 0.55 mm thickness fixed to the ceiling at 1220 mm grid points using GI cleat and steel expansion fasteners.
- 4.3 Intermediate channels shall be of 45 mm channel, 0.9 mm thick with two flanges of 15 mm each. The intermediate channel shall be screwed to the suspenders.
- 4.4 Ceiling section shall be of 0.55 mm thickness curled web channel with web of 51.5 mm and two flanges of 26 mm each, with lips of 10.5 mm. The ceiling channel is fixed to the intermediate channel at 457 mm centers with the help of connecting clips.
- 4.5 12.5 mm tapered edge Gypboard (conforming to IS 2095)/Calcium silicate board as per the BOQ is then screw fixed to ceiling section with 25 mm drywall screws at 230mm centers. Screw fixing is done mechanically either with screw driver or drilling machine with suitable attachment.
- 4.6 The edge of the ceiling near the walls or partition shall be screwed to GI perimeter channels. The perimeter channels shall be 0.55mm thick with 27 mm web, one flange of 27mm and another flange of 30 mm. The perimeter channel shall be fixed to wall or partition with the help of nylon sleeves and screws at 610mm centers.

- 4.7 Finally the boards are to be jointed and finished so as to have a flush look which includes filling and finishing the tapered and squared edges of the boards with jointing compound. Joint paper tape and two coats of drywall topcoat suitable for Gypboard /Calcium silicate board as per recommended practices of India Gypsum or approved manufacturer.
- 4.8 The direction of Intermediate channels shall be preferably in the shorter direction of the room. The openings required for light fittings, diffusers, cutouts etc., shall be accommodated between the intermediate channels. The edges of openings shall be stiffened using perimeter channels of 20mm x 27mm x 30mm x 0.55 mm screwed to the intermediate channels.
- 4.9 Where steps are specified by EIC/drawing, angle beads shall be used to get straight line finish. Additional suspenders/ intermediate channels/ ceiling channels shall be provided to maintain the stiffness of the suspended ceiling at steps.
- 4.10 Edge beads shall be used to protect the exposed gypsum core of Gypboard/Calcium silicate board at the cut edges of openings for light fittings, diffusers, etc. The exact size of the openings to be provided shall be directly taken from the type of light fitting of AC grills with due allowance for edge clearance available in such fittings as directed by Consultant.
- 4.11 In cases where the ceilings are longer than 10m control joints shall be provided. The location of such joints shall be as directed by consultant.
- 5.0 Suspended precoated GI Grid System:**
- 5.1 The grid system shall be precoated GI system from approved manufacturer. The suspended ceiling grid shall be of self-interlocking precoated GI, T bars main runners and cross runners of specified section and pattern as required to suit the span as per drawing/Directions of EIC.
- 5.2 Gypsum tiles: The tiles shall be of 12.5 mm thickness either plain in design or perforated tile as specified in the drawings/Directions of EIC.
- 5.3 The Gypsum tile used shall be of size approximately 595 x 595 mm size or as specified in the schedule of items. The tile shall be provided with PVC edge channel to protect the edges of the tiles. The tiles shall be placed on the soffit of precoated GI insection Tees and screwed using GI screws.

- 5.4 Openings for light fittings, AC grills and trap doors if any, shall be stiffened with tees / L-angles used for perimeter sections.

6.0 Acceptance criteria:

- 6.1 The false ceiling shall be checked for level and lines in both direction and diagonally.
- 6.2 The alignment of light fittings and AC grills and Trap doors shall be approved by Consultant.

7.0 Mode of Measurement:

- 7.1 The false ceiling provided shall be measured in square metres.

8.0 METAL FALSE CEILING SYSTEM & THERMAL INSULATION METAL FALSE CEILING SYSTEM (LUXALON 300 C / 610MM X 610MM PANEL OR EQUIVALENT):

8.1 MATERIALS

- 8.1.1 False ceiling : Manufacturing and Product: Hunter Douglas India Private Ltd/approved manufacturer.
- 8.1.2 Product: Luxalon 300 C / lineal aluminium false ceiling or 610 mm x 610mm x 1mm thk. Panel or equivalent
- 8.1.3 COLOUR : As specified or as approved by the Engineer-in-Charge
- Material Description: All components shall be made of aluminium and manufactured by M/s. Hunter Douglas India Private Limited approved manufacturer and as per manufacturers specification.

9.0 LUXALON 300 C METAL CEILING:

- 9.1 PANEL: The panel shall be cold roll formed panels 300mm wide and 15.5mm deep with a 5mm beveled edge creating an 8mm V groove made from corrosion resistant Al.-Mg. Alloy AA5050. The length of each panel shall be upto 6000mm. The aluminium panels shall be chromatised for maximum bond between metal and paint enameled twice under high temperature, one side with a full primer and finish coat in a polyester paint for a dry film thickness of 20 microns, the other side (inner side) with a primer coating and skin coat on a Continuous Paint Line.
- 9.2 CARRIER: The carrier on which the panels shall be clipped on to will be 41.5mm wide, 62mm deep, made of black stove enameled 0.95mm thick aluminium alloy AA5050. When two or more carriers are to be joined, they shall be joined together by means of splices, which will clip on to holes provided for the same.

- 9.3 WALL TRIM: The wall trim shall be 15mm deep x 30mm wide x 15mm deep x 0.4mm thick with inward right angled bent lip of 2mm thick Aluminium Alloy AA5050 with square edges and length of 5 mtr.
- 9.4 ROD HANGER: The rod hanger of suitable length shall be made of 4mm dia. galvanized steel (Zinc coating 120 gms/Sqm.).
- 9.5 SUSPENSION CLIP: The adjustment suspension clip shall be made of galvanized spring steel V shaped with two holes to accommodate the rod hanger.
- 9.6 ANCHOR FASTNERS: The single piece sleeve anchor with assembled hanger taper bolt and nut which has smaller driller dia. Anchor fastener shall be of arrow make or equivalent with thread size 5mm.
- 9.7 SUSPENSION SYSTEM : The carriers would be suspended from the roof by 4mm dia galvanized (Zinc coating 120gms/Sqm.) steel wire rod hangers with height adjustment springs out of galvanized spring steel. Hangers shall be fixed to roof by '3' hooks and Anchor Fasteners.
- 9.8 **FINISHING OF SURFACE OF STRIPS FOR INTERNAL USE (ALUMINIUM):**

The coils from which aluminium panels are made shall be cold roll formed & stove enameled on a continuous coil coating paint line with dried in place roller coated application for pre-treatment. The coils to go through four stages of pre-treatment, three times oven baked through conversion coating, priming and finished coat, ensuring superior adhesion, high corrosion resistance and good colour retention. The coils shall be painted on both sides after being degreased, Prime coat of at least 5 microns to be applied on both sides and a back coat of 5 micron of neutral colour to be applied on the inside surface and 5 micron of binder and 15 microns of top coat of desired colour shall be additionally provided on the exposed surface.

Pencil Hardness	: phh > F
Light Fastness	: Light fastness of at least 6 according to international wool scale.
Colour Fastness	: All finishes shall have a colour fastness of at least 6.
Colour Variation	: Colour diff. Bet batches $\pm$ 4 units : Colour diff. Within one batch + 2 units.
Colour Uniformity	: Maximum allowable deviation is 2 NBS units.
Specular Gloss	: U 10 deg/00 (matt) ; 0 25 deg/00 (satin)

Resistance to Salt Spray Test	:	After 100 hrs testing under creep from the edges or the Cross, shall exceed 2mm. Blistering shall not exceed F 8.
Impact resistance	:	To withstand an impact test of 5mN/mm metal thickness Without loss of adhesion
Paint adhesion	:	Better than or equal rating 1
Humidity Resistance	:	No formation of blister.
Chemical Resistance	:	No loss of adhesion or gloss and no colour change or Staining.

9.9 **FIXING:** The panels shall be clipped on to a carrier. The carriers to be suspended with an adjustment spring of galvanized spring steel, V shaped with two holes to accommodate the rod hanger. The rod hanger to be made of 4mm dia, galvanized steel and suspended from the ceiling by) hooks fixed at 1.5mm centre to centre.

9.10 **WORKMANSHIP:** The ceiling shall be erected in continuous sequence. Spans would not exceed those recommended by M/s. Hunter Douglas India Pvt. Ltd. All work in this section shall be performed in an efficient manner by the installing agency approved by the manufacturers and as per manufacturer's recommended procedures.

9.11 **FIRE RESISTANCE:** The false ceiling including the paint shall be fire resistant as per DIN 4102.Class A2. It should also be classified as P- NOT EASILY IGNITABLE - AS PER B5 476. Part 6 and should have a fire propagation classification of Class as per BS 476. Part 6.

10.0 **THERMAL INSULATION:**

10.1 **UNDERDECK INSULATION:**

10.1.1 **METHOD OF APPLICATION:**

10.1.1.1 Clean the surface and make it free from dust and loose particles.

10.1.1.2 Apply a coat of Shalicoat/approved make as per BOQ to the underside of the roof.

10.1.1.3 Apply CPRX compound to the underside of each prelaminated Phenolic Foam panel and press the slabs in position. Butt the joints well together.

10.1.1.4 Secure panel in position with the help of screws, rawl plug and washers.

10.1.1.5 Deal all the joints with the help of self adhesives Aluminium tapes.

10.2 **INSULATION ABOVE FALSE CEILING:**

- 10.2.1 The insulation tiles shall be placed above the Al carriers, which are at one meter c/c.
- 10.2.2 The insulation tiles should be cut to the required size for placement over carriers as per the spacing and pattern of false ceiling lay out.
- 10.2.3 The rate quoted shall be inclusive of cutting to the required size, wastage etc.
- 10.2.4 The tiles shall abut each other to provide a continuous barrier for effective thermal insulation.
- 10.3 **GENERAL:**
- 10.3.1 Extremely low 'K' value 0.018 Kcal/hr M.C.
- 10.3.2 Low water vapour transmission level.
- 10.3.3 Should be available in a single component system.
- 10.3.4 Should be approved by both TAC and NIC.
- 10.3.5 Should be mildly antiseptic with resistance to fungal and bacterial growth and should not attract rodents/insects.
- 10.3.6 Should have good acoustic properties.
- 10.3.7 Temperature Range: + 125 degrees C to - 190 degrees C.
- 10.3.8 Material shall be classified as P [not easily ignitable] - BS 476 Part 5.
- 10.3.9 Material should conform to Building Classification "0 based on the propagation index BS 476 Part 6.
- 10.3.10 Material shall have a Class I surface spread of flame, the highest rating possible BS 476 Part 7.
- 10.3.11 Lowest smoke obscuration 5% (almost negligible) - BS 5111 Part 1.
- 10.3.12 Toxicity index of 0,04478 - Naval Engineering Standards 713 (NES) Ministry.

11.0 **LUXALON 600MM X 600MM X 0.7MM PLAIN UNPERFORATED CLIP- IN TYPE ALUMINIUM FALSE CEILING**

- 11.1 Tiles : This shall be beveled edged and two sides of each tile shall be raised and pipped and stopped to ensure positive engagement into the clip-in profile to allow for demounting of individual tiles. The paint finish shall consist of 70 micron thick (50% gloss) polyester based powder coat of white colour. The suspension system shall be as detailed below.

Clip-in Suspension system :

This shall be made out of GI with a thickness of 0.5mm which will be suspended by means of suspension rods made out of 4mm GI rods with a hold on clamp suspension clip. Clip-in profile should be suspended at every

600mm. Suspension system along clip in lines shall be at 1200mm maximum.

11.2 EXECUTION

11.2.1 EXAMINATION

- A. Examine areas receiving metal tile ceiling system for conditions that might adversely affect installation.
- B. Verify that all work above ceiling system has been satisfactorily completed prior to start of ceiling installations.
- C. Do not start ceiling installations until all unsatisfactory conditions affecting ceiling systems have been corrected.

11.2.2 PREPARATION

- A. Provide layouts for inserts, clips and other support items required to be installed by other trades. Furnish inserts, clips and related items to other trades in a timely manner to preclude construction delays.
- B. Coordinate with other trades for proper installation of inserts and related items.
- C. Verify ceiling layouts by actual field measurements.
 - 1. Establish ceiling layout to balance borders and minimize out-of-square conditions. Coordinate all work that penetrates tile.

11.2.3 INSTALLATION

- A. Install metal tile system in accordance with manufacturer's printed installation instructions, submittals, applicable industry standards, and governing regulatory requirements for the work.

11.2.4 ADJUST AND CLEAN

- A. Adjust components to provide uniform tolerances.
- B. Replace all tile that are scratched, dented or otherwise damaged.
- C. Clean exposed surfaces with non-solvent, non-abrasive commercial type cleaner.

12.0 LUXALON 600MM X 600MM x 50/22mm Combicell Ceiling System

- 12.1 Product :** LUXALON Combi cell ceiling to be manufactured from preprinted, stove enameled aluminium material, alloy AA 5050 (according to EN 1396 and ECCA standards), thickness 0.50mm to achieve a cell size 150mm x 1500mm / 75mm x 75mm with tiles of size 600mm x 600mm with all 'U' profiles 15mm wide and 50 /22mm high and to have 2.6mm wide return top flanges. The cross connections of all 'U' profiles to feature a level difference avoiding visible uncoated edges. When incorporated into the suspension bridge, the tiles shall fully integrate in the cell ceiling. 'U' profiles of the grid and the tiles are to be in the same colour coating quality. Suspension grid shall consist of main runners 2400mm length and cross

runners 600mm length. Rows of main runners are to be installed at 600mm centers by means of rod hangers of varying length to cater for difference in heights on account of sloped RCC slab as per drawing, fixed to the main runners by means of cell hangers allowing for level adjustment at a maximum distance of 1200mm c/c. Cross runners are to be clicked in between the main runners at 600mm c/c. Each combi cell tile is to be executed with clean cut ends, using special sliding clip for easy placement and removal of the tiles and allowing direct downward tile removal. System shall be fully modular meaning that the grid and the tiles can be cut to modular size whereas sliding clips and adaptor brackets allow for standard finishing of the cell ceiling at pillars, light fixtures and at the perimeter. The entire product shall have a tough and durable two layered polyester finish coating of minimum thickness 20 micron applied in a continuous coil coating process ensuring uniform coating and absolute adhesion.

12.2 Perimeter profiles : This shall consist of

1. Half blind 'U' shaped runners with identical dimensions and same material as the cell ceiling (15 x 50/22mm) forming one integral unit with the ceiling for floating installation.
2. 'L' profiles (25 x 50mm) made of 0.50mm thk. Aluminium for wall to wall installation.
3. 'C' shaped profiles (15mm x 50/22mm) made of 0.50mm thk. Aluminium clipping on the edges of the cell ceiling for floating installation with oblique angles or non-modular trimming.

All perimeter profiles shall have the same colour coating quality as that of the combi cell ceiling on all visually exposed sides.

12.3 Installation: All materials shall be installed in strict compliance with all local codes, manufacturer's recommendations including specific additional requirements as may be called for in the specifications or shown in the drawing.

13.0 Mode of Measurement: Unit of measurement shall be in square metres.

C-31: SPECIFICATIONS FOR DRAINAGE WORK WITH NP2/NP3 CLASS RCC HUME PIPE

1.0 MATERIALS:

The pipes shall be R.C.C. spun pipes NP2/ NP3 class as specified, conforming to IS. 458-1988 and shall be approved by the Engineer-in-Charge for soundness before incorporation in the work.

2.0 LAYING R.C.C. SPUN PIPES:

- 2.1 The work consist of providing, laying, jointing and testing R.C.C. spun pipe storm water drain of required diameter as mentioned in the schedule to discharge Sewage/storm water to the required location as shown in the drawing.
- 2.2 After the cement concrete cradle has been laid properly, if specified or as directed by the Engineer-in-Charge, the pipes shall be lowered gradually into the trenches over the concrete cradle or bed. Necessary working space/gap for collars shall be made at every joint. Laying of pipe shall proceed upgrade of a slope. The collars shall be slipped-on before the next pipe is laid.
- 2.3 The pipe drain shall rest on the bed at every point through its length. To ensure this the space between the undersides of the pipe on the invert of the cradle shall be carefully grouted solid with cement slurry consisting of one part of cement to one part of clean washed sand in such a manner that no void is left. It shall be ensured that the load of the pipes and the super imposed load of the earth filing is evenly distributed on the cradle or bed.
- 2.4 The contractor shall take precautions to see that no dirt; earth or other foreign matter is allowed on the surface of the cradle or bed of the pipe resting there-on, all to the full satisfaction of the Engineer-in- Charge. After the alignment and grading of the pipes is checked by the authorized representative of the Department, the grouting shall be done with specified stiff mix of cement mortar.
- 2.5 The cradle of concrete shall be allowed to set a least for three days before any pipe is placed on it and the contractor shall take due care in setting the pipe in the cradle so that no damage is occur to the cradle. If any damage to the cradle occurs, it shall be rectified to the satisfaction of Engineer-in-Charge and in any particular case where damage to the cradle is beyond repair in the opinion of the Engineer-in- Charge, the contractor shall cut out the damaged section of the cradle and re do the same at his own expenses to the complete satisfaction of the Engineer-in-Charge.
- 2.6 No pipe shall be laid or placed till the alignment of the pipe drain and its levels and gradient have been carefully checked and found correct/approved by the Engineer-in-Charge.

3.0 **JOINTS:**

- 3.1 The joints for the pipes shall be made by loose collars/as per make/as specified in the BOQ and the connecting space shall be as minimum as possible. The collars shall be specifically roughened inside to provide a better grip.
- 3.2 The two adjacent pipes will be so designed and manufactured that when butted together concentrically, a dowel is left between the two ends, In this dowel, cement mortar of (1:1) proportion or mix as specified in the schedule be filled and then between the ends a paste of cement mortar of the same proportions will be placed. The space remaining between the pipe ends and the collar being then caulked with cement mortar of (1:1) or other specified proportion so that an even space appears all round the external diameter of the pipes. All the joints shall be finished off smooth at an angle of 45° with the longitudinal axis of the pipe on either side of the collars.
- 3.3 The interior of the pipe drains shall be cleaned off all dirt, cement mortar and superfluous materials and joints shall be cured for at least 7 days.

4.0 **TESTING OF R.C.C. SPUN PIPES:**

- 4.1 After sufficient interval has been allowed for the joints to set, the pipe drains will be tested under a water head of at least 1.2 m. and in no case under a head greater than 1.8 m. of water above the top of the pipes. In addition, the pipe drains shall be examined for leaks of land/sub-soil water making its way through the joints. The contractor shall make the pipe drains water tight against the entrance of land/sub- soil water from outside and also against the leakages of water from the inside of the pipe drains at the test heads specified above to the full satisfaction of the Engineer-in-Charge.
- 4.2 All defective or leaking pipes or joints shall be cut out and replaced and made good by the contractor at his own cost. In case of the joints that may be defective and cannot be made good, they shall be entirely embedded/surrounded externally with cement concrete of 1:2:4 proportion to render the joint (s) water tight and this shall be allowed to set before encasing or back filling is done. A strong colour shall be added to the water used for testing of the pipes, in order to detect any leakage easily. The cost of testing of the pipe drain shall be borne by the contractor and is deemed to be included in the rates quoted by the contractor.

5.0 **MODE OF MEASUREMENT:**

- 5.1 The length of pipe shall be measured in running metre nearest to a centimeter along the centre line of the pipes over all fittings such all collars, bends, junctions etc.
- 5.2 Fittings/ specials shall not be measured separately.

- 5.3 The rate shall include the cost of materials and labour including jointing, grouting, cutting of pipes to the required lengths, wastages etc. involved in all the operations described above.
- 5.4 Excavation, back filling, shoring and timbering in trenches and cement concreting wherever required shall be measured separately under relevant items of work.

C-32: SPECIFICATIONS FOR FENCING WORK WITH BARBED WIRE, CHAIN LINK ETC

1.0 GENERAL:

The work shall generally be carried out as per these specifications, relevant drawings and as directed by the Engineer-in-Charge.

2.0 M.S. POSTS AND STRUTS:

All the M.S. posts/struts shall be free from rust, scale, cracks, twists and other defects and shall be fabricated to the required shape and size out of the specified sections. The posts and struts shall be conforming to relevant specifications stipulated here-in-before under relevant sections. All the posts and struts shall be of sizes and lengths as specified in the BOQ and drawing. The posts and struts shall have split ends for proper fixing and shall be embedded in the cement concrete of mix. 1:3:6 or as specified in the drawing. The exposed surfaces of the posts and struts shall be painted with two coats of synthetic enamel paint of approved make and shade over a coat of approved primer.

3.0 R.C.C. POSTS AND STRUTS:

3.1 All the posts and struts shall be of standard size as specified in schedule/drawing. These shall be cast on suitable places/platforms in cement concrete 1:2:4 (1 cement 2 coarse sand : 4 graded stone aggregate 12.5 mm. nominal size) as per relevant specifications stipulated here-in-before. The reinforcement shall be provided as shown in the drawings or as directed by Engineer-in-Charge and as specified here-in-before under relevant sections. The posts and struts shall be free from honeycombing, cracks and other defects.

3.2 After casting, the posts/struts shall be left at the same place and cured for a minimum period of 7 days. After 7 days curing the same shall be shifted to a levelled ground and stacked for further curing for 14 days. After 21 days of curing only, the posts/struts shall be transported to work site without any damage, for fixing in position.

4.0 SPACING OF THE POSTS AND STRUTS:

The spacing of posts shall be 3 m. centre to centre unless otherwise specified or as directed by the Engineer-in Charge, to suit the dimensions of the area to be fenced. Every 10th post, last but one end post, corner post, and posts where the level of fencing changes in steps and end post when the fencing changes its direction shall be struted on both sides, or as directed by the Engineer-in-Charge. End posts where barbed wire fencing is discontinued shall be struted on one side only.

5.0 FIXING OF M.S./R.C.C. POSTS AND STRUTS:

5.1 Pits of size 45 x 45 x 45 cm. deep or of sizes mentioned in the drawings, shall first be excavated centrally in the direction of proposed

fencing work, true to line and level to receive the posts. In case of struts, the pits shall be so excavated, as to receive minimum 15 cm. concrete cover at any point of the struts to suit its inclination or as shown in the drawing.

- 5.4 The pits shall be filled with a layer of 15 cm. thick cement concrete of specified mix. The posts and struts shall then be placed in the pits, the posts projecting to the specified height above ground level, true to line, plumb and position, by providing adequate supports temporarily, and cement concrete of specified mix shall then be filled-in so that the posts are embedded in cement concrete blocks of specified sizes. The concrete in foundation shall be watered for atleast 7 days to ensure proper curing.

6.0 **BARBED WIRE:**

- 6.1 The barbed wire shall be of M.S. or G.I. as specified and it shall generally conform to I.S. 278-1978.
- 6.2 The base metal of the line and point wire shall be of good commercial quality mild steel. The line and point wire shall be circular in section, free from scales and other defects and shall be uniformly galvanized if specified.
- 6.3 The line wire shall be in continuous lengths and shall generally be free from signs of welds. It shall be able to withstand wrapping and unwrapping 8 turns round its diameter.
- 6.4 The barbed wire shall consist of two splices per reel. The barbed wire shall be formed by twisting two lines wires one containing the barbs.
- 6.5 The barbed wire and its weight shall be as given in the table below:

Type	Nominal Diameter of wire		Nominal distance between two barbs (in mm)	Mass of complete barbed wire (n in gm./m.
	Line wire (in mm.)	Point wire (in mm.)		
1	2.50 (12G)	(12G)	75	146(136-155)
2	2.50	2.50	150	114 (108-120)
3	2.50	2.00 (14G)	75	117 (108-125)
4	2.50	2.00	150	96 (89-103)
5	2.24 (13G)	2.00	75	102 (97-106)
6	2.24	2.00	150	82 (78-85)

- 6.6 The barbs shall carry four points and shall be formed by twisting two

point wires, each two turns, tightly round one line wire, making altogether 4 (four) complete turns, the barbs shall be so finished that the four points are set and locked at right angles to each other.

- 6.7 The barbs shall have a length of not less than 13 mm. and not more than 18 mm. The points shall be sharp and well pointed. Barbed spacing shall be as given in the above table. Wherever required for every 50 reels or part thereof, samples of the barbed wire and the individual line wires shall be put to tensile test and in case of failure to conform to tensile properties given below, two additional tests of each kind shall be made on the samples cut from other reels.

7.0 **TENSILE PROPERTIES:**

Size of line wire Nominal dia (in mm)	Breaking load of line wire		Min. breaking load of complete barbed wire (in Kg.)
	Min. (In Kg.)	Max. (In Kg.)	
2.50 (12 G)	216	302	444
2.24 (13 G)	128	179	263

- 7.1 On the results of these additional tests, the whole or portion of the barbed wire shall be accepted or discarded as the case may be.

8.0 **FIXING OF BARBED WIRE:**

- 8.1 The barbed wire shall be stretched and fixed in number of rows and two diagonals as specified. The bottom row shall be 140 mm. above ground and the rest at 125 mm or at given spacing as per drawing. The diagonals shall be stretched between adjacent posts from top wire of one post to the bottom wire of the 2nd post. The diagonal wires will be interwoven with horizontal wires by fixing the odd rows of wires, then the diagonal cross wires and lastly the even rows of wires. The jointing of the barbed wire in between the posts shall not be permitted.

- 8.2 Necessary holes should be tapped in the post and the barbed wire shall be fixed in position by means of 'U' clamps or bolts and nuts as specified in drawings. In case of fixing with 'U' clamps, the legs of the 'U' clamps passing through the 10 mm. dia. hole in the R.C.C. post to hold barbed wire shall be turned up and down to get an over-lap of 25 mm. on the face of RCC post. Turn buckles and straining bolts shall be used at the end posts if specified.

9.0 **MODE OF MEASUREMENT:**

- 9.1 The work shall be measured in running metre length of fencing correct to a centimeter for the finished work, from centre to centre of the posts.
- 9.2 The rate shall include the cost of labour and materials involved in all the operations described above including the cost of barbed wire, turn buckle,

straining bolts, bolts and the nuts/U clamps including excavation and foundation concrete or as specified in item description for the work.

10.0

CHAIN LINK:

The chain link shall be of approved manufacture and of correct size, gauge etc. It shall be of M.S. or G.I. as specified of approved manufacture and of required size, gauge etc. The base materials of the wire shall be of good commercial quality mild steel. The wire shall be circular in section, free from rust, scale, cuts, welds and other defects and shall be uniformly galvanized if specified.

10.1

FIXING OF THE CHAIN LINK FENCING TO MS. OR R.C.C. POST:

The chain link of specified height of fencing shall be fixed first to the end post with necessary G.I. approved type U clamps threaded at both the ends and G.I. nut, bolts, washers etc. and with 6 mm. dia. full height M.S./G.I. anchor bar. After fixing the chain link at the end post, it shall be stretched tightly and fixed to next post one after the other by the above mentioned clamps and bars etc. leaving 50 mm. clearance from the ground and 20 mm. clearance in the case of concrete coping at bottom to avoid rusting. The point at the change in level of the fencing top/bottom, necessary links shall be adjusted suitably as per the manufacturer's specification or as directed by the Engineer-in-Charge. The entire chain link fence shall be painted with two coats of synthetic enamel paint of approved make and shade over a coat of approved primer or as specified in the item/drawing.

10.2

MEASUREMENT:

10.2.1

The work shall be measured in running metre length of fencing correct to a centimetre for the finished work from centre to centre of the posts or as specified in BOQ.

10.2.2

The rate shall include the cost of labour and material involved in all the operation described above including the cost of chain link fence, bolts and the nuts/U clamps, 6 mm. dia. M.S./G.I. anchor bar etc. including excavation and foundation concrete or as specified in item description for the work.

C – 33: SPECIFICATIONS FOR EXPANSION JOINTS

1.0 SCOPE OF WORK:

The work contemplated under these specifications consist of supplying the expansion joint fiber boards, sealing compound, stainless steel plates (1mm thick) etc. strictly as per these specifications and relevant drawings.

2.0 General

Expansion and isolation joints in concrete structures shall be provided at specific places as per details indicated on the drawings. The materials and types of joints shall be as specified hereinafter. In case of liquid retaining structures, additional precautions shall be taken to prevent leakage of liquids as may be specified on the drawings or as directed by the Engineer-in-Charge. All materials are to be procured from reliable manufacturers and must have the approval of the Engineer-in-Charge. Where it is the responsibility of the Contractor to supply the material, the Engineer-in-Charge may demand test certificates for the materials and/or instruct the Contractor to get them tested in an approved laboratory free of cost to the Owner. Joints shall be formed true to line, level, shape, dimension and quality as per drawings and specifications. Prior approval of the method of forming the joints should be obtained from the Engineer-in-Charge before starting the work.

2.0 MATERIALS:

2.1 Bitumen Board: Bitumen impregnated fiber board of approved manufacturer as per IS: 1838 may be used as fillers for expansion joints. It must be durable and waterproof. It shall be compressible and possess a high degree of rebound. The dimensions of the board should be equal to that of the joint being formed. It should, preferably be manufactured in one piece, matching the dimension of the joint and not prepared by cutting to size smaller pieces from larger boards at site. At the exposed end, the joint shall be sealed with approved sealing compound to a depth of at least 25 mm after application of an approved primer. The sealing compound and the primer shall be applied as specified by the manufacturer. The sealing compound to close the gaps at the edges shall be of best quality rubberized bituminous hot pour, made from special grades of bitumen and shall not show flowing tendency in hot weather and is resilient in the cold weather. The liquid primer shall be made from blown grade bitumen of approved quality.

2.2 Expanded Polystyrene Boards If required, commercial quality of expanded polystyrene products commonly used for thermal insulations may also be used as filler material in expansion joints. The thickness may vary from 12 mm to 50 mm. The material will have to be procured from reliable manufacturers as approved by the Engineer-in-Charge. The method of installations will be similar to that recommended by the manufacturers for

fixing on cold storage walls. A coat of Bitumen paint may have to be applied on the board against which concrete will be placed.

2.3 The **stainless steel** plates for fixing at floor level shall be of specified size and out of extruded sections, free from any rolling defects.

2.4 The **stainless steel** sheet for fixing at bottom of beams or sides of columns shall be of specified size without any defects.

2.5 **Joint Sealing Strips**

Joint sealing strips may be provided at the construction, expansion and isolation joints as a continuous diaphragm to contain the filler material and/or to exclude passage of water or any other material into or out of the structure. The sealing strips will be non-metallic like rubber or P.V.C.

Sealing strips will not have any longitudinal joint and will be procured and installed in largest practicable lengths having a minimum number of transverse joints. The material is to be procured from reputed manufacturers having proven records of satisfactory supply of joint strips of similar make and shape for other jobs. The jointing procedure shall be as per the manufacturer's recommendations, revised if necessary, by the Engineer-in-Charge. The Contractor is to supply all labour and material for installation including the material and tools required for jointing, testing, protection, etc. If desired by the Engineer-in-Charge, joints in rubber seals may have to be vulcanized.

Non-metallic sealing strips will be normally in Rubber or P.V.C. Rubber or P.V.C. joint seals can be of shape having any combination of the following features:

- i) Plain
- ii) Central bulb
- iii) Dumb-bell or flattened ends
- iv) Ribbed and Corrugated Wings
- v) V shaped

As these types of seals can be easily handled in very large lengths, transverse joints will be allowed only under unavoidable circumstances and with the specific approval of the Engineer-in-Charge.

The method of forming these joints, laps etc. shall be as specified by the Manufacturer and/or as approved by the Engineer-in-Charge taking particular care to match the central bulbs and the edges accurately.

a) **Rubber Sealing Strips**

The minimum thickness of Rubber sealing strips shall be 3 mm and the minimum width 100 mm. The actual size and shape will be as shown in drawings/schedule of items and/or as directed by the Engineer-in-Charge. The material will be natural rubber and be resistant to corrosion, abrasion and tear and also to attacks from the acids, alkalis and chemicals normally encountered in service. The physical properties will be generally as follows. The actual requirements may be slightly different as decided by the Engineer-in-Charge:

Specific Gravity	:	1.1 to 1.15
Shore Hardness	:	65A to 75A
Tensile Strength	:	25 – 30 N/Sq.mm
Max. Safe Continuous Temperature	:	75 Deg.C
Ultimate Elongation	:	Not less than 350%

b) P.V.C. Sealing Strips

The minimum thickness of P.V.C. sealing strips will be 3 mm and the minimum width 100 mm. The actual size and shape will be as shown in drawings/schedule of items and/or as directed by the Engineer-in-Charge. The material should be of good quality Polyvinyl Chloride highly resistant to tearing, abrasion and corrosion as well as to chemicals likely to come in contact with during use. The physical properties will generally be as follows. The actual requirements, which will be directed by the Engineer-in-Charge, may vary slightly:

Specific Gravity	:	1.3 to 1.35
Shore Hardness	:	60A to 80A
Tensile Strength	:	10 – 15 N/Sq.mm
Max. Safe Continuous Temperature	:	70 Deg.C
Ultimate Elongation	:	Not less than 275%

2.6 Joint Sealing Compound

When directed, the gap in expansion joints shall be thoroughly cleaned and bitumen compound laid as per manufacturer's specifications. The compound to be used shall be of approved manufacture and shall conform to the requirements of IS: 1834.

Alternatively, when directed, the expansion Joints may be filled with joint sealing compound like “Sikalastic” or approved equivalent and shall be applied as per manufacturer’s specification.

2.7 Isolation Joints

Strong and tough alkathene or PVC sheet or equivalent, about 1 mm in thickness and as approved by the Engineer-in-Charge shall be used in isolation joints. It shall be fixed by an approved adhesive compound on the cleaned surface of the already set concrete, to cover it fully. Fresh concrete shall be laid against the sheet, care being taken not to damage the sheet in any way.

2.8 Rubber Pad

Hard foundation quality rubber pads of required thickness and shapes shall be put below machine or other foundations as shown on the drawings or as directed by the Engineer-in-Charge. The rubber shall have a unit weight of 1500 Kg/Cu.m, a shore hardness – 65A to 70A and be of best quality of approved manufacture, durable, capable of absorbing vibration and must be chemically inert in contact with moist or dry earth or any other deleterious material expected under normal conditions.

3.0 PREPARATION OF SURFACES:

All the concrete surfaces already cast and where the expansion joint is to be formed, shall be properly cleaned off all dirt, mortar/concrete sticking, dust etc. One coat of primer shall be applied by brush to the entire concrete surface, just prior to the next concreting.

4.0 WORKMANSHIP:

4.1 Soon after the primer is applied, the filler board shall be placed at the side and held tight with the concrete surface, by suitable means. Care shall be taken that the boards do not get damaged or warped during all the operations. Utmost care shall also be taken to ensure that the board is held tightly to the concrete surface and no stone chip, concrete etc. is allowed to splash between the board and the existing concrete surface against which the board is placed.

4.2 After the de shuttering, the surface shall be cleaned off all grit, mortar, cement plaster etc. and edges filled with the sealing compound, the details of which are given below and properly pressed to render smooth and uniform surface,

A. Elastomeric Sealant

1.0 A two part elastomeric sealant based on a liquid polysulphide polymer having excellent adhesion to different surfaces like, timber, masonry, concrete, glass, aluminum, etc. The sealant shall take care of thermal expansion. The Sealant shall be applied for joint size for 5 to 50mm depth to width ratio as 1:2(Mim.) and shall have a density $1.58 \pm 0.03\text{kg/Ltr.}$

2.0 The specifications shall comply with BS 4254-1983. The product shall be similar to PIDISEAL PS41G/4P or equipment.

3.0 **METHOD OF APPLICATION:**

1. The surface should be cleaned to remove all the loose particles like dust, grease, laitance etc., using a brush.
2. Fix masking tape on either side of the joint to maintain a neat application.
3. The two sides of the concrete surface should be primed with sealant primer.
4. Maintain the depth/width ratio of the joint in the required ratio and insert a 'bond-breaking tape/backer material (closed cell poly ethylene backer rod).
5. Mix the two components of the polysulphide sealant using a slow speed drill to a uniform consistency and fill the expansion joint when the primer is still tacky.
6. Remove the masking tape after the sealant is touch-dry and allow the sealant to self-cure for 24 hrs.

B. Specification for Silicone Sealant

1.0 Silicone Sealant is an acetoxycure, high modulus, single component silicone sealant. When properly cured, it becomes a permanently elastic compound. It has excellent adhesion to glass, ceramics and sanitary ware, concrete, masonry surfaces, etc. The Sealant shall be ready to use, solvent free and non-sagging type. This shall be flexible at low and high temperatures. This should have low shrinkage good UV resistance and insulation properties. The product shall be similar to Dr. FIXIT SILICONE SEALANT WX or equivalent.

2.0 **METHOD OF APPLICATION:**

- The surface should be made clean, dry and degreased before applying Dr. Fixit Silicone Sealant.
- It is supplied in ready to use plastic cartridges. Cut nozzle at an angle to desired bead size. Cut the tip of cartridge and fix the nozzle. Load the cartridge into the sealant gun.

- Fix the masking tape on the both sides of joint leaving exact gap of filling. This will make joint look good and uniform.
- Fill the joint Silicone Sealant and Immediately after filling the joint, the sealant should be tooled either with pallet knife or similar tool of required size. Tooling is essential to remove air bubbles if any and to fill up all voids by the compacting action. This results in proper adhesion to the size of the joint. It also gives better aesthetic surface.
- Remove masking tape once the sealant is in touch dry condition

3.0 If desired by the Engineer-in-charge, the stainless steel plates/sheets of specified thickness and sizes shall be fixed to under side/above beams. The plates shall have round holes at 300 mm. c/c. of required diameter on one side of joint through which screws shall be fixed into the concrete. On the other side, slotted holes at 300 mm. c/c shall be provided so that when screwed, these shall render smooth movement of plates during expansion/contraction. The plates shall be fixed correctly to required level, line, plumb etc. and as directed by the Engineer-in-- charge.

3.1 In case of plates fixed on floors, they shall be fixed when floor mortar screed is laid to required level over the expansion joint duly filled up with sealing compound.

4.4 In case of roof, the expansion joint in beams placed vertically, shall be extended upwards, when RC/Brick masonry curbing is laid to the desired height (approximate 450 mm.) over which sealant shall be provided at the joints followed by a stainless steel sheet of thickness 1mm covering the full length and width. In both directions, the stainless steel sheet shall be bent down for a distance of 150mm minimum. Over this, cast in situ RCC of shape as given in the drawings shall be cast. Adequate care shall be exercised at the ends, junctions, turning points of the expansion joint areas to ensure that no area is left unprotected

5.0 **MODE OF MEASUREMENT:**

5.1 Unless otherwise mentioned, all the vertical and horizontal expansion joints in columns and beams shall be measured in a net area in sqm. actually laid at site. The length and breadth shall be measured correct upto half centimeter. The stainless steel plates/sheets shall be measured in kg or as specified in the item.

5.2 The rate shall include the cost of all materials, labour, scaffolding, transport, making holes in plates, grouting, making good the surface etc. all operations required to complete the job.

C-34: SPECIFICATIONS FOR POLYCARBONATE SHEETING WORKS

1.0 SCOPE:

The work covered under this specification includes all polycarbonate sheet roofing works of all shapes envisaged in the package works over RCC beams, pergolas, structural members etc.

2.0 GENERAL:

This item shall be carried out generally as described in the relevant item of schedule and as directed by the Engineer _incharge. The polycarbonate transparent sheet material shall withstand most extreme weather conditions including UV resistance, virtually unbreakable and shall allow a minimum of 89% sunlight transmission. It shall have fire resistant properties.

3.0 INSTALLATION:

This shall be fixed over anodized aluminium framework with EPDM gaslets, silicone sealants, washers, bolts etc. and entire fixing shall be made water tight.

4.0 MODE OF PAYMENT:

The mode of measurements shall be on square metre basis only.

C-35: SPECIFICATIONS FOR DOUBLE INTERLOCKING GLAZED ROOF TILES

1.0 SCOPE:

The work covered under this specification includes all glazed roof tile works over roofs, structural members etc.

2.0 GENERAL:

This item shall be carried out generally as described in the relevant item of schedule and as directed by the Engineer _incharge. The glazed tile shall be moss/ algae resistant, shall not fade, and shall have good heat resisting properties. This shall be manufactured through double firing process to achieve minimum breaking strength of 140 Kg.

3.0 INSTALLATION:

This shall be fixed over anodized aluminium framework with EPDM gaslets, silicone sealants, washers, bolts etc. and entire fixing shall be made water tight.

4.0 MODE OF PAYMENT:

The mode of measurements shall be on square metre basis only.

C-36: SPECIFICATIONS FOR PUBLIC HEALTH ENGINEERING WORKS (INTERNAL & EXTERNAL PH ENGG.WORKS)

- 1.1 GENERAL INSTRUCTIONS: The detailed specifications given hereinafter are for the items of works described in the schedule of quantities attached herein, and shall be guidance for proper execution of work to the required standards. It may also be noted that the specifications are of generalized nature and these shall be read in conjunction with the description of item in schedule of quantities and drawings. The work also includes all minor details of construction which are obviously and fairly intended and which may not have been referred to in these documents but are essential for the entire completion in accordance with standard Engineering practice.

Unless specifically otherwise mentioned, all the applicable latest codes and standards published by the Indian Standard Institution and all other standards shall govern in all respects of design, workmanship, quality and properties of materials and methods of testing, method of measurements etc. Wherever any reference to any Indian Standard Specification occurs in the documents relating to this contract, the same shall be inclusive of all amendments issued their to or revisions thereof, if any. In case, there is no I.S.I. specification for the particular work, such work shall be carried out in accordance with the instructions in all respects, and requirements of the Engineer-in- Charge. The work shall be carried out in a manner complying in all respects with the requirements of relevant codes and standards or as directed by the Engineer-in-Charge and, unless otherwise mentioned, nothing extra shall be paid on this account.

Samples of various materials, fittings etc. proposed to be incorporated in the work shall be submitted by the contractor for approval of the Engineer-in-charge before order for bulk supply is placed.

The contractor shall take instructions from the Engineer-in-Charge regarding collection and stacking of materials in any place. No excavated earth or building materials shall be stacked on areas where other buildings, roads, services, compound walls etc. are to be constructed.

The contractor shall maintain in perfect condition all works executed till the completion of the entire work allotted to him. Where phased delivery is contemplated, this provision shall apply to each phase.

The contractor shall give a performance test of the entire installation(s) as per standard specifications before the work is finally accepted and nothing extra whatsoever shall be payable to the contractor for the test.

The contractor shall clear the site thoroughly of all debris, surplus excavated materials and rubbish etc. left out of his work and dress the site around the building to the satisfaction of the Engineer-in-Charge before the work is considered as complete.

In case of any difference or discrepancy between the specifications and the description in the schedule of quantities, the schedule of quantities shall take precedence. In case of any difference or discrepancy between specifications and drawing, the specifications shall take precedence. In case of any difference or discrepancy between the specifications for Civil works and specification for Public Health Engineering. works, specifications for Civil works shall take precedence. In tenders/works where both specifications for Civil works & specification for Public Health Engineering. Works are combined; the specifications for Civil works shall take precedence for common sections such as earth work etc.

1.1.01 APPROVAL : The materials for P.H. Engineering works which are to be supplied by the contractor shall conform to the relevant IS specifications and the approved vendor list attached along with the specification and shall be approved by the Engineer-in-Charge prior to installation of fixture and the approved samples shall be maintained at site till the completion of work. The approved makes of main items are, however specified in the list of approved makes of materials separately.

1.1.02 PRECAUTIONS : While carrying out pipe line work, in case, the contractor encounters any interference with other services such as cables, conduits etc, he shall take sufficient precautions in order to prevent any damage to them. If any damage occurs, it shall be rectified to its original condition at his own cost to the satisfaction of the officers concerned with such services and no claim whatsoever shall be entertained in this regard.

The contractor shall ensure that all inserts, pipe lines embedded in structural members or sleeves are placed in position in co-ordination with civil work.

All public health engineering services shall be handed over to Engineer- in-charge complete in all respects on completion of the work. Incomplete work will not be taken over. Any loss or damage to these services due to any reasons by anybody whatsoever before handing over will be at contractor's risk and cost. Any damage to any structural/finishing work done during the testing or rectification shall be made good by the contractor at his own cost and risk.

1.1.03 COST TO BE COVERED: The rates quoted by the contractor under this contract shall cover the cost of all the following elements.

1.1.04 MISCELLANEOUS WORK: The contractor carrying out the construction work shall take effective measures to carefully open out all existing channels, culverts, bridges, pipelines, conduits, water courses, sewer, drains, electrical cables, transmission lines and their supports and all works buried or otherwise where such services have to be interfered with the

purpose of the construction of the works. He shall provide and arrange all necessary temporary supports and diversions if necessary across/under/even through along sides of the trenches and all other parts of construction works for all such channels, culverts, bridges, pipe lines, conduits.

- 1.1.05 **CLEARANCE FOR ROADS AND FOOT PATHS** : The contractor shall arrange to carry out all works with least interference practicable with public footpath and vehicular traffic and with existing waste water or storm water drainage arrangements and provide all necessary road barriers, fences, notices, lights, gangways, access crossings, diversions for traffic, temporary drains, dewatering channels, chutes pumping or water lifting arrangements and all other facilities for the proper execution of the works to the approval and satisfaction in all respects of the Engineer-in-Charge. Any work carried out by the contractor in this connection shall be deemed as temporary works incidental to the construction work.
- 1.1.06 **LOCATION** : The rates quoted by the tenderer under this contract shall be applicable for the work at all floors and locations.
- 1.1.07 **DEWATERING** : The rates quoted by the tenderer under this contract shall include bailing or pumping out all the water which may accumulate during the progress of the work either through seepage, springs, rain or any other cause.
- 1.1.09 **FORMALITIES WITH STATUTORY BODIES** : The contractor shall approval from all the statutory bodies necessary for execution of the work, and nothing shall be paid extra for this. work shall be carried out in a manner complying in all respects with requirement of the codes and standards or as directed by the Engineer-in-Charge and, unless otherwise mentioned, nothing extra shall be paid on this account.

1.2 LIST OF INDIAN STANDARDS

The following IS codes shall be referred in execution of PH Engineering works.

Indian Standard	Reaffirmation	Subject
27 - 1992	Reaffirmed 2002	Specifications for Pig Lead
269- 1989	Reaffirmed 2004	Specifications for 33 grade Ordinary Portland Cement
407- 1981	Reaffirmed 2001	Brass tubes for General purposes
456- 2000	--	Code of practice for Plain & Reinforced concrete.
458- 2003	--	Specifications for Concrete Pipes.
554- 1999	--	Dimensions for pipe thread where pressure

		tight joints are required.
636- 1988	Reaffirmed 2003	Fire fighting hose, rubber lined or fabric reinforced rubber lined woven jacketed
638- 1979	Reaffirmed 2003	Sheet rubber jointing & rubber insertion jointing
651- 1992	Reaffirmed 2003	Specifications for Salt glazed stoneware pipes & fittings.
771 (Pt I & VII)		Glazed Fire Clay Sanitary Appliances.
771 - 1979 (Pt. I)	Reaffirmed 2003	General requirements
771 - 1985 (Pt. II)	Reaffirmed 2003	Specific requirements of kitchen & laboratory sinks
771 - 1979 (Pt. III/ Sec 1)	Reaffirmed 2003	Specific requirements of urinals (section 1- slab urinals)
771 - 1985 (Pt. III/ Sec2)	Reaffirmed 2000	Specific requirements of urinals (section 2- Stall urinals)
771- 1979 (Pt. IV)	Reaffirmed 2003	Specific requirements of postmortem slabs.
771- 1979 (Pt.V)	Reaffirmed 2003	Specific requirements of shower trays
771- 1979 (Pt. VI)	Reaffirmed 2003	Specific requirements of bed pan sinks
771 - 1981 (Pt. VII)	Reaffirmed 2003	Specific requirements of slop sinks
774- 1984	Reaffirmed 2000	Flushing cistern for water closet and urinals.
775- 1970	Reaffirmed 2000	Cast iron brackets and supports for wash basin and sink.
778- 1984	Reaffirmed 2000	Specifications for copper alloy gate & Globe check valves for water works
779- 1994	Reaffirmed 2004	Water meters (domestic type)
781- 1984	Reaffirmed 2001	Specifications for cast copper alloy screw down bib taps & stop cocks for water services
782- 1978	Reaffirmed 2003	Specification for Caulking lead.
783- 1985	Reaffirmed 2001	Code of practice for laying concrete pipes.
784- 2001	Reaffirmed 2002	Pre-stressed concrete pipes.
884- 1985	Reaffirmed 2000	Fire aid hose reel for fire fighting (for fixed installation)
901 - 1988	Reaffirmed 2003	Specification for couplings, double males & double female, instantaneous pattern for Fire

		Fighting
902 - 1992	--	Specification for suction hose couplings for Fire Fighting purposes.
903 - 1993	Reaffirmed 2003	Couplings for fire hose delivery, branch pipe, nozzles specification
904 - 1983	Reaffirmed 2000	Specification for 2 way and 3 way suction collecting heads for Fire Fighting purposes.
905 - 1980	Reaffirmed 2002	Specification for delivery breechings, dividing and collecting instantaneous pattern for Fire Fighting
906 - 1988	Reaffirmed 2000	Specification for revolving branch pipe for Fire Fighting
907 - 1984	Reaffirmed 2000	Specification for suction strainer, cylindrical type for Fire Fighting purposes.
908- 1975	Reaffirmed 2000	Fire Hydrants, Stand post type
909- 1992	Reaffirmed 2002	Specifications for underground fire hydrants, sluice valve type
940 - 1989	--	Portable Fire Extinguisher, water Type (Gas Cartridge) — Specification
941- 1985	Reaffirmed 2000	Specification for Blower and Exhauster for Fire Fighting.
1172- 1993	Reaffirmed 2002	Code of basic requirements for water supply, drainage and sanitation
1200-1979 (Pt. 16)	Reaffirmed 2002	Method of measurements for Laying of water and sewer lines including appurtenant items.
1200-1981 (Pt. 19)	Reaffirmed 2002	Method of measurements for Water supply, plumbing and drains.
1239-2004 (Pt. I)		Specifications for Mild steel tubes
1239- 1992 (Pt. II)	Reaffirmed 2002	Specifications for Mild steel Tubular & other wrought steel pipe fittings
1300- 1994	Reaffirmed 2000	Phenolic moulding material specification
1536- 2001	--	Specifications for Centrifugally cast iron (spun) pressure pipes for water, gas and sewage
1537- 1976	Reaffirmed 2000	Specifications for Vertically cast iron pressure pipes for water, gas and sewage
1538 -1993	Reaffirmed 1999	Cast iron fittings for pressure pipes for water, gas and sewage
1700- 1973	Reaffirmed 2003	Drinking fountains
1701- 1960	Reaffirmed 2003	Combination valve, mixing valves

1703- 2000		Ball valve (horizontal plunger type) including floats for water supply.
1711- 1984	Reaffirmed 2000	Self closing taps.
1726- 1991	Reaffirmed 2003	Cast iron manhole covers and Frames.
1729- 2002	--	Cast iron/ductile iron drainage pipes and fittings for over ground NP pipeline S/S series.
1742- 1983	Reaffirmed 2002	Code of practice for building drainage
1795- 1982	Reaffirmed 2000	Pillar taps for water supply purposes
1978- 1982	Reaffirmed 2002	Specification for line pipe (MS Seamless)
1979- 1985	Reaffirmed 2002	Specification for high test line pipe
2065- 1983	Reaffirmed 2001	Code of practice for water supply in buildings.
2097-1983	Reaffirmed 2000	Specification for foam making branch pipe.
2104- 1981	Reaffirmed 2003	Water meter boxes (domestic type)
2171 -1999	--	Specification for portable fire extinguisher, dry powder (Cartridge Type)
2190- 1992	Reaffirmed 2002	Code of practice for selection ,installation & maintenance of portable first-aid fire extinguishers
2267- 1995	Reaffirmed 2000	Polystyrene moulding and extension materials — specification
2326- 1987	Reaffirmed 03	Automatic flushing cistern for urinals
2379- 1990	Reaffirmed 2000	Colour code for identification of pipe lines.
2401- 1973	Reaffirmed 2003	Code of practice for selection, installation & maintenance of domestic water meters
2470 (Pt. I to II)	--	Code of practice for installation of septic tanks
2470- 1985 (Pt. I)	Reaffirmed 2001	Design criteria & construction
2470- 1985 (Pt.II)	Reaffirmed 2001	Secondary Treatment & disposal of septic tank effluent
2527- 1984	Reaffirmed 2000	Code of practice for fixing rain water gutters and down pipes for roof drainage
2546 - 1974	Reaffirmed 2000	Specification for galvanized Mild Steel Fire bucket.

2548- 1996 (Pt. I)	Reaffirmed 2002	Plastic water closet seats and covers.
2548- 1996(Pt. II)	Reaffirmed 2002	Plastic water closet seats and covers.
2556 (Pt. 1 to XV)	--	Specification for Vitreous (Vitreous China) sanitary appliances.
2556- 1994 (Pt.1)	Reaffirmed 2004	General requirements
2556- 1994 (Pt.2)	Reaffirmed 1999	Specific requirements of wash down water-closets
2556- 2004 (Pt.3)	--	Specific requirements of squatting pans
2556- 2004 (Pt. 4)	--	Specific requirements of wash basins
2556- 1994 (Pt.5)	Reaffirmed 2004	Specific requirements of laboratory sinks
2556- 1995(Pt.6)	Reaffirmed 2003	Specific requirements of urinals & partition plate
2556- 1995 (Pt.7)	Reaffirmed 2003	Specific requirements of accessories for sanitary appliances
2556- 1995 (Pt.8)	Reaffirmed 1998	Specific requirements of pedestal close coupled & wash down and siphonic water closets
2556- 2004 (Pt.9)	--	Specific requirements of pedestal type bidets
2643 -1999	--	Type Threads where pressure tight joints are not made on the threads — dimension, tolerances and designation
2692- 1989	Reaffirmed 2003	Specification for Ferrules for water services.
2871- 1983	Reaffirmed 2000	Specification for Branch pipe, universal, for fire fighting purposes
2878 - 2004	--	Fire Extinguisher, Carbon Dioxide Type (Portable and Trolley Mounted) — Specification.
2951 (Pt. I to II)	--	Recommendation for estimate of flow of liquids in closed conduits.
2951- 1965 (Pt. I)	Reaffirmed 2003	Head loss in straight pipes due to frictional resistance
2951- 1965 (Pt. II)	Reaffirmed 2003	Head loss in valves & fittings.
3006- 1979	Reaffirmed 2003	Specification for Chemically resistant glazed S.W. pipes and Fitting
3076- 1985	Reaffirmed 2003	Low density polyethylene pipes for potable water supply

3114- 1994	Reaffirmed 2004	Code of practice for laying of Cast Iron pipes.
3311- 1979	Reaffirmed 2003	Waste plug & its accessories for sinks & wash basins.
3328- 1993	Reaffirmed 2003	Quality tolerances for water for swimming pools
3389- 1994	Reaffirmed 2000	Urea formaldehyde moulding materials
3486- 1966	Reaffirmed 2000	Specification for Cast iron spigot and socket drain pipes
3489- 1985	Reaffirmed 2000	Specifications for enameled steel bath tubs
3589- 2001		Specifications for steel pipes for water & sewage (168.3 to 2540 mm outside dia.)
3597- 1998		Method of test for concrete pipes.
3844- 1989	Reaffirmed 2000	Code of practice for installation and maintenance of internal fire hydrants Hose Reels in premises.
3950- 1979	Reaffirmed 03	Specification for Surface boxes for sluice valve.
3989- 1984	Reaffirmed 2000	Centrifugally cast (spun) iron spigot and socket soil, waste and ventilating pipes, fittings & accessories.
4038- 1986	Reaffirmed 2000	Foot valves for water works purposes.
4111 (Pt. I to V)		Code of practice for ancillary structures in sewage system.
4111- 1986 (Pt. I)	Reaffirmed 2001	Manholes
4111- 1985 (Pt. II)	Reaffirmed 2001	Flushing tanks
4111- 1985 (Pt. III)	Reaffirmed 2001	Inverted siphon
4111- 1968 (Pt. IV)	Reaffirmed 2001	Pumping stations & pumping mains (rising mains)
4111- 1993 (Pt. V)	Reaffirmed 2004	Tidal out-falls
4120- 1967	Reaffirmed 2000	Tubs and baths.
4127- 1983	Reaffirmed 2001	Code of practice of laying of glazed stone ware pipes.
4308- 2003	--	Dry Chemical Powder for Fighting B & C class Fires— Specification.
4350- 1967	Reaffirmed	Specification for concrete porous pipes for

	2001	under drainage.
4733- 1972	Reaffirmed 1992	Methods of sampling & test for sewage effluents
4736-1986	Reaffirmed 2001	Specification for hot dip zinc coating on mild steel tubes
4854 (Pt. I to III)		Glossary terms for valves and their parts
4854- 1969 (Pt. I)	Reaffirmed 1999	Screw down stop, check & gate valves & their parts
4854- 1968 (Pt. II)	Reaffirmed 1999	Plug valves & cocks & their parts
4854-1974 (Pt. III)	Reaffirmed	Butterfly valves
4927- 1992	Reaffirmed 2002	Unlined flax canvass hose for fire fighting
4927- 1985	Reaffirmed 2000	Specification for gas cartridge for use in Fire extinguishers.
4985- 2000	--	Specifications for unplasticised PVC pipes for potable water supplies
5290- 1993	Reaffirmed 2003	Specifications for Landing valves.
5312 (Pt. I)		Swing check type reflux (non return) valves
5312- 1984 (Pt. I)	Reaffirmed 2000	Reflux (non return) valves — single door pattern
5329- 1983	Reaffirmed 2001	Code of Practice for sanitary pipe work above ground for building
5330- 1984	Reaffirmed 2000	Criteria for design for anchor blocks for pen-stocks with expansions joints.
5382- 1985	Reaffirmed 2003	Specifications for rubber sealing rings for water, gas & sewer mains
5455- 1969	Reaffirmed 2003	Cast iron steps for manholes
5600- 2002	--	Specifications for Sewage and drainage pumps
5611- 1987	Reaffirmed 2002	Code of Practice for waste stabilization ponds (Facultative type)
5714- 1981	Reaffirmed 2002	Specifications for Hydrant stand-pipe for fire fighting
5822- 1994	Reaffirmed 2004	Code of Practice for laying of welded steel pipes for water supply
5961- 1970	Reaffirmed 2003	Specifications for Cast Iron grating for drainage purposes
6234-2003		Portable fire Extinguisher water Type (Stored Pressure) — Specification
6279- 1971	Reaffirmed	Equipment for grit removal

	2001	
6280- 1971	Reaffirmed 2001	Sewage screens
6295- 1986	Reaffirmed 2001	Code of practice for water supply & drainage in high altitude & / or sub-zero region
6392- 1971	Reaffirmed 1998	Steel pipe flanges
6411- 1985	Reaffirmed 2000	Specifications for gel coated glass fiber reinforced polyester resin bath tubs
6418- 1971	Reaffirmed 2000	Cast Iron & malleable flanges for general engg. Purpose
6494- 1988	Reaffirmed 2000	Code of Practice for water proofing of under ground water tanks & swimming pools
6587- 1987	Reaffirmed 2003	Specifications for Spun hemp yarn
7181- 1986	Reaffirmed 2000	Horizontally Cast Iron Double Flanged pipe for water, gas & sewage.
7231- 1994	Reaffirmed 2004	Specifications for Plastic Flushing Cisterns for w.c. & urinals
7558- 1974	Reaffirmed 2001	Code of Practice for domestic hot water installations
7634 (Pt. I to III)		Code of Practice for Plastic pipe work for potable water supplies
7634- 1975 (Pt. I)	Reaffirmed 2002	Choice of materials & general recommendations
7634- 1975 (Pt. II)	Reaffirmed 2002	Laying & jointing polyethylene (PE) pipes
7634- 2003 (Pt. III)	--	Laying & jointing un plasticised PVC pipes
7740- 1985	Reaffirmed 2001	Code of Practice for road gullies
7834 (Pt. I to VIII)		Injection moulded PVC socket fittings with solvent cement joints for water supplies
7834— 1987(Pt,I)	Reaffirmed 2003	General requirements
7834- 1987 (Pt.II)	Reaffirmed 2003	Specific requirements for 45 ° elbows
7834- 1987 (Pt, III)	Reaffirmed 2003	Specific requirements for 90° elbows
7834- 1987 (Pt. IV)	Reaffirmed 2003	Specific requirements for 90° tees
7834- 1987 (Pt.V)	Reaffirmed 2003	Specific requirements for 45° tees

7834- 1987 (Pt. VI)	Reaffirmed 2003	Specific requirements for sockets
7834-1987 (Pt. VII)	Reaffirmed 2003	Specific requirements for unions
7834- 1987 (Pt. VIII)	Reaffirmed 2003	Specific requirements for caps
8008(Pt. I to VII)		Injection moulded HOPE fittings for potable water supplies
8008- 2003 (Pt. I)	--	General requirements for fittings
8008- 1976 (Pt. II)	Reaffirmed 1997	Specific requirements for 90 ° bends
8008- 2003 (Pt. III)		Specific requirements for 90 ° bends
8008- 2003 (Pt. IV)	--	Specific requirements for reducers
8008- 2003 (Pt. V)	--	Specific requirements for ferrule reducers
8008- 2003 (Pt. VI)	--	Specific requirements for pipe ends
8008- 2003 (Pt. VII)	--	Specific requirements for sandwich flanges
8090 — 1976	Reaffirmed 2000	Coupling, branch pipe, nozzle used in hose reel tubing for fire fighting
8329- 2000	--	Centrifugally cast (spun) ductile iron pressure pipes and fittings for water, gas & sewage
8413 (Pt. I)		Requirements for biological treatment 1 equipment
8413- 1977 (Pt. I)	Reaffirmed 2001	Trickling Filter
8718- 1978	Reaffirmed 2000	Specifications for vitreous enameled steel kitchen sinks
8727- 1978	Reaffirmed 2000	Specifications for vitreous enameled steel wash basin
8835-1978	Reaffirmed 1999	Guideline for planning and design of surface drains.
8931- 1993	Reaffirmed 2003	Specifications for copper alloys Fancy single taps, combination tap assembly & stop valves for water services
9140- 1996	Reaffirmed 2002	Method of sampling of vitreous & fire clay sanitary appliances
9293- 1991	Reaffirmed 1996	Specifications for flax canvas
9338- 1984	Reaffirmed 2000	Specifications for Cast Iron screw down stop valves and stop & check valves for water works purposes .

9668- 1990	Reaffirmed 2000	Code of practice for provision & maintenance of water supplies for Fire Fighting
9739- 1981	Reaffirmed 2003	Specifications for Pressure reducing valves I for Domestic water supply system.
9758- 1981	Reaffirmed 2003	Flush valves and Fittings for water closets and urinals
9762- 1994	Reaffirmed 2004	Specifications for polyethylene floats for float valves
9763- 2000	--	Specifications for Plastic Bib taps, pillar taps, angle valves and stop valves for hot & cold water service.
9972 -2002	--	Specification for Automatic sprinkler Heads for Fire Protection Service.
10221- 1982	Reaffirmed 1997	Code of practice for coating and wrapping of underground M.S. steel pipeline
11108 - 1984	Reaffirmed 2000	Specification for portable fire Extinguisher Halon 1211 Type
11606 - 1986	Reaffirmed 2000	Method for sampling of cast iron pipes and I fittings.
12183- 1987 (Pt. I)	Reaffirmed 2004	Code of practice for Plumbing in multistoried buildings (for water supply).
12231-1987	Reaffirmed 2003	UPVC pipes for section & delivery lines of agricultural pumps—Specification
12235 - 1986	Reaffirmed 1998	Method of test for UPVC pipe for potable water supply
12288 - 1987	Reaffirmed 2002	Code of practice for use and laying of Ductile Iron pipes.
12469 - 1988	Reaffirmed 2002	Specifications for pumps
12592- 2002	--	Precast concrete frame & cover (SFRC frame & cover)
12701-1996	Reaffirmed 2002	Specifications for rotational moulded polyethylene water storage tanks
12709 - 1994	Reaffirmed 2004	Glass fiber reinforce plastic(GRP) pipes, joints & fittings for use for potable water supply — Specification.
12820 - 1989	Reaffirmed 1999	Dimensional Requirements of Rubber Gaskets for Mechanical Joints & push in joints for use with Cast Iron Pipes & fittings for carrying water, Gas & sewarge.
13095-1991	Reaffirmed 2003	Butterfly valves for general purposes
13382-2004		Cast Iron specials for mechanical & push-on flexible joints for pressure pipelines for

		Water, gas & sewage
13592- 1992	Reaffirmed 2002	Specifications for PVC soil, waste & rain water (SWR) including ventilation pipes
13593 - 1992	Reaffirmed 2002	UPVC pipes fittings for use with section and Delivery lines for Agricultural pumps Specification.
13916 -1994	Reaffirmed 2004	Code of practice for installation of GRP piping system.
13983-1994	Reaffirmed 2004	Specifications for stainless steel kitchen sinks & drain boards for domestic purpose
14333-1996	Reaffirmed 2001	Specification for HDPE pipes for sewerage system.
14402-1996	Reaffirmed 2001	GRP pipes, joints & fittings — Specification.
14735-1999	Reaffirmed	UPVC injection moulded fittings for UPVC—SWR pipes — Specifications.
14845- 2000	Reaffirmed 2004	Resilient seated cast iron air relief valves for water works purposes — Spn
14846- 2000	--	Specifications for sluice valve for water works purposes (50 to 1200 mm size
15265 - 2003	--	Specifications for flexible PVC pipes or polymer reinforcement thermo plastic hoses for suction and delivery lines for Agricultural pumps.
15328 - 2003	--	UPVC non pressure pipes for use in underground drainage and sewerage system — Specifications.
15450- 2004		Polyethylene/Aluminium/Polyethylene composite pressure pipes for hot and cold water supplies — Specifications.

1.3 MINIMUM WEIGHT OF MOST COMMONLY USED SANITARY APPLIANCES & WATER FITINGS:

The minimum unit weight of each fitting shall not be less than as given in the following table and tolerance for weight shall be as per relevant IS code.

S.N.	Description of items	Nominal size/thickness	IS code	Minimum Unit Weight
1	Brass non-fancy type Bib Tap Please see Table under relevant item for other sizes.	15mm	781- 1984	400 Grams
2	C.P. brass fancy type Bib Tap	15mm	8931- 1993	550 Grams

3a	Brass non-fancy types Stop cock -Internally threaded	15mm	781- 1984	330 Grams
3b	Brass non-fancy types Stop cock -Externally threaded	15mm	781- 1984	400 Grams
4	C.P. brass fancy types Stop cock	15mm	8931- 1993	550 Grams
5	C.P. brass concealed typed Stop cock	15mm	8931- 1993	750 Grams
6	C.P. brass fancy Pillar Tap	15mm	1795- 1982	650 Grams
7	C.P. brass waste coupling	32mm	3311- 1979	200 Grams
8	C.P. brass waste coupling	40mm	3311- 1979	250 Grams
9 a	C.I. Nahani Trap 165mm inlet dia.	75mm(outl et)	1729-2002/ 3989- 1984	6.50 Kg.
9 b	Cl. Floor Trap 100 mm inlet dia.	75mm(outl et)	1729-2002/ 3989- 1984	4.80 Kg.
9 c	C.I. Nahani Trap with 20 mm water seal	65mm(outlet)	non ISI	4.50 Kg.
10	Cast Iron surface box for sluice valve	(rectangula r shape)	3950-1979	33 kg.

The minimum unit weight of each fitting shall not be less than as given in the following table which are used in General practice.

S.N.	Description of items	Nominal size/ thickness	Minimum Unit Weight
1.	C.P. brass fancy Shower rose	15mm	125 Grams
2.	C.P. brass bottle trap	32mm.	500 Grams
3.	C.P. brass bottle trap	40mm	550 Grams
4.	C.P. brass liquid soap dispenser		250 Grams
5.	C.P. brass coat and hat hook		150 Grams
6.	C.P. brass Towel rod bracket [pair]		100 Grams
7.	C.P. brass Towel rod [600 mm long]	20mm	150 Grams
8.	G.I. Clamps thickness for GI piping	2 MM	
9.	MS Clamps thickness for CI piping	3 MM	
10.	Rain water lead sheet flashing		38.00 kg/sqm
11.	C.I. frame and cover for Gully Trap		7.50 kg.

12.	S.S. Grating for Nahani Trap		50 Grams
13.	C.P. brass grating for Nahani Trap		190 Grams
14.	C.P. Brass Dome shape grating 1		275 Grams
15.	Cast Iron surface box for sluice valve 1 (circular shape)		14 kg.

1.4 MANDATORY TESTS / OPTIONAL TESTS

1. The following mandatory tests shall be carried out when the qty. of materials to be incorporated in the work exceeds the minimum qty. specified in col.5 of the table below irrespective of whether the materials are with I.S. mark, or otherwise.
2. Optional tests specified or any other tests shall be carried out in case of specialized work/ important structure at Engineer In charge's discretion.
3. Testing charges including incidental charge and cost of sample for testing shall be borne by the contractors for all mandatory tests.
4. Testing charges for optional tests shall be paid by the Dept. However, the incidental charges and cost of sample for testing shall be borne by the contractor.
5. In case of non-I.S. materials, it shall be the responsibility of the contractor to establish the conformity of material with relevant ~~IS~~ specification by carrying out necessary tests. Testing charges including incidental charge and cost of sample for testing shall be borne by the contractors for such tests.

1.4.1 Mandatory tests for P.H.E. works:

Material	Test	Field/lab test	Test procedure	Minimum quantity of material / work for carrying out the test 5	Frequency of sampling	Remarks
1	2	3	4	5	6	7
I. pipes	<u>Physical</u> Dimensional Nominal unit wt. Tensile Elongation <u>Chemical</u> Mass of zinc coating sulphur, phosphorus	Field /lab Field /lab Lab Lab Lab	IS 4736 IS 228 IS 228	>20tubes > 20tubes >1000/500 upto 25 mm ore >25 mm bore respectively. Up to bore 25mm 1 tube/1000 or part thereof >25mm bore 1 tube/500 tube	Sampling & criteria for conformity as per IS 4711	

C.I. pipes Water Quality "LA/A/B" Class	<u>Dimensional</u> <u>Unit weight</u> <u>Hammer test</u> <u>Hydrostatic</u> <u>test</u> <u>Hardness &</u> <u>grade</u>	Field/lab Field/lab Field/lab Field/lab --		>20 copies >20 copies	Sampling & conformity as per IS 1536/2001 IS 1500	Hardness & grade shall be optional
C.I. Pipe Soil quality	<u>Dimensional</u> <u>Unit weight</u> <u>Hammer test</u> <u>Hydrostatic</u> <u>test</u> <u>Hardness &</u> <u>grade</u>	Field/lab Field/lab Field/lab Field/lab Field/lab		>20 pipes >20 pipes	Sampling & Conformity as per IS 3981 IS 1729 IS 1500	Hardness & grade shall be optional
Pig lead	<u>Chemical</u> <u>Analysis</u>	Lab	IDS 1817	Lot >1000 kg, if less Mfr. test report to be furnished	Each lot >1000 Kg.	
Stone ware pipes	<u>Hydraulic Test,</u> <u>Absorption</u> <u>Test,</u> <u>Test for acid</u> <u>resistance,</u> <u>Test for Alkali</u> <u>resistance,</u> <u>Crushing</u> <u>strength Test</u> <u>for Alkali</u> <u>resistance</u> <u>crushing</u> <u>strength test</u>	Lab	IS 651	3 no. for lot of 150 5 no. for 151 to 1200 8 no. for 1201 to 1000		
Cement, brick	As per civil specification					
Pre Cast Concrete man hole frame & covers gratings	Dimension Load test	Lab	IS 12592 (Part I)	>20 frame & covers / gratings	Sampling as per IS 12592 (part I)	
CI man hole frame & covers	Dimension Load test	Lab	IS 1726	>50 frame & covers gratings	Sampling as per IS 1726	
Hume pipe NP class	Dimension Hydrostatic test Three-edge bearing Absorption test	Lab/field Lab Lab Lab	IS 458 IS 3597 IS 3597 IS 3597	>50 pipes	As per IS 458	
Sanitary fittings	Manufacturers test certificate to be produce IS mark materials.					

CP brass fittings bib taps / stop cocks	Manufacturer's test certificate to be produced IS mark materials.					

1.4.2 Testing, tolerances, Acceptance and mode of payment

- a) The materials should pass all tests and tolerance in dimensional, chemical, physical properties should be within the limit as stipulated in relevant I.S. for acceptance. Such materials will be accepted as standard.
- b) Payments shall be restricted to standard unit mass, or as specified in the schedule, without making any cost adjustment towards mass or any other properties provided the material pass all the tests and tolerance are within the specified limit.
- c) In case of non-standard materials, materials not covered under any I.S specification, such as aluminium sections etc, the payment shall be made based on the actual unit weight as determined by testing at random sampling or as specified in the BOQ.

Post construction Inspection and testing : After completion of work and during the maintenance liability period of contract, the work shall be subjected to "Post construction and testing". In case, if the materials incorporated in the work are found to be inferior, though the sample collected from the materials might have been passed at the time of execution, it shall be the responsibility of the contractor to replace the same without any cost to the department failing which the department may rectify the same at the risk and cost of the contractor or the department may accept the same as substandard, and cost be adjusted from the outstanding security deposit as per the terms and condition of the contract for the work.

2.0 GENERAL SPECIFICATIONS:

2.1 EARTH WORK AND BACKFILL

2.1.1 SCOPE OF WORK:

The scope of work covered under this specifications pertains to excavation of trenches, pits and over areas, in all sorts of soils, soft and hard rock, correct to dimensions given in the drawing including shoring, protections of existing underground utilities if any, such as water lines, electric cables etc., dewatering and shoring if necessary, stacking the useful materials as directed within the lead specified, refilling around the foundation and into the plinth with selected useful excavated earth and disposing off the surplus earth/materials within specified lead and finishing the surface to proper levels, slopes and camber etc. all complete.

2.1.2 SITE CLEARANCE:

Before the earth work is started, the area coming under cutting and filling shall be cleared of all obstructions, loose stones, shrubs, rank vegetation, grass, brush-wood, trees and saplings of girth up to 30 cm. measured at a height of one metre above ground and rubbish removed up to a distance of 150 metres outside the periphery of the area under clearance. The roots of trees shall be removed to a minimum depth of 60 cm. below ground level, or a minimum of 30 cm. below formation level whichever is lower, and the hollows filled up with earth, levelled and rammed. This work is deemed to be included in the earth work items and no separate payment will be admissible for the work.

The trees of girth above 30 cm. measured at a height of one meter above ground, shall only be cut after permission of the Engineer-in-charge is obtained in writing. The roots shall also be removed as described in the preceding sub-para. Payment for cutting and removing roots of such trees shall be made separately. Any material obtained from the site will be the property of the Department and the useful materials as decided by the Engineer-in-charge will be conveyed and properly stacked as directed within the lead specified.

2.1.3 SETTING OUT AND MAKING PROFILES:

Masonry or concrete pillars will be erected at suitable points in the area to serve as bench marks for the execution of the work. These bench marks shall be connected with G. T. S. or any other permanent bench mark approved by the Engineer-in-charge. Necessary profiles with pegs, bamboos and strings or Burjis shall be made to show the correct formation levels before the work is started. The contractor shall supply labour and materials for setting out and making profiles and Burjis for the work at his own cost and the same shall be maintained during the excavation work. The Engineer In charge will show grid Co-ordinate or other reference points. It shall be the responsibility of the contractor to set out centre lines correctly with reference to the drawings and install substantial reference marks. Checking of such alignment by the Engineer In charge / Department will not absolve the contractor from his responsibility to execute the work strictly in accordance with the drawings.

2.1.4 EARTHWORK:

The contractor shall notify the Engineer-in-charge before starting excavation and before the ground is disturbed, to enable him to take existing levels for the purpose of measurements. The ground levels shall be taken at 5 to 15 metres intervals in uniformly sloping ground and at closer distance where local mounts, pits or undulations are met with or as directed by the Engineer-in-charge. The ground levels shall be recorded in field books and plotted on plans, which shall be signed by the Contractor and the Engineer-in-charge, before the earth work is actually started. The labour required for taking levels, shall be supplied by the Contractor at his own cost. The Contractor shall perform excavation in all types of soils, murrum, soft and hard rock,

boulders etc. in foundation, over areas and in trenches to widths, lines, levels, grades and curves as shown in the drawing or lesser widths, lines and levels as directed by the Engineer-in-charge and as per items in the schedule of quantities.

2.1.4.1 The item in the schedule of quantities shall specify the excavation in trenches. For this purpose, the excavation in trenches for foundations and for pipes, cables etc. not exceeding 1.5 m. in width and for chambers, manhole, shafts, wells, cesspits and the like not exceeding 10 sqm. on plan and to any depth shall be described as Excavation in trenches for foundation, drains, pipes and cables and returning the excavated material to fill the trenches after pipes, cables etc, are laid and their joints tested and passed and disposal of surplus excavated material upto 50 m lead.

2.1.4.2 Excavation exceeding 1.5 mtr. in width as well as 10 sqm. on plan (excluding trenches for pipes, cables etc.) and exceeding 30 cm in depth shall be described as Excavation over areas.

2.1.5 **CLASSIFICATION OF EARTH WORK:**

The earth work shall be classified under the following main categories and measured separately for each category.

- a) All types of soils, murrum, boulders.
- b) Soft rock.
- c) Hard rock.

2.1.5.1 a) ALL TYPES OF SOILS, MURRUM, BOULDERS: This includes earth, murrum, top deposits of agricultural soil, reclaimed soil, clay, sand or any combination thereof and soft and hard murrum, shingle etc. which is loose enough to be removed with spades, shovel and pick axes. Boulders not more than 0.03 cum. in volume found during the course of excavation shall also fall under this classification.

b) EXCAVATION IN SOFT ROCK: This shall include all materials which are rock or hard conglomerate, all decomposed weathered rock, highly fissured rock, old masonry, boulders bigger than 0.03 cum. in volume but not bigger than 0.5 cum. and other varieties of soft rock which can be removed only with pick axes, crow bars, wedges and hammers with some difficulty. The mere fact that the contractor resorts to blasting and/or wedging and chiselling for reasons of his own, shall not mean the rock is classifiable as hard rock.

c) EXCAVATION IN HARD ROCK: This includes all rock other than soft rock mentioned in para 2.1.5.1 b viz, soft rock, occurring in masses, boulders having approximate volume more than 0.5 cum. plain or reinforced cement concrete, which can best be removed by blasting or chiselling and wedging where blasting cannot be permitted owing to any restriction at site.

d) EXCAVATION IN HARD ROCK BY CHISELLING AND WEDGING: Where blasting is not permitted and if the Engineer-in-Charge so desires, the

excavation shall be done by chiselling and wedging or any other agreed method.

NOTE : All the excavated hard rock obtained shall be stacked properly and neatly within the specified lead by the contractor as directed by the Engineer-in-Charge.

2.1.6 EXCAVATION : The excavation under all classifications in areas in trenches or in pits shall be carried out systematically. Cutting shall be done from top to bottom and no under-pining or undercutting will be allowed. The bottom and sides of excavation shall be dressed to proper level, slopes, steps, camber etc. by removing high spots, and ramming thoroughly as directed by the Engineer-in-charge.

All the excavation shall be carried out strictly to the dimensions given in the drawing. The width shall generally be of the width of mud mat concrete and depth as shown in drawing or as directed by the Engineer- in-Charge, according to availability of the desired bearing capacity of soil below. Any excavation, if taken below the specified depths and levels, the contractor shall at his own cost fill up such overcut to the specified level with cement concrete 1:4:8 in case of excavation in all types of soils and with cement concrete 1:3:6 in case of excavation in soft and hard rock.

After the excavation is completed, the contractor shall notify the Engineer-in-Charge to that effect and no further work shall be taken up until the Engineer-in-Charge has approved the depth and dimensions and also the nature of foundation materials. Levels and measurements shall also be recorded prior to taking up any further work.

2.1.6.1 SIZES OF TRENCH FOR EXCAVATION FOR PIPE LINE:

Where the width of trench is not specified, the following shall apply.

- a) Up to 1.0 metre deep shall be arrived at by adding 25 cm to the external diameter of pipe (not socket/collar) cable, conduit etc where a pipe is laid on concrete bed/cushioning layer, the authorised width shall be the external diameter of the pipe (not socket/collar) plus 25 cm or the width of concrete bed/cushioning layer whichever is more.
- b) For depths exceeding one metre, an allowance of 5 cm per metre of depth for each side of the trench shall be added to the authorised width (that is external diameter of pipe plus 25 cm) for excavation. This allowance shall apply to the entire depth of the trench in firm soils upto a depth of 2 metres from the bottom. For depths greater than 2 metres, the excavation profiles shall be widened by allowing steps of 50 cm on either side after every two metres from bottom.
- c) Where more than one pipe, cable, conduit etc. are laid, the diameter shall be reckoned as the horizontal distance from outside to outside of the outermost pipes, cable, conduit etc.

- d) Where the soil is soft, loose or slushy, width of trench shall be suitably increased or side sloped or the soil shored-up as directed by the Engineer-In-Charge. It shall be the responsibility of the contractor to take complete instructions in writing from the Engineer-In-charge regarding increase in the width of trench, sloping or shoring to be done for excavation in soft, loose or slushy soils.

2.1.6.2 SIZES OF TRENCH FOR EXCAVATION FOR CHAMBERS, MANHOLES, SHAFTS, WELLS, CESSPITS:

Authorised working space shall be special in each case. Where authorised working space is not so specified, the following shall apply.

600 mm measured from the external face of substructure/walls (including protective measures like water proof plaster, tile cladding etc. if any) at lowest level, where extra working space is required.

2.1.7 SHORING:

Unless separately provided for in the schedule of quantities, the quoted rate for excavation shall include excavation of slopes to prevent falling in soil by providing and/or fixing, maintaining and removing of shoring, bracing etc. The contractor would be responsible for the design of shoring for proper retaining of sides of trenches, pits etc. with due consideration to the traffic, superimposed loads etc. Shoring shall be of sufficient strength to resist the pressure and ensure safety from slips and to prevent damage to work and property and injury to persons. It shall be removed as directed after items for which it is required are completed. Should the slips occur, the slipped material shall be removed and slope dressed to a modified stable slope. Removal of the slipped earth will not be measured for payment.

2.1.8 DEWATERING:

Unless specifically provided for as a separate item in the schedule of quantities, rate shall also include bailing or pumping out all water which may accumulate in the excavation during the progress of further works such as mud mat concrete, R.C. footings, shuttering etc. either due to seepage, springs, rain or any other cause and diverting surface flow by bunds or other means. Care shall be taken to ensure that the water is discharged sufficiently away from the foundations to keep it free from nuisance to other works in the neighbourhood.

2.1.9 DISPOSAL OF EXCAVATED MATERIALS:

- a) **ANTIQUITES** : Any finds of archaeological interest such as relics of antiquity, coins, fossils or other articles of value shall be delivered to the Engineer-in-Charge and shall be the property of the Government.

b) **USEFUL MATERIALS** : Any material obtained from the excavation which in the opinion of the Engineer-in-Charge is useful, shall be stacked separately in regular stacks as directed by the Engineer-in-Charge and shall be the property of the Government.

No material excavated from foundation trenches of whatever kind they may be are to be placed even temporarily nearer than about 3 m. from the outer edge of excavation. Discretion of the Engineer-in-Charge in such cases is final. All materials excavated will remain the property of the Department. Rate for excavation includes sorting out of the useful materials and stacking them separately as directed within the specific lead.

Materials suitable and useful for refilling or other use shall be stacked in convenient place but not in such a way as to obstruct free movement of materials, workers and vehicles or encroach on the area required for constructional purposes. It shall be used to the extent required to completely backfill the structure to original ground level or other elevation shown on the plan or as directed by the Engineer-in-Charge. Materials not useful in anyway shall be disposed off, leveled and compacted as directed by the Engineer-in-charge within a specified lead. The site shall be left clean of all debris and leveled on completion.

2.1.10 REFILLING IN SIDES OF CHAMBERS, DRAINS ETC.:

The back filling shall be done after the concrete or masonry has fully set and shall be done in such a way as not to cause under-thrust on any part of the structure. Where suitable excavated material is to be used for back filling, it shall be brought from the place where it was temporarily deposited and shall be used in refilling. The scope of work for back filling/filling in sides of chambers and other areas shall include filling for all the excavation covered under the contract. Surplus earth available from the excavation, if required, shall be used for refilling/filling for filling the trenches for pipes, cables, buildings also within the specified lead mentioned in the item.

All timber shoring and form work left in the trenches, pits, floors etc. shall be removed after their necessity ceases and trash of any sort shall be cleared out from the excavation. All the space between foundation masonry or concrete and the sides of excavation shall be refilled to the original surface with approved materials in layers not exceeding 200 mm. in thickness, watered and well consolidated by means of rammers to at least 95% of the consolidation obtainable at optimum moisture content (Proctor density). Flooding with water for consolidation will not be allowed. Areas inaccessible to mechanical equipment such as areas adjacent to walls and columns etc. shall be tamped by hand rammer or by hand held power rammers to the required density. The backfill shall be uniform in character and free from large lumps, stones, shingle or boulder not larger than 80 mm. in any direction, salt, clods, organic or other foreign materials which might rot. The refilling in plinth and under floors shall be done in similar way in layers not exceeding 250 mm. thick and

shall be well consolidated by means of mechanical or hand operated rammers as specified to achieve the required density.

Test to establish proper consolidation as required shall be carried out by the contractors at his own cost.

2.1.11 REFILLING IN TRENCHES FOR PIPES, CABLES ETC.

Filling in trenches shall be commenced soon after the joints of pipes, cables, conduits etc. have been tested and passed. The space all round the pipes, cables, conduits etc. shall be cleared of all debris, brick bats etc. Where the trenches are excavated in hard/soft soil, the filling shall be done with earth on the sides and top of pipes in layers not exceeding 20 cm in depth. Each layer shall be watered, rammed and consolidated. All clods and lumps of earth exceeding 8 cm in any direction shall be watered, rammed and consolidated. All clods and lumps of earth exceeding 8 cm in any direction shall be broken or removed before the excavated earth is used for filling. In case of excavation of trenches in ordinary/hard rock, the filling up to a depth of 30 cm above the crown of pipe, cable, conduits etc. shall be done with fine material like earth, murrum or pulverised/decomposed rock according to the availability at site. The remaining filling shall be done with boulders of size not exceeding 15 cm mixed with fine material like decomposed rock, murrum or earth as available to fill up the voids, watered, rammed and consolidated in layers not exceeding 30 cm. Excavated material containing deleterious material, salt peter earth etc. shall not be used for filling. Ramming shall be done with iron rammers where feasible and with blunt ends of crow bars where rammers cannot be used, Special care shall be taken to ensure that no damage is caused to the pipes, cables, conduits etc. laid in the trenches.

2.1.12 LEAD & LIFT

LEAD : The lead for disposal/deposition of excavated materials shall be as specified in the respective item of work. For the purpose of measurements of lead, the area to be excavated or filled or area on which excavated material is to be deposited/ disposed off shall be divided in suitable blocks and for each of the block, the distance between centre lines shall be taken as the lead which shall be measured by the shortest straight line route on the plan and not the actual route adopted.

LIFT : Lift is deemed from the natural ground level. All excavation , filling works are to be considered for all heights / depths i.e (lifts).

2.1.13 MODE OF MEASUREMENTS:

- 2.1.13.1 All excavation in pits, trenches etc. shall be measured net. The dimensions for the purpose of payment shall be reckoned on the horizontal area of the excavation at the base for foundations of the walls, columns, footings, rafts

or other foundations, multiplied by the mean depth from the surface of ground determined by levels. Reasonable working slopes for excavation in soils shall be permitted by the Engineer-in-Charge or as specified in the BOQ. Safety of excavation work shall be the responsibility of the contractor.

- 2.1.13.2 Wherever direct measurements of rock excavation are not possible, volume of rock be calculated on the basis of length, breadth and depth of stacks made at site. The net volume shall be worked out by reducing it by 50%, taking the voids into consideration as 50%. Similarly, to arrive at net quantity to be paid in the case of soil, reduction @ 20% of corresponding stack/truck measurements shall be made.
- 2.1.13.3 The rate for excavation shall include carting and disposing and levelling the excavated materials within the specified lead. The rate shall also be inclusive of cost of all tools, plants, explosives, shoring, dewatering at various stages, labour, materials etc. to complete all the operations specified.
- 2.1.13.4 The backfilling and consolidation in sides of foundation and in plinth with excavated material will not be paid for separately. The rate quoted for excavation shall be deemed to have been included the cost of stacking of excavated materials, conveying within the specified lead, picking of selected stacked materials, conveying it to the place of final backfill, compaction to the required proctor density etc or as specified in the schedule of quantities.
- 2.1.13.5 Payment for filling and consolidation inside the trenches, sides of foundations, plinth etc. with selected materials brought by the contractor other than the excavated material, shall be paid for separately as per the rates in schedule of quantities which includes cost of such materials/excavation, royalty, its conveyance within the specified lead, watering, consolidating, dressing etc. Actual quantity of consolidated filling shall be measured and paid in cubic metres up to two places of decimal.
- 2.1.13.6 Measurements for excavation over areas shall be determined by levels or by "Dead men" or both at the discretion of the Engineer-in-Charge. If however the Engineer-in-Charge decides on measurement by levels, levels of site shall be jointly taken and recorded by the Engineer-in-Charge or his representatives and the contractor, before commencement of the work and after completion of the work and the quantity of work done shall be computed based on these levels. The volume of earthwork shall be computed based on "Simpson's formula" or any other approved method at the discretion of the Engineer-in-Charge.
- 2.1.14 **MODE OF PAYMENT :** The contract rate shall be for unit cubic meter of earth work.

3.0 SANITARY INSTALATIONS

3.1 INDIAN WATER CLOSET

- 3.1.01 GENERAL : The item pertains for providing white or colour glazed vitreous chinaware Indian water closet of size and colour as specified in the schedule including fixing.
- 3.1.02 MATERIAL : Squatting Pan (Orissa Pattern) is of white or colour glazed vitreous China conforming to IS 2556 Part III. Pan shall have flushing rim and are inlet of self draining type. It shall have weep hole at the following inlet to the Pan. The flushing inlet shall be in front unless otherwise specified. The inside of the bottom of the pan shall have sufficient slope from the front to the outlet and surface shall be uniform and smooth to enable easy and quick disposal while flushing. The exterior surface of the outlet below the flange shall be an unglazed surface which shall have groove at right angle to the axis of the outlet. In all the cases pan shall have be provided with 100mm Glazed Vitreous China 'P' or 'S' trap with 50 mm water seal and 40 mm size vent.
- 3.1.03 FIXING : The water closet pan shall be placed in position as shown in the drawing. The IWC shall be supported on brick masonry in CM 1:4 or as directed by the Engineer-in-charge. The pan shall be fixed slightly lower than the floor level. If the pan or trap is damaged during handling of fixing, it shall be replaced by the contractor at his own cost. The pan, trap and Cl. /UPVC Pipe shall be jointed in 1:1 Cement Mortar with hemp yarn caulked. The gap between W.C. and floor shall be finished with white/matching cement as directed,
- 3.1.04 PROTECTION AND FINAL CLEANING : The IWC shall be covered with husk and sand till all the civil and electrical works are completed and shall be removed and cleaned on completion of civil and electrical works prior to testing and handing over. However, the contractor should ensure that the out let is plugged with gunny bags or similar materials to avoid the pipe getting blocked.
- 3.1.05 THE RATE INCLUDES FOR:
1. Water Closet pan with trap 'P' or 'S' type and jointing in 1:1 cement mortar with hemp yarn caulked.
 2. Cutting wall / slab / beam etc. and making all the damage goods to original condition after completion of work.
 2. Testing the entire system and rectification of defects, if any.
 3. All necessary labour, material and use of tools.
- 3.1.06 MODE OF MEASUREMENT: The measurement shall be for each unit of W.C. Pan fixed.
- 3.1.07 MODE OF PAYMENT : The contract rate shall be for each unit of W.C. pan fixed.

3.2 EUROPEAN ANGLO INDIA WATER CLOSET:

- 3.2.01 GENERAL : The item pertains for providing white or colour glazed vitreous chinaware European or Anglo Indian water closet with seat and cover of size and colour as specified in the schedule including fixing.
- 3.2.02 MATERIAL : European type water closet shall be wash down pattern unless otherwise specified. Water closet shall be vitreous china conforming to IS 2556 (Part-I & II). The closet shall be of one piece construction and shall have minimum two hole of 6.5 mm diameter for fixing closet to floor. Closet shall have an integral flushing rims of self draining type. Each water closet shall have an integral trap with either 'S' or 'P' outlet with and trap shall be uniform and smooth in order to enable an efficient flush. Plastic seat and cover shall be of black colour or as specified. They shall have conformity to IS 2548 Part I & II.
- 3.2.03 FIXING : The water closet pan shall be placed in position as shown in the drawing. If the pan trap is damaged during handling or fixing, it shall be replaced by the contractor at his own cost. The pan, soil pipe shall be jointed in 1:1 Cement Mortar with hemp yarn caulked. The gap between W.C. and floor shall be finished with white/matching cement and sand as directed. Seat and cover shall be fixed to the Pan by two corrosion resistance hinge with 65 mm shank and threaded to within 25 mm from of flange. Seat shall be fixed in level by providing the washers of rubber with non ferrous or stainless steel washer to bolt.
- 3.2.04 THE RATE INCLUDES FOR:
1. European type water closet with an integral 'P' or 'S' trap, plastic seat cover, etc. jointing in 1:1 cement mortar with hemp yarn caulked.
 2. Cutting hole in wall / slab / beam etc. wherever required. and making all damages good to original condition after completion of work
 3. Testing the entire system and rectification of defect if any.
 4. All necessary labour, material and use of tools.
- 3.2.05 MODE OF MEASUREMENT : The measurement shall be for each unit of W.C. fixed.
- 3.2.06 MODE OF PAYMENT : The contract rate shall be for each unit of W.C. fixed.

3.3 WASH BASIN:

- 3.3.01 GENERAL : The item pertains for providing colour or white glazed vitreous chinaware wash basin with or without pedestal of size and colour as specified in the schedule including fixing.
- 3.3.02 MATERIAL : Wash basins shall be of vitreous china conforming to IS : 2556(Part- IV) of flat back or angle back as specified shall be of one piece construction including combined over flow, basin shall be provided with single or double tap holes of size 28 mm square or 30 mm rounded. Each basin shall have circular waste hole, or 5 sq.cm slot type over flow. Pedestals for wash

basin shall be exactly of the same glazing that of basin. Pedestal shall be capable of supporting the basin and completely recessed at the back to accommodate supply and waste pipes and fittings. The basin shall be supported on pan of C.I cantilever brackets conforming to IS 775. Use of MS angle or Tee Section as bracket is not permitted.

- 3.3.03 **FIXING** The wash basin shall be fixed in position as indicated in the drawing or as per directions of EIC. Basin shall be supported on a pair of C.I brackets which is embedded in cement concrete (1:2:4) block 100 x 75 x 150 mm.

Oval shape or round shape wash basins are required to be fixed in polished granite slabs either fully sunk in stone top or flush with slab.

The wall plaster on seat shall be cut to rest over the top edge of the basin so as not to leave any gap for water seepage through between wall plaster & skirting of basin. The gap between basin and wall shall be finished with white matching cement.

- 3.3.04 **THE RATE INCLUDES FOR:**

1. Wash Basin with pair of C.I bracket as required.
2. Cutting hole in wall / slab / beam etc. wherever required. and making all damages good to original condition after completion of work.
3. All necessary material, labour and use of tools.

- 3.3.05 **MODE OF MEASUREMENT** : The measurement shall be for each unit of wash basing fixed,

- 3.3.06 **MODE OF PAYMENT** : The measurement shall be for each unit of wash basin fixed.

3.4 **URINAL:**

- 3.4.01 **GENERAL** : The item pertains for providing colour or white glazed vitreous chinaware urinal in single or range (1,2 & 3) and size as specified in the schedule with necessary fittings and appliances including fixing.

3.4.02 **MATERIAL:**

- 3.4.02.1 **LARGE FLAT BACK TYPE (WITH FLUSHING RIM)** : Urinal basin shall be flat back type lipped in front, the vitreous china conforming to IS 2556 (Part VI). Urinal shall have integral flushing rim and inlet or supply horn for connecting flush pipe. Flushing rim and inlet shall be of the self draining type. At bottom of basin and outlet horn for connecting outlet shall be provided. The inside surface of the urinal shall be uniform and smooth throughout to ensure efficient flushing.
- 3.4.02.2 **LARGE FLAT BACK WITHOUT FLUSHING RIM** : They shall be of vitreous china conforming to IS:2556 (Part-VI) constructed in one piece with providing slot or alternative fixing arrangement at flat back and where the integral flushing

rim is not provided, they shall be provided with ridges inside the bowl to divert towards the front line of the urinal.

3.4.02.3 STALL URINALS : The stall urinal and its screen shall be glazed fire clay conforming IS :771 (Part-III, Sec-2). The inside surface of stall and screen shall be regular and smooth throughout to ensure efficient flushing.

3.4.02.4 CP BRASS FLUSH PIPE : The flushing arrangement to urinals for single or in range shall be of CP brass with CP brass spreader of 15 mm dia conforming to IS : 407. The capacity of flush pipe for urinal in a range shall be as follows:

Nos. of urinals in range	Capacity of flush	Size of C.P. brass Flushtank	
		Main	Distribution
One	05 litres	15mm	15 mm
Two	10 litres	20 mm	15 mm
Three	10 litres	25 mm	15 mm

3.4.03 FIXING:

3.4.03.1 LARGE FLAT BACK URINAL WITHOUT FLUSHING RIM (Single or Range): Urinal shall be fixed in position by using rawl plug, wooden plug, C.P screws etc. It shall be fixed at height of 65 cm from the standing level to the top of the lip of urinal or as directed by the Engineer-in-charge. Each urinal shall be connected with 32 mm size waste pipe which shall discharge into channel or a floor trap.

3.4.03.2 STALL URINALS : The lip of the stall urinal shall be flush with the finished floor level. The stall urinal shall be laid over a fine sand cushion on average 25 mm thickness. The gap between wall surface, finished floor level and urinals shall not be more than 3mm and filled with water proofing plastic compound.

3.4.03.3 CP BRASS FLUSHING ARRANGEMENT: The flushing arrangement to urinal in single or in range shall be of CP brass from 25 mm dia to 15 mm dia and CP brass spreader of 15 mm size to each urinal including the cost of CP brass elbows, tees, coupling, crosses, clamps, clips, union CP brass check nut and screws etc. CP brass.

3.4.04 THE RATE INCLUDES FOR:

1. Glazed Urinals(single or in range) and CP brass pipe flushing arrangement including the cost of jointing material.
2. Cutting hole wherever required and making all damage good to original condition after completion of work.
3. Testing the entire system and rectification of defects if any.
4. All necessary materials, labour and use of tools.

3.4.05 **MODE OF MEASUREMENT** : The measurement shall be for each unit of urinal set (single or range) fixed.

3.4.06 **MODE OF PAYMENT** : The contract rate shall be for each unit of urinal set (single or range) fixed.

3.5 URINAL SQUATTING PLATE:

3.5.01 **Material** : The squatting plates shall be of white vitreous china conforming to IS 2556 (Part-I), IS : 2556 (Part-VI) with internal flushing rim with front or side inlet. Each squatting plate shall have integral longitudinal flush pipe. These shall be of 100 mm dia white glazed vitreous china channel with slope and outlet piece in front.

3.5.02 **FIXING** : The plate shall be fixed in position. The top edge of squatting plate shall be flush with the finished floor level adjacent to it. It shall be embedded on a layer of 25 mm thick cement mortar 1:6 laid over a bed of cement concrete 1:3:6. Gap between wall, floor etc. shall be finished with white/matching cement.

3.5.03 **THE RATE INCLUDES FOR:**

1. Urinals (single or in range) squatting plate.
2. Cutting hole wherever required and making all damage good to original condition after completion of work.
3. Testing the entire system and rectification of defects if any.
4. All necessary materials, labour and use of tools.

3.5.04 **MODE OF MEASUREMENT** : The measurement shall be for each unit of squatting plate (single or range) fixed.

3.5.05 **MODE OF PAYMENT** : The contract rate shall be for each unit of urinal squatting plate (single or range) fixed.

3.6 MARBLE / GRANITE PARTITION:

3.6.01 **GENERAL** : The item pertains for providing marble / granite partition of size and colour as specified in the schedule including fixing.

3.6.02 **MATERIAL** : The partition shall be of marble/granite slab of size & thickness as specified in the schedule, it shall be polished on both sides with exposed to proper shape the exposed edges of Marble/granite shall be made smooth corners rounded. Cracked or damaged marble/granite slab shall not be used in the work and shall be replaced if any by the contractor at his own cost and charges +/- 3mm tolerance shall be permissible for thickness of slab.

3.6.03 **FIXING** : Partition shall be fixed vertically in position as indicated in the drawing at proper height. 100 mm wide chases shall be cut in the wall and the partition shall be embedded at least 50 mm in the wall using 1:2:4 cement concrete. After fixing the partition slab, the chases cut in the wall shall be made good to original condition.

3.6.04 THE RATE INCLUDES FOR:

1. Marble/granite partition slab including cost of cement concrete, cement mortar etc.
2. All necessary labour, material and use of tools.

3.6.05 MODE OF MEASUREMENT : The measurement shall be for each sqm of marble/granite partition fixed.

3.6.06 MODE OF PAYMENT : The contract rate shall be for each sqm of marble/granite partition fixed.

3.7 **DIVISION PLATE / PARTITION PLATE:**

3.7.01 GENERAL : The item pertains for providing white or colour glazed vitreous chinaware division plate of size and colour as specified in the schedule including fixing.

3.7.02 MATERIAL : Division plate shall be white or colour glazed of size as specified in the schedule, and shall conform to IS .2556 Part VI.

3.7.03 FIXING : Division plate shall be fixed vertically in position at proper height with expandable anchor fasteners, CP brass screws, wooden plugs etc.

3.7.04 THE RATE INCLUDES FOR:

1. Glazed division plate including the cost of CP brass screws, wooden plugs, expandable anchor fasteners etc.
2. All necessary labour, material and use of tools.

3.7.05 MODE OF MESUREMENT : The measurement shall be for each unit of division plate fixed,

3.7.06 MODE OF PAYMENT : The contract rate shall be for each unit of division plate fixed.

3.8 **HALF ROUND CHANNEL:**

3.8.01 GENERAL : The item pertains for providing colour or white glazed vitreous chinaware half round channel of size and colour as specified in the schedule including laying and fixing.

3.8.02 MATERIAL: The half round channel shall be of white or colour glazed vitreous chinaware of size as mentioned in the schedule with or without dead end and shall conform to IS 2556 part VII.

3.8.03 FIXING : The channel shall be laid to the correct alignment to required slope. It shall be fixed on 80 mm thick bed of 1:2:4 cement concrete. The channel shall be used in standard length. Pieces are not allow except where it is necessary to make up exact length. The joint and gap shall be finished with white / matching colour cement.

3.8.04 THE RATE INCLUDES FOR:

1. Cement concrete, cutting the channel and wastage etc.
2. Supplying & fixing vitreous china half round channel
3. All necessary labour, material and used of tools.

3.8.05 **MODE OF MEASUREMENT** : The measurement shall be for unit running meter length of half round channel of specified diameter fixed.

3.8.06 **MODE OF PAYMENT** : The contract rate shall be for unit running meter of half round channel fixed.

3.9 **GLAZED FLOOR TRAP WITH DOME SHAPED GRATING:**

3.9.01 **GENERAL** : The item pertains for providing white glazed vitreous chinaware floor trap with dome shaped C.P. Brass grating of size as specified in the schedule including fixing.

3.9.02 **MATERIAL** : The trap shape be of white vitreous chinaware of 100 mm dia. or as specified in the schedule with hinged type dome shaped grating of chromium plated brass or stainless steel as specified.

3.9.03 **FIXING** : The trap shall be laid to the correct alignment and to required slope. The trap shall be fixed on 80 mm thick bed or 1:2:4 cement concrete. The caulking shall be done using 1:1 cement concrete. The caulking shall be done using 1:1 cement mortar and hemp yarn.

3.9.04 **THE RATE INCLUDES FOR:**

1. Floor trap, dome shaped grating, concrete, cement mortar etc.
2. Caulking with 1:1 cement mortar with hemp yarn.
3. All necessary labour, material and use of tools.

3.9.05 **MODE OF MEASUREMENT** : The measurement shall be for each unit of floor trap fixed.

3.9.06 **MODE OF PAYMENT** : The contract rate shall be for each unit of floor trap fixed.

3.10 **TOILET PAPER ROLL HOLDER:**

3.10.01 **GENERAL** : The item includes providing white or colour glazed vitreous chinaware toilet roll holder of size as mentioned in the schedule including fixing.

3.10.02 **MATERIAL** : The toilet paper roll holder shall be of CP brass or vitreous china on specified and of size and design as approved by the Engineer-in-charge. Toilet paper roll holder shall conform to IS standard and should have ISI mark.

3.10.03 **FIXING** : Toilet paper roll holder shall be fixed in position by means of C.P brass covers and raw plug embedded in the wall. Vitreous china toilet paper roll holder shall be fixed into the wall with 1:2 cement mortar. The pocket shall be cut in wall for toilet paper roll holder if not left finishing

the gap with white/matching cement.

3.10.04 THE RATE INCLUDES FOR:

1. Toilet paper roll holder, cement, sand, curing etc.
2. Cutting the pocket if they are not left.
3. All necessary labour, material and use of tools.

3.10.05 MODE OF MEASUREMENT : The measurement shall be for each unit of toilet paper roll holder fixed.

3.10.06 MODE OF PAYMENT : The contract rate shall be for each unit of toilet paper roll holder fixed.

3.11 PVC/UPVC WATER INLET CONNECTION:

3.11.01 GENERAL : The item pertains to providing colour or white PVC water inlet connection for cistern and wash basins,

3.11.02 MATERIAL : PVC water inlet connection shall conform to IS specifications and shall be of standard pattern with nylon insulation of minimum 450 mm long with CP brass check nut at both the ends and shall be able to withstand the testing pressure of 1 MPa (10 kg/sq.cm.)

3.11.03 FIXING : The PVC water inlet connection shall be fixed in position as indicated in the drawing or as directed by the Engineer-in-charge for flushing cistern and wash basins.

3.11.04 THE RATE INCLUDES FOR:

- 1 Supplying and fixing of PVC water inlet connection.
- 2 All necessary labour, material and use of tools.

3.11.05 MODE OF MEASUREMENT : The measurement shall be for each unit of water inlet connection fixed.

3.11.06 MODE OF PAYMENT : The contract rate shall be for each unit of PVC water inlet connection fixed.

3.12 GLAZED FIRE-CLAY/ VITREOUS CHINA SINK:

3.12.01 GENERAL : Item includes providing white or colour glazed -fire clay sink for kitchen or vitreous china sink for lab as specified in the schedule of quantities including fixing.

3.12.02 MATERIAL : Laboratory sink shall be of vitreous china conforming to IS 2556 (PART-V) and kitchen sink shall be of glazed fire-clay conforming to IS 771 (Part-II) and shall have combined over flow of the weir type and invert shall be 30 mm below the top edge. These shall be of one piece construction and floor of sink shall gently slope towards the outlet, The outlet of sink should be suitable for waste fitting having flanges 88 mm diameter and waste hole of

65 mm diameter. the waster hole shall be either rebated or beveled having the depth of 10 mm. C.I brackets for supporting sink shall confirm to relevant IS.

3.12.03 **FIXING** : The sink shall be supported on C.I cantilever brackets, embedded in cement concrete 1:2:4 block of size 100 x 75 x 150 mm. Bracket shall be fixed in the position before dado work is done. The height of front edge of sink from floor level shall be 80 cm or as directed by the Engineer-in-charge. The gap between floor/wall and sink shall finish with white cement.

3.12.04 **THE RATE INCLUDES FOR:**

1. Sink & C.I brackets (Pair) cement, sand etc.
2. All necessary labour, material and use of tools.

3.12.05 **MODE OF MEASUREMENT** : The measurement shall be for each unit of sink fixed.

3.12.06 **MODE OF PAYMENT** : The contract rate shall be for each unit of sink fixed.

3.13 **STAINLESS STEEL SINK:**

3.13.01 **GENERAL** : Item includes providing the stainless steel sink with or without drain board of size as specified in the schedule including fixing.

3.13.02 **MATERIAL:** The sink shall be manufactured from stainless steel of Salem or equivalent steel conforming to IS: 13983. Stainless steel sink shall be of one piece construction moulded out of 19 SWG (1mm) stainless steel sheet of grade AISI 304 (18/8) with stainless steel choke — stop strainer (waste coupling) checknuts conforming to IS 13983.

3.13.03 **FIXING** : The sink shall be fixed in position as indicated in the drawing. The sink shall be placed over the brackets or on the platform. Gap between sink and platform / wall shall be finished with white/ matching cement.

3.13.04 **THE RATE INCLUDES FOR:**

1. S.S. sink with waste coupling cement sand etc.
2. All necessary labour, material and use of tools.

3.13.05 **MODE OF MEASUREMENT** : The measurement shall be for each unit of SS sink fixed.

3.13.06 **MODE OF PAYMENT** : The contract rate shall be for each unit SS sink fixed.

3.14 **SINK DRAIN BOARD:**

3.14.01 **GENERAL** : The item includes providing white or colour glazed / fire clay drain board of size mentioned in the schedule fixing.

- 3.14.02 MATERIAL : The drain board shall be manufactured from stainless steel of Salem or equivalent steel conforming to IS: 13983. Stainless steel sink shall be of one piece construction and its thickness not less than 1 mm.
- 3.14.03 FIXING : The drain board shall be fixed in the position as indicated in the drawing. It shall be place over the brackets or on the platform. Gap between board and platform / wall shall be finished with white /matching cement.
- 3.14.04 THE RATE INCLUDES FOR:
1. Drain board, cement, sand etc.
 2. All necessary labour, material and use of tools.
- 3.14.05 MODE OF MEASUREMENT : The measurement shall be for each unit of drain board fixed.
- 3.14.06 MODE OF PAYMENT : The contract rate shall be for each unit of drain board fixed.
- 3.15 **SOAP DISH:**
- 3.15.01 GENERAL : The item includes providing white or colour glazed chinaware type soap dish of size as mentioned in the schedule including fixing.
- 3.15.02 MATERIAL :. Soap Dish shall be of CP brass or vitreous China on specified and of size, design an approved by the Engineer-in-charge. Soap Dish shall conform to relevant IS standard and should have ISI certification mark.
- 3.15.03 FIXING : Soap Dish shall be fixed in position by means of C.P brass covers and rawl plug embedded in the wall. Vitreous china Soap Dish shall fixed into the wall with 1:2 cement mortar. The pocket shall be cut in wall, if not left, finishing the gap with white/matching cement.
- 3.15.04 THE RATE INCLUDES FOR:
1. Soap dish, cement, sand, curing etc.
 2. Cutting the pocket if they are not left.
 3. All necessary labour, material and the use of tools.
- 3.15.05 MODE OF MEASUREMENT : The measurement shall be for each unit of soap dish fixed.
- 3.15.06 MODE OF PAYMENT: Contract rate shall be for each unit of soap dish fixed.
- 3.16 **GLASS MIRROR:**
- 3.16.01 GENERAL : The item providing beveled or plain edges mirror with or without frame of size as mentioned in the schedule including fixing.
- 3.16.02 MATERIAL : The mirror shall be of superior float glass with edges rounded off or beveled, size 600 x 450 mm unless specified in the

schedule. It shall be free from flaws, specks or bubbles and thickness plated and should not be less than 5.0 mm. The back of mirror shall be uniformly silver plated and should be free from silvering defects. Silvering shall now have a protective uniform covering of red lead paint, where beveled edge mirror are not available. Fancy looking mirrors with PVC beading/border or aluminum beading on stainless steel beading/border based on manufacturer's specification, provided nothing extra shall be paid on this account. The backing of mirror shall be provided with 6mm thick marine plywood or environmentally friendly material other than asbestos cement sheet.

3.16.03 **FIXING** : Mirror shall be fixed in position with 6mm thick marine ply wood backing. It shall be fixed by means of 4 nos. of CP brass screws & caps over rubber washers and rawl plug or as per the manufacturer's specification unless specified otherwise the longer side shall be fixed horizontally.

3.16.04 **THE RATE INCLUDES FOR:**

1. Glass mirror with plywood backing CP screws and CP caps etc.
2. All necessary labour material and the use of tools.

3.16.05 **MODE OF MEASUREMENT** : The measurement shall be for unit square meter or each unit to glass mirror of size as specified in the schedule.

3.16.06 **MODE OF PAYMENT** : The contract rate shall be for unit square meter or each unit of glass mirror of size as specified in the schedule.

3.17 **GLASS SHELF:**

3.17.01 **GENERAL** : The item includes providing glass shelf of size as mentioned in the schedule including fixing.

3.17.02 **MATERIAL** : Glass shelf shall consist of an assembly of glass shelf frame of size as specified in the schedule. It shall be with a pair of CP Brass brackets fixed to the wall with CP screws and CP brass rails all round with guard bar of 6 mm diameter fixed to the glass shelf frame with five numbers CP brass brackets. . The glass shall not be less than 5 mm thick. PVC stainless steel shelf or as per manufacturer's specification and size as specified in the schedule of work shall be provided.

3.17.03 **FIXING** : The complete accessories shall be fixed to proper line and level as indicated in drawing with 40 mm long CP brass screws, wooden rawl plug, drilling hole and making good the wall to original condition after fixing the glass shelf.

3.17.04 **THE RATE INCLUDES FOR:**

1. Glass shelf with glass, CP bracket, guard bars, CP screws etc.
2. All necessary labour material and the use of tools.

- 3.17.05 **MODE OF MEASUREMENT** : The measurement shall be for each unit of glass shelf fixed.
- 3.17.06 **MODE OF PAYMENT** : The contract rate shall be for each unit glass shelf fixed.
- 3.18 **LIQUID SOAP DISPENSER:**
- 3.18.01 **GENERAL:** The item includes providing CP liquid soap dispenser of shape as mentioned in the schedule including fixing.
- 3.18.02 **MATERIAL** : Liquid Soap Dispenser shall be of C.P brass of heavy quality and from list of approved make.
- 3.18.03 **FIXING** : The liquid soap dispenser shall be fixed to proper height and level as indicated in drawing with 40 mm long CP brass screws, wooden rawl plug, drilling hole etc. and making good the wall to original condition after fixing.
- 3.18.04 **THE RATE INCLUDES FOR:**
1. Liquid soap dispenser with CP brackets CP screws etc.
 2. All necessary labour, material and the use of tools.
- 3.18.05 **MODE OF MEASUREMENT** : The measurement shall be for each unit of liquid soap dispenser fixed.
- 3.18.06 **MODE OF PAYMENT** : The contract rate shall be for each unit of liquid soap dispenser fixed.
- 3.19 **TOWEL ROD /TOWEL RING:**
- 3.19.01 **GENERAL:** The item includes providing Towel rod / towel ring of size as mentioned in the schedule including fixing.
- 3.19.02 **MATERIAL** : Towel rail shall be of C.P brass with two CP brass bracket coated with chromium plating of thickness not less than grade No.2 of IS 4827. The size of rail shall be 600 mm x 20 mm dia unless otherwise specified in the schedule. Towel ring of CP brass with one CP brass bracket with thickness not less than Grade No.2 of IS 4827. The diameter of the ring shall be 175 mm unless otherwise specified in the schedule. The diameter of ring rod shall not be less than 8 mm.
- 3.19.03 **FIXING** : The towel rod/ ring shall be fixed to proper line and level as indicated in drawing with CP brass screws, wooden raw plug, drilling hole etc. and making good the wall to original condition after fixing the towel rod.
- 3.19.04 **THE RATE INCLUDES FOR:**
1. Towel rod rail/ring CP brackets & screws etc.
 2. All necessary labour, material and the use tools.

3.19.05 MODE OF MEASUREMENT : The measurement shall be for each unit of towel rod fixed.

3.19.06 MODE OF PAYMENT : The contract rate shall be for each unit of towel rod fixed.

3.20 **SHOWER ROSE:**

3.20.01 GENERAL : The item pertains to provide chromium plated brass shower rose of specified diameter with accessories including fixing.

3.20.02 MATERIAL : The shower rose shall be CP brass of approved and heavy quality. It's accessories shall conform to IS 1239 Part II.

3.20.03 FIXING : Shower rose shall be fixed to be water supply pipe line with necessary G.I fittings etc. as required by the Engineer-in-charge. Jointing shall be done with the zinc, spun yarn etc. A few turns of fine hemp yarn dipped in linseed oil shall be taken over the threaded ends to obtain complete water tightness. Leaky joint shall be remade to make it leak proof at his risk & cost.

3.20.04 THE RATE INCLUDES FOR:

1. Shower rose, bend, socket, union/nuts, nipple etc.
2. All necessary labour, material and the use of tools.

3.20.05 MODE OF MEASUREMENT : The measurement shall be for each unit of shower rose fixed.

3.20.06 MODE OF PAYMENT : The contract rate shall be for each unit of shower rose fixed.

3.21 **BIB TAP, STOP COCK & ANGLE STOPCOCKS:**

3.21.01 GENERAL : The item pertains to provide chromium plated brass bib tap and stop cock and angle stop cocks, free flanges (if joined to concealed pipe) including fixing.

3.21.02 MATERIAL : Bib cock (Bib tap) is drawn off tap with a horizontal inlet and free out let and a stop cock is a valve with a suitable means of connections for insertion in a pipe line for controlling or stopping the flow. These shall be of size 15 mm size or as specified and shall be of screw down type. The closing device shall work by means of disc, carrying a renewable non- metallic washer with shuts against the water pressure on a seating right angles to the axis of the threaded spindle which operates it. The handle shall be crutch, butterfly or fancy design type securely fixed to the spindle. The tap shall open anti clock wise direction.

Brass bib taps and stop cocks and angle stop cocks shall conform to IS 781, they shall be polished bright. The minimum finished weight of different sizes of bib tap weight of 15 mm size bib tap and stop cock shall be as per table given below. They shall be sound and free from taps, blow hole and fitting. Internal & External surface shall be clean, smooth and free from sand and neatly dressed. Taps shall be nickel chromium plated and thickness of coating

shall not be less than service grade No.2 of IS 4827 and plating shall be capable of taking high polish which shall not be easily tarnished.

MINIMUM FINISHED MASS OF BIB TAPS AND STOP VALVES AS PER IS 781:1984 (Reaffirmed 2001)

Size	Minimum Finished Mass			
	Bib taps	Stop Valves		
		Internally threaded	Externally threaded	Mixed end
<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>
mm	Kg	Kg	Kg	Kg
8	0.250	0.220	0.250	0.235
10	0.330	0.330	0.350	0.325
15	0.400	0.330	0.400	0.365
20	0.750	0.675	0.750	0.710
25	1.250	1.180	1.300	1.250
32	-	1.680	1.800	1.750
40	-	2.090	2.250	2.170
50	-	3.700	3.850	3.750

Every tap complete with its component shall withstand an internally applied hydraulic pressure of 2 MPa (20 kg/sq.cm) maintained for a period of 2 minutes during the period it shall neither leak nor sweat. Leaky joint shall be remade to make it leak proof without any extra cost from contractor.

3.21.04 **FIXING** : Bib tap stop cock shall be fixed to the pipe line with C.P. brass or G.I. specials, if required or as ordered by Engineer-in-charge. Jointing shall be done with white zinc, spun yarn etc. A few turns of fine hemp yarn dipped in linseed oil shall be taken over the threaded ends to obtain complete water tightness.

3.21.04 **THE RATE INCLUDES FOR:**

1. Bib tap and stop cock, special etc.
2. All necessary labour, material and the use of tools.

3.21.05 **MODE OF MEASUREMENT** : The measurement shall be for each unit of bib tap and stop cock fixed.

3.21.06 **MODE OF PAYMENT** : The contract rate shall be for each unit of bib tap or stop cock angle stop cock fixed.

3.22 **COMBINATION TAP ASSEMBLY (WALL/ PILLAR MOUNTED):**

3.22.01 **GENERAL**: The item pertains to provide chromium plated brass combination tap assembly, wall mounted hot & cold mixing for bath, pillar mounted hot & cold mixing for sink, basin, tub etc. including free flanges and fixing.

3.22.02 **MATERIAL** : The combination tap assembly shall be 15 mm nominal size or as specified in the schedule. It shall be of C.P. brass approved and heavy quality, and shall conform to I.S. 8931.

Combination tap assembly shall be chromium plated-brass and shall conform to IS 8931. The nominal size of combination tap assembly shall be 15 mm nominal size or as specified. Casting of combination tap assembly shall be sound and free from laps, blow hole and pitting. External and internal surface shall be clean, smooth and free from sand and be neatly dressed. All the parts fitted to pillar tap shall be axial, parallel and cylindrical with surfaces smoothly finished. Thickness of C.P coating shall not be less than service grade no.2 of IS 4827 and plating should be capable of taking high polish which shall not easily tarnish or scale.

3.22.03 **TESTING** : Combination tap assembly shall withstand and internally applied hydraulic pressure of 1.6Mpa (16 kg/ sq.cm) for period of 1 minutes during which, it shall neither leak nor sweat. Leaky joint shall be remade to make it leak proof.

3.22.04 **FIXING** : Combination tap assembly shall be fixed to the pipe line as indicated in the drawing with necessary special as required or as ordered by Engineer-in-charge. Jointing shall be done with white zinc, spun yarn etc. A

few turns of fine hemp yarn dipped in linseed oil shall be taken over the threaded ends to obtain complete water tightness.

3.22.05 THE RATE INCLUDES FOR:

1. Combination tap assembly (wall mounted / pillar mounted as specified in the schedule of work) including free flanges and fixing.
2. All necessary labour, material and the use of tools.

3.22.06 MODE OF MEASUREMENT : The measurement shall be for each unit of combination tap assembly fixed.

3.22.07 MODE OF PAYMENT : The contract rate shall be for each unit of combination tap assembly fixed.

3.23 PILLAR TAP: (Non fancy & Fancy Type)

3.23.01 GENERAL : The item pertains to provide chromium plated brass pillar tap including fixing.

3.23.02 MATERIAL : The pillar tap shall be 15 mm nominal size or as specified in the schedule. Fancy type pillar tap shall be of C.P. brass approved quality and shall conform to I.S.8931. Non fancy pillar tap shall be chromium plated-brass and shall conform to IS 1795. The nominal size of Pillar tap shall be 15 mm or as specified.

Casting of Pillar tap shall be sound and free from laps, blow hole and pitting. External and internal surface shall be clean, smooth and free from sand and be neatly dressed. All the parts fitted to pillar tap shall be axial, parallel and cylindrical with surfaces smoothly finished. The minimum of finish weight of Pillar tap shall not be less than 650 grams (body weight 250 gms, washer plate loose valve 150 gms and back nut 40 gms. Thickness of C.P coating shall not be less than service grade no.2 of IS 4827 and plating should be capable of taking high polish which shall not easily tarnish or scale.

3.23.03 TESTING: Pillar tap shall withstand and internally applied hydraulic pressure of 2 MPa (20 kg/sq.cm) for period of 2 minutes during which period, it shall neither leak nor sweat. Leaky joint shall be remade to make it leak proof without any extra cost from the contractor.

3.23.04 FIXING: Pillar tap shall be fixed to the pipe line as indicated in the drawing with necessary special as required or as ordered by Engineer-in-charge. Jointing shall be done with white zinc, spun yarn etc. A few turns of fine hemp yarn dipped in linseed oil shall be taken over the threaded ends to obtain complete water tightness.

3.23.05 THE RATE INCLUDES FOR:

1. Pillar tap including fixing.
2. All necessary labour, material and the use of tools.

3.23.06 MODE OF MEASUREMENT : The measurement shall be for each unit of pillar tap fixed.

3.23.07 **MODE OF PAYMENT** : The contract rate shall be for each unit of pillar tap fixed.

3.24 FLUSH VALVE:

3.24.01 **GENERAL** : The items pertains to provide chromium plated brass flush valve or a brass concealed type flush valve with necessary accessories including fixing. (Free flanges if joined to concealed pipes)

3.24.02 **MATERIAL** : The Flush valve shall be nominal diameter as specified in the schedule of quantities. It shall be of C.P. brass approved and heavy quality, and shall conform to IS. 9758. The flush valve shall have working pressure of 0.15 to 0.5 MPa. The valve shall be tested to a Hydraulic pressure of 2 MPa for 2 minutes.

3.24.03 **FIXING** : Flush valve shall be fixed to the pipe line as indicated in the drawing with necessary special as required or as ordered by Engineer-in-charge. Jointing shall be done with white zinc, sun yarn etc. A few turns of fine hemp yarn dipped in linseed oil shall be taken over the threaded ends to obtain complete water tightness. Leaky joint shall be remade to make it leak proof.

3.24.04 **THE RATE INCLUDES FOR:**

1. Flush valve, connecting pipe, socket, union, nipple, wall flanges if connected to concealed pipe.
2. All necessary labour, material and the use of tools.

3.24.05 **MODE OF MEASUREMENT** : The measurement shall be for each unit of flush valve fixed.

3.24.06 **MODE OF PAYMENT** : The contract rate shall be for each unit of flush valve fixed.

3.25 WASTE COUPLING:

3.25.01 **GENERAL** : The item pertains to providing chromium plated brass waste coupling including fixing.

3.25.02 **MATERIAL** : Waste Coupling shall conform to IS 3311. Waste fittings shall be of CP with thickness of CP coating not less than service Grade No.2 of IS 4827 which is capable of receiving polish and will not easily scale off. The fitting shall conform in all respect to IS 2963 and shall sound, free from laps, blow, holes and fittings and other manufacturing defects. External and internal surface shall be clean and smooth. They shall be neatly dressed. The waste fitting for wash basin shall be of nominal size of 32 mm and for sink shall be nominal size 50 mm.

3.25.03 **FIXING** : Waste coupling shall be fixed to wash basin, sink or urinal as ordered with necessary specials. Jointing shall be done with white zinc, yarn etc. A few turns of fine hemp yarn dipped in the linseed oil shall be taken

over the threaded ends to obtain complete water tightness. Leaky joint shall be remade to make it leak proof.

3.25.04 THE RATE INCLUDES FOR:

1. Waste coupling with necessary specials.
2. All necessary labour, material and the use of tools,

3.25.5 MODE OF MEASUREMENT : The measurement shall be for each unit of waste coupling fixed.

3.25.06 MODE OF PAYMENT: The contract rate shall be for each unit of waste coupling fixed.

3.26 **BOTTLE TRAP:**

3.26.01 GENERAL : The item pertains to provide chromium plated brass bottle trap including fixing.

3.26.02 MATERIAL : Bottle trap shall be of C.P with thickness of CP coating not less than service grade No. 2 of 1S 4827 which is capable of receiving polish and will not easily scale off. The fitting shall conform in all respect of IS 2963 and shall be sound, free from laps below, holes and fittings and other manufacturing defects. External and internal surface shall be clean and smooth. They shall be neatly dressed and be truly machined so that nut smoothly moves on the body. The Bottle trap for wash basin shall be of nominal size of 32 mm and for sink shall be nominal size 50 mm.

3.26.03 FIXING : Bottle trap shall be fixed to wash basin, sink or urinal as indicated in the drawing with necessary specials or as ordered by the Engineer-in-charge. Jointing shall be done with white zinc, spun yarn etc. A few turns of fine hemp yarn dipped in linseed oil shall be taken over the threaded ends to obtain complete water tightness. Leaky joint shall remade to make it leak proof.

3.26.04 THE RATE INCLUDES FOR:

1. Bottle trap with necessary specials.
2. All necessary labour, material and the use of tools.

3.26.05 MODE OF MEASUREMENT : The measurement shall be for each unit of bottle trap fixed.

3.26.06 MODE OF PAYMENT : The contract rate shall be for each unit of bottle trap fixed.

3.27 **COAT AND HAT HOOK:**

3.27.01 GENERAL : The item pertains to provide chromium plated brass coat and hat hook including fixing.

3.27.02 MATERIAL : Coat & hat Hook shall be of three way type of approved and heavy quality. Coat & Hat Hook shall be CP brass and two/three way hook type

or as specified in the BOQ. CP coating shall not be less than service grade No.2 of IS 4827.

3.27.03 **FIXING** : The Coat and hat hook shall be fixed to proper line & level as indicated in drawing with CP brass screws.

3.27.04 **THE RATE INCLUDES FOR:**

1. Coat and hat hook with CP screws etc.
2. All necessary labour, material and the use of tools.

3.27.05 **MODE OF MEASUREMENT:** The measurement shall be for each unit of coat and hat book fixed.

3.27.06 **MODE OF PAYMENT** : The contract rate shall be for each unit of coat and hook fixed.

3.28 **FLUSHING CISTERN:**

3.28.01 **GENERAL** : The item pertains to provide white or colour glazed chinaware / PVC flushing cistern with all inside syphonic fitting including fixing.

3.28.02 **MATERIAL** : The flushing cistern shall be automatic or manually of rates high level or low level as specified for water closets and urinals.

Cisterns shall be of vitreous china conforming to IS 2326 for Automatic flushing cistern and Plastic (IS 7231). Cistern shall be mosquito proof. All working parts shall be designed to operate smoothly and efficiently. The cistern shall have removable covers which shall fit closely on it and be screwed against top displacement where operating mechanism is attached to the cover. This may be made in two sections, but the section supporting the mechanism shall be securely fitted or screwed to the body. The outlet fitting of the cistern shall be securely connected to the cistern. The nominal internal diameter of the cistern outlet shall not be less than 32 mm and 38 mm for high level and low level respectively. Length of outlet cistern shall be 37 +/- 2 mm. Ball valve shall be screwed type 15 mm in diameter and shall conform of IS 1703. The flat shall be made of polyethylene as specified in IS 9762. A low level cistern with maximum height of 30 cm between the top of the pan and under side of the cistern. In case of low level cistern handle shall be of CP brass. In case of Plastic cistern, operation of cistern shall be through Push Button at the top for dual system and beyond plastic handle.

The discharge rate of the cistern as per IS 774 shall be 10 +/- .5 litres 6 second and 5 +/- .5 litres in 3 second for cistern capacity 10 ltrs. and S ltrs. respectively. Flush pipe shall be of class 'B' G.I pipe of 32 +/- mm diameter for high level. Polyethylene flush pipe shall be low density conforming to IS 3076 or high density conforming to IS 4984 or UPVC pipe conforming to IS 4965 of 40 mm outer diameter.

Over flow pipe shall not be less than +/- 5mm 'B' diameter. It shall be of G.I valve with mosquito proof jalli of 1.25mm dia.

3.28.03 **FIXING:** The chinaware flushing cistern shall be placed over a pair of C.I. brackets. C.P. brass flush pipe shall be fixed to cistern and W.C. pan using check nut, spun yarn, cement mortar etc.

The cast iron flushing cistern shall be placed over a pair of C.I. or G.I. or PVC flush pipe of specified diameter shall be fixed to cistern and W.C. pan by using check nut, white zinc, spun yarn, cement mortar etc.

The PVC flushing cistern shall be placed or fixed as recommended by the manufacturer, PVC flush pipe of specified diameter shall be fixed to cistern and W.C. pan by using check nut, white zinc, spun yarn, cement mortar etc.

3.28.04 **THE RATE INCLUDES FOR:**

1. Supply and fixing flush tank, flush pipe and over flow pipe.
2. Painting all the metallic parts with two coats of flat oil paint over a coat of primer.
3. Cutting hole in wall / slab / beam etc. wherever required and making good the same to original condition after fixing.
4. Cost of jointing materials such as zinc, spun yarn, cement mortar 1:1 etc.
5. Testing the entire system and rectification of defects, if any.
6. All necessary materials, labour and use of tools.

3.28.05 **MODE OF MEASUREMENT:** The measurement shall be for each unit of flushing cistern fixed as a whole.

3.28.06 **MODE OF PAYMENT :** The contract rate shall be for each unit flushing cistern fixed as a whole.

3.29 **BRACKET:**

3.29.01 **GENERAL :** The item pertains to provide a pair of bracket for wash basin, sink, Flushing, cistern etc. including fixing.

3.29.02 **FIXING :** Brackets shall be embedded into or fixed to the wall with plugs, screws, nails etc. Hole shall be made in the wall, if they are not left for fixing the brackets and shall be made good after fixing. The gap shall be filled with 1:2 cement mortar and finishing shall be done with white / matching colour cement.

3.29.03 **THE RATE INCLUDES FOR:**

1. Supplying and fixing the brackets.
2. Painting brackets with two coats of flat oil paint over a coat of primer.
3. Cutting hole in wall beam etc. wherever required and making good the same to original condition after fixing.
4. All necessary materials, labour and use of tools.

3.29.04 **MODE OF MEASUREMENT:** The measurement shall be for each pair of bracket fixed included in the items of sink, wash basin, cu etc. as specified in schedule of quantities.

3.29.05 **MODE OF PAYMENT:** The contract rate shall be for each pair of bracket fixed.

4.0: WATER SUPPLY SYSTEM:

4.1 G.I. PIPING WORK (Exposed):

4.1.01 **GENERAL :** The item includes provision of G.I. pipes with G.I. fitting of specified nominal bore and class as mentioned in the schedule including laying, fixing. The G.I. pipes and fittings shall run on the surface of the walls or ceilings unless otherwise specified.

4.1.02 **MATERIAL :** The pipes and fittings shall be of M.S. galvanised as specified in the schedule. They shall conform to IS 1239 (P-1). All the pipes and fitting shall have ISI certification mark. The specified nominal bore of the pipe shall refer to inside approximate bore according to the thickness corresponding to outside fixed diameter. The pipe and fittings shall be smooth, sound, free from any imperfections and neatly dressed and fitting shall be able to withstand a hydrostatic test pressure of 5 MPa (50 Kg/cm²) maintained for at least 3 seconds at manufacturing works (lab test). The table showing the dimensions and different bores of pipes are given below.

WEIGHT OF GALVANISED & BLACK (BOTH) M.S. TUBES FOR ORDINARY USES IN WATER

A) CONFORMING TO IS: 1239 (PART-I) 2004

Nominal Bore	Class	Outside Diameter		Wall thickness in mm	Nominla weight(Kg/M)	
		Max. mm	Min mm		Plain Ended	Screwed & Socketed
15	L	21.4	21.0	2.0	0.947	0.956
	M	21.8	21.0	2.6	1.21	1.22

	H	21.8	21.0	3.2	1.44	1.45
20	L	26.9	26.4	23	1.38	1.39
	M	27.3	26.5	2.6	1.56	1.57
	H	27.3	26.5	3.2	1.87	1.88
25	L	33.8	33.2	2.6	1.98	2.00
	M	34.2	33.3	3.2	2.41	2.43
	H	34.2	33.3	4.0	2.93	2.95
32	L	42.5	41.9	2.6	2.23	3.27
	M	42.9	42.0	3.2	3.10	3.13
	H	42.9	42.0	4.0	3.79	3.82
40	L	48.4	47.8	2.9	3.23	3.27
	M	48.8	47.9	3.2	3.56	3.60
	H	48.8	47.9	4.0	4.37	4.41
50	L	60.2	59.6	2.9	4.08	4.15
	M	60.8	59.7	3.6	5.03	5.10
	H	60.8	59.7	4.5	6.19	6.26
65	L	76.0	75.2	3.2	5.71	5.83
	M	76.6	75.3	3.6	6.42	6.54
	H	76.6	75.3	4.5	7.93	8.05
80	L	88.7	87.9	3.2	6.72	6.89
	M	89.5	88.0	4.0	8.36	8.53
	H	89.5	88.0	4.8	9.90	10.10
100	L	113.9	113.0	3.6	9.75	10.00
	M	115.0	113.1	4.5	12.20	12.50
	H	115.0	113.1	5.4	14.50	14.80
125	M	140.8	138.5	4.8	15.90	16.40

	H	140.8	138.5	5.4	17.90	18.40
150	M	166.5	163.9	4.8	18.90	19.50
	H	166.5	163.9	5.4	21.30	21.90

4.1.03 LAYING : The plumbing contractor shall set the layout of the plumbing approved by the Engineer-in-charge as may be required by the bye-laws. Pipes shall be laid in plumb and in straight and parallel lines. When unavoidable, pipes may be buried for short distances provided additional protection is given against damage and where so required joints are not buried. Where directed by the Engineer —in-charge, A M.S. tube sleeve shall be fixed at a place the pipe is passing through a wall or floor for reception of the pipe and to allow freedom for expansion ,contraction and other movements. In case the pipe is embedded in walls or floors the pipes shall be painted with anticorrosive bitumastic paints of approved quality. The pipe shall not come in contact with mortar or lime concrete as the pipe is affected by lime. Under the floors the pipe shall be laid in layer of sand filling as done under concrete floors.

4.1.04 FIXING : The entire pipe line shall be fixed in position as shown in the drawing or as directed by the Engineer-in-charge. All pipes shall be fixed truly vertical and horizontal unless unavoidable. The pipe line shall be supported with “U” type G.I. clamps not less than 2 mm thick and G.I. nails not less than 40 mm long, wooden gutties etc keeping the pipe about 15 mm clear of the wall.

Spacing between clamps for fixing internal piping shall be as per IS 2065 — 1983 as given below

Nom. bore of pipe	For Horizontal Runs	For Vertical Runs
15mm	2.0 M	2.5 M
20mm to 32mm	2.5M	3.0M
40 mm to 50 mm	3.0M	3.5M
65 mm to 80mm	3.5M	5.0M

No joints shall be located inside the wall. If the pipe is required to be cut and the end threaded, the burns of the cut end shall be filed smooth and any obstruction in bore shall be entirely eliminated, downtake line shall be provided with union at every floor for easy maintenance. This shall be made of line threaded pipe ends and coupler with checknut to avoid leakage. Die cast union shall not be permitted in the shaft.

- 4.1.05 JOINTING : While fixing the pipe line, the joints shall be made by applying a few turns of hemp yarn dipped in linseed oil, which shall be taken over the threaded end of the pipe and socket screwed home using the pipe wrench. The pipes connected shall touch each other and the socket covering each end about equally. The branch connection shall not protrude in the bore of parent pipe.
- 4.1.06 PAINTING : G.I. pipes and fittings running exposed shall be painted with two coats of oil paint of approved make and shade over a coat of approved primer.
- 4.1.07 PRECAUTIONS
- a) All water supply pipes shall be so laid and so fixed and maintained as to be and remain completely water tight.
 - b) During installation open ends of each pipe shall be protected by suitable covers or plugs so that the ends, thread, sockets or spigot are not damaged and no foreign materials can make its way into the pipe line.
 - c) Due care should be taken to ensure that there shall be no cross connection whatsoever between a pipe or fitting for conveying or containing wholesome water and a pipe or fitting containing impure water or water liable to contamination or of an uncertain quality of water which has been used for any other purposes.
 - d) Fittings and fixtures liable to be stolen shall be fitted and fixed just before testing and handing over.
- 4.1.08 TESTING : The pipes and fittings after they are laid and jointed shall be tested to hydraulic pressure of 1 MPa (10 Kg/sq.cm). The pipes shall be slowly and carefully charged with water allowing all air to escape and avoiding all shock or water hammer. The draw off taps and stop cocks shall then be closed and specified hydraulic pressure shall be applied gradually, Pressure gauge must be accurate and preferably should have been recalibrated before the test. The test pump having been stopped, the test pressure should be maintained without loss for at least 2 (two) hours. The pipes and fittings shall be tested in sections as the work proceeds, having the joints exposed for inspection during the testing. Pipes or fittings which are found leaking shall be replaced and joints found leaking shall be redone, without extra payment.
- 4.1.09 THE RATE INCLUDES FOR:

1. Supplying GI pipes and GI fittings such as sockets, elbows, bends, tees, enlargers, reducers, checknuts, plugs, unions etc. of specified diameter & class including hemp yarn, linseed oil, clamps, screws, wooden gutties etc.
2. Laying, jointing and fixing the pipe with fittings including threading, cutting pipes, wastage etc.
3. All necessary materials, labour and use of tools.

4.1.10 **MODE OF MEASUREMENT** : The measurement shall be for unit running metre length of pipe line of specified nom. bore laid or fixed and shall be taken along center line of the pipe line.

4.1.11 **MODE OF PAYMENT** : The contract rates shall be for unit running metre length of pipe line of specified nom. bore laid or fixed. No extra payment shall be made for fitting and fixtures.

4.2 **G.I. PIPING WORK (Concealed):**

4.2.01 **GENERAL** : The item includes provision of G.I. pipes with concealed type fittings of specified nom. bore and class mentioned in the schedule including laying, fixing, wrapping with hessian cloth, painting and testing.

4.2.02 **MATERIAL**: Please refer clause 4.1.02

4.2.03 **CHASES** : Chases of size 75 mm x 75 mm shall be cut in the wall, floor, slab wherever required or as directed by chases cutting machine. After testing the pipe line, the chases shall be filled with cement mortar 1:3 and surface made good to its original condition.

4.2.04 **LAYING** :The plumbing contractor shall set the layout of the plumbing as per the standard procedure and approved by the Engineer-In-Charge. Pipes shall be laid in plumb and in straight and parallel lines. No lime plaster or composition containing lime shall be allowed to come in direct contact with the pipe, which are to be concealed as the pipe is affected by lime.

4.2.05 **FIXING** : The entire pipe line shall be fixed in position as shown in the drawing or as directed by the Engineer-in-charge. All pipes and fittings, which are to be concealed, shall be properly embedded in the wall, flooring etc. after being treated. No moulding or plaster design or any ornamental plaster work shall be done over the walls or flooring or ceiling where concealed pipes have been laid.

If the pipe is required to be cut and the end threaded, the burrs of the cut end shall be filed smooth and any obstruction in bore shall be entirely eliminated.

4.2.06 **JOINTING**: Please refer Clause No. 4.1.05

4.2.07 **PAINTING** : All the concealed piping work shall be thoroughly painted with two coats of anti-corrosive black bitumastic paint of approved quality shade over a coat of approved primer before concealing and filling the mortar.

- 4.2.08 INSULATION : The hot water pipe line concealed on the wall, floor etc. after painting shall be insulated with 2.5 mm thick 95% asbestos magnesia compound of approved make all round the pipe and fittings.
- 4.2.09 WRAPPING : After painting the cold water pipe line, it shall be wrapped with two layers of hessian cloth of approved quality.
- 4.2.10 PRECAUTIONS
- a) All water supply pipes shall be so laid and so fixed and maintained as to be and remain completely water tight.
 - b) During installation open ends of each pipe shall be protected by suitable covers or plugs so that the ends, thread, sockets or spigot are not damaged and no foreign materials can make its way into the pipe line.
 - c) Due care should be taken to ensure that there shall be no cross connection whatsoever between a pipe or fitting for conveying or containing wholesome water and a pipe or fitting containing impure water or water liable to contamination or of an uncertain quality of water which has been used for any other purposes.
 - d) Fittings and fixtures liable to be stolen shall be fitted and fixed just before testing and handing over.
- 4.2.11 TESTING : Please refer clause No.4.1.08
- 4.2.12. THE RATE INCLUDES FOR:
1. Supplying GI pipes and concealed type G.I, fittings such as sockets, elbows, bends, tees, enlargers, reducers, checknuts, plugs, unions etc. of specified diameter and class including hemp yarn, linseed oil etc.
 2. Laying, jointing and fixing the pipe with fittings including threading, cutting pipes, wastage, etc.
 3. Wrapping the cold water pipe line with hessian cloth including painting and testing.
 4. Wrapping the hot water pipe line with asbestos cloth.
 5. Cutting 75 mm x 75 mm size chases in the wall, floor, slab, etc. and making good the same using 1:3 cement mortar after the pipeline is laid.
 6. All necessary materials, labour and use of tools.
- 4.2.13 MODE OF MEASUREMENT : The measurement shall be for unit running metre length of pipe line of specified nom. bore laid or fixed and shall be measured along the center line of the pipe line.

- 4.2.14 **MODE OF PAYMENT** : The contract rate shall be for unit running metre length of pipe line of specified nom. bore laid or fixed. No extra payment shall be made for fittings and fixtures.

4.3 UNDER GROUND G.I. PIPING WORK:

- 4.3.01 **GENERAL** : The item includes supplying G.I. pipes and fittings of specified nom. bore and class as mentioned in the schedule including laying, jointing and painting.
- 4.3.02 **MATERIAL**: Please refer clause 4.1.02
- 4.3.03 **TRENCHES** : The galvanised iron pipes and fittings are to be laid in trenches. The widths and depths of the trenches for different diameter of the pipes shall be as given below

Diameter of pipe (mm)	Min. Width of trench (mm)	Min. Depth of trench (mm)
15 to 50	300	600
65 to 100	450	750

When excavation is done in rock, it shall be cut deep enough to permit the pipes to be laid on a cushion of sand of min. 7.5 cm.

At joints, the trench width shall be widened where necessary. The work of excavation and refilling shall be done true to line and gradient in accordance with general specifications for earth work in trenches as per clause 2.0.

- 4.3.04 **LAYING** : Where a pipe is to be laid underground, the particular length of pipe should be protected by first painting before laying and then wrapping around the pipe a layer of jute or hessian cloth in the form of bandage, so that this cloth in the form of bandage, stick to the composition which has been freshly applied.

Pipes shall be so laid as not to expose to sun or be subjected to any injury or risk to the pipe. As far as possible, pipes shall be laid in straight and parallel lines. They shall be used in standard length pipe pieces being used only where necessary to make up the exact length.

- 4.3.05 **JOINTING** : Please refer clause No. 4.1.05

- 4.3.06 **DEWATERING** : The contract rate shall include bailing or pumping out all the water if accumulated during the progress of the work either from rain, seepage, springs or any other cause.

4.3.07 TESTING: Same as clause 4.1.08

4.3.08 PAINTING: G.I. pipes and fittings shall be painted with two coat of anticorrosive paint before pipe line is laid and wrapping the pipe and fitting with jute or hessian cloth in the form of bandage.

4.3.09 PRECAUTIONS

- a) All water supply pipes shall be so laid and so fixed and maintained as to be and remain completely water tight.
- b) During installation open ends of each pipe shall be protected by suitable covers or plugs so that the ends, thread, sockets or spigot are not damaged and no foreign materials can make its way into the pipe line.
- c) Due care should be taken to ensure that there shall be no cross connection whatsoever between a pipe or fitting for conveying or containing wholesome water and a pipe or fitting containing impure water or water liable to contamination or of an uncertain quality of water which has been used for any other purposes.
- d) Fittings and fixtures liable to be stolen shall be fitted and fixed just before testing and handing over.

4.3.10 THE RATE INCLUDES FOR:

- 1. Supplying G.I. pipes and fittings such as sockets, elbows, bends, tees, enlarges, plugs, reducers, checknuts, unions etc. of specified diameter including hemp yarn, linseed oil etc.
- 2. Laying, jointing and fixing the pipe with fittings including threading, cutting pipes, wastage etc.
- 3. Covering with hessian cloth, painting and testing the pipe line,
- 4. Dewatering the trench or pit till completion of work.
- 5. All necessary labour, material and use of tools.

4.3.11 MODE OF MEASUREMENT : The measurement shall be for unit running metre length of pipe line of specified nom, bore laid or fixed and shall be measured along the center line of the pipe line.

- 4.3.12 **MODE OF PAYMENT** : The contract rate shall be for unit running metre length of pipe line of specified nom. bore laid or fixed. No extra payment shall be made for fittings and fixtures.

4.4 HIGH DENSITY POLYETHYLENE PIPING WORK FOR WATER SUPPLY:

- 4.4.01 **GENERAL** : The item includes supplying of HDPE pipes with fittings of specified diameter including laying, fixing, cutting, jointing.
- 4.4.02 **MATERIAL** : The pipes and fittings shall conform to series IV of IS 4984. HDPE pipes and fittings shall be free from cracks, flaws and defects and shall be able to withstand a pressure as mentioned in the schedule.
- 4.4.03 **EXAMINING** : Before laying the pipe line, it shall be first examined for damages and cracks. No cracked or damaged pipe and fittings shall be used in the work and they shall be removed from the site by the contractor at his own cost and charge.
- 4.4.04 **LAYING** : The pipes shall be carefully laid straight to the correct alignment in gradients as indicated in the drawing. All the pipe shall be used in standard length as far as possible. Cut length may be used only where it is necessary to make up exact length.
- The entire length of pipe shall be evenly supported on bed of the trench throughout. Care shall be taken to prevent any sand, earth or other materials from entering into the pipes during laying. At the end of day's work, the open end shall be suitably plugged.
- 4.4.05 **FIXING** : The pipe line shall be fixed in position as shown in the drawing or as directed by the Engineer-in-charge. The pipe shall be fixed with G.I. clamps not less than 2 mm thick or with suitable diameter HDPE clamps. The clamps shall be fixed into the wall with M.S. nails not less than 40 mm long./ Wooden gutties etc. chromium plated screws with wooden gutties fixing the pipe line on internal wall surface.
- 4.4.06 **MAKING JOINT**: The joining of pipes and fittings generally shall be done by Butt weld with heat mirror jointing. The pipe shall be cut to desired length. Care shall be taken that profile of cut surfaces is not changed and the fibrous material shall be removed with scraper or knife. The butt weld jointing shall be made with electrical heated plated at the required

temperature around 205 ± 5 degree Centigrade. While jointing, care shall be taken that formation of the rim at end of pipe after heating by hot plate should be made uniform and complete on both the ends. Holding and pressing of pipe is done manually or mechanically to give the leak proof joint.

- 4.4.07 DETACHABLE JOINT : Detachable joints shall be made where pipes of different materials have to be jointed or as specified in the schedule. The flanges are first pushed over the pipe ends and a rim is made by heating the pipe end in a suitable device to 70-180 Centigrade and welding pre- heated rim of the pipe.
- 4.4.08 DEWATERING : In case of underground pipes, the contract rate shall include bailing or pumping out all the water till completion of work if accumulated during the progress of work either from seepage, springs, rain or any other cause.
- 4.4.09 TESTING : Solvent welded pipe shall not be pressure tested until at least 24 hours after the last solvent cemented joint has been done. All control valves shall be positioned open for the duration of the test and open end closed with water tight fittings. The testing pressure on completion of the work shall not be less than 1.5 times the working pressure of the pipes.

Pressure shall be applied either by hand pump or power driven pump. Pressure gauges shall be correctly positioned and closely observed to ensure that at no time are the test pressure exceeded. The systems shall be slowly and carefully filled with water to avoid surge pressure or water hammer. Air vents shall be open at all high points so that air may be expelled from the system during filling.

When the system has been fully charged with water and air displaced from the line, air vent shall be closed and the line initially inspected for seepage at joints and firmness of supports under load. After the pressure is reached, without any additional requirement of make-up-water, the test pressure should not fall more than 0.02 MPa (0.2 kg./sq.cm) at the end of one hour test duration.

4.4.10 PRECAUTIONS

- a) All water supply pipes shall be so laid and so fixed and maintained as to be and remain completely water tight.
- b) During installation open ends of each pipe shall be protected by suitable covers or plugs so that the ends, thread, sockets or spigot are not damaged and no foreign materials can make its way into the pipe line.
- c) Due care should be taken to ensure that there shall be no cross connection whatsoever between a pipe or fitting for conveying or containing wholesome water and a pipe or fitting containing impure water or water liable to contamination or of an uncertain quality of water which has been used for any other purposes.

- d) Fittings and fixtures liable to be stolen shall be fitted and fixed just before testing and handing over.

4.4.11 THE RATE INCLUDES FOR:

1. Supplying of HDPE pipes and fittings of specified diameter.
2. Laying and cutting the pipe wherever necessary and wastage.
3. Making the solution joint or mirror joint, painting if mentioned in schedule of quantities.
4. Fixing the pipe line with G.I. clamps not less than 20 mm x 1 mm thick and G.I./M.S. nails length not less than 40 mm or HDPE clamps, screws, rawl plug etc.
5. In case of underground pipes, dewatering the pit or trench till completion of work.
6. All necessary labour, materials and use of tools.

4.4.12 MODE OF MEASUREMENT : The measurement shall be for unit running meter length of pipe line laid or fixed. The measurement shall be taken along the centre line of pipe. No measurement shall be recorded separately for fitting, making joint, painting if mentioned in schedule of quantities and testing.

4.4.13 MODE OF PAYMENT : The contract rate shall be for unit running meter length of pipe line laid.

4.5 UPVC PIPING WORK FOR WATER SUPPLY:

- 4.5.01 GENERAL :** The item includes supplying of UPVC pipes with fittings of specified diameter including laying, fixing, cutting, joining, painting etc. for vent, over flow, waste water pipe line etc.
- 4.5.02 MATERIAL :** The pipes and fittings shall conform to series IV of IS 4985-2000, UPVC pipes and fittings shall be free from cracks, flaws and defects and shall be able to withstand a pressure as mentioned in the schedule of quantities.
- 4.5.03 EXAMINING :** Before laying the pipe line, it shall be first examined for damages and cracks, No cracked or damaged pipe and fittings shall be used in the work and they shall be removed from the site by the contractor at his own cost and charge.
- 4.5.04 CLEANING :** All the pipes and fittings shall be thoroughly cleaned with brush and washed if necessary to remove any accumulated stone, soil or dirt inside and out side surfaces.
- 4.5.05 TRENCHES :** The trench bottom shall be carefully examined for the presence of hard objects such as flints, rock projection or tree roots etc. Pipe shall be embedded in sand or soft soil, free from rock & gravel, back fill 150mm above the pipe shall also be of fine sand or soft soil. Pipe shall not be painted. The

width of trench shall not be less than out side diameter of pipe plus 300 mm in case of gravel soils. Pipe shall be laid at- least 900 mm below the ground level (measured from the surface of the ground to the top of pipe).

- 4.5.06 LAYING : The pipes shall be carefully laid straight to the correct alignment in gradients as indicated in the drawing. All the pipe shall be used in standard length as far as possible. Cut length may be used only where it is necessary to make up exact length.

The entire length of pipe shall be evenly supported on bed of the trench through out. Care shall be taken to prevent any sand, earth or other materials from entering into the pipes during laying. At the end of day's work, the open end shall be suitably plugged.

- 4.5.07 FIXING : The pipe line shall be fixed in position as shown in the drawing or as directed by the Engineer-in-charge. The pipe shall be fixed with G.I. clamps not less than 2 mm thick or with suitable UPVC clamps, The clamps shall be fixed into the wall with G.I. nails not less than 40 mm long and wooden gutties.

Spacing between clamps for fixing internal piping shall be as given below:

Pipe dia	For Horizontal Runs	For Vertical Runs
20 mm	700 mm	1050 mm
25mm	750mm	1125mm
32mm	825 mm	1240 mm
40 mm	975 mm	1460 mm
50 mm	975 mm	1460 mm

- 4.5.08 MAKING JOINT : The jointing of pipes and fittings generally shall be done with approved make cement solvent including making surface rough. The pipe shall be cut to desired length. Care shall be taken that that profile or cut surfaces shall not be changed and the fibrous material shall be removed with scraper or knife.
- 4.5.09 DETACHABLE JOINT : Detachable joints shall be made where pipes of different materials have to be jointed or as specified in the schedule. The flanges are first pushed over the pipe ends and jointing shall be made by cement solvent.
- 4.5.10 PAINTING : If mentioned in schedule of work, the exposed pipe line shall be painted with two coats of approved oil paint of matching colour over a coat of primer. Underground pipeline shall not be painted.
- 4.5.11 DEWATERING : In case of underground pipes, the contract rate shall include bailing or pumping out all the water till completion or work if accumulated during the progress of work either from seepage, springs, rain or any other cause.
- 4.5.12 PRECAUTIONS

- a) All water supply pipes shall be so laid and so fixed and maintained as to be and remain completely water tight.
- b) During installation open ends of each pipe shall be protected by suitable covers or plugs so that the ends, thread, sockets or spigot are not damaged and no foreign materials can make its way into the pipe line.
- c) Due care should be taken to ensure that there shall be no cross connection whatsoever between a pipe or fitting for conveying or containing wholesome water and a pipe or fitting containing impure water or water liable to contamination or of an uncertain quality of water which has been used for any other purposes.
- d) Fittings and fixtures liable to be stolen shall be fitted and fixed just before testing and handing over.

4.5.13 TESTING : Please refer clause No.4.4.9

4.5.14 THE RATE INCLUDES FOR:

- 1. Supplying of UPVC pipes and fittings of specified diameter.
- 2. Laying and cutting the pipe wherever necessary and wastage.
- 3. Fixing the pipe line with G.I. clamps not less than 2 mm thick and G.I./M.S. nails length not less than 40mm or with PVC clamps, screws, wooden gutties etc.
- 4. Making the solution joint, painting the pipe line, if mentioned in schedule of quantities.
- 5. In case of underground piping, dewatering till completion of work.
- 6. All necessary materials, labour and use of tools.

4.5.15 MODE OF MEASUREMENT : The measurement shall be for unit running meter length of pipe line laid or fixed. The measurement shall be taken along the center line of pipe. No measurement shall be recorded separately for fittings, making joint, painting if mentioned in schedule of work and testing. length of pipe line laid or fixed.

4.5. a In case of CPVC and PVC pipes the above mentioned specification of UPVC pipes shall be applicable along with the relevant IS Codes and standard industry practice.

4.6 **GUN METAL/ BRASS FULL WAY VALVE:**

4.6.01 GENERAL : The item includes provision of full way (gate or globe) valve of specified diameter as mentioned in the schedule including fixing. Full way valve is a valve suitable for controlling or stopping the flow in water supply lines.

4.6.02 MATERIAL:

Full way valve shall be of either Brass fitted with a cast iron hand wheel or Gun metal fitted with a CI. hand wheel as the case may be and shall be of Gate valve type opening full way and of the size as specified conforming to IS 778. The weight of the full way gate valve shall be as per the table given below with a tolerance of 5 percent.

Diameter in mm	Flanged arch (Kg)	Screwed arch (Kg)
15	1.021	0.567
20	1.503	0.680
25	2.495	1.077
32	3.232	1.559
40	4.082	2.268
50	6.691	3.232
65	10.149	6.804
80	13.381	8.845

- 4.6.03 **FIXING:** The valves shall be fixed in position in the pipeline as shown in the drawing or as directed with necessary socket or union, nuts etc. The screwed, flanged joint shall be made with few turns of fine hemp yarn dipped in linseed oil taken over the threaded ends to obtain complete water tightness.
- 4.6.04 **TESTING :** The joints shall be tested to a hydraulic pressure of 1 MPa (10 kg/cm² along with the testing of pipe line.
- 4.6.05 **THE RATE INCLUDES FOR:**
- 1 Valve, G.I. fittings, hemp yarn, linseed oil, zinc, fixing and testing.
 2. All necessary labour, materials and use of tools.
- 4.6.06 **MODE OF MEASUREMENT:** The measurement shall be for each unit valve of specified diameter fixed.
- 4.6.07 **MODE OF PAYMENT:** The contract rate shall be for each unit of valve of specified diameter fixed. No extra payment shall be made for G.I. fittings used in fixing of the valve.
- 4.7 **WATER METER:**
- 4.7.01 **GENERAL :** The item includes provision of Water meter with or without end flanges or non-return valve of specified diameter as mentioned in the schedule with strainer, sockets, flange, union, nuts etc. including fixing and testing.
- 4.7.02 **MATERIAL :** Water Meter shall conform to IS 779 and should have ISI certification mark. Non return valve and strainer shall be of the same diameter as that of water meter. Strainer, sockets, flange, union, union nuts, rubber packing etc. shall be as per the description of item.
- 4.7.03 **FIXING :** Water meter shall be fixed in position on the inlet pipe line and the joints shall be made either screwed or flanged with necessary sockets, flanges and union nuts as required or as directed by the Engineer-in-charge.

- 4.7.04 SCREWED JOINT : A few turns of fine hemp yarn dipped in linseed oil shall be taken over the threaded ends to obtain complete water tight joint.
- 4.7.05 FLANGED JOINT : The flange joint shall be made for flange type water meter and the joint shall be as per the specification of flanged joint.
- 4.7.06 TESTING : The joints shall be tested to a hydraulic pressure of 1 MPa (10 kg/cm² along with testing of pipe line for a minimum duration of two hours.
- 4.7.07 THE RATE INCLUDES FOR:
1. Water meter, hemp yarn, linseed oil, zinc, fixing and testing.
 2. Supplying of strainer non-return valve, sockets, union nut etc.
 3. Making screwed or flanged joints.
 4. All necessary labour, material and use of tools.
- 4.7.08 MODE OF MEASUREMENT : The measurement shall be for each unit of water meter of specified diameter fixed.
- 4.7.09 MODE OF PAYMENT: The contract rate shall be for each unit Water Meter of specified diameter fixed. No extra payment shall be made towards making flanged and other joints and G.I. fittings used in fixing of the water meter.
- 4.8 **PRESSURE REDUCING VALVE:**
- 4.8.01 GENERAL : The item includes provision of pressure reducing valve of specified diameter as mentioned in the schedule including fixing.
- 4.8.02 MATERIAL: Pressure reducing valve is a device with suitable means of connection for insertion in a vertical pipe line for controlling the water pressure. Valve shall be of brass and shall be vertical flow type, conforming to IS 9739-1981.
- 4.8.03 FIXING : The valve shall be fixed in position on the pipe line as shown in the drawing or as directed. The screwed or flanged joint shall be made to obtain complete water tight joint.
- 4.8.04 TESTING : The joints shall be tested to a hydraulic pressure of 1MPa (10 kg/cm² along with testing of pipe line for a minimum duration of 2 hrs.
- 4.8.05 THE RATE INCLUDES FOR:
1. Supplying Valve including fixing and testing.
 2. All necessary labour, materials and use of tools.
- 4.8.06 MODE OF MEASUREMENT : The measurement shall be for each unit of valve of specified diameter fixed.
- 4.8.07 MODE OF PAYMENT : The contract rate shall be for each unit of valve of specified diameter fixed.
- 4.9 **CAST IRON WATER QUALITY PIPING WORK:**

4.9.01 **GENERAL** : The item includes the provision of supplying water quality cast iron pipe of specified diameter including cutting, laying, fixing, and painting the pipe line.

4.9.02 **MATERIAL** : The pipes shall be centrifugally cast (spun) Iron Pressure pipe conforming to IS 1536 and shall be of class "LA", 'A' or "B". These shall be of socket and spigot or double flanged. All the pipes shall be cylindrical reasonably true with inner and outer surfaces and nearly concentric as practicable. The outer surface shall be smooth, sound, free from pin holes, cracks and other imperfections. The pipes shall be treated with solution of Dr. Angus Smith's solution. The coated surface shall give glossy finish. The table showing the dimensions & weight of different diameter of pipes is given below:

CENTRIFUGALLY CAST (SPUN) IRON 'WATER QUALITY' PIPES

Tolerances: a) Length $\pm$ 25 mm (b) weight 5% (c) Thickness $\pm$ (1+0.05e)mm

Value of 'e' for

- (i) LA class pipe $e = 10/12 (7 + 0.02 \text{ DN})$
- (ii) A class pipe $e = 11/12 (7 + .02 \text{ DN})$
- (iii) B class pipe $e = (7 + 0.02 \text{ DN})$

**CENTRIFUGALLY CAST (SPUN) IRON 'WATER QUALITY' PIPES
WEIGHT FOR SOCKET & SPIGOT PIPES (IS 1536-2001)**

Nom. Dia	Class	Barrel				Socket Mass	Total weight for one working length 'L' in meter					
DN Mn		Lead joint	Push on joint	Thickness	Mass for 1 Mt		3.66	4	4.5	5	5.5	6
		DE mm	DE mm	E mm	Kg	Kg.	Kg.	Kg.	Kg.	Kg.	Kg.	Kg.
80	LA	98	95	7.2	14.7	5.5	59.0	64.0		79.0		-
	A	98	95	7.9	16.0	5.5	64.0	70.0	78.0	86.0		-
	B	98	95	8.6	17.3	5.5	69.0	74.0	83.0	92.0		-
100	LA	118	115	7.5	18.6	7.1	75.0	82.0	91.0	100.0	109.0	119.0
	A	118	115	8.3	20.5	7.1	82.0	89.0	99.0	109.0	120.0	130.0

	B	118	115	9.0	22.0	7.1	88.0	95.0	106.0	117.0	128.0	139.0
125	LA	144	141	7.9	24.2	9.2	98.0	106.0	118.0	130.0	142.0	154.0
	A	144	141	8.7	26.4	9.2	106.0	115.0	128.0	141.0	155.0	168.0
	B	144	141	9.5	28.7	9.2	114.0	124.0	138.0	153.0	167.0	181.0
150	LA	170	167	8.3	30.1	11.5	122.0	132.0	147.0	162.0	177.0	192.0
	A	170	167	9.2	33.2	11.5	133.0	144.0	161.0	178.0	194.0	211.0
	B	170	167	10.0	35.9	11.5	143.0	155.0	173.0	191.0	209.0	227.0
200	LA	222	219	9.2	44.0	16.5	178.0	193.0	215.0	237.3	259.0	281.0
	A	222	219	10.1	48.1	16.5	193.0	209.0	233.0	257.0	281.0	305.0
	B	222	219	11.0	52.5	16.8	207.0	225.0	251.0	278.5	304.0	329.0
250	LA	274	271	10.0	59.3	22.9	240.0	250.0	290.0	319.0	349.0	379.0
	A	274	271	11.0	65.0	22.9	261.0	283.0	315.0	348.0	380.0	413.0
	B	274	271	12.0	70.5	22.9	281.0	305.0	341.0	376.0	411.0	447.0
300	LA	326	323	10.8	76.5	29.8	310.0	336.0	374.0	412.0	450.3	489.0
	A	326	323	11.9	84.0	29.8	337.0	366.0	408.0	450.0	492.0	534.0
	B	326	323	13.0	91.4	29.8	364.0	395.0	441.0	487.0	533.0	578.0
350	LA	378	375	11.7	96.3	37.5	390.0	423.0	471.0	519.5	567.0	615.0
	A	378	375	12.8	105.0	37.5	422.0	458.0	510.0	563.0	615.0	668.0
	B	378	375	14.0	114.5	37.5	457.0	495.0	553.0	610.5	667.0	725.0
400	LA	429	426	12.5	116.9	46.3	474.0	514.0	572.0	631.0	690.0	748.0
	A	429	426	13.8	128.7	46.3	517.0	561.0	625.0	690.0	754.0	819.0
	B	429	426	15.0	139.5	46.3	557.0	604.0	674.0	744.0	814.0	883.0
450	LA	480	477	13.3	141.0	56.0	572.0	620.0	690.0	761.0	832.0	902.0
	A	480	477	14.7	156.0	56.0	627.0	680.0	758.0	836.0	914.0	992.0
	B	480	477	16.0	169.0	56.0	675.0	732.0	816.0	901.0	986.0	1070.0
500	LA	532	529	14.2	165.2	66.0	671.0	727.0	809.0	892.0	974.0	1057.0
	A	532	529	15.6	181.0	66.0	728.0	790.0	880.0	971.0	1061.0	1152.0
	B	532	529	17.0	196.7	66.0	786.0	853.0	951.0	1049.0	1148.0	1246.0

600	LA	635	632	15.8	219.8	89.3	894.0	968.0	1162.0	1188.0	1298.0	1408.0
	A	635	632	17.4	241.4	89.3	975.0	1055.0	1141.0	1272.0	1404.0	1544.0
	B	635	632	19.0	262.9	89.3	1052.0	1141.0	1272.0	1404.0	1535.0	1667.0
700	LA	738	735	17.5	283.2	116.8	1153.0	1250.0	1391.0	1538.0	1675.0	1816.0
	A	738	735	19.3	311.6	116.8	1257.0	1363.0	1519.0	1675.0	1830.0	1986.0
	B	738	735	21.0	338.2	116.8	1355.0	1470.0	1639.0	1808.0	1977.0	2146.0
750	LA	790	787	18.3	317.2	131.7	1293.0	1400.0	1559.0	1718.0	1876.0	2035.0
	A	790	787	20.	348.9	131.7	1409.0	1527.0	1702.0	1876.0	2051.0	2225.0
	B	790	287	22.	380.6	131.7	1525.0	1644.0	1844.0	2029.0	2225.0	2415.0
800	LA	842	839	19.2	354.9	147.8	1447.0	1567.0	1745.0	1922.0	2100.0	2277.0
	A	842	839	21.1	389.1	147.8	1572.0	1704.3	1899.0	2093.0	2288.0	248.0
	B	842	839	23.	423.1	147.8	1696.0	1840.0	2052.0	2263.0	2475.0	2686.0
900	LA	945	942	20.	421.8	182.6	1763.0	1910.0	2126.0	2342.0	2558.0	2773.0
	A	945	942	22.	474.3	182.6	1918.0	2080.0	2317.0	2554.0	2791.0	3028.0
	B	945	942	25.	516.6	182.6	2073.0	2249.0	2507.0	2766.0	3024.0	3282.0
1000	LA	104	104	22.	518.3	222.3	2119.0	2295.0	2555.0	2814.0	3073.0	3392.0
	A	104 8	104 5	24.	570.0	222.3	2308.0	2502.0	2787.0	3072.0	3357.0	3642.0
	B	104 8	104 5	27.	619.2	222.3	2489.0	2699.0	3009.0	3318.0	3621.0	3938.0
1050	LA	112 4	118	23.	583.4	309.6	2445.0	2643.0	2935.0	3227.0	3518.0	3810.0
	A	112 4	118	26.	641.2	309.6	2656.0	2874.0	3195.0	3516.0	3836.0	4157.0
	B	112 4	118	29.	713.3	309.6	2920.0	3163.0	3519.0	3876.0	4223.0	4589.0

B

- 4.9.03 **UNLOADING** : The pipe shall be unloaded where they are required, Where mechanical handling facility are not available, pipes weighing upto 60 kg shall be handled by two persons by hand passing and heavier pipes shall be unloaded from the lorry or wagon by holding them in loops, formed with ropes and sliding over plank set not steeper than 45 degrees. Two ropes always shall be used and only one pipe shall be unloaded at a time, Under no circumstances shall pipes be thrown down from the carriers or be dragged or rolled along hard surfaces. The pipes shall be checked for any visible damage while unloading and shall be sorted out for reclamation.
- 4.9.04 **STORING** : The pipes shall be lined upon on one side of the alignment of the trench, socket facing upgrade when line runs uphill and up stream when line runs on level ground. Each stack shall contain pipes of same class and size. Storage shall be done on firm, level and clean ground. Wedges shall be provided at the bottom layer to keep the stack stable.
- 4.9.05 **CLEANING** : The pipes shall be thoroughly cleaned with brush and washed if necessary to remove any accumulated stone, soil or dirt inside and inside of socket and outside of the spigot shall also be cleaned in similar way.
- 4.9.06 **EXAMINATION** : Before pipe is laid it shall be first examined for damage and cracks. No cracked or damaged pipe shall be used. The pipe shall be tested with a hammer to prove its soundness.
- 4.9.07 **DAMAGED MATERIAL** : If any material is found damaged or cracked, the same shall not be used in the work. The contractor has to replace the same at his own cost and charges.
- 4.9.08 **TRENCHES** : The depth of the trenches shall not be less than 1000 mm measured from the top of the pipe to the surface of the ground under roads and not less than 750 mm elsewhere. The width of the trench shall be the nominal diameter of the pipeline plus 400mm, but it shall not be less than 550 mm in case of all kind of soil, excluding rock and not less than 1000 mm in case of rock.

Trench shall be so deep that the pipes may be laid to the required alignment and at required depth. The width of trench at bottom between face of sheeting shall be such as to provide not less than 200 mm clearance on either side of the pipe. Trenches shall be of such extra width, when required as will permit the convenient placing of timber supports strutting and planking handling of specials etc. The bed of trench, in soft or made up earth, shall be well watered and rammed before laying the pipes and depression, if any, shall be properly filled with earth and consolidated in 20 cm layers.

If the trench bottom is extremely hard or rocky or loose stony soil, the trench shall be excavated 150mm below the trench grade. Rocks, stones or other hard substances from the bottom of the trench shall be removed & trench brought back to the required grade by filling with selected fine earth or sand or fine murrum & compact so as to provide a smooth bedding for pipe.

After the excavation of the trench is completed, hollows shall be cut at the required position to receive the socket of the pipe. The barrels of the pipes shall rest through their entire length on the solid ground that sufficient space left for jointing the under side of the pipe joints. These socket holes shall be refilled with sand after jointing the pipe.

The trench shall be kept free from water. shoring and timbering shall be provided wherever required. Excavation below water table shall be done after dewatering the trenches.

The road crossing shall be excavated half at a time and where the pipe line/drain crosses on existing road after the pipe have been laid in the first half and the trench refilled. Care shall be taken not to disturb the electrical & communication cable net with during the course of excavation,

4.9.09 **LOWERING** : The pipe shall then be placed in trenches by means of proper sheer legs, chains and other tacts and shall be properly driven home. In no case, pipe shall be rolled or dropped into the trench. One end of rope may be tied to a wooden or steel peg or driven into ground and other end held by men which shall then be slowly released till the pipe is slowly released into the trench.

4.9.10 **LAYING** : The pipes shall be carefully laid straight to correct alignment in raising or falling gradients. The socket end of the pipe shall face uphill. All the pipes shall be used in standard length as far as possible. Cut length may be used only where it is necessary to make up exact length. While jointing the spigot it should be neatly placed into the socket for full length and properly supported. The pipe shall be carefully packed underneath so that they shall bear loads arising from traffic evenly throughout their whole length. The entire length of pipe shall be supported on bed of the trench evenly throughout. Care shall be taken to prevent any sand, earth or other materials from entering into the pipes during laying. At the end of the day's work the open end shall be suitably plugged.

No pipe shall be laid until the trench has been excavated to its required depth for a distance of about 5 M in front of the pipe to be laid. No pipe shall be covered until it has been passed by the Engineer-in-charge.

In unstable soils, such as soft soil and dry lumpy soil, it shall be checked whether the soil can support the pipe and if required, suitable special foundation shall be provided.

Where the soils are drastically affected by extremes of saturation and dryness, those soils are subjected to extraordinary shrinkage which from wide and deep cracks in the earth surface may result in damage to underground pipe because of tight gripping bond between pipe and clay, subjecting to it excessive stresses as the clay shrinks. In such case, an envelop of minimum 100 mm of tamped sand shall be made around the pipe line to avoid any bonding.

In places where rock is encountered, cushion of fine earth or sand shall be provided for a depth of 150mm by excavating extra depth of the trench where

the gradient of the bad slopes is more than 30 depths, it may necessary do and or fine pipe against sliding downwards.

- 4.9.11 **FIXING:** The contractor shall first get the layout for pipe line approved by the Engineer-in-charge as may be required by the bye-laws. The pipe line shall be so fixed / laid as not to expose to the heat or subject to any injury or risk to the pipe. The socket end of the pipe shall be facing up. All the pipes shall be used in standard length as far as possible. Cut length may be used only where it is necessary to make up exact length.

- 4.9.12 **THRUST BLOCK :** Thrust blocks are required to transfer the resulting hydraulic thrust from the fittings of pipe on to a larger load bearing soil section. Thrust blocks shall be installed wherever there is a change in the direction/size of the pipe line or the pressure line diagram, or the pipe line ends at a dead end. If necessary, thrust blocks may be constructed at valves also. Thrust block shall be constructed taking into account the pipe size, water pressure, type of filling, gravity component when laid on slopes and the type of soil. In case of pipe line laid in soft soil, joints/couplings are to be anchored on each side by providing side thrust blocks without restricting the coupling.

Pipes on slopes need be anchored only when there is a possibility of the backfill around the pipe sloping down the hill and carrying the pipe with it. Generally for slopes upto 30 degrees, good, well drained soil carefully damped in layers of 100mm under and over the pipe, right up to the top of trench will not require anchoring.

For steeper slopes, one out of every three pipes shall be held by straps fastened to vertical supports anchored in concrete.

- 4.9.13 **BACK FILLING:** Back filling shall follow the pipe installation as closely as possible to protect pipe from falling boulders, eliminating possibility of lifting of the pipe due to flooding of open trench and shifting pipe out of line by caved in soil.

The soil under the pipe and coupling shall be solidly tamped. The initial back fill material shall be free of large stones and dry lumps.

In bags and Monshers gravel or crushed stone may be used for this purpose. The initial back fill shall be placed evenly in a layer of 100 mm thick and consolidated up to a cushion of at least 300 mm cover over the pipe. Joints shall be taken care to resist the movement of the pipe due to pressure while testing.

- 4.9.14 **TESTING :** After a new pipe has been laid, jointed and back filled (or any valved section thereof), it shall be subjected to the following two tests.
- a) Pressure test at a pressure of at least double the maximum working pressure-pipe and joints shall be absolutely water tight under the test.
 - b) Leakage test (to be conducted after the satisfactory completion of the pressure test) at a pressure to be specified by the authority for a duration of two hours.

Hydrostatic Tests:

Portions of the line shall be tested by subjecting to pressure test as the laying progresses before the entire line is completed. In this way any error of workmanship will be found immediately and can be corrected at a minimum cost. Usually the length of the section to be tested shall not exceed 500 m.

Where any section of a main is provided with concrete thrust blocks or anchorages, test shall not be made until atleast two days have elapsed.

Prior to testing, enough back fill as described in 4.9.12 shall be placed over the pipe line to resist upward thrust. All thrust blocks forming part of the finished line shall have been sufficiently cured and no temporary bracing shall be used.

The open end of the section shall be sealed temporarily with an end cap having an outlet which can serve as an air relief vent or for filling the line, as may be required. The blind face of the end cap shall be properly braced during testing by screw jacks and wooden planks or steel plate. The section of the line to be tested shall be filled with water manually or by a low pressure pump. Air shall be vented from all high spots in the pipe line before making the pressure strength test because entrapped air gets compressed and causes difficulty in raising the required pressure for the pressure strength test.

The test pressure shall be gradually raised at the rate of approximately one kg/ sqcm/ mm. The duration of the test period if not specified shall be sufficient to make a careful check on the pipe line section.

Procedure for pressure test :

Each valved section of the pipe shall be slowly filled with water and all air shall be expelled from the pipe through hydrants and blow offs. If these are not available at high places, necessary tapping may be made at points of highest elevation before the test is made and plugs inserted after the tests have been completed.

If the trench has been partially back-filled, the specified pressure based on the elevation of the lowest point of the line or section under test and corrected to the elevation of the test gauge shall be applied by means of a pump connected to the pipe in a manner satisfactory to the Engineer-in- Charge. The duration of the test shall not be less than 5 minutes.

Examination under Pressure: All exposed pipes, fittings, valves, hydrants and joints should be carefully examined during the open-trench test. When the joints are made with lead, all such joints showing visible leaks shall be recaulked until tight. When the joints are made with cement and show seepage or slight leakage, such joints shall be cut out and replaced as directed by the authority. Any cracked or defective pipes, fittings, valves or hydrants discovered in consequence of this pressure test shall be removed and replaced by sound material and the test shall be repeated until satisfactory to the Engineer-in-Charge.

If the trench has been back-filled to the top, the section shall be first subjected to water pressure normal to the area and the exposed parts shall be

carefully examined. If any defects are found, they shall be repaired and the pressure test repeated until no defects are found. The duration of the final pressure tests shall be at least one hour.

Procedure for Leakage Test:

Leakage is defined as the quantity of water to be supplied into the newly laid pipe, or any valved section thereof, necessary to maintain the specified leakage test pressure after the pipe has been filled with water and the air expelled.

No pipe installation shall be accepted until the leakage is less than the number of cm³/h determined by the formula

$$ql = \frac{ND\sqrt{P}}{3.3}$$

Where ql = the allowable leakage in cm³/h.
 N = number of joints in the length of the pipe line. D =
 diameter in mm, and
 P = the average test pressure during the leakage testing kg/cm².

Variation from Permissible Leakage : Should any test of pipe laid in position discloses leakage greater than that specified in above para., the defective joints shall be repaired until the leakage is within the specified allowance.

4.9.15 DEWATERING : The contract rate shall include bailing or pumping out all the water if accumulated during the progress of the work either from rain, seepage, springs or any other cause.

4.9.16 THE RATE INCLUDES FOR:

1. Supplying spigot and socket or monolithic double flanged CI. Pipe of specified class & diameter.
2. Laying the pipe and cutting the pipe wherever necessary and wastage.
3. Dewatering the Trench or pit if found necessary till completion of work.
4. Fixing the pipe line using M.S. clamps not less than 3 mm thick with wooden gutties etc. if required.
5. Testing the pipe line.
6. All necessary labour, materials and use of tools.

4.9.17 MODE OF MEASUREMENT : The measurement shall be for unit running metre length of pipe line laid or fixed. Measurement shall be taken along the centre line of the pipe deducting outer to outer length of specials.

4.9.18 MODE OF PAYMENT : Contract rate shall be for unit running meter length of pipe line laid or fixed.

4.10 SPECIALS FOR C.I. WATER SUPPLY PIPE LINE:

- 4.10.01 GENERAL :** The item includes supplying cast iron water quality or M.S. specials of specified diameter for C.I. water supply pipe including laying, fixing and painting the specials.
- 4.10.02 MATERIALS:** The specials for cast iron water quality pipe shall be conforming to IS 1538 & 13382 with socket and spigot or monolithic double flanged. All the fittings shall be cylindrical, reasonably true with inner and outer surfaces and nearly concentric as practicable. The outer surface shall be smooth, sound, free from pin holes, cracks and other imperfections. MS. specials shall be made out of M.S. plate of thickness of 6 mm for pipes upto 100mm and 8 mm thick for pipes above 100 mm to 300mm. 10 mm thick for pipe above 300 mm.
- 4.10.03 :** M.S. specials shall be treated with Anticorrosive coating of Bituminous based epoxy coat.
- 4.10.04 CLEANING :** The specials and fittings shall be thoroughly cleaned with brush and washed if necessary to remove any accumulated stone, soil or dirt inside the socket and outside of the spigot.
- 4.10.05 EXAMINING :** Before special is laid, it shall be first examined for damage and cracks. No cracked or damaged pipe shall be used. The pipe shall be tested with a hammer to prove its soundness.
- 4.10.06 DAMAGED MATERIAL :** If any material found damaged or cracked, the same shall not be used in the work. The contractor has to replace the same at his own cost and charges.
- 4.10.07 LOWERING :** The specials shall then be placed in trenches by means of proper sheer legs, chains and other tacks and shall be properly driven home.
- 4.10.08 FIXING :** The specials shall be fixed by means of lead or flanged joint on C.I. Pipe line wherever required and as shown in the drawing or as directed by the Engineer-in-charge.
- 4.10.09 TESTING:** Joints shall be tested to a hydraulic pressure of 10 kg/cm² along with testing of pipe line and shall be maintained for minimum two hours. All leakages, defects etc. shall be rectified.
- 4.10.10 DEWATERING :** The contract rate shall include bailing or pumping out all the water if accumulated during the progress of the work either from rain, seepage, springs or any other cause till the completion of work.
- 4.10.11 THE RATE INCLUDES FOR:**
1. Supplying spigot and socket or monolithic double flanged C.I. or MS. specials.
 2. Fixing the specials wherever necessary.
 3. Dewatering the trench or pit if found necessary till completion of work.
 4. All necessary labour, materials and use of tools.

4.10.12 MODE OF MEASUREMENT : The measurement shall be on the basis of IS 1538 for standard weight of specials and/or on the basis of actual unit weight for fixed specials.

4.10.13 MODE OF PAYMENT : The contract rate shall be on the basis of unit weight.

4.11 LEAD JOINT:

4.11.01 GENERAL : The item includes making lead joints for C.I. water quality pipes and fittings/specials including testing etc.

4.11.02 MATERIAL : Lead shall be conforming to IS 782 and of good quality manufactured by Hindustan zinc or equivalent. Fine hemp yarn shall be the best available in the market.

4.11.03 PREPARATION : Outside of the spigot and inside of the socket shall be thoroughly cleaned with brush. The spigot shall be carefully centred in the socket by one or more laps of spun hemp yarn twisted into ropes of uniform thickness thoroughly soaked in hot coal-tar or bitumen and cooled before use.

4.11.04 POURING : Pouring of lead shall be done by means of ropes covered with clay or by using special leading rings. The lead shall be melted rendering it thoroughly fluid and each joint shall be filled in one pouring.

4.11.05 CAULKING : The caulking shall be carried out with molten lead. Hemp yarn shall be driven into the bottom of the socket and leave the space required. The molten lead shall then be run in sufficient quantity so that after being caulked solid, the lead may project 3 mm beyond the face of the socket against the outside of the spigot, but must be flushed with the outside edge of the socket.

The lead taken from the pot shall be run hot into the joint and the joint filled in one running. The joint shall be caulked well, by a suitable caulking tool and 2 kg hammer and the joint left neat and smooth. In case C.I. fittings are also conforming to the same specification that of pipes, the consumption of lead will be worked out on the basis of actual consumption for each joints.

The following table shows consumption of the weight of lead & yarn per joint as per IS

Nominal Internal Dia in mm :	Spun Yarn Mass In kg.	Lead Mass in Kg.	Depth of Lead joint MM
80	0.17	1.8	45
100	0.23	2.2	45
125		2.6	45
150	0.34	3.4	50
200	0.57	5.0	50
250	0.74	6.1	50
300	0.82	7.2	55
350	1.17	8.4	55
400	1.33	9.5	55
450	1.84	14.0	55
500	1.99	15.0	60
600	2.83	19.0	60
700		22.0	60
750	3.52	25.0	60
800		31.5	65
900	4.25	35.0	65
1000		41.0	65
1100		46.0	65
1200	6.01	52.0	70
1500		66.5	75

NOTE : i) The quantities of lead given are on average basis and a variation of 10 percent is permissible .

ii)Before pipes are jointed on large scale, three or four sample joints shall be made and the average consumption of lead per joint shall be got approved by the Engineer-in-charge.

4.11.06 TESTING : The pipe line after being laid and jointed shall be tested under the supervision of the Engineer-in-Charge. The testing shall be carried out by the contractor at his own cost and charges. Any joint found leaking shall be redone and all leaking pipes removed and replaced without extra cost.

The length of pipes to be tested shall be first filled with water from a higher section of pipe and the test pressure is applied. The test pressure shall be 10 kg per square centimeters and shall be maintained for two hours continuously.

4.11.07 DEWATERING : The contract rate shall include bailing out all the water if accumulated during the progress of the work either from rain, seepage, springs or any other cause till the completion of work.

4.11.08 THE RATE INCLUDES FOR:

1. Pig lead and treated yarn, fuel, wood, etc.
2. Winding the rope on spigot and centering the pipe, caulking, casting molten lead etc.
3. Testing and making good the defective joints.
4. Dewatering the trench or pit till completion of work.
5. All labour, material and use of tools.

4.12 GM GATE VALVE CHAMBER:

4.12.01 GENERAL : The item includes construction of brick masonry valve chamber of size as specified in this schedule including providing M.S./C.I. frame and cover over R.C.C pre-cast cover with or without surface box.

4.12.02 MATERIAL : Brick work, plastering, concreting etc. shall be as per general specification . Precast RCC cover slab, surface box, C.I./M.S frame and cover etc. shall be size and weight as specified in the schedule.

4.12.03 CONSTRUCTION:

- a) Foundation concrete of mix 1:4:8 shall be of 150 mm thick with 150 mm offset around or as specified in the schedule.
- b) Brick masonry in cement mortar 1:4 as specified.
- c) Plastering inside and outside surfaces of walls in two courses using cement mortar 1:3 of thickness as specified mixed with water proofing compound of specified Quality including inner surfaces finished smooth with neat cement punning.

4.12.04 RCC PRECAST/CAST IRON COVERS

4.12.04.1 RCC PRECAST COVER (for chambers of size upto 600 x 600 mm) : Chamber cover shall be cast as shown in the drawing having minimum 75

mm thick in cement concrete 1:2:4 or as specified in the schedule by using nominal reinforcement 100 kg/ Cum of concrete including shuttering, finishing, curing, placing in position etc.

4.12.04.2 CAST IRON/ M.S COVER : Cast iron/M.S cover of specified size and weight shall be supplied and placed over the chamber as directed. The cover shall be painted with 3 coats of black bitumastic paint.

4.12.05 DEWATERING : The water accumulated in the pit due to rain, seepage, springs or any other cause during the progress of work shall be pumped/bailed out till the completion of work.

4.12.06 THE RATE INCLUDES FOR:

1. Bed concrete, Brick masonry, cement plaster, RCC pre-cast cover slab with or without surface box cast /MS cover etc.
2. Dewatering the trench or pit if necessary.
3. All necessary labour, materials and use of tools.

4.12.07 MODE OF MEASUREMENT : The measurement shall be for each unit of valve chamber of specified internal size and depth constructed.

4.12.08 MODE OF PAYMENT : The contract rate shall be for each unit of valve chamber of specified internal size and depth constructed.

4.13 C.I. SLUICE VALVE CHAMBER:

4.13.01 GENERAL : The item includes construction of brick masonry valve chamber of size as specified in this schedule including providing M.S./G.I. frame and cover over R.C.C pre-cast cover with or without surface box.

4.13.02 MATERIAL : Brick work, plastering, concreting etc. shall be as per general specification . Precast RCC cover slab, surface box, C.I./M.S frame and cover etc. shall be size and weight as specified in the schedule.

4.13.03 CONSTRUCTION:

- a) Foundation concrete of mix 1:4:8 shall be of 150 mm thick with 150 mm offset around or as specified in the schedule.
- b) Brick masonry in cement mortar 1:4 as specified.
- c) Plastering inside and outside surfaces of walls in two courses using cement mortar 1:3 of thickness as specified mixed with water proofing compound of specified Quality including inner surfaces finished smooth with neat cement punning.

4.13.04 RCC PRECAST/CAST IRON COVERS

4.13.04.01 RCC PRECAST COVER (for chambers of size above 1000x1000 mm)

Chamber cover shall be coated in minimum three equal parts or more as directed with lifting hooks as shown in the drawing. RCC slab shall be cast

alongwith galvanised MS. angle iron frame with stiffness and anchors made out of the sizes as specified in the schedule. The exposed portion of the angle frame shall be painted with the coats of silver paint over a a coat of primer.

RCC pre-cast slab shall be of 100 mm thick (unless otherwise specified) in cement concrete 1:2:4 of size as specified in the drawing schedule by using nominal reinforcement 100 kg/Cum of concrete including shuttering, curing etc. and shall be placed in position as directed. Cast iron rod surface of prescribed weight shall be fixed to the cover slab during casting the slab for key rod operation.

Rod surface box shall be of size 100x125x150 mm conforming to IS 3950 having hinges and weighting not less than 14 kg. The surface box shall be fixed on top of the RCC cover slab during the casting of slab for key rod operation. The surface box shall be painted with 3 coats of black bitumastic paint.

4.13.04.2 CAST IRON/ M.S COVER : Cast iron/M.S cover of specified size and weight shall be supplied and placed over the chamber as directed. The cover shall be painted with 3 coats of black bitumastic paint.

4.13.05 DEWATERING : The water accumulated in the pit due to rain, seepage, springs or any other cause during the progress of work shall be pumped/bailed out till the completion of work.

4.13.06 THE RATE INCLUDES FOR:

1. Bed concrete, Brick masonry, cement plaster, RCC pre-cast cover slab with or without surface box cast /MS cover etc.
2. Dewatering the trench or pit if necessary.
3. All necessary labour, materials and use of tools.

4.13.07 MODE OF MEASUREMENT : The measurement shall be for each unit of valve chamber of specified internal size and depth constructed.

4.13.08 MODE OF PAYMENT : The contract rate shall be for each unit of valve chamber of specified internal size and depth constructed,

4.14 FLANGES & FLANGED JOINT: (Screwed or welded Flanges)

4.14.01 GENERAL : The item includes supplying flanges and providing flanged joint for G.I./ M.S./ C.I pipes, fittings and specials including testing.

4.14.02 MATERIAL : The CI flanges shall be confirming to IS 3516 or IS 1536. The heavy quality G.I./ MS. flanges shall be conforming to IS 6392 having thickness not less than 20 mm for pipes having diameter beyond 80 mm and 12 mm for pipes having diameter below 80 mm including

drilling holes in new flanges, jointing with the pipe by means of welding or screwed joint. Rubber insertion shall be of three ply not less than 3 mm thick of approved make or fiber board impregnated with chemically neutral mineral oil having smooth & hard surface weighing not less than 112 gm/mm thickness. Bolts, nuts and washers used shall be of good quality.

4.14.03 MAKING JOINT : Flanged joints shall be made by jointing the facing of the flange with the packing of rubber insertion and boiling up evenly on all sides. A thin layer of lead wool shall be provided for making the joints water tight where facing of the pipe is not true. The packing shall be of rubber insertion of three ply and of approved make and thickness. The packing should be of full diameter of the flange with proper pipe hole and bolt hole; cut even at both the inner and outer edges.

4.14.04 DEWATERING : The contract rate shall include bailing or pumping out all the water if accumulated during the progress of the work either from rain, seepage, springs or any other cause till the completion of work,

4.14.05 TESTING : The joints shall be tested along with pipe line after the pipe line is laid and jointed. The testing shall be as per the clause of testing of the pipe line

4.14.06 THE RATE INCLUDES FOR:

1. Cost of flanges, making bolt holes in flanges, supplying rubber insertion, making flanged joint.
2. Testing and making good the defective joints.
3. Dewatering the trench or pit till completion of work.
4. All labour, material and use of tools.

4.14.07 MODE OF MEASUREMENT : The measurement shall be for each unit of flange joint of specified size made with supplying one or two new flanges as specified in the schedule of quantities.

4.14.08 MODE OF PAYMENT: The contract rate shall be for each unit of flange joint made.

4.15 FLEXIBLE PUSH-ON JOINT (TYTON/ RING JOINT)

- 4.15.1 GENERAL :** The item includes push-on joint with rubber ring for C.I. pipes, fittings and including testing.
- 4.15.2 MATERIAL :** Rubber ring shall be moulded or tubular natural or synthetic rubber gasket conforming IS 12820.
- 4.15.3 JOINTING :** The groove and the socket shall be thoroughly cleaned before inserting the rubber gasket while inserting the gasket it shall be made sure that it faces the proper direction and that it is correctly seated in the groove. After cleaning dirt or foreign materials from the plain end, non petroleum lubricant shall be applied in accordance with the pipe manufacturer's recommendations. The plain end of the pipe is pushed into the socket of the pipe and while pushing, the pipe shall be kept straight. If any deflections are to be made in the alignment, it may be made after the joint is assembled. The permissible deflection shall not be exceeded as per IS 3114 for socket and spigot rubber joint is 5 for 80 to 300 mm nom. bore, 43 for 350 to 400 mm nom bore and 33 for 450 to 750 mm nom bore pipe. A timber header shall be used between the pipe and crowbar or jack to avoid damage to the pipe while the plain end of the pipe is pushed into the socket either with a crowbar or jack or lever puller.
- 4.15.4 TESTING :** The joints shall be tested along with pipe line after the pipe line is laid and jointed. The testing shall be as per the clause of testing of the pipe line
- 4.15.5 DEWATERING :** The contract rate shall include bailing out all the water if accumulated during the progress of the work either from rain, seepage, springs or any other cause till the completion of work.
- 4.15.6 THE RATE INCLUDES FOR**
1. Rubber ring, lubricant etc.
 2. Testing and making good the defective joints.
 3. Dewatering the trench or pit till completion of work,
 4. All labour, material and use of tools.
- 4.15.7 MODE OF MEASUREMENT :** The measurement shall be for each unit of rubber ring joint made.
- 4.15.8 MODE OF PAYMENT :** The contract rate shall be each unit of rubber ring joint made,

4.16 C.I. SLUICE VALVE:

- 4.16.01 GENERAL :** The item includes supplying of C.I. Sluice Valve of specified diameter as mentioned in the schedule including fixing.

- 4.16.02 MATERIAL :** The Sluice valve shall be of Class or pressure rating as specified in the schedule of quantities and conforming to I.S. 14846. The valve shall be of cast iron and / or spheroidal iron having non-rising spindle with hand wheel & spindle of stainless steel.
- 4.16.03 FIXING :** The C.I. sluice valve shall be fixed in position as indicated in the drawing or as directed. They shall be fitted with the tail pieces on both sides by means of flange joints.
- 4.16.04 DEWATERING :** The contract rate shall include bailing or pumping out all the water if accumulated during the progress of the work either from rain, seepage, springs or any other cause till completion of the work.
- 4.16.05 TESTING :** The Sluice Valve and the joints shall be tested as per the clause of testing of the pipe line. The testing shall be done along with the pipe line testing.
- 4.16.06 THE RATE INCLUDES FOR:**
1. Supplying and fixing of C.I. Sluice Valve of specified diameter.
 2. Dewatering the trench or pit till completion of work.
 3. All necessary labour, materials and use of tools.
- 4.16.07 MODE OF MEASUREMENT :** The measurement shall be for each unit of Sluice Valve fixed. Tail piece, making flange joint and lead joint shall be measured under the relevant items.
- 4.16.08 MODE OF PAYMENT :** The contract rate shall be for each unit of Sluice Valve fixed.
- 4.17 C.I. NON RETURN VALVE:**
- 4.17.01 GENERAL :** The item includes supplying of C.I. Non-Return Valve of specified size in the schedule of quantities including fixing.
- 4.17.02 MATERIAL :** Non-return valve shall be conforming to IS 9338 or IS 5312 as specified in schedule of quantities. The body, domes, covers, stuffing box, thrust plates, hand wheel, wedges, gland and cap shall be of cast iron not less than of grade FG200 and all in side working parts should be of any non ferrous or ferrous materials such as gun metal. Valve of single door pattern swing type shall have test pressure of PN1.6(50 to 125 mm size), PN1.0 (150 to 300mm size), PNO.6 (350 to 600 mm size) as per IS 5312 (part.1). Valve of multi door pattern swing type shall have test pressure of PN0.6(400 to 1200 mm size), PN1.0 (400 to 1200mm size) as per IS 5312 (part 2). Valve shall be tested for the body and seat and the defective valve shall be replaced by the contractor at his own cost.

- 4.17.03 FIXING :** The C.I. Non-Return valve shall be fixed in position as indicated in the drawing or as directed. They shall be fitted with the tail pieces on both sides by means of flange joints.
- 4.17.04 DEWATERING :** The contract rate shall include bailing or pumping out all the water if accumulated during the progress of the work either from rain, seepage, springs or any other cause.
- 4.17.05 TESTING :** The C.I. Non-Return valve shall be fixed in position shall be tested hydraulically to a minimum pressure as per testing clause of piping work. The testing shall be done along with the testing of pipe line.
- 4.17.06 THE RATE INCLUDES FOR:**
1. Supplying and fixing of C.I. Non-Return Valve of specified dia.
 2. Dewatering the trench or pit till completion of work.
 3. All necessary labour, materials and use of tools.
- 4.17.07 MODE OF MEASUREMENT:** The measurement shall be for each unit of Non-Return Valve fixed. Tail piece, making flange joint and lead joint shall be measured under the relevant items.
- 4.17.08 MODE OF PAYMENT:** The contract rate shall be for each unit of Non-Return Valve fixed.
- 4.18 FOOT-VALVE:**
- 4.18.01 GENERAL :** The item includes supplying of C.I. body. Foot-Valve of specified diameter as mentioned in the schedule including fixing.
- 4.18.02 MATERIAL :** Foot-Valve shall be conforming to IS 4038 and with C.I. body not less than of grade FG200 and strainer with internal gun metal working parts. The valve shall be screwed end (25 to 150 mm size), flanged end (50 to 450 mm size), single disc type (up to 150 mm size), two disc type (exceeding 150 mm size), lift type (up to 100 mm size) The valve shall be tested for housing 0,6 MPa (6 kg/cm²)and for seat 0.2 MPa (2 kg/cm²) for 2 minutes as per IS 4038. The ball type foot valve with nitrile rubber ball and with bronze seat may be used as specified in the schedule of quantities. The defective Foot-Valve shall be replaced by the contractor at his own cost.
- 4.18.03 FIXING :** Foot-valve shall be fixed in position as shown in the drawing or as directed. They shall be fitted by means of flange joints.
- 4.18.04 TESTING :** The C.I. Foot-Valve and the joints shall be tested hydraulically to a minimum pressure as per testing clause of piping work. The testing shall be done along with the testing of pipe line.
- 4.18.05 THE RATE INCLUDES FOR:**
1. Supplying and fixing of C.I. Foot-Valve of specified diameter.
 2. All necessary labour, material and use of tools.

4.18.06 MODE OF MEASUREMENT : The measurement shall be for each unit of Foot-Valve fixed. Tail piece, making flange joint and lead joint shall be measured under the relevant items.

4.18.07 MODE OF PAYMENT : The contract rate shall be for each unit of Foot-Valve fixed.

4.19 AIR VALVE:

4.19.01 GENERAL : The item includes supplying of single, double action or kinetic air Valve of specified diameter as mentioned in the schedule including fixing.

4.19.02 MATERIAL : The Air Valve shall be of heavy quality conforming to IS 14845 with IS certification mark and isolation valve. The body, domes, covers, stuffing box, thrust plates, wedges, gland and cap shall be of cast iron not less than of grade 20 and inside working parts should be of any non-ferrous or ferrous materials.

4.19.03 FIXING : The Air Valve shall be fixed in position as indicated in the drawing or as directed. They shall be fitted by means of flange joints or screwed joint to the pipe line.

4.19.04 TESTING : The Air Valve and the joints shall be tested hydraulically to a minimum pressure as per testing clause of piping work. The testing shall be done along with the testing of pipe line.

4.19.05 THE RATE INCLUDES FOR:

1. Supplying and fixing Air Valve of specified diameter and type.
2. Supplying G.I. pipe and fittings if required.
3. All necessary labour, material and use of tools.

4.19.06 MODE OF MEASUREMENT : The measurement shall be for each unit of Air Valve fixed CI. and G.I. specials, making lead or flange joint etc. shall be measured under the relevant items.

4.19.07 MODE OF PAYMENT: The contract rate shall be for each unit of air valve fixed.

4.20 BUTTER FLY VALVE:

4.20.01 GENERAL : The item includes supplying and fixing of butterfly valve of specified diameter as mentioned in the schedule.

4.20.02 MATERIAL : The butterfly valve shall be flanged type or as specified conforming to IS 13095 & BS - 5155. The valve shall be bubble tight, resilient sealed suitable for flow in either direction with accompanying flanges and steel handle.

- 4.20.03 FIXING :** The butterfly valve shall be fixed to the pipe line in position as indicated in the drawing and as directed by the Engineer-In-Charge.
- 4.20.04 TESTING :** The valve and the joints shall be tested to a minimum hydraulically pressure of 10kg/sqcm for a duration of two hours or as per testing clause of piping work, The testing shall be done along with the testing of pipe line. The leaky joints shall be rectified to the satisfaction of the Engineer-in-Charge.
- 4.20.05 THE RATE INCLUDES FOR:**
1. Supplying and fixing Butterfly Valve of specified diameter.
 2. Supplying G.I. pipe and fittings if required.
 3. All necessary labour, material and use of tools.
- 4.120.06 MODE OF MEASUREMENT :** The measurement shall be for each unit of butterfly Valve fixed. CI. and G.I. specials, making lead or flange joint etc. shall be measured under the relevant items.
- 4.20.07 MODE OF PAYMENT:** The contract rate shall be for each unit of butterfly valve fixed.
- 4.21 STAND POST TYPE FIRE HYDRANT:**
- 4.21.01 GENERAL :** The item includes supplying of C.I. Stand Post type Fire hydrant, C.I. sluice valve etc. including fixing.
- 4.21.02 MATERIAL :** Stand post column shall be fitted with 65 mm size instantaneous male coupling and 80 mm size C.I. duck-foot bend, CI. sluice valve etc.. Stand post hydrant shall conform to the relevant IS code. 80 mm socketed or flanged tail piece shall be as per site requirements. Sluice valve shall conform to the relevant IS code with necessary flanged/lead joints.
- 4.21.03 FIXING :** Hydrant and CI. sluice valve shall be fixed in position as indicated in the drawing or as directed. They shall be fitted by means of flange joints on the pipe line.
- 4.21.04 TESTING :** The Hydrant and the joints shall be tested under the testing clause of pipe line. The testing shall be done along with the testing of pipe line.
- 4.21.05 DEWATERING :** The contract rate shall include bailing or pumping out all the water if accumulated during the progress of the work either from rain, seepage, springs or any other cause.
- 4.21.06 THE RATE INCLUDES FOR:**
1. Supplying and fixing 80 mm dia. stand post column fitted with 65 mm size instantaneous male coupling, C.I. duck-foot bend, CI. sluice valve, making lead/flanged joints etc.
 2. Dewatering the trench or pit till completion of work.

3. All necessary labour, material and use of tools. -

4.21.07 MODE OF MEASUREMENT : The measurement shall be for each unit of stand post hydrant fixed. Tail piece, making additional flange joint, lead joint for extension piece etc. shall be measured under the relevant items.

4.21.08 MODE OF PAYMENT : The contract rate shall be for each unit of stand post hydrant with CI. Sluice valve fixed.

4.22 MAKING CONNECTION WITH WATER MAIN:

4.22.01 GENERAL : The item includes connection with the existing CI or GI water supply line including fittings & fixtures.

4.22.02 MATERIAL : CI or GI specials shall be conforming to relevant IS code and flange joint or lead joint shall be as per specifications described herein before.

4.22.03 MAKING CONNECTION : The connection shall be made with existing C.I. or G.I. water pipe line of specified diameter. The existing water supply pipe line shall be cut or disjointed carefully where the connection is to be made. The connection shall be made with providing C.I. or G.I. specials as per site requirement including making flanged joint or lead joint.

4.22.04 DEWATERING : The contract rate shall include bailing or pumping out all the water if accumulated during the progress of the work either from rain, seepage, springs or any other cause till completion of the work.

4.22.05 TESTING : The connection shall be tested under the testing clause of pipe line. The testing shall be done along with the testing of pipe line.

4.22.06 THE RATE INCLUDES FOR:

1. Cutting, disjointing the CI. or G.I. water supply line.
2. Supplying of CI. or G.I. specials
3. Making flanged joint, lead or screwed joint including providing new flange.
4. Dewatering the trench or pit till completion of the work.
5. All necessary labour, material and use of tools.

4.22.07 MODE OF MEASUREMENT : The measurement shall be for one job making connection with existing water supply line complete in all respect. Including required fittings, fixtures, specials, making flanged joint or lead joint etc. which shall not be measured separately.

4.22.08 MODE OF PAYMENT : The contract rate shall be for one job making connection with existing water supply line complete in all respect. No payment shall be made for any required fittings, fixtures, and specials and making flanged joint or lead joint used in the connection.

5.0 DRAINAGE SYSTEM

5.1 CAST IRON SOIL QUALITY PIPING WORK:

5.1.01 GENERAL: The item includes supplying of soil quality CAST IRON pipe of specified diameter with fittings and fixtures including laying, fixing, cutting, jointing and painting the pipe line.

5.1.02 MATERIAL Cast Iron soil quality pipes and fittings shall have ISI certification mark. Sand -Cast, Cast Iron Soil quality or rain water pipes and fittings shall confirm to IS 1729 and centrifugally cast (Spun Cast) cast iron soil quality pipe shall confirm to IS 3989. All the pipes and fittings shall be cylindrical reasonably true with inner and outer surfaces and nearly concentric as practicable. The outer surface of the pipe and fitting shall be finished well, sound, free from pin hole, cracks and other imperfections. The pipes & fittings shall be treated with solution of Dr. Angus Smith's solution.

The dimensions, weight of Sand-Cast Iron/ Ductile Iron pipes and fittings shall be as per following table of IS 1729 - 2002 or its latest revision.

Tolerance : Mass (-) 5%, thickness (-) —2mm, pipe length (+/-) 20 mm, fitting length (+/-) 10mm

Sr. No.	Nominal Dia	Thickness of wall	Nominal weight for pipes of overall length (L) (Exclusive of ears)								
			2.0 m	1.80M	1.50m	1.20	0.90m	0.75m	0.6m	0.45m	0.3m
			Kg.	Kg.	Kg	Kg.	Kg.	Kg.	Kg.	Kg.	Kg.
1.	50mm	5mm	12.65	11.41	9.56	7.9	6.0	5.1	4.2	3.3	2.4
2.	75mm	5mm	18.37	16.52	13.83	11.5	8.8	7.5	6.1	4.8	3.4
3.	100 mm	5 mm	24.15	21.67	18.14	15.1	11.6	9.8	8.0	6.3	4.5
4.	150 mm	5 mm	35.66	31.92	26.70	22.6	17.3	14.7	12.1	9.5	6.9

The Dimensions, weight of Spun cast pipes and fittings shall be as per following table of IS 3989 - 1984 or its latest revision.

Tolerances: ((a) Thickness (-)15% (b) Weight (-) 10% (C) Length (+ / -) 20 mm) shall as per IS 3989

SN	Nominal Dia.	Thickness	Approximate weight for pipes of overall length (L)				
			3.0 m	2.5 m	2.0 m	1.8 m	1.5 m
			Kg	Kg	Kg	Kg	Kg
1.	50 mm	3.5 mm	13.4	11.3	9.2	8.4	7.1
2.	75 mm	3.5 mm	20.0	16.8	13.8	12.5	10.6
3.	100 mm	4 mm	30.0	25.5	21.0	18.8	16.0
4.	150 mm	5 mm	56.0	47.0	38.5	34.9	29.5

5.1.03 EXAMINING : Before laying the pipe line, it shall be first examined for damages and cracks. No cracked or damaged pipe and fittings shall be used in the work and they shall remove from the site by the contractor at his own cost & charge.

5.1.04 CLEANING : All pipes and fittings shall thoroughly cleaned with brush and washed if necessary to remove any accumulated stone, soil or dirt inside and out side of piping material.

5.1.05 FIXING : The pipe shall be fixed as shown in the drawing. If the holes are not left in parapet, wall, beam, slab, floor, etc., they shall be cut and cavity surrounding the pipe made good properly after fixing the pipe. The pipe shall be fixed with nails and MS. clamps having thickness not less than 3 mm , 20 mm wide or as specified in the schedule with socket facing up.

Spacing between clamps for fixing internal piping shall be as per IS 2065 — 1983 as given below:

Nom.dia of pipe	Horizontal runs	Vertical runs
50 mm	2 M	2 M
80 & 100 mm	2.5 M	2.5 M

The pipe and fitting shall be kept 50 mm away from the wall face to facilitate cleaning and painting etc. For rain water pipe the inlet end shall be carefully fixed to admit water from roof and shoe shall be fixed at outlet. Cowl shall be fixed at top end of the vent pipe.

5.1.06 LAYING : The pipes shall be carefully laid straight to correct alignment in gradients as indicated in the drawing or as directed by the Engineer-in-charge. The socket end of the pipe shall be uphill. All the pipes shall be used in standard length as far as possible. Cut length may be used only where it is necessary to make up exact length. While joining, the spigot shall be neatly placed into the socket for full length and properly supported, The entire length of pipe shall be evenly supported on the

trench bed through out. Care shall be taken to prevent any sand, earth or other materials from entering into the pipes during laying. At the end of days work the open end shall suitably plugged.

No pipe shall be laid until the trench has been excavated to its required depth for a distance of about 5 M in front of the pipe to be laid. No pipe shall be covered until it has been passed by the Engineer-in-charge.

5.1.07

MAKING LEAD JOINT : The spigot shall be carefully centered in the socket by one or more laps of spun hemp yarn twisted into ropes of uniform thickness thoroughly soaked in hot coal-tar or bitumen and cooled before use. The joints shall be made with molten lead and hemp yarn. The lead shall be melted rendering it thoroughly fluid and each joint shall be filled in one pouring. The lead may project 3 mm beyond the face of the socket against the outside of spigot, but must be flushed with the outside edge of the socket.

After the lead has been run into the joint, the lead shall be thoroughly caulked by a suitable caulking tool and 2 Kg hammer and the joint left neat and smooth. The consumption of lead will be worked out on the basis of actual observation at sit. The following table shows consumption of lead and yarn per joint.

DIAMETER OF PIPE (MM)	YARN (in kg.)	LEAD (in kg.)
50	0.06	0.77
80	0.09	0.88
100	0.11	0.98
150	0.18	1.20

5.1.08

TESTING : The pipe line which is laid on the ground or below the ground level, the joints shall be tested with two meter head of water from a higher section of pipe line.

The pipe line fixed vertically on the wall shall be tested by the smoke test. The Greasy cotton waste shall be burnt in a smoke machine consisting of bellows and a burner. If any lead joint is found to be sweating or leaking, the contractor shall rectify the same till water tightness is attained to the full satisfaction of the Engineer-in-charge.

5.1.09

DEWATERING : In case of underground piping, the contract rate shall include bailing or pumping out all the water till completion of work if accumulated during the progress of work either from seepage, springs, rain or any other cause,

5.1.10 THE RATE INCLUDES FOR:

1. Supplying of C.I. soil quality Pipes and fittings, cowl for vent and shoe for rain water pipe of specified diameter with M.S. clamps and nails.
2. Laying, fixing, cutting and joining the pipe wherever necessary and wastage.
3. Making the lead joint including cost of fuel, wood, jointing with lead, spun yarn etc.
4. Fixing the pipe line with MS. clamps not less than 3 mm thick, 20 mm wide and M.S. nails length not less than 60mm and painting the clamps and nails.
5. Supplying and fixing rubber gasket to every cleaning access of cast iron pieces.
6. Painting the pipe line with two coats of black anti corrosive bitumastic paint or painting with synthetic enamel paint over appropriate primer, in case the pipe line exposed in elevation.
7. Testing the pipe line with smoke test or with two meter head of water.
8. Dewatering, if necessary till completion of work.
9. All necessary materials, labour and use of tools.

5.1.11 MODE OF MEASUREMENT : The measurement shall be for unit running meter length of pipe line laid or fixed. The measurement shall be taken along the center line of pipe. No measurement shall be recorded separately for fittings. Making lead joint, painting and testing.

5.1.12 MODE OF PAYMENT : The contract rate shall be for unit running meter length of pipe line laid or fixed.

5.2 UPVC- SWR PIPING WORK:

5.2.01 GENERAL : The item includes supplying of UPVC soil, waste and rain water (SWR) and ventilation pipes with fittings of specified diameter including laying, fixing, cutting, joining, painting if required etc.

5.2.02 MATERIAL : The pipes shall conforming to IS 13592, UPVC - SWR and fittings conforming to IS 13591 shall be free from cracks, flaws and defects and shall be able to withstand a pressure as mentioned in the schedule of work. Rubber sealing rings conforming to IS 5382 with lubricant for sliding socket joints as mentioned in the schedule of work.

5.2.03 EXAMINING : Before laying the pipe line, it shall be first examined for damages and cracks, No cracked or damaged pipe and fittings shall be used

in the work and they shall be removed from the site by the contractor at his own cost and charge.

5.2.04 CLEANING : All the pipes and fittings shall be thoroughly cleaned with brush and washed, if necessary to remove any accumulated stone, soil or dirt inside and out side surfaces.

5.2.05 LAYING : The pipes shall be carefully laid straight to the correct alignment in gradients as indicated in the drawing. All the pipe shall be used in standard length as far as possible. Cut length may be used only where it is necessary to make up exact length.

The entire length of pipe shall be evenly supported on bed of the trench through out. Care shall be taken to prevent any sand, earth or other materials from entering into the pipes during laying. At the end of days work the open end shall be suitably plugged.

5.2.06 FIXING : The pipe line shall be fixed in position as shown in the drawing or as directed by the Engineer-in-charge. The pipe shall be fixed with G.I. clamps not less than 2.0 mm thick or with suitable UPVC clamps/clips, The clamps/clips shall be fixed into the wall with C.I. nails not less than 40 mm long and wooden gutties keeping the pipe about 15 mm clear of the wall.

5.2.07 MAKING JOINT : The jointing of pipes and fittings generally shall be done with approved make cement solvent including making surface rough or rubber sealing rings with lubricant for sliding socket joints . The pipe shall be cut to desired length. Care shall be taken that that profile or cut surfaces shall not be changed and the fibrous material shall be removed with scraper or knife.

5.2.08 DETACHABLE JOINT : Detachable joints shall be made where pipes of different materials have to be jointed or as specified in the schedule. The flanges are first pushed over the pipe ends and jointing shall be made by cement solvent.

5.2.09 PAINTING : In case of underground piping, the pipe line shall be painted with two coats of approved oil paint of matching colour over a coat of primer.

5.2.10 DEWATERING : In case of underground pipes ,the contract rate shall include bailing or pumping out all the water till completion or work if accumulated during the progress of work either from seepage, springs, rain or any other cause.

5.2.11 TESTING : Please see clause no.5.3.10

5.2.12 THE RATE INCLUDES FOR:

1. Supplying of UPVC-SWR pipes and fittings of specified diameter.
2. Laying and cutting the pipe wherever necessary and wastage,

3. Fixing the pipe line with G.I. clamps not less than 2mm thick and G.I./MS. nails length not less than 40mm or with UPVC clamps, screws, wooden gutties etc.
4. Making the solution joint and painting if mentioned in schedule of work the pipe line.
5. In case of underground pipes, dewatering if necessary till completion of work.
6. All necessary materials, labour and use of tools.

5.2.13 MODE OF MEASUREMENT : The measurement shall be for unit running meter length of pipe line laid or fixed. The measurement shall be taken along the center line of pipe. No measurement shall be recorded separately for fittings, making joint, painting if mentioned in schedule of work and testing.

5.2.14 MODE OF PAYMENT : The contract rate shall be for unit running meter length of pipe line laid or fixed.

5.3 HIGH DENSITY POLYETHYLENE PIPING WORK FOR DRAINAGE:

5.3.01 GENERAL : The item includes supplying of HDPE pipes with fittings of specified diameter including laying, fixing, cutting, jointing.

5.3.02 MATERIAL : The pipes and fittings shall conform to IS 14333. HDPE pipes and fittings shall be free from cracks, flaws and defects and shall be able to withstand a pressure as mentioned in the schedule.

5.3.03 EXAMINING : Before laying the pipe line, it shall be first examined for damages and cracks. No cracked or damaged pipe and fittings shall be used in the work and they shall be removed from the site by the contractor at his own cost and charge.

5.3.04 LAYING: Please refer clause 4.4.03

5.3.05 FIXING: Please refer clause 4.4.05

5.3.06 MAKING JOINT: Please refer clause 4.4.06

5.3.07 DETACHABLE JOINT: Please refer clause 4.4.07

5.3.08 ANTISYPHONAGE : The HDPE pipes shall be used for anti-syphonage including provision, cutting, wastage, bending, dressing, jointing with cement solution, necessary plugs, brass fittings such as brass thimbles, brass union, brass cleaning caps and other brass fittings as required.

5.3.09 DEWATERING : In case of underground piping works, the contract rate shall include bailing or pumping out all the water till completion of work if accumulated during the progress of work either from seepage, springs, rain or any other cause

5.3.10 TESTING : The joints shall be tested by either smoke test for vertical stacks or 2.5 m head of water at the highest point of the section under test for horizontal drainage pipes. Smoke shall be pumped into the pipes at the lowest end from a smoke machine which consists of a below and burner .The material usually burnt is greasy cotton waste which gives out a clear pungent smoke which is easily detectable by sight as well as by smell, if there is leak at any point of the drain. The water head test shall be carried out by suitably plugging the lower end of the drain and the ends of the connection if any and filling the system with water. A knuckle bend shall be temporarily jointed to it so as to provide required test head , or the top may be plugged with a connection to a hose ending in a funnel which could be raised or lowered till the required head is obtained and fixed suitable for observation. The leaky joints shall be remade and section re-tested at no extra cost.

5.3.11 THE RATE INCLUDES FOR:

1. Supplying of HDPE pipes and fittings of specified diameter.
2. Laying and cutting the pipe wherever necessary and wastage.
3. Making the solution joint or mirror joint, painting if mentioned in schedule of work
4. Fixing the pipe line with G.I. clamps not less than 20 mm x 1 mm thick and C.I./M.S. nails length not less than 40mm or HDPE clamps, screws, rawl plug etc.
5. In case of underground pipes, dewatering the pit or trench till completion of work.
6. All necessary labour, materials and use of tools.

5.3.12 MODE OF MEASUREMENT : The measurement shall be for unit running meter length of pipe line laid or fixed. The measurement shall be taken along the centre line of pipe. No measurement shall be recorded separately for fitting, making joint, painting if mentioned in schedule of work and testing.

5.3.13 MODE OF PAYMENT : The contract rate shall be for unit running meter length of pipe line laid.

5.4 UPVC PIPING WORK:

5.4.01 GENERAL : The item includes supplying of UPVC pipes with fittings of specified diameter including laying, fixing, cutting, joining, painting etc. for vent, over flow, waste water pipe line etc.

5.4.02 MATERIAL : The pipes and fittings shall conform to series IV of IS

4985, UPVC pipes and fittings shall be free from cracks, flaws and defects and shall be able to withstand a pressure as mentioned in the schedule.

5.4.03 EXAMINING : Before laying the pipe line, it shall be first examined for damages and cracks, No cracked or damaged pipe and fittings shall be used in the work and they shall be removed from the site by the contractor at his own cost and charge.

5.4.04 CLEANING : All the pipes and fittings shall be thoroughly cleaned with brush and washed if necessary to remove any accumulated stone, soil or dirt inside and out side surfaces.

5.4.05 LAYING : Please refer clause 4.5.05

5.4.06 FIXING : Please refer clause 4.5.06

5.4.07 MAKING JOINT: Please refer clause 4.5.07

5.4.08 DETACHABLE JOINT: Detachable joints shall be made where pipes of different materials have to be jointed or as specified in the schedule. The flanges are first pushed over the pipe ends and jointing shall be made by cement solvent.

5.4.09 PAINTING : If mentioned in schedule of work, the pipe line shall be painted with two coats of approved oil paint of matching colour over a coat of primer.

5.4.10 DEWATERING : In case of underground pipes, the contract rate shall include bailing or pumping out all the water till completion or work if accumulated during the progress of work either from seepage, springs, rain or any other cause.

5.4.11 TESTING : The joints shall be tested hydraulically to a pressure as specified in the schedule. The leaky joints shall be remade and section re-tested at no extra cost. The period of test shall be for maximum 2 (two) hours.

5.4.12 THE RATE INCLUDES FOR:

1. Supplying of PVC pipes and fittings of specified diameter.
2. Laying and cutting the pipe wherever necessary and wastage.
3. Fixing the pipe line with G.I. clamps not less than 2mm thick and CI/MS. nails length not less than 40mm or with PVC clamps, screws, wooden gutties etc.
4. Making the solution joint and painting the pipe line, if mentioned in schedule of work.
5. In case of underground piping, dewatering, if necessary till completion of work.
6. All necessary materials, labour and use of tools.

5.4.13 MODE OF MEASUREMENT : The measurement shall be for unit running meter length of pipe line laid of fixed. The measurement shall be

taken along the center line of pipe. No measurement shall be recorded separately for fittings, making joint, painting and testing.

5.4.14 MODE OF PAYMENT : The contract rate shall be for unit running meter length of pipe line laid or fixed.

5.5 GULLY TRAP:

5.5.01 GENERAL : The item includes provision of SW. Gully trap with C.I. frame including construction of Gully Trap Chamber.

5.5.02 MATERIAL : The Gully Trap shall be of salt glazed stoneware with 150 mm nominal square inlet or as specified in the schedule with 100mm diameter outlet. Brick work, plastering, concreting shall be as per general specifications under section-II.

5.5.03 CONSTRUCTION:

1. Internal dimension of the Gully trap chamber shall be as specified in the schedule.
2. Foundation of 1:4:8 concrete shall be 150 mm thick, and shall have 100mm offset.
3. Brick masonry shall be of 230mm thick in cement mortar 1:4 and masonry shall be plastered with 15mm thick plaster in 1:3 cement mortars inside and outside surface with smooth finish.

5.5.04 C.I. FRAME AND COVER : C.I. frame and cover shall be fixed with the cement concrete 1:2:4 at the top of Gully trap chamber, the weight of frame and cover shall not be less than 7.5 kg. and they shall be painted with two coats of black bitumastic paint.

5.5.05 DEWATERING : The contract rate shall include bailing or pumping out all the water till completion or work if accumulated during the progress of work either from seepage, springs, rain or any other cause.

5.5.06 THE RATE INCLUDES FOR:

1. Supplying of stoneware gully trap with C.I. frame and cover.
2. Concreting, brick work, plastering, fixing frame and cover.
3. Dewatering if necessary till completion of work.
4. All necessary materials, labour and use of tools.

5.5.07 MODE OF MEASUREMENT : The measurement shall be for unit of Gully Trap chamber of specified internal size and depth constructed including stoneware Gully Trap and Cl. frame and cover fixed.

5.5.08 MODE OF PAYMENT : The contract rate shall be for unit of Gully Trap chamber constructed as a whole.

5.6 C.I. NAHANI FLOOR TRAP:

5.6.01 GENERAL : The item includes supplying of cast iron nahani / floor trap with CP brass/stainless steel grating of specified diameter with fittings and fixtures including fixing and jointing with the pipe line,

5.6.02 MATERIAL : 65 mm nominal outlet dia C I Nahani trap weighing not less than 4.5 kg with an effective water seal of 20 mm or 75mm nom. outlet dia. floor trap (100mm inlet dia.)/ nahani trap (165mm inlet dia.) conforming to IS 3989 or IS1729 shall be provided as specified in the schedule of quantities. Top grating shall be of CP brass or stainless steel of heavy quality of size and shape to suit the trap.

5.6.03 FIXING : C.I. nahani/ floor trap with the bend and pipe piece shall be fixed in position over the bed of 1:2:4 cement concrete. The jointing trap and pipe shall be caulked with 1:1 cement mortar. The grating shall be fixed over the nahani / floor trap flush with the floor level and the gap finished with matching cement.

5.6.04 THE RATE INCLUDES FOR:

1. C.I . nahani/ floor trap with CP brass or stainless steel grating as specified in the item.
2. Fixing the trap and getting with cement mortar or concrete.
3. All necessary materials, labour and use of tools.

5.6.05 MODE OF MEASUREMENT : The measurement shall be for unit of nahani trap fixed.

5.6.06 MODE OF PAYMENT: The contract rate shall be for unit of nahani trap fixed.

5.7 RAIN WATER GRATING:

5.7.01 GENERAL : The item includes supplying of cast iron grating of specified diameter including fixing and painting.

5.7.02 MATERIAL : The rain water grating shall be Cast Iron with closed grained without any casting defects. The thickness should be uniform throughout, one shaped C.I. grating.

5.7.03 FIXING : C.I. rain water grating shall be fixed in position with 1:1 cement mortar.

5.7.04 THE RATE INCLUDES FOR:

1. The cast iron rain water grating cement, sand etc.
2. Fixing the grating.
3. All necessary materials, labour and use of tools.

5.7.05 MODE OF MEASUREMENT : The measurement shall be for each unit of grating fixed.

5.7.06 MODE OF PAYMENT: The contracts rate shall be for each unit of grating fixed,

5.8 LEAD SHEET FLASHING:

5.8.01 GENERAL : The item includes supplying lead sheet flashing of specified size including laying, fixing, cutting, jointing and laying.

5.8.02 MATERIAL : Lead sheet flashing shall not be less than 3 mm thick & weight should not be less than 38 Kg. per sqm.

5.8.03 FIXING : The lead sheet shall be fixed all around the rain water pipe. The sheet shall project one diameter of socket all-round beyond the outer face of the socket & shall project inside the socket at least half the diameter of the rain water pipe socket. It shall be fixed by bending & breaking the sheet to shape, placing, tucking below waterproofing courses etc.

5.8.04 THE RATE INCLUDES FOR:

1. The lead sheet flashing, cement concrete and cement mortal etc.
2. Fixing the lead sheet in position.
3. All necessary materials, labour and use of tools.

5.8.05 MODE OF MEASUREMENT : The measurement shall be for each unit of lead sheet flashing fixed.

5.8.06 MODE OF PAYMENT : The contract rate shall be for each unit of lead sheet flashing fixed.

5.9 RAIN WATER G.I. SPOUT:

5.9.01 GENERAL : The item include supplying of G.I. rain water spouts of specified diameter with or without fitting at outlet including fixing. Cutting and painting.

5.9.02 MATERIAL : The rain water spout shall be of heavy quality G.I. pipe of approximate 400 mm length or as specified in the schedule of work. The 'T' of same diameter shall be fixed at the outlet of spout. G.I. Pipe and fitting shall be as per specifications.

5.9.03 FIXING : G.I rain water spout shall be fixed in the position as shown in the drawing including breaking, cutting RCC pardi, brick wall, RCC floor etc. It shall be fixed with 1:1 cement mortar and 1:2:4 cement concrete.

5.9.04 PAINTING : The exposed part of spout shall be painted with two coats of approved flat oil paint over a coat of primer.

5.9.05 THE RATE INCLUDES FOR:

1. The G.I. rain water spout, cement concrete and cement mortar.
2. Fixing and painting the spout.
3. All necessary materials, labour and use of tools.

5.9.06 MODE OF MEASUREMENT : The measurement shall be for each unit of C.I. spout fixed.

5.9.07 MODE OF PAYMENT : The contract rate shall be for each unit of G.I. spout fixed.

5.10 RAIN WATER C.I. SPOUT:

5.10.01 GENERAL : The item include supplying of C.I. spouts of specified diameter including fixing, cutting, and painting,

5.10.02 MATERIAL : The spout shall be of heavy quality C.I. pipe of approximate 600 mm long or as specified in the schedule of work. Pipe shall be as per specifications of C.I. piping work.

5.10.03 FIXING : C.I rain water spout shall be fixed in the position including breaking, cutting RCC/ brick structure etc. It shall be fixed with 1:1 cement mortar and 1:2:4 cement concrete.

5.10.04 PAINTING : The exposed part of spout shall be painted with two coats of anticorrosive black bitumastic paint over a coat of primer.

5.10.05 THE RATE INCLUDES FOR:

1. The CI Spout, cement concrete and cement mortar,
2. Fixing and painting the spout.
3. All necessary materials, labour and use of tools.

5.10.06 MODE OF MEASUREMENT : The measurement shall be for each unit of G.I. spout fixed.

5.10.07 MODE OF PAYMENT : The contract rate shall be for each unit of C.I. spout fixed.

5.11 INSPECTION CHAMBER:

5.11.01 GENERAL : The item includes provision of brick masonry Inspection Chamber of internal size as specified in the schedule.

5.11.02 MATERIAL : Concreting, benching ,Brick work, plastering etc, shall be as per specification as given in general specification.

5.11.03 CONSTRUCTION:

1. Internal dimensions and initial depth shall be as specified in the schedule or as shown in the drawing.

2. Foundation of 1:2:4 concrete shall be 150 mm thick and shall have 150 mm offset.
3. The concrete 1:2:4 shall be laid to necessary shapes to form the channel for the pipe being received in the channel. It shall be of appropriate diameter and shall be half round. The sides shall be kept sloping towards the channel.
4. Brick masonry shall be 230 mm thick in cement mortar 1:2 or as specified in the schedule of work, making brick tapering for longitudinal wall 450 mm from top of cover of the chamber.
5. Brick masonry shall be rendered with 20 mm thick plaster in cement mortar 1:3 with water proofing compound or as specified in the schedule of work inside and outside surfaces in two courses and inside surface finished smooth with neat cement punning.

5.11.04 DEWATERING : The contract rate shall include bailing or pumping out all the water, if accumulated during the progress of the work either from rain, seepage, springs or any other cause.

5.11.05 THE RATE INCLUDES FOR:

1. Concreting in foundation, forming the channels, constructing brick masonry and plastering over the brick work, and finishing smooth inside surfaces.
2. Cutting existing stoneware/RCC Flume pipe line to facilitate construction the Inspection chamber.
3. Dewatering the pit, if found necessary till completion of work.
4. All necessary labour, materials and use of tools.

5.11.06 MODE OF MEASUREMENT : The measurement shall be for an Inspection chamber of specified finished internal size and initial depth measured vertically from top of the frame and cover to the invert of chamber. Extra for additional depth or rebate for lesser depth shall be measured in R.M.

5.11.07 MODE OF PAYMENT : The contract rate shall be for unit Inspection chamber of specified internal size and initial depth., Extra/Rebate for additional/lesser depth respectively shall be paid in RM.

5.12 CIRCULAR MANHOLE:

5.12.01 GENERAL : The item includes provision of brick masonry Circular manhole of internal size as specified in the schedule.

5.12.02 MATERIAL : Bottom PCC, shuttering, Concreting with water proofing compound, benching, Brick work, plastering etc. shall be as per specification as given in general specification.

5.12.03 CONSTRUCTION:

1. Internal dimensions and initial depth shall be as specified in the schedule of work or as shown in the drawing.
2. Foundation of 1:2:4 concrete shall be 300 mm thick and shall have 300 mm offset.
3. The concrete 1:2:4 shall be laid to necessary shapes to form the channel for the pipe being received in the channel. It shall be of appropriate diameter and shall be half round. The sides shall be kept sloping towards the channel.
4. CI rungs shall be fixed as per the provisions of IS 5455 for manholes over 0.8m depth.
4. Brick masonry shall be in cement mortar 1:2 or as specified in the schedule of work. One meter height from top shall be conical in shape and shall be constructed in 230 mm thick brick masonry and remaining height shall be 345mm thick in cylindrical shape.
6. Brick masonry shall be rendered with 20 mm thick plaster in cement mortar 1:1 or as specified in the schedule of work inside and outside surfaces in two courses and inside surface finished smooth with neat cement punning.

5.12.04 DEWATERING : The contract rate shall include bailing or pumping out all the water if accumulated during the progress of the work either from rain, seepage, springs or any other cause.

5.12.05 THE RATE INCLUDES FOR:

1. Concreting in foundation, forming the channels, constructing brick masonry and plastering over the brick work and finishing smooth inside surfaces.
2. Cutting existing stoneware/RCC hume pipe line to facilitate construction of new manhole.
3. Dewatering the pit if found necessary till completion of work.
4. All necessary labour, materials and use of tools.

5.12.06 MODE OF MEASUREMENT : The measurement shall be for one circular manhole of specified finished internal size and initial depth measured vertically from top of the frame and cover to the invert of manhole. Extra over for additional depth or rebate for lesser depth shall be measured in R.M.

5.12.07 MODE OF PAYMENT : The contract rate shall be for unit circular manhole of specified internal size and initial depth, Extra/Rebate for additional/lesser depth respectively shall be paid in RM.

5.13 EXTRA DEPTH FOR INSPECTION CHAMBER AND MANHOLE:

5.13.01 GENERAL : The item includes provision for extra depth of Inspection Chamber and manholes of brick masonry.

5.13.02 MATERIAL : Concreting, Brick work, plastering etc. shall be as per specification as given in general specification.

5.13.03 CONSTRUCTION : Extra depth for inspection chamber and manhole shall be constructed under the clause 5.12.00 & 5.13.00 of the Section - 5.

5.13.04 DEWATERING : The contract rate shall include bailing or pumping out all the water if accumulated during the progress of the work either from rain, seepage, springs or any other cause.

5.13.05 THE RATE INCLUDES FOR:

1. Constructing brick masonry and plastering over the brick work.
2. Dewatering the pit if found necessary till completion of work.
3. All necessary labour, materials and use of tools.

5.13.06 MODE OF MEASUREMENT: The measurement shall be for unit meter depth or part thereof for inspection chamber / circular manhole constructed. Depth of manhole or chamber shall be measured from top of the frame and cover to the invert level of manhole deducting the initial depth of at manhole/ chamber. Extra for additional depth or rebate for lessor depth shall be measured in R.M.

5.13.07 MODE OF PAYMENT : The contract rate shall be for unit meter depth of inspection chamber / circular manhole constructed.

5.14 DROP CONNECTION:

5.14.01 GENERAL : The item includes provision of drop connection of salt glazed of nominal diameters as specified in schedule of quantities including 1:2:4 cement concrete encased to pipe all round.

5.14.02 MATERIAL : Concreting, mortar for jointing the pipes, hemp yarn, salt glazed stoneware pipes and specials like bends, tees, crosses (double tees), plugs caps etc. of specified diameter shall be of grade 'A' or 'AA' conforming to IS 651. All the pipes and fitting shall be free from pin Holes, cracks and other imperfections and should have be free from pin holes, cracks and other imperfections and should have the glossy finish in salt glazing, necessary form work for encasing the pipe.

- 5.14.03 DAMAGED MATERIAL :** Any material found damaged or cracked shall not be used in the work and contractor has to replace the same from the site at his own cost and charges.
- 5.14.04 LAYING, FIXING, JOINTING, CLEANING, TESTING :** Above shall be done as specified in clause 5.18.00 i.e. salt glazed stone ware piping work.
- 5.14.05 ENCASING THE PIPE LINE :** After the joints and pipes have been proved to be water tight then pipe line shall be embedded in cement concrete as specified in the schedule of quantities and as shown in drawings including necessary form work.
- 5.14.06 DEWATERING :** The contractor's rate shall include bailing or pumping out all the water, if accumulated during the progress of the work either from rain, seepage, springs or any other cause.
- 5.14.07 THE RATE INCLUDES FOR:**
1. Stone ware pipe with specials viz, bends, tees, crosses (double tees), plugs, caps etc. cement mortar 1:1 and spun yarn
 2. Laying, jointing and testing the pipe line including cutting & wastage
 3. Concreting and formwork for encasing
 4. Dewatering if found necessary till completion of work.
 5. All necessary labour, materials and use of tools.
- 5.14.08 MODE OF MEASUREMENT :** The measurement shall be for one drop connections of specified nominal dia. of pipe & depth of drop connection shall be measured vertically from the bed level of drop pipe cleaning chamber (i.e. finished top of bed concrete) to the invert level of manhole or chamber. Extra/Rebate for additional/lesser than the initial depth respectively shall be measured in RM.
- 5.14.09 MODE OF PAYMENT :** The Contract rate shall be for one drop connection of specified nominal diameter & depth as specified in the schedule & drawings.

5.15 EXTRA OVER DEPTH FOR DROP CONNECTION:

- 5.15.01 GENERAL :** The item includes provision of extra depth for drop connection including providing and laying salt glazed stone ware pipe & specials, 1:2:4 (or as specified in schedule) cement concrete for on casing the pipe al round square in shape all as specified in drawings & schedule.
- 5.15.02 MATERIAL :** Concreting, mortar for jointing the pipes, hemp yarn, salt glazed stoneware pipes and specials of specified diameter shall be of grade 'A' or AA' class and conforming to IS 651-1971. All the pipes and fittings

shall be free from pin holes. Cracks & other imperfection and should have the glossy finish of salt glazing, necessary form work encasing the pipes.

5.15.03 DAMAGE / MATERIALS : This clause shall be as per clause 5.21 salt glazed stone ware piping work.

5.15.04 LAYING, FIXING JOINTING, CLEANING AND FIXING : This clause shall be as per clause 5.21 i.e. salt glazed stone ware piping work.

5.15.05 ENCASING THE PIPE LINE : This clause shall be as per clause 5.15.00 as i.e. Drop connection.

5.15.06 DEWATERING : This clause shall be as per clause 5.15.00 as i.e. drop connection.

5.15.07 THE RATE INCLUDES FOR:

1. SW. pipe with specials, cement mortar 1:1 and spun yarn.
2. Laying, jointing and testing the pipe line including cutting and wastage.
3. Concreting and form work for encasing
4. Dewatering if found necessary till completion of work.

5.15.08 MODE OF MEASUREMENT : The depth of drop connection shall be measured vertically from the bed level of drop pipe cleaning chamber (i.e. finished top of bed concrete) to the invert level of manhole or chamber and initial depth shall be deducted.

5.15.09 MODE OF PAYMENT : Contract rate shall be for unit meter depth or part thereof for drop connection

5.16 DROP PIPE CLEANING CHAMBER:

5.16.01 GENERAL : The item includes construction of brick masonry valve chamber of size as specified in this schedule including providing MS/G.I. frame and cover over R.C.C pre-cast cover with or without surface box.

5.16.02 MATERIAL : Brick work, plastering, concreting etc. shall be as per general specification . Precast RCC cover slab, surface box, C.I./M.S frame and cover etc. shall be size and weight as specified in the schedule.

5.16.03 CONSTRUCTION:

- a) Foundation concrete of mix 1:2:4 shall be of 150 mm thick with 150 mm offset around or as specified in the schedule.
- b) Brick masonry in cement mortar 1:2 as specified.
- c) Plastering inside and outside surfaces of walls in two courses using cement mortar 1:1 of thickness as specified mixed with water proofing

compound of specified Quality including inner surfaces finished smooth with neat cement punning.

5.17 RCC PRECAST/CAST IRON COVERS

5.17.1 RCC PRECAST COVER (for chambers of size upto 600 x 600 mm)
Chamber cover shall be cast as shown in the drawing having minimum 75 mm thick in cement concrete 1:2:4 or as specified in the schedule by using nominal reinforcement @ 100 kg/ Cum. of concrete including shuttering, finishing, curing, placing the cover in position as directed by Engineer-in-charge.

5.17.2 CAST IRON/ MS COVER : Cast iron/ M.S cover of specified size and weight shall be supplied and placed over the chamber as directed. The cover shall be painted with 3 coats of black bitumastic paint.

5.17.3 DEWATERING : The water accumulated in the pit due to rain, seepage, springs or any other cause during the progress of work shall be pumped/bailed out till the completion of work.

5.17.4 THE RATE INCLUDES FOR:

1. Bed concrete, Brick masonry, cement plaster, RCC pre-cast cover / MS cover etc.
2. Dewatering the trench or pit if necessary.
3. All necessary labour, materials and use of tools.

5.17.5 MODE OF MEASUREMENT : The measurement shall be for each unit of chamber of specified internal size and depth constructed.

5.17.6 MODE OF PAYMENT : The contract rate shall be for each unit of chamber of specified internal size and depth constructed.

5.18 C.I. FRAME AND COVER FOR MANHOLES:

5.18.01 GENERAL : The item includes supply LD/MD/HD/EHD/C.I. frame and cover as specified in schedule including fixing and painting.

5.18.02 MATERIAL : C.I. Frame and cover shall conform to IS 1726 and shall have IS certification mark with grade LD/MD/HD/EHD and the weight of frame and cover shall not be less than as specified in the schedule.

5.18.03 FIXING : Frame shall be fixed in the cement concrete 1:2:4 for bearing course and capping on the brick masonry wall of the chamber of manhole and finishing shall be done in 1:2 cement plaster finished smooth with neat cement.

5.18.04 PAINTING : The frame and cover shall be painted with two coats of approved black bitumastic anticorrosive paint over a coat of primer.

5.18.05 THE RATE INCLUDES FOR:

1. C.I. frame and cover, cement concrete, cement plaster, painting etc.
2. All necessary labour, material and use of tools.

5.18.06 MODE OF MEASUREMENT : The measurement shall be for C.I. Frame & cover on actual unit weight basis.

5.18.07 MODE OF PAYMENT: The contract rate shall be for C.I. Frame and cover on actual unit weight basis.

5.19 PRECAST CONCRETE FRAME AND COVER FOR MANHOLES:

5.19.01 GENERAL : The item includes supply LD/ MD/ HD/ EHD factory made precast steel fiber reinforced concrete (SFRC) frame and cover as specified in schedule including fixing and placing.

5.19.02 MATERIAL : The precast frame and cover shall be of steel fiber reinforced concrete (SFRC) conforming to IS 12592 and shall be of approved make. The frame and cover shall be of LD/ MD/ HD/ EHD grade, size and thickness as mentioned in the description of the item. The defective Frame and cover shall be replaced by the contractor at his own cost and charges.

5.19.03 FIXING : Frame shall be fixed in cement concrete 1:2:4 for bearing course & capping on the top of masonry wall of chamber or manhole and finishing shall be done in 1:2 cement plaster finished smooth with neat cement.

5.19.04 THE RATE INCLUDES FOR:

1. Precast S.F.R.C. Frame and cover, cement concrete, cement plaster etc.
2. All necessary labour, material and use of tools.

5.19.05 MODE OF MEASUREMENT : The measurement shall be for unit set of Precast S.F.R.C. Frame and cover fixed.

5.19.06 MODE OF PAYMENT : The contract rate shall be for unit set of Precast S.F.R.C. Frame and cover fixed.

5.20 CAST IRON STEPS / RUNGS:

5.20.01 GENERAL : The item includes supplying of cast iron steps including fixing and Painting

5.20.02 MATERIAL : The steps shall be of cast iron and minimum 150 mm wide. The minimum weight of each step shall not be less than 5 kg or as specified in the schedule.

- 5.20.03 FIXING :** The steps shall be fixed in brick masonry wall. with 1:2:4 cement concrete with 75 mm cement concrete cover at all around the step. The first step shall be 450 mm below from top surface of structure and next shall be fixed 300 mm centre to centre in two rows at 300 mm distance or as shown in the drawing.
- 5.20.04 PAINTING :** The projected portion of the cast iron step shall be painted with two coats of approved black bitumastic anti corrosive paint over a coat of primer.
- 5.20.05 DEWATERING :** The contract rate shall include bailing or pumping out all the water if accumulated during the progress of the work either from rain, seepage, springs or any other cause.
- 5.20.06 THE RATE INCLUDES FOR:**
1. C.I. Steps cement concrete and painting etc.
 2. Dewatering if found necessary till completion of work.
 3. All necessary labour, material and use of tools.
- 5.20.07 MODE OF MEASUREMENT:** The measurement for C.I. steps shall be on actual unit weight basis or unit C.I. step fixed as specified in the schedule.
- 5.20.08 MODE OF PAYMENT :** The contract rate for C.I. steps shall be on actual unit weight basis or unit C.I. step fixed.

5.21 SALT GLAZED STONE WARE PIPING WORK:

- 5.21.01 GENERAL :** The item includes supplying, laying and fixing the salt glazed Stone ware pipes with necessary fittings of specified diameter including laying, jointing etc.
- 5.21.02 MATERIAL :** Salt glazed stoneware pipes and specials of specified diameter shall be of grade "A" or "AA" conforming to IS 651. All the pipes and fitting shall be free from pin holes, cracks and other imperfections and should have the glossy finish of salt glazing.
- 5.21.03 DAMAGED MATERIAL :** Any material found damaged or cracked shall not be used in the work contractor has to replace the same from the site at his own cost and charge.
- 5.21.04 TRENCHES :** The trench shall be so dug that the pipe can be laid to the required alignment and at the required depth. When the pipe line is under road way, a minimum cover of 900 mm is recommended for adoption, but it may be modified to suit local conditions.

Unless otherwise specified by the Engineer-in-Charge, the width at bottom of trenches for different diameters of pipe laid at different depths shall be as given below:-

- a) For all diameters, upto an average depth of 1200 mm, width of trench in mm shall be equal to diameter of pipe plus 300 mm.
- b) For all diameters for depths above of 1200 mm , width of trench in mm shall be equal to the diameter of pipe plus 400 mm
- c) Not withstanding (a) & (b) above, the total width of trench shall not be less than 750 mm for depths exceeding 900 mm.

The width of trench in the upper reaches shall be increased as described in sub head under “Earth Work.”

5.21.05 LAYING AND FIXING : Pipes shall be laid carefully to the correct alignment, levels and gradient and care shall be taken to prevent for entering the sand, earth or other foreign material into the pipes during laying. The pipes between manhole shall be laid truly in straight line, without vertical or horizontal undulations.

All inverts shall be laid from sight rails fixed at the true levels, with proper boning rods, The pipes shall be laid sockets facing up the gradient, alignment at the lower end and with the socket resting in the concrete bed if specified. Each pipes shall be laid singly and no pipe shall be laid until the trench has been excavated up to the required depth for a distance of 5 meter in front of the pipes to be laid.

5.21.06 JOINTING : Spun yarn soaked in cement wash shall be passed round the spigot and spigot inserted in the socket, The spun yarn shall then be caulked with 1:1 cement mortar with a little water, pressed into the joint with hand and finished at 45 degree The mortar shall be cured for seven days.

The following table shows the details of materials used for jointing the SW. pipe.

Internal dia of pipe (mm)	Depth of socket in mm	Depth of yarn in mm	Depth of C.M. paste in mm
100	50	20	44
150	56	30	30
230	65	30	35

5.21.07 CLEANING : Interior surface of the pipes and fittings shall be cleaned off from all dirt, cement mortar and superfluous materials.

5.21.08 TESTING : The joints of S.W. Pipe line shall be tested for a minimum 600 mm water head over the crown of the highest pipe between the two manholes. The lower end shall be plugged water tight. Water shall then

be filled in the inspection chamber or manhole at the upper end of the line with 600 mm depth of water over the crown. If it is found the certain pipe joints are leaking, the water shall be drained off and joints shall be recaulked.

5.21.09 ENCASING THE PIPE LINE : After the joints and pipes have been proved to be water tight then pipe line shall be embedded in cement concrete if specified to the extent of one half of external diameter of the pipes as directed, the concrete being made to slope away towards the sides of the foundations bed. Refilling shall be done with fine selected materials and shall be done in layers not exceeding 150mm thick, watered, consolidated and rammed properly, as specified.

5.21.10 DEWATERING : The contract rate shall include bailing or pumping out all the water if accumulated during the progress of the work either from rain, seepage, springs or any other cause.

5.21.11 THE RATE INCLUDES FOR:

1. SW. Pipes with specials, cement mortar 1:1 and spun yarn.
2. Laying, jointing and testing the pipe line including cutting and wastage.
3. Dewatering if found necessary till completion of work.
4. All necessary labour, materials and use of tools.

5.21.12 MODE OF MEASUREMENT: The measurement shall be for unit meter length of pipe line laid. The pipe shall be measured along the center line over all fittings. The measurement does not include for encasement of the pipe, which will be paid the relevant item.

5.21.13 MODE OF PAYMENT : The contract rate shall be for unit meter SW pipe line laid.

5.22 SEWER TRAP:

5.22.01 GENERAL : The item includes supplying, laying and fixing the Stone ware sewer trap of specified diameter including fixing, jointing and embedding.

5.22.02 MATERIAL : Sewer trap shall be salt glazed of stoneware of specified diameter and shall be of grade "A" or "M" conforming to IS 651. Sewer trap should be free from pin holes, cracks and other imperfections and should have the glossy finish of salt glazing.

5.22.03 DAMAGED MATERIAL : Any material found damaged or cracked shall not be used in the work and contractor ahs to replace the same from the site at his own cost and charge.

5.22.04 FIXING : Sewer trap shall be laid carefully to the correct alignment, levels and gradient and care shall be taken to prevent for entering the sand, earth

or other free material into the trap during laying. The trap shall be on bedded in CC 1:2:4 including necessary form work.

5.22.05 TESTING : The testing shall be done along with the testing of sewer line with the same specification.

5.22.06 DEWATERING : The contract rate shall include bailing or pumping out all the water if accumulated during the progress of the work either from rain, seepage, springs or any other cause.

5.22.07 THE RATE INCLUDES FOR:

1. S.W. sewer trap, cement mortar 1:1 and spun yarn.
2. Laying, jointing on bedding in CC 1:2:4 .
3. Dewatering if found necessary till completion of work.
4. All necessary labour, materials and use of tools.

5.22.08 MODE OF MEASUREMENT: The measurement shall be for each unit of sewer trap fixed.

5.22.09 MODE OF PAYMENT: The contract rate shall be for each unit of sewer trap fixed.

6.0 WATER TANK, SEPTIC TANK, UPFLOW FILTER & SOAK PIT

6.1 FRAME AND COVER:

6.1.01 GENERAL : The item includes supplying of M.S. or C.I. frame with cover of size as specified in the schedule including fixing and painting. The frame and cover shall be of mosquito proof condition and approved by the Engineer Incharge

6.1.02 MATERIAL : The frame and cover shall be of mild steel or cast iron as specified in the schedule. The weight of frame and cover shall not be less than 50 kilograms. They should have locking arrangement.

6.1.03 FIXING : The frame shall be fixed in the roof slab of tank or built with hold fast to R.C.C. slab by chasing or cutting slab and grouting with 1:2 cement mortar.

6.1.04 PAINTING : The frame and cover shall be painted with two coats of approved anti corrosive black bitumastic paint over a coat of approved quality primer.

6.1.05 THE RATE INCLUDES FOR:

1. Supplying and fixing frame and cover with locking arrangement.
2. All necessary materials, labour, painting and use of tools.

6.1.06 MODE OF MEASUREMENT: The measurement shall be on actual unit weight basis.

6.1.07 **MODE OF PAYMENT** : The contract rate shall be for unit weight basis.

6.2 **SPOOL PIECE:**

6.2A **MILD STEEL / CAST IRON:**

6.2A.01 **GENERAL** : The item includes supplying of MS. Spool piece with end coupling or C.I. Spool piece with end flanges of size as specified in the schedule including fixing and painting.

6.2A.02 **MATERIAL** : Spool piece shall be in length 400 mm of G.I. pipe with end coupling or to 600 mm of C.I. spun pipe with end flanges, as specified in the schedule, A mild steel plate of size 3D x 3D or 200 mm x 200 mm whichever is more (where 'D' is the outer diameter of pipe) and shall be welded on the pipe such a way that it can be placed in the center of the RCC wall/ floor. The plate shall not be less than 4 mm thick.

6.2A.03 **FIXING** : The Spool piece shall be fixed in position as shown in the drawing or as directed by the Engineering in charge. The spool piece in RCC wall / floor of water tank / septic tank shall be fixed by making hole in the shuttering and tying it with reinforcement with M.S. wire, all as directed by the Engineer-in-charge.

6.2A.04 **PAINTING** : Projected length of Spool piece shall be painted with two coats of oil paint or anticorrosive black bitumastic paint as specified.

6.2A.05 **THE RATE INCLUDES FOR:**

1. Supplying and fixing of spool piece.
2. All necessary materials, labour, painting and use of tools.

6.2A.06 **MODE OF MEASUREMENT** : The measurement shall be taken for each spool piece of specified diameter fixed.

6.2A.07 **MODE OF PAYMENT** : The contract rate shall be for each spool piece of specified diameter fixed.

6.2B **STAINLESS STEEL:**

6.2B.01 **GENERAL:** The item includes supplying of stainless steel Spool piece with end flanges with required number of bolt holes of size as specified in the schedule & drawings including fixing.

6.2B.02 **MATERIAL** : Spool piece shall be of approximate 600 mm long or standard available length of stainless steel pipe conforming to ASTM A312, TP304/TP304L with end flanges as specified in the schedule. A stainless steel plate of size 3D x 3D or 200 mm x 200 mm, whichever is more (where 'D' is the outer diameter of pipe) and shall be welded on the pipe such a way that it can be placed in the center of the RCC wall/ floor. The plate shall not be less than 4 mm thick. The stainless steel pipe shall be seamless and scheduled / classified / graded as per actual system requirement and as per ANSI B36.19

6.2B.03 FIXING : The spool piece shall be fixed in position as shown in the drawing or as directed by the Engineer-in-charge. The spool piece in RCC wall and floor of water tank shall be fixed by making hole in the shuttering and tying it with reinforcement using M.S, wire, all as directed by the Engineer-in-charge.

6.2B.04 THE RATE INCLUDES FOR:

1. Supplying and fixing of spool piece.
2. All necessary materials, labour and use of tools,

6.2B.05 MODE OF MEASUREMENT : The measurement shall be on total weight / mass basis of pipe pieces, flanges and puddle plate fixed as one unit.

6.2B.06 MODE OF PAYMENT : The contract rate shall be for unit weight of each spool piece fixed.

6.3 OVER FLOW COUPLING:

6.3.01 GENERAL : The item includes supplying of C.P. Brass over flow coupling with mosquito proof jalli of size as specified in the schedule including fixing and painting.

6.3.02 MATERIAL : The overflow coupling shall be of heavy quality. Over flow coupling and Mosquito proof Jalli shall be of C.P. brass.

6.3.03 FIXING : The over flow coupling & jalli shall be fixed in position as shown in the drawing with leak proof joints.

6.3.04 THE RATE INCLUDES FOR:

1. Supplying & fixing Overflow coupling with mosquito proof jalli.
2. All necessary materials, labour, painting and use of tools.

6.3.05 MODE OF MEASUREMENT : The measurement shall be for each Over flow coupling fixed with mosquito proof jalli.

6.3.06 MODE OF PAYMENT : The contract rate shall be for each over flow coupling fixed.

6.4 BALL VALVE:

6.4.01 GENERAL : The item includes providing horizontal type ball valve with PVC or copper float of size as mentioned in the schedule including fixing.

6.4.02 MATERIAL : Horizontal plunger type ball valve with PVC or copper float shall be conforming to IS 1703. The lever shall be of brass and may be made in one piece and the diameter of the lever rod shall not be less than

the diameter of the thread for boss of ball. Float shall be watertight and non-absorbent and shall not contaminate water. Adhesives for joining the part shall not be used. The minimum thickness for copper sheet of copper float shall be 0.45 mm up to 115 mm diameter and 0.55 mm for ball over 115 mm diameter. Valve shall be tested in closed position to the hydraulic pressure of 2 MPa for a minimum period of 2 minutes without leakage and sweating.

6.4.03 MINIMUM MASS : The minimum mass of finished ball valve and float of different size and class shall be as per Table No. 8 of IS 1703.

6.4.04 FIXING : Valve shall be fixed in position as indicated in the drawing with necessary socket, union nuts etc. as per site requirements. A few turns of fine hemp yarn dipped in linseed oil shall be taken over the threaded ends to obtain complete water tight joint. Leaking joint if any shall be rectified to make it leak proof.

6.4.05 TESTING : Testing shall be done along with the testing of pipe line, Separate testing if required shall be done as per ISI norms.

6.4.06 THE RATE INCLUDES FOR:

1. Supply of specified diameter ball valve with copper or PVC float & brass lever arm, hemp yarn, linseed oil, zinc etc.
2. All necessary materials, labour and use of tools.

6.4.07 MODE OF MEASUREMENT : The measurement shall be for each ball valve fixed.

6.4.08 MODE OF PAYMENT: The contract rate shall be for each ball valve fixed.

6.5 RUNGS

6.5.01 GENERAL : The item includes supplying of copolymer polypropylene, steel reinforced plastic foot rests/ Rungs of size as specified in the schedule including fixing and painting

6.5.02 MATERIAL : The Steps shall be of 20 mm size, round or square of copolymer poly propylene, steel reinforced plastic foot rests conforming to ASTM-D4101 or as specified in the schedule of work,

6.5.03 FIXING : The Rungs shall be fixed in position as shown in the drawing or as directed by the Engineer-in-charge. It shall be fixed with cement concrete 1:2:4 in position in stone / brick masonry wall or direct cast to concrete wall. The first step shall be fixed 450 mm below from the top surface of structure and other rungs shall be fixed 300 mm center to center (staggered) as shown in the drawing.

6.5.04 THE RATE INCLUDES FOR:

1. Copolymer steel reinforced rungs, cement concrete etc.
2. All necessary materials, labour and use of tools.

6.5.05 MODE OF MEASUREMENT : The measurement shall be on the basis of unit rung fixed.

6.5.06 MODE OF PAYMENT: The contract rate shall be for unit rung fixed.

6.6 POLYETHYLENE WATER TANK:

6.6.01 GENERAL : The item includes providing polyethylene plastic water tank with cover of capacity as mentioned in the schedule including fixing and making connections such as inlet, outlet, scour, overflow etc.

6.6.02 MATERIAL : The water tank shall be made out of best moulded Polyethylene plastic. It shall be vertical or horizontal type as specified, watertight and non-absorbent and shall not contaminate water. Adhesives shall not be used in joints. The cover shall be of polyethylene / MS. / C.I. as approved.

6.6.03 FIXING : The plastic water tank with cover shall be installed and fixed as per the manufacturer's specification. The connections such as inlet, outlets, over flow, scour etc. of specified diameter shall be made as mentioned in the schedule including the cost of fittings, fixtures and pipe of approximate 400 mm long.

6.6.04 THE RATE INCLUDES FOR:

1. Supply of polyethylene plastic tank, cover, C.I. pipe, fittings etc.
2. Installation of tank and making connections.
3. All necessary materials, labour and use of tools.

6.6.05 MODE OF MEASUREMENT : The measurement shall be for each polyethylene water tank of specified capacity installed or per litre capacity of water tank.

6.6.06 MODE OF PAYMENT : The contract rate shall be for each polyethylene water tank of specified capacity installed. The support for the tank shall be paid under relevant item.

6.7 MEDIA FOR UP-FLOW FILTER:

6.7.01 GENERAL : The item pertains to the provision of Stone aggregate as filter media of specified size for upflow filter as mentioned in the schedule including laying and filling.

6.7.02 MATERIAL : The media of stone aggregate shall be irregular or cubical in shape. They shall be free from thin, elongated and flat pieces. They should have high specific surface area, high percentage void, space, resistance to abrasion or disintegration during placement, insolubility in sewage or other waste water and resistance to spelling and flaking.

6.7.03 LAYING : The filter media made up of stone aggregate ranging from

40 mm to 75 mm in sizes as shown in the drawing and the same shall be placed in different layers starting from bigger sizes to smaller sizes from bottom.

6.7.04 DEWATERING : The contract rate includes bailing or pumping out all the water if accumulated during the progress of work either from rain, seepage, springs or any other cause till completion of the work.

6.7.05 THE RATE INCLUDES FOR:

1. Supplying and laying stone aggregate.
2. Dewatering, if necessary till completion of work.
3. All necessary materials, labour and use of tools.

6.7.06 MODE OF MEASUREMENT : The measurement shall be for unit cubic meter aggregate filled.

6.7.07 MODE OF PAYMENT: The contract rate shall be for unit cubic meter aggregate filled.

6.8 GENERAL SPECIFICATIONS FOR WATER TANK AND SEPTIC TANK:

6.8.01 GENERAL : Construction of water tank, septic tank and up flow filter is required to be done very carefully with good quality materials. Construction of Septic tank shall be according to the provisions of IS 2470. Dense, well compacted concrete of required strength has to be achieved in order to make water tight compartment. The slope in the bed of tank, invert levels of insert, and also the levels of partition and baffle walls should be properly maintained for proper flow of liquid.

6.8.02 TESTING OF WATER TANK AND SEPTIC TANK : After construction of tank, it shall be tested for leak proofness, The tank shall be first filled with water up to the top of wall. The water level should not drop more than 50 mm within 48 hours. If the drop of water level is found more than 50 mm the defective and leakage point shall be rectified to the full satisfaction of the Engineer-in-charge.

6.8.03 COMMISSIONING OF SEPTIC TANK: Before commissioning the septic tank, a little quantity of digested sludge, horse or cow dung may be added as a seed sludge to start functioning of bacterial activity in sewage.

6.8.04 BACK FILLING : The back filling shall be done as per specification after satisfactory testing of the tanks. Back filling shall be done in layers all around the tank and above the roof slab of the tank up to the height / depth as directed by the Engineer-in-charge.

6.8.05 CLEANING OF WATER TANK : The cleaning of the tank shall be done by manually or by Hydro dynamic mechanism with low or high pressure as directed. Potable water, approved disinfectant etc. shall be used for cleaning of water tank before use.

- 6.8.06 DEWATERING :** The contract rate shall include bailing or pumping out all the water if any accumulated during the progress of work either from rain, seepage, springs or any other cause till completion of the work.
- 6.8.07 MODE OF MEASUREMENT :** The work shall be measured under relevant item in the schedule of quantities and paid for. Quoted rates are deemed to include for dewatering, back filling testing and commissioning of water tank, septic tank and up-flow filter.
- 6.8.08 MODE OF PAYMENT :** No additional payments shall be made towards dewatering back filling & commissioning.
- 6.9 HUME PIPE SEPTIC TANK:**
- 6.9.01 GENERAL :** The item pertains to providing Hume pipe septic tank of specified diameter with vent pipe and cap including laying, fixing and making connections. It shall conform to IS 9872.
- 6.9.02 MATERIAL :** The Hume pipe septic tank of specified diameter and capacity with vent pipe and cap. The Hume-pipe septic tank shall be in good condition without any damage and cracks.
- 6.9.03 LAYING AND FIXING :** Hume pipe septic tank shall be fixed in position and level as indicated in the drawing as per the manufacturer's specifications. The pipe joints for connection shall be made in cement mortar 1:1 The vent pipe with cap shall be fixed to the septic tank. Septic tank shall be completely filled with water just before putting into use.
- 6.9.04 DEWATERING :** The contract rate includes bailing or pumping out all the water if accumulated during the progress of work either from rain, seepage, springs or any other cause till completion of the work.
- 6.9.05 THE RATE INCLUDES FOR:**
1. Hume pipe septic tank, vent pipe with cap, cement mortar etc.
 2. Laying Hume pipe septic tank, fixing vent pipe, making inlet pipe connection and filling the tank with water.
 3. Dewatering the pit, if necessary till completion of work.
 4. All necessary labour, material and use of tools.
- 6.9.06 MODE OF MEASUREMENT :** The measurement shall be for each unit of Hume pipe septic tank for specified capacity provided.
- 6.9.07 MODE OF PAYMENT :** The contract rate shall be for each unit of Hume pipe septic tank for specified capacity provided.

6.10 SOAK PIT:

6.10.01 GENERAL : The item pertains to providing Soak pit of specified size as mentioned in the schedule of quantities including filling with brick bats and coarse sand filling around the honey comb brick wall. It shall conform to IS 2470.

6.10.02 MATERIAL : The brick bats shall be from properly burnt bricks and not from over burnt bricks, Coarse sand filling. Brick work and plastering shall be as per general specifications

6.10.03 CONSTRUCTION : Brick masonry shall be in cement mortar and its size and type shall be as specified in the schedule. The pit shall be filled with loosely packed brick bats. The coarse sand shall be filled around the honey comb brick wall of specified thickness.

6.10.04 DEWATERING : The contract rate includes bailing or pumping out all the water. If accumulated during the progress of work either from rain, seepage, springs or any other cause till completion of the work.

6.10.05 THE RATE INCLUDES FOR:

1. Providing all materials required for the construction of soak pit.
2. Dewatering the pit, if necessary till completion of work.
3. All necessary labour, materials and use of tools.

6.10.06 MODE OF MEASUREMENT : All the items shall be measured separately under the relevant items or as specified in the schedule of work.

6.10.07 MODE OF PAYMENT : All the items shall be paid separately under the relevant item or as specified in the schedule of work.

6.11 RCC SPUN PIPE FOR DRAIN WORK:

6.11.01 GENERAL: The item includes supplying. Laying and fixing the RCC spun pipe of specified diameter and class including all necessary fittings, laying, jointing etc.

6.11.02 MATERIAL: NP3 / NP2 class pipe and collar shall comply with IS 458.

6.11.03 LAYING : The pipe shall be laid to lines, level and slope as indicated in the drawing. The pipe drain shall rest on the bed throughout its length. To ensure this the space between under side of the pipe and the invert of the cradle shall be carefully grouted with cement slurry consisting of one part of cement to three parts of clean washed sand in a manner to avoid the voids during grouting. The contractor shall take precautions to see that dirt, earth or other foreign matter is not allowed on the surface of the cradle or of the pipe resting there on.

No pipe shall be laid / placed / jointed till the alignment of the pipe drain and its levels and gradient have been carefully checked and found correct.

- 6.11.04 CONCRETE CRADLE :** The cradle of concrete shall be allowed to set at least for three days before any pipe is placed on it and the contractor shall take due care in setting the pipe on the cradle so that no damage to the cradle shall occur. If any damage to the cradle occurs, it shall be remade or rectified. In case the damage to the cradle is beyond repair, contractor shall cut out the damaged section of the cradle and replace the same at his own cost to the complete satisfaction of the Engineer- In-Charge.
- 6.11.05 JOINTING :** The joints of pipe shall be made by loose collars and the connecting space shall be as minimum as possible. The collars shall be specially roughened inside to provide a better grip. The two adjacent pipe ends will be so designed and manufactured that when butted together concentrically, a dowel shall be left between the two ends. In this dowel, Cement mortar of 1:1 proportion or as specified in the schedule shall be filled. The remaining space between the pipe ends and the collar shall then be caulked with cement mortar 1:1 around the external diameter of the pipes. Every joint shall be finished off smooth at an angle of 45 degree with the longitudinal axis of the pipe of the collars.
- 6.11.06 CLEANING :** The interior of the pipe drains shall be cleaned off from all dirt, cement mortar & superfluous materials
- 6.11.07 TESTING :** The joints of R.C.C. spun pipe line shall be tested for 1.80 meter water head over the crown of the highest pipe between the two manholes. The lower end shall be plugged water tight. Water shall then be filled in the manhole at the upper end of the line with 1800 mm depth of water over the crown.
- The test shall be for an hour or longer as directed by the Engineer-in-charge. If the water level does not fall more than 12 mm in a length of 92 mtr. The test may be considered satisfactory. If it is found that certain pipe joints are leaking, the water shall be drained off and joints shall be remade/recaulked.
- 6.11.08 ENCASING THE PIPE LINE :** After the joints and pipes have been proved to be water tight, the pipe line shall be embedded in cement concrete if specified to the extent of one half of external diameter of the pipes as directed, the concrete being made to slope away towards the sides of the foundation bed, Refilling shall be done with fine selected materials in layers not exceeding 150mm thick, watered, consolidated and rammed properly, as specified.
- 6.11.09 DEWATERING :** The contract rate shall include bailing or pumping out all the water if accumulated during the progress of the work either from rain, seepage or any other cause till completion of the work.
- 6.11.10 THE RATE INCLUDES FOR:**
1. RCC Spun pipe with collar, cement mortar 1:2 and spun yarn.
 2. Laying, jointing and testing the pipe line including cutting and wastage.
 3. Dewatering if found necessary till completion of work.

4. All necessary labour, materials and use of tools.

6.11.11 MODE OF MEASUREMENT : The measurement shall be for length in running meter of pipe line laid and shall be measured along the center line.

6.11.12 MODE OF PAYMENT : The contract rate shall be for unit running meter of pipe line laid. Making the cradles and encasing the pipe line shall be paid under the relevant item.

6.12 GREASE TRAP CHAMBER:

6.12.01 GENERAL : The item includes provision of brick masonry Grease Trap Chamber of internal size as specified in schedule of work.

6.12.02 MATERIAL : Concreting, Brick work, plastering etc. shall be as per specifications given in general specification under section-II.

6.12.03 CONSTRUCTION:

1. Internal dimensions and depth shall be as specified in the schedule of work.
2. 150 mm thick foundation shall be in 1:4:8 cement concrete and shall have 150 mm offset from outer surface of brick wall.
3. Brick masonry shall be in cement mortar 1:
4. Brick masonry shall be plastered with 20 mm thick cement mortar 1:3 inside and outside surfaces in two courses, inside surface finished smooth with neat cement punning.

6.12.04 DEWATERING : The contract rate shall include bailing or pumping out all the water if accumulated during the progress of the work either from rain, seepage, springs or any other cause.

6.12.05 THE RATE INCLUDES FOR:

1. Concreting in foundation, constructing brick masonry and plastering over the brick work.
2. Dewatering the trench or pit if found necessary till completion of work.
3. All necessary labour, materials and use of tools.

6.12.06 MODE OF MEASUREMENT : The measurement shall be for each unit of grease trap chamber of specified internal size and depth constructed.

6.12.07 MODE OF PAYMENT: The contract rate shall be for each unit of grease trap chamber of specified internal size.

C-37: NORMS OF CEMENT CONSUMPTION

1.00.00 GENERAL

1.01.00 For calculating the requirements of cement in various items of work, the following standards shall be adopted. Over the above theoretical quantity of cement, additional allowance upto plus or minus 3% shall also be allowed as certified by the Engineer Incharge.

1.02.00 For items not covered in this standard, CPWD standards shall be followed or calculated as per uses/requirement in absence of standard norms. Cement required for enabling work and cement required for testing purposes will be taken into account for consumption purpose. However, in no case such quantity should exceed 5% of the total cement used in the work or as certified by the Engineer Incharge based on actual observation whichever is less.

Technical requirement of cement for various items of work

Sl. No.	Brief description of item	Unit	Qty of Cement in Kg.	Qty of Cement in Bags
1.	C.C. 1:5:10	Cu.m.	130.0	2.6
2.	C.C. 1:4:8	Cu.m.	170.0	3.4
3.	C.C. 1:3:6	Cu.m.	220.0	4.40
4.	C.C. 1:2:4	Cu.m.	320.0	6.40
5.	R.C.C. 1:2:4	Cu.m.	320.0	6.40
6.	R.C.C. 1:1:5:3	Cu.m.	400.0	8.0
7.	R.C.C. 1:1:2	Cu.m.	610.0	12.20
	* <u>Note:</u> To be mutually agreed based on mix design to be prepared by contractor & approved by the Engineer Incharge plus wastage and all incidentals as decided.			
8.	Brick masonry in C.M, 1:4	Cu.m.	95.0	1.90
9.	Brick masonry in C.M, 1:5	Cu.m.	78.5	1.57
10.	Brick masonry in C.M, 1:6	Cu.m.	62.0	1.25
11.	Half brick masonry in C.M. 1:4 with RCC Stiffeners.	Sq.m.	13.4	0.27
12.	Half brick masonry in C.M. 1:3	Sq.m.	14.3	0.286
13.	Half brick masonry in C.M. 1:4	Sq.m.	10.6	0.21

14.	a) R.R. masonry in C.M. 1:6	Cu.m.	82.5	1.65
	c) Random Rubble Masonry in CM 1:4	Cu.m.	125.5	2.51
	c) C.R. masonry in C.M. 1:6	Cu.m.	78.0	1.56
	d) Coursed Rubble Masonry in CM 1:5	Cu.m.	98.0	1.96

15.	<u>IPS Flooring</u>			
	a) 30mm thick (IPS) cement concrete flooring 1:2:4 with 20mm and down stone chips finished with a floating coat of neat cement	Sq.m.	11.3	0.23
	b) 40mm thick (IPS) cement concrete flooring 1:2:4 with 20mm and down stone chips finished with a floating coat of neat cement	Sq.m.	15.0	0.30
16.	c) 40mm thick (IPS) flooring with base coat 30mm thick 1:2:4 using stone chips 10mm nominal size and 10mm topping coat 1:1 (1 cement : 1 stone chips 3 to 6mm size) with a floating coat of neat cement	Sq.m.	23.2	0.464
	d) Extra for each additional thickness of 5 mm granolithic layer of 1:2:4 for flooring	Sq.m.	0.16	0.0032
17.	Hardonate flooring - 50 mm thick	Sq.m.	20.5	0.41
18.	<u>Kota stone</u>			
	a) Flooring (With lime mortar bedding).	Sq.m.	6.4	0.13
	b) Skirting with C.M. 1:3	Sq.m.	13.7	0.27
	c) Coping	Sq.m.	6.4	0.13
19.	<u>Terrazo Tile</u>			
	a) Flooring (with lime mortar bedding)	Sq.m.	8.8	0.18
	b) Skirting	Sq.m.	13.9	0.28
	c) Treads, hydraulic pressed.	Sq.m.	18.5	0.37

	d) Treads in one piece	Sq.m.	14.1	0.28
	e) Risers, hydraulic pressed	Sq.m.	13.9	0.28
	f) Risers, one piece	Sq.m.	11.7	0.23
20.	<u>Cast in site Terrazo</u>			
	a) Flooring, 40 mm thick	Sq.m.	13.1	0.26
	b) Skirting, 20 mm thick	Sq.m.	12.7	0.25
21.	White glazed tile – flooring & dado	Sq.m.	15.7	0.31
22.	Cement tile			
	a) Flooring (Lime mortar bedding)	Sq.m.	8.8	0.18
	b) Skirting	Sq.m.	13.9	0.28
23.	Plaster skirting, 20mm thick in C.M. 1:3.	Sq.m.	14.5	0.30
24.	Cuddapah stone kitchen platform.	Sq.m.	14.9	0.30
25.	Cuddapah stone window sill	Sq.m.	13.7	0.27
26.	Fixing hold fasts in cement concrete 1:3:6 of size 300 x 100 x 150 mm for doors and windows.	100 nos.	110.0	2.20
27.	Fixing steel windows with 1:2:4 concrete blocks	Sq.m.	400	8.00
28.	Cement plaster in C.M. 1:4 / 1:5/ 1:6			
	A) C.M. 1:4			
	a) 6mm thick	Sq.m.	2.8	0.056
	b) 12 mm thick	Sq.m.	5.5	0.11
	c) 15 mm thick	Sq.m.	6.5	0.13
	d) 20 mm thick	Sq.m.	8.5	0.17
	B) C.M. 1:5			
	a) 12 mm thick	Sq.m.	4.5	0.09
	b) 15 mm thick	Sq.m.	5.5	0.11
	c) 20 mm thick	Sq.m.	7.0	0.14
	C) C.M. 1:6			
	a) 15 mm thick	Sq.m.	4.4	0.088

29.	Cement plaster in c.m. 1:4 in two coat with neat cement punning.			
	a) 15 mm thick	Sq.m.	9.0	0.18
	b) 20 mm thick	Sq.m.	11.00	0.22
30.	Cement plaster in c.m. 1:4, 20 mm thick rough finish.	Sq.m.	8.5	0.17
31.	Sand faced plaster, 20 mm thick.	Sq.m.	10.4	0.21
32.	Rough cost plaster, 25 mm thick.	Sq.m.	13.4	0.27
33.	Cement plaster in c. m. 1:3 with waterproofing compound finished smooth with best cement.			
	a) 12 mm thick	Sq.m.	9.5	0.19
	b) 20 mm thick	Sq.m.	13.6	0.27
34.	Cement pointing in c.m. 1 :3 .			
	a) Ruled pointing	Sq.m.	1.2	0.02
	b) Raised & cut pointing	Sq.m.	1.9	0.04
35.	Cement based waterproofing (M/g. India waterproofing or equivalent).			
	a) Terrace type average 110 mm thick.	Sq.m.	22.5	0.45
	b) Basement type (Box type)	Sq.m.	35.0	0.70
	c) Basement type (surface)	Sq.m.	30.0	0.60
	d) In sunken type floor of toilet, chajjas,, parapets.	Sq.m.	15.0	0.30
	e) Brick bat coba in toilets, extra in roof.	Cu.m.	150.0	3.00
	f) D.H. Water tanks	Sq.m.	25.0	0.50
	g) Expansion joints	Metre	25.0	0.50
36.	Damp proof course in c. c. 1:2:4			

	a) 25 mm thick	Sq.m.	8.0	0.16
	b) 38 mm thick	Sq.m.	12.2	0.24
37.	Laying RCC Spun pipes			
	a) 100 mm dia.	10 mtr	5.0	0.10
	b) 150 mm dia.	10 mtr	6.0	0.12
	c) 250 mm dia	10 mtr	9.0	0.18
	d) 300 mm dia	10 mtr	11.0	0.22
	e) 450 mm dia	10 mtr	24.0	0.48
	f) 600 mm dia	10 mtr	32.0	0.64
38.	Cement mortar 1:4 screed			
	a) 20 mm thick	Sq.m.	7.6	0.16
	b) 50 mm thick	Sq.m.	19.0	0.38
39.	Chain link fencing/barbed wire fencing:			
	a) Angle iron post	Metre	10.5	0.21
	b) With c. c. 1:2:4 posts.	Metre	10.5	0.37
40.	Kerb stone in c .c. 1:3:6	Metre	10.3	0.21
41.	Shah bad stone paving	Sq.m.	1.2	0.02
42.	Pointing & grouting the stone pitching in C.M. :	Sq.m.	7.0	0.14
43.	For manufacture of tiles			
	a) Terrazo tiles 20 mm	Sq.m.	16.5	0.33
	b) Terrazo tiles 25 mm	Sq.m.	20.0	0.40
	c) Cement tiles 20 mm	Sq.m.	15.0	0.30
	d) Terrazo tread 40 mm	Sq.m.	22.5	0.45
44.	Grouting			
	With CM 1:2	Cu.m.	718	14.36
	With CM 1:3	Cu.m.	540	10.80
45.	Cement-sand mortar :-			
	1:1 (1 cement : 1 sand)	Cu.m.	1020	20.4
	1:2 (1 cement : 2 sand)	Cu.m.	680	13.6
	1:3 (1 cement : 3 sand)	Cu.m.	510	10.2
	1:4 (1 cement : 4 sand)	Cu.m.	380	7.6
	1:5 (1 cement : 5 sand)	Cu.m.	310	6.2
	1:6 (1 cement : 6 sand)	Cu.m.	250	5.0

Note:

Brief description of items have been indicated above. The theoretical quantity of cement for various items given above is for the scope of works as described in detail in the respective items of Schedule of Rates.

C-38: DIMENSIONAL TOLERANCE

1.00.00 GENERAL

- 1.01.0 A high standard of workmanship and accuracy shall be achieved in all sections and parts of the work. The workmanship shall be in accordance with the latest and the best civil engineering practice.
- 1.02.0 The Contractor shall ensure that all sections of the work are carried out with utmost care to achieve the dimensions shown in drawings or specifications. In the absence of such specific mention in drawings the following dimensional deviations may be tolerated, provided they do not impair the appearance or render the particular section of work unacceptable to the purpose for which it is intended. Tolerance for materials and workmanship not covered in this part as mentioned hereinafter will be in accordance with the relevant IS code.
- 1.03.0 Tolerance is a specified permissible variation from lines, grade or dimensions given in the drawings. No tolerance specified for horizontal and vertical building lines or footings shall be considered to permit encroachment beyond the legal boundaries. Unless otherwise specified, following tolerances shall be permitted.

Description		Permissible tolerance
Building bricks in length, width & height		: As per IS 1077
Laterite stone, in length, width & height		: ± 5 mm
Natural building stones		
a)For stones required in ashlar masonry	Length, width	: ± 5 mm
	Height	: ± 3 mm
b)For stones required other than in shlar masonry	Length & width	: $+ 5$ mm & -10 mm
	Height	: ± 5 mm
Concrete & Reinforced concrete pipes	Length	: $\pm 1\%$ of standard length
	Internal dia upto 300 mm	: $+ 3$ mm, $- 1.5$ m
Cast iron spigot & socket pipes and fittings	Length of fittings	: ± 10 mm
	Length of pipes	: ± 20 mm
	Thickness	: $- 1$ mm
	Internal dia of socket	: ± 3 mm
	Depth of socket	: ± 10 mm
	External dia upto 75 mm	: ± 3 mm
	100 mm	: ± 3.5 mm
	150 mm	: ± 4 mm
Stone ware pipes	Upto 75 cm dia in length	: ± 10 mm
	Upto 90 cm dia in length	: ± 15 mm
	In thickness of barrel & socket not exceeding 450 mm	: ± 2 mm

	In thickness of berrel and socket between 50 to 600 mm	:	± 3 mm
Glazed tiles	Length of all four sides	:	± 0.8 mm
	Individual dimensions and thickness	:	± 0.5 mm
Metal doors, windows & ventilators	In overall dimensions	:	± 1.5 mm
Wooden doors windows & ventilators	In overall dimensions	:	± 3 mm
All components of shutter except glazing bars	Width	:	± 3 mm
	Thickness	:	± 1 mm
Glazing bars	Width & thickness	:	± 1 mm

Mild steel tubes, tubulars and other wrought steel fittings

	Thickness	Butt welded light tubes	:	+ not limited , - 8 %
		Medium and heavy tubes	:	+ not limited, - 10 %
		Seamless tubes	:	+ not limited, - 12.5 %
	Weight	Single tube (irrespective of the quality)	:	+ 10 %, - 8 %
		For quantity of less than 150 m of one size	:	+ 10 %, - 8 %
		For quantity of 150 m and over of one size	:	+ 4 %, - 4%

Earth work

	Finished level of site leveling in hard rock	:	± 50 mm
	Finished level of site leveling except for hard rock	:	± 100 mm
	Level of pits, trenches and foundations	:	± 50 mm

Concrete & Reinforced concrete

	1.	Plan dimensions	:	+ 50 mm, - 12 mm
		Eccentricity	:	0.02 times the dimension of footing in the direction limited to 50 mm
		Thickness	:	± 0.05 times the specified thickness
	Foundations	Deviation of plane and lines of their intersection from vertical or inclination along full height	:	± 20 mm
		Deviation of horizontal plane from horizontal line	:	
		For 1 m of plane in any direction	:	± 5 mm
		For the whole plane	:	± 20 mm
		Sizes of cross section	:	± 8 mm
		Surface of inserts to support loads	:	± 5 mm
		Length of elements	:	± 20 mm
			:	
	Equipment foundations	Top level of bolts	:	+ 20 mm
		Top level of foundation before grouting	:	- 20 mm
		Axes of anchor bolts in plan	:	± 5 mm
		Axis of foundation in either direction	:	± 10 mm
		Deviation in vertical line along height	:	± 5 mm
		Sizes of pits in plan	:	± 20 mm
		Sizes of steps in plan	:	- 20 mm
		Levels of steps, benches and pits	:	- 20 mm
		Axes of inserts in plan	:	± 10 mm
		Basic dimensions in plan	:	± 10 mm
		Deviation of horizontal plane from horizontal line	:	
		For 1 m of plane in any direction	:	± 5 mm

		For whole plane	:	± 20 mm
		Local deviation of top surface when checked with a 2 m long straight edge	:	± 8 mm
	2.	Surface when checked with a 2 m long straight edge	:	± 8 mm
		Sizes of cross section	:	+ 8 mm, - 0 mm
		Length of elements	:	± 20 mm
		Deviation from horizontal plane for whole building	:	± 10 mm
		verticality	:	1 in 1000 of height
		For columns supporting floor beams	:	± 10 mm
		For frame columns linked with crane girders & beams	:	± 10 mm
	3.	Length	:	± 20 mm
		Flatness of surface when checked with a 2 m long straight edge	:	± 8 mm
		Level of top surface to support assembled elements	:	± 5 mm
		Deviation in planes and lines of intersection from vertical	:	± 15 mm
		Size of cross section	:	± 8 mm
	4.	Length of bar upto 75 cm long (other than straight bars)	:	+ 3 mm, - 5 mm
		75 to 150 cm long	:	+ 5 mm, - 10 mm
		150 to 250 cm long	:	+ 6 mm, -15 mm
		250 cm long and above	:	+ 7 mm, -25 mm
		Straight bars, all lengths	:	± 25 mm

		Spacing bars	:	+ 5 mm
	5.	Shift in location in plan	:	± 5 mm
		Same when bolts are located outside of structural columns	:	+ 10 mm
		Top level	:	± 20 mm
		Threaded length	:	+ 30 mm

Masonry work

		For walls		For pillars
	Width	± 10 mm		± 10 mm
	Shift in axes	± 10 mm		
	Deviation from horizontal line for every 10 m length	± 15 mm		
	Flatness of surface when checked with a 2 m long straight edge	± 10 mm		± 5 mm
	Deviation in lines separating storeys	± 15 mm		± 15 mm
	Deviation of surface from vertical and at angles and corners for 1 storey	± 10 mm		± 10 mm
	For whole building	± 30 mm		± 30 mm
	Dimensions of openings for doors, windows, etc.	+ 15 mm, - 0mm		

Flooring, Skirting, Dado and Plastering

		In situ flooring	:	4 mm
		Concrete tile and mosaic in any 3 m length	:	3 mm

		In large open area	:	15 mm
	Wall tiling	surface should not vary from general plane by more than	:	1 in 200
	Marble and such superior work	In any 2 m length	:	1.5 mm
		In any row	:	3 mm
		Flatness when checked with a 2 m long straight edge	:	3 mm
		Vertical surfaces upto 1 storey	:	5 mm
		Over full height	:	10 mm
Metallic inserts				
	On assembled components	Length & width	:	± 3 mm
Road work				
	The levels of subgrade and different pavement courses should not vary from those calculated with reference to the longitudinal and cross sections of the road as shown on the drawing beyond the tolerance given below:			
		Subgrade	:	± 25 mm
		Sub base	:	+ 20 mm
		Base	:	± 15 mm
		Wearing coat	:	± 6 mm

C-39: LIST OF SUGGESTED MAKES/ BRANDS/ MANUFACTURERS

- 1.01.0 The makes and brands suggested for 'Part - I - Civil Works' are specified in Tender document, available in www.barc.gov.in → Tenders and NITs, → Other Information (Refer Corrigendum No.-12; Annexure 'B'). The suggested makes and brands are merely for guidance purpose. However, the bidder(s) can prefer any other alternate or equivalent makes and brands which is/are meeting the performance parameters and tender specifications by submitting technical details to substantiate their claims. To ensure equal opportunity, fair treatment for all bidders, and to avoid delays during execution of work, the pre-bid clarification stage is the appropriate time to propose alternate or equivalent makes and brands. The department will review these proposals and recognize them in the pre-bid clarification document after verifying the submitted technical details. Any delays after the award of work due to the time taken to convey acceptance or rejection of alternate or equivalent makes and brands suggested by the contractor (if any) will be the contractor's responsibility. Additionally, any extra costs resulting from superior specifications or performance of items or materials will not be payable. Only make and brands that meet the minimum local content as per the Public Procurement (Preference to Make in India) Order 2017 shall be considered for approval.

Additional specifications for civil works

1. Architectural design and development of detailed Architectural drawings. Structural Analysis, Design and development of detailed Structural drawings.

1.1. Scope of work:

1.1.1. Architectural designs and development of detailed drawings consisting of the following: a) development of detailed Architectural drawings, b) Working Drawings, all floor Plans, all Elevations, Sections through both the directions (X&Y), Door & Window Drawings including window grill drawings, detailed toilet drawings, Staircase drawings with railing details, Reflective ceiling plans/ false ceiling plans, Flooring pattern drawings, signages. c) detailed 3D Views indicating elevational details from all sides of buildings including colour schemes, walk through videos. d) Generation of drawings for all connected building elements & services such as structural, Civil finishes, plumbing, sanitary, Electrical installations, and HVAC e) Support in obtaining all necessary statutory clearances from BARC authorities for construction clearance related to architectural aspects, along with documentation work and the supply of six sets (sizes not less than A-1) of all Good for Construction drawings (Please refer SOQ for facility wise work description).

1.1.2. Structural Analysis & Design consisting of the following: a) Detailed Structural Analysis & Design including seismic analysis b) Preparation of detailed structural & Fabrication drawings. c) Obtaining approval for all the analysis & designs documents, drawings from any IIT/ NIT/ IISC/Approved Govt. Engg. College. All the documents/ drawing shall be signed by a person not below the rank of a professor. d) Support in obtaining all necessary statutory clearances from BARC authorities for construction clearance related to structural aspects, along with documentation work and the supply of six sets (sizes not less than A-1) of all Good for Construction structural drawings (Please refer SOQ for facility wise work description).

1.2. Details of Facilities, Inputs provided by BARC, Statutory Clearance Required and Total Built Up Area:

Sr. No.	Building/ facility/ Area Name	Description of Building/ facility/ Area	Inputs Provided by BARC	Support in obtaining the following clearances	Total Built Up Area
1	Fire Station	RCC framed structure with only Ground floor	Partially done Architectural drawings, Design Basis Report (DBR), FEM Model (STAAD Model), Design Report (DR).	(a) DBR: BARC-Design Safety Review Committee, Working Groups at BARC, Mumbai and BARC Mysuru.	1100 Sqm
2	Drill tower	RCC framed structure with Ground+3 floors		(b) FEM Model, Civil DR and GFC drawings: BARC Design Review Teams at Mumbai & Mysuru.	100 Sqm
3	Tank farm areas	Open to sky, chemical storage area with foundations for tanks and underground sumps.	Editable tender drawings	Approval from EIC.	1740 Sqm
4	Vehicle Parking sheds (~8 no's of vehicles & 1 no of fire tender)	Steel Shed	Editable tender drawings	Approval from EIC.	480 Sqm

Note: (a) The areas indicated are tentative with +10% variation. (b) The above-mentioned inputs

will be made available to the bidder only for inspection at the project site (i.e. Special Materials Facility, BARC, DoddUllarthi Kaval, Challakere, Karnataka-577537) during the mentioned tender sale period and bidders, if required can come personally to study the documents/drawings and the same shall not be available on the web site.

- 1.3. The design works shall be complete as per enclosed preliminary tender drawings, required safety class and seismic category, scope of work, specification, schedule of quantities and other provisions detailed in tender documents and as directed by Engineer-In- Charge.
- 1.4. The contractor shall nominate a Structural Engineer with a minimum of five years' experience to act as the nodal technical representative for coordinating design activities at BARC Mumbai, BARC Mysuru, and the project site. The nominated engineer shall be stationed at either Mysuru or Mumbai until all design activities are completed. Additionally, the nominated engineer shall travel to BARC Mumbai, BARC Mysuru, and the project site as required for attending review meetings, providing clarifications, obtaining approvals, and carrying out other related coordination activities.
- 1.5. The works to be carried by the Contractor shall include, but may not be limited to, the items briefly summarized below:
 - 1.5.1. Design and Preparation of architectural drawings at various stages (preliminary (GA)/ working (GFC)) including but not limited to, dimensioned plans, elevations, internal layout, sections, details, schedule of openings, Finishes etc. for individual buildings/ structures.
 - 1.5.2. Preparation and submission of design concept notes along with relevant drawings based on the inputs provided by BARC before initiating the detailed design. This shall include design criteria & procedures, codes & standards, computer software to be used, seismic & safety parameters, regulatory compliance, assumptions etc. All calculations shall be done in S.I./metric units. Codes & standards to be followed shall be as specified by BARC.
 - 1.5.3. Preparation of load list and loading diagram based on the preliminary inputs given by BARC.
 - 1.5.4. Buildings shall be designed for earthquake resistance as per applicable seismic category.

- 1.5.5. Design of RC trenches, and Cable trenches, Machine/equipment foundations, Supports, Embedded Part (EPs), PH and Storm water drains etc. wherever applicable.
- 1.5.6. Tentative Requirement of utility services such as electrical, ventilation, communication, process water, etc. will be provided by BARC. The same shall be incorporation in civil drawings.
- 1.5.7. The contractor shall perform detailed design of civil structure and related items of works. Analysis & Design as per applicable codes for various anticipated loads (Static, Dynamic, Wind etc.) & load combinations shall also be a part of this activity. Static and Dynamic analysis shall be carried out through commercial software such as SAP2000/ MIDAS FEA/ STAAD Pro which are capable to consider soil structure interaction, modal damping, missing mass correction, accidental torsion effects etc.
- 1.5.8. The contractor shall support BARC in obtaining clearances by submission of documents as required and participating in the safety/regulatory review meetings, providing clarifications and updating the designs/details/drawings/documents based on the recommendations of the regulatory authorities.
- 1.5.9. The contractor shall prepare GA, design drawings, loading drawings, Good for Construction drawings as applicable and construction sequence based on the above detailed designs.
- 1.5.10. The contractor shall suggest alternatives, modifications and improvements in structural layout in line with design and detailing requirements.
- 1.5.11. The contractor shall prepare detailed design and drawings of the temporary structures to facilitate the construction of proposed structures.
- 1.5.12. The design life of civil structures is 50 years. The Contractor shall consider in the design measures against degradation caused or accelerated by factors related to exposure to hostile environment.
- 1.5.13. The contractor shall prepare Design Basis Reports (DBRs), design reports (incorporating detailed calculations), in proper format (as given for ref document of fire station) for submission to Regulatory Authorities.
- 1.5.14. All documents and calculation sheet shall be submitted to BARC in editable format without locking of cells/files etc. along with PDF and hard copies.
- 1.6. Mode of Submission:

- 1.6.1. During the process of finalization, acceptance and approval of deliverables, the Contractor shall progressively submit hard and soft copies (editable) for BARC's review and comments. Contractor shall submit two (2) prints and soft copy of each of the documents, as applicable and instructed by BARC. Commented copies of drawings and documents will be returned to Contractor, as the case may be, for incorporation of BARC's comments. In the preparation cycle of documents, a reasonable number of resubmissions of drawings and documents may be necessary based on the quality of the drawing / document prepared and as a result of BARC's comments/ observations on the same.
- 1.6.2. Prior to submission of drawings and documents to BARC, all drawings and documents shall be checked, reviewed and approved by the competent persons of the Contractor. Each drawing or document shall carry the signatures with date, of the persons who have prepared, checked, reviewed and approved the drawings/documents.
- 1.6.3. Signed hard copy of final deliverables such as drawings/documents (1 copy) shall also be submitted after BARC acceptance. The inputs used for preparing / updating the model shall also be compiled and submitted back to BARC in DVDs, pen drives/external hard disks along with hard copy of the list of these drawings. Editable files of all the BARC approved deliverables shall also be provided to BARC.
- 1.6.4. Before submission to BARC the drawings which are complete in all respects, shall be thoroughly checked, stamped Good for Construction (GFC), and signed APPROVED by the Contractor's own responsible Civil/structural graduate (minimum) engineer (irrespective of the fact that the same are prepared in the Contractor's own design office or by an approved agency). Incomplete, unchecked, unsigned and unstamped documents/drawings and designs shall not be accepted for review/ construction and shall be returned forthwith.
- 1.7. Deliverables (Please refer SOQ for facility wise work details).:
- 1.7.1. Architectural drawings & Working Drawings, all floor Plans, all Elevations, Sections through both the directions (X&Y), Door & Window Drawings including window grill drawings, detailed toilet drawings, Staircase drawings with railing details, Reflective ceiling plans/ false ceiling plans, Flooring pattern drawings, signages.

1.7.2. Detailed 3D Views indicating elevational details from all sides of buildings including colour schemes, walk through videos.

1.7.3. Generation of drawings for all connected building elements & services such as structural, Civil finishes, plumbing, sanitary, Electrical installations, and HVAC

1.7.4. Design basis report

1.7.5. Design Report

1.7.6. All Good for construction drawings (Architectural/Structural/Fabrication etc.)

1.8. General:

1.8.1. BARC shall have the right to request in writing for additions, alterations, modifications or deletions in the design and drawing of any part of the work and to request in writing for additional work in connection therewith and the contractor shall comply with such requests without any extra cost. No extra payment shall be made to contractor by BARC on account of such Additions & Alterations as enumerated above.

1.8.2. The scrutiny of the drawing, and designs by BARC does not absolve the contractor of their responsibility under the agreement. The contractor shall remain solely responsible for structural soundness of the design and other services for all provisions of the contract.

1.8.3. All designs and drawings shall be the property of BARC. The name and logo of BARC shall be predominantly displayed on all the drawings and documents.

1.9. Timeline for Submission of Design Activities and Duration for Issuance of Clearances/Comments by Statutory Authority and Engineer-in-Charge (EIC):

Sr. No.	Activity		Timeline	Remarks
1.	Preliminary meeting with all stakeholders from BARC & Contractor		T ₀ +15 Days (T ₀ = Stipulated start date of the contract)	(a) BARC shall share all inputs and formats for the DBR, DR, drawings, etc. with the contractor. (b) By this time, the contractor shall appoint and nominate a Structural Engineer with a minimum of five years' experience to act as the nodal technical representative for coordinating the design activities.
2.	Architectural drawings &	1 st Submission	T ₀ +30 Days	(a) If the submitted DBR and drawings are acceptable, considering the inputs and

	DBR			formats provided by BARC, comments shall be issued by BARC within 7 days of submission. (b) If the quality of the submission is not acceptable, the submission shall be rejected, and the contractor shall be asked to resubmit. The resubmission shall be treated as the first submission. (c) The resubmission shall be made within 7 days of rejection and this delay shall be attributable to the contractor.
		2 nd Submission	T ₀ +44 Days	(a) 2nd Submission shall be made within 7 days of issuing the comments on the 1st Submission. (b) If the comments provided on the 1st submission are fully incorporated, then comments on the second submission shall be issued within 3 days. (d) If the comments provided on the 1st submission are not incorporated, the submission shall be rejected, and the contractor shall be asked to resubmit. The resubmission shall be treated as the 2nd Submission. (c) The resubmission shall be made within 3 days of rejection and this delay shall be attributable to the contractor.
		3 rd Submission	T ₀ +50 Days	(a) 3rd Submission shall be made within 3 days of issuing the comments on the 2nd Submission. (b) If the comments provided on the 2nd Submission are fully incorporated, the submission shall be forwarded to BARC statutory authorities for clearance. Final

				clearance shall be granted within one month of submission. (c) Contractor shall be asked to proceed with for starting activities related to DR & GFC Drawings within 7 days of submission. (d) If the comments provided on the 2nd submission are not incorporated, the submission shall be rejected, and the contractor shall be asked to resubmit. The resubmission shall be treated as the 3rd Submission. (e) The resubmission shall be made within 3 days of rejection and this delay shall be attributable to the contractor.
3.	DR & GFC drawings	1 st Submission	T ₀ +71 Days	(a) If the submitted DR and drawings are acceptable, considering the inputs and formats provided by BARC, comments shall be issued by BARC within 7 days of submission. (b) If the quality of the submission is not acceptable, the submission shall be rejected, and the contractor shall be asked to resubmit. The resubmission shall be treated as the first submission. (c) The resubmission shall be made within 7 days of rejection and this delay shall be attributable to the contractor.
		2 nd Submission	T ₀ +85 Days	(a) 2nd Submission shall be made within 7 days of issuing the comments on the 1st Submission. (b) If the comments provided on the 1st submission are fully incorporated, then comments on the second submission shall be issued within 3 days.

				(e) If the comments provided on the 1st submission are not incorporated, the submission shall be rejected, and the contractor shall be asked to resubmit. The resubmission shall be treated as the 2nd Submission. (f) The resubmission shall be made within 3 days of rejection and this delay shall be attributable to the contractor.
		3 rd Submission	T ₀ +91 Days	(a) 3rd Submission shall be made within 3 days of issuing the comments on the 2nd Submission. (b) If the comments provided on the 2nd Submission are fully incorporated to the satisfaction of EIC, then Construction clearance shall be given within 7 days. (c) Final clearance shall be granted within three months of submission. (d) If the comments provided on the 2nd submission are not incorporated, the submission shall be rejected, and the contractor shall be asked to resubmit. The resubmission shall be treated as the 3rd Submission. (e) The resubmission shall be made within 3 days of rejection and this delay shall be attributable to the contractor.
Note.: (a) The above timeline applies to Fire station and drill tower. (b) For Tank farm areas and parking sheds the date for first activity shall be considered as 'T₀+45 Days' instead of 'T₀+15 Days'. The dates for other activities shall follow at similar intervals. (c) 'T₀' is Stipulated start date of the contract.				

1.10. Mode of Measurement and Payment Terms:

1.10.1. Payment shall be made after receiving approved Good for Construction drawings at construction site.

1.10.2. The mode of measurement shall be on a square meter (sqm) basis, and payment shall be made only for the quantities specified below:

Sr. No.	Building/ facility/ Area Name	Total Area for which payment shall be paid
1	Fire Station	1100 Sqm
2	Drill tower	100 Sqm
3	Tank farm areas	1740 Sqm
4	Vehicle Parking sheds ($\approx$ 8 no's of vehicles & 1 no of fire tender)	480 Sqm
Note: (a) The areas indicated are tentative with +10% variation. However, measurement and payment will be made based on the quantities mentioned above.		

1.11. List of Code/Standards to be Followed

a)	Code of practice for plain & reinforced concrete	IS:456
b)	Code of practice for general construction in steel	IS:800
c)	Code of practice for use of cold formed light gauge steel Structural members in general building construction	IS:801
d)	Dimensions for Hot Rolled Steel Beam, Column, Channel and Angle Sections	IS:808
e)	Code of practice for design loads	IS:875
f)	Criteria for earthquake resistant design of structures (Part 1,2 &4)	IS:1893
g)	Code of practice for structural safety of buildings-Shallow foundations	IS:1904
h)	Code of practice for structural use of unreinforced masonry	IS:1905
i)	Hot Rolled Low, Medium and High Tensile Structural Steel	IS:2062
j)	Recommended practice for hot dipped galvanizing on iron and steel	IS:2629
k)	Code of practice for design & construction of machine foundations	IS:2974
l)	Code of practice for concrete structures for storage of liquids	IS:3370
m)	Specification for Crane Rail sections.	IS:3443
n)	Code of practice for anti-termite measures in buildings	IS:6313

2. Water proofing treatment with integral crystalline water proofing coating / slurry

2.1. General

This Integral crystalline water proofing coating / slurry of hydrophilic in nature is applied to surface of the concrete to water proof and protect the concrete in-depth. It

consists of Portland cement, specially treated quartz sand and a compound of active chemicals. Integral crystalline water proofing coating material needs only to be mixed with water prior to application.

When integral crystalline water proofing material is applied to a concrete surface, the active chemicals react with moisture and the by-products of cement hydration to cause a catalytic reaction that generates an insoluble, crystalline structure. These crystals fill the pores and minor shrinkage cracks in the concrete to prevent any further water ingress (even under pressure). However, integral crystalline water proofing material will still allow the passage of vapor through the structure (i.e. the concrete will be able to “breathe”). Even after the concrete has cured, integral crystalline water proofing material remains dormant in the concrete and will reactivate in the presence of moisture to seal capillary tracts and hairline cracks.

In addition to water proofing the structure, integral crystalline water proofing slurry protects concrete against seawater, wastewater, aggressive groundwater and many other aggressive chemical solutions. Integral crystalline water proofing material is approved for use in contact with potable water and is therefore suitable for use in water storage tanks, reservoirs, water treatment plants, etc.

2.2. Material:

This Integral crystalline water proofing material consists of Portland cement, specially treated quartz sand and a compound of active chemicals.

The water proofing compound used in integral crystalline water proofing treatment shall satisfy all the requirements indicated in relevant standards or as specified in concerned relevant codes etc. and the same shall be got tested and get approved from the Engineer-in-charge before its use.

Technical Specification/ Parameters:

The integral crystalline slurry / coating material of hydrophilic in nature shall confirm to the following requirements:

- i. Dosage as specified in the nomenclature of item or higher as recommended by manufacturer's specification. The material shall fulfill the requirements of American Concrete Institute Guidelines ACI-212- 3R-10 Chapter 15 or European norms EN 934-2-T2 and fall under PRAH (Permeability reducing Admixtures for HYDROSTATIC conditions) and shall be capable of withstanding/resistant to 16 bar hydrostatic pressure and reduce Coefficient of Permeability of concrete by more than 90, when compared to controlled

concrete and tested as per DIN 1048 Part 5 or EN 12390-8 by carrying out 4 cycles each of 5 bar hydrostatic pressure for 72 hours and drying for 48 hours between the cycles. The co-efficient of Permeability calculated as per Darcy's Formula/ Valenta equation by incorporating penetration values obtained at the end of fourth cycle pressure.

- ii. It shall confirm to EN1504-3 (For structural repairs-R3, Compressive Strength >25MPa) supplied from an approved manufacturing unit having CE approval confirming to EN1504-3R3.
- iii. The product has no corrosion effect on reinforcement steel according to test norm DIN V18998. The maximum chloride content less than 0.1%.
- iv. The Integral Crystalline Slurry must be capable of self-healing of cracks up to a width of 0.5mm.
- v. The crystalline water proofing coating/slurry, when used in the concrete, will have no detrimental side effects in terms of Alkali Silica Reaction (ASR), corrosion of Steel Reinforcement etc.
- vi. The product performance shall not be affected by wear abrasion of the treated concrete surface and crystalline treated concrete shall not require protection layer.
- vii. The crystalline water proofing coating/slurry shall be non toxic and suitable for use in potable water facilities- NSF listed as per ANSI 61 listing or DVGW-W347, Germany or equivalent and a declaration of performance certificate supervised by a reputed European/US third party.
- viii. The manufacturer shall submit guarantee in respect of crystalline water proofing coating/slurry performance for 10 years against any leakage.

Note: The manufacturer shall submit test certificates in respect of all above said specifications/ parameters of Integral Crystalline water proofing slurry material from reputed National/International laboratories as per relevant codes. Total quantity of the Integral Crystalline water proofing slurry material required shall be arranged at site of work only after obtaining the prior approval of the Engineer-in-Charge in writing. The proper account of water proofing compound used in the work shall be maintained. It shall be ensured that the consumption of the compound is as per specified requirements. The Contractor shall associate himself with anyone of the

applicator of water proofing compound duly approved by the Engineer-in-Charge before start of work relating to the water proofing treatment.

2.3. Preparation of surface

All concrete to be treated with integral crystalline water proofing slurry material must be clean and have an “open” capillary surface. Remove laitance, dirt, grease, etc. by means of high pressure water jetting, wet sand blasting or wire brushing. Faulty concrete in the form of cracks, honeycombing, etc. must be chased out, treated with the same material and filled flush with the mortar mixture as specified by the manufacturer. Surface must be carefully pre-watered prior to the application of integral crystalline water proofing material. The concrete surface must be damp but with no wet sheen on the surface.

2.4. Mixing

Integral crystalline water proofing slurry / coating material should be mechanically mixed with clean water to a creamy consistency resembling to thick oil. Only that much material should be mix as can be used within 20 minutes and mixture should be stirred frequently. The mixture should not be allowed to set, if it happens, simply re-stir to restore workability but no more water should be added to it. The ratio of integral crystalline water proofing material with water should be as below

- (i) Vertical surface: - For applying with brush the mixing ratio shall be 5 parts of integral crystalline water proofing coating material to 2 parts of water.
- (ii) Horizontal surface: - The ratio should be 3 parts of Integral Crystalline water proofing coating material to 1 part of water. This should be applied by brush only

2.5. Application Procedure

The slurry mix of the Integral Crystalline water proofing slurry material shall be applied in one or two coats as specified/ required according to work situation in the item. After preparation of surface as described in above, and making the surface saturated with water before application of Crystalline Slurry, then first coat of the slurry mix shall be applied by the brush or appropriate power spray equipment. The second coat as specified shall be applied while the first coat is still green.

The other method of application known as dry powder consistency can also be applied on horizontal surfaces only. The specified amount of integral crystalline water proofing material is distributed in powder form through a sieve or a semi mechanical barrow spreader and troweled into the freshly placed concrete as this reaches the initial set.

The integral crystalline water proofing material to be used shall be as following:-

- (i) Vertical surface: - Two coats of integral crystalline water proofing material slurry coat shall be applied @ of 0.70 kg per sqm. per coat or more as specified by the manufacturer specification.
- (ii) Horizontal surface: - One coat of integral crystalline water proofing material slurry coat shall be applied @ of 1.10 kg per sqm or more as specified by the manufacturer specification to harden concrete. Alternatively integral crystalline water proofing material mix can be dry sprinkled @ of 1.10 kg per sqm and trowel applied to fresh concrete when it has reached initial set.
- (iii) Construction joint: - Integral crystalline water proofing material mix shall be applied either as slurry coat or dry powder consistency immediately prior to placing the next lift/ bay of concrete @ 1.60 kg per sqm. or more as specified by the manufacturer specification.
- (iv) Binding concrete: - Integral crystalline water proofing material mix shall be applied either as slurry coat or dry powder consistency immediately prior to placing the overlying concrete slab.

2.6. Curing

The treated surfaces should be kept damp for a period of five days and must be protected against direct sun, wind and frost, by covering with polyethylene sheeting, damp burlap or similar material.

2.7. Precaution / Special Consideration

Do not apply Integral Crystalline Slurry at temperatures at or below freezing or to frozen or freezing surfaces. Integral Crystalline slurry cannot be used as an additive to concrete or plasters. (Integral Crystalline Admixture should be considered for these applications).

2.8. Storage / Shelf Life

When properly stored in a dry place in unopened and undamaged original packaging its self life is one year.

2.9. Measurement The Length & breadth/height of the coated area by Integral Crystalline slurry shall be measured in metre correct to two places of decimal. Measurement shall be made in sqm of the area.

2.10. Rate The rate shall include the cost of all the labour, material and equipments involved in all the operations described above.

3. Kerb stone (precast)

3.1. Laying

Trenches shall first be made along the edge of the wearing course of the road to receive the kerb stones of cement concrete of specified grade. The bed of the trenches shall be compacted manually with steel rammers to a firm and even surface and then the stones shall be set in cement mortar of specified proportion.

The kerb stones with top 20 cm. wide shall be laid with their length running parallel to the road edge, true in line and gradient at a distance of 30 cm. from the road edge to allow for the channel and shall project about 12.5 cm. above the latter. The channel stones with top 30 cm. wide shall be laid in position in chamber with finished road surface and with sufficient slope towards the road gully chamber. The joints of kerb and channel stones shall be staggered and shall be not more than 10 mm. Wherever specified all joints shall be filled with mortar 1:3 (1 cement : 3 coarse sand) and pointed with mortar 1:2 (1 cement: 2 fine sand) which shall be cured for 7 days.

The necessary drainage openings of specified sizes shall be made through the kerb as per drawings or as directed by the Engineer-in-Charge for connecting to storm water drains.

3.2. Finishing

Berms and road edges shall be restored and all surplus earth including rubbish etc. disposed off as directed by the Engineer-in-charge. Nothing extra shall be paid for this.

3.3. Measurements

It shall be measured in cubic meters with Length of the finished work (for specified width and height of stone) shall be measured in running metre along the edge of the road correct to a cm.

3.4. Rate

The rate shall include the cost of all the materials and labour involved in all the operations described above.

4. **Concertina coil fencing**

4.1. Material: Angle iron post & strut shall be as specified in respective items. Concertina coil fencing shall be dia 610 mm (having 15 nos round per 6 mtre. length), spring core (2.5 mm thick) wire of high tensile strength of 165 kg./sq.mm with tape (0.52 mm thick) and weight 43.478 gm/metre.

4.2. Measurements The length of fencing shall be measured correct to a cm. for finished work.

5. **Welded steel wire fabric fencing**

- 5.1. Materials: Posts and struts shall be as specified in the drawings/specification. Welded steel wire fabric will conform to IS 4948 and shall be of rectangular mesh 75×25 mm size weighing not less than 7.75 kg/sqm.
- 5.2. Finishing The steel wire fabric shall be painted with two or more coats of approved shade of enamel paint over a coat of steel primer as for new work.
- 5.3. Measurements: Fencing to be measured in square metre correct to two places of decimal after taking length and width of the finished work in metre.

6. Galvalume sheet roofing

6.1. Sheets

The sheets shall confirm to IS 15961 - YS 350 (Grade)- AZ150 / AZ200, unless otherwise specified in the description of item. These shall be of the thickness specified in the description of the item. The sheets shall be free from cracks, split edges, twists, surface flaws etc. They shall be clean, bright and smooth. The sheets shall be non-injured and shall be in perfect condition. The sheets shall not show signs of rust or white powdery deposits on the surface. The corrugations shall be uniform in depth and pitch and parallel with the side.

6.2. Purlins

Purlins of the specified material or M.S. rolled sections of requisite size shall be fixed over the principal rafters. These shall not be spaced at more than the following distances. (refer Table 12.1 of CPWD specification-2019)

The top surfaces of the purlins shall be uniform and plane. They shall be painted before fixing on top. Embedded portions of wooden purlins shall be coal tarred with two coats.

6.3. Slope

Roof shall not be pitched at a flatter slope than 1 vertical to 5 horizontal. The normal pitch adopted shall usually be 1 vertical to 3 horizontal.

6.4. Laying and Fixing

- 6.4.1. The sheets shall be laid and fixed in the manner described below, unless otherwise shown in the working drawings or directed by the Engineer-in-Charge.
- 6.4.2. The sheets shall be laid on the purlins to a true plane, with the lines of corrugations parallel or normal to the sides of the area to be covered unless otherwise required as in special shaped roofs.
- 6.4.3. The sheets shall be laid with a minimum lap of 15 cm at the ends and 2 ridges of corrugations at each side. The above minimum end lap of 15 cm shall apply to

slopes of 1 vertical to 2 horizontal and steeper slopes. For flatter slopes the minimum permissible end lap shall be 20 cm. The minimum lap of sheets with ridge, hip and valley shall be 20 cm measured at right angles to the line of the ridge, hip and valley respectively. These sheets shall be cut to suit the dimensions or shapes of the roof, either along their length or their width or in a slant across their lines of corrugations at hips and valleys. They shall be cut carefully with a straight edge chisel to give a smooth and straight finish.

6.4.4. Sheets shall not generally be fixed into gables and parapets. They shall be bent up along their side edges close to the wall and the junction shall be protected by suitable flashing or by a projecting drip course, the later to cover the junction by at least 7.5 cm.

6.4.5. The laying operation shall include all scaffolding work involved.

6.4.6. Sheets shall be fixed to the purlins or other roof members such as hip or valley rafters etc. with galvanised J or L hook bolts and nuts, 8 mm diameter, with bitumen and G.I. limpet washers or with a limpet washer filled with white lead or as directed by the Engineer-in-Charge. The length of the hook bolt shall be varied to suit the particular requirements.

The bolts shall be sufficiently long so that after fixing they project above the top of the nuts by not less than 10 mm. There shall be a minimum of three bolts placed at the ridges of corrugations in each sheet on every purlin and their spacing shall not exceed 30 cm. Coach screws shall not be used for fixing sheets to purlins.

6.4.7. The galvanised coating on J or L hooks, and bolts shall be continuous and free from defects such as blisters, flux stains, drops, excessive projections or other imperfections which would impair serviceability.

The galvanised coating should conform to IS 1367 (Pt. XIII). The mass of coating per square meter of the surface shall be as under:

Minimum Mass (g/m²): 375

Average Thickness (µm): 54

Minimum Mass (g/m²): 300

Individual Thickness (µm): 43

6.4.8. Where slopes of roofs are less than 21.5 degrees (1 vertical to 2.5 horizontal) sheets shall be joined together at the side laps by galvanised iron bolts and nuts 25 × 6 mm size, each bolt provided with a bitumen and a G.I. limpet washer or a G.I. limpet washer filled with white lead. As the overlap at the sides extends to two

corrugations, these bolts shall be placed zig-zag over the two overlapping corrugations, so that the ends of the overlapping sheets shall be drawn tightly to each other. The spacing of these seam bolts shall not exceed 60 cm along each of the staggered rows. Holes for all bolts shall be drilled and not punched in the ridges of the corrugations from the underside, while the sheets are on the ground.

6.5. Wind Tie

Wind ties shall be of 40 x 6 mm flat iron section or of other size as specified. These shall be fixed at the eaves of the sheets. The fixing shall be done with the same hook bolts which secure the sheets to the purlins. The ties shall be paid for separately unless described in the item of roofing.

6.6. Finish

The roof when completed shall be true to lines, and slopes and shall be leak proof.

6.7. Measurements

6.7.1. The length and breadth shall be measured correct to a cm. Area shall be worked out in sqm correct to two places of decimal.

6.7.2. The superficial area of roof covering shall be measured on the flat without allowance for laps and corrugations. Portion of roof covering overlapping the ridge or hip etc. shall be included in the measurements of the roof.

6.7.3. No deduction in measurement shall be made for opening upto 0.4 sqm and nothing extra shall be allowed for forming such openings. For any opening exceeding 0.4 sqm in area, deduction in measurements for the full opening shall be made and in such cases the labour involved in making these openings shall be paid for separately. Cutting across corrugation shall be measured on the flat and not girthed. No additions shall be made for laps cut through.

6.8. Rate

The rate shall include the cost of all the materials and labour involved in all the operations described This includes the cost of roof sheets, self-drilling / self-tapping screws of size (5.5 X 55 mm) with EPDM seal or with polymer coated J or L hooks, bolts and nuts 8 mm diameter with bitumen and G.I. limpet washers cost of scaffolding work, bituminous and galvanised iron limpet washers etc.

7. **Polyethylene water storage tanks**

7.1. Material

Polyethylene used for manufacture of tanks and manhole lids may be high density (HDPE), low density (LDPE) or linear low density (LLDPE) and shall conform to IS 10146. Polyethylene shall be compounded with carbon black so as to make the tank resistant to ultra violet rays from the sun. The percentage of carbon black content in polyethylene shall be 2.5 ± 0.5 percent and it shall be uniformly distributed. The materials used for the manufacture of tank, manhole lid and fittings shall be such that they neither contaminate the water nor impart any taste, colour, odour or toxicity to water.

7.2. Manufacture and Finish

The tanks shall be manufactured by rotational moulding process. Each tank and the manhole lid shall be single piece having arrangement for fixing and locking the manhole lid with the tanks. Excess material at the mould parting line and near the top rim shall be neatly cut and finished. The internal and external surface of the tanks shall be smooth, clean and free from hidden internal defects like air bubbles, pit and metallic or other foreign material inclusion. Capacity of the tank, minimum weight of the empty tank (without manhole lid) and the manufacture brand name shall be embossed on the top surface of the tank near manhole.

7.3. Shape, Size and Capacity

The tank shall be cylindrical vertical with closed top having a manhole. Diameter and height of the tank of various capacities shall be as per manufacturer's specifications and a clearance of ± 3 percent shall be permitted on these dimensions. Capacity of the tank or up to the bottom of the inlet location whichever is less. Capacity of the tank shall be specified. Extra capacity if any shall be ignored.

7.4. Weight and Wall Thickness

Minimum weight of the empty tank (exclusive of manhole lid fittings) and the minimum wall thickness of top, bottom and sides shall be specified in Table below. Wall thickness shall be checked beyond 150 mm of the edge where the direction the plane of tank surface changes.

S.No	Capacity (ltr)	Minimum Wall Thickness (mm)	Minimum Weight of Empty Tank (kg)
1	200	4.4	7.8
2	300	4.4	9
3	400	5.5	15

4	500	6	18
5	700	6.6	23.5
6	1000	7	33
7	1250	7	40
8	1500	7	47
9	1700	7	54
10	2000	8.2	64
11	2500	8.2	81
12	3000	8.8	96
13	4000	10.4	138
14	5000	10.7	191
15	6000	10.7	209
16	7500	10.7	250
17	10000	11.5	363
18	15000	11.5	550
19	20000	13.2	814

7.5. Installation and Fittings

The flat base of the tank shall be fully supported over its whole bottom area on a durable rigid flat and level platform sufficiently strong to stand without deflection the weight of the tank when fully filled with water.

Depending upon the capacity and location tanks may be suitably anchored as per the directions of the Engineer-in-Charge. For inlet, outlet and other connections fully threaded GI, HDPE or PVC connections with hexagonal check nuts and washers on either side of the tank wall shall be provided. Holes for threaded connections shall be drilled and not punched. Pipes entering or leaving the tank shall be provided with unions and suitably supported on a firm base to avoid damage to the tank walls.

7.6. Manhole Lid

The lid shall rest evenly and fit over the rim of the manhole so as to prevent the ingress of any foreign matter into the tank. The lid shall be provided with suitable arrangement for locking it with the tank.

7.7. The tank and its components shall conform to the local bye-laws for preventions of mosquito menace.

7.8. Measurements: Shall be units.

8. Galvalume roofing accessories

- 8.1. The roofing accessories shall confirm to IS 15961 - YS 350 (Grade)- AZ150 / AZ200, unless otherwise specified in the description of item. These shall be of the thickness specified in the description of the item. The sheets shall be free from cracks, split edges, twists, surface flaws etc. They shall be clean, bright and smooth. The sheets shall be non-injured and shall be in perfect condition. The sheets shall not show signs of rust or white powdery deposits on the surface.
- 8.2. Measurements: The length of the Galvalume roofing accessories shall be measured for the finished work correct to a cm. The laps along the length including the portion embedded in masonry, shall not be measured.
- 8.3. Rates: The rate for Galvalume roofing accessories, shall be for all the labour and materials specified above, including self-drilling / self-tapping screws or with polymer coated J or L hooks, bolts, nuts and or G.I. seam bolts and nuts, G.I. plain and bitumen washers complete connecting the roof sheets to the roof members.

9. Specifications for dismantling and demolition

9.1. Scope of Work:

The work envisaged under this sub-head is for dismantling and demolition of brick masonry in cement/lime mortar, reinforced cement concrete works, removing wooden chowkhats of doors, wooden or steel windows.

9.2. General:

The term Dismantling implies carefully taking up or down and removing without damage. This shall consist of dismantling one or more parts of the building as specified or shown on the drawings. The term Demolition implies taking up or down or breaking up. This shall consist of demolishing whole or part of work including all relevant items as specified or shown on drawings.

9.3. Precautions:

Necessary propping, shoring and/or underpinning shall be provided for the safety of the adjoining work or property, which is to be left intact, before dismantling and demolishing is taken up and the work shall be carried out in such a way that no damage is caused to the adjoining work or property. Wherever required, temporary enclosures or partitions shall also be provided. Necessary precautions shall be taken to keep the dust- nuisance down as and when necessary. Dismantling shall be commenced in a systematic manner. All materials which are likely to be damaged by dropping from a height or demolishing roofs, masonry etc., shall be carefully dismantled first. The

dismantled articles shall be passed by hand where necessary and lowered to the ground and not thrown. The materials then be properly stacked as directed by the Engineer-in-charge. All materials obtained from dismantling or demolition shall be the property of the Government unless otherwise specified and shall be kept in safe custody until handed over to the Engineer-in-charge. Any serviceable material, obtained during dismantling or demolition shall be separated out and stacked properly as indicated by the Engineer-in-charge within a lead of 150 m. or as specified in the item. All under serviceable materials, rubbish etc. shall be disposed off as directed by the Engineer-in-charge.

9.4. Treatment: All the dismantled area shall be rendered clean off all debris, dust etc. The sides of jambs, sills, soffits etc. of the openings if any, after taking out doors and window chowkhats, unless and otherwise to be treated, shall be plastered in C.M. 1:3 with neeru finish to render true sides, corners, edges etc.

9.5. Mode of Measurement:

9.5.1. Brick Masonry & R.C.C. Works: The measurement of brick masonry with or without plaster/painting shall be taken correct to a centimeter and volume calculated in cubic metres up to two places of decimal.

Tentative Quality Assurance Plan for Civil Works and Structural Steel Building Works

Sr. No	Component / Operation	Characteristics	Class Of Check	Type of Check	Quantum of check	Reference Document	Acceptance Norms	Format of Records		M	C	Remarks
								Document	SR			
1	2	3	4	5	6	7	8	9	10			12
1	EARTH WORK:											
A	Excavation											
	i	Check the preliminary survey and layout of foundations, including initial ground level. (Pework Level)	Major	Measurements	100%	Layout/ Foundation Drawings	Layout/Foundation Drawings IS:3764,4081, 9759,10379	IR	√	P	W	
	ii	Check the Dimensions of Excavations Pit.	Major	Measurements	100%	Layout/ Foundation Drawings	Technical specification	IR	-----	P	R	
	iii	Check the Pit Bed Level.	Major	Measurements	100%	Layout/Foundation Drawings	Technical specification	IR	√	P	R	
	iv	Check the appropriate Side Slope.	Minor	Review.	Random	Visual Inspection	Technical specification	IR	-----	R	R	
	v	Check for general safety precautions	Major	Visual	100%	Visual Inspection	Contractor and BARC to review and permit for further work	----	----	R	R	
B	Earth Filling and Compaction											
	i	Backfilling to be done by the excavated material (Approved by Client).- Visual check Backfilling to be done in compacted layer not exceeding 200 mm properly watered rammed, consolidated & compacted before the successive layer is laid.	Minor	Test	100%	Approved Soil investigation report / Approved drawing & Technical specification	Approved Soil investigation report / Approved drawing/Technical specification	Test Report	-----	P	W	
	ii	Proctor Density Testing by Core cutter Method	Major	Review	Proctor density testing to be done for each compacted layer of 200 mm	IS: 2720 (part-VII & part-XIV, Part -XXIX)	Technical specification	Test Report	√	P	W	

Tentative Quality Assurance Plan for Civil Works and Structural Steel Building Works

Sr. No	Component / Operation	Characteristics	Class Of Check	Type of Check	Quantum of check	Reference Document	Acceptance Norms	Format of Records		M	C	Remarks
								Document	SR			
1	2	3	4	5	6	7	8	9	10			12
2	CEMENT											
	A	Physical Properties.										
	i	Source qualification	Cement will be of approved makes (Reputed cement Manufacturer)									
	ii	Normal consistency	Major	Lab Test	Test to be done for each consignment of 50T or part thereof.	IS:456,IS:269,IS:122 69,IS:1489.IS:4031 & IS: 8112	IS:456,IS:269,IS:122 69,IS:1489.IS:4031 & IS: 8112	MTC/ Third Party test as and when required.	√	P	R	
	iii	Initial & final setting time	Major	Site Lab Test	Test to be done for each consignment of 50T or part thereof.	IS:456,IS:269,IS:122 69,IS:1489.IS:4031 & IS: 8112	IS:456,IS:269,IS:122 69,IS:1489.IS:4031 & IS: 8112	MTC/ Third Party test as and when required.	√	P	R	
	iv	Compressive strength	Major	Site Lab Test	Every fortnight for each consignment.	IS:456,IS:269,IS:122 69,IS:1489.IS:4031 & IS: 8112	IS:456,IS:269,IS:122 69,IS:1489.IS:4031 & IS: 8112	MTC/ Third Party test as and when required.	√	P	R	
	v	Soundness	Major	Site Lab Test	1 sample / per 50MT or Part thereof	IS:456,IS:269,IS:122 69,IS:1489.IS:4031 & IS: 8112	IS:456,IS:269,IS:122 69,IS:1489.IS:4031 & IS: 8112	MTC/ Third Party test as and when required.	√	P	R	
	vi	Fineness	Major	Test	1 sample / per 50MT or Part thereof	IS:456,IS:269,IS:122 69,IS:1489.IS:4031 & IS: 8112	IS:456,IS:269,IS:122 69,IS:1489.IS:4031 & IS: 8112	MTC/ Third Party test as and when required.	√	P	R	
	B.	Chemical Composition of Cement	Major	Lab Test/MTC.	1 sample / per 50MT or Part thereof	IS:456,IS:269,IS:122 69,IS:1489.IS:4031 & IS: 8112	IS:456,IS:269,IS:122 69,IS:1489.IS:4031 & IS: 8112	MTC/ Third Party test as and when required.	√	P	R	Manufacturer Test Certificate is sufficient for review.
3	REINFORCEMENT STEEL (TMT BAR)											
		Source qualification	Reinforcement steel will be of approved makes (TATA / SAIL / RINL)MTC & Third party test will be provided for every lot.									
		free from scale formation, rust, oil & grease	Major	Visual Inspection	100%	Technical specification	Technical specification	SR	----	R	R	
		Free from deformation & minor cracks	Major	Visual Inspection	100%	Technical specification	Technical specification	SR	----	R	R	
		Chemical Properties	Major	Review	100%	IS:1786 –1985	Technical specification		√	R	R	MTC/TPR
		Physical Properties (Yield Strength, Ultimate Tensile Strength & Elongation, Bend & Rebend Test)	Major	Third Party Test	100% Third Party test for every 20T or part thereof	IS:1786 –2008	Technical specification	MTC & TR	√	R	R	MTC/TPR

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								Document	SR			
1	2	3	4	5	6	7	8	9	10			12
4	COARSE AGGREGATES FOR RCC WORKS {{ Stone grit }}											
		Source qualification	Coarse aggregate shall be of approved source									These test will be carried out while establishing Design Mix also.
		Specific gravity	Major	Site Lab Test	One sample per 45 Cum or part thereof.	IS: 2386 (part I to VIII), IS 456, IS 383	IS: 2386 (part I to VIII), IS 456, IS 383	TR	√	P	R	Testing to be done at approved lab / site lab
		Sieve Analysis / Gradation	Major	Site Lab Test	One sample per 45 Cum or part thereof.	IS: 2386 (part I to VIII), IS 383	IS: 2386 (part I to VIII), IS 383	TR	√	P	R	Site Lab Testing
		Flakiness Index & Elongation Index	Major	Site Lab Test	One sample per 45 Cum or part thereof.	IS: 2386 (part I to VIII), IS 383	IS: 2386 (part I to VIII), IS 383	TR	√	P	R	Site Lab Testing
		Crushing value	Major	Site Lab Test	1 Sample per source	IS: 2386 (part I to VIII), IS 383	IS: 2386 (part I to VIII), IS 383	TR	√	P	R	Site Lab Testing
		Impact value	Major	Site Lab Test	1 Sample per source	IS: 2386 (part I to VIII), IS 383	IS: 2386 (part I to VIII), IS 383	TR	√	P	R	Testing to be done at approved lab / site lab
		Abrasion value	Major	Site Lab Test	1 Sample per source	IS: 2386 (part I to VIII), IS 383	IS: 2386 (part I to VIII), IS 383	TR	√	P	R	Testing to be done at approved lab / site lab
		Moisture content	Major	Site Lab Test	One sample per 40 Cum or part thereof.	IS: 2386 (part I to VIII), IS 383	IS: 2386 (part I to VIII), IS 383	SR	√	P	R	Site Lab Testing
		% of deleterious material	Major	Site Lab Test	For all quantities	IS: 2386 (part I to VIII), IS 383	IS: 2386 (part I to VIII), IS 383	TR	√	P	R	Site Lab Testing
		Organic Impurities	Major	Site Lab Test	Every 40 Cum or Part thereof	IS: 2386 (part I to VIII), IS 383	IS: 2386 (part I to VIII), IS 383	TR	√	P	R	Site Lab Testing
5	FINE AGGREGATES {{ SAND }}											
		Source qualification	Fine aggregate shall be of approved source									
		Specific gravity	Major	Site Lab Test	One sample per 40 Cum or part thereof.	IS: 2386 (part I to VIII), IS 383	IS: 2386 (part I to VIII), IS 383	TR	√	P	R	Testing to be done at approved lab / site lab
		Sieve Analysis	Major	Site Lab Test	One sample per 40 Cum or part thereof.	IS: 2386 (part I to VIII), IS 383	IS: 2386 (part I to VIII), IS 383	TR	√	P	R	Site Lab Testing
		Moisture content	Major	Site Lab Test	One sample per 20 Cum or part thereof.	IS: 2386 (part I to VIII), IS 383	IS: 2386 (part I to VIII), IS 383	SR	√	P	R	Site Lab Testing
		Silt content	Major	Site Lab Test	One sample per 20 Cum or part thereof.	IS: 2386 (part I to VIII), IS 383	IS: 2386 (part I to VIII), IS 383	TR	√	P	R	Site Lab Testing
	Deleterious material	Deleterious material	Major	Site Lab Test	1 Sample per source	IS: 2386 (part I to VIII), IS 383	IS: 2386 (part I to VIII), IS 383	TR	√	P	R	Testing to be done at approved lab / site lab

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								Document	SR			
1	2	3	4	5	6	7	8	9	10			12
6	WATER											
		Source qualification	Major	Test	Every 3 Months	Water will be of approved source	IS: 3025 / IS: 3550	TR	√	P	W/R	Testing to be done at approved lab
		PH Value for respective Source	Major	Test	Every 3 Months	IS: 3025 / IS: 3550	IS: 456 / IS: 3025	TR	√	P	W/R	Testing to be done at approved lab / site lab
		Test for neutralisation of water for respective source	Major	Test	Every 3 Months	IS: 3025 / IS: 3550	IS: 456 / IS: 3025	TR	√	P	W/R	Testing to be done at approved lab / site lab
		Test for limits of solids of water for respective source	Major	Test	Every 3 Months	IS: 456 / IS: 3025/IS 3026	IS: 456 / IS: 3025/IS 3026	TR	√	P	W/R	Testing to be done at approved lab / site lab
		Chloride Contents for respective source	Major	Test	Every 3 Months	IS: 3025 / IS: 3550	IS: 456 / IS: 3025	TR	√	P	W/R	Testing to be done at approved lab / site lab
7	BRICK - MASONRY											
		Source qualification	Major	Visual Inspection	Random	Bricks will be from approved source/Locally available.	Technical specification	TR	√	P	R	
		Verification of dimension	Major	Site Lab Test	20 Nos per 50,000 Nos	Technical Specification / IS: 1077/ IS 5454	same as ref. std.	SR	√	P	R	Verification at site
		Compressive strength	Major	Site Lab Test	15 Nos per 50,000 Nos	IS: 3495 (part 1)/ IS 5454	same as ref. std.	TR	√	P	R	Site Lab Testing
		Water absorption	Major	Site Lab Test	15 Nos per 50,000 Nos	IS: 3495 (part 2)/ IS 5454	same as ref. std.	SR	√	P	R	Site Lab Testing
		Salt Efflorescence	Major	Site Lab Test	15 Nos per 50000	IS: 1077	same as ref. std.	TR	√	P	R	Testing to be done at approved lab / site lab
8	MS STRUCTURAL STEEL (INCL. EMBEDDED PARTS) PLATES / PIPES / SHAPES								√			
		Source qualification	Structural steel will be of approved makes (TATA /SAIL / RINL)						√			
		Visual Inspection - imperfections, mill scales, slag intrusions, laminations, pittings, rusts.	Minor	Visual Inspection	100%	Technical specification	free from imperfections, mill scales, slag intrusions, laminations, pittings, r	SR	√	P	W	
		Chemical Properties	Major	MTC/TEST	100% for Third Party test & 1 sample / per lot	IS:2062	IS:2062	MTC & TPL	√	R	R	MTC & TPL
		Physical Properties (Yield Strength, Ultimate Tensile Strength & Elongation)	Major	MTC & THIRD PARTY TEST	100% for Third Party test & 1 sample / per lot	IS:2062	IS:2062	MTC & TPL	√	R	R	MTC & TPL

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								Document	SR			
1	2	3	4	5	6	7	8	9	10			12
9	REINFORCEMENT STEEL (FABRICATION, INSERTION)											
		Bar bending schedule (BBS)	Major	Measurements	Every	Approved drawing	same as ref. std.	BBS	√	P	R	
		Check cut length	Major	Measurements	Entire lot	Approved BBS / IS: 2502	Approved BBS / IS: 2502	SR	√	P	R	
		Check no of bars & spacing	Major	Measurements	100%	Approved BBS / Drg	Approved BBS / Drg	SR	√	P	W	
		Check placement and clear cover	Major	Measurements	100%	Approved drawing	Approved drawing	SR	√	P	W	
		Reinforcement insertion certification before concreting	Major	Measurements	100%	Approved BBS / Drg	Approved BBS / Drg	SR / Pourcard	√	P	W	
10	FORM WORK											
		Soundness of staging, shuttering's and scaffoldings	Major	Visual	Every	Technical Specification / IS: 2750 / 4014 & 3696 (part 1 & 2)	IS: 14687	SR	√	W	RW	
		Connections between individual scaffoldings units and safe slenderness ratio.	Major	Visual	Once in fortnight	IS: 14687	IS: 14687	SR	√	W	RW	
		Double independent safety measures against collapse	Major	Visual	Once in fortnight	IS: 14687	IS: 14687	SR	√	W	RW	
		Alignment / Slope - Measurement	Major	Visual	For each lift	Approved Drawing	Approved Drawing	SR / LB	√	W	RW	
		Check form's seam marks and water tightness	Major	Visual	Every	Approved Drawing	Approved Drawing	SR / LB	√	W	RW	
		Checking for Permanent embedment	Major	Measurements	100%	Approved Drawing	Approved Drawing	SR / LB	√	W	RW	
		Ensuring safe removal of form work	Major	Visual	100%	Technical Specification	same as ref. std	SR	√	W	RW	

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								Document	SR			
1	2	3	4	5	6	7	8	9	10			12
11	CONCRETING WORKS (PCC & RCC)											
		Concrete Mix design M25 & M30 grade	Major	As Per Drgs/Spec.	Each grade	Technical specification / IS: 4926	same as ref. std	TR & Pour card	√	P	W	Client's approved mix design to be followed
		Workability (slump test)	Major	Measurements.	1 Sample per Truck Load of concrete	IS: 456 & Technical specification	IS: 456	SR & Pour card	√	P	W	For all concreting work clearance to be taken through pour card.
		Crushing strength of cubes (7 days and 28 days)	Major	Measurements.	Each activity and each grade as per IS 456:2000 frequency. Every 5 Cum or part thereof for column & 20 Cum or part thereof beam slab	IS: 456 / IS: 516	IS: 456	SR	√	P	H	
		Ensure submerged curing process	Major	Visual	100%	IS: 456	IS: 456	SR	-----	P	R	
		* - Hold will be cleared based on reports of 7 days test. However, Contractor to maintain 7 days & 28 days test report & site Register										
12	PRECAST CONCRETE WORKS											
		Check for Workmanship defects	Major	Visual	100%	Technical specification	Free from honeycombing, exposure of reinforcement steel and surface shall be smooth and even	SR	----	W	R	
		Workability (slump test)	Major	Measurements.	1 Sample per Truck Load of conc	IS: 456	IS: 456	SR	√	W	R	
		Crushing strength of cubes (7 days and 28 days)	Major	Measurements.	Each activity and each grade as per IS 456:2000 frequency.	IS: 456	IS: 456	SR	√	W	H	
		Ensure submerged curing process	Major	Visual	100%	IS: 456	IS: 456	SR	---	W	R	
		* - Hold will be cleared based on reports of 7 days test. However, Contractor to maintain 28 days test report .										

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								Document	SR			
1	2	3	4	5	6	7	8	9	10			12
13	ERECTION AND FABRICATION OF STRUCTURAL STEEL AND GROUTING											
		Check for lines, levels, grades, plumbs, joint characteristics including tightness of bolts	Major	Measurements.	100%	Technical specification	Approved Drawing	----	----	P	R	
		Check for weld thickness and weld quality	Major	Visual	100%	Technical specification	Approved Drawing	----	----	P	R	
		Painting - preparation of surface, quality of primers, paints & thinners, application & uniformity of coats	Major	Visual	100%	Technical specification	Approved Drawing	---	---	P	R	
		Foundation bolt checking	Major	Measurement	100%	Approved Drawing	Approved Drawing	---	---	P	W	
		Base plate grouting-cleaning and roughness of foundation, check quality of grouting mix used.	Major	Visual	100%	Technical specification	Approved Drawing	---	---	P	W	
		Consistency & strength of grout	Major	Visual	100%	Technical specification	Approved Drawing	---	---	P	W	
1	RAW MATERIAL											
	a	Steel Plates										
		Chemical Composition	Major	Doc Review	100%	ASTM AA-572, IS2062, IS 1852	Two Sample per Lot/Heat no. have to be sent for third party testing			R	R	
		Mechanical Properties	Major	Doc Review	100%					R	R	
		Dimension	Major	Measurement	10%					RI	RI	
		Visual Defects	Major	Visual Inspection	10%					RI	RI	
	b	Hot Rolled Sections										
		Chemical Composition	Major	Doc Review	100%	IS 2062, 1852	Two Sample per Lot/Heat no. have to be sent for third party testing			R	R	
		Mechanical Properties	Major	Doc Review	100%					R	R	
		Dimension	Major	Measurements.	10%					RI	RI	
		Visual Defects	Major	Visual Inspection	10%					RI	RI	
	c	Round Bar and Square Hollow Sections										
		Chemical Composition	Major	Doc Review	100%	IS 2062, 1852	Two Sample per Lot/Heat no. have to be sent for third party testing			R	R	
		Mechanical Properties	Major	Doc Review	100%					R	R	
		Dimension	Major	Measurement	10%					RI	RI	
		Visual Defects	Major	Visual Inspection	10%					RI	RI	

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								Document	SR	M	C	
1	2	3	4	5	6	7	8	9	10			12
2	BOUGHT OUT ITEMS											
	a	Bolts										
		Chemical Composition	Major	Doc Review	100%	ASTM-A 325	IMIR Reports, MTCs			R	R	
		Mechanical Properties	Major	Doc Review	100%					R	R	
		Dimension	Major	Measurement	5no.s for 1000 Dimensional					RI	RI	
		Visual Defects	Major	Visual Inspection	5no.s for 1000 Dimensional					RI	RI	
	b	Nuts										
		Chemical Composition	Major	Doc Review	100%	ASTM-A 563	IMIR Reports, MTCs			R	R	
		Mechanical Properties	Major	Doc Review	100%					R	R	
		Dimension	Major	Measurement	5no.s for 1000 Dimensional					RI	RI	
		Visual Defects	Major	Visual Inspection	5no.s for 1000 Dimensional					RI	RI	
	c	Washer										
		Chemical Composition	Major	Doc Review	100%	ASTM-A 436	IMIR Reports, MTCs			R	R	
		Mechanical Properties	Major	Doc Review	100%					R	R	
		Dimension	Major	Measurement	5no.s for 1000 Dimensional					RI	RI	
		Visual Defects	Major	Visual Inspection	5no.s for 1000 Dimensional					RI	RI	
	d	Chemical Composition	Major	Doc Review	100%	ASME Sec II C	T.Cs			R	R	
		Mechanical Properties	Major	Doc Review	100%					R	R	
		Dimension	Major	Measurement	10%					RI	RI	
3	WELDING PROCEDURE QUALIFICATION											
		WPS, PQR	Major	Doc Review	100%	AWS D1.1	WPS, PQR			R	R	
4	WELDER/OPERATOR QUALIFICATION TEST											
		Welder/Operator Qualification Records WPQR	Major	Doc Review	100%	AWS D1.1	WPQ Format			R	R	

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								Document	SR	M	C	
1	2	3	4	5	6	7	8	9	10			12
5	INPROGRESS FABRICATION PROCESS											
	a	Shearing of Plates										
		Dimension	Major	Measurement	10% of lot	Drawing	Drawing			RI	RI	
	b	Flange to Flange Fit up & welding										
		Dimension	Major	Measurement	10% of lot	Drawing, Approved WPS, WPQR				RI	RI	
		WPS, PQR & WPQR	Major	Doc Review	100%					RI	RI	
		Weld Defects	Major	Visual Inspection	10%					RI	RI	
	c	Web to Web Fit up & Welding										
		Dimension	Major	Measurement	10% of lot	Drawing, Approved WPS, WPQR				RI	RI	
		WPS, PQR & WPQR	Major	Doc Review	100%					RI	RI	
		Weld Defects	Major	Visual Inspection	10%					RI	RI	
	d	H- Beam Welding										
		Dimension	Major	Measurement	10% of lot	Approved WPS, Operator Qualification Record				RI	RI	
		WPS, PQR & Welding operator Qualification	Major	Doc Review	100%					RI	RI	
		Weld Defects	Major	Visual Inspection	10%					RI	RI	
	e	Fill up of Base/Splice Plates, clits etc										
		Dimension	Major	Measurement	100%	Drawing MBMA				H	H	
	f	Full Welding										
		WPS, PQR & Welding Fillet sizes & welding Defects	Major	Welding Parameter and Visual Inspection		Approved WPS, WPQR				S	S	

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								Document	SR	M	C	
1	2	3	4	5	6	7	8	9	10			12
	g	Dye Penetrant Test										
		Root DPT & fillet Weld DPT	Major	Visual Inspection	100% DPT has to be conducted for columns, Rafters & Beams, 10% DPT for Other members	AWS D 1.1, ASTM E-165				W	W	
	h	Final Inspection										
		Dimension	Major	Measurement	100%	Drawing, AWS D1.1				H	H	
		Welding Inspection	Major	Visual Inspection	100%					H	H	
	i	Sand Blasting & Painting Inspection										
		Dry- Film Thickness	Major	Measurement	10%	QCM				P	R	
		Cross Hatch Test	Major	Visual Inspection	10%					P	R	
	j	Shipping Inspection										
		Identification	Major	Visual Inspection	100%	BOQ				H	H	
		Free from damage, distortion etc	Major	Visual Inspection	100%					H	H	
6	SECONDARY ITEMS											
	a	Anchor Bolts, Sag Rods, Brace Rods, Flange Bracing Clips etc.										
		Dimension	Major	Measurement	Per Lot/ Size	Physical Parameters, Yield, UTS				RI	RI	
	NOTE: 1) Magnetic particle Test: 50% has to be conducted for columns, Beams, Rafters, 10% DPT for other Members 2) Ultrasonic testing of welds: 10% of the members											

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								Document	SR	M	C	
1	2	3	4	5	6	7	8	9	10			12
14	BRICK WORK											
		Check for lines, levels & plumbs	Major	Visual	100%	Approved Drawing	same as ref. std	----	Check list to be signed by BARC & Contractor	W	W	
		Check for mortar thickness (min. 10mm) & quality (Proportion)	Major	Visual	100%	Approved Drawing	same as ref. std	----	---	W	W	
		Brick Bonding.	Major	Visual	100%	Technical specification	same as ref. std	---	---	W	W	
		Check for openings	Major	Visual	100%	Approved Drawing	Approved Drawing	---	---	W	W	
		Ensure adequate curing process	Major	Visual	100%	IS: 2212	IS: 2212	---	---	W	W	
15	PLASTERING											
		Check for levels & plumbs	Major	Measurements	100%	Approved Drawing	Approved Drawing	---	---	P	W	
		Check for plaster thickness & mortar quality	Major	Measurements	100%	Approved Drawing	Approved Drawing	---	---	P	W	
		Check for Mortar proportion	Major	Visual	100%	Technical specification	same as ref. std			P	W	
		Ensure plain & smooth finish without voids	Major	Visual	100%	Technical specification	same as ref. std	---	---	P	W	
		Check for subsequent finishing requirement	Major	Measurements	100%	Approved Drawing	Approved Drawing	---	---	P	W	
		Ensure adequate curing process	Major	Visual	100%	IS: 1661	IS: 1661	---	---	P	W	

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								Document	SR	M	C	
1	2	3	4	5	6	7	8	9	10			12
16	FINISHING											
		Ensure surface finishes as per finishing schedule	Major	Visual	100%	Approved finishing schedule	Approved finishing schedule	---	---	W	W	
		Check for level, slope, plumb	Major	Measurements	100%	Approved finishing schedule	Approved finishing schedule	---	---	W	W	
		Check for pattern & symmetry	Major	Visual	100%	Approved finishing schedule	Approved finishing schedule	---	---	P	W	
		Check for alignment of joints, dividing strips, if any	Major	Visual	100%	Approved finishing schedule	Approved finishing schedule	---	---	P	W	
		Check for colour & texture	Major	Visual	100%	Approved finishing schedule	Approved finishing schedule	---	---	P	W	
		Check for surface/ underbed preparation	Major	Visual	100%	Approved finishing schedule	Approved finishing schedule	---	---	P	W	
		Check for workmanship and durability	Major	Visual	100%	Technical specification	same as ref. std.	---	---	P	W	
		Check for type of joinery & glazing	Major	Visual	100%	Joinery schedule	Joinery schedule	---	---	P	W	
		Check for infringement and interfacing with other utilities	Major	Visual	100%	Architectural layout	Architectural layout	---	---	P	W	
17	WATER SUPPLY DRAINAGE AND SANITATION LINES											
		Ensure that all the pipes and fittings are as per relevant code and drawings.	Major	Inspection	100%	Technical specification/ Approved Drawings	Technical specification/ Approved Drawings	IR	---	P	W	
		Check for proper alignment, level and slope of each laid length	Major	Measurements	100%	Technical specification/ Approved Drawings	Technical specification/ Approved Drawings	IR	---	P	W	
		Ensure proper jointing of each laid length of pipe	Major	Measurements	100%	Technical specification/ Approved Drawings	Technical specification/ Approved Drawings	IR	---	P	W	
		Ensure proper curing of joints on RCC Pipe lines	Major	Measurements	100%	Technical specification/ Approved Drawings	Technical specification/ Approved Drawings	IR	---	P	W	
18	CHAIN LINK FENCING AND GATES											
		Review of material test certificate	Major	Review	Random	Technical specification/ Approved Drawings	Technical specification/ Approved Drawings	IR	---	R	R	
		Verticality and alignment	Major	Measurements	Random	Technical specification/ Approved Drawings	Technical specification/ Approved Drawings	IR	---	W	R	
		Finishing free from visual defects	Major	Visual	Random	Technical specification/ Approved Drawings	Technical specification/ Approved Drawings	IR	---	W	R	

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								Document	SR			
1	2	3	4	5	6	7	8	9	10			12
19	ROADS WORK											
I	Borrow Area Soil											
	a	Check for Gradation	Major	Field Test	2Test/8000CUM	IS:2720(IV)	Tech.Spec.	Formats.		W	R	
	b	Standard Procter Test	Major	TPL	2Test/8000CUM	IS:2720 Part 8/7	Tech.Spec.	Formats/TPC.		W	R	
	c	Plasticity Index	Major	TPL	2Test/8000CUM	IS:2720(V)	Tech.Spec.	Formats/TPC.		W	R	
	d	Deleterious Constituents	Major	TPL	As required.	IS:2720(27)	Tech.Spec.	Formats/TPC.		W	R	
	e	Natural Moisture Contents.	Major	TPL	Every 500 CUM	IS:2720(2)	Tech.Spec.	Formats/TPC.		W	R	
II	Compaction Control/Sub base.											
	a	Moisture content just before Compaction.	Major	Field Test	Every1500 CUM	Tech.Spec.	Tech.Spec.	Formats.		W	R	
	b	Dry Density of Compacted Layer	Major	Field Test	Every 1000 CUM	Tech.Spec.	Tech.Spec.	Formats.		W	R	
	c	Checking of level	Major	Field Test	Random	As per Drawing.	Tech.Spec.	Formats.	√	W	W	
III	Water Bound Macadam											
	a	Los Angles Abrasion value/Aggregate Impact Value.	Major	Field Test/TPL	1 Test per before start of work/Source approval.	As per IS:2386 Part-4.	Tech.Spec.	Formats/TPC.	√	W	R	
	b	Gradation of aggregate & Screening.	Major	Field Test/TPL	1 Test per before start of work/Source approval.	As per IS:2386 Part-3.	Tech.Spec.	Formats/TPC.		W	R	
	c	Flakiness & Elongation Index.	Major	Field Test/TPL	1 Test per before start of work/Source approval.	As per IS:2386 Part-1.	Tech.Spec.	Formats/TPC.		W	R	
	d	Plasticity of Binding Material	Major	Field Test/TPL	1 test per 500CUM	As per IS:2720 Part-5.	Tech.Spec.	Formats/TPC.		W	R	
	e	Control of Grade, Camber, thickness & Surface Finish.	Major	Field Test/TPL	Regularly.	As Per Spec.	Drawing.	Formats/TPC.	√	W	W	

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Sr. No	Component / Operation	Characteristics	Class Of Check	Type of Check	Quantum of check	Reference Document	Acceptance Norms	Format of Records		M	C	Remarks
								Document	SR			
1	2	3	4	5	6	7	8	9	10			12
iv	Bituminous Macadam											
	a	Los Angeles Abrasion value/Aggregate Impact Value.	Major	Field Test/TPL	1 Test per before start of work/Source approval.	As per IS:2386 Part-4.	Tech.Spec.	Formats/TPC.	√	W	R	
	b	Gradation of aggregate & Screening.	Major	Field Test/TPL	1 Test per before start of work/Source approval.	As per IS:2386 Part-3.	Tech.Spec.	Formats/TPC.		W	R	
	c	Flakiness & Elongation Index.	Major	Field Test/TPL	1 Test per before start of work/Source approval.	As per IS:2386 Part-1.	Tech.Spec.	Formats/TPC.		W	R	
	d	Plasticity of Binding Material	Major	Field Test/TPL	1 Test per before start of work/Source approval.	As per IS:2720 Part-5.	Tech.Spec.	Formats/TPC.		W	R	
	e	Water Absorption	Major	Field Test/TPL	1 Test per before start of work/Source approval.	IS: 2386 (Part-3)	Tech.Spec.	Formats/TPC.		W	R	
	f	Control of Grade, Camber, thickness & Surface Finish.	Major	Field Test/TPL	Regularly.	As Per Spec.	Drawing.	Formats/TPC.	√	W	W	
v	Bitumen tests											
	a	Bitumen Content Test	Major	TPL	1 Test before start of work	As Per Spec.	Tech.Spec.	TPC.		W	R	
	b	SPECIFIC GRAVITY	Major	TPL	1 Test before start of work	As Per Spec.	Tech.Spec.	TPC.		W	R	
	c	PENETRATION VALUE	Major	TPL	1 Test before start of work	As Per IS : 1203-1978	Tech.Spec.	TPC.		W	R	
	d	SOFTENING POINT	Major	TPL	1 Test before start of work	IS : 1205-1978	Tech.Spec.	TPC.		W	R	
20	HAND RAILS											
		Material approval , Layout , line level and plumb	Major	Measurements	100%	Approved Drawings	Approved Drawings	IR	----	W	H	
		Welding and grouting of welding joints	Major	Visual	100%	Approved Drawings	Approved Drawings	IR	----	W	H	
		surface preparation for painting	Major	Visual	100%	Approved Drawings	Approved Drawings	IR	----	W	H	
		Colour/ brand of paint	Major	Visual	100%	Approved Drawings	Approved Drawings	IR	----	W	H	
		Final inspection	Major	Visual	100%	Approved Drawings	Approved Drawings	IR	----	W	H	

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								Document	SR			
1	2	3	4	5	6	7	8	9	10			12
21	GROUTING											
		Check for following										
		Composition of grout material	Major	Inspection	100%	Technical specification/ Approved Drawings	Technical specification/Approved Drawings	IR	----	W	H	
		Compressive Strength	Major	Inspection	Random	Technical specification/ Approved Drawings	Technical specification/Approved Drawings	IR	----	W	H	
22	PAINTING											
		Check for following										
		Colour , shade and brand	Major	Inspection	100%	Technical specification/ Approved Drawings	Technical specification/Approved Drawings	PROTOCOL	----	W	W	
		surface preparation and nos of coats	Major	Visual	100%	Technical specification/ Approved Drawings	Technical specification/Approved Drawings	PROTOCOL	----	W	R	
		Curing if any	Major	Visual	100%	Technical specification/ Approved Drawings	Technical specification/Approved Drawings	PROTOCOL	----	W	R	
		Final finish (DFT)	Major	Measurements	100%	Technical specification/ Approved Drawings	Technical specification/Approved Drawings	PROTOCOL	----	W	W	
23	DOOR, WINDOW ,VENTILATORS											
		Steel windows and ventilators										
		check for sections, dimensions and door fittings	Major	Measurements	100%	Technical specification/ Approved Drawings	Technical specification/Approved Drawings	IR	----	W	R	
		line level and plumb	Major	Measurements	100%	Technical specification/ Approved Drawings	Technical specification/Approved Drawings	IR	----	W	R	
		Check for thickness and type of glass	Major	Measurements	100%	Technical specification/ Approved Drawings	Technical specification/Approved Drawings	IR	----	W	R	
		Grouting of lugs	Major	Visual	100%	Technical specification/ Approved Drawings	Technical specification/Approved Drawings	IR	----	W	R	
		Surface preparation for painting	Major	Visual	100%	Technical specification/ Approved Drawings	Technical specification/Approved Drawings	IR	----	W	R	
		Shade / brand of paints, numbers of coats	Major	Visual	100%	Technical specification/ Approved Drawings	Technical specification/Approved Drawings	IR	----	W	W	
		Aluminium Doors , Windows & Ventilators										

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								Document	SR	M	C	
1	2	3	4	5	6	7	8	9	10			12
		check for sections, dimensions and door fittings as	Major	Measurements	100%	Technical specification/ Approved Drawings/ Approved shop drawings	Technical specification/ Approved Drawings/ Approved shop drawings	IR	----	W	R	
		check for hydraulic door closer/ Floor springs	Major	Inspection	100%	Technical specification/ Approved Drawings	Technical specification/ Approved Drawings	IR	----	W	R	
		Check for thickness and type of glass	Major	Measurements	100%	Technical specification/ Approved Drawings	Technical specification/ Approved Drawings	IR	----	W	R	
		Shade Brand and colour	Major	Visual	100%	Technical specification/ Approved Drawings	Technical specification/ Approved Drawings	IR	----	W	W	
		wooden Doors frame , Windows and shutter										
		check for sections, dimensions and door fittings	Major	Measurements	100%	Technical specification/ Approved Drawings/ Approved shop drawings	Technical specification/ Approved Drawings/ Approved shop drawings	IR	----	W	R	
		Check for thickness and type of wood	Major	Measurements	100%	Technical specification/ Approved Drawings	Technical specification/ Approved Drawings	IR	----	W	R	
		Final finish	Major	Measurements	100%	Technical specification/ Approved Drawings	Technical specification/ Approved Drawings	IR	----	W	R	

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								Document	SR	M	C	
1	2	3	4	5	6	7	8	9	10			12
24	EMBEDED PARTS											
		Position , level of embedded parts	Major	Site Inspection	100%	Technical specification/ Approved Drawings		Formats & Check list to be signed by BARC & Contractor	√	P	W	
		Position, depth & size of bolts holes	Major	Site Inspection	100%	Technical specification/ Approved Drawings		Formats		P	W	
		Bolt holes sleeves provided before concreting	Major	Site Inspection	100%	Technical specification/ Approved Drawings		Formats		P	W	
		Bolts & sleeves are welded in its position to avoid disturbance during concreting	Major	Site Inspection	100%	Technical specification/ Approved Drawings		Formats		P	W	
		Anti-corrosive paint for exposed parts	Major	Site Inspection	100%	Technical specification/ Approved Drawings		Formats		P	R	
25	Structural glazing work/stone cladding work											
		Position , level of stone/glass	Major	Site Inspection	100%	Technical specification/ Approved Drawings		----	---	P	W	
		check for sections, dimensions and fittings	Major	Measurements	100%	Technical specification/ Approved Drawings/ Approved shop drawings		----	----	W	R	
		Check for surface/ underbed preparation	Major	Visual	100%	Approved finishing schedule	Approved finishing schedule	---	---	P	W	
		Check for workmanship and durability	Major	Visual	100%	Technical specification	same as ref. std.	---	---	P	W	
		Check for Grouting and pointing joints	Major	Visual	100%	Technical specification		----	----	W	R	
		Check for type of joinery & glazing	Major	Visual	100%	Joinery schedule	Joinery schedule	---	---	P	W	

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								Document	SR	M	C	
1	2	3	4	5	6	7	8	9	10			12
26	PUF (PUR CHEMICALS)											
	a	Density 40+/-2 kg/m3	Major	Measurement	Samples/Lot/Thickness	IS 11239, Part-2:2009				P	R&W	
27	PUF PANEL											
	a	Length +/- 2mm	Major	Measurement	Samples/Lot/Thickness		BOQ, Specification			P	R&W	
	b	Width +/- 2mm	Major	Measurement	Samples/Lot/Thickness		BOQ, Specification			P	R&W	
	c	Thickness +2mm,-1mm	Major	Measurement	Samples/Lot/Thickness		BOQ, Specification, IS 12436			P	R&W	
	d	Appearance	Major	Visual	Samples/Lot/Thickness		Should be free from any surface defect, Scratches, Damages, Color peel off etc.			P	R&W	
	e	Fire Rating (Horizontal Burning)	Major	Burning Chamber	Samples/Lot/Thickness	IS 11329 (Part-12), 1988 (IS12436-1988)	Max 125 mm per Minute			P	R&W	
28	STEEL SHEET											
	a	Outer Sheet										
		PPGL 0.50mm TCT 550MPa RAL 9002 SMP AZ-150GSM Without Guard Film	Major	All Steel Sheet Parameters mentioned in Supplier Test Certificate		Work Order Outer Rib Type-Trapezoidal				P	R&W	
	b	Inner Sheet										
		PPGL 0.50mm TCT 550MPa RAL 9002 SMP AZ-150GSM Without Guard Film	Major	All Steel Sheet Parameters mentioned in Supplier Test Certificate		Work Order Inner Rib Type-Microribbed				P	R&W	

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								Document	SR	M	C	
1	2	3	4	5	6	7	8	9	10			12
29	MINERAL WOOL											
	a	Dimensional										Inspection Method
		Top Sheet Thickness	Major	Measurement	Every Coil	Work Order	± 0.04mm	Checklist / Inspection Report		P	R&W	Micro meter
		Bottom Sheet Thickness	Major				± 0.04mm			P	R&W	Micro meter
		Panel Length	Major		Two Panels at every Hrs.		± 2mm			P	R&W	M. Tape
		Panel Width	Major				± 2mm			P	R&W	M. Tape
		Panel Thickness	Major				± 2mm			P	R&W	Vernier Calliper
		Varriation in Diagonal Measurement of Panel	Major				≤ 2mm			P	R&W	M. Tape
	b	Visual										
		Both end sides filling	Major	Visual	Two Panel at every Hr.	As Per Work Order/ As per Approved Drawing		Checklist / Inspection Report	P	R&W		Proper Filling
		Profile							P	R&W		
		Gasket & Tape							P	R&W		
		Matching of male & female sides of two panels					Gap Between two Sheets ≤ 5mm		P	R&W		
		Parllality of upper and Lower sheet of panel							≤ 2mm	P	R&W	
		Colour of Top and Bottom Sheet		Visual	100%				P	R&W		
		Blow Holes on Rockwool surface			100%		No Blow Holes		P	R&W		
		Cleaning of sides & Burrs on cutting ends			100%		No Extra Rockwool & no burrs		P	R&W		
		Microribbing			100%			Checksheet	P	R&W		
		Placing of Identification Stickers			100%				P	R&W		
		Stacking in Bundle			100%		No Diffrence length in one bundle		P	R&W		
		Lifting and Placing of Bundles			100%		No Damage, Bend, Sheet Tear on sides		P	R&W		
	c	Performance										
		Density 100 kg/m3	Major	Weighing Scale	Twice a day	BOQ	± 10 kg/m3, As per Data Sheet	Inspection	P	R&W		
		Fire Rating	Major	Testing at Lab	One Panel	ASTM E 119	2 Hr. fire Rating		P	R&W		

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								Document	SR	M	C	
1	2	3	4	5	6	7	8	9	10			12
		Moisture Content	Major	Verified from Vender TC	TC	IS 8183/IS3144	Max 2%	Report	P	R&W		
		Recovery after compression when compressed to 75% of actual thickness	Major			IS 8183/IS3145	Min 90		P	R&W		

LEGEND:

Agencies: M = CONTRACTOR , C=BARC

Action/ checks : P = Perform W = Witness R = Review H = Hold S = Surveillance RW = Witness at Random RI = Random Inspection

Documents: SR = Site Register TR = Test report MTC = Material Test Certificate LB = Log book. TPL = Third Party Lab. IR = Inspection Report

This document shall be read in conjunction with Client's tech. spec., BOQ, drawings & any other relevant document. Indian Standards referred are latest available editions.

JOB HAZARD ANALYSIS (JHA)
CIVIL
WORKS

JHA OF SITE CLEARANCE

1. Engineer-in-Charge : (Site specific)
2. Manpower required for the job : (Site specific)
3. Tools and tackles required : Axe, Sickle
4. Personnel Protective Equipments: required : Helmet, safety shoes, cotton hand gloves, suitable protective clothing and gum boots.
5. Authorization required : Work Permit, authorized by Plant authorities.

Sl. No.	Activity	Possible Hazards	Preventive actions to be taken
1.	Bush Removal manually	a) Insect bite/snake bite b) Grass and dry bushes fire	1. The area should be surveyed by long stick to check the presence of snake and wasp/ honey bees etc. and the workers shall be briefed about the hazards. 2. Use Personnel Protective Equipments like gumboots & cotton hand gloves. 1. Avoid smoking beedi/cigarettes near the dry bushes/grass. 2. Do not burn grass in the same area. Take the grass out of the area for safe disposal either to make compost manure or to burn.
2.	Removal of trees /bush with machinery	a) Toppling of machinery due to irregular surface b) Poor illumination at night	1. Survey the area for pits & rocks etc. 2. The job should be carried out with the help of a signal man. 1. Arrange adequate lightning at the site of work

3.0	Collection and disposal of cut material	a) Grass / dry wood fire due to cigarette /bidi butts. b) Fall of person from trolley c) Fall of loaded material from Trolley d) Toppling of trolley due uneven surface and improper loading	1. Dispose the waste material in ear marked place with the knowledge of Engineer In-charge (EIC). 2. Smoking should be prohibited near the cut materials - dry grass, dry wood etc. 1. Person should not be allowed to travel in the loaded trolley. 1. Trolley should not be loaded beyond the height of sides. 2. Loading of tipper must be done in such a way that there should not be falling of material during the transportation. 3. All the dumpers shall possess canopy. 4. Ensure backdoors are properly closed. 1. Make sure the trolley is positioned on even ground, hand break applied and stopper provided. 2. Ensure survey pf dumping yard is done before start of job, looking for uncompacted ground. 3. Helpers must guide the drivers while reversing. 4. While dumping no tipper truck must be allowed to get on the heap. Dumping must be done on the ground and spread by dozer. 5. Loading should be done in uniform manner such as not to cause imbalance.

JHA OF SITE EXCAVATION IN SOIL

1. Engineer-in-Charge : (Site specific)
2. Manpower required for the job : (Site specific)
3. Tools and tackles required : Axe, sickle
4. PPE's required : Helmet, safety shoes, safety belt, gum boot, and cotton hand gloves .
5. Authorisation required : Work Permit.

Sl. No.	Activity	Possible Hazards	Preventive actions to be taken
1.	Clearing of site	Tripping and cut injury	1. The area should be surveyed for tripping hazards and workers shall be briefed for the hazard. 2. All persons working shall use PPE's like helmet, shoes etc.
2.	Excavation	a) Damage to buried utilities. b) Injury due to tools and tackles	1. Take clearance from authorities related to electrical, gas pipeline and municipal sections. 2. Look for route markers. 3. Look for warning tapes/cable covering mats/concrete saddles/sand padding. 4. Use cable detectors 5. Adhere strictly to manual excavation in case of presence of underground cables, pipe lines etc. 1. Experienced persons shall be deployed who are aware of handling excavation tools. 2. Safe distance between crew members to be maintained to avoid hit injury. 3. Regular inspection of condition of tools.

		c) Fall of person into the pit. d) Caving in e) Fall of person due to leaving the excavated area overnight. f) Landslide due to bad weather.	1. Proper access ladder. 2. Proper barricading with warning signs to be put. 3. Provide proper slope for stability of excavation or provide suitable bracing as required. 1. Provide proper shoring. 2. Remove excavated earth immediately. 3. Do not keep heavy objects and muck near the edge of pit. 4. Excavation from top to bottom. 5. Provide benching where depth is more than 3 mtrs. Keep area de-watered at all time. 6. Provide proper slope for stability of excavation or provide suitable bracing as required. 7. Vehicles should not be allowed nearer to excavated areas. The minimum offset distance is to be maintained depending on the site conditions. 8. Barrier should be provided surrounding the excavation pit such that vehicle movement is reasonably away from the excavated pit. 1. Impart safety instructions to all workers to guard against fall. 2. Proper demarcation around the pit by tape/lighting and cordoning off the area with sturdy barriers where ever possible. 1. Keep 'Danger' sign board and cordon off the hazardous area.

		g) Breathing problem and health hazard in deep pits.	1. Check oxygen and H₂S % and do not allow anybody to work if oxygen is less than 20%. If requirement is there to move in the pit, use breathing set apparatus for making an entry to a pit of 3 meters deep. 2. Provide suitable ventilation while working. 3. Health condition of personnel shall be ensured. 4. Buddy system should be followed at excavation areas. 5. Procedure for rescue of person affected by asphyxiation should be readily available. 6. Follow proper confined space entry protocols.
3.	Removal of excavated materials	Fall of heavy objects/stones, boulders etc. in the excavated pit.	1. Keep the removed earth at least 1.5m away from the pit. 2. No underpinning operations should be carried which will cause collapse of the sides of the pit.

JHA OF MECHANICAL EXCAVATION

1. Engineer-in-Charge : (Site specific)
2. Manpower required for the job : (Site specific)
3. Tools and tackles required : Excavator, Dumper, Tractor, Pick
Axe etc.
4. PPE's required : Helmet, Shoes.
5. Authorisation required : Work Permit.

Sl. No.	Activity	Possible Hazards	Preventive actions to be taken
1.	Deployment of machine	a) Defective machine b) Inadvertent operation of machine	1. As per standard checklist, check the working of machine and its condition without fail before start of the job. 2. Get the defects corrected before use . 1. Park the machine at level ground. 2. Keep the machine in appropriate gear while parked to avoid movement. 3. Keep the machine locked when not in use. 4. Only authorised persons should be allowed in the excavation area. 5. No one should be allowed to come near machine while machine is in use.
2.	Excavation	b) Damage to buried utilities.	1. Take clearance from authorities related to electrical, gas pipeline and municipal sections. 2. Look for route markers. 3. Look for warning tapes/cable covering mats/concrete saddles/sand padding. 4. Use cable detectors 5. Adhere strictly to manual excavation in case of presence of

		c) Fall of heavy objects/stones, boulders etc. in the excavated pit. d) Caving in e) Fall of persons into pit. f) Dust g) Working in congested areas	underground cables, pipe lines etc. 1. Use only approved equipment. 2. No entry into the pit during excavation. 3. Keep the removed earth at least 1.5m away from the pit. 1. Maintain proper slope. 2. Provide shuttering/shoring. 3. Remove the excavated earth immediately. 4. Do not keep heavy objects on the edge of the pit. 5. Provide proper slope for stability of excavation or provide suitable bracing as required. 1. Provide barricading with warning signals (warning light at night). 2. Use standard ladder to get into the pits. 3. Keep muck minimum 1.5 meters away from the edge of the excavation. 4. Provide barrier 1.5 meter (min) away from the edge of excavation. 1. Sprinkle water to moist the ground to settle the dust. 2. Use dust mask and goggles. 3. Consume sufficient drinking water. 1. Allow only minimum number of persons to work at the same time with a time limit. 2. Train the workers for safe use of hand tools, and safe manual working procedures. 3. Procedure for rescue of person affected by asphyxiation should be readily available. 4. Follow proper confined space entry protocols. 5. Provide alternate emergency access out of excavation.

		h) Heavy equipment operation.	1. Deploy experienced operator having medical fitness. 2. Provide trained banks men. 3. Keep distance of minimum 10M between two equipment while in use. 4. Use only approved equipment and employ competent operators. 5. Ensure stability of earth moving equipment e.g. use of outriggers for mobile vehicles 6. Earthmovers and loading equipment shall be at least 2m away from the edge of any earth cut or as far as reasonably practicable depending on site condition. 7. Keep safe overhead distance. 8. Obtain special permits wherever required. 9. Strictly adhere to banks men's signals and directions.
		i) Fall of machinery into pit.	1. Follow safety procedure. Operate machinery keeping safe distance to avoid excavating area landslide. 2. Deploy trained banks man.
		j) Dumper/tripper	1. Provide hood over driver's cabin, check brakes horn, rear view mirror. 2. Provide stay for wheel of dumper while is in parking position.

JHA OF ROCK BREAKING WITH PNEUMATIC/HYDRAULIC EQUIPMENT/BREAKER

1. Engineer-in-Charge : (Site specific)
2. Manpower required for the job : (Site specific)
3. Tools and tackles required : Pneumatic hammer, Breaker, Wooden log, barricading tape etc.
4. PPE's required : Helmet, safety shoes, ear plugs, dust masks
5. Authorisation required : Safety Work Permit.

Sl. No.	Activity	Possible Hazards	Preventive actions to be taken
1.	Attachment & removal of hammer	Hydraulic oil leakage	1. Disconnect hydraulic hose only after closing appropriate valves.
2.	Rock Breaking	a) Fall of hammer b) Damage to surroundings c) Hitting/striking to a person standing nearby d) Jolts to operator e) Flying particles	1. Use healthy tools and barricade the area where rock breaking is planned. 2. Hammers should be anchorage using chains. 3. Deploy trained operator. 1. Covering to nearby equipment, if any, should be done. 1. Keep the work force at least 5m away from breaker. 2. Strict adherence to the instruction of banks man. 1. Avoid application of excessive force to hammer. 2. Deploy trained operator. 1. Operation should lead to minimal production of fly rock and dust. 2. Ensure wet drilling. 3. Provide shield to the cabin window. 4. Keep workers at safe distance.

		f) Noise	1. Use only well-maintained equipment & drilling accessories.
		g) Dust	2. Use of ear plugs and muffs to be ensured.
			1. Use of Dust masks to be ensured.
			2. Use of goggles/spectacles.
3.	Leaving trench after end of day's work	Fall of material/equipment/ persons	1. Barricade the area and post warning signs.
			2. Deploy watchman during off working hours.
			3. Illumination in excavated area should be provided in night hours.
4.	Laying down the hammer	Injury due to fall of hammer	1. Place wooden block and lay the hammer pointing inside.
5.	Removal of pin of hammer	Striking/hitting	1. Position the hammer horizontally on wooden block and remove pin by gentle tapping.

JHA OF ROCK BLASTING

1. Engineer-in-Charge : (Site specific)
2. Manpower required for the job : (Site specific)
3. Tools and tackles required : Drilling equipment, Explosive van, Explosives and detonators, stemming bamboo.
4. PPE's required : Helmet, Hand Gloves, Goggles, Dust mask, ear plugs, ..
5. Authorisation required : Work Permit.

Sl. No.	Activity	Possible Hazards	Preventive actions to be taken
1.	Cleaning of site	Tripping hazards and cutting injury	1. All workers will be guided properly through safety induction program regarding tripping hazards and cutting injury due to unlevelled land, bushes and cutting instruments. 2. Use of proper protective equipment like helmet, shoes, hand gloves to be ensured. 3. Entry of unauthorised persons should be controlled through a work permit.
2.	Drilling of holes	a) Dust and noise b) Injury due to unauthorised operation of Drilling Machine. c) Occupational health hazards d) Electric Shock e) Eye irritation due to dust.	1. Dust mask and Earplug shall be used. 1. Only authorised, skilled and experienced workers to be deployed for carrying out this task. 1. Drilling operators shall be checked by a qualified Doctor and Medical Fitness Certificate should be issued before starting the operation. 1. Buried power lines if any should be diverted before drilling. 1. Safety goggles and fresh water will be provided for washing

			eyes in case of injury. 2. Advise drinking sufficient water.
3.	Blasting Permit	Unauthorised entry of explosives and blasting operation	Documentation signed by Site-in-charge need to be submitted to BARC for their approval and then to CISF/security for their final approval to avoid unauthorized entry of explosives and control of blasting activity. The document should consist the method of informing the plant authorities and also announcing on public address system about location and time of blasting.
4.	Charging operations	Unintended explosion	1. Licensed persons shall only be deployed (mining Engineer/foreman). 2. Smoking shall not be allowed. 3. Electronic and Electric instruments should not be permitted, in blasting area. 4. Use of instrument/equipment having source of ignition should be prohibited at site which may include mobile phones. 5. Use of synthetic clothes by persons handling detonators and explosives should not be allowed to avoid blast by static charge if possible provide cotton boiler suits to perform. 6. Total charge will be properly calculated and charged accordingly to control ground vibrations. 7. The condition of the holes will be checked by wooden bamboo.
5.	Controlled Blasting	Chances of flying of rock.	1. Before blasting all the persons and machinery to be shifted from the blasting zone to a safe place. 2. Actions for suppression of dust and flying particles to be included. 3. Necessary muffling with MS steel plate /rubber tyre/sand bags shall be provided. 4. Alerting by means of siren,

			whistles and flags. 5. Ensure no person shall enter the area immediately after blasting.
6.	Post Blasting	Chances of misfire	1. After proper checking, misfire, if any, to be identified by authorized blaster. 2. Unexploded charge and detonators shall be defused using compressed air or water jetting only 30 min after blasting completion. 3. In case of misfire, special precautions to be taken for handling partially used explosives.
7.	Completion of blasting	Unauthorised handling of explosive	1. After the blasting remaining explosives and other materials will be checked and balance will be recorded & signed by the BARC CISF/security representatives & Company safety officers.
8.	Storage of explosives	Mishandling	1. The blasting material should be stored in a licensed area. 2. Detonator and explosives shall be stored in separate compartment. 3. Combustible materials like grass, papers etc., shall be removed from vicinity.

JHA OF DEWATERING SYSTEM

1. Engineer-in-Charge : (Site specific)
2. Manpower required for the job : (Site specific)
3. Tools and tackles required : Dewatering pumps
4. PPE's required : Helmet, Safety Shoes, breathing Set, Apparatus, safety belt and life jacket,
5. Authorisation required : Work Permit.

Precautions:

1. Use of submersible type slurry pump should be preferred.
2. Use of Gum Boots instead of safety should be preferred inside the pits.
3. Removed water to be channelized to appropriate drain.

Sl. No.	Activity	Possible Hazards	Preventive actions to be taken
1.	Installation of pumps	a) Fall of a person b) Fall of pumps and accessories. c) Electric shock d) Drowning e) Land slide	1. Provide proper walkway/platform arrangements to avoid fall of person into pit while shifting pumps or its accessories. 1. All the pumps are to be provided with proper bedding/foundation arrangement for stability. 2. Use Mechanical equipment's like crane for handling /erecting heavy pumps. 1. All the metal parts of the electrical equipment's are to be earthed properly. 2. Necessary arrangements to be made for all the pumps to protect against rain water. 3. Electric supply to the motor is to be given through MCB's 1. Ensure use of Life jackets by the person working in deep waters. 1. Dress the sides of the

			pit/trench to stable slopes.
2.	Dewatering from the pits/trenches	a) Land slide	1. Dress the sides of the pit/trench to stable slopes. 2. If required, shoring and strutting to be done to avoid land slide. 3. Delivery of water should be away from the excavated area.

JHA OF DISPOSAL & DUMPING OF EXCAVATED EARTH

1. Engineer-in-Charge : (Site specific)
2. Manpower required for the job : (Site specific)
3. Tools and tackles required : Dumper/trailer of suitable loading capacity.
4. PPE's required : Safety helmet, fluorescent signals & aprons,
.
5. Authorisation required : Work Permit.

Sl. No.	Activity	Possible Hazards	Preventive actions to be taken
1.	Dumper /trailer movement	Overturning	1. Trained driver with valid license shall be deployed. 2. Medical fitness of driver shall be ensured. 3. Physical fitness of vehicle like brake, horn, rear view mirror, reverses horn should be checked. 4. Presence of attendant is essential. 5. Each dumper should have a signal man attached 6. No reversing of vehicle without assistance should be permitted. 7. During dumper unloading persons should be away from the vehicle. 8. Headlights, horn, mirrors should be available on dumper vehicle. 9. Dumper should be driven at a maximum speed of 15 kmph. 10.No reversing of vehicle without assistance should be permitted.
2.	Improper access road	Fall of dumper	1. Ensure proper access roads with suitable gradient. 2. During monsoon ensure that roads are not slippery. 3. Turning radius on curves. 4. Width for two-vehicle movement.

			5. Deep-water pit shall be barricaded. 6. Proper lighting of dumping area to be ensured.
3.	Overloading	Over turning, slippage, failure of equipment	1. Overloading shall be avoided by keeping check on load by putting suitable markings in loading area.
4.	Dumping yard	Over turning of dumper/trailer	1. From bottom to top the storage should be in layer duly compacted.

JHA OF PILING WORK

1. Engineer-in-Charge : (Site specific)
2. Manpower required for the job : (Site specific)
3. Tools and tackles required : Derrick crane, winch block, Pile casings, Pile driving tool, and bentonite slurry,
4. PPE's required : Helmet, Hand Gloves, Goggles, Boiler suit etc.
5. Authorisation required : Work Permit.

Sl. No.	Activity	Possible Hazards	Preventive actions to be taken
1.	Transportation of Derrick crane, winch & pile driving tool.	a) Slippage of crane winch or pile driving tool during transportation in a trailer. b) Injury due to protruding derrick legs beyond the trailer.	1. Side stopper should be ensured in the trailer. 2. Wooden plank shall be used between the trailer. 3. Speed of the trailer should be kept minimum. 4. Load the materials in a trailer ensure stability of the same during transportation. 5. Materials should be tied with trailer. 1. Provide red flags at the end of protruding derrick legs. 2. Provide red light at the end of protruding derrick legs during night.
2.	Installation of derrick & winch	a) Derrick legs may slip during installation. b) Sliding of winch on the ground.	1. Trained manpower should be deployed for installation of derrick. 2. The derrick legs should be supported on firm ground. 3. Derrick legs should be properly anchored to the ground. 1. Winch should be installed on a firm ground. 2. Winch should be properly anchored to the ground. 3. Trained manpower should be deployed for the job.

3.	Operation of pile driving	a) Hitting of pile driving tool to a person. b) Sling failure due to loose D-shackles, deteriorated slings etc. c) Winch rope failure. d) Hitting of pile driving tool to a person during driving of casing.	1. The person after connecting the winch rope to pile driving tool should stand away from the tool. 2. Trained personnel should be employed on the job. 3. Area under the derrick should be clearly visible to the winch operator. 1. Ensure that maximum safe load on the sling is more than the weight of pile driving tool alongwith slurry being lifted. 2. Use proper D-shackles & ensure its strength and capacity. 3. Check the slings for cracks, breaks etc. (daily visual inspection). 4. Use proper SWL rated slings & D-shackles. 1. Ensure that maximum safe load on the winch rope is more than the weight of pile driving tool alongwith slurry being lifted. 2. Use proper D-shackles & ensure its strength and capacity. 3. Check the winch rope for cracks, breaks etc. (daily visual inspection). 4. Use proper SWL rated winch ropes & D-shackles. 5. The Winch operator should be provided with proper guard to safeguard him from the hitting of broken winch rope. 6. The person helping the movement of pile driving tool should stand sufficient distance away from the pile driving activity. 1. Trained winch operator should be deployed on the job. 2. Trained person should be deployed for putting the casing into bore hole. 3. The persons positioning the casing in the hole should move away during driving operation.

4.	Concreting of pile	a) Hitting of a person by a concrete bucket. b) Hitting of casing during its removal. c) Disposal of material	1. Trained winch operator should be deployed on the job. 2. Trained person should be deployed for placing concrete into bore hole. 3. The persons placing concrete should stand away during concreting operation. 1. Trained manpower should be deployed for the job. 2. The person removing casing should stand away after connecting the casing to winch rope. 1. Appropriate disposal of slurry/material removed after piling work shall be ensured.

JHA OF HANDLING AND PLACEMENT OF REINFORCEMENT

1. Engineer-in-Charge : (Site specific)
2. Manpower required for the job : (Site specific)
3. Tools and tackles required : Reinforcement material, binding wire, binding tool.
4. PPE's required : Helmet, Safety belt, gloves and boiler suit.
5. Authorisation required : Work Permit.

Sl. No.	Activity	Possible Hazards	Preventive actions to be taken
1.	Lifting of reinforcement bars	a) Slippage of bars causing injury. b) Fall of bars due to overloading/ breakage of sling.	1. Bar bundles should be tied with sling/wire rope before lifting at minimum two points. 2. No jerk should be given to the load. 3. Centre of gravity of load should be ascertained. 1. All the preventive measures required to be taken while lifting a load should be observed strictly. 2. Overloading should not be permitted and slings of adequate capacity should be used. 3. Slings should be tightened before lifting. 4. Use of Gloves, Safety shoes and helmet to be ensured.
2.	Cutting of bar and binding wires	Injury due to defective tools/slipping of chisel.	1. Healthy chisel should be used. 2. Chisel should not be held with hands but appropriate 'holder' should be used.

3.	Placement of bars	a) Trapping of hand below bars b) Fall of heavy bars while binding. c) Tripping due to loose binding of bars. d) Injury due to sharp ends of binding wires.	1. Do not drop the bars. 2. Care should be taken to remove the hand before placing the bar in position. Bars should preferably be placed on cover blocks to avoid trapping of hands. 3. Proper co-ordination between co-workers should be ensured. 1. Tie the bars at 2-3 locations with more numbers of binding wires. 2. Use couplers in case of very heavy and long bar. 1. Bars should be tied with double binding wires. 2. Walking over bars should not be allowed till bars are tied with binding wires. 1. Bend the ends of binding wire so that it is not protruding. 2. Use gloves.

JHA OF FABRICATION OF REINFORCEMENT WORK

1. Engineer-in-Charge : (Site specific)
2. Manpower required for the job : (Site specific)
3. Tools and tackles required : Cutting machine, bending machine etc.
4. PPE's required : Hand gloves, Safety Helmet, Safety Shoes, boiler suit, Safety goggles.
5. Authorisation required : Work Permit.

Sl. No.	Activity	Possible Hazards	Preventive actions to be taken
1.	Transportation	a) Injury to personnel due to hit of protruding rods beyond the truck desk. b) Slippage of rods from the trailer bed.	1. Provide red flags at the end of protruding rods. 2. Speed of the trailer/truck should be kept minimum. 3. Sudden turning/braking are to be avoided. 4. Load material in stable condition and tighten properly. 1. Side stoppers should be ensured in the trailer/truck. 2. Wooden planks shall be used between the bed of trailer and the rods. 3. Bars should be tied with trailer body. 4. Speed of the trailer/truck should be kept minimum. 5. Avoid sudden break/turning.
2.	Unloading	a) Fall of the load b) Hitting of personnel due to sway.	1. The crane capacity should be tested before lifting the load. 2. The weight being lifted should be less than crane capacity. 3. Proper unloading procedure should be followed. 1. The ends of the load should be tied with rope to control the sway.

		c) Toppling of vehicle	2. The workman should use proper helmet and safety shoes etc. 3. The work should be carried out under proper supervision. 4. Stack material on sleeper after loading. 1. Vehicle should be parked on even ground. 2. Loading/Unloading operations should be done with due care ensuring imbalance/hitting of vehicle.
3.	Straightening of rods	Person may get his hand injured.	Use proper PPE like Hand gloves, safety shoes etc.
4.	Cutting and bending of rods by machine	a) Person may injure his finger/hand in the machine. b) Machine disfunction. c) Shock hazard d) Fly of rods after cutting	1. Use of necessary PPE hand gloves, safety shoes shall be ensured. 2. Provision of safety plug/pin in the machine shall be ensured. 3. Provide guard to moving parts. 1. Machine should be serviced and certified for safe use. 1. Ensure proper electrical connections. 2. Ensure the machine is earthed properly. 1. Provide stand on bolts sides of the machine to hold the steel in place.
5.	Cutting and bending of rods manually	a) Toppling of chisel b) Slippage/fly of bar cutting.	1. The tools shall be handled safely. 2. Only competent workmen should be put on the job. 3. Use catcher to hold chisel. 1. The bar should be firmly held in position. 2. The operating handle should be handled safely.
6.	Stacking of	Slippage of rods	1. The fabricated rods shall be

	rods		stacked over wooden planks only. 2. The number of layers should be separated by additional wooden planks in between the layers. 3. More than 5 layers should not be stacked.
7.	Transportation of fabricated rods	a) Fall of load while lifting & placing on the trailer b) Slippage of rods from the trailer on transportation.	1. The rods should be bundled and tied before lifting. 2. While lifting, the load carrying capacity of the crane and sling quality should be checked. 3. No. of sling shall be decided based on 4 way sling. 1. Slide stoppers should be ensured in the trailer. 2. Wooden planks shall be used at appropriate locations in between the stacks of bars. 3. Tie the bar with body of trailer.
8.	Unloading at site	Same as Sl.No.2	Same as Sl.No.2

JHA OF SCAFFOLDING ERECTION AND DISMANTLING

1. Engineer-in-Charge : (Site specific)
2. Manpower required for the job : (Site specific)
3. Tools and tackles required : Hammer, Plier, Spanners etc.
4. PPE's required : Safety belts, Helmet & safety shoes etc.
5. Authorisation required : Safety Work Permit.

Sl. No.	Activity	Possible Hazards	Preventive actions to be taken
1.	Erection of scaffolding for safe working at height, with cross bracing, planks, holding pins, split pin etc. (Please refer Appendix-1 for further detail)	a) Man & Material may fall from height. b) Fear of height. c) Unsafe surroundings or environment.	1. wear safety helmet, wear safety belt and anchor the lifeline. Use fall arrest system. 2. Ensure safety net is installed. 1. Ensure Medical checkup and physical fitness of the workers. Height pass 1. Should not be done during rain or unfavorable weather condition.
2.	Placement of the scaffolding	Scaffolding may collapse.	1. Check for bracing in each stage. 2. Use hard soil. If soil is sandy use piece of wood or thick plate beneath the scaffolds. 3. Lock the structure with permanent structure building. 4. Use of base plate and tie should be ensured.
3.	Use of Tools, Tackles and lifting the	Falling material i.e. tools, bracing and other material.	1. Carry tools in a bag or tie the tools with rope. 2. Use rope & pulley for lifting the

	material		material. 3. Check that the rope knot is properly tied while lifting the material. Check all the locking pins split pin etc., are properly in position. 4. Cordon off the area and post sign of caution.
4.	Tie up of wooden planks/landing mats.	Man & material may fall & lead to injury to personnel.	1. Fix wooden planks/landing mats properly with the scaffolding. Preferably cross the rope to each other.
5.	Up & down movement of persons for work	a) While moving up & down, persons may slip and fall or may hit against fixture. b) Material may fall.	1. In case ladder is not there allow persons(s) up & down in stage with safety belts & helmets. The life line of safety belt to be anchored. 2. Fall arrestor to be provided. Safety Net to be installed as ultimate defence. 3. Ladder to be used for climbing. 1. Check and rectify the scaffolding for any loose material before using the same. 2. Put safety net below the work. 3. Remove the barricade & allow the persons up & down for work after checking the complete installed scaffolding tower like bracing, locking pins & split pins, etc.
6.	Dismantling of scaffold	Fall of scaffold material while dismantling.	1. The area where dismantling takes place should be barricaded and appropriate communication in nearby areas made. 2. People working in near by area should use proper PPE. 3. Dismantling should be done by competent work men.

JHA OF SHUTTERING AND DE-SHUTTERING AT HEIGHT

1. Engineer-in-Charge : (Site specific)
2. Manpower required for the job : (Site specific)
3. Tools and tackles required : Shuttering materials, hammer, nails, wood cutting machine, lifting device spanners, crowbars etc.
4. PPE's required : Helmet, Safety belt and Safety goggles etc.
5. Authorisation required : Work Permit.

Sl. No.	Activity	Possible Hazards	Preventive actions to be taken
1.	Handling of wooden planks and supports	a) Injury due to sharp edges/nails in old materials. b) Fall of material. c) Tripping hazard	1. Avoid handling the material with sharp edge side. 2. Remove nails before reuse. 1. Secure the pieces properly in a stack. 2. Do not overload if carried in a truck/tractor with all sides of the vehicle closed to prevent fall of items. 1. Maintain good Housekeeping.
2.	Cutting wood/ply to required size	Defective cutting machine/tools causing injury	1. Check for proper operation of all the tools & cutting machine before start of the job. 2. Ensure greasing/lubrication to machine parts as per Manufacturer's Instruction. 3. Guard moving parts of the machines. 4. Maintain tools in sharp conditions as blunt tools may cause injury due to application of excessive

			force.
3.	Preparation of shuttering parts	Flying nails while hammering	1. Wear safety goggles/shoes. 2. Do not allow crowding near the work place. 3. Drive the nail with full concentration and maintain hammer-center on the nail.
4.	Erection of shuttering	a) Fall of shuttering b) Fall of workers	1. Provide proper access to the work place. 2. Do not keep bolt/materials attached to shuttering. Carry tool bag at height. 3. No worker should be allowed to stand below suspended load. 4. Shuttering should be firmly tied at center after proper assessment of center of gravity. 5. Check condition of bolts and threads of through bolts and nuts before use. 6. Ensure full tightening of holding bolts/through bolts in the shuttering before detaching from the lifting device. 7. Barricade the area. 1. Anchor safety belt to a rigid structure before starting job. 2. Provide lifeline where anchoring is not possible to rigid structure. 3. Provide working platform with hand rail before erection of shuttering and tie it with scaffolding. 4. Provide safety net, wherever possible.
5.	De-shuttering	a) Fall of shuttering	1. Observe all precautions relevant to the used lifting device. 2. Keep other workers away from the deshuttering area. 3. Tie the shuttering at its centre of gravity with the crane/lifting device before loosening the supports/bolts. 4. Do not throw bolts/nuts from the

		b) Injury by nails c) Fall of workers	top. 5. Do not throw shuttering material rather lower it slowly with the lifting device/crane. 1. Inspect for protruding nails. 2. Remove nails wherever holding the shuttering. 3. Collect and dispose used nails at the ground level and maintain good housekeeping. 1. Anchor safety belt to a permanent rigid structure not part of the shuttering/scaffolding immediately after reaching work place. 2. Provide lifeline when anchorage is not possible and anchor safety belt to lifeline. 3. Follow the sequence of deshuttering as per engineers instructions. 4. Provide safety net, wherever possible.

JHA OF CONCRETING OF RAFT

1. Engineer-in-Charge : (Site specific)
2. Manpower required for the job : (Site specific)
3. Tools and tackles required : Concrete mixer, Concrete pump, vibrator and de-watering pump etc.
4. PPE's required : Helmet, hand gloves, Goggles.
5. Authorisation required : Work Permit.

Sl. No.	Activity	Possible Hazards	Preventive actions to be taken
1.	Manual concreting	a) Tilting of mixture machine b) Workers may come in contact with the rotating parts of the machines. c) Body injury due to fall of concrete mixer hopper.	1. Ground for mixture machine should be leveled properly so that the machine can rest firmly. 1. All rotating parts like gears, chains & rollers should be guarded or barricaded. 1. Fall of mixture hopper hoist & anchoring break will be checked & adjusted.
2.	Concreting with ready mix concrete	Injury due to unsafe driving of transit mixture	1. Speed limit should not be more than 15kmph 2. Proper ramp for concrete unloading in bucket/pump should be provided. 3. One signal man should be deputed for signaling. 4. Adequate turning area and end stoppage for transit mixer should be provided.
3.	De-watering	a) Worker may come	1. All rotating parts should be

		in contact with the rotating parts of machine. b) Electric shock	barricated/guarded. 1. Earthing & other electrical line should be checked before operation. 2. Provide ELCB.
4.	Use of Vibrator	Electric shock	1. Vibrator shall be properly earthed and cable joints should be avoided. 2. Provide ELCB.
5.	Placing of Concrete	Excessive vibration to the operator in particular direction.	1. Trained person should be deployed for vibration activity. 2. Proper supervision should be ensured. 3. Technical specification should be strictly followed.

JHA OF CONCRETING OF COLUMNS/ TALL COLUMNS

1. Engineer-in-Charge : (Site specific)
2. Manpower required for the job : (Site specific)
3. Tools and tackles required : Shuttering Materials, Steel Rod, transit Mixer, vibrators.
4. PPE's required : Helmet, Hand Gloves, Goggles, safety belt and Manila rope etc.
5. Authorisation required : Work Permit.

Sl. No.	Activity	Possible Hazards	Preventive actions to be taken
1.	Loading, unloading, transportation of shuttering material and steel rod	Fall of materials, hit injury, cut injury, fall of a person due to hitting of rolling load/material on application of vehicle brakes.	1. Vehicle worthiness to be checked along with brake, horn and rear view mirror. 2. All the materials should be kept inside the tractor safely (in layers). No overhanging will be allowed. Red flag to be displayed at the back. 3. Special care should be taken during loading and unloading by constant supervision. 4. Material should be properly loaded considering its weight, dimensions, capacity of the carrier, centre of gravity of load, clearance required for safety, etc. 5. While transporting, the material should be stacked and lashed properly. 6. Steel bars should be stacked properly and red caution or red lamp in the nights should be displayed on the projected end. 7. Men should not stand near the load or over the load where there is a possibility of rolling or shifting due to sudden application of brake.

2.	Staging with sole plates	Fall of person, fall of materials	1. Necessary PPE's like helmet, safety belt shall be provided. 2. Workers shall be given talk regarding safe material handling. 3. No other activity other than staging shall be carried out nearby. 4. Before starting the scaffolding erection, the surface on which it has to be erected must be made firm and level. 5. Once the surface is ready, sole plates have to be kept. It can be timber sleeper or steel plate. Sole plates should be long enough to hold at least two vertical pipes and should extend 600mm beyond the vertical pipes. Sole plates may be avoided in case if the scaffold is erected on a firm ground like concrete floor. 6. The working platform shall be sufficiently wide and provide with hand rail of about 42 inch height with one top rail, mid rail and toe board of 4 inch high.
3.	Lifting of Shuttering material & Reinforcement	Fall of person, fall of material, shearing off rope.	1. Necessary PPE like safety helmet, safety belt, hand gloves shall be provided. 2. Ladders with handrail should be provided to approach the working spot. 3. Safe working platforms and walk ways with double mat width and hand rail should be used along with toe board. 4. Landing mat should be tied to scaffolding and safety net should be provided below the platform. 5. Use Crane as far as possible or a good quality manila rope of sufficient load carrying capacity manila rope should be used for the purpose of lifting forms and reinforcement bars with double knot tying device using chain pulley block. 6. Visual checking of rope should be done everyday before start of job. 7. Chain pulley block should be tested before use and the safe lifting capacity should be mentioned over

			the blocks. 8. All ladder of vertical height more than 30 feet shall be provided with an intermediate landing with guard rail, mid rail and toe board. 9. Do not use a metal ladder close to live electric wiring or any operational piping like acid, gas, etc/. which could be damaged. 10. Housekeeping should be good.
4.	Reinforcement placing & binding	Fall of material, fall of person	1. Working platform with handrail. 2. Ladder for approach platform. 3. Tested chain pulley block to be fixed at secure location and used. 4. Necessary PPE like safety helmet, safety belt hooked with lifeline, hand gloves etc., to be used.
5.	Shuttering	Fall of material, fall of person	1. Tested chain pulley blocks to be used. The chain pulley block to be fixed at secure location. 2. Necessary PPE like safety helmet, safety belt, hand gloves etc. will be provided.
6.	Transportation of concrete	Over speeding/over turning of Transit mixer	1. Speed limit to be maintained below 15kmph. 2. Proper ramp for unloading of concrete to be made. 3. Check worthiness of transit mixers. 4. All gears, chains and rollers of concrete mixer should be adequately guarded to prevent damage/danger. 5. Concrete mixer hopper shall be protected by side railing to prevent damage/danger. 6. Concrete mixer hopper shall be protected by side railing to prevent workers from passing under them and operators shall make sure before lowering the skip that all workers are safe. 7. Ensure double earthing is done for Electrical Mixer.
7.	Pouring of Concrete	Tilting of concreting platform, fall of	1. Concreting Platform will be rigidly tied and supported firmly. 2. Safety belt will be tied to rigid

		persons.	structure and not to the scaffolding. - Concrete to be poured under a authorised supervisor/with due care. - No person shall be allowed to work below the area of concreting. - During concrete pouring operation, there should be constant inspection of the staging system with provision for correction as necessary.
8.	Vibration of concrete	Electric Shock	- Vibrator shall be properly earthed and cable joints should be avoided. - Vibrating unit should be completely enclosed and belt transmitting the power to the unit adequately guarded. - Electrically operated compact Vibrators shall be totally enclosed and be protected against overloads by suitable overload relays and shall be effectively earthed. - Be sure that sufficient length of cable is provided to the vibrator. - Provide ELCB.

JHA OF BLOCK/ BRICK MASONRY WORK

1. Engineer-in-Charge : (Site specific)
2. Manpower required for the job : (Site specific)
3. Tools and tackles required : Mortar basket, trowel, plumb.
4. PPE's required : Helmet, goggles and safety shoes etc.
5. Authorisation required : Work Permit.

Sl. No.	Activity	Possible Hazards	Preventive actions to be taken
1.	Storage of concrete blocks/bricks at manufacturing point	Fall of blocks/bricks causing injury	1. Restrict height of stack of blocks/bricks to 1.5m. 2. Adopt cross tier system of storage. 3. Wear Safety shoes.
2.	Loading transportati-on and unloading of concrete blocks/bricks to site	a) Fall of blocks/bricks causing injury. b) Cut injury due to edges of blocks.	1. Block should be stacked in cross tier in the truck/tractor/trolley. 2. Speed limit should be observed. 3. Use safety shoes. 1. Blocks/bricks should be handled carefully with gloves to avoid injury.
3.	Shifting & stacking of blocks at work place	a) Back strain while manual lifting. b) Collapse of stack	1. Training should be given to workers about correct lifting method. 1. No. of blocks/bricks stacked on a platform should not exceed load carrying capacity of the platform.
4.	Preparation of cement mortar	a) Improper handling of cement bags. b) Cement dust causing	1. Training for handling method should be imparted. 1. Use gloves and dust mask while handling cement bags.

		allergy/eye injury	2. Wash eyes with clean water if cement enters in eyes.
5.	Laying of concrete blocks/bricks	a) Fall of platform/fall of materials b) Allergy to hand due to use of cement mortar.	1. Working platform should be adequate (at least 900mm wide) and securely tied with the scaffolding. 2. No worker should be allowed to work under the area where masonry work is in progress. Loose blocks/bricks should not be left on the wall or on working platform at the end of the day. All placed blocks/bricks should be joined with cement mortar. 1. Gloves should be used to protect hand.

JHA OF PLASTERING OF WALLS & CEILING

1. Engineer-in-Charge : (Site specific)
2. Manpower required for the job : (Site specific)
3. Tools and tackles required : Morton basket, trowel etc.
4. PPE's required : Safety shoes, safety helmet, safety belt, goggles,.
5. Authorisation required : Work Permit.

Sl. No.	Activity	Possible Hazards	Preventive actions to be taken
1.	Scaffolding and working platform	Refer JHA on Erection and dismantling of scaffolding	
2.	Plastering	a) Workmen fall from height. b) Fall of mortar c) Inhalation of cement dust d) Eye injury due to concrete and ingestion of cement.	1. The scaffolding should be firm. 2. The platform should be of minimum width of 1m. 3. Safety belts should be anchored at a firm location. 1. Workman should use goggle to avoid mortar falling on to his eyes. 2. GI sheet may be used at the level of the working platform so that the falling mortar is collected there itself. 1. Wear respiratory Protection PPE's. 1. Wear safety goggles. 2. Wash hands before taking food. 3. Take shower after completion of job.

JHA OF FABRICATION OF STRUCTURES AND ERECTION

1. Engineer-in-Charge : (Site specific)
2. Manpower required for the job : (Site specific)
3. Tools and tackles required : Welding machine, grinder, gas cylinders etc..
4. PPE's required : Helmet, Safety Shoes, breathing set Apparatus, safety belt,.
5. Authorisation required : Work Permit.

Sl. No.	Activity	Possible Hazards	Preventive actions to be taken
1.	Cutting and Welding (Please refer Appendix-1 for further detail).	a) Eye injuries b) Over pressurization of gas cylinders, breaking of cylinder valve causing movement of cylinder like a jet c) Electric shock	1. Deploy qualified and authorised persons to carry out welding and gas cutting operations. 2. Use appropriate safety glass/goggles suitable for gas cutting/welding 1. Provide shelter to store the empty/full gas cylinders and avoid cylinders exposure to direct sunlight. 2. Use cylinder trolleys for shifting the gas cylinders. 3. Do not roll the cylinders on the floor. 4. Keep portable fire fighting equipments near the gas cylinder storage area. 5. Segregate the gas cylinders with their properties and chain them properly. 6. Display caution board like no smoking etc. near the storage area. 1. Avoid welding cable crossing on the walkway. 2. Use separate cable for main

		d) Flying fragments e) Exposure with dust and fumes generated during welding/cutting f) Fall of gas cylinders g) Heat Radiation	path and return path 3. Use ELCB's for tapping of electricity. 1. While working at height, precautions to be taken to prevent sparks/hot metal falling on to persons by using asbestos cloth. 2. Keep portable fire extinguisher near the location of welding operation. 3. Hot work permit should be obtained for working at vulnerable area. 1. Isolate the welding/cutting work from the normal activity. Sit upwind or provide ventilation toy fan. 2. Use proper respirator to avoid exposure with dust. 1. Keep all gas cylinders specially acetylene in vertical position and support them properly. 1. Use appropriate protective equipments like hand gloves, face shield, safety shoes, aprons, safety goggles etc.
2.	Grinding (Please refer Appendix-1 for further detail)	a) Flying fragments b) Electric shock	1. Use grinding machine with wheel guard provided 2. Use proper face shield for grinding job. 3. Use grinding wheels of specified diameter. No inter changing of grinding wheels is permitted. 4. Do not use wheels with expiry date. 5. RPM of wheel should match to that of grinding machine. 1. Ensure the earth connection of the grinding machine or ensure use of double insulated tool. 2. Check the cables for insulation damage

		c) Noise pollution d) Wheel guard damage	3. Lay the electric cable properly without affecting the walkway/gangway 4. Do not operate the electrical switch with wet hands. Use three-pin plug top for tapping electricity. 1. Use appropriate ear protection for noise pollution. 2. Check the expiry date of grinding wheel. 3. For pedestal grinder, the tool rest clearance should be maintained to 3mm 1. Do not permit operation of grinding machine without proper wheel guard
3.	Painting	a) Eye injury due to paint. b) Fire hazards during painting. c) Working in dark, fall of person while getting into Jhula & coming out from Jhula.	1. Safety goggles should be used. 2. In case of ingress of paint in eyes, immediately it should be washed with water. 1. Painters should not smoke during painting. 2. No cutting, grinding & welding works should be carried out at near by painting work spot. 3. Ensure fire extinguisher in the area. 1. Ensure work carried out with adequate illumination to prevent mislanding of persons while getting into Jhula from ladder due to darkness or inadequate illumination.

JHA OF ERECTION OF ROOF TRUSS

1. Engineer-in-Charge : (Site specific)
2. Manpower required for the job : (Site specific)
3. Tools and tackles required : Tower crane, electric Winch, Cargo Pulley blocks, Steel wire ropes, D shackles, slings, welding generator, poly propylene/nylon rope, wrenches, 8mm steel wire rope etc.
4. PPE's required : Fall arrester system, Full body harness with double lanyard, Safety net, Safety helmet, safety shoes and hand gloves.
5. Authorisation required : Work Permit.

Sl. No.	Activity	Possible Hazards	Preventive actions to be taken
1.	Unloading the truss parts of length 10-12m (variable) from the Trailer/Tractor	a) Crane failure b) Sling Failure because of loose D shackles, broken sling etc. c) Body part caught in	1. Ensure the crane and load lifting appliances are load tested and certified by a competent person and available with valid documents. 2. Ensure that the max safe load of the crane is more than the weight of the load to be lifted. 3. Ensure there is no person under the crane. 1. Use proper D shackles and ensure its strength and capacity. 2. Check the slings for cracks, breaks etc. (daily visual inspection) 3. Gunny bags should be provided at each tied position. 4. Use proper SWL rated slings & 'D' shackles. 1. Ensure proper training imparted to workers like

		between d) Fall of the entire load by slipping and injury to the persons near by.	riggers, signal man, fitters, welders and helpers. 2. Ensure proper supervision. 3. Use proper PPE (viz.Safety Helmet, Safety Shoes, Hand Gloves etc.) 1. Wherever possible provide mechanical stopper to arrest fall of material from the trailer, otherwise properly tied. 2. Proper clearance (of both persons and objects) should be ensured in the vicinity and barricade the area. 3. Required number of wooden sleepers in required lengths, size etc, should be placed on the ground below the load. 4. Load to be kept on firm and level ground or wooden sleeper. 5. Deploy proper number of manpower including one experienced signal man/assistant.
2.	Assembling of truss parts to form full span by welding	a) Body parts caught in between b) Shock Hazard c) IR and UVRadiation d) Burn injury (Eye injury)	1. Proper clearance (of both persons and objects) should be ensured in the vicinity. 1. The welding machine should be connected with proper cable connector. 2. Welding machine should be properly earthed (including body earthing) 3. Switch off before any maintenance works. 1. The welders are to be protected from radiation by using suitable face shield. 1. Ensure no molten slag is falling down and use proper sheet/asbestos blanket to

			prevent fall of molten slag and other materials. 2. A welder should wear a special type of helmet with a shaded face mask attached to the helmet. 3. Welding goggles shall be free from damage. 4. All the welders/operators must be well experienced. 5. Gloves are to be dry and hole free.
3.	Placing the assembled part in a lifting position (horizontal)	a) Sling Failure due to loose D shackles, deteriorated slings, etc. b) Load may slip on ground if not properly placed on required number of wooden sleepers/blockers c) Load may hit to the nearby persons/objects causing injury/property damage.	1. Ensure that the max safe load of the crane is more than the weight of the load to be lifted. 2. Use proper D shackles and ensure its strength and capacity. 3. Check the slings for cracks, breaks etc. (daily visual inspection). 4. Use proper SWL rated slings & 'D' shackle. 1. Required number of wooden sleepers in required lengths, size etc. should be placed on the firm and level ground below the load. 1. Ensure proper pep talk imparted to workers before proceeding work. 2. Use proper PPE (viz., Safety Helmet, Safety Shoes, Hand gloves etc.) 3. Proper clearance (of both persons and objects) should be ensured in the vicinity. 4. Deploy proper number of manpower including one experienced signal man/assistant.
4.	Movement of crawler crane to the load /truss	Contact/hit with any other mobile/ stationery bodies nearby.	1. An assistant/signal man should be there to convey standard hand signals to guide the operator or he must be

	structure location for lifting		deployed with a Walkie-Talkie for communication. Signal persons to be trained before the start of work and walkie to be tested before the work. - Area clearance should be ensured for both persons and objects. - While trailer/crawler is in movement, provide red flags on both sides.
5.	Lifting the respective Roof truss structure to the particular EL	a) Sling Failure due to loose D shackles, deteriorated slings, etc. b) Load may slip from rigging if not properly attached. c) Electrical hazards/shock hazards d) Crane failure e) Hitting of Girder to persons/structures due to free movement in air and could result in injury/property loss/load falling	- Ensure slings free of cuts, breaks etc. (daily visual inspection) - Use Four legged sling for lifting - Properly attached to hook with proper required D shackles. - Ensure load must not be eccentric on shackles. - Proper selection of rigging materials. - Inspect hook for wear and tear. - Ensure the usage of tagline to control all loads. - Check the area for any electrical overhead lines and clear it before lifting. - Ensure proper grounding of crane and other equipments that could come into contact. - Ensure the crane and load lifting appliances are load tested and certified by a competent person and available with valid documents. - Ensure that the max safe load of the crane is more than the weight of the load to be lifted. - Before lifting ensure the availability of a continuous lifeline made of 8mm dia steel wire rope or 25mm dia poly propylene rope, tied column to column at both sides along the axis.

			2. Warn with proper cautioning nearby workers and ensure continuous supervision. 3. An assistant/signal man should be there to give standard registered signals to the operator. 4. Ensure wind velocity is not exceeding the prescribed limit while doing the operation on a working platform. 5. Ensure proper approach ladder to reach the working platform. 6. Ensure the crane is positioned such that hoist ropes are vertical. 7. Ensure the load is not raised high above the ground than is necessary. 8. Ensure if the load has a large surface/Weight ratio, the operations should not be carried out during high wind. 9. Ensure all motions should be carried out at low speed. 10. Ensure the operation should be under the direct supervision of a competent person and should be carefully planned in advance. 11. Ensure the usage of gunny bags or half round pipes at the points where wire rope comes into contact with the sharp edges of concrete beams.
6.	Placement of Truss assembly to the anchor bolts on the beams required	a) Fall of person from height.	1. All workers who are engaged should wear full body harness/safety belts and hooked it to the lifeline made of 8mm steel wire ropes. 2. Ensure the availability of a continuous lifeline made of 8mm dia steel wire rope or 25mm dia polypropylene rope, tied column to column at both sides along the axis. 3. Utmost care should be taken

		b) Fall of materials/tools from height.	while working. - Should be in a convenient position while working on the working platform. - Proper approach ladder to reach the working platform to be provided. - Use four legged sling arrangement for lifting. - An assistant/signal man should be there to give standard registered signals to the operator. - The tools have to be carried in a separate bag tied to the workers body.
7.	Releasing the steel wire rope sling from the body	Hitting of sling wire/D shackles to the body parts of workers, while releasing	- Intense care should be maintained while releasing. - Ensure proper clearance from the sling while releasing.

JHA OF ERECTION OF PURLINS AND BRACINGS

1. Engineer-in-Charge : (Site specific)
2. Manpower required for the job : (Site specific)
3. Tools and tackles required : Tower crane, electric Winch, Cargo Pulley blocks, Steel wire ropes, D shackles, slings, welding generator, poly propylene/nylon rope, wrenches, 8mm steel wire rope etc.
4. PPE's required : Fall arrester system, Full body harness with double lanyard, Safety net, Safety helmet, safety shoe, hand gloves, Boiler suit etc.
5. Authorisation required : Work Permit.

Sl. No.	Activity	Possible Hazards	Preventive actions to be taken
1.	Lifting the purlin and chord Bracings using Electric Winch to the particular location where truss structure rests.	a) Sling Failure due to loose D shackles, deteriorated slings, etc.	1. Ensure load test of lifting machine, tool and tackles. Ensure slings free of cuts, breaks etc. (daily visual inspection). 2. Properly attached to hook with proper required D shackles. 3. Use four legged sling for lifting. 4. While Purlin erection Rigger/supervisor should observe there is no obstruction of the purlin while lifting. 5. Safety belt of the worker should not be hooked on the job/object being handled. 6. Safety Net should be provided at possible locations. 7. Proper access way to higher elevation is to be made with suitable stairs, scaffoldings and platforms with railings. Lifelines (for hooking the safety belt) are to be provided to prevent fall of person on floor. 8. Housekeeping of the area should be checked. 9. Safe working load with gearing arrangement should be marked on the winch and tested regularly and it should not be overloaded.

			10. The break, ratchet arrangement, gear and pinion including the meshing, wire rope and its clamping arrangements and direction of receiving rope drum, the rods should be checked before using the winch.
		b) Load may slip from rigging if not properly attached. c) Displacement of winch assembly from the working position. d) Electrical hazards/ Shock hazards e) Hitting of Bracing pipes to persons/structures due to free movement in air and could result in injury/property loss/load falling.	1. Ensure the usage of gunny bags or half round pipes at the points where wire rope comes into contact with the sharp edges of concrete lifting members. 1. Ensure that the winch is in a rigid ground and fixed well. 2. Longer members to be tied to at least two points while lifting. 1. Ensure proper earthing of electric winch. 2. Proper cover/guard should be given to all moving parts like gears, shafts etc. 1. A puller to be tied at each end of the members to arrest the free movement. 2. Warn with proper cautioning nearby workers and ensure continuous supervision. An assistant/signalman should be there to give standard signals to the operator.
2.	Bolting the Purlin, Top Chord bracing and Bottom Chord bracing to the truss structure for sheeting arrangements.	a) Fall of person from height. b) Fall of	1. All workers who are engaged must be qualified for height pass & should wear full body harness/safety belts and hooked it to the lifeline made of 8mm steel wire rope. 2. They should use all other required PPE. 1. All hand tools should be properly tied while working, it should not fall down. Hand

		materials/tools from height.	tools should be carried in a bag while going up and coming down. 2. Intense care should be taken while working to avoid slipping of tools/tackles. 3. A safety net made of poly propylene/nylon wire of size (12m x 12m) should be hooked to the truss structures, so that fall of persons and tools/objects can be safety arrested.
		(c) Body strain/ loss of Balance	1. Should be in a convenient position preferably on working platform while working. 2. A continuous lifeline made of 8mm dia steel wire rope or 25mm dia polypropylene/nylon rope should be tied along the truss surface. 3. They should use all other required PPE.

JHA OF ERECTION OF ROOFING SHEETS

1. Engineer-in-Charge : (Site specific)
2. Manpower required for the job : (Site specific)
3. Tools and tackles required : Tower crane, electric Winch, Cargo Pulley blocks, Steel wire ropes, D shackles, slings, poly propylene/nylon rope, wrenches, 8mm steel wire rope etc.
4. PPE's required : Safety shoes, Safety Helmet, Safety belt, Hand Gloves, Goggles, .
5. Authorisation required : Work Permit.

Sl. No.	Activity	Possible Hazards	Preventive actions to be taken
1.	Location of crane and crane positioning (in case of mobile crane)	Settlement/tilting of crane due to un compacted earth/ground	1. Ensure ground over which crane is going to be positioned to carry out truss erection is leveled and strong/hard enough to bear the load of crane with materials during erection and the same is to be checked & confirmed before crane reaches.
2.	Lifting of sheets, A.C. Sheets or GI sheets	Fall of sheets during lifting and fixing	1. Use suitable clamps with rope arrangements to prevent fall of sheets while lifting to elevations. 2. Number of sheets to be lifted have to be tied together tightly and lifted by 4 way slings. 3. Have minimum number of sheets at top(ie) over purlin and the same has to be kept in tag by tying using a rope to prevent flying of sheets. 4. Trained personnel should be engaged on works. 5. During lifting and fixing of roofing sheets wind velocity must be taken into account.

JHA OF ROOF INSULATION AND WATER PROOFING

1. Engineer-in-Charge : (Site specific)
2. Manpower required for the job : (Site specific)
3. Tools and tackles required : Pulley arrangement, Nylon rope, concrete mixer, transit mixer, painting brush etc.
4. PPE's required : Safety helmet, gloves, goggles, apron and .
5. Authorisation required : Work Permit.

Sl. No.	Activity	Possible Hazards	Preventive actions to be taken
1.	Installation of ladders/scaff old stairways	a) Slipping or falling from scaffold. b) Fall of materials	1. Structure supporting the stair/ladder should be erected vertically in plumb on the base plate. 2. Sole board should be used while erecting on loose soil. 3. Landing plate should preferably be made by steel grating. 4. Grating should be secured at both ends 5. All landings should be horizontal. 6. Bracing should be provided diagonally. 7. It is essential that all scaffolds be securely tied to the building or structure throughout their length and every interval of about 4m height to prevent their movement. 8. Foundation must be of adequate strength and disperse the load. 9. Ladder to be used for climbing on scaffold. 10. Only steel scaffold to be used. 1. Area below the scaffolding tower should be barricaded. 2. Entrance should be cleaned and

			obstruction should be removed.
2.	Installation of Pulley arrangement for lifting/lowering materials	a) Fall of materials b) Collapse of scaffolding arrangement	1. Scaffolding arrangement should be made on parapet wall. 2. Suspension of scaffold tube should not be extended more than 750mm. 3. Pulley hook must be suspended on 6mm wire rope lashing with at least five turn round the hook and tube. 4. Hook must be latched to ensure it cannot be displaced. 5. Nylon rope/polymide rope should have a minimum dia. of 18mm. 1. The maximum load that should be raised or lowered by a Pulley and rope at any one time should be about 50 Kg . 2. Care should be taken particularly when lowering materials. If the weight is too great either the man lowering the load will weigh less than the load and will pull off his feet or complete assembly may collapse.
3.	Installation of foam processing machine and concrete mixer	a) Caught in or between	1. All gears, belts rollers, of the mixers shall be properly guarded. 2. Operators, workers, helper should wear safety helmet/shoes. 3. When workman are cleaning inside of the mixer, the operating power supply should be switched off. Suitable notice should be hanging at the places. 4. No cleaning work should be carried out without informing the operator. 5. All cables, clamps, hooks, gears, slings etc. of the mixer shall be checked and cleaned, oiled and

		b) Electric shock due to insulation break down of cables and wires.	greased once in a week. 1. Check all the cables and wires once in month/weekly with the help of Megger. 2. Do not allow any PVC wire or joints to come in contact with water. Because water reduces insulation resistance. 3. Do not keep any cable/wire with joints on the floor or ground. 4. Do not pass more current than the rating of wire. 5. Cable joints should not lie in water. 6. Use cable glands when connecting cables to electrical switch. 7. Ensure the replacement of damaged cables. 8. Cable should be kept away from the source of heat or sparks such as welding, grinding, gas cuttings etc. 9. Cable should be prevented from mechanical damages such as fall of material, contact with sharp objects, crushing due to heavy equipment. 10. Cables should be protected from rat bites. 11. Electrical motor, starter and mixer should be double earthed. 12. Electrical connection should be made through ELCB of proper rating. 13. Electrician should use proper insulated tools, rubber hand gloves, electrical resistant shoe etc.
4.	Concrete mixing by concrete mixer (cement + sand) mortar & unloading	Skin diseases irritant to skin, eyes, nose, throat	1. Workers should wear gumboot and rubber hand gloves. 2. Use proper goggles. 3. Use nose mask or suitable respirator.

5.	Mortar lift in container by Pulley	Fall of mortar	1. Extreme care should be taken while lifting container full of mortar. 2. Extreme care should be taken while filling container with mortar. Total weight of mortar with container should not be more than 50kg. 3. Pulley should be tied with 6mm wire rope lashing with atleast 5 turns round the hook and tube and with 'U' clamps. 4. Use polymide/nylon rope with minimum 18mm dia. 5. Workers who are engaged in rope pulling, they should be instructed to use proper hand gloves, shoe and hard helmet with chin strip.
6.	Transportation of mortar by concrete mixer	a) Overturning of the concrete mixer b) Transit mixer accident	1. Transit mixer moving area should be leveled. 2. While reversing the transit mixer in the vicinity of an excavation the weight of concrete and transit mixer should be considered. 1. No person should stand behind reversing concrete delivery transit mixer. 2. Identify the place of transit mixer for unloading concrete into the bucket of tower crane. 3. Check back view mirror and reverse horn. 4. One attendant to signal the driver shall be available.
7.	Placement of mortar by concrete bucket of tower crane	a) Crane failure	1. Ensure tower crane and load lifting appliances are load tested and certified by competent person and available with valid documents. 2. Ensure that the maximum safe load of the tower crane is more than the weight of filled mortar bucket to be lifted.

		b) Sling failure because of loose 'D' shackles or broken slings etc. c) Improper functioning of the bucket	1. Sling and 'D' shackles should be tested by competent person. 2. Use proper 'D' shackles and ensure its strength and capacity. 3. Use proper SWL rated slings. 4. Deploy trained signal man. 1. Buckets handled by crane should be inspected prior to each operation. Following points should be taken care of: a. Safety latch of the hook b. Condition of slings c. Welded joints 2. Closing & locking of exist door of the bucket . (It is essential to avoid accidental opening of the exist door & consequent falling of the mortar). 3. Care must be taken that the loose mortar does not fall off during lifting. 4. Men should be moved away from the swinging area. 5. Unloading and loading area shall have proper lighting.
8.	Laying of two coats or bitumen paint	Skin disease, allergy and irritation	1. Workers should wear hand gloves. 2. Workers should wear safety helmet and safety shoe.
9.	Heating of tar/Bitumen	a) Fire	1. Heating should be done in vats or drum or other container away from building. 2. Container should be resistant to damage by heat and transportation 3. It should be leak proof and should have suitable outlet which can be controlled for taking out the hot material. 4. Heating should be done in the presence of a person and the cover of the container kept closed. 5. Observer temperature constantly. 6. Remove all unwanted and combustible materials near by area.

		b) Burn injury	1. Worker should wear suitable PPEs like gumboot, safety helmet, safety goggles and safety aprons etc. 2. While handling hot bitumen, workers should be careful to prevent accidental spillage. 3. Buckets and cans used for carrying hot material from the boiler should be checked before use to ensure that they are in tact and in safe condition. 4. In no case leak bitumen shall be allowed to remain around the worker. 5. Painting of the hot bitumen should be done very carefully with long brush. 6. Area should be neat and clean before painting of hot bitumen.

JHA OF PAINTING ON THE EXTERNAL WALL OF THE BUILDING

1. Engineer-in-Charge : (Site specific)
2. Manpower required for the job : (Site specific)
3. Tools and tackles required : Jhula, Pulleys, PP rope & Fall arrester facility.
4. PPE's required : Safety Shoe, Safety Helmet, Safety Belt, Hand gloves, Goggles, Boiler suits.
5. Authorisation required : Work Permit.

Sl. No.	Activity	Possible Hazards	Preventive actions to be taken
1.	Preparation of suspended scaffold/Boat swain chair.	Improper knot/tie at top with rigid member both fall arrester and pulley rope. Improper anchoring of the suspended scaffolding.	1. Ensure fall arrester rope & Jhula's rope are tied to a rigid and strong member/structure. 2. Tying of rope for Jhula & fall arrester must be proper and should be checked by second person to confirm the anchoring/fastening by rope is done rightly.
2.	Lifting and lowering of Jhula through pulley from top.	a) Striking and sudden drop of Jhula while lowering, tilting of Jhula. b) Fall of person and material from Jhula. c) Fire hazards during painting	1. Keep the surface neat & clean over which PP rope of Jhula will be passing to ensure smooth passing of rope and to avoid damage of Jhula rope. 2. Engage trained personnel to lower the Jhula parallelly to maintain the level of the Jhula and to avoid tilt. 1. Area should be cordoned and nobody should work under Jhula. Don't over load the Jhula. 2. Jhula should have handrails and toe board at all the four sides. 3. No loose materials should be put in Jhula. 1. Smoking should be prohibited.

3.	Painting	a) Eye injury due to paint. b) Fire hazards during painting. c) Working in dark, fall of person while getting into Jhula & coming out from Jhula.	1. Safety goggles should be used. 2. In case of ingress of paint in eyes, immediately it should be washed with water. 1. Painters should not smoke during painting. 2. No cutting, grinding & welding works should be carried out at near by painting work spot. 3. Ensure fire extinguisher in the area. 1. Ensure work carried out with adequate illumination to prevent mislanding of persons while getting into Jhula from ladder due to darkness or inadequate illumination.

JHA OF DISMANTLING AND CHIPPING OF CONCRETE

1. Engineer-in-Charge : (Site specific)
2. Manpower required for the job : (Site specific)
3. Tools and tackles required : Chipper (electrical or Pneumatically operated).
4. PPE's required : Goggles and Hand Gloves .
5. Authorisation required : Work Permit.

Sl. No.	Activity	Possible Hazards	Preventive actions to be taken
1.	Chipping	a) Eye injury b) Electric Shock c) Hand injury d) Injury to other persons	1. Goggle should be worn to protect against flying particles. 1. Shock proof electric chipper shall be used. 2. The earthing of the equipment should be ensured. 1. Gloves should be worn. 1. Work area should be isolated/cordoned off.
2.	Dismantling	a) Fall of person b) Fall of material c) Fly off of chipped material	1. Ensure that scaffolding is stable. 2. The person should use necessary PPE. 3. Area shall be well illuminated 1. Use safety nets 2. Area below should be cordoned off. 1. Workers involved should use eye protection.

JHA OF SAFETY NET

1. Engineer-in-Charge : (Site specific)
2. Manpower required for the job : (Site specific)
3. Tools and tackles required : Safety net.
4. PPE's required : Helmet, Safety Shoes and Safety belt etc.
5. Authorisation required : Work Permit.

Sl. No.	Activity	Possible Hazards	Preventive actions to be taken
1.	Fixing the safety net	Fall of a person (Please refer Appendix-1 for further detail)	1. Safety nets at a height of 3-4m from the ground throughout the working area should be provided to ensure safety of men if there is a danger of fall of a person from height (Refer AE(F) Rules, 1996). 2. Issue height pass permit for the workers involving work at heights. 3. Provide safety helmet, safety belt to the workers. 4. Provide proper access and use for reaching the higher elevation.
2.	Removing the safety net	Fall of person (Please refer Appendix-1 for further detail)	1. Issue height pass permit for the workers involving work at heights. 2. Provide safety helmet, safety belt to the workers. 3. Provide proper access for reaching the higher elevation.

JHA OF ERECTION OF TEMPORARY SHEDS

1. Engineer-in-Charge : (Site specific)
2. Manpower required for the job : (Site specific)
3. Tools and tackles required :
4. PPE's required : Helmet, Safety Shoes and Safety belt etc.
5. Authorisation required : Work Permit.

Sl. No.	Activity	Possible Hazards	Preventive actions to be taken
1.	Design	a) Collapse of shed due to winds b) Electrocution	1. The shed should be suitably designed. 2. Anchoring against lifting by wind. 1. The electrical wiring shall be certified by a licensed electrician.
2.	Construction and erection of truss	Please refer JHA on Erection of Roof truss.	1. Please refer JHA on Erection of Roof truss. 2. Heavy load should not be kept on the temporary shed top.
3.	Fixing of roof sheeting	Over turning of shed	1. Opening for cross flow of wind should be provided. Please refer JHA on roof sheeting.

APPENDIX-1

JHA OF COMMON JOBS

Sl. No.	Activity	Possible Hazards	Preventive actions to be taken
1.	Work at height	a) Fall of person b) Fall of objects c) Release of toxic gases d) Unfavorable weather condition.	1. Ensure medical fitness of persons deployed for work at height. 2. Provide safe means of access near the work such as ladder /rope ladder / rope grab fall arrester, etc. 3. Provide safe working platform scaffold as per IS:3696-1966. 4. Workman working on the platform/ scaffold shall wear full body harness 5. Safe distance shall be maintained in case of any overhead power line existing near the work. 6. Use tested & certified electrically operated hand tools. 1. Do not keep any loose material on the scaffold platform. 2. Provide tool kit /bucket to keep the tools to prevent their fall. 3. Lifting and lowering of tools & tackles shall be done by means of rope attached to bucket/tool kit. 4. Cordon the area below the work, with display of warning sign. 1. Workers shall be imparted with training on emergency preparedness. 1. In case of unfavorable weather condition like heavy rain/wind, lightening etc. the workmen shall stop the work and come down.

Sl. No.	Activity	Possible Hazards	Preventive actions to be taken
2.	Welding	a)Entanglement with electrical cables and electric shock b)Ultra violet radiation c)Falling of molten metals /sparks(while working at height)	1. Cables shall not be laid on the pathways. 2. Prevent mechanical damage to cable insulation. Insulation healthiness of cables shall be checked daily before starting the job. 3. Cable shall not be run over by vehicles or forklifts. 4. Earthing of machines shall be ensured. 5. Workmen shall wear electrical safety shoes. 6. Current carrying Cables shall not be kept coiled to prevent heat generation and damage of insulation. 7. Current carrying cables shall not be coiled around the body of workers. 8. Welding Electrodes shall not be left in energised condition in electrode holders. 9. Cable joints and distribution boards shall not come in contact with water. 10. ELCB shall be provided to the distribution board. 1. Welder shall wear welder's shield with shaded glasses appropriate to the current consumed. 2. Welder and his assistant shall wear thick cotton clothes and welder's hand gloves. 1. Cordon the area below the work with display of caution boards. 2. Un-authorized entry to that area shall be prevented. 3. Contain the falling spatters by means of asbestos blanket to prevent them falling on the persons, cables, equipments etc. 4. Welder and his assistant shall wear thick cotton clothes and welder's hand gloves.
		d) Inhalation of metal fumes	1. For welding work in open area, the workers shall be in upwind direction

	e)Fire	with respect to the job. 2. For welding work in confined space the workmen shall wear BA sets or canisters. Exhaust ventilation shall be provided near the welding work. 1. Area shall be free from combustible materials. 2. Keep portable fire fighting arrangement near the work.
	f)General	1. While working at height, electrodes shall not be left in energised condition when there is no welding work.. 2. Electrical earth connections shall not be connected to plant structures. They should be connected to earth strips. 3. Number of joints in cable should be minimum as they act as hot spots. 4. Healthiness of the welding machines shall be ensured before putting in service. 5. Electrode butts shall be collected and disposed properly.

3.	Gas cutting	a) Fire/ explosion of cylinders b) Heat hazard c) Flying objects d) Fall of molten metals (while working at height)	1. Area shall be free from combustible materials 2. Leakage from cylinders shall be checked before starting the job. 3. Leaky cylinders shall be kept away from the work area. 4. Healthiness of hoses and gas cutting torch shall be ensured before starting the work. 5. Gas Cylinders shall not be kept close to the area of hot work. 6. Cylinders shall be kept away from flame or sources of direct heat. 1. Persons doing gas cutting shall wear leather hand gloves. 1. Workmen shall wear safety goggles or face shields. 1. Molten metals falling during gas cutting shall be contained by using GI sheets/ asbestos blankets. General Precaution Gas cutting torch shall not be used as a hammer to remove the molten metals as it will damage the nozzle of the gas cutting torch.
4.	Grinding (by portable grinding machine)	a) Fall of flying objects on eye and hands b) Breakage or damage of grinding wheel	1. Operators shall wear face shield/ safety goggles and cotton/leather hand gloves while doing grinding. Before putting in service : 1. Check the grinding wheels for cracks, cleanliness and deposits. 2. Check the shelf life of grinding wheels (expired wheels shall not be used) 3. Check the healthiness of the grinding wheels by doing metal ring test. Cracked wheels shall not be put in service. 4. Check and ensure that the RPM of wheel is matching with that of the machine.

		c)Electric shock	5. Ensure that the wheels are tightly fitted to the machine. 6. Ensure that guard is provided for the grinding wheel. 7. Check for correct direction of rotation. 1. Ensure use of three pin power plug for machines with metallic casing or ensure if it has double insulation. 2. Healthiness of cable insulation shall be ensured. 3. Power cables shall not be coiled around the body of the operator. 4. Power cables should not be laid on the pathway to prevent entanglement. 5. Cable joints and distribution boards shall not come in contact with water. General safety precaution 1. Do not over tighten the wheels 2. Ensure that the switch in “off” position before plugging in the grinder. 3. Hold the wheel away from the body while starting the grinding machine. 4. Do not allow any type of horse playing with the machine. 5. Do not drop the grinding machine or wheel. 6. Do not apply excessive pressure. 7. Power distribution/extension boards shall be provided with ELCB.

APPENDIX-2

JOB HAZARD ANALYSIS FOR WORK INSIDE CONFINED SPACE

Sl. No	Job	Hazard	Precaution
1.	Preparation & Entry into confined space	a) Toxic gases/Asphyxiates	1. Work shall be carried out under valid safety work permit for entry into confined space. 2. Ensure positive isolation of the system by inserting blinds in inlet / outlet lines or by removing the spool pieces. Suitability and adequacy of the blinds shall be ensured before putting them in service. A list shall be prepared for the points where blinds have been inserted and the same shall be attached to the SWP. This will be helpful for normalisation of the system after completion of the work. 3. As a precautionary measure, mobile BA sets may be used by the workmen while working inside the confined space.
		b) Oxygen deficiency	1. Depressurize/ drain/ transfer the contents of the vessel/ confined space. 2. Water wash the inside of the vessel/confined space if permissible 3. Ensure thorough purging of the vessel inside/ confined space with air. 4. Check the oxygen and H₂S concentration before allowing entry of persons inside the vessel / confined space and periodically during the execution of the work. Under no circumstances oxygen concentration shall be less than 20% failing which execution of the work inside the confined space shall not be permitted. 5. Ensure continuous supply of plant air into the vessel/confined space. This is also required to dissipate the inside heat of the confined space for

			comfort of the workmen. (The human body can efficiently work at an ambient temperature of upto 78 °F. Above 78 °F human efficiency starts decreasing due to heat effect. This problem is also multiplied if humidity content of the atmosphere inside the confined space is high.) 6. As a precautionary measure, mobile BA sets may be used by the workmen while working inside the confined space.
		c) Presence of flammable gases / vapours	1. Check the concentration of toxic / flammable gases inside the confined space before allowing entry of the persons and periodically during the execution of the work. It shall always be maintained well within the permissible limit (less than 10% of LEL) failing which execution of the work inside the confined space shall not be permitted.
		d) Electrical Hazards from power supply line to the electrically operated equipments / machines existing inside the confined space/vessel.	1. Ensure de-energisation of all the electrically operated equipments fitted inside the confined space/vessel and to that effect remove the fuses of power supply lines.
		e) Electrical Shock & Flash Over from temporary power supply lines for illumination / electrically operated equipments inside the confined space.	1. Supply voltage shall not exceed 24 volts. 2. In case it is required to supply power exceeding 24 volts, adequacy of the insulation of power supply cable shall be ensured. Fuses on power supply board shall be of desired rating and ELCB shall be provided on the power supply board. 3. Earthing of vessels & connected piping and electrically operated equipments shall be ensured. 4. To the extent possible pneumatic tools shall be preferred for cutting, grinding and drilling inside the confined space / vessels.
		f) Fall of person(s) due to lack of access into the confined space/	1. Arrange adequate and safe means of access into the confined space/vessel.

		vessel.	
		g) Hitting of head with roof or wall and body injury	1. Wear safety helmet and the relevant PPE to prevent injury to head and body parts.
		h) Fire/ explosion hazard from combustible materials or nearby equipments.	1. Combustible materials shall not be permitted to be taken inside the confined space /vessel unless due care is taken. 2. Naked flame, spark producing materials, match boxes etc. shall not be permitted inside the confined space / vessel. 3. If any hot work is to be carried out inside the confined space, the same can be carried out under a valid SWP after taking all necessary precautions. 4. Pyrophoric materials, if present/deposited inside the confined space/ vessel, shall be removed out at the earliest and kept in an area free from combustible materials. 5. Adequate fire fighting arrangements shall be available near the confined space/ vessel. 6. In case of any fire near the confined space/vessel, stop the work and come out of the vessel. Isolate the power supply to all electrically operated equipments and close the knobs of gas cylinders. 7. In case of explosive dusts inside the confined space, due care shall be taken to prevent dust explosion. Explosion can be initiated by either of the following: - Sparks generated during welding, - Naked flame used for gas cutting, - Sparks from static electricity generated on the dust surface, - sparks generated during use of non-sparking tools. Controlling the concentration of flammable/ combustible dust inside the confined space can minimise the above hazards.

		i) Poor visibility due to dusts present inside the confined space/ vessel.	1. Efforts shall be made to reduce the dust concentration inside the confined space/vessel. 2. Adequate nos. of lighting points shall be provided inside the confined space.
		j) Inhalation of dusts	1. For the comfort of the workmen, dust respirators / canisters/ Mobile BA sets shall be provided.
		k) Exposure to toxic gases or vapours (Source of toxic gases or vapours : From nearby equipments or during accidental release from the system/ during emergency situation).	All safety precautions for working in hazardous area shall be followed :- 1. Persons deployed for the work inside confined space/ vessel shall be physically and medically fit. 2. Persons engaged in work shall be trained on confined space entry, hazardous area safety precautions and actions to be taken during emergency or accidental release of toxic gases into work environment. 3. Rescue team shall be available near the confined space/ vessel. 4. Members of rescue team shall be trained in first aid. 5. One observer shall be available near the manhole to keep an eye on the workmen. 6. Persons entering inside shall wear safety belt/ full body harness with lifeline extended to outside for ease of rescue. 7. Adequate means of communication shall be made available near the work. 8. Emergency mock drill for rescue shall be carried out. 9. Persons working inside the confined space may be provided with "motion indicators" [Ex - FIRE FLY motion indicator] which will give audio alarm if the wearer becomes motionless for more than 20 seconds. 10. One register shall be maintained at the entrance of the confined space/vessel for proper accounting of entry and exit of persons and tools & tackles.
		l) Radiation hazard from	1. Radioactive sources shall be

		the radioactive sources placed inside/ near the confined space.	shielded before starting the work. In case it is not possible to shield them, they shall be removed away by taking the help of experts.
2	Preparation of and working on the platform inside the confined space/ vessel.	Fall of person(s), fall of materials, toppling / collapse of scaffold.	1. All safety precautions required for erection & dismantling of scaffold and also for working on scaffold shall be followed. 2. Permittee shall ensure healthiness and stability of the scaffold(s). 3. Tools and equipments lying around the outside of confined space shall be kept at a safer location (preferably in a tool box) to prevent their fall/kicked-in to the confined space.
3	Welding and gas cutting	Fire/explosion hazard.	1. All safety precautions for gas cutting and welding shall be followed. Workmen shall wear the relevant PPE. 2. Portable fire extinguisher shall be available near the work area. 3. The confined space/ vessel shall be free from toxic / flammable gases before starting welding / gas cutting. 4. BA sets shall be worn by the people engaged in welding / gas cutting inside the confined space/ vessel. 5. Exhaust ventilation facility should be provided to the confined space/ vessel to take away the toxic gases or vapors. Otherwise, adequate nos. of air hoses shall be provided during the work to ensure forced ventilation. 6. Temporary power extension boards for work inside the confined space/ vessel shall be provided with ELCB. 7. To the extent possible pneumatic tools shall be preferred for cutting and drilling inside the confined space / vessels.
4	Painting	a) Exposure to paint vapours /mists.	1. Ensure use of dust respirators / BA sets. 2. Provide exhaust ventilation/ forced ventilation to take away the paint vapours/ mists generated during painting.

			3. Instead of spray painting, brush painting should be preferred inside the confined space to prevent formation of paint mists.
		b) Fire hazard due to paint mists.	1. No naked flame or spark shall be allowed inside confined space during painting. 2. Exhaust ventilation / forced ventilation shall be provided to take away the paint vapours/ mists generated during painting. 3. Adequate fire fighting arrangement shall be provided near the confined space/ vessel.
		c) Contact of paints on skin	1. Use of whole body protection shall be ensured
5	Replacement of Pyrophoric catalysts.	Fire hazard due to Pyrophoric catalysts	1. Special arrangements for Nitrogen cooling and pneumatic catalyst removal system need to be installed. Such specialised jobs need to be carried out with the help of expert teams equipped with special chemical entry suits, special respiration and communication system and special tools for digging and removal of catalysts.

APPENDIX-3

JOB HAZARD ANALYSIS FOR PORTABLE POWER TOOLS

Commonly used Portable Power Tools

Electric : Circular Saws (for Tube / Rod cutting), drills, grinders, vibrators, buffing wheels etc.

Pneumatic : Circular Saws (for Tube / Rod cutting), drills, grinders, vibrators, buffing wheels etc.

Hazards involved:

1. Electric Shock
2. Personal Injury due to broken parts such as cuts, sprains burns, trips / entanglement, fall etc.
3. Damage to the tools due to fall or hitting with other objects
4. Fire / Explosion of vapors or gases in the work area
5. Tripping hazard due to cables or hoses carrying air.

Sources of injury: Electrical shock, entry of particles in the eye, fire, falls, Explosion of gases, falling tools etc.

Safety precautions to be taken during handling / operation of portable power tools

Sr.No.	Hazards	Precautions to be taken
1	Electric shock	1. For portable electrically operated power tools ensure use of 3 pin power plugs or ensure use of double insulated portable electrically operated power tools or tools with casing made of non-conducting material like fiber, having two pin plug. 2. Avoid unnecessary lengthy cables for power supply to portable electrically operated power tools. To the extent possible power extension boards shall be provided near the work area from where power can be tapped. 3. Ensure use of tested and certified portable electrically operated power tools. 4. Ensure healthiness of the cable insulation before putting in use. 5. Do not coil the power supply cable around the body of the operator. 6. Disconnect the tool from source of power before changing accessories. Use guards over the rotating parts of the tools. 7. Persons operating Portable Power Tools shall wear electrically safe shoes to prevent electric shock.

		8. Body of the user shall not be wet. 9. Always use three pin plug and three wire cables of proper size and fitting. Under size cables / conductors will get over heated and damage the insulation causing electric shock.
2	Entanglement of clothes with rotating parts	1. Use guards over the rotating parts of the tools. 2. Ensure that the guards in correct position before starting up the portable electrically operated power tools. 3. Loose fitting dresses shall not be used while using portable electrically operated power tools. 4. To the extent possible keep the hands and clothing away from the working end of the tools.
3	Hit by flying objects	1. Use guards over the rotating parts of the tools. 2. Ensure that the guards in correct position before starting up the portable electrically operated power tools. 3. Operators shall wear appropriate personal protective equipments while operating Use guards over the rotating parts of the tools.
4	Fall of Portable Power Tools	1. Portable Power Tools shall not be left in an overhead place, where there is a chance that the cable or hose, if pulled, will cause the tool to fall. 2. While shifting the Portable Power Tools at overhead / higher elevation, please ensure availability of suitable platform. Otherwise please ensure use of fall protection devices by the workmen while doing shifting. 3. Portable Power Tools shall be disconnected from power supply before shifting. 4. Cables or hoses of Portable Power Tools shall be kept out of the operator's way to avoid entanglement.
5	Accidental operation / activation	1. Portable Power Tools shall be kept at safe places and not left in such areas where they can be struck or activated accidentally by a passer by.
6	Stumbling / tripping hazard by cables / hoses	1 Cables / hoses shall not be kept laid on the floor. To the extent possible they shall be kept suspended over work area in such a manner that they will not cause any obstruction in movement of persons.
7	Damage to cables / hoses	1. To the extent possible cables / hoses shall be kept out of operator's passway. In case the cable / hose are to be laid across the floor, they shall be protected by wooden strips or other suitable protection such as pipes to avoid any damage.

		2. Do not hang cables / hose over nails, bolts or sharp edges. 3. Cables / hoses shall be kept away from oil, hot surface and chemicals.
8	General precautions	1. Portable Power Tools shall be used by skilled and experienced operators. 2. Periodic inspection of Portable Power Tools shall be carried out and their healthiness shall be ensured. 3. Use of relevant Personal Protective Equipment such as hand gloves, safety goggles/face shield, hearing protection, rubber mats etc. shall be ensured while using Portable Power Tools. 4. Ensure use of appropriate size and rating Portable Power Tools. Never use under sized / rating or over sized / rating Portable Power Tools. 5. Suitable and adequate approach to the work point shall be provided for safe and efficient job performance. 6. A set of instructions for safe operation shall be attached to all the Portable Power Tools. 7. The operator shall position himself to maintain full control of the tool. He shall avoid using portable power tool above shoulder height. 8. Jigs or fixtures shall be used to hold the work piece whenever possible. 9. Portable Power Tools shall never be locked with ON position, since the nature of job may require stopping of Portable Power Tools quickly. 10. Reasonable safe distance shall be maintained between body of the operator and the tool when the Portable Power Tool is in operation.
9	Special precautions for Air powered tools	1. Workers should be warned against disconnecting the air hose from the tool and using it for cleaning of machines. 2. Air jets should not be used to remove dust from clothing. 3. A short chain attached to the hose coupling and the tool housing will keep the hose from whipping about if the coupling should break. Air supply should be cut off before attempting to disconnect the air hose from the air line. Air pressure inside the line should be released before disconnecting. 4. Operators shall be instructed to a) Keep hands and clothing away from the working end of the tool b) Follow safety requirements applicable to tools being used and nature of work being performed.

		c) Inspect and test the tool, air hose and coupling and rectify the defects before each use. d) Be careful to prevent injury to hands, feet or body if machine slips or tool breaks.

SECTION-V(iii)

TECHNICAL SPECIFICATIONS

PRE-ENGINEERED BUILDING WORKS

Technical specifications for Pre-Engineered Building Works

Architectural design and development of detailed Architectural drawings. Structural Analysis, Design and development of detailed Structural drawings. Development of Good for construction drawings. Obtaining approval for all the analysis & designs documents, drawings from any IIT/ NIT/ IISC/Approved Govt. Engg. College. Support in obtaining all necessary statutory clearance from BARC authority for Construction clearance for Architectural, Structural aspects; along with Documentation work and supply of 6 sets (sizes not less than A-1) of all Good for construction drawings. Manufacture, supply, erection, testing and commissioning of Pre-Engineered Building portion as indicated in the tender drawings. The contractor shall go through the specifications in detail and should bring to the notice of BARC about missing items/specifications which are required for successful erection testing and commissioning of facility/building during pre-bid stage.

Please refer to the tender drawings and it may be noted that the levels or room dimensions indicated in the drawing are tentative and based on architectural design, these levels/size/dimensions may vary. However overall outer dimensions will remain same.

Approximate windows and door locations are shown in the attached tender drawing. However, changes if any will be finalized during preparation of architectural drawings.

- 1) **GENERAL:** The scope of work for Pre-Engineered Building System is as defined in the following section under the contract which includes Architectural design and development of detailed Architectural drawings, Structural Analysis, Design and development of detailed Structural drawings, Obtaining approval for all the analysis & designs documents, drawings from any IIT/ NIT/ IISC/Approved Govt. Engg. College., Support in obtaining all necessary statutory clearance from BARC authority for Construction clearance manufacture/fabrication, supply and erection of Pre-Engineered Building System, Metal Roof System, Wall System, mezzanine floor, Roof and wall insulation, Natural day lighting and Ridge ventilators , Louvers , Gutter , down take system including pipe , Trims and Flashings, fascia all-round the building, canopies/chajja for all windows, doors and rolling shutters, construction of brick masonry wall upto 3 m height as per technical specifications enclosed in the civil & PH section, providing false ceiling, support for lightening mast, partition inside the facilities including all accessories as required for the successful and satisfactory completion of the contract as per the specifications and drawings indicated in this tender.

- 2) **Scope of work:**

- Architectural designs and development of detailed drawings consisting of the following: a) development of detailed Architectural drawings, b) Working Drawings, floor Plans, all Elevations, Sections through both the directions (X&Y), Door & Window Drawings including window grill drawings, detailed toilet drawings. c) detailed 3D Views indicating elevational details from all sides of buildings including

colour schemes, walk through videos. d) Generation of drawings for all connected building elements & services such as structural, Civil finishes, plumbing, sanitary, Electrical installations, MHE, and HVAC

- Structural Analysis & Design consisting of the following: a) Detailed Structural Analysis & Design including seismic analysis b) Preparation of detailed structural & Fabrication drawings. c) Obtaining approval for all the analysis & designs documents, drawings from any IIT/ NIT/ IISC/Approved Govt. Engg. College (as per decision of EIC). All the documents/ drawing shall be signed by a person not below the rank of a professor. d) Support in obtaining all necessary statutory clearances from BARC authorities for construction clearance related to Architectural & structural aspects, along with documentation work and the supply of six sets (sizes not less than A-1) of all Good for Construction drawings.
- Inputs provided by BARC and Statutory Clearance required are as follows:

Inputs Provided by BARC	Support in obtaining the following clearances
Editable tender drawings.	(a) Design Basis Report: BARC-Design Safety Review Committee, Working Groups at BARC, Mumbai & BARC Mysuru. (b) FEM Model, Civil Design Report and GFC drawings: BARC Design Review Teams at Mumbai & Mysuru.

- The inputs Provided by BARC will be kept for viewing during pre-bid conference.
- The contractor shall submit the Architectural & structural design and detailed drawing of pre-engineered structure and Support in obtaining clearances as stated above.
- The contractor shall support BARC in obtaining clearances by submission of documents as required and participating in the safety/regulatory review meetings, providing clarifications and updating the designs/details/drawings/documents based on the recommendations of the regulatory authorities.
- The contractor shall nominate a Structural Engineer with a minimum of five years' experience to act as the nodal technical representative for coordinating design activities at BARC Mumbai, BARC Mysuru, and the project site. The nominated engineer shall be stationed at either Mysuru or Mumbai until all design activities are completed. Additionally, the nominated engineer shall travel to BARC Mumbai, BARC Mysuru, and the project site as required for attending review meetings, providing clarifications, obtaining approvals, and carrying out other related coordination activities.
- The design works shall be complete as per enclosed preliminary tender drawings, required safety class and seismic category, scope of work, specification, schedule of quantities and other provisions detailed in tender documents and as directed by Engineer-In- Charge.

- Manufacture/fabrication, protective packaging, supply, erection, performance testing and handing over of Pre-Engineered Building and accessories as per building descriptions, technical specifications and drawings.
- The tenderer shall furnish all technical specifications / technical parameters/drawings.
- Submission of design basis report for approval from BARC.
- Providing data about the structural reactions along with the structural supporting conditions, corner conditions and highlights of the system to the BARC for their approval.
- Submission of all the drawings, design calculations, along with STAAD files, design brief and all information relating to the design shall be submitted to the BARC for their approval.
- Based on the approval, re submission and getting the approval from the BARC, if required, before proceeding with the fabrication.
- Fabrication of all structural steel based on the approved drawings including roofing and cladding system which comprises of base plates, rafters, anchor bolts, purlins/girts, bracings, framed openings, roofing, skylights, ridge vents, louvers wherever specified along with approved accessories etc.
- Supply of anchor bolts as per the approved design along with double templates (as may required by the client to suit construction schedules) in approved fabricated form to the site for casting of the reinforced cement concrete elements.
- Supervision and checking of positioning and alignment of the anchor bolts and authorizing the position of the anchor bolts before completion of casting of reinforced cement concrete elements.
- Coordination with the bidders' sub-contractors (when sub-contracting is allowed by BARC in tender) operating in the project site for better monitoring.
- Complete fabrication of the material as per approved drawings and technical specifications including the application of primer as per the agreed building descriptions and technical specifications.
- Getting the approval from the BARC before the application of final painting.
- Application of final painting as per the approved technical specifications and building descriptions to the satisfaction of BARC.
- Protective packaging to avoid the damage during transit and transporting of the material to the site as per the agreed norms.
- Unloading of material at the site at the allocated area and stacking/storing of material as per the agreed norms.
- Erection of the structure, roofing and wall panels with accessories as per the approved erection sequence (erection sequence methodology shall be submitted by the contractor for approval of BARC)
- Providing false ceiling in the areas specified in the drawings.

- Testing and commissioning of the complete system with accessories (inclusive of all but not limited to water test as per the relevant specifications wherever required by BARC)
 - Touch up paint wherever required shall be applied
 - All other works which may be necessary for completing the broader definition of scope of works mentioned in the above.
 - All roof panels are to be provided with provision for tying the life line at all rafter locations on all the sides of the building at the eaves level for maintenance provision.
 - Supporting arrangement for the split A/C outdoor units needs to be considered
 - Completion of civil & PH works as per the specifications and drawings enclosed in tender documents.
 - To provide maintenance guide lines and giving the demonstration to the maintenance personnel.
 - The contractor shall follow the Quality Assurance Plane (QAP) and Job Hazard Analysis (JHA) reports attached along with tender documents. If there is/are any work(s) for which QAP and JHA are not available, the same shall be prepared by the contractor and submit for approval of BARC.
 - The contractor shall perform cleaning of items provided as a part of the contract, before final acceptance of the work by BARC including removal of unwanted construction debris dust, dirt, stains, etc.
 - The contractor shall remove trash and rubbish from every area as soon as practicable during and after completion of the work, dismantle the temporary construction facilities and remove from BARC premises the construction offices, stores, plant and equipment, fences, scaffolding, rubbish of every kind, surplus materials, temporary hard structures and supplies belonging to contractor or its subcontractors and leave as found.
- 3) Documentation: Good for construction drawings (GFC – architectural and structural), fabrication drawings, erection drawings, as built drawings & design documents, Design basis reports, Design reports Quality report, MTC and third-party reports, Inspection Records, specific documents mentioned in the tender and test certificates.

4) **AREA STATEMENT**

Overall dimension of the building:

The dimensions of the Boiler House are 18 m (Length) x 16 m (Width) x 7 m (Height). It is a single storey portal frame structure for housing Boilers.

The flooring shall be designed as per flooring specifications indicated in section I (civil specifications).

All the heights indicated are clear height i.e. when measured from finished floor level to the lowest portion of the roof level i.e. bottom of rafter/haunch bottom if provided, at eaves level. Plan dimensions indicated are centre to centre distance between structural steel columns at ends in length and width directions.

5) **STRUCTURAL COMPONENTS:** The building should contain all the below components with necessary accessories required for completion of the building.

- Roofing system as per specifications and drawings,
- Side wall system, Girts, Purlins, eave strut, sag rods, cleats, bolts and nuts etc.
- Ridge Ventilator of 600 mm throat as per drawings or building description given in this document.
- 8 mm thick Multicell poly carbonate sheets for approx. 5% of the roof area of the entire building as per approved GFC drawing (if given in drawings or building description given in this document).
- Mezzanine floor and corridor in mezzanine floor with handrails as indicated in drawing. Structural staircase with handrails as per IS specifications shall be provided. The design of the staircase shall be as per IS code.
- Rest rooms with accessories as per drawings (refer civil technical specifications)
- 80 mm thick sandwich Mineral wool panel for the entire building (external walls, internal partitions and false ceiling)
- Fascia for all the sides of the building.
- Steel Portal Frames including Crane bracket /stepped column,
- Rafter bracings
- Column bracings,
- Gable end sheeting, purlin, columns,
- Trims and Flashings
- Gutters, calculation to be shown to justify the size,
- Down take pipes, calculation to be shown to justify the size,
- Stair case to approach crane and building at multiple locations. Staircase for mezzanine floor.
- Aluminum Doors, Aluminum sliding doors, Aluminum windows, Ventilators with toughened glass/laminated boards/frosted glass for rest rooms and motorized rolling shutters as per civil specifications & relevant IS codes.
- Canopy for full length of the building above louvers with ends closed and soffit sheeting.
- Connecting bolts (high strength),
- Canopy for doors, windows and rolling shutters with ends closed and soffit sheeting.
- Motorized rolling shutters (Part of civil section I)

- Base plates with Gussets for stiffening as per design.
- Shim plates for column erection
- Rest rooms as indicated in the drawing as per specifications indicated in civil section.
- Supports for false ceiling, lightening mast, HVAC works (if specified in the tender).
- All aspects of quality assurance, including procurement & testing of materials and other components of the work, as specified or as directed.
- Clearing of site and handing over of all the works, as directed,
- Submission of completion (i.e., 'as-built') drawings and other related documents as specified
- Any other requirement for the commissioning of the building in all respects in accordance with the provisions of the Contract and/or to ensure the structural serviceability, stability and safety during and after construction.

6) DETAILED ENGINEERING:

- 1) The contractor shall design the structures and prepare all the required drawings needed for correct and accurate construction. The design shall be strictly in accordance with the "Design Specifications" and building description given in *this document*. The design shall be submitted to BARC for approval. Manual design calculations shall be submitted for basic design. Stress calculations are to be carried out with Software.
- 2) The contractor shall submit the design basis and General Arrangement (G.A) of the structure along with required sketches/drawings and get the same reviewed by BARC before starting the final design and Good for Construction (GFC) drawings.
- 3) Construction of the structure shall not be taken up at site till all the drawings are reviewed by BARC and comments/suggestions given by BARC are to be incorporated.
- 4) BARC reserves the right to review any/all of the designs and drawings at any stage of contract. Review by BARC shall not relieve the contractor of his responsibility for correct design and execution of the works.
- 5) The final design and GFC drawings shall directly adhere to the reviewed design basis and general arrangement and shall incorporate all the comments / suggestions given by BARC without any extra cost.
- 6) After the completion of erection and construction, the contractor shall submit to BARC "As Built" drawings in 3 sets of copies.

7) CONSTRUCTION:

- 1) Erection of all structural works, roofing, cladding, framed openings etc., including supply of all materials, labour, supervision, plant, tools and tackles etc., shall be carried out by the Contractor.

- 2) All materials and construction shall conform to the Material and Painting Specifications given in this document.
- 3) Foundation Bolts shall be fixed and grouted by the contractor. The alignment and levels are to be checked and certified by the Manufacturer's Engineer.
- 4) No welding is permitted at site unless otherwise cleared by BARC.
- 5) The contractor has to carry out excavation and civil works as detailed in earlier sections.
- 6) The contractor has to carry out the testing for all the materials like cement, sand, aggregates, reinforcement steel, structural steel etc. before using at site as per quality assurance plan approved by BARC. Third party testing from the approved laboratory is required for the Reinforcement steel, structural steel& cement and any other material as mentioned in approved QAP.

8) BUILDING DESCRIPTION

1	Usage	Boiler House
2	Type	Rigid Frame Clear span
3	Width	As per Tender drawings
4	Length	
5	Clear Ht.	
6	Slope	1 in10
7	Bracings	As per design calculations in compliance with IS 800:2007
8	End wall type	Non expandable
9	End wall Bay spacing	AS PER VENDOR DESIGN
10	Wall cladding conditions	Brick works up to 3 m (cost of brick work, plastering, painting shall be paid in the civil works SOQ) and 80 mm tk sandwich mineral wool panels above the wall.
11	Framed Openings:	For windows, rolling shutters, doors as per architectural drawings (preparation of architectural drawings is in the scope of contractor and shall be prepared based on tender drawings and get it approved by BARC)
12	Canopy	Required for all windows, doors and rolling shutters. Canopies for main door and rolling shutters should be of 2 m projection and 1 m for all windows with Top color coated Galvalume

		sheets of 0.5 mm thk with Crimp sheets at the ends and Liner sheet of 0.5 mm thk at the bottom. All corners and edges should be neatly covered with proper flashings
13	Internal partitions	N.A.
14	Roofing	Roof shall be with 0.6 mm thick Standing seam roof (SSR) system.
15	False ceiling	N.A. However, ceiling/roof shall be provided for washroom at 3 m height with 80 mm tk sandwich mineral wool panels including supporting arrangements.
16	Painting	The cleaning & painting specifications for the Structural Steel Member of the PEB system Shall be: Two shop coat of zinc phosphate grey primer (total 50 micron) and two shop coat synthetic enamel paint (total 70 micron). The paint specifications and painting work shall be as per relevant IS code.
17	Flashings, Gutter / Down take Pipe	Galvalume flashings & gutter & PVC down take pipe. Gutter shall be provided outside the external wall.
18	Fascia	Vertical fascia to match the elevation features on all four sides with double side cladding with top flashings and structural support. Height to match with the ridge level. Both side sheets will be color coated Galvalume sheet 0.5 mm thk. The height of the fascia will be decided based on the architectural design of building up to gravent height. Fascia will be double side cladded and all around the building
19	Roof life line	Roof life line on complete periphery of roof of approved make. The roof line design shall be as per relevant IS/International codes.
20	Cage ladder	1 no's for roof access
21	Galvalume Louvers	Supply and installation of 1 m wide galvalume Louvers made up of 0.5 m thk Galvalume sheet with Mosquito mesh behind on all sides of the building.

- Doors, rolling shutters and windows as shown in the drawing and specifications.
- **PVC down take Pipe**
PVC down take pipe shall be provided as per schedule of 40+/-4 Kg/cm² as per IS specification and as directed by Engineer In charge. Necessary pipe bends, socket/collar required for joining the pipes shall also be part of this.

9) Timeline for Submission of Design Activities and Duration for Issuance of Clearances/Comments by Statutory Authority and Engineer-in-Charge (EIC):

Sr. No.	Activity		Timeline	Remarks
1.	Preliminary meeting with all stakeholders from BARC & Contractor		T ₀ +45 Days (T ₀ = Stipulated start date of the contract)	(a) BARC shall share all inputs and formats for the DBR, DR, drawings, etc. with the contractor.
2.	Architectural drawings & DBR	1 st Submission	T ₀ +60 Days	(a) If the submitted DBR and drawings are acceptable, considering the inputs and formats provided by BARC, comments shall be issued by BARC within 7 days of submission. (b) If the quality of the submission is not acceptable, the submission shall be rejected, and the contractor shall be asked to resubmit. The resubmission shall be treated as the first submission. (c) The resubmission shall be made within 7 days of rejection and this delay shall be attributable to the contractor.
		2 nd Submission	T ₀ +74 Days	(a) 2 nd Submission shall be made within 7 days of issuing the comments on the 1 st Submission. (b) If the comments provided on the 1 st submission are fully incorporated, then

				comments on the second submission shall be issued within 3 days. (d) If the comments provided on the 1st submission are not incorporated, the submission shall be rejected, and the contractor shall be asked to resubmit. The resubmission shall be treated as the 2nd Submission. (c) The resubmission shall be made within 3 days of rejection and this delay shall be attributable to the contractor.
		3 rd Submission	T ₀ +80 Days	(a) 3rd Submission shall be made within 3 days of issuing the comments on the 2nd Submission. (b) If the comments provided on the 2nd Submission are fully incorporated, the submission shall be forwarded to BARC statutory authorities for clearance. Final clearance shall be granted within one month of submission. (c) Contractor shall asked to proceed with for starting activities related to DR & GFC Drawings within 7 days of submission. (d) If the comments provided on the 2nd submission are not incorporated, the submission shall be rejected, and the contractor shall be asked to resubmit. The resubmission shall be treated as the 3rd Submission. (e) The resubmission shall be made within 3 days of rejection and this delay shall be

				attributable to the contractor.
3.	DR & GFC drawings	1 st Submission	T ₀ +101 Days	(a) If the submitted DR and drawings are acceptable, considering the inputs and formats provided by BARC, comments shall be issued by BARC within 7 days of submission. (b) If the quality of the submission is not acceptable, the submission shall be rejected, and the contractor shall be asked to resubmit. The resubmission shall be treated as the first submission. (c) The resubmission shall be made within 7 days of rejection and this delay shall be attributable to the contractor.
		2 nd Submission	T ₀ +115 Days	(a) 2nd Submission shall be made within 7 days of issuing the comments on the 1st Submission. (b) If the comments provided on the 1st submission are fully incorporated, then comments on the second submission shall be issued within 3 days. (e) If the comments provided on the 1st submission are not incorporated, the submission shall be rejected, and the contractor shall be asked to resubmit. The resubmission shall be treated as the 2nd Submission. (f) The resubmission shall be made within 3 days of rejection and this delay shall be attributable to the contractor.
		3 rd	T ₀ +121 Days	(a) 3 rd Submission shall be made within 3 days

		Submission		of issuing the comments on the 2nd Submission. (b) If the comments provided on the 2nd Submission are fully incorporated to the satisfaction of EIC, then Construction clearance shall be given within 7 days. (c) Final clearance shall be granted within two months of submission. (d) If the comments provided on the 2nd submission are not incorporated, the submission shall be rejected, and the contractor shall be asked to resubmit. The resubmission shall be treated as the 3rd Submission. (e) The resubmission shall be made within 3 days of rejection and this delay shall be attributable to the contractor.
Note.: (a) 'T ₀ ' is Stipulated start date of the contract.				

10) DESIGN SPECIFICATIONS

1. **ANALYSIS:** The buildings mentioned in the project description shall be analyzed as 3-Dimensional frame structural system. The buildings shall be modeled and analysed using STAAD PRO. SI units shall be followed for entire analysis and design. The model space frame shall be analyzed for dead loads (DL), live loads (LL), wind loads (WL), collateral loads and seismic loads (EQ) and their combinations. Confirming to IS: 875 – 1987: Code of Practice for design loads (other than earthquake) for buildings and structures & IS: 1893 (Part 1 & 4): Criteria for Earthquake Resistant Design of the structures and structure is to be designed as per the standard practice and in conformity with IS: 800-2007: Structural Steel Design. **The design life span of all structures shall be taken as 75 years.**
2. **SUPPORT CONDITIONS:** Support conditions can be either pinned or fixed as per designer's choice at the Plinth level for the analysis as per the requirements. Effective length of the columns shall be considered as per the standard codes of practice.

3. **LOADS:** The structure shall be designed for all loads, including the weight of structure, live load, wind and earthquake, solar panel load over entire roof area of building, utility piping loads, mezzanine floor load including office accessories (the office areas consist of metal racks, compactors etc. hence sufficient safety factor is to be considered while designing the mezzanine floor). Due consideration shall be given to loading during the construction/erection phase and accounted for in the design.

a. Dead Load (DL): Dead loads shall cover unit weight/mass of materials, and parts or components in a building that apply to the determination of the dead loads in the design of buildings and shall be considered as per IS: 875 (Part 1–) according to the densities of the possible components. This includes Self Weight of Structure including Purlins, Sheeting, Girts, Bracings, weight of turbo ventilators (if provided) to be added as Dead load. etc.

b. Imposed Loads (LL): Imposed loads shall be considered as per IS: 875 (Part 2)
Live load shall be considered as 0.75 KN/sqm on roof for the analysis and design. Live load of mezzanine is 5 kN/sqm or as per IS code whichever is maximum.

c. Wind Load (WL): Wind loads shall be as per IS: 875(Part 3)
The contractor shall submit wind load calculations and the design shall prove that the structure is safe. The calculations shall be as per IS code. wind load calculation shall be as per IS: 875 (Part 3) latest revision.

d. Collateral Load: Collateral load from the roof and mezzanine (other than the dead load and live load) shall be considered from the purlins as per the following for various buildings for services such as electrical cable trays, sprinkler pipes, compressor pipe lines and other services etc.

- For utility Support under deck : 0.30 KN/sqm

e. Solar panel load: Structure shall include 1.5 kN/sqm on roof as solar panel load in addition to other loads mentioned in this document.

f. Seismic Load (EQ): The proposed structures in this project shall be analyzed for seismic forces.

The seismic zone shall be considered as per IS: 1893 (Part 1)& IS: 1893- (part 4).

g. Fire protection load: The load due to fire protection applied to columns and rafters shall be considered. Load shall be taken as 2 kN/Rm.

Load Combinations

- Load combinations shall be considered as per IS 800, IS 1893 and IS 456 (all latest revisions)

4. GENERAL:

Design of all primary members such as columns, rafters, monitor roof, crane girders & gable end columns will be in the scope of contractor. Based on the above, the contractor shall prepare GA drawings, fabrication drawing, erection drawings required for completion of the work.

Design of all secondary members such as roof bracing, column bracings, purlins, wall girts, cleats, clips, eaves strut, hanger bracings, sag rod, crane walk way, Staircase etc., shall be designed by the contractor and release the fabrication / erection drawings after duly vetting of calculations.

The design considerations given hereunder establish the minimum basic requirements for the design. However, structure shall be designed for the satisfactory performance of the functions for which the same is to be constructed.

Whenever any reference to IS Code is made, the same shall be taken as the latest revision (with all amendments issued there to) on the notified date of submission of tender. For this work IS 800-2007 and IS 456-2000 to be followed.

Apart from the IS Codes mentioned in particular for wind, live and earthquake loads in the various clauses of this specifications, all other relevant codes such as American standards (AISC, MBMA, AISI & AWS specifications) related to the specific job under consideration and / or referred to in the above mentioned codes may be followed wherever applicable, if the specifications for the same are not available in the relevant IS codes.

In case of any variation / contradiction between the provisions of Codes and the specifications given hereunder, the provisions given in these specifications shall be followed.

METHOD OF DESIGN

All the structural steel elements shall be designed as per IS: 800-2007. Fabrication & Erection as per relevant IS Code.

CONNECTION DETAILS

All flanges and webs of primary members shall be welded on both sides of the web.
All connections shall be bolted unless otherwise specified.

PITCH OF THE ROOFING

A slope of 1 in 10 shall be considered for all the buildings for the roofing system unless otherwise specified.

VERTICAL DEFLECTION AND HORIZONTAL SWAY LIMITS:

Limiting Deflection: The limiting permissible vertical deflection for structural steel members shall be as specified below:

Structures / structural components: as per IS 800-2007 code.

The limiting permissible horizontal deflection for as per IS 800-2007 code

FRAME ANALYSIS:

The frame shall be analyzed with either fixed/pinned base. Loads shall be considered as per IS 875, IS 1893 and load combinations shall be considered as per IS 800, IS 456, IS 875 and IS 1893 as and when applicable. Loadings shall be considered as maximum of the values mentioned in this document and corresponding IS codes.

Frame modelling, analysis and analysis shall be carried out as per IS 800-2007 (LSM) and IS 456. Detailing including provision of expansion joints shall be envisaged as per IS 800-2007/IS 456 as applicable for structure. Provision of expansion joint in roof and walls shall be considered as per manufacturers specifications and good engineering practice.

APPLICABLE CODES:

The codes and standards generally applicable to the work of this section are listed below. Latest revisions of the codes on the last date of tender submission shall only be applicable.

- IS - 875 PART 1 TO 5
- IS-1893: Criteria for Earth Quake Resistance Design Structures
- IS-800 :Code of Practice for General Construction in Steel. And all the codes listed in annex-A of the code
- IS-801:Code of Practice for use of Cold-Formed Light Gauge Steel Structure
- IS-807:Design, Erection & Testing (Structural Portion) of Cranes and Hoists – Code of Practice.
- IS-816: Code of Practice for use of Metal Arc Welding for General Construction.
- IS: 102 Ready mixed paint, brushing, red lead non-setting, priming IS: 104 Ready mixed paint, brushing, zinc-chrome, priming.
- IS: 806 Code of Practice for use of Steel Tubes in General Building Construction.
- IS: 808 Dimensions of Hot Rolled Steel Beam, channel and angle sections IS:811 Cold Formed Light Gauge Structural Steel Sections.
- IS:813 Scheme of Symbols for Welding
- IS:814 Covered Electrodes for Manual Metal Arc Welding of Carbon and Carbon-Manganese Steel
- IS:816 Code of Practice of use of Metal Arc Welding for General construction in Mild Steel.

- IS:818 Code of Practice for Safety and Health requirements in electric and Gas Welding and Cutting operations.
- IS:822 Code of Procedure for Inspection of welds.
- IS:875 Code of Practice for Structural Safety of Building, Loading Standards
- IS:1024 Code of Practice for use of welding in Bridges and Structures Subject to Dynamic Loading.
- IS:1120 Coach Screws
- IS:1161 Steel Tubes for Structural Purposes
- IS:1182 Recommended practice for Radiographic Examination of Fusion Welded butt Joints in Steel plates.
- IS:1363 Hexagon Head Bolts, Screws and Nuts (Grades –C)
- IS:1364 Hexagon Head Bolts, Screws and Nuts (Grades A&B)
- IS:1365 Slotted Counter-sunk Head Screws
- IS:1367 Technical Supply condition for threaded fasteners.
- IS:1852 Rolling and Cutting Tolerances for Hot Rolled Steel Products.
- IS:1977 Low Tensile Structural Steel
- IS:2016 Plain washers
- IS:2062 Steel for General Structural Purposes
- IS:2074 Ready Mixed Paint, Air drying, Red Oxide-Zinc chrome priming.
- IS:3063 Fasteners-Single Coil Rectangular Section Spring Washers
- IS:3443 Crane Rail Sections
- IS:3600 Testing methods of fusion welded joints and weld metal in steel.
- IS:3613 Acceptance tests for wire flux combination for submerged, arc welding.
- IS:3757 High strength structural bolts.
- IS:4000 Code of practice for high strength bolts in steel structures
- IS:4923 Hollow Steel sections for structural use.
- IS:5369 General Requirements for plain washers and lock washers
- IS:5624 Foundation bolts.
- IS:6227 Code, of practice for use of metal arc welding in tubular structures
- IS:6623 High strength structural nuts.
- IS:6639 Hexagonal bolts for steel structures.
- IS:8500 Structural Steel Micro-alloyed (Medium and high strength qualities)
- Code of practice of industrial ventilation

11) PARTICULAR SPECIFICATIONS

STEEL STRUCTURES:

This section covers the general requirements of designing, preparing necessary drawings, and providing, fabricating, painting, transporting, erecting, fixing in position Structural steel work for buildings, including all necessary temporary works and conducting of associated tests.

12) DESIGN:

The contractor will be required to carry out detailed design of the structures, prepare engineering drawings and detailed 'shop drawings', get these approved before start of fabrication work based on approved drawings.

Contractor's designs shall, unless otherwise specified, be based on provisions of relevant BIS codes. Design guideline and design parameters are mentioned in earlier sections to these specifications.

Where corresponding parameters mentioned in BIS codes are different from those mentioned above, the latter shall take precedence.

Contractor's designs shall be based on general descriptions of buildings given in these specifications, and those shown in tender drawings.

Where codes and standards listed above do not cover the requirements of design, only in those cases the contractor may refer to other international standards of design, however such references should be made only with the approval of the Engineer in charge.

Contractor shall submit his design calculations and 'Engineering Drawings' along with proof design to the Engineer in charge for his approval. The contractor is advised to discuss his design philosophy and design procedure with the Engineer in charge or his representative before proceeding with the final design work.

It shall be the responsibility of the contractor to obtain all relevant design information from the Engineer in charge for preparing his design, and other utility services supported by the structure.

13) DRAWINGS:

Tender Drawings shall be the 'Basic' drawings for developing design drawings. Design drawings shall then be developed in to final 'Shop Drawings' to be prepared by the contractor. For preparing shop drawings, the contractor shall obtain written approval from the Engineer in charge.

Tender drawings furnished to the contractor shall form a part of these specifications. The contractor shall consult these in detail for all the information contained therein, which pertains to and is required for his work.

Revisions to drawings, even after release for preparation of shop drawings, are likely to be made to reflect additional data, or, additional details defining updated requirements. Revisions to drawings and any new drawings made to include additional work for the Contractor shall be

considered a part of this specification and contract. Extra claims by the contractor on this account shall not be entertained.

It shall be clearly understood that the Tender drawings are only informative drawings and are not intended to show exact and final information or specific connection details.

In case of variations in 'Drawings' and 'Specifications', the decision of the Engineer in charge shall be final and binding. Should the Contractor during the execution of his work, find discrepancies in the information furnished to him, he shall refer such discrepancies to the Engineer in charge before proceeding with such work.

Contractor shall prepare all fabrication and erection drawings necessary for completing the work satisfactorily.

Drawings shall be of one standard size and shall be clear and legible.

Drawings shall be based on Tender drawings supplied to the contractor, but he shall verify actual clearances and dimensions from site on works executed by other agencies and from Engineer in charge.

Shop drawings shall include, but not be limited to: -

- Detailed marking plans.
- Details member connections and connections to other structures and components of building.
- Detailed dimensions for fabrication indicating dimensional modifications required for field conditions
- Welding and bolting procedures to be used both at shop and field.
- Cambers required to be provided, and permissible tolerances in fabrication.
- Assembly and Erection sequences indicating components to be connected at field.
- Complete bill of materials for each component (preferably drawing wise.)

Before submitting of shop drawings and calculations to the Engineer in charge for approval, these shall be checked and certified by the authorized and certified structural Engineer (As mentioned above). Till such time shop detail of a component is approved. Fabrication work for the component shall not be started.

If necessary and called for by the Engineer, shop drawings shall be revised to suit modified requirements and these shall be resubmitted for approval of the Engineer in charge.

While the shop drawings prepared by the contractor, and approved by the Engineer in charge represent the correct interpretation of work to be done, the contractor is not relieved of his responsibilities for: -

- Dimensional accuracy
- Correctness of engineering and design of connections
- Fit of parts
- Details
- Errors or omissions
- Material and workmanship
- Methodology of fabrication and erection
- Safety of performance

14) SUBMITTALS:

On commencement of the Project, the Contractor shall submit the following to the Engineer in charge: -

- Prior to the technical submittals, the contractor shall submit detailed baseline program and methodology indicating the proposed overall schedule for documentation such as calculations, shop/working drawings, plan/procedures and records. Submission of samples, process of fabrication / delivery to site storage yard for the approval of the Engineer in charge.
- Complete fabrication drawings, materials lists, cutting lists, bolt lists, welding schedules and QC schedules, based on the design drawing furnished to him and in accordance with the approved schedule. It is highlighted that structural steel members, dimensions thereof indicated in tender drawings are tentative only, and may be modified during final design stage.
- Results of any tests, as and when conducted and as required by the Engineer in charge.
- Manufacturer's mill test reports in respect of steel materials, bolts, nuts and electrodes, wires as may be applicable.
- A detailed list of all constructional Plant & Equipment, such as cranes, derricks, winches, welding sets etc. their makes, model, present condition and location, available to the contractor and the ones he will employ on the job to maintain the progress of work in accordance with the contract.
- The total number of experienced personnel of each category, like fitters, welders, riggers etc., which he intends to deploy on the project.
- While the conceptual drawings of the PEB will be given by BARC, Contractor has to prepare Architectural drawings for improvement in the functional requirement based on conceptual drawings given by BARC, however BARC reserves the right to whether consider the suggestions or not. Contractor shall also submit complete design calculations, STAAD file and Drawings of primary and secondary members for vetting by BARC.

15) MATERIALS:

STEEL SUPPLIED BY THE CONTRACTOR:

The Contractor shall furnish to the Engineer in charge all mill orders covering the material ordered by him for this work and also the test reports received from the Mills for his approval and information. It is not intended that all the steel materials to be supplied by the Contractor for the work shall be specially purchased from the rolling mills. The Contractor's stock material may be used, provided the mill test reports identified with the materials, satisfactorily demonstrate the specified grade and quality. The Engineer in charge shall have the right to test random samples to prove authenticity of the test certificates produced by the Contractor, at the Contractor's cost.

All steel materials supplied by the Contractor shall be in a sound condition, of recent manufacture, free from defects, loose mill scale, slag intrusions, laminations, pitting, flaky rust etc. and be of full weight and thickness specified.

Wherever the Contractor, in order to accommodate his other materials in stock, desires to substitute structural steels or plates for the sizes shown on drawings, such substitutions shall be made only after authorization in writing by the Engineer in charge.

The Engineer in charge may direct that substitution be made, when he considers such substitution is necessary.

16) HANDLING AND STORAGE:

Proper storage of steel (sections and fabricated members) at the job site shall be the responsibility of the Contractor.

Structural steel shall be stored out of mud and dirt. Proper drainage of the storage area shall be provided. These shall be protected from damage or soiling by adjacent construction operations.

Fabricated steel shall not be handled until the paint has thoroughly dried. Care shall be taken to avoid paint abrasions and other damage. Steel work shall be transported in such a way so as not to over stress the fabricated sections. All pieces bent or otherwise damaged shall be rejected and shall be replaced by the contractor at his own cost.

Checking and inspection of fabricated structural steel work by the Engineer in charge shall be done at various stages of completion of fabrication work. The contractor is required to ensure that fabricated steel work is properly stacked such that all joints of all members are either visible or accessible for inspection at all stages of inspection work. Care should also be taken to ensure that fabricated members are not subjected to stresses due to defective stacking.

17) FABRICATION:

All fabrication work shall be done in accordance with IS: 800: 2007 read in conjunction with relevant codes mentioned therein.

Fabrication shall be done in workshops approved by Engineer in charge, unless specifically permitted by Engineer in charge that fabrication can be done at site. Under such circumstances work shall be done on a specially designed and constructed platform. Location, size, specification and construction of such a platform shall have prior approval of Engineer in charge. Loads associated with such platforms shall be provided to Engineer in charge.

Mild steel rolled sections and plates shall be cut by shearing/machining and grinding the surfaces to true sizes and shapes. Gas cutting of mild steel may be permitted by the Engineer in charge, provided that every cut face and edge is smoothened by grinding operation. Prior approval of Engineer in charge must be obtained for using gas-cutting techniques either by mechanized gas cutters or manually operated gas cutters. While, using gas-cutting methods, proper allowance must be made for grinding to bring the cut piece to exact required dimensions.

Extensive use of templates shall be made in doing fabrication work.

Templates shall be clean and should have true surfaces prepared for every successive use. Reinforcements for the structural steel members if required shall be included. In case actual members are used as templates for similar pieces are fit to be incorporated in the finished structure. Jigs and manipulators shall be used, where practicable, and shall be designed to facilitate welding and to ensure that all welds are easily accessible to the operators.

All material shall be straight and free from twist and bends unless required to be curvilinear in form. If necessary the material shall be straightened and / or flattened/straightened by pressure. Heating of rolled sections and plates for purpose of straightening shall not be permitted.

Curvilinear members shall be formed by bending with the help of pneumatic press. Final shaping, to a very limited extent, however, may be done by local heat application. This shall be done only on receiving approval from the Engineer in charge.

HOLING:

All holes shall be made at right angles to the surface of the member.

Holes shall be clean cut without any torn or jagged edges. Holes shall be done by drilling. Punching shall not be resorted to, unless previously approved by the Engineer. In any case, punching of holes in materials having a thickness in excess of the connector diameter, or, for

materials thicker than 16mm, the hole shall be punched 3mm less in diameter than the required size and then reamed to the full size. Holes shall not be formed or enlarged by burning or gas cutting under any circumstances.

18) WELDING:

GENERAL:

In general, only Automatic submerged arc welding will be used for fabrication. Subject to approval of Engineer in charge, Metal inert gas welding may be done for short length where access to the location of the weld does not permit submerged arc welding. The welding and the welded work shall conform to IS:816, unless otherwise specified. As much work as possible shall be welded in shops and the layout and sequence of operations shall be so arranged as to eliminate distortion and shrinkage stresses. Unless otherwise specified all weld shall be for full contact for all sides.

Electrodes for shielded-arc manual welds shall comply with the requirements of IS: 814 and shall be amenable to radiographic tests and shall be of approved make. The electrodes for manual arc welding shall be suitable for use in the position and type of work, as laid down in the above specifications and as recommended by the manufacturers. Electrodes classification group 1 or 2 as given in IS: 814 shall be used for welding steel conforming to IS:2062. Electrodes shall conform to IS-1442 for steel conforming to IS: 8500. Joints in materials above 20mm thick, and, all important connections shall be made with low hydrogen electrodes Electrode flux covering shall be sound and unbroken. Broken or damaged coating shall cause the electrodes to be discarded. Covered electrodes for manual arc-welding shall be properly stored in an oven prior to use in a manner recommended by the Manufacturer and only an hour's quota shall be issued to each welder from the oven. Electrodes larger than 5mm diameter shall not be used for root-runs in butt-welds. Welding plant and accessories shall have capacity adequate for the welding procedure laid down and shall satisfy appropriate standards and be of approved make and quality, the Contractor shall maintain all welding plant in good working order. All the electrical plant in connection with the welding operation shall be properly and adequately earthed and adequate means of measuring the current shall be provided.

All welds shall be made only by welders and welding operators who have been properly trained and previously qualified by tests to perform the type of work required as prescribed in the relevant applicable standards.

All welds shall be free from defects like blow holes, slag inclusions, lack of penetration, undercutting, cracks etc. All welds shall be cleaned of slag or flux and show uniform sections, smoothness of weld metal, feather edges without overlap and freedom from porosity.

Fusion faces and surfaces adjacent to the joint for a distance of at least 50mm on either side shall be absolutely free from grease, paint loose scales, moisture or any other substance which might

interfere with welding or adversely affect the quality of the weld. Joint surfaces shall be smooth, uniform and free from fins, tears, laminations etc. Preparation of fusion faces shall be done in accordance with the approved fabrication drawings by shearing, chipping, machining or machine flame cutting except that shearing shall not be used for thickness over 8mm.

In the fabrication of cover-plated beams and built up members all shop splices in each component part shall be made before such component part is welded to other parts of the member. Wherever weld re-enforcement interferes with proper fit-up between components to be assembled for welding, these welds shall be ground flush prior to assembly.

Members to be joined by fillet welding shall be brought and held as close together as possible and in no event shall be separated by more than 3mm.

If the separation is 1.5mm or greater, the fillet weld size shall be increased by the amount of separation. This shall only apply in the case of continuous welds. The fit-up of joints at contact surfaces which are not completely sealed by welds shall be close enough to exclude water after painting.

The separation between fraying surfaces of lap joints and butt joints with backing plate shall not exceed 1.5mm. Abutting parts to be butt welded shall be carefully aligned and the correct root gap maintained throughout the welding operation. Misalignments greater than 25 percent of the thickness of the thinner plate or 3mm whichever is smaller shall be corrected and in making the correction the parts shall not be drawn into a slope sharper than 2 degrees (1in 27.5).

Welding procedures recommended by appropriate welding standards and known to provide satisfactory welds shall be followed. A welding procedure shall be prepared by the Contractor and submitted to the Engineer in charge for approval before start of welding.

Approval of the welding procedure by the Engineer in charge shall not relieve the Contractor of his responsibility for correct and sound welding without undue distortion in the finished structure. Voltage and current (and polarity if direct current is used) shall be set according to the recommendations of the Manufacturer of the electrode being used, and suitable to thickness of material, joint form etc. The work shall be positioned for flat welding wherever practicable and overhead weld shall be avoided.

No Welding shall be done when the surface of the members is wet, not during periods of high wind unless the welding operator and the work are properly protected. In joints connected by fillet welds, the minimum sizes of single run fillet welds or first runs and minimum full sizes of fillet welds shall conform to the requirements of IS:816 and IS:823, Fillet welds larger than 8mm shall be made with two or more passes.

All 'full penetration butt welds' made by manual arc-welding, except when produced with the aid of backing material or welded in flat position, from both sides in square-edge material, not over 8mm thick with root opening not less than one-half the thickness of the thinner part joined, shall have the root of the initial layer gouged out on the back side before welding is started from that side, and shall be so welded as to secure sound metal and complete fusion throughout the entire cross section.

Butt welds shall be terminated at the ends of a joint in a manner that will ensure their soundness where abutting parts are 20mm or more in thickness, run-on and run-off plates with similar edge preparation end having a width not less than the thickness of the thicker part joined shall be used. These extension pieces shall be removed upon completion of the weld and the ends of the weld made smooth and flush with the abutting parts. Where the abutting parts are thinner than 20mm the extension pieces may be omitted but the ends of the butt welds shall then be chipped or gouged out to sound metal and side welded to fill up the ends to the required reinforcement.

Each layer of a multiple layer weld except root and surface runs may be moderately peeled with light blows from a blunt tool. Care shall be exercised to prevent scaling or flaking of weld and base metal from over peeling.

Before commencing fabrication of a member or structure in which welding is likely to result in distortion and/or locked up stresses, a complete program of fabrication, assembly and welding shall be made and submitted to the Engineer in charge for his approval. Such a program shall, include, besides other appropriate details, full particulars in regard to the following: -

- Proposed pre-bending of components such as flanges and presetting of joints to offset expected distortion.
- Make up of sub-assemblies proposed to be welded before incorporation in final assembly.
- Proposed joint forms, classification of wire and flux or covered electrodes, welding process including fitting and welding sequence with directions in which freedom of movement is to be allowed. Proposed number, spacing and type of strong details of jigs and fixtures for maintaining proper fit up and alignment during welding.
- Any other special features like assembling similar members back to back or stress relief
If so desired by the Engineer in charge, mock up welding shall be carried out at the contractor's cost to establish the efficacy of the proposed programme, with any modification suggested by the Engineer in charge in limiting distortion or/and residual stress to acceptable levels. Such modifications will not relieve the contractor of any of his responsibilities.

The ends of butt joints shall be welded so as to provide full throat thickness. This may be done by the use of extension pieces, cross-runs or other approved means. The weld face shall, at all

places, be deposited projecting the surface of the parent metal. Where a flush surface is required, the surplus metal shall be dressed off. Splices and butt joints of compression members, depending on contact for stress transmission, shall be accurately machined over the whole section. In column bases, the ends of shafts together with the attached gussets, angles, channels etc., after bolting and/or welding together as the case may be, shall be accurately machined so that the parts connected butt over the entire surface of contact. Care shall be taken that connecting angles or channels are fixed with such accuracy that they are not reduced in thickness by machining by more than 0.80mm.

The minimum leg length of a fillet weld as deposited shall be not less than the specified size. In no case shall a concave weld be deposited, unless specifically permitted. Where permitted, the leg length shall be increased above that specified length, so that the resultant throat thickness is as great as would have been obtained by the deposition of a flat-faced weld of the specified leg length.

After making each run of welding, all slag shall be thoroughly removed and the surface cleaned. The weld metal shall be properly fused with the parent metal without under cutting or overlapping at the toes of the weld. The surface of the weld shall have a uniform consistent contour and regular appearance.

INSPECTION OF WELDS:

All welds shall be inspected for flaws by any of the methods described in these Specifications, and as per IS: 822. The choice of the method to be adopted, shall be determined by the Engineer in charge.

The contractor shall arrange for all tests as called for, at his own cost.

In case the tests uncover defective work, such tests shall be at the Contractor's cost and the Contractor shall correct such defects at his own cost and prove the soundness of rectified work. The correction of defective welds shall be carried out as directed by the Engineer in charge without damaging the parent metal. When a crack in the weld is removed, magnetic particle inspection or any other equally positive means as prescribed by the Engineer in charge shall be used to ensure that the whole of the crack and material up to 25mm beyond each end of the crack has been removed. Cost of all such tests and operations incidental to correction shall be to the Contractor's account.

19) FABRICATION TOLERANCES:

Unless otherwise shown on drawings, the fabrication tolerances shall be followed as per IS 7215. When specifications are not available on drawings/specified IS code, international standards may

be referred to for this purpose. In case tolerance limits are not available below mentioned shall be followed.

STRAIGHTNESS:

The dimensional and weight tolerance for rolled shapes shall be in accordance with IS: 1852 for indigenous steel and equivalent applicable codes for imported steel. The acceptable limits for straightness (sweep and camber) from rolled or fabricated members shall be: -

- Struts and columns: L/1000 or 10mm whichever is smaller. For all other members not primarily in compression such as purlins, beams, bracings & web members of trusses
- latticed girders: L/500 or 15mm whichever is less. (Where L is the length of finished member, or such lesser length as the Engineer in charge may specify).

TWISTS:

A limit of twist (prior to erection) in: -

- Box girders and heavy columns: L/1500
- Other members L/1000

CAMBER:

- Tolerance in specified camber of structural members shall be $\pm 3\text{mm}$.

LENGTH:

Tolerance in specified length shall be as follows: -

Type of member Tolerance

- A column finished for contact bearing: $\pm 1\text{ mm}$
- Other members (e.g. beams) under 10 m : + 0 and -3mm
- Other members (e.g. beams) 10 m long and over : + 0 and -5mm

SQUARE-NESS AT END OF MEMBERS:

Beam to beam and beam to column connections where the abutting parts are to be jointed by butt welds, permissible deviation from the square-ness of the end is:-

- Beams up to 600mm in depth: 1.5mm
- Beams over 600mm in depth : 1.5mm every 600 mm depth up to a max of 3mm
- Where abutting parts are to be jointed by bolting through cleats or end plates, the connections require closer tolerance.
- Beams up to 600mm in depth: 1.0mm
- Beams over 600mm in depth : max of 1.5mm

BUTT JOINTS:

For full bearing, two abutting ends of columns shall first be aligned to within 1 in 1000 of their combined length and then the following conditions shall be met:

- Over at least 80% of the bearing surface the clearance between the surfaces does not exceed 0.10mm.
- Over the remainder of the surfaces the clearance between the surfaces does not exceed 0.30mm.

Where web stiffeners are designed for full bearing on either the top flange or bottom flange or both, at least half the stiffener shall be in positive contact with the flange. The remainder of the contact face could have a max. gap of 0.25mm.

DEPTH OF MEMBER:

Acceptable deviation from the specified overall depth is:

- For depths of 900 mm and under: $\pm 3\text{mm}$.
- For depths over 900 mm and under 1800mm: $\pm 5\text{mm}$
- For depths of 1800 mm and over: +8 mm: - 5mm

WEB PLATES:

Acceptable deviation from flatness in girder webs in the length between the stiffeners or in a length equal to the girder depth shall be 1/150th of the total web depth.

FLANGE PLATES:

Limit for combined warpage and tilt on the flanges of a built-up member is 1/200 of the total width of flange or 1.5 mm whichever is smaller measured with respect to centre line of flange. Lateral deviation between centre line of web plate and centre line of flange plate at contact surfaces, in the case of built up sections shall not exceed 3 mm.

20) INSPECTION:

The contractor shall give due notice to the Engineer in charge in advance if the materials or workmanship getting ready for inspection.

All rejected material shall be promptly removed from the shop and replaced with new material for the Engineer in charge's approval / inspection. The fact that certain material has been accepted at the Contractor's shop shall not invalidate final rejection at site by the Engineer in charge, if it fails to be in proper condition has fabrication inaccuracies which prevents proper assembly. No materials shall be painted or dispatched to site without inspection and approval by the Engineer in charge unless, such inspection is waived in writing by the Engineer in charge.

Shop inspection by the Engineer in charge or his authorized representative, or submission of test certificates and acceptance thereof by the Engineer, shall not relieve the Contractor from the responsibility of furnishing material conforming to the requirements of these specifications.

Nor shall it invalidate any claim, which the Engineer in charge may make because of defective or unsatisfactory material and/or workmanship.

The Contractor shall provide all the testing and inspection services and facilities for shop work except where otherwise specified. For fabrication work carried out in the field, the same standard of supervision and quality control shall be maintained as in shop fabricated work. Inspection and testing shall be conducted in a manner satisfactory to the Engineer in charge.

21) TESTING:

MATERIAL TESTING:

If mill test reports are not available for any steel materials, the same shall be tested by the contractor to the satisfaction of Engineer in charge to demonstrate conformity with the relevant specification.

TESTS ON WELDS:**MAGNETIC PARTICLE TEST:**

Only where the Engineer in charge requires that flaw-detection of welds be done by 'magnetic particle test', in such cases the tests are to be done in accordance with IS:3703. If heat treatment is performed, the completed weld shall be examined after the heat treatment. All defects shall be repaired and retested.

Magnetic particle tests shall be carried out using alternating current.

Direct current may be used with the explicit written permission of the Engineer in charge.

DYE PENETRATION TEST:

Where welds are required to be examined by dye penetration inspection method, such tests shall be carried out in accordance with IS:3658.

RADIOGRAPHIC INSPECTION:

Radiographic examination shall be done in accordance with the recommendations of IS:1182 if given in QAP.

TEST FAILURE:

At any stage, in the event of any material or work failing to meet an inspection of test requirement, which is not seen by the Engineer in charge, the Contractor shall notify the Engineer in charge immediately. The contractor must obtain permission from Engineer in charge before repair is undertaken. The quality control procedures to be followed to ensure satisfactory repair shall be subjected to approval by the Engineer in charge. The Engineer in charge has the right to specify additional inspection or testing as he deems necessary, and the additional cost of such testing shall be borne by the Contractor. The Contractor shall maintain records of all inspection and testing which shall be made available to the Engineer in charge on demand.

1) SHOP MATCHING:

Some steel work, particularly columns along with tie beams, bracings etc. may have to be shop assembled to ensure satisfactory fabrication, if the Engineer in charge so desires, he may order such assembly at shop for verification. The contractor shall comply with such instructions without claiming any extra cost.

2) SHOP ASSEMBLY:

Steel work shall be temporarily shop assembled, as necessary, so that the accuracy of fit may be checked before dispatch. The parts shall be shop assembled with a sufficient number of parallel drifts to bring and keep the parts in place.

Since parts drilled or punched, with templates having steel bushes shall be similar and, as such, interchangeable, such steel work may be shop erected in part only, as agreed by the Engineer in charge.

22) ASSEMBLY:

All parts assembled for bolting shall be in close contact over the whole surface.

The component parts shall be so assembled that they are neither twisted nor otherwise damaged, specified cambers, if any, shall be provided.

All parts of bolted and welded members shall be held firmly in position by means of jigs or clamps while bolting or welding. No drifting of holes shall be permitted, except to draw the parts together and no drift used shall be larger than the nominal diameter of the bolt. Drifting done during assembling shall not distort the metal or enlarge the holes.

Trial assemblies shall be carried out at the fabrication stage to ensure accuracy of workmanship, and these checks shall be witnessed by the Engineer in charge/Authorized inspecting agency. Such trial assembly shall be at the cost of the contractor.

FIELD BOLTS:

- Requirements stipulated under bolting shall apply for field bolts also. Field bolts nuts and washers shall be furnished by the contractor in excess of the nominal numbers required. He shall supply the full number of bolts, nuts and washers and other necessary fittings required for completing the work, together with the additional bolts, nuts and washers totaling to 10% of the requirement subject to minimum of 10 Nos.
- At the time of assembly, the surfaces in contact shall be free of paint or any other applied finish, oil, dirt, loose rust, loose scale, burrs and other defects which would prevent solid seating or the parts or would interfere with the development of friction between them.
- If any other surface condition, including a machined surface, is specified, it shall be the responsibility of the Contractor to work within the slip factor specified for the particular case.
- Each bolt and nut shall be assembled with washers of appropriate shape, quality and number in cases where plane parallel surfaces are involved, such washers shall be placed under the bolt head or the nut, whichever is to be rotated during the tightening operation.

The rotated nut or bolt head shall be tightened against a surface normal to the bolt axis, and the appropriate tapered washer shall be used when the surfaces are not parallel. The angle between the bolt axis and the surface under the non-rotating component (i.e. the bolt head or the nut) shall be 90 ± 3 degree. For angles outside these limits, a tapered washer shall be placed under the non-rotating component. Tapered washers shall be correctly positioned.

No gasket or other flexible material shall be placed between the holes. The holes in parts to be joined shall be sufficiently well aligned to permit bolts to be freely placed in position. Driving of bolts is not permitted. The nuts shall be placed so that the identification marks are clearly visible after tightening. Nut and bolts shall always be tightened in a staggered pattern and where there are more than four bolts in anyone joint, they shall be tightened from the centre of the joint outwards.

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- If after final tightening, a nut or bolt is slackened off for any reason, the bolt, nut and washer or washers shall be discarded and not used again.

23) MARKING OF MEMBERS:

After checking and inspection, all members shall be marked for identification during erection. This mark shall correspond to distinguishing marks on approved erection drawings and shall be legibly painted and stamped on it. The erection mark shall be stamped with a metal dye with figures at least 20mm high and to such optimum depth as to be clearly visible, even after a member is galvanized.

All erection marks shall be on the outer surface of all sections and near one end, but clear of bolt-holes. The marking shall be so stamped that they are easily discernible when sorting out members. The stamped marking shall be encircled boldly by a distinguishable paint to facilitate easy location.

Erection marks on like pieces shall be at identical location. Members having lengths of 7.0m or more shall have the erection mark at both ends.

Each fabricated member, whether assembled prior to dispatch or not so assembled, shall bear an erection mark, which will help to identify the member and its position in respect of the whole structure, to facilitate re erection at site. This erection mark shall be incorporated in the shop detail and erection drawings.

24) ERRORS:

Any error in shop work which prevents proper assembling and fitting up of parts in the field by moderate use of drift pins or moderate amount of reaming will be classified by the Engineer in charge as defective workmanship. All charges incurred by the Engineer either directly or

indirectly because of the poor workmanship will be deducted from the amount due to the contractor before payment is made. The amount of such deduction will consist of the sum total of the costs of labour direct or indirect, material, plant, transportation, equipment rental and overhead expenses. In case the Engineer chooses to reject the material because of poor workmanship, the cost of all handling and returning the material to the contractor, if he so desires, shall entirely be the contractors account. All the replacement materials shall be supplied free and in all such cases, the cost of handling, transport and delivery to site shall be borne by the contractor.

25) ERECTION:

Erection of structural steel fabricated components shall be done generally in accordance with provisions of IS 800-2007.

Before starting of erection work, the contractor shall ensure the fulfillment of the following activities: -

- The contractor shall submit, for examination by the Engineer in charge, detailed particulars of his proposed methods of erection of the superstructure steelwork, together with complete calculations relating to strength and deflection, if the erection scheme necessitates the attachment of strength steel work to the permanent steel work, the contractor shall submit, for approval of the Engineer in charge, the methods he proposes for making good the permanent steel work after removing the temporary work. The contractor shall also submit the design and fabrication drawings including detailed calculations of temporary nose, counter weight all temporary support, staging, braces etc. required for safe erection, for approval of the Engineer in charge. The contractor shall provide all construction and transport equipment, tools, tackle and consumables, materials, labour and supervision required for the erection of the structural steel work.
- Handling, assembling, bolting, welding and satisfactory installation of all fabricated structural steel materials in proper location, according to approved erection drawings and/or as directed by the Engineer in charge.
- Setting out, aligning, plumbing, leveling, bolting, welding and securely fixing the fabricated steel structures in accordance with the erection scheme or as directed by the Engineer in charge.

ERECTION TOLERANCES:

Erection tolerances shall be as per table-33 of IS 800-2007 and as detailed in this document.

26) QUALITY CONTROL & TESTING REQUIREMENTS:

The contractor shall follow the QAP attached along with tender documents, in case for any particular item quality plan is not available, contractor shall submit the same for approval of BARC.

In addition, contractor shall submit the following for approval:

- Quality plan for approval for fabrication as well as erection.
- Proposed overall schedule for documentation of shop drawings, plan/procedures and records, submission of procedure of fabrication.

The contractor shall himself inspect all materials and shop work to satisfy the specified tolerance limits and quality norms before the same are inspected by Engineer in charge.

The contractor shall through appropriate planning and continuous measurements in the workshop and the erection at site ensure that the tolerances specified in this specification are strictly adhered to.

Fabricating agency shall have in-house facilities for all testing of weld, in case facilities are not available, testing shall be carried out by the NABL accredited and ISO certified agency with prior approval of Engineer in Charge

VISUAL EXAMINATION:

The contractor shall conduct visual examination and measurement of the external dimensions of welds for all joints. Before examining the welded joints, areas close to it on both sides of the weld for a width not less than 20 mm shall be cleaned of slag and other impurities. Examination shall be done by a magnifying glass which has a magnification power of ten (10) and measuring instrument which has an accuracy of ± 0.10 mm or by weld gauges. Welded joints shall be examined from both sides. The contractor shall examine the following during the visual checks.

- Correctness and shape of the welded joints
- Incomplete penetration of weld metal
- Influx
- Burns
- Un welded craters
- Undercuts
- Cracks in welded spots and heat affected zones
- Porosity in welds and spot welds.
- Compression in welded joints as a result of electrode impact while carrying out contact welding Displacement of welded element.

The contractor shall document all data as per sound practices.

In order to exercise proper control of the quality of the welding, contractor shall enforce methods of control as tabulated below:

27) MATERIAL & PAINTING SPECIFICATIONS: For some of the items specifications are to be referred in civil section which are enclosed along with this document.

MATERIAL SPECIFICATIONS

<u>S.No</u>	<u>Item</u>	<u>Specifications</u>
1	Structural Steel	
1.1	Primary members	All Primary members by using HOT ROLLED plates shall conform to the physical specification of E350 of IS 2062 or equivalent and welded by continuous automatic submerged arc welding.
1.2	Secondary members	Supply, fabrication and erection of secondary members (Z/C sections) from cold formed steel coils conforming to ASTM A 653 M Grade 345 or IS 1079 or equivalent. The secondary members shall be treated with zinc coating to Z275 designation(275g/sqm).
1.3	Roof & wall bracings	Roof and wall bracings shall have minimum yield strength of 250 MPa and shall conform to the specifications IS 2062.
1.4	Bracing rods	Solid plain round steel bars conforming to ASTM A615M (or equivalent)
1.5	Sag rods	Solid plain round steel bars conforming to ASTM A615M (or equivalent)
1.6	Flange bracings	Angles confirming to ASTM A36M(or equivalent) minimum thickness 4.0mm, OR Cold-formed from steel coils conforming to ASTM A 653M Grade SS 340 Class 1 (or equivalent), with zinc coating of 120 g/m2 –
1.7	Anchor Bolts	Made from solid round steel bars conforming to IS 1875(or equivalent) with a min. yield strength of 220 MPa.
1.8	Framed Openings	Galvanized Structural framing members to be provided for fixing Windows, Ventilators, Louvers, wall extractors to the required nos. etc. where ever necessary. The doors, windows and rolling shutters are also in the contractor's scope. Sufficient bracing arrangements shall be made to prevent sagging of the framing members.
2	Painting	The cleaning & painting specifications for the Structural Steel

		Member of the PEB system shall be as below: a) Sandblasting. b) Two shop coat of zinc phosphate grey primer (total 50 micron) c) two shop coat of synthetic enamel paint (total 70 micron)
3	Roofing, wall panels	The walls above 3 m brick wall including all the partitions of the rooms (GF and MF if present) and ceiling below rafter shall be with 80 mm tk Mineralwool sandwich panels as per below specifications. Supply and Erection of roof with sandwich panels (2 Hours Fire rated mineral wool PANEL 80 – Prefabricated Sandwich mineral wool Insulated Panels comprising of: Top & Bottom Sheet: Plain sheets with slight ribs, made out of 0.5 mm TCT, 550 MPa - yield stress, AZ150, Colour coated Galvalume Steel, SMP Coated. Thickness of the coating shall be a minimum of 20microns Over 5 microns primer on top and 5 microns primer and 5 microns back coat in the bottom of sheet. Insulation Core: Mineral wool Lamella cut in 80±2 thickness, density 100kg/m3 as per IS 8183. It shall have a high compressive strength of greater than 137kPa and the thermal conductivity is 0.040 W/mk as per ASTM C518. The insulation material's water absorption shall not be more than 2%. The offered panel shall meet the above specifications and shall be rated for fire for 2 hours. The fire rated certificates as per ASTM E 119 or equivalent IS code shall be submitted. Roofing shall be with 0.6 mm SSR system of the following specification: Providing & fixing structural standing Seam Roof Panels with true standing seam configuration requiring no end closures. The standing seam roof panels shall be precision roll formed panels & will be finished to maximum possible lengths to minimize the end laps. The panel ends will be sufficiently lapped located at supporting members and sealed with butyle mastic tap. Factory rib notching shall be furnished on panels requiring end laps.

		The standard panels will be minimum thickness of 0.6 mm bare metal thickness. The material shall be cold rolled steel, 250-350 Mpa yield stress With hot dipped metallic coating of aluminium Zink alloy (150gms/sqm total of both sides, AZ 150 as per ASTM A792 or AS per IS 1397),0.6mm thickness. The cleats (connecting clips) shall be of the same material as secondary members. Provision for fixing life line at every rafter location at both the eave ends and gable ends to be provided. Seaming shall be double lock type.
5	Soffit cladding for Canopy	with 0.5 mm TCT & 0.45BMT Color Coated Galvalume
6	Gutter	Galvalume Gutter of 0.5mm TCT & 0.45BMT silicon modified polyester colour coated Zinc alume / Galvalume sheet with straps at adequate intervals for providing rigidity.
7	Down take pipes	PVC pipe of sufficient size to effectively drain off the rain water.
8	Flashings	Galvalume Flashings made of 0.5 mm TCT thk at the rake, corners, eaves, service openings and framed openings and matching with the color of wall. Material shall match with the physical specifications of sheeting. edges , eves , gable etc.
9	Gravent on ridge	Supply and installation of 600 mm throat width Ridge ventilator made up of 0.5 mm thk Galvalume sheet with SS mesh on the ridge.
10	Day light sheets on roof	8 mm thk MULTICELL poly carbonate translucent sheets on roof. Area to be covered approximately 5% of the total roof area. GI weld mesh of suitable design approved by BARC, to be provided as a safety measure against fall protection.
11	Foam closures	Solid or closed cell E.T.P (Ethylene Polypropylene Terpolymer) or equivalent, matching the profile of the panels
12	Bead Mastic/Rope Seal	Extruded elastomeric butyl rubber based sealant supplied in rolls on silicon release paper conforming to Federal Specification TT-C-1796 A Type II Class B (or equivalent).

13	High strength bolts Machine bolts	i. All primary bolted connections shall be provided Confirming to ASTM A325 Class 8.8 Type-1 or equivalent- hot dipped/Electro galvanized(for primary members) ii. All secondary connections Confirming to ASTM A 307 of grade 4.6 Type A(or equivalent) electro-galvanized with a yellow chromate colour conversion coating(for secondary members)
14	Roof and Wall Fasteners	Metallic-polyester coated, heat-treated carbon steel, conforming to AS 3566 Class 3. They are 5.5 mm diameter, hex-head, self-drilling screws, assembled with galvanized steel washers bonded with EPDM seals. The wall fasteners shall be colour coated to match the color of the wall panels.
15	Roof Life line	Roof life line on complete periphery of approved make.
16	Flooring and false roof	The flooring requirements along with specifications of the entire PEB including office areas are indicated in section I of this document. False ceiling shall be mineral wool panels of specifications: Prefabricated Sandwich mineral wool Insulated Panels comprising of: Top & Bottom Sheet: Plain sheets with slight ribs, made out of 0.5 mm TCT, 550 MPa - yield stress, AZ150, Colour coated Galvalume Steel, SMP Coated. Thickness of the coating shall be a minimum of 20microns Over 5 microns primer on top and 5 microns primer and 5 microns back coat in the bottom of sheet. Insulation Core: Mineral wool Lamella cut in 80±2 thickness, density 100kg/m³ as per IS 8183. It shall have a high compressive strength of greater than 137kPa and the thermal conductivity is 0.040 W/mk as per ASTM C518. The insulation material's water absorption shall not be more than 2%. The offered panel shall meet the above specifications and shall be rated for fire for 2 hours. The fire rated certificates as per ASTM E 119 or equivalent IS code shall be submitted.

Many IS codes are referred in this document. However, the contractor has to follow the codes indicated as above. For other items relevant IS codes is to be taken reference.

28) Material Tests:

The Contractor shall submit manufacturers' quality test certificates for all the materials supplied by him. In case, quality certificates are not available or are incomplete or when material quality differs from standard specifications, such materials shall not be used in the construction. However, the Contractor shall get all appropriate tests conducted in approved test houses for such materials as directed by the Engineer-in-Charge, at no extra cost, and submit the same to Engineer-in-Charge for his approval. The Engineer-in-Charge may approve the use of such materials entirely at his discretion.

The Contractor shall ensure that all materials brought to site are duly approved by the Engineer in-Charge. Rejected materials shall not be used and shall be removed from site forthwith. Any material of doubtful quality for which specific tests are to be carried out as per the instruction of the Engineer-in-Charge shall be separately stacked and properly identified and shall not be used. These shall be removed from site forthwith.

Fabrication Drawings

Fabrication and erection drawings shall be prepared by the Contractor on the basis of "Approved for Construction (AFC)" design drawings, BARC Standards issued to the Contractor. These drawings conforming to IS: 800 shall be prepared by the Contractor or by an agency appointed by the Contractor and approved by the Engineer-in-Charge.

Fabrication and erection drawings shall be thoroughly checked, stamped "Approved for Construction" and signed by the responsible Engineer (As mentioned above) irrespective of the fact that such drawings are prepared by the Contractor or his approved agency, to ensure accuracy and correctness of the drawings. Unchecked and unsigned drawings by Engineers shall not be used for the purpose of proceeding with the work. The Contractor shall proceed with the fabrication and erection work only after thoroughly satisfying himself in this regard.

All fabrication and erection drawings shall be issued for construction by the Contractor directly to his work- site. A copy of such drawings in soft copy (editable format) shall simultaneously be submitted to the Engineer in-Charge who may check/ review some or all such drawings at his sole discretion and offer his comments for incorporation in these drawings by the Contractor. If so desired by the Engineer-in-Charge, fabrication and erection drawings shall be submitted in hard copy format as well in the paper size suitable to study the drawings as per instructions of the

Engineer-in-Charge. However, the Contractor shall not proceed with the fabrication of such structures whose fabrication drawings are required to be reviewed before taking up the fabrication work as noted on "Approved for Construction (AFC)/Good for Construction (GFC)" design drawings issued to the Contractor or as conveyed by the Engineer-in-Charge. The fabrication of such structures shall be done only as per the reviewed fabrication drawings.

The review of such drawings by BARC shall be restricted to the checking of the following only:

- Structural layout, orientation and elevation of structures members,
- Sizes of members,
- Critical joint details.

Fabrication drawings shall convey the information clearly and adequately. Following information shall be furnished on such drawings:

- Reference to design drawing number (along with revision number) based on which fabrication drawing has been prepared.
- Structural layout, elevations & sections (with distinct erection marking of all members).
- Framing plans, member sizes, orientation and elevations.
- Layout and detailing of rain water pipes and gutters showing all necessary levels,
- connections and provisions wherever required.
- Detailing of shop/field joints, connections, splices, for required strength and erection.
- Location, type, size and dimensions of welds and bolts.
- Shapes and sizes of edge preparation for welding.
- Details of shop and field joints/welds.
- Bill of materials.
- Quality of structural steel, plates etc., welding electrodes, bolts, nuts and washers to be used.
- Erection assemblies identifying all transportable parts and sub-assemblies with special erection instructions, if required.
- Method of erection and special precautions to be taken during erection as required.
- The design of ladders, platforms, handrails, stairways & the like shall be as per standard drawings.

The Contractor shall additionally ensure accuracy of the following and shall be solely responsible for the same:

- Provision for erection and erection clearances.
- Marking of members
- Cut length of members
- Matching of joints and holes.

- Provision kept in the members for other interconnected members.
- Bill of materials

Connections, splices and other details, where not shown on the design drawings shall be suitably designed and shown on the fabrication drawings based on good engineering practice developing full member strength. Design calculations for such connections/splices shall be submitted to the Engineer-in-Charge along with the fabrication drawings.

Any substitution or change in section shall be allowed only when prior written approval of the Engineer-in-Charge has been obtained. Fabrication drawings shall be updated incorporating all such substitutions/changes by the Contractor at no extra cost to the BARC.

In case during execution of the work, the Engineer-in-Charge on review of drawings considers any modifications/substitutions necessary to meet the design parameters, good engineering practice, these shall be brought to the notice of the Contractor who shall incorporate the same in the drawings and works without any extra cost to the BARC. The Contractor will be totally responsible for the correctness of the detailed fabrication drawings and execution of the work. Contractor shall incorporate all the revisions made in the design drawings during the course of execution of work in his fabrication drawings and resubmit the drawings at no extra cost to the BARC. All fabrication shall be carried out only as per the latest AFC design drawings and corresponding fabrication drawings.

The Contractor shall supply three prints each of the final/as built drawings along with their transparencies to Engineer-in-Charge for reference and record. The rates quoted shall include for the same.

29) Fabrication

General

Fabrication of structures shall be done strictly as per "Approved for Construction" fabrication drawings (prepared by the Contractor based on the latest design drawings) and in accordance with IS: 800, 9595 & other relevant BIS Codes and BIS Hand Book SP: 6(1).

Prior to commencement of structural fabrication, undulations in the fabrication yard, if any, shall be removed and area leveled and paved by the Contractor. Any defective material used in the work shall be replaced by the Contractor at his own expense.

Necessary care and precautions shall be taken so as not to cause any damage to the structure during any such removal and replacement. Any faulty fabrication pointed out at any stage of

work by the Engineer-in-Charge, shall be made good or replaced by the Contractor at his own cost. Tolerances for fabrication of steel structures shall be as per IS: 7215.

Fabrication Procedure

Straightening & Bending

All materials shall be straight and if necessary, before being worked shall be straightened and/or flattened (unless required to be of curvilinear form) and shall be free from twists.

Bending of rolled sections and plates shall be done by cold process to shape/s as shown on drawings.

Clearances

The erection clearance for cleated ends of members shall be not greater than 2mm at each end. The erection clearance at ends of beams without web cleats and end plates shall be not more than 3mm at each end but where for practical reasons, greater clearance is necessary, suitably designed seatings approved by the Engineer-in-Charge shall be provided.

Cutting

Prior to cutting, all members shall be properly marked showing the requisite cut length/width, connection provisions e.g. location and dimensions of holes, welds, cleats etc. Marking for cutting shall be done judiciously so as to avoid wastages or unnecessary joints as far as practicable. Marking shall be done by placing the members on horizontal supports/pads in order to ensure accuracy. Marking accuracy shall be limited to + 1mm. Cutting may be affected by shearing, cropping or sawing. Gas cutting by mechanically controlled torch shall be permitted for mild steel. Hand flame cutting may be permitted subject to the approval of the Engineer-in-Charge.

Except where the material is subsequently joined by welding, no loads shall be transmitted into metal through a gas cut surface.

Shearing, cropping and gas cutting shall be clean, square, free from any distortion & burrs, and should the Engineer-in-Charge find it necessary, the edges shall be ground afterwards, to make the same straight and uniform at no extra cost to the BARC.

Shop Erection

The steel work shall be temporarily shop erected complete or as directed by the Engineer-in-Charge, so that the accuracy of fit may be checked before dispatch.

Inspection & Testing of Structures

The Engineer-in-Charge (or his authorized representative) shall have free access at all times to those parts of the Contractor's works which are concerned with the fabrication of the steel work

and shall be provided with all reasonable facilities for satisfying himself that the fabrication is being undertaken in accordance with the provisions of these specifications & other relevant BIS Codes.

Should any structure or part of a structure be found not to comply with any of the provisions of this specification (or relevant BIS Codes as referred to), it shall be liable to rejection. No structure or part of the structure, once rejected shall be resubmitted for inspection, exception cases where the Engineer-in-Charge or his authorized representative considers the defect as rectifiable.

Defects which may appear during/after fabrication/ erection shall be made good only with the consent of the Engineer-in-Charge and procedure laid down by him. All necessary gauges and templates shall be supplied free to the Engineer-in-Charge by the Contractor whenever asked for during inspection. The Engineer-in-Charge may at his discretion, check the test results obtained at the Contractor's works by independent tests at a test house, and the cost of such tests shall be borne by the Contractor.

Shop Painting

Surface preparation by grit/sand blasting

The grit blasting of the surface shall be carried out by compressed air and blasting gun. Clean screened grit of uniform size shall be used for blasting purpose. For grit blasting, the surface shall be made free from mill scale, rust, grease, oil or other foreign material and shall appear to have foreign white base metal roughened texture to form good adhesion of the primer coating, conforming to Swedish Standards "Sa 2 ½".

Compressed air should be free from moisture and oil. The grit blasted surface shall be applied with primer coat within 3 to 4 hours or before any trace of oxidation appears on the cleaned surface.

Primer Application

All components and members of steel work shall be given two shop coats of zinc phosphate grey primer (total 50 micron). Primer coat shall be applied immediately after the surfaces have been properly prepared by grit blasting as explained above and cleaned. The primer coat shall be applied over completely dry surfaces (using brushes of good quality) in a manner so as to ensure a continuous and uniform film without "holidaying". Special care shall be taken to cover all the crevices, corners, edges etc. However, in areas which are difficult to reach by brushing, daubers/mops shall be used by dipping the same in paint and then pulling/ pushing them through the narrow spaces. The primer coat shall be air dried and shall have a minimum film thickness of 50 microns or (tolerance + 10%) after drying, as applicable.

Final Paint Application

After the primer is hard dry, lightly sand the primer surface with emery paper no.320 and clean the dust with dry cloth. Apply two shop coat of synthetic enamel paint (total 70 micron)..

Paint shall be applied by brushing/spraying so that a film free from "holidaying" is obtained. The colour & shade of first coat of paint shall be slightly lighter than the second coat in order to identify the application of each coat. The second coat of paint shall be applied after the first coat is hard dry. The minimum thickness of both films combined shall be 70 microns (+ 10% tolerance) after drying.

The Contractor shall carry out the painting work in all respects with the best quality of approved materials (conforming to relevant BIS Codes) and workmanship in accordance with the best engineering practice. The Contractor shall furnish characteristics of paints (to be used) indicating the suitability for the required service conditions. The paint manufacturer's instructions supplemented by Engineer-in-Charge's direction if any shall be followed at all times. Particular attention shall be paid to the following:

- Proper storage to avoid exposure & extremes of temperature,
- Surface preparation prior to painting.
- Mixing & thinning.
- Application of paint and the recommended limit on time intervals between consecutive coats.
- Painting shall not be done in frost or foggy weather, or when humidity is such as to cause condensation on the surfaces to be painted.

Primers & finish coat paints shall be from the same manufacturer in order to ensure compatibility. Painting colour code shall be as per Annexure-'B'.

Surfaces which are inaccessible after shop assembly, shall receive the full specified protective treatment before assembly (this shall not apply to the interior of sealed hollow sections).

Steel surfaces shall not be painted within a suitable distance of any edges to be welded if the paint specified would be harmful to welders or impair the quality of the welds.

Welds and adjacent parent metal shall not be painted prior to de slagging, inspection and approval by the Engineer-in-Charge.

Parts to be encased in concrete shall have only one coat of primer and shall not be painted after erection.

Packing

All items shall be suitably packed in case these are to be dispatched from the fabrication shop to the actual site of erection so as to protect them from any damage/distortion or falling during transit. Where necessary, slender projecting parts shall be temporarily braced to avoid warping during transportation.

Small parts such as gussets, cleats etc., shall be securely wired on to their respective main members.

Bolts, nuts washers etc. shall be packed in crates.

Transportation

Loading and transportation shall be done in compliance with transportation rules. In case, certain parts cannot be transported in the lengths stipulated on the drawings, the position details of such additional splice joints shall be got approved by the Engineer-in- Charge.

Site (Field) Erection

Plant & Equipment

The suitability and capacity of all plant and equipment used shall be to the complete satisfaction of the Engineer-in-Charge

Storing & Handling

All steel work shall be so stored and handled at site so that the members are not subjected to excessive stresses and any damage.

Setting Out

One set of reference axes and one bench mark level shall be furnished to the Contractor. These shall be used for setting out of structures.

The Contractor shall assume complete responsibility for correct setting out of all steel work, erecting it correctly as per alignment / levels shown in the drawings and plumb (verticality) of vertical members.

Safety & Security during Erection

The contractor shall comply with IS: 7205 for necessary safety and adhere to safe erection practices and guard against hazardous as well as unsafe working conditions during all stages of erection.

During erection, the steel work shall be securely bolted or otherwise fastened and when necessary, temporarily braced/guyed to provide for all loads to be carried by the structure during erection till the completion, including those due to the wind, erection equipment & its operation etc. at no extra cost to the BARC. For the purpose of guying, the Contractor shall not use other structure in the vicinity without prior written permission of the Engineer-in-Charge.

No permanent bolting or welding shall be done until proper alignment has been achieved. Proper access, platform and safety arrangement shall be provided for working and inspection, (at no extra cost to the BARC) whenever required.

Field Connections

Field Bolting

Field bolting shall be carried out with the same care as required for shop bolting.

Field Welding

All field assembly and welding shall be executed in accordance with the requirements for shop assembly and welding. Holes made for all erection bolts- where removed after final erection shall be plugged by welding. Alternatively, erection bolts may be left and secured.

Scheme and Sequence of Erection

The Contractor shall furnish the detailed scheme and sequence of erection to match with the project schedule and get the same approved by the Engineer-in-Charge. All necessary coordination and synchronization shall be done with the civil contractor where civil works are not included in the scope of structural contractor at no extra cost so as to match with the project schedule.

Welds, bolts, nuts, washers, shims, pack plates, wedges, grout and shop painting shall not be separately measured. The quoted rate shall be deemed to include the same.

The rate shall include all expenses related to safety & security arrangements during erection and all plants & tools required for fabrication, transportation & erection

Painting after Erection

General

Only touch up painting shall be applied as necessary after erection and the Contractor shall obtain written instruction in this regard sufficiently prior to taking up any procurement of paint and execution of painting work after erection of steel structures.

The procedure of touch up painting shall be followed same as described earlier for applying primer coat and final paint application.

Inspection & Testing of Painting Works

All painting materials including primers & thinners brought to site by the Contractor for application shall be procured directly from reputed and approved manufacturers and shall be accompanied by manufacturer's test certificates. Paint formulations without certificates shall not be accepted.

The Engineer-in-Charge at his discretion may call for additional tests for paint formulations.

The Contractor shall arrange to have such tests performance including batch wise test of wet paints for physical & chemical analysis. All costs shall be borne by the Contractor.

The painting work shall be subject to inspection by the Engineer-in-Charge at all times. In particular, the stage inspection will be performed and Contractor shall offer the work for inspection and approval at every stage before proceeding with the next stage. The record of inspection shall be maintained. Stages of inspection are as follows:

- Surface preparation
- Primer application
- Each coat of paint

Any defect noticed during the various stages of inspection shall be rectified by the Contractor to the entire satisfaction of the Engineer-in-Charge before proceeding further. Irrespective of the inspection, repair and approval at intermediate stages of work the Contractor shall be responsible for making good any defects found during final inspection/guarantee period/defect liability period, as defined in General Conditions of Contract. Dry film thickness (DFT) shall be checked and recorded after application of each coat. The thickness shall be measured at as many locations as decided by the Engineer-in-Charge. The Contractor shall provide standard thickness measuring instrument such as Elko meter (with appropriate range for measuring dry film thickness of each coat) free of cost to the Engineer-in-Charge whenever asked for.

Annexure A: Maximum Permissible Erection Tolerances

Erection tolerances shall be as per IS 12843. If not found in IS code, international standards may be resorted to for this purpose. In case of non-availability, below limits can be followed for this purpose.

A. Columns

1. Deviation of column axes at foundation top level with respect to true axes.
 - i) In longitudinal direction ± 5 mm
 - ii) In lateral direction ± 5 mm
2. Deviation in the level of bearing surface of columns at foundation top with respect to true level ± 5 mm
3. Out of plumb (Verticality) of column axis from true vertical axis, as measured at top:
 - i) Up to and including 30m height $\pm H/1000$ or ± 25 mm Whichever is less
 - ii) Over 30m height $\pm H/1200$ or ± 35 mm Whichever is less.
4. Deviation in straightness in longitudinal & transverse planes of column throughout the height. $\pm H/1500$ or ± 10 mm Whichever is less.

5. Difference in the erected positions of adjacent pairs of columns along length or across width of building prior to connecting trusses/beams with respect to true distance. ± 5 mm
6. Deviation in any bearing or seating level with respect to true level ± 5 mm .
7. Deviation in difference in bearing levels of a member on adjacent pair of columns both across & along the building. ± 5 mm

Note: 1. Tolerance specified under 3 should be read in conjunction with 4 & 5.

Note: 2. 'H' is the column height in mm.

B. Trusses

1. Shift at the centre of span of top chord member with respect to the vertical plane passing through the centre of bottom chord. $\pm 1/250$ of height of truss in mm at centre of span or ± 15 mm whichever is less.
2. Lateral shift of top chord of truss at the centre of span from the vertical plane passing through the centre of supports of the truss. $\pm 1/1500$ of span of truss in mm or ± 10 mm whichever is less.
3. Lateral shift in location of truss from its true position. ± 10 mm
4. Lateral shift in location of purlin from its true position. ± 5 mm
5. Deviation in difference of bearing levels of truss from the true level. $\pm 1/1200$ of span of truss in mm or 20 mm whichever is less.

C. Gantry Girders & Rails

1. Shift in the centre line of crane rail with respect to centre $\pm$ [web thickness(mm) + 2mm] line of web of gantry girder. 2
2. Shift of alignment of crane rail (in plan) with respect to ± 5 mm true axis of crane rail at any point.
3. Deviation in crane track gauge with respect to true gauge.
 - i) For track gauge up to and including 15 m. ± 5 mm
 - ii) For track gauge more than 15 m. $\pm [5 + 0.25 (S - 15)]$ mm Subject to maximum ± 10 mm, where S in metres is true track gauge.
4. Deviation in the crane rail level at any point from true level. ± 10 mm
5. Difference in levels between crane track rails (across the bay) at
 - i) Supports of gantry girders 15 mm
 - ii) Mid span of gantry girders 20 mm
6. Relative shift of crane rail surfaces at a joint in plan and 2 mm subject to grinding of Elevation surfaces for smooth Transition

Annexure B: Painting Colour Code for Structural Steel

1. GANTRY GIRDER & MONORAIL SMOKE GREY NO. 692 (IS-5)
 2. GANTRY GIRDER & MONORAIL STOPPER SMOKE GREY NO. 692 (IS-5)
 3. BUILDING STRUCTURAL STEEL COLUMNS. SMOKE GREY NO. 692 (IS-5)
- BRACKETS, BEAMS, BRACINGS, ROOF TRUSS, PURLINS, SIDEGIRTS, LOUVERS

4. PIPE RACK STRUCTURE & TRESTLE SMOKE GREY NO. 692 (IS-5)
5. CHEQUERED PLATE (BOTH FACES) JET BLACK
6. GRATING JET BLACK
7. LADDER, STRINGERS JET BLACK
8. HAND RAILING
 - HANDRAIL, MIDDLE RAIL, TOE PLATE JET BLACK
 - VERTICAL POST SMOKE GREY NO. 692 (IS-5)

Remark: - All colours mentioned above are tentative and final colours will be finalized with successful bidder

30) All the items of the PEB building including accessories shall be manufactured as per the specifications given in this document or as per requirements of IS specifications.

31) List of Suggested Makes/Brands

The makes and brands suggested below are general recommendations and merely for guidance purpose. However, the bidder(s) can prefer any other alternate or equivalent makes and brands which is/are meeting the performance parameters and tender specifications by submitting technical details to substantiate their claims. To ensure equal opportunity, fair treatment for all bidders, and to avoid delays during execution of work, the pre-bid clarification stage is the appropriate time to propose alternate or equivalent makes and brands. The department will review these proposals and recognize them in the pre-bid clarification document after verifying the submitted technical details. Any delays after the award of work due to the time taken to convey acceptance or rejection of alternate or equivalent makes and brands suggested by the contractor (if any) will be the contractor's responsibility. Additionally, any extra costs resulting from superior specifications or performance of items or materials will not be payable. Only make and brands that meet the minimum local content as per the Public Procurement (Preference to Make in India) Order 2017 shall be considered for approval.

Sl No	Item Description	Suggested Makes/Brands
1	Structural steel	SAIL / TISCO/ RINL/ Essar Steel/ with prior approval of Engineer-in-charge
2	MS Pipes	Jindal Pipes Ltd., Tata Iron Steel

		Co.
3	GI Pipes and fittings	Jindal Pipes Ltd., Tata Iron Steel Co.
4	CPVC/PVC Pipes and fittings	Jindal, Finolex, Supreme
5	Painting	Asian Paints Ltd, Berger paints India ltd.
6	Metal sheets for sandwich panels, SSR etc.	TATA, Jindal
7	Roof life line system	SafetyLink, KeeSafety

*****End of Technical specifications for Pre-Engineered Building Works*****

SECTION-V (iv)

TECHNICAL SPECIFICATIONS

ELECTRICAL WORKS

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1 Important Instructions to Contractor

1.1 General Details and Guidelines

- The present work is at Bhabha Atomic Research Centre, Challakere, which is located approximately 13kM from Challakere, Chitradurga district, Karnataka- 577 537. Complete site is having restricted entry with security guidelines as per department instructions. Connectivity to the site shall be enquired and visited by contractor while applying for tender.
- Contractor shall have Valid Electrical Class-I License/ Electrical Super Grade Contractor license or any license issued by any government/ Aided officials in India, suitable for execution of the electrical works of the tender.

Or

Contractor should sub-contract the electrical works to an agency having “Electrical Class-I License/ Electrical Super Grade Contractor license or license issued by any government/ Aided officials in India, suitable for execution of the electrical works of the tender”.

- Contractor shall follow all security guidelines while entering the site, working and all other time.
- Contractor shall submit PVC, RC, License, ID/Address Proof, Insurance, fitness certificate and other documents of employees as instructed by EIC as per rules time to time.
- Safety shoes, belts, helmets, safety boards and other equipment and rules shall applicable as per safety guidelines. Contractor personnel not allowed to execute works without safety equipment.
- Contractor shall construct temporary storage for all equipment supplied with security guard and with other provisions including safety if there is no space available for storage. However, in all cases contractor shall be responsible for all equipment supplied or installed or commissioned until handover or final bill. No claim is accepted by BARC in this regard.
- Samples before supply of materials/equipment- EIC reserves the right to call for samples, if considered necessary, and the same shall be submitted by the Contractor free and without any obligation.
- Until the final handing over work shall not be treated as completed. It is the responsibility of contractor in all aspects

1.2 Location of the Site

----- Refer Respective Documents -----

1.3 Safety Instructions

- All the workers/employees/staff shall wear safety shoes, jackets, helmets, belts, All PPE Kits etc. without which it is not allowed to work.
- The safety posters/regulation for prevention of accidents shall be displayed by the Tenderer at appropriate places. Notices and warning signs shall be displayed for all sources of dangers.
- When the work is carried out at night or in the obscure daylight, adequate for flood lighting in the working area shall be made by Tenderer at his own cost and got approved by the EIC.
- Contractor Shall Arrange Fire extinguishers, First Aid Equipment as a part of safety all times as instructed by EIC without any Deviation.
- All equipment shall be complete with approved safety devices and with provision for safe access of personnel to and around the equipment for operation and maintenance. The design of plant & machinery shall include not only those usually furnished components but also the additional covers, stairways, ladders, steel structural platforms for operators control panels, handrails, partitions etc. which are necessary for safe operation of the plant.
- The Tenderer must take sufficient care in moving his construction plants and equipment from one place to another so that those may not cause any damage to the Property of BARC/other Tenderer's particularly to the overhead and underground cables and other service lines.
- All safety measures as required to be adopted as per the statutory regulations and the safety rules of the plant shall be strictly followed by the Tenderer during the execution of the Contract.
- Adequate number of first aid boxes and fire extinguishers as instructed shall be provided and maintained at all work sites.
- All equipment/personnel carrying out work shall have fitness certificate and relevant documents. It shall be submitted to EIC, based on his instructions

2 Scope of Electrical Works

2.1 Scope of Electrical Work

Scope of work Includes Layout design for internal electrification (as per BOQ items), engineering, submission of GTP/ drawings, technical documents, arrangement of factory inspection as applicable, loading, safe transportation, unloading, erection, pre-commissioning testing, commissioning of various electrical systems and associated equipment as per approved design, SOQ, Technical Specifications. Work includes tapping of power supply from the existing Lt substation feeder and distribution to the facilities as per approved design.

The brief scope includes Design, Supply, Installation, testing and commissioning of the following:

- Various LT Panels
- UPS and UPS Distribution Board
- Seven Segment and MCB DB's, Conduit, Wires
- Modular type approved model Switches, Sockets
- 1.1kV FRLS Grade Un -armoured & Un Armoured LT Power Cables with terminations, Lugs, Double compression brass glands and cable trays
- Maintenance free Earthing and Lightning Protection System
- Indoor, Outdoor Illumination System including Lighting Mast
- And Other associated works as per SOQ, technical Specifications

Contractor shall consider all necessary equipment, accessories, tools, tackles etc. which specifically not mentioned in the tender, but required for the completion of the work. The contractor shall hand over the system in fully functional stage up to the satisfaction of EIC.

2.2 Compliance with Specification, Standards and Regulations

- This Technical Specification shall be read in conjunction with SOQ, General Conditions of Contract and other project requirements provided in other tender documents.
- This scope of work consist design, approval of drawings and execution of work. Technical specifications define the guiding principles for the design of system and equipment. However, contractor shall make necessary changes as per directions of EIC. EIC may approve drawings with changes in the technical specifications without

changing the functional requirement of equipment. contractor shall execute the same without any additional cost. Decision of EIC shall be strictly followed.

- Design guidelines in technical Specifications are extensively prepared based on the expected requirement, Approved design shall be based on the as per actual site condition.
- All equipment accessories & services offered under the scope of this tender shall conform to Technical Specifications / Approved drawings documents.
- Technical specifications, BOQ/SOQ descriptions prepared are individual item wise, however specifications of relevant item shall be applicable if it is mentioned in any part of tender document.
- The design, manufacture, performance, testing and installation (including safety, earthing and other essential provisions) of equipment and accessories covered under this specification shall, in general, comply with the latest issue of:
 - ❖ Applicable Standards and Codes of Practices published by Bureau of Indian Standards
 - ❖ Central Board of Irrigation and Power
 - ❖ Indian Electricity Act and Rules
 - ❖ Applicable IS/IEC standards relative to each and every equipment
 - ❖ Equipment complying with other recognized Standards such as IEC, BS, VDE, DIN etc. will also be considered if it ensures performance equivalent to or superior to Indian Standards.
- In case of conflict between applicable Standards referred to in this part and the Technical Specifications, Decision of Engineer In-charge is final and exclusive.

2.3 Installation of Equipment, Testing and Commissioning

- The Tenderer shall be fully responsible for the satisfactory Erection, Testing, Commissioning, start-up, and performance test of equipment.
- For complete erection and commissioning, the successful Tenderer shall be responsible for arranging at his cost all necessary consumables, tools and tackles, special kits, equipment and instruments as required.
- The successful Tenderer shall furnish to BARC the names and particulars of the certificate of competence of the supervisors and workmen to be engaged for carrying out the installation work against this specification.

- The System along with equipment shall be handed over in fully completed state and ready to use condition as instructed by EIC.
- Pre-dispatch inspection, site testing, samples, pre-commissioning testing shall be carried out wherever it is instructed by EIC.

2.4 List of Deliverables:

Following is the list of deliverables to be made during the procurement, installation & commissioning of the systems and also after the commissioning of systems.

- Design scheme and drawing of various systems as per directions of EIC
- Test Certificates as per directions of EIC
- Load distribution scheme of the system
- Warranty certificates from OEM as applicable
- As built drawings in CAD, A0/A3/A4 format
- Maintenance manuals as required
- Any Other documents instructed by EIC
- As build Electrical Drawings/SLD of Important systems as instructed shall be 3 – Hard Copies in A0 Format

Note: Above List is indicative EIC may add or delete any from above as per requirement of site.

2.5 As Built Drawings

Following documents shall be submitted.

As Built Drawings	A0/A3/Approved size wiring layout, lighting layout- 3 sets
Maintenance Manuals	For major equipment Transformers/Panels/DG/UPS/HT Panels as approved as per recommendation of EIC -3 Sets
Equipment Operation	For major equipment Transformers/Panels/DG/UPS/HT Panels as approved as per recommendation of EIC – 3 Sets
SLD	SLD of the system as per Instructions of EIC -3 Sets
Design Calculations	Design calculations wherever instructed by EIC shall be submitted
Testing certificates	Testing certificates of system as approved shall be submitted

3 LT Power Distribution Panels as per Specifications

3.1 Scope of the work

Scope of work Includes Design, engineering, submission of GTP, drawings, technical documents, fabrication, arrangement of factory inspection, loading, safe transportation, unloading, erection, pre-commissioning testing, commissioning of various types of LT Panels as per respective SLD, BOQ and as per specification mentioned below.

❖ Panels as per IEC 61439 – 1 & 2 Fully Type Tested Design Verified

Panels	<u>SITC of Mains Class IV Panel Type - 1</u>
Breakers & Bus bar Type and Rating	<u>Incomer - 2 No's of Electrically Interlocked 4-Pole, 630 A, 36kA, MCCBs with LSIG Protection</u> <u>2 Incomers 1 For Raw Power Supply & 1 For DG Supply</u> <u>Suitable UV relay shall be provided as per approved drawing</u> <u>Outgoings – All 25kA, LSIG Protection</u> 2 No's of 400Amps MCCB's 2 No's 200A MCCB's 2 No's of 160A MCCB's 6 No's of 100A MCCB's
Bus Bar	<u>Electrolytic grade Copper 100% Neutral Suitable rating</u>
Meters and Indicators	For both Incomers <u>Graphical Display with DSP/Microprocessor based capable of measuring harmonics, Power etc. as approved-2 No's</u> Also, Suitable rating Analog Voltmeters shall be provided as approved -2 No's <u>Outgoings – Digital Ammeters shall be provided</u>
Other Details	As per mentioned

❖ Panels as per IEC 61439 – 1 Type Tested

Panels	<u>SITC of Mains Class IV Panel Type - 2 as per specification</u>

Breakers & Bus bar Type and Rating	<u>Incomer</u> - 1 No's of 4-Pole, 400Amps, 36kA, MCCBs with LSIG Protection <u>Outgoings</u> – All 25kA, LSIG Protection 1 No's 200A MCCB's 3 No's of 160A MCCB's 5 No's of 100A MCCB's
Bus Bar	<u>Electrolytic grade Copper-100% Neutral</u>
Meters and Indicators	<u>Incomers</u> MFM for each breaker having capabilities to measure True PF, THD% and individual harmonics up to 15th harmonics in all L-N, L-L, Active reactive apparent energy, Power reading, L-N, L-L Voltage, Current readings, and other applicable approved features required. Also, Suitable rating Analog Voltmeters shall be provided as approved -2 No's <u>Outgoings – Digital Ammeters shall be provided</u>
Other Details	As per mentioned
Panels	<u>SITC of UPS Distribution Board UPS Distribution Board Type</u> <u>-3</u>
Breakers & Bus bar Type and Rating	<i>(kA As per UPS Short circuit calculation)</i> <u>Incomer</u> - 1 No's of 3-Pole, 200A, MCCBs with LSIG Protection <u>Outgoings</u> – All LSIG Protection 6 No's of 100A MCCB's- 3 Pole
Bus Bar	<u>Electrolytic grade Copper</u>
Meters and Indicators	<u>Incomer, Bus Coupler</u> MFM for each breaker having capabilities to measure True PF, THD% and individual harmonics up to 15th harmonics in all L-N, L-L, Active reactive apparent energy, Power reading, L-N, L-L Voltage, Current readings, and other applicable approved features required. Also, Suitable rating Analog Voltmeters shall be provided as approved -2 No's

	<u>Outgoings – Digital Ammeters shall be provided</u>
Other Details	As per mentioned

3.2 Technical Parameters of Various Panels

System voltage	415 +/- 10%, 50HZ, 3 Phase, 4 wire AC, 50Hz, solidly grounded Control Supply single phase / 24 V DC as per availability at site – to be approved at the design stage
Form of separation	As approved Minium Form 3B/ Form 4a (Except for MCB)
Degree of protection	IP 52 or higher- Indoor IK 10
Clearances (Except Component terminals)	Between phases & between live parts and earth – As per IEC
Short Circuit levels	components like, circuit breakers etc. shall be compatible with the short-circuit levels
Relays, meters etc.	flush mounted, all metering equipment shall be digital unless specified or approved as per requirement by EIC
Compartmentalization	By Metal separator (Not by PVC/Hylam)

Main busbars (Aluminium)	Shall be designed to carry continuous current rating of 1.2 times of incomer MCCB/ACB unit's continuous current rating and STC of 25 kA for 1 sec. Temperature rise, short circuit design shall be as per IS/IEC. -Max. Current density for the Busbar material: Aluminum: 1.0 Amp/Sq.mm Rectangular cross section suitable to take full load current and fault level indicated, color coding RYBN
Bus bar support	Non-breakable, non-hygrosopic epoxy resin or glass fiber reinforced polymer insulated supports able to withstand operating temperature of 110O C at regular intervals, to withstand the forces arising from a fault level
Temperature rise of the bus bar over the specified design ambient temperature	As per IEC
Multi- Function Meter	Incomers with MFM with three parameter display having RS 485 communication port capabilities to measure True PF, THD% and individual harmonics up to 15th harmonics in all L-N, L-L, Active reactive apparent energy, Power reading, L-N, L-L Voltage, Current readings, and applicable approved features required. Incomers shall be provided with LCD display indicators as per requirement
Analog Ammeters/Voltmeters	AC moving coil, class 1.0 accuracy, linear scale CT operated/Rectifier type moving coil class 1.0 accuracy Incomers shall be provided with one analogue Ammeter & Voltmeter along with Digital MFM with RS 485 having capabilities to measure True PF, THD% and individual harmonics up to 15th harmonics in all L-N, L-L, Active reactive apparent energy, Power reading, L-N, L-L Voltage, Current readings, and applicable approved features required Outgoings shall be provided with Digital Ammeters as indicated.

Neutral busbar for AC	Shall be designed to carry continuous current rating of at least 100% / 50% of current as per requirement
	tinned copper busbar having maximum current density of 1.24A/Sqmm to withstand symmetrical fault level same as that of Incomer for 1 Sec 65kA/50kA etc. as per requirement)
Bus supports	Non hygroscopic material having high impact & dielectric strength& Halogen/ CFC Free (SMC/DMC)
Control transformer	Substation LT panels of incomer rating above 1600A shall be provided with control transformer of 415/240V, 1 kVA for supplying control AC power to Panel equipment's
<u>Cabinet details</u>	CRCA sheet steel, CNC fabricated and as per IEC with minimum thickness as Base frame -6mm Door – 2mm Main frame – 2.5 mm Gland plate – 3mm
Earthing	Extending on either side through gasketed opening at two points. Shall be of copper, sizing as per prospective earth fault current minimum thickness 25 X 3 tinned copper
Gaskets	Neoprene for Suitable IP
Space heater	230 Volts of Adequate rating to be provided as applicable and approved
Insulation level	Power circuit - 2.5 KV / 1 minute Control circuit – 1.5 KV / 1 minute
Cable entry	Bottom / Top as per site condition
CT & PTS's	Resin cast unless specified otherwise or as approved by the customer
Wiring	FRLS PVC insulated multi strand electrolytic grade copper conductor wires- Termination with crimping method only.
Size of wires	Power circuit: Suitable to carry continuous current rating of outgoing MCCB/SFU with red, yellow, blue & Black colours for

	identification, along with ferrules at both ends. Control wiring: ≥ 1.5 Sq.mm in grey colour with printed ferrules at both ends C.T. Sec wiring: ≥ 2.5 Sq.mm in grey colour with printed ferrules at both ends Earth wires: ≥ 2.5 Sq.mm in banded green colour
Spares to be handed over	Suitable numbers of LED indicators, LOCKS, Keys, Others as applicable
Paint	7/9 Tank Powder coated epoxy with neat finish as per approval
Tests	All type and routine tests as per IEC

3.3 Technical Parameters of Circuit Breakers

Standard Applicable (Isolation function with the test for line/ load interchangeability)	IS: 13947 (Part –I to Part –IV)
Rated insulation voltage	1000 Volts
One minute dry withstand test voltage	2500 Volts
No of Poles	4 Poles (3 Phase + 100% Neutral) unless otherwise mentioned specifically in SLD 3 Poles where specifically mentioned
Draw out	ACB's Draw out MCCB's – non-draw out
Protection	Micrologic Numerical/Digital Relay with LSIG Protection unless otherwise specifically mentioned
Indicators	Shall have ON/OFF/Trip Indicator LEDs
Rating of circuit breaker	As per SLD
Momentary short time current rating (rms) for 1 sec. (Icw)	As per SOQ ICu=100% of ICs
Type of tripping mechanism	Direct /Shunt trip (Electrical) Manual (mechanical)
Normal voltage of tripping coils	As per approved Design based on the available voltage

	at site
Voltage for spring charging motor (for stored energy mechanism)	415/ 230 V AC +10% - 15%
ACB Breaker operations	Electrically operated with draw out type
Electrical Closing and tripping	By spring return sequence locking type ODS switch
Operating duty	0-3 min. – CO - 3Min. – CO
Features of circuit breaker	Trip free and anti-pumping
Method of closing	Electrically operated spring charged (normal), mechanical (emergency)
Communication capability	All ACB's shall be with RS 232/ RS 485 port or better
Tiers	Air Circuit Breakers shall be Draw out and arranged in Single tier/Multi-tier (Nor more than two ACBs in a single vertical) formation only to facilitate ease of operation and maintenance. MCCB/Motor Feeders shall be fixed type mounted on a single base Plate.
Paint	7/9 Tank Powder coated epoxy powder coating with neat finish as per approval

3.4 Applicable Reference Standards for Panels

The equipment's covered under this specification shall conform to the latest revisions of relevant Indian and International Standards some of which are listed below

IEC 61439-1 & 2	Low Voltage switchgear and control Gear assemblies
IS 8623: 1993	Low Voltage switchgear & Control Assemblies
IS 13947:1993	General requirements of Switchgear and Control Gear for Voltage not exceeding 1000 / 1200V AC
IS 11353:1985	Guide for uniform system of marking Identification of Busbar and Terminals
IS 13703	Low Voltage Fuses
IS 2705:1992	Current transformers
IS 694 1990	PVC insulated cables for voltages including 1100 V
IS 5082	Electrolytic Aluminium Busbar, Trunking system, Rod tubes &

	sections for Electrical Purposes
IS 13779 1999	AC Electric Meters / Static Meters
IEC 60529	Degree of Protection of Enclosures for low voltage switchgear
IEC 61641	Internal arc

3.5 Design and Constructional Guidelines for panels

❖ **Design guidelines for Switchboard Configuration Panels**

- The LV switchboards shall be continuous line of uniform panels of similar, compact to the extent with good appearance without occupying more floor area as per the standards IEC 61439-1 & 2 / IEC 61439-1 as mentioned in the SOQ with modular bolted design,
- Type test certificate, as built drawings along with complete interlocks shall be submitted.
- Panels shall be metal clad, CNC fabricated, non-draw out type, compartmentalized, floor mounting type with suitable no. of foundation holes on all four sides of bottom channel, rigid free-standing enclosure with circuit breakers, Control gear, relays, bus bars, controls, metering, and all other associated equipment as per the approved drawing.
- The panel shall be suitably sized to accommodate all the components with proper spacing between them for effective cooling, maintenance, easy of approach and identification
- Cable compartments shall be of adequate size for easy termination of all incoming and outgoing cables entering from bottom or top. The construction shall include necessary and adequate and proper support shall be provided in cable compartments to support and clamping the cable in the cable alley / cable chamber.
- Operator safety IP2 X (touch proof) protection to be available even after opening the feeder compartment door. The compartmentalization to be achieved by using metal separators.
- The overall height of the switchboard shall be limited to 2400 mm for all the Busbar ratings and type of switchboards. Panel should have integral base frame of 75mm, hence total panel height should not be more than 2475mm. The height of the operating handle push buttons etc. shall be restricted between 300 mm and 2000 mm from finished floor level. Any changes in this shall be as per directions of EIC as per actual requirement.
- Intrinsic load bearing member shall be used as per design verified assembly and should have min. thickness of 2 mm. Joints of any kind in sheet metal shall be seam welded and all welding slag ground off and welding pits wiped smooth with plumber metal.

Detachable cable gland plates with 3 mm thick CRCA sheet having knockouts shall be provided.

- All the doors and covers shall be with full neoprene gasket to prevent any ingress of dust. Door hinges shall be concealed type for compartment doors. However, for wire ways, busbar chambers covers and dropper chamber covers shall be bolted type for safety purpose. The unused openings within the switchboards shall be closed using suitable grommets.
- Switchboards shall be made up of requisite vertical sections, which when coupled together, shall form continuous dead front switchboards.
- Special care to be taken to ensure effective earthing of the frame and doors of the switchboards
- The switchboards shall be designed for use in high ambient temperature and humid tropical conditions as specified. Ease of inspections, cleaning and repairs while maintaining continuity of operation shall be provided in the design
- Terminal blocks for both power wiring & control wiring shall be ELMEX/SALZER type, 650 V grade and rated according to the capacity of the feeder, one-piece Moulded flame retardant, non-hygroscopic complete with insulated barriers & identification strips. 20% spare terminals block shall be provided in control wiring circuits as per approval.
- Connections to terminal blocks shall be easily removable for testing purposes. Terminal blocks shall be mounted not less than 230 mm above bottom plate of panel and shall be easily accessible.
- Components like push buttons, indicating lamps, meters, selector switches, MCCB /SF unit operating handles shall be mounted on the door. They shall be suitably located on the door for ease of maintenance and better appearance.
- The control supply to each feeder shall be tapped from their respective feeders using proper rated SP/DP MCBs
- The individual feeder's cable terminating power terminal blocks shall be suitably brought out in the cable alley such that the cables can be easily terminated and in case of maintenance they can be easily accessible. The power terminal shall be separated from each other by providing insulated barriers between TBs
- Wiring for potential free contacts: The ON, OFF and TRIP status indications for each feeder from the potential free contacts of MCCB's, contactors, OLRs shall be wired up to TBs for remote indication in addition to local indication in the panel

- Wiring for interlocks: Each power contactor control will be wired up to TBs for a minimum three sets of process interlocks
- Each component shall be identified with engraved labels as per the circuit diagram. The door front components shall be identified also with their designation as per the drawing, engraved labels, and tags
- All holes in metalwork shall be protected by substantial grommets or bushes to protect wiring passing through them.
- Ventilating openings and vent outlets shall be provided as per requirement as approved wherever it is required.
- Joints of any kind in sheet metal shall be seam welded and all welding slag ground off and welding pits wiped smooth with plumber metal.
- Earthed metal or insulated shutters shall be provided between draw out and fixed portion of the switchgear such that no live parts are accessible with equipment drawn out. Degree of protection within compartments shall be at least IP 2X.
- Sheet steel hinged lockable doors for each separate compartment shall be provided and duly interlocked with the breaker in "ON" and "OFF" position as approved.
- For all Circuit Breakers separate and adequate compartments shall be provided for accommodating instruments, indicating lamps, control contactors and control MCB etc. These shall be accessible for testing and maintenance without any danger of accidental contact with live parts of the circuit breaker, busbars and connections.
- If instructed by EIC for Some MCCB feeders for critical loads like UPS it may be required to have operation only after opening the door, all other facilities like pad lockable rotary handle to be provided for such feeder. It shall be possible to do this change during execution of order
- A horizontal wire way with screwed cover shall be provided at the top to take interconnecting control wiring between vertical sections.
- Cable compartments shall be of adequate size for easy termination of all incoming and outgoing cables entering from bottom or top. The construction shall include necessary and adequate and proper support shall be provided in cable compartments to support and clamping the cable in the cable alley / cable chamber.
- Danger board in sizes of approved standards shall be affixed on both front and rear side on all sections of the panel.

❖ **Design guidelines for BUS BARS:**

- Busbars shall be as mentioned above/SOQ and to be made of high-grade hard drawn high conductivity Copper of rectangular.
- The Busbar sizes shall be determined taking into consideration the continuous rating and fault level indicated, as applicable, without exceeding the temperature raise limits as per IEC, over ambient temperature.
- Suitable calculations for the bus bars shall be submitted if required as instructed by EIC.
- Busbar shall withstand mechanical forces for specified peak short circuit current.
- Bus bar supporting systems shall withstand the short circuit forces circuits, without deflection or deformation.
- Busbars shall be fully insulated for working voltage with specified phase and ground clearances. Heat shrunk PVC sleeves for busbars and shrouds for joints shall be provided. Further busbars shall be colour coded for phase identification.
- The bus bars shall be supported on non-breakable, non-hygroscopic epoxy resin or glass fiber reinforced polymer insulated supports able to withstand operating temperature of 110 Degree Centigrade at regular intervals, to withstand the forces arising from a fault level. The material and the spacing of the Busbar support should be same as per the type tested assembly.
- Direct access to, or accidental contact with busbars and primary connections shall not be possible
- Auxiliary buses for control power supply, space heater power supply or any other specified service shall be provided. These buses shall be insulated, adequately supported and sized to suit specific requirement
- All busbars and main current carrying connections shall have the same cross sectional area throughout their lengths.
- The busbar supports and their terminal connections shall be designed to permit expansion and contraction of the buses with variations in temperature, which may occur in actual service.
- Busbars shall have minimum cross section corresponding to current density of 1.24A/Sqmm for copper at rated current. Actual current density shall be as per requirements of permissible maximums temperature at rated loading.
- The connecting busbars for the incoming line circuit breaker shall have continuous current capacity same as specified for main busbars. For the outgoing feeders, the

connecting busbars shall have the continuous current capacity not less than the rated current of the circuit breaker, irrespective of the release settings.

- Earth bus shall be provided running continuously at the bottom of the switchgear with a bolted link to the neutral busbar. Horizontal busbar shall be extensible on both sides.
- Auxiliary busbars shall be provided for control supply, space heater supply. These busbars shall be segregated from the main busbars and adequately sized to meet the specific requirement. Material of busbars shall be electrolytic tough pitch copper. The busbars shall be adequately supported and due clearances shall be observed.

❖ **Design guidelines for ACB/MCCB:**

- Air Circuit Breakers shall be provided in draw out cubicles, unless otherwise stated. These cubicles shall be such that draw out is possible without disconnection of the wires and cables.
- The power and control circuits shall have self-aligning and self-isolating contacts. Mechanical latches shall be integrated in ACB at service, test and isolated position to ensure that Breaker is firmly latched in respective position. It shall not be possible to move the breaker from the position unless latch is manually operated.
- MCCBs shall be of triple pole construction suitable for panel mounting, Operating mechanism shall be trip free, quick make, quick break type.
- The MCCBs shall be provided with front operating handles and mechanical ON/OFF/Trip indicators. In case of trip, the handles shall rest in an intermediate position.
- The compartment door shall be interlocked with the handle of the MCCB.
- The power supply for the ACB's shall be from 230V AC & 24 V DC as per availability at site.

❖ **Design guidelines for Interlocks and Contactors:**

- Electrical Interlocks with NO/NC contactors between incomers and bus couplers shall be provided.
- For Panels having Class-III (DG Supply) incomer necessary interlocks for incomers & Bus couplers along with AMF panel shall be considered.

- The contractor shall submit the interlocks control scheme along the drawings and all required equipment like UV relays, Contactors etc. which specifically not mentioned but required for the foolproof interlock operation shall be considered.
- The contactors shall be of modular with triple / four pole air break type with suitable voltage range of operation.
- The utilization category of the contactors AC 3 / AC 4 to match with the load requirements. The contactor rating shall be chosen to provide type 2 discrimination however; the minimum rating shall be 16A at AC 3 utilization category.
- The contactor shall be provided with adequate no. of NO and NC auxiliary contacts. The auxiliary contacts shall be such that NO contacts close after the main poles have closed and NC contacts open before the main poles have closed. Further, it shall be possible to change NO contacts to NC and NC contacts to NO at site.
- Directional contactors shall be electrically and mechanically interlocked.
- The closed state of the contactor shall be visually identifiable by means of a mechanical indicator.
- Necessary spare terminals to the contactor shall be provided as approved by EIC.

❖ **Design guidelines for Earthing:**

- One Earthing terminals shall be provided on each side of switchboard.
- The Cu earth bus size must be sized for prospective earth fault current.
- The earth bar shall be electrically continuous and shall run the full extent of each board as well as the same side as the cable entry.
- Each unit shall be constructed to ensure satisfactory electrical continuity between all metal parts which are not intended to be alive.
- Suitable holes with bolts and nuts shall be provided at each end of earth bar of switchgear for connection to a main Earthing grid.
- The earth bar shall be accessible in each cable entering compartment either directly or through a branch extension to ground the cable armor and shields.
- Door earthing shall be provided for all feeder doors, rear doors and CBC doors

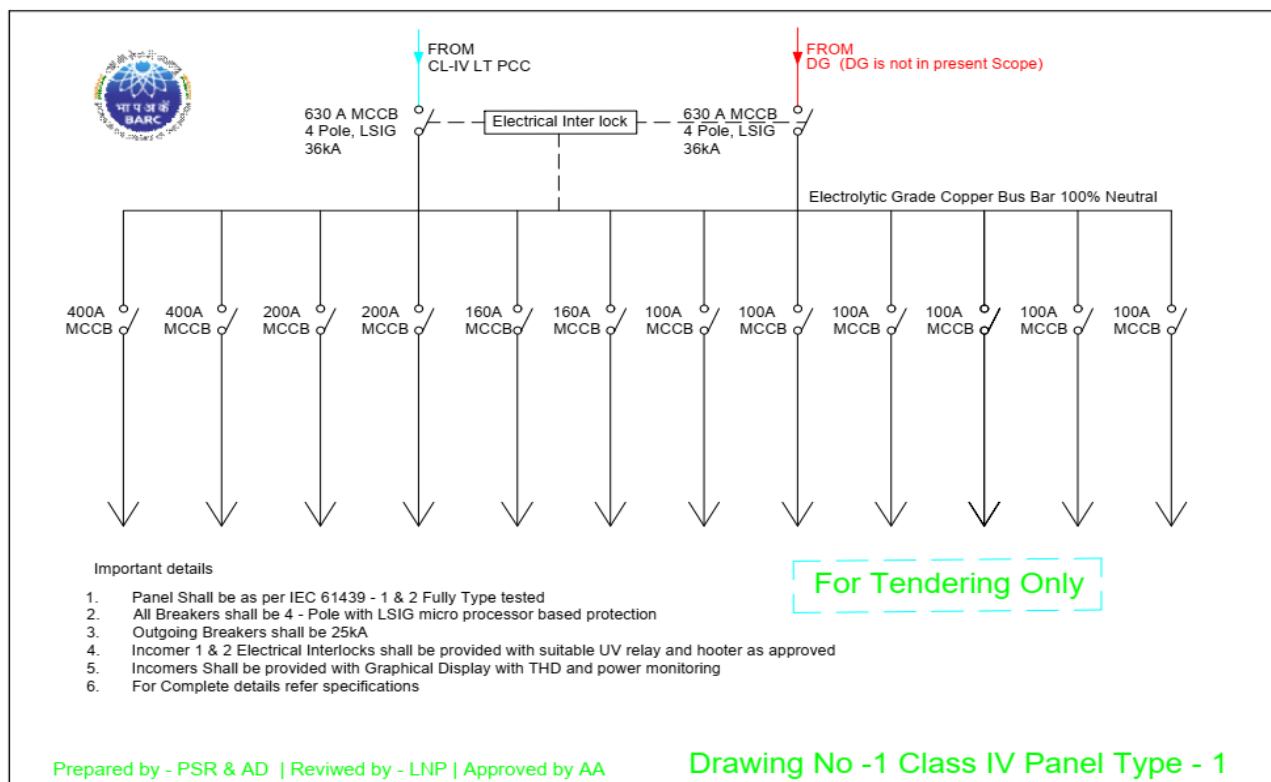
❖ **Design guidelines for Space heaters, Illumination, Sockets**

- Door Suitable number of Space heaters with Differential Thermostats 230 V, Illumination, Sockets shall be provided as per instructions of EIC

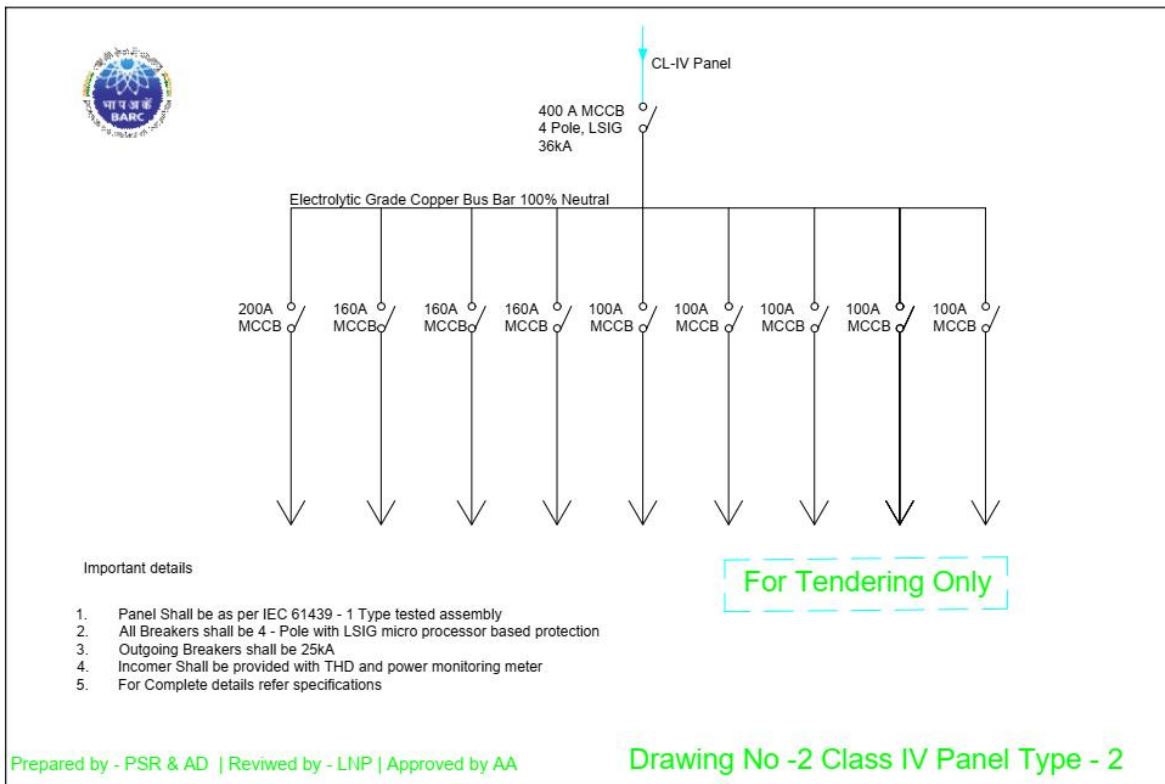
3.6 Testing, Name Plate & labels

- Panel shall be tested routine tests, type tests, pre-commissioning testing for ensuring the proper functionality.
- Before dispatch factory testing shall be carried out at fabricators facility in the presence of BARC representative.
- One name-plate giving designation of the switchboard shall be affixed prominently on top
- Details of designation shall be specified Feeder Number, Equipment Tag, Type of unit etc as per directions of EIC.
- All components whether mounted inside the switchboard or on the door shall be permanently and clearly labelled with reference number and/or letter of their function. Labels for feeder panel designation shall be fixed on the front side of respective panels

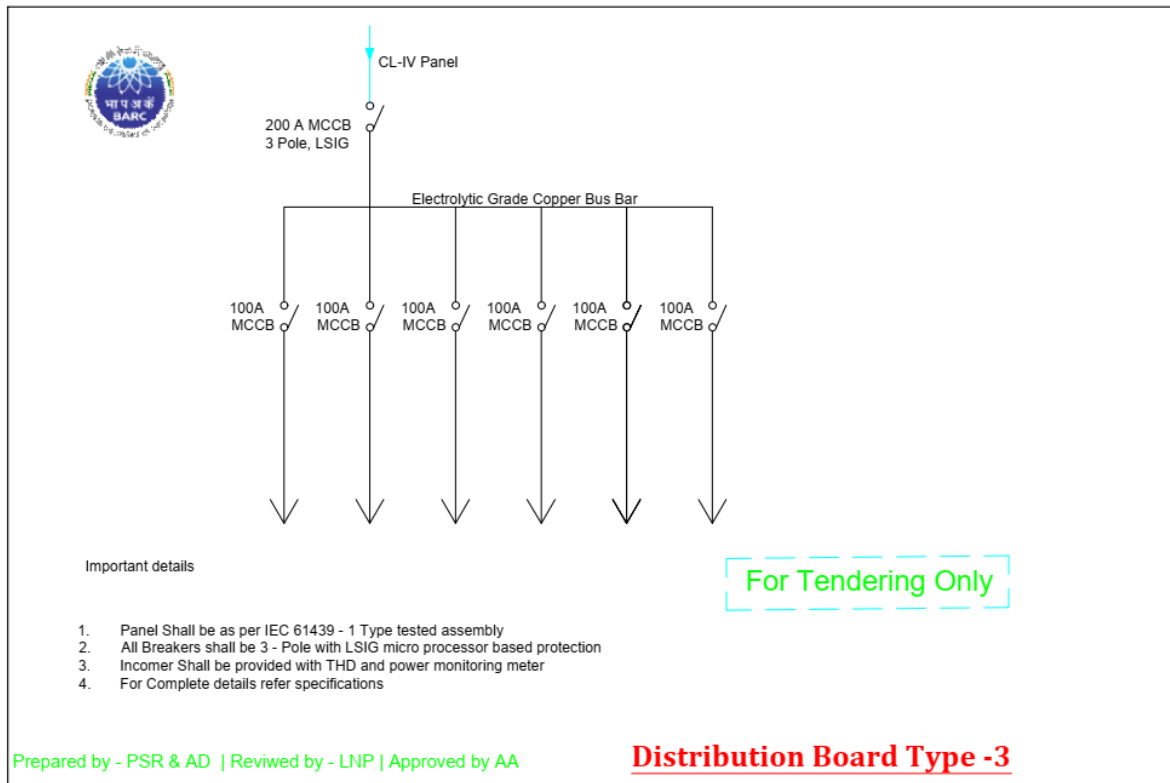
3.7 Drawing for Class IV panel Type- 1



3.8 Drawing for Class IV panel Type- 2



3.9 Drawing for UPS Distribution Board type-3



4 SITC of 2 X 10kVA UPS System with minimum 100AH 12 Volts Batteries -2

Separate units

4.1 Scope of the work

Scope of work Includes Design, engineering, submission of GTP, drawings, technical documents, fabrication, arrangement of factory inspection, loading, safe transportation, unloading, erection, pre-commissioning testing, commissioning of 2 X 10kVA Parallel redundant UPS System with batteries of minimum 100AH, 12V – 2 sets including stands along with all required accessories.

4.2 Specifications

Rating	2 X10 kVA
Application	Office are lighting, PCs etc.
Input	3 Phase LT,50Hz with allowable fluctuations
Output	Single Phase LT, 50Hz
Cables	As per approval – If the suitable size is not available contractor shall arrange the cables without extra cost Cables shall be FRLS
Type	Online, 100% parallel redundant type with static bypass as approved True online double-conversion technology with high power density, utility frequency independence, and generator compatibility
Switching	High Frequency switching sinusoidal with PWM
PF	Greater than 0.85
Input PF	Greater than 0.9
Overall efficiency	Greater than 90%
Isolation Transformer	Input or output as approved
Protections	Back feed protection, SC as per approval 3ph or 1ph input auto detection Overload etc. shall be provided as per IS/IEC
Overload	4min 100~110% 1 min 111~130%

	10 s 131~150% 2 s >150%
De- rating	As approved for lower voltages
Display	Suitable shall be provided for indicating parameter
Battery type	12 Volts, Minimum 100AH VRLA maintenance free with suitable stand
Ventilation fans	Redundant ventilation fans Shall be provided as approved
Spares	UPS Card, 2 No's of additional batteries etc. as approved
Note	UPS Shall be as per approved design Contractor shall submit the drawings and design calculations of UPS with all required details to EIC. And shall made the necessary changes as per direction of EIC

4.3 Testing

- UPS shall be as per relevant IS/IEC standards
- Testing shall be carried out as per relevant standards and necessary documents maintenance manuals shall be submitted.

5 Conduiting, Wiring, Switches, Sockets, MCB DB's

5.1 Scope of the work

The scope of this sections includes Design, supply, installation, testing and commissioning of

- **MCB DB's** of various types including Seven Segment of various types for Protection/controlling of lights along with all MCB's, MCCB's, RCBO along with Metal Enclosures
- **Hot dipped galvanized GI Conduit** pipe along with fixing accessories on wall, surface, Perlin, Puff panel and all other locations as per site condition and as instructed by EIC. The Conduit laying shall also include cutting of wall/Perlin etc. and installation of conduit, closing the wall with smooth finish and approved same paint shade.
- **FRLS Copper PVC** insulated wires of 1100 Volt grade multi stranded flexible as per IS 694, for lights/sockets/Illumination/DB's/Any other equipment Etc. as per approved design by EIC.
- **Modular Switches, sockets,** frame with metal box, etc. as per approved drawing and as instructed by EIC

5.2 Applicable Standards

IEC 61439	For MCB DB's and Seven Segment DB's
IS - 732	Code of practice for electrical wiring installation (system voltage not exceeding 650Volts)
IS - 694	PVC insulated cables with copper conductors for voltages up to 1100Volts
IS - 1646	General code of practice for fire safety of building of electrical installation
IS-3854	Switches for domestic and similar purposes
IS-1293	Three pin plugs and socket outlets
IS - 4237	General requirement for switchgear and control gear for voltages not exceeding 1000Volts
IS - 375	Specification for marking and general arrangement

IS - 2147	Degree of protection provided by enclosure for low voltage switch gear
BS - 3871	Specifications for MCB
	Indian Electricity Rules 1956, Indian Electricity Act 2003 as amended up to date and local supply authorities' rules & regulations

5.3 Design Guidelines

5.4 Seven Segment DB's and Enclosures

Description of Item – Supply, installation, Testing and commissioning of 415V / 230V, 50 Hz TPN Seven segment wall mounting/Surface Mounting type MCB distribution boards made from 14 G CRCA sheet with complete internal wiring and ferruling --Chipping of wall/Concrete for fixing DB along with encloser, Disposal of wall material, neat finishing, painting same as existing wall with all required civil works shall be carried out --Shall be of IP 43 protection and as per IEC 61439-3 --Separate compartment for incomer, sub incomer and outgoing devices --100 A Copper Bus bar for each phase with neutral bar, earth bar and cable ties -- Fully insulated bus bar and shrouded Neutral Bars	
Seven Segment TPN IP-43 8 Way Distribution Board	Seven Segment TPN IP-43 8 Way Distribution Board consisting 63/100 A 4-Pole DX3 MCB- 1 No's - as incomer 2 Pole, 32/40 A, 30mA RCBO - 3 No's - as sub incomer 6/20A SP MCB Outgoings - 24 No's - outgoings
Seven Segment TPN IP-43 12 Way Distribution Board consisting	Seven Segment TPN IP-43 12 Way Distribution Board consisting 63/100 A 4-Pole DX3 MCB- 1 No's - as incomer 2 Pole, 32/40/63 A, 30mA RCBO - 3 No's - as sub incomer 16/20A SP MCB Outgoings - 36 No's - as outgoings
Enclosures for DB's Supply of MS box made from 16 SWG to be embedded in the wall and by mounting above DB's with two sections of which one with 63A/ 100A MCCB with R/Y/B Indicating lamps, and other section with above DB's all necessary fixing and mounting arrangements with approved color shade for EB DB's, Emergency DB's and UPS DB's	
Enclosures for above 8	Metal Enclosure suitable for 8 way Seven segment above DB

way - DB with MCCB	with 63/100A MCCB Similar with indicating LED's
Enclosures for above 8 way - DB with MCCB	Metal Enclosure suitable for 12 way Seven segment above DB with 63/100A MCCB Similar with indicating LED's
Painting of enclosure	Powder coated as per approved type and shade

- Scope of the work includes supply, Installation testing commissioning of OEM Factory made Seven segment DB's of suitable MCCB's, MCB's, RCBO's of suitable characteristics as mentioned in SOQ.
- DB with phase segmentation and separation between incomer and Outgoings as per IEC 61439-3 shall be Suitable for Flush Mounting and Surface Mounting
- Cost of MCB's, RCBO's, MCB's Shall be included while submission of tender.
- Higher ratings of MCB's shall be provided as per approved design wherever it is required without any additional cost
- DB's shall be with 100 A Copper Busbar for each phase, With Neutral bar, Earth bar and Cable ties for Cable management.
- MCB's shall be suitable for manual closing and opening and also automatic trip on overload and short circuit.
- DB's shall be Supplied with wire set and all other required accessories
- **Enclosures for DB's shall be of MS** box made out of 16 SWG to be embedded in the wall and by mounting above DB's with two sections of which one with 63A/ 100A MCCB with R/Y/B Indicating lamps, and other section with above DB's similar to tender drawing for all necessary fixing and mounting arrangements with approved color shade for EB DB's, Emergency DB's and UPS DB's.
- Necessary Earthing terminals and connections shall be provided for enclosures
- The doors and other parts of the enclosure shall be with smooth finish, necessary locking arrangement shall be provided.
- Computerized Ferruling and Labelling shall be done
- Wiring shall be carried out with suitable lugs
- All sheet steel enclosures shall be chemically cleaned, rinsed, phosphated, and dried. After the treatment, steel surfaces shall be given undercoats of primer and finished with two coats of sprayed on enamel or lacquer paint of approved shade or as per standard practice of manufacturer.

- Lighting/power distribution board shall have one concealed hinged door which will cover the entire front portion. The door shall be provided with gasket to make the equipment dust tight and also with insulated quick turn screws.

5.5 MCB DB's

Description of Item –	
MCB DB Type - 1	SITC of factory made suitable thickness 8 Module Power Distribution board with IP - 40 having Transparent Crystal clear Door with SP/DP/3P Suitable rating MCB as incomers & outgoings Suitable rating, Suitable for Surface or Flush mounting including all required accessories complete set (Module is counted as is counted as incomers and outgoings, MCB ratings incomer – 32 Amp maximum, Outgoing 6A/10A/16A)- As per approval and site condition
MCB DB Type - 2	Supply of 16/20 Module Power Distribution board with IP - 40 having Transparent Crystal clear Door with SP/DP/3P Suitable rating MCB as incomers & outgoings as approved Suitable for Surface or Flush mounting including all required accessories complete set (Module is counted as is counted as incomers and outgoings, MCB ratings incomer – 32 Amp maximum, Outgoing 6A/10A/16A)- As per approval and site condition
MCB DB Type - 3	Supply of 8 Module Weather proof Power Distribution board with IP - 65 having Transparent Crystal clear Door/approved metal door with Suitable MCB's including all required accessories MCB as incomers & outgoings as approved Suitable for Surface or Flush mounting including all required accessories complete set (Module is counted as is counted as incomers and outgoings,

	MCB ratings incomer – 32 Amp maximum, Outgoing 6A/10A/16A)- As per approval and site condition

- Scope of the work includes supply, Installation, testing and commissioning of MCB DB's, necessary civil works including painting, chipping etc. whatsoever is applicable
- MCB DB's Shall be of as per **IEC 61439** Suitable for Surface / Flush mounting Completely flexible to organize the distribution as per site requirements with Pre fitted masking sheet Self-extinguishing:
- It shall be of Dust proof cabinets with **IP 40 - IK 07** and Class II Spacing between rails 150mm Door opening direction is bottom to top.
- Cost of MCB's, RCBO's, MCB's Shall be included while submission of tender.
- All DB's Models shall be approved by EIC prior procurement
- The doors and other parts of the enclosure shall be with smooth finish, necessary locking arrangement shall be provided.
- DB's shall be Supplied with wire set and all other required accessories
- Computerized Ferruling and Labelling shall be done
- Wiring shall be carried out with suitable lugs
- Elmex type terminal blocks shall be provided wherever applicable
- Lighting/power distribution board shall have one concealed hinged door which will cover the entire front portion. The door shall be provided with gasket to make the equipment dust tight and also with insulated quick turn screws.

5.6 Hot dipped galvanized GI Conduit

Description for following items

20 MM, 16 SWG, GI Conduit

25 MM, 16 SWG, GI Conduit

40 MM, 14 SWG, GI Conduit

Supply of GI Conduit Pipe hot-dip galvanized straight blister free Pipes in standard lengths of 3/3.75/Approved meters, threaded at both ends with Junction Boxes of 3 way/4 way with GI couplers, bends, screws, clips, clamps, and other required accessories as per requirement of site and as instructed by EIC

-- Chipping/ cutting of wall installation of conduit and final finish of civil works including

paint with neat finish shall be carried out

-- Installation shall be of along the wall, cable trays, ground etc.

-- Conduits shall be cut, threatened from standard length as per requirement of site

-- Wastages shall be included in quoted rate, no extra payment will be made

-- All accessories' clips, clamps, screws etc. shall be included in quoted rate

-- Conduits shall have smooth galvanized process fabrication

-- Junction Boxes installed in Outdoor Areas Shall have IP-55 or higher protection as approved

-- All conduits shall be of same make unless approved by EIC for functional requirement.

Important Note: Some conduits shall be Installed for FDA/Telephone/LAN/Voice address System for such systems Fish wire shall be installed and left for easy future requirement as approved. No extra rate shall be paid for the fish wire.

Fish wire shall be installed for all the conduits before concreting for avoiding blockages as per direction of EIC.

- Conduits shall be concealed type in all places unless otherwise approved by EIC. (For PEB's, Others as per site condition)
- Conduit drawing shall be approved by EIC. Fish wire of suitable SWG shall be laid along the conduit at concealed places for easy pulling of wires
- Conduits shall be rigid steel, hot-dip galvanized, furnished in standard length meters, threaded at both ends shall confirm to IS 9537.
- Hot Dip Galvanized Steel Conduits complying to BS 4568 Part 1 :1993 with (Heavy Protection)
- Each piece of conduit shall be straight, free from blister and other defects and covered with capped bushings at both ends.
- GI couplers, Tees, Elbows, bends, screws, clips, clamps and all other required suitable fixing accessories shall be provided
- Accessories shall be as per IS 3837:1976
- Exposed conduits shall be laid along walls, floors, ceilings, on steel supports etc. as per working drawings/site requirements in consultation with the supervisory personnel.
- The conduits shall be neatly run and evenly spaced.

- Necessary civil works wherever concealed conduit is to be laid including chipping of wall, neat finish, concreting, plastering and same type paint.
- Fixing of conduits to the supports on wall, column, structure shall not be done by welding. Exposed conduits shall be adequately supported by racks, clamps, straps etc. Jointing of conduits shall be done only in straight portion and not in bend portion.
- The Tenderer shall have available at site bending facilities for conduits as well as dies for threading conduits of diameters and threads corresponding to the standards. The threaded ends of conduits shall be painted with anticorrosive paint. The outer ends shall be smoothened free of burrs and sharp edges. Bushings shall be fitted at both ends of conduits
- All conduits shall be effectively connected to the earth terminal of the equipment where it terminates.
- Both ends of conduits shall be suitably earthed. Earthing continuity to be maintained by means of flexible wire wherever two conduits are joined with sockets.
- Approved conduit bending machines to be arranged by the contractor and shall be used for bending conduits at site. The radius of any conduit bend shall be as per standards for cabling. Bends shall be free from cracks, crimps or other damage to the pipe or its coating.
- Test certificate of conduit or similar shall be submitted as per directions of EIC wherever it is instructed.
- No wastage is paid so all care must be taken for installation of conduit
- Measurement of conduit is starting to ending point including bends, elbows, Tees, GI Flexible (Length shall not be more than light hanging arrangement as approved by EIC).
- Junction boxes shall be of 16 SWG sheet steel hot-dip galvanized dust and damp-proof, generally conforming to IP-55.
- Junction boxes shall be complete with gasketed inspection cover, conduit knock out/threaded hub and terminal blocks.
- Junction boxes for outdoor use shall be weatherproof IP-55 and those for hazardous location shall be flame-proof type.
- Junction boxes shall have Circuit nos. on top, Circuit nos. with ferrules etc.
- Flexible conduits shall be made with cold rolled, annealed & electro-galvanized mild steel strips coated internally with epoxy and externally PVC.
- Ceiling roses shall be provided wherever it is required.
- The conduit shall be designed with minimum length from DB's to room sockets/switch to light/fan/AC/etc. point.

5.7 FRLS PVC Wires

Description of Item –

Supply and pulling of 1100V grade PVC insulated FRLSH compounded multistrand flexible High grade copper conductor as per IS 8130/2013 and latest amendments single core industrial wires as per IS 694: 2010 and latest modifications

--Insulation as per TYPE-D as per IS 5831/1984 and latest modifications as applicable

--Necessary test certificates for FRLS properties as per IS standard shall be submitted, EIC may instruct for testing of any part/lot of the wires if required. The contractor shall make necessary arrangements for testing of the same at no extra cost. contractor shall consider the necessary requirements before submission of bid.

-- OEM of wire manufacturing shall have in house testing facilities, relevant certificates as required Instructed by EIC shall be given

-- Wires Colours Phase R/Y/B/, Neutral-Black, Green-Earth as per standards shall be followed for balanced load.

-- All wires shall be terminated at MCB/Sockets/Switchboard etc. properly with necessary lugs by crimping only as per industrial practice unless Instructed by EIC Contractor shall quote accordingly no extra payments will be made

--NO wastage of wires will be paid; wire shall have ISI marked as applicable

-- Each colour shall be supplied in bundles of 90/180 Meters or above (Measurement as actuals).

-- No joints shall be allowed except as instructed by EIC and Jointing at T junctions to be done with proper terminal connectors

-- No Wastage of wires will be paid so quoted rates shall be inclusive of wastage

-- Pulling of wires shall be carried out only after smoothing of GI pipe/Trays Etc.

-- Suitable No of Wires shall be pulled as per directions of EIC In each Conduit

-- All wires shall be of same make

PVC insulated FRLSH as per IS 694:2010 2 Runs of 1.5 Sqmm + 1 Run of 1.5 Sqmm	2 Runs of 1.5 Sqmm (R/Y/B for Phase + Black for Neutral) and 1 Run of 1.5 Green Wire for Earthing --1 RMT of measurement Shall Consists of Phase wire, Neutral wire, and earth wire each of one meter length i.e. total 3 meters.

PVC insulated FRLSH as per IS 694:2010 2 Runs of 2.5 Sqmm + 1 Run of 1.5 Sqmm	2 Runs of 2.5 Sqmm (R/Y/B for Phase + Black for Neutral) and 1 Run of 1.5 Green Wire for Earthing --1 RMT of measurement Shall Consists of Phase wire, Neutral wire, and earth wire each of one meter length i.e. total 3 meters.
PVC insulated FRLSH as per IS 694:2010 2 Runs of 4.0 Sqmm + 1 Run of 2.5 Sqmm	2 Runs of 4 Sqmm (R/Y/B for Phase + Black for Neutral) and 1 Run of 2.5 Green wire for Earthing --1 RMT of measurement Shall Consists of Phase wire, Neutral wire and earth wire each of one meter length i.e. total 3 meters.
PVC insulated FRLSH as per IS 694:2010 2 Runs of 6.0 Sqmm + 1 Run of 2.5 Sqmm	2 Runs of 6 Sqmm (R/Y/B for Phase + Black for Neutral) and 1 Run of 2.5 Green Wire for Earthing --1 RMT of measurement Shall Consists of Phase wire, Neutral wire, and earth wire each of one meter length i.e. total 3 meters.

- Lighting cables shall be 1100 Volt grade, multi stranded flexible FRLS PVC Copper conductor as per IS 694 of suitable cross section.
- The wiring for lighting circuits shall be done in looping system. The phase conductor shall be looped at switch box for sub-circuit. The neutral conductor for sub-circuit can be looped either from switch box or from light/fan/socket points. Twisted joints for looping are not acceptable.
- Straight through joints shall not be permitted on single core wires and flexible.
- Colored insulated wires of respective color shall be used for phase conductor and black colours insulated wires shall be used for neutral conductor.
- All the wires shall be terminated with suitable sizes of copper lugs.
- 25mm Conduit shall carry up to 2-3 circuits of 1.5Sqmm/2.5sqmm and up to 2 circuits of 4sqmm Circuits based on the approved design drawing by EIC as per site condition.
- Following different pattern DB's may be considered. Drawing Shall be approved by EIC and EIC may change based on the requirement of site.

1. Raw Power Lighting & Power Sockets (For minor Loads)	2. UPS Lighting & Power Sockets (For minor Loads)

3. Raw Power A/C Socket, Fans and Power Sockets	4. UPS Control Instrumentation/PC/Power Socket Points
5. Emergency DG Lighting	

- All the conduits shall be ensured to have no foreign material, bliss, rust inside of it before installation.
- Waste oil shall be used for smooth pulling of wires in conduit with cotton waste
- All wires Insulation Resistance shall be carried out before and after installation and all circuit values to be submitted to EIC.

5.8 Switches and Sockets

Supply and fixing of concealed /surface mounted Modular type polycarbonate covers/Plate/GI box/Socket/Suitable Switch with suitable earthing screws, Mounting and all other required accessories as per specifications and approved GA drawings

-- All sockets/switches, plates shall be of modern design, applicable IP rating, necessary strength as per relevant IS/IEC standards

-- All sockets/switches/plates/frame/GI box etc. shall be of same make to ensure the maximum functionality unless approved by EIC

--Necessary Test certificate shall be submitted as per directions of EIC

-- Colours/design/model shall be as per directions of EIC for functional suitability and maximum life

-- All equipment shall be supplied with required necessary accessories

Important Note – Samples shall be brought to site for EIC inspection. Selection shall be suitable models only as per specification, necessary certificates, and as per actual requirement of site.

- Supply and Installation of Various sizes Modular Plate + Frame+ White/Graphite Polycarbonate cover along with GI metal box with all required accessories as mentioned in the BOQ as per approved design.
- The switches, sockets, plate, frame etc. all shall be of modular type and same make unless approved by EIC.
- Location of installation is on wall/flush type/concealed/Perlin/on M.s Frame etc.
- Necessary dummy shall be provided as per EIC Approved design

- Size of the modular plate shall as per approved drawing by EIC
- Different plates, frame, switch, socket etc. of different colour white/graphite shall be provided for UPS and Raw Power as per approved drawing by EIC
- All frames/switches/sockets/GI Box shall be in complete including all the required fixing accessories.

5.9 Testing Of Installation at Site:

- Before the installation is put into service, the following tests shall be completed with

Insulation resistance	The insulation resistance shall be measured by applying between earth and whole system of conductors or any section thereof. 500 Volts D.C. for single phase system be means of a megger. The insulation resistance shall not be less than one mega-ohm
Testing earth continuity path	The earthing conductors shall be tested for electrical continuity. The electrical resistance of the same along with earthing lead from connection with earth electrode to any point, in any point in earth continuity conductor in the complete installation shall be less than one ohm
Testing of polarity of single pole switch	The test shall be made to verify that all single pole switches have been fitted between phase conductors and light/fan/socket outlet etc.
Testing RCBO for its sensitivity	Each RCBO shall be tested at site for tripping in the range of 15-30mA leakage current by pressing the test button.

- For other equipment which specifically not mentioned required testing as per standards shall be carried out as per direction of EIC.

6 1.1kV LT Power and Control Cables

6.1 Scope of the work

Scope of work Includes Design, engineering, submission of GTP, Safe transportation, unloading, manufacture, testing at manufacturer's works and delivery to site and installation, termination, testing at site & commissioning of 1.1 KV grade LT PVC/XLPE insulated, Aluminum/copper conductor cables in operational state. Cable termination Includes supply, installation & commissioning of cable glands, cable lugs, cable termination kits, cable clamps, cable ties, cable identifier tags etc., for all cables.

6.2 Design Guidelines

Applicable Reference Standards for cables	
Unless otherwise specifically mentioned in the document, the design, manufacture, testing and performance of all cables shall conform with latest edition of the following standards & codes:	
IS 7098 (Part-I)	Cross linked polyethylene insulated PVC sheathed cable for working voltage and including 1100 Volts
IS 1554 (Part-I)	PVC insulated (heavy duty) electric cables for working voltage up to and including 1100V.
IS 3961 (Part-II)	Recommended current ratings for cables
IS 3975	Mild steel wires, strips and tapes armoring of cables
IS 4905	Methods for random sampling
IS 5831	PVC insulation and sheath of electrical cables.
IS 8130	Conductors for insulated electrical cables and flexible cords.
IS 10418	Specification for drums for electric cables
IS 10810	Method of tests for cables.
ASTM-D-2843	Standard test method for density of smoke From the burning or decomposition of plastics.
ASTM-D-2863	Standard method for measuring the minimum oxygen concentration to support E3 candle like construction plastics.

IEC-754 (Part-I)	Test on gases evolved during combustion of electric cables.
SS:4241475	Flammability testing of cables.
Power system details	415 V +/-10%, 3 phase, 4 wire solidly earthed.
Size of cable, conductor & quantity	As per SOQ
Core identification	Colour scheme as per IS 1554 (part I)/ 88 or latest
Conductor	Aluminum - Stranded and compacted plain Aluminum of grade H2, generally conforming to IS: 8130 Copper - stranded, high conductivity annealed plain copper, generally conforming to IS: 8130
Rated voltage	1100 Volts
Insulation	XLPE conforming to IS 7098 part-1
Inner sheath	Extruded PVC inner sheath
Overall serving (outer sheath)	Anti rodent and anti-termite extruded black FRLS grade PVC sheath (Type ST-2)
Filler material	If used, shall be compatible with other materials of cable construction
Armouring	Single layer galvanized steel round wire/ flat strip armoured.
FRLS	FRLS compound outer sheath shall be resistant to water, UV radiation, fungus, termite and rodent attack and shall have the following parameters: Critical Oxygen Index – More than 29% Temperature Index - More than 250 degrees Smoke density rating - Maximum 20% Acid gas, Gas generation – Less than 20%

Cable Size calculation	Short circuit current, Continuous current, Installation conditions, Voltage drops under normal running and starting condition Apart from above, consideration shall also be given to limit the cable to some standard sizes instead of using too many types. However final ratings shall be as per direction of EIC
Jointing of cables	Care shall be taken for avoiding the jointing of cables. No separate cost for jointing shall be paid to contractor unless otherwise mentioned in BOQ (Only for few cables jointing considered separately as per BOQ, Other cables it shall be included in the quoted rate). Jointing shall be only with the approval of EIC. Jointing kits shall be Outdoor type (for all cables) as per relevant IS standards.
Important Note – Cable drums for fully used cable shall be returned to contractor. For the cables if the cable retained more than 100 meters, drums shall not be given to contractor. Rate shall be quoted accordingly.	

6.3 Installation of cables

- Transformers Cables shall be installed in the Cable trays/bus ways/Underground/wall mount etc. as per requirement of site as per approved design.
- Contractor shall design the suitable cable size based on the current carrying capacity, fault current etc. as per relevant IS/IEC standards and as per directions of EIC.
- Number of runs of cable shall be considered for higher capacity.
- Cables shall be earthed as per approval
- Excavation for cables shall be separate item as per BOQ
- Length of cable drums shall be as per as IS / as approved by EIC.
- Completely used cable drums shall be returned to contractor. Necessary cost adjustments shall be considered while submission of tender.
- BARC may take some of the quantity of cables as only supply considering the future requirement like cabling for upcoming machines/ future replacement /additional requirement as decided by EIC. For such cables if the cable retained more than 100 meters, drums shall not be given to contractor.

6.4 Termination of cables & Jointing of cables

- End jointing of 1.1 KV grade, Aluminum / copper conductor PVCA/XLPE power / control cables with supply & installation of all materials including supply of double compression type glands, crimping type long barrel heavy duty copper lugs, insulation tape etc. of sizes as detailed in schedule of quantities (SOQ).
- Cable gland shall be suitably earthed. Earthing of clamp should be included in the cost.
- Cables shall be planned without Jointing. Jointing of cables shall be avoided maximum unless approved by EIC. No additional cost for the jointing shall be paid to contractor unless otherwise mentioned in the BOQ. The quoted rate shall include the jointing kit of suitable rating outdoor type.

6.5 Cable identification and Marking

- Cable shall be embossed / printed on the outer sheath at regular intervals as under :1.1 kV, PVC/XLPE, conductor material, No. of core and size of cable, sequential marking for the metered length of cable, make and year of manufacturing and others as approved by EIC.

6.6 Testing

- The cables shall be subjected to shop tests & witnessed by department engineer in accordance with relevant standards to prove the design and general qualities of the cables like Routine tests on each drum of cables, acceptance tests on drums chosen at random for acceptance of the lot.
- Type tests Certificates shall be submitted for particular size & design of cable.
- The cables after installation at site shall be subjected to HV test & Megger test as per instruction of EIC.

7 Cable Trays and Cable Trays Management System

7.1 Scope of the work

Scope of work Includes Design, engineering Supply, Installation, commissioning and. Other general requirements for the supply of Ladder type/ Perforated type GI Cable Trays along with all required accessories.

Description: SITC of Cable trays along walls, trenches etc. as per requirement of site

7.2 Applicable Standards

IS:2062, IS:1079, IS:811, IS:513, IS:808, IS:1730, IS:8910,	Steel used for fabrication
IS:813, IS:816	Welding
IS:1364, IS:1367, IS:1368, IS:2016	Bolts, Screws, Nuts, Washers, Fasteners
IS:2629, IS:2633, IS:4759, IS:4826	Hot dip galvanizing
IS:5216, IER, IS:1646, NEC-318	Electrical Work related to cable laying

7.3 Design and laying Guidelines

- The cable tray and cable support system shall be designed considering facility for easy laying of cables, Access to maintenance, Neat and Aesthetic appearance, safety of equipment and personnel.
- All cable trays and accessories shall be hot dip galvanized to a minimum thickness of 60 - 80 microns and zinc coating as per BS 729.
- The sizes of the trays shall be as per above mentioned scope description/SOQ, if the cable trays are mentioned as per RMT, necessary jointing kits, bolts, accessories shall be included in the quoted cost.
- If the cable trays are mentioned as per kg. in SOQ all accessories weight will measured accordingly.
- Support for the cable trays shall be paid in MS item. GI thread rod supports in office/wall etc. will be considered as MS weight.
- Cable trays and its covers are of prefabricated ladder/perforated types and the associated accessories such as coupler plates, tees, elbows, etc., shall be fabricated from minimum

1.6 mm thick mild steel sheets and cable tray covers shall be fabricated from minimum 1.4 mm thick MS sheets.

- Cable trays shall be perforated/Ladder type with hot dip galvanized according to above mentioned applicable standards suitable for indoor/outdoor use having moderate humidity and air pollution.
- Cable trays shall be complete with all necessary hot dip galvanized accessories such as, coupler plates, ground continuity connections, nuts, bolts, washers' hangers, clamps, supports, horizontal/vertical bends, tee, reducers etc.
- The straight sections shall be supplied in standard length not less than 2.5 Meters
- All cable trays and accessories shall be hot dip galvanized to a minimum thickness of 60 - 80 microns and zinc coating
- The zinc coating shall be smooth, clean and uniform thickness and free from defects like ash and dross inclusions, bare patches, black spots, pimples, lumpiness, rust stains, blisters etc.
- The galvanizing shall not adversely affect the mechanical properties of the coated material.
- All manufacturing process including punching, cutting, bending and welding of perforated cable trays shall be completed and burrs shall be removed before the application of galvanization process is applied.
- The joints of two trays shall be butt construction and shall be made with the help of coupler plates by nuts and bolts. The coupler plate and nuts and bolts shall also be properly hot dip galvanized.
- The perforated trays shall be free from sharp edges and burns etc. so that joint between two trays shall be without any clearance and matched in proper shape.
- Coupler plate shall be fitted at each side runner at one end. The coupling plates shall be supplied with bolts, nuts and washers fitted at the other four holes for fixing to adjoining member.
- All the works and selection & type of cable trays shall be as instructed by EIC as per actual site condition.
- The tenderer shall do necessary civil works for installation of cable trays wherever it is required.
- Cable trays shall be earthed regularly as per relevant standards and as per directions of EIC.

- Vertical raceways shall be formed by either structural members or slotted angles or by running the prefabricated trays vertically. Bends, elbows, T-joint etc., shall be prefabricated to suit site conditions.

7.4 Cable Tray Supports

- Cable tray supports shall be fabricated from standard steel structures of different sizes. The sizes selected shall be adequate for the weight of cables/trays encountered.
- The steel members shall be cleaned thoroughly for rust and painted as follows:
- If the cable trays are mentioned as per kg. in SOQ all accessories weight will measured accordingly.
- If the cable trays mentioned as per RMT, Support for the cable trays shall be paid in MS item. GI thread rod supports in office/wall etc. will be considered as MS weight.
- Cable trays sizing installation locations shall be as per directions of EIC.

7.5 Inspection & Testing:

- The Following Visual Inspection Tests shall be carried out on Ladder/Perforated Trays.
 - a) Quality and thickness of Cable Trays and Tray Covers.
 - b) Dimension as per specified in this specification.
 - c) Uniformity of Galvanizing Coating.
- The tenderer shall submit all required test documents as instructed by EIC wherever it is required.

8 Maintenance Free Earthing System

8.1 Scope of the work

Scope of work Includes Design, engineering, submission of GTP, Safe transportation, unloading, manufacture, testing at manufacturer's works and delivery to site and installation, termination, testing at site & commissioning of maintenance free earthing system for System Earthing, Equipment Earthing, Earthing for Lightning protection of buildings.

Description
Type -1 Earth Pits: SITC of 3.0 Mts X 15 mm Dia (10' X 5/8") molecular bonded copper rod (Minimum Copper Bonding Shall be of 250 Microns) configured earthing system with 3 bags of Non -Corrosive, Non-Soluble, Electrically Conductive, Treatment 11kG Ground Enhancing Material Conforms to IEC 62561-7 Standard, earth rod clamp, Earth pit chamber etc. -- Exothermic welding of joints/Bolt nuts Fixing between earth electrode & GI / tinned Cu strip and between GI / tinned Cu strips, used for interconnection of earth electrodes.
Type -2 Earth Pits: SITC of Tripolar Earthing System similar to above as per Specifications.
For Tri polar Earthing & Type-1 Earthing Concrete Chamber and cover wherever is required as per design shall be paid under necessary Civil Item. For Other readymade chamber shall be supplied as per Ts and approval

8.2 Design Guidelines

Applicable Reference Standards for cables	
Unless otherwise specifically mentioned in the document, the design, manufacture, testing and performance of all cables shall conform with latest edition of the following standards & codes:	
IS 3043	Code of practice for earthing.
ANSI/UL 467	Safety for Grounding & bonding equipment.
IEC 62561-2	Requirement for conductors and earth electrodes.
IEC 62561-7	Requirement for earthing enhancing compound.

IEC 60068-2-52	Salt Mist Test and Humid Sulphur Atmosphere Test
IEC 60068-2-52	Potential dynamic polarization resistance methods.
CET/TS 14997	Leaching behaviors principles and methods.
RDSO/SPN/197	Specification for Code of Practice for Earthing & Bonding System for Signaling Equipment's.
IEEE 80: 2000	Substation Earthing
BS 7430: 1998	Code of practice for earthing.
GP-311	CBIP Manual on Earthing of AC system.

8.3 System Particulars & Requirement

Voltage Level	11kV/415V/Lightning
Nature of soil	Most of the area is Hard Rock area. Necessary planning for drilling etc. shall be made and quoted price shall include with all required components
Earthing conductor to be used	Copper/ Aluminum /GI Strip / Other – Materials Specified in BOQ

8.4 Design Guidelines for the Earthing System

❖ Earthing System:

- Earthing system means, providing total earthing system (G1 General Electrical Earthing /G2 Instrument Earthing/G3 Electronic Reference Earthing/ Earthing for Lightning protection of buildings) including all material and services consumables required for system, safety & lightning protection earthing for all the plant and equipment, buildings, structures covered.
- **System Grounding G1:** Neutral point of three-phase system of Transformer to be grounded with zero resistance—to establish a definite zero point. This earth pit connection shall be extended through a braided round tinned copper conductor in many parallel ways and it shall reach to many non-live parts of equipment / instruments / motors / structures / frames to connect as equipment grounding through earthing conductor and protective conductor.

- **Equipment Grounding G1 (safety Grounding):** To connect all structures or the frame of electrical equipment, non-live parts of the equipment to the G1 ground circuit. This is to provide safety to the operating personnel and to safe guard the plant against lightning discharges. All equipment grounding shall also connect to the nearest equipment earth pits. All equipment earth pits shall be interconnected at earth pit level around the building. This is nothing but forming an equipotential plane almost at zero, by using earthing conductor.
- **Lightning grounding arrangement G1:** Lightning mast shall be connected with solid conductor to an earth pit, called as G1 lighting earth pit. It shall also be connected to power equipment earth G1 and to nearest equipment earth pits (G1). Any portion of the equipment / structure located on roof top of the installation shall be connected to lightning ground bus/ grid (G1) and later all those will be connected lightning earth pit, to ensure all static charges to reach earth. Later equipment ground pit and lightning earth pit shall also be interconnected.
- Metallic screen of control cables, instrumentation cables, EMI protection of electronic equipment shall be provided with insulated Copper conductor for earthing and shall be taken to earth pit outside the building separately and shall be connected to combination of treated copper plate earth pit and maintenance free tripolar earthing. This earthing system shall form G2 Instrument Earthing.
- Earthing for zero reference in electronic and instrumentation system shall be provided with separate earthing network and shall be connected to separate earthing. This earthing system shall form G3 Electronic Reference Earthing.
- The philosophy, however as per approved design subjected to BOQ and scope as decided by EIC at the design stage

❖ **Earth Electrode:**

- The earth electrode shall be made of high tensile low carbon steel circular rods, molecularly bonded with copper on outer surface to meet the requirements of Underwriters Laboratories (UL) 467-2007 or latest or IEC 62561-2.
- The earth electrode shall be UL listed of 15/17.2 mm diameter and 3m length.
- The earth electrode shall be connected to GI/ tinned Cu strip by exothermic welding only.
- Marking: Manufacturer's name or trade name, length, diameter, UL catalogue number must be punched on every earth electrode.

- The earth electrode shall be provided with poly-plastic inspection chamber with cover as per manufacturers standard. wherever inspection cover as mentioned below & SOQ is specifically mentioned poly plastic inspection chamber is not required to be provided.

❖ **Earth Enhancement material:**

- Earth enhancement material is a superior conductive material that improves earthing effectiveness, especially in areas of poor conductivity (rocky ground, areas of moisture variation, sandy soils etc.) it improves conductivity of the earth electrode and ground contact area. It shall be tested and confirm to the requirements of IEC 62561-7 and generally having following characteristics
 - Shall have high conductivity, improves earth's absorbing power and humidity retention capability.
 - Shall be non-corrosive in nature.
 - Shall be suitable for installation in dry form or in a slurry form.
 - Shall not depend on the continuous presence of water to maintain conductivity.
 - Shall be permanent & maintenance free and in its "set form", maintains constant earth resistance with time.
 - Shall be thermally stable between -10deg. C to + 60deg. C ambient temperatures.
 - Shall not dissolve, decompose or leach out with time.
 - Shall not require periodic charging treatment nor replacement and maintenance.
 - Shall be suitable for soils of different resistivity.
 - Shall be ROHS compliant & not pollute the soil or local water table and meets environmentally friendly requirements for landfill.
 - Shall not be explosive.
 - Shall not cause burns, irritation to eye, skin etc.
 - Marking: The Earth enhancement material shall be supplied in sealed, moisture proof bags. These bags shall be marked with Manufacturer's name or trade name, quantity etc.

❖ **Backfill material:**

- The excavated soil/ good agricultural soil is suitable as a backfill but should be sieved to remove any large stones and placed around the electrode taking care to ensure that is well compacted.

- Material like sand, salt, coke breeze, cinders and ash shall not be used because of its acidic and corrosive nature.
- The backfill material shall be non-corrosive & ROHS compliant.
- One location inside the site shall be shown by EIC for back fill soil and contractor shall excavate and fill from the shown location. No additional cost will be paid for the same.

❖ **Earth grid:**

- The earth electrodes, as per approved drawing, shall be installed and connected to form an earth grid
- These earth pits shall then be inter linked using GI / tinned Cu strip, as per drawing, to form a loop using exothermic welding technique.
- Contractor shall design and submit the drawing for the approval of EIC.

❖ **Earth pit (Inspection chamber):**

- Each earth grid shall have one no. earth pit housing GI / tinned Cu main equipotential bar, as indicated above for the purpose of measuring earth grid resistance.
- The earth pit shall be concrete (1:2:4) chamber of size 600 X 600 X 600mm (inside dimension) & Suitable thick with MS chequered plate hinged cover shall be provided.
- The marking plate /pit marking space should be present on the cover.
- The date of testing and earth resistance value shall be written on the cover with black base with yellow paint.

8.5 Measurement of earth resistance and Important Notes

- The earth resistance shall be measured at the GI/ tinned Cu main equipotential bar with all the earth pits interconnected and tested as per IEEE 80, BS 7430 & IS 3043 with the digital earth tester for measurement of grid resistance.
- As the area is hard rock area, for the confirmation of the values as per relevant standards contractor shall prepare one earth pit initially. After obtaining the value satisfactorily contractor may install other earth pits.
- If the value of the earth pits not as per the relevant standard, contractor shall use additional GEM etc. in consultation with OEM for obtaining satisfactory values. (GEM Quantity additional, other than above mentioned if specifically mentioned in BOQ shall be paid).
- Reference values

Value of each isolated safety earthing grids for transformer and DG set neutral	shall be less than 1Ω
The earth resistance value of each isolated safety earthing grids for substation equipment's	shall be less than 1Ω
The earth resistance value of each isolated lightning protection system	shall be less than 10Ω .
Other values as per IS and as approved by EIC.	

9 Lightening Protection System

9.1 Scope of the work

Scope of work Includes Design, engineering, submission of drawings to EIC, approval, Safe transportation, unloading, Installation, testing as required covers design, submission of drawings to EIC for approval, supply, installation, testing and commissioning of lightning protection system for protection of building and allied structures etc.

Air Termination System: SITC of air termination rod of 2-meter length of Copper Bonded Steel Rod 16mm dia. The rod shall be mounted with fixing accessories

SITC of 8mm Dia Copper Bonded steel round conductor for air termination system Cross sectional area of conductor should be 50 mm² to meet the requirement of IS/IEC - 62305. Tested as per IEC 62561-2

Accessories/Fixing Arrangements -

Folded clamp/Metal roof holder for 8mm dia Solid Round Conductor for horizontal Air terminal above metal sheet with fixing screws, Supply of Conductor Holding clip for fixing the 8 mm dia round conductor on the side wall, and other fixing arrangements shall be considered in the quoted rate

9.2 Applicable Standards

IEC 62305-1 Part 1	General Principles
IEC 62305-1 Part 2	Risk Management
IEC 62305-1 Part 3	Physical Damage to Structure and Life Hazard
IEC 62305-1 Part 4	Electrical and Electronic Systems within Structures
NFC 17-102 design and tested	Lightening Protection System-Early Steamer Emission System

9.3 Early Steamer Emission Lightning Protection System

- Early Steamer system Design shall be carried out by OEM of supplier, and Design drawings shall be submitted for the approval.
- Early steamer emission Lightning protection design requirements, protection level calculations and protection radius obtained from this standard.

- ***Lightning Test Current (10/350), Peak Value I Imp- 100kA, Short circuit Current (8/20 Microsecond), Peak I_{max} – 1kA.***
- ***Delta T for calculations minimum 45 micro seconds***
- **Type of protection – Class Highest possible optimum level of protection with minimum Protection radius of 48 Meters.** (However, this subject to approval based on the design requirement).
- The mounting pole used to support the lightning air terminal shall be of 4 Mt to 7 Meters (Based on the design approval by EIC) non-corrosive and made up of medium class GI / SS pipe (as approved) of minimum 1.5" diameter having base plate at bottom for securely fixing the mast on roof top. However, this subject to the roof type, surroundings, material on roof top like solar etc. Contractor shall carry out the work without any extra cost.
- The mounting pole and supports shall be securely fixed with the brackets and PVC insulated metallic guy wires to withstand the maximum wind velocity of that area.
- ESE Stainless Steel (SS) Air Termination Rods are Active Lightning Protection System (LPS) conforming to International Standards NFC 17-102: 2011 & UNE 21 186
- **Suitable mounting mast shall be installed** based on the design approval with suitable clamps, fixing arrangements, clips etc. which are required for the complete installation of the system
- Down Conductor – Pure copper suitable flat/wire as per SOQ shall be installed for connecting to the ground. Ceramic spacer shall be installed along the down conductors of suitable quantity.
- ESE shall be SS – 304 /Copper as per Standards, as per approved design.
- ESS (Early steamer system) type lightning protection system which includes supply and erection of all necessary items like Dynasphere Air terminal, insulated mast, down conductor, lightning event counter and mounting accessories and hardware with suitable fixing arrangement and linking with insulated copper wire of 95 Sq.mm from lightning rod to earthing pit with fixing clamps
- As per NFC 17-102 standard, if width of building is more than 2 times height of the building or building height is more than 28m, then 2 down conductors should be routed from the nearest opposite path of the lightning conductor.
- care should be taken in routing the down conductor. It should be routed through the straight and shortest path to earth and also such that all water pipes, wires & cables etc. should be minimum 1-2m far from it. Sharp bends should be avoided

- **Lightning Strike Counter:** suitable lightning counter with Six digits Electromechanical display with Inductive probe and IP rating of minimum IP 65 with enclosure. Suitable metal enclosure with door shall be provided. Cost shall be included in the quoted price.
- **Test Certificate** – OEM Test certificate and other relevant test certificates for the system components like ESE, Insulators, Supports, Counter shall be provided as per direction of Engineer In-charge.
- **Tests after Installation** – Necessary tests after Installation shall be carried out as per standards/As per directions of Engineer In-charge.

9.4 Design Guidelines Conventional Lightening Protection System

- This Section specifies the lightning protection system for the building(s) or structure(s). This system shall provide safety for the building and occupants by preventing damage to the structure caused by lightning.
- The design of this system is to be in accordance with according to **IS/IEC 62305** Standard.
- All components shall be ready made type & shall meet the requirement of IEC 62305 standard.
- Lightning protection materials shall be coordinated with building construction materials to assure compatibility
- Lightning Protection components shall be tested for natural weathering and exposure to corrosion in Salt Mist Treatment test according to EN 60068-2-52 and Humid sulphureous atmosphere treatment test according to BS EN ISO 6988. The test reports shall be submitted wherever instructed by EIC.
- Lightning protection system for Code of practice for protection of buildings and allied structures against lightning.
- **Air terminal:** For the purpose of lightning protection, the vertical and horizontal conductors are considered equivalent and the use of pointed air termination or vertical finials is, therefore, not regarded as essential. However, vertical air termination shall be provided where indicated as per approved drawing.
- Air termination materials for different roof shall be as per following unless otherwise specified in SOQ
- **Roof/Down conductor:** Down conductors shall be distributed round the outside walls of the structure. They shall preferably be run along the corners and other projections, due considerations being given to the location of air terminations and earth terminations

- Down conductors shall follow the most direct path possible between the air termination and the earth termination avoiding sharp bends upturns and kinks. Joints shall as far as possible be avoided in down conductors. Metal pipes should not be used as protection for the conductors
- Down conductors shall be supplied with all suitable materials, fixing accessories, insulators etc. as required.

9.5 Earthing system:

- Maintenance free earthing as mentioned in the sub sequent sections of technical specifications

9.6 Test Certificates

- Necessary test certificates as per directions of EIC/IS standards shall be submitted.

10 Illumination System

10.1 Scope of the work

The scope of this sections includes Design, supply, installation, testing and commissioning of Illumination system with all required accessories, supporting GI threads etc. as required as per direction of EIC.

The lighting fixtures shall have 5 Years OEM, On-site repair/replacement warranty except for EXIT Light, Spot lamp, Strip, Emergency light

Minimum 36W Recess - Indoor	Size – 2 X 2 ft / 1 X 4 Ft / 2ft / 4ft as approved as per requirement of site
Minimum 18W Recess - Indoor	Type & IP – Decorative & Suitable for indoor minimum IP 20
Minimum 36W Surface hanging type/Pendent type - Indoor	Efficacy – Minimum 100 Lm/Watt Deep drawn CRCA housing or equivalent for recess/Powder coated etc. for suitable location application as per approved design
Minimum 36W Batten - Indoor	Driver shall be suitable as per relevant IS/IEC Standards for Glare/Flicker free illumination
Minimum 18W Batten - Indoor	
Minimum 5W Batten - Indoor	
Minimum 3W spot lamps	
Minimum 18 W Batten with inbuilt battery up to 2 Hrs. backup and self-charging - 800	Shall have Inbuilt LI-ion or suitable battery as approved
Minimum 36W Batten	Outdoor type with IP 65
Area Light - Minimum 70 Watt	Minimum IP 65, Suitable IK, 110 Lumens / Watt, With 4kV Internal Surge Protection, UV resistant Glass, PDC Housing with secondary optics etc. as per applicable outdoor conditions.
Area Light - Minimum 120	Minimum IP 65, Suitable IK, 120 Lumens / Watt, With

Watt	4kV Internal Surge Protection, 10kV external Surge protection UV resistant Glass, PDC Housing with secondary optics etc. as per applicable outdoor conditions.
Medium bay Light minimum 60/80 watts	Minimum IP 65, Suitable IK, 120 Lumens / Watt, With 4kV Internal Surge Protection, min 6kV external Surge protection as applicable, PDC/Al Housing with secondary optics etc. as per applicable outdoor conditions.
Flame Proof Light	Supply Installation of certified 2 X 18W LED flameproof batten with Twin LED tube suitable for Gas/Vapor group of IIA & IIB and Zone 1 & 2 with IP65 Protection including hanging rods up to 3 meters length, screws, bolts and all required accessories for fixing of the Fixture as required -- Installation of Height of Lights is up to 14 Meters -- Minimum 100 Lumens / watt --Quoted rate shall include 2 No's of suitable spare drivers suitable for the supplied LED's
Important Details for illumination	Beam Angle, IP rating shall be as per approved design The contractor shall bring samples and necessary test certificates as per requirement of site Housing for outdoor lights shall be PDC/Aluminum as approved. Outdoor lights above 36 watts shall have UV resistant glass Drivers shall be with suitable IP high quality Constant current as per approved design Wherever it is required external surge protection shall be provided.

10.2 General Applicable Standers

16101: 2012	General Lighting - LEDs and LED modules
LM 80/IS16106	SMD LED Chip
IS:10322/Part 5/Section5/2012 latest and IS: 16107 (Part 2/Sec 1):2012 Latest	Conforming Standard
IS 15885 (Part 2/Sec 13)	Driver Compliance
16102 Part 1 & 2 :2012	Self- Ballasted LED Lamps for General Lighting Services Safety & performance Requirements
16103(Part 1 & 2) : 2012	Led Modules for General Lighting Safety & performance Requirements
16104: 2012	DC or AC Supplied Electronic Control Gear for LED Modules - Performance Requirements
16105: 2012	Method of Measurement of Lumen Maintenance of Solid-State Light (LED) Sources
16106: 2012	Method of Electrical and Photometric Measurements of Solid-State Lighting (LED) Products
16107Part 1):2012	Luminaires Performance Part 1 General Requirements & Part -2 Particular requirements
16108: 2012	Photobiological Safety of Lamps and Lamp Systems

10.3 Design Criteria

- Design of Lux level shall be 50 – 300/400 as per direction of EIC for various locations.
- Above values are only representative, EIC shall approve Illumination levels required for each area as per requirement and site conditions.
- Highly efficient Energy Efficient LED Fittings as mentioned in SOQ and as per design and as approved by EIC.

- Ladders up to 14 meters height shall be arranged by contractor for installation, all safety instructions working at height shall be followed no additional charges will be paid by BARC
- Flame proof fittings as mentioned in SOQ shall be provided in Battery areas and other process areas wherever applicable as instructed by EIC.
- LED Lighting Fixtures with Lamps and suitable standard hanging rods, accessories in High Bay area, Mid bay Area Office rooms, Toilets, Panel rooms and all other areas as instructed by EIC.
- In case of any lights with suitable configuration is not available at the time of supply approved model as per direction of EIC shall be brought. Contractor shall supply the same without any extra cost.
- LED high bay fittings along with MCB DB switch shall be as per design.
- All lights shall be considered 5700-6500K CCT colour temperature as approved by EIC. However, in conference room and other areas EIC may change the temperate range to 4700K, contractor shall provide lights at no extra cost
- Suitable maintenance factor shall be considered for design

10.4 Samples and Testing

- Samples shall be brought to site on demand by EIC as per design without any additional cost
- The lighting fixtures shall have 5 Years OEM, On-site repair/replacement warranty except for EXIT Light, Spot lamp, Strip, Emergency Inverter Lamp.
- In case OEM's unable to provide the warranty for 5 Years, Suitable spare drivers shall be provided as per direction of EIC. However, this is as a last option. However, Lights shall mandatorily have 2 Years OEM Onsite.
- EIC may change the model numbers as per requirement of site
- LM-79 & LM -80 Report mentioning Total Lumen output, Power, Power Factor, Current in Amps, CRI & CCT of the Luminaire to be submitted on demand as instructed by EIC wherever it is required
- LED lights shall have necessary testing certificates as per instructions of EIC.

10.5 Handing Over

- Contractor may hand over the completed work in sections/building etc. as per direction of EIC

- For LED's suitable drive models number etc. shall be submitted.

11 Lighting High Mast

11.1 Scope of the work

The scope of this sections includes Design, supply, installation, testing and commissioning of Integral Motor 16M high mast shaft in two sections suitable for 39 m/sec wind speed as per IS: 875 part-III, with head frame, winch mounting bracket, luminaries carriage suitable to install 8 Nos 200W Flood light luminaries in symmetrical arrangement with Hot Dip Galvanized as per BS EN ISO 1461.

Quoted rate Shall include – DB, High mast and associated equipment, Lights – 200 Watts 8 No's, Double sheath FRLS PVC Cables, Pipe for cable entry, aviation lamp and associated equipment.

Cable up to DB, Civil Works Shall be paid in respective SOQ item.

11.2 Technical Details:

- 16M high mast shaft in two sections suitable for 39 m/sec wind speed as per IS: 875 part-III, with head frame, winch mounting bracket, luminaries' carriage suitable to install 8 no's 200W Flood light luminaries in symmetrical arrangement.
- raising lowering system comprising double drum winch, 6mm diameter SS wire rope, trailing cable, connector, integral power tool motor, manual handle, junction box, lightening finial
- Rust proof foundation bolts manufactured from special steel along with nuts, washers, anchor plate and common template.
- Outdoor stand mounted feeder pillar with 63A 4Pole MCB incomer, single dial time switch, 32A FP contactor for the automatic switching of luminaries, power tool control with 2 no 32A contactors and raise lower push button for suitable cable size
- Supply of LED type Single dome aviation obstruction light – 1 No's
- Erection of the high mast with the help of suitable tools and plants, wiring of luminaires with all wiring materials like PVC insulated PVC Double sheathed flexible cable of suitable copper conductor cores with lugs, MCB.

Shaft	Polygonal – Approx 20 Sided
Anchor Bolts	Hex Nuts or approved
16 Meters	In various sections 410 A/F to 150 A/F Outside to

	outside as approved
Lightening Air terminal	1.2 Meters
Rope	High Quality as per approved Design
Base Dia	570 Outer Dia PCD inside 490 PCD
Base holes	8 No's of 36mm hole to suite M30 X 850Lg Anchor Bolts as per approval design
Head Arm	To be provided
Mounting Plate on Mast	shall be provided for MCB and cable fixing
Shaft/Gussets Materials	S355 as per BS EN 10025
Flange Door Stiffener	As per IS-2062
Foundation Bolts	TS 600N/Sqmm Y S 405 N/Sqmm
Junction Box for Trailing Cable	Shall be provided
Pipe for cable	Suitable Dia Embedded pipe for PVC Shall be provided
luminaries	Minimum 200 watts, 120lum/watt, Minimum IP 65, 4kV inbuilt and External Surge Protection – 8 No's
Civil	Civil works like excavation, Base concreting PCC shall be as per Manufacturer's recommendation – Quantities will be measured and paid in respective civil items.

11.3 Erection and Testing

- High Mast shall be erected with all safety precautions as per directions of EIC
- Necessary test certificates for mast, cables etc shall be submitted.

12 Street Lights and Other Lights

12.1 Scope of the work

The scope of the work shall include Design of Street light system, Supply Installation Testing, and commissioning of Street light system, Post Top lantern lights, Ballard Lights along with all required accessories.

Description of Items	
Street Light Pole Type -1	7 meter Street Light Pole with GI Pipes, Fixing arrangement, Bolt nuts and other required accessories • Supply, installation, Testing & commissioning (SITC) of 7 meter high Internally and Externally GI Coated Octagonal Street Light Pole with mounting with necessary clamps, earthing arrangement, all related civil works concrete, pedestal with 2 no's of 40 mmx2000mm Class B GI pipe up to junction boxes and required earth excavation. • Quote Price Shall include Suitable Dia Class-B GI Pipes- 2 No's for both incoming and outgoing cable of each approximately 1.5 meters length, mounting brackets, 2 Meter 2 No's of 8 SWG GI wire for earthing of pole coiled in earth of 1.4 meter depth • <i>Quoted Price Shall include – Mounting MCB on Din rail or suitable as approved with connecting terminal, 3C X 2.5Sqmm Double Sheath FRLS copper cable for lights of suitable length.</i> Foundation, excavation will be paid in respective civil item
Cross Arm	Supply and Installation of Medium class GI Pipe Cross arm of length 1.5 Meters suitable for LED light and Above street light Pole as per Technical Specifications with closing caps, fixing bolts and all other required accessories Note -2 No's Single Cross arms shall be considered as Double Cross Arms and it shall be paid accordingly
Street Light Control Panel at Field	Supply, installation, Testing & commissioning (SITC) of Outdoor pedestal mounting type Weather Proof IP 56 Street Light control panel made out of 2 mm tick CRCA sheet steel powder coated to RAL 7026

	with one Number 100 Amps 4 Pole 36 KA rated MCCB as incomer and Three Nos 63 Amps 4 pole 25 KA rated MCCB and 63 Amps rated 4 pole power contactors controlled by Astronomical timer and LDR with complete wiring of approximate size 600 mm(H) x 400 mm (W) x 200 mm (D).
Street Light LED as per specs Type - 1	Street Light Pole LED Light - Supply and Installation of 90 Watts LED's treat light with pressure die-cast housing, toughened glass with IP66 ingress protection. Fixture shall have 4kV inbuilt and 10kV external surge protection. -- Fixture Shall have 120 Lumens/Watt Efficacy -- Lights Shall have 5 Years OEM Onsite warranty from the Date of Procurement of Light
Post Top lantern light as per specs	Post top LED indirect lighting type luminaries as approved Including LED Light having a minimum efficacy of 100 lumen/watt and a minimum output of 3500 lumens, with 4000 to 6500 degree K CCT, having IP65 & IK07 protection, dark sky norms etc. as per approval Quoted Price shall Include 3-meter Pole, Bolts nuts, accessories, cross arm, all required accessories, and Foundation work. Quoted rate shall include foundational cost & LED
Bollard light as per specifications	Bollard LED's for Turnings/Gardening - Supply, Installation and commissioning of 9 watts Bollard LED light with Opal diffuser and IPP 66 Protection. 3000K/approved CCT including pole of suitable height as per approved drawing and directions of EIC

12.2 Details of Technical Parameters for street lights

Design	The Octagonal poles shall be designed to suit structurally the max wind speed prevailing at site as per IS-875 Part III, 1987. The top loading i.e. area and the weight of fixtures are to be considered to calculate maximum deflection of the pole and the same shall meet the requirement of BS: 5649 Part VI 1982. Poles are to be designed for a design life of 25 years

Pole Shaft	The pole shaft shall have Octagonal cross section and shall be continuously tapered with single longitudinal weld. There shall not be any circumferential welding. All octagonal pole shafts shall be provided with the rigid flange plate of suitable thickness with provision for fixing 4 foundation bolts. This base plate shall be fillet welded to the pole shaft at two locations i.e. from inside and outside. The welding shall be done as per qualified MMAW process approved by Third Party Inspection agency
Material Of Poles	Structural steel Confirming to grade / BSEN 10025 S 355 JO / FE 510 or IS 8500
Galvanisation	The pole shall be hot dip galvanized as per BSEN ISO 1461/IS 2629 with a minimum average coating thickness of 70 micron. The galvanization will be done in single dipping method only. Hot dip Galvanization both internally and externally as per IS 4759
Fixing Type	The Octagonal pole shall be bolted on RCC foundation with a set of four foundation bolts. The design of the foundation shall be got approved from E-I-C before commencement of work
Arm Bracket for Mounting Light Fixtures	The pole shall be provided with single arm/ double arm bracket as per SOQ. The bracket pipe shall be conforming to IS 1239 medium variety or as specified in the SOQ. The bracket shall be welded to 80 NB pipe conforming to IS 1239 heavy variety or as specified in the SOQ, to fit on top of pole shaft with overlap of minimum 500mm & top cover. The 80 NB pipe shall be fixed to the pole shaft with 3 no's 10mm pinch bolts 120 degrees apart. A stiffener plate of 200x250x6mm shall be fixed to reinforce the bracket joint
Tolerances	As per BS 5649-2, EN 40 -2
Numbering	Poles shall be numbered as designated by EIC indicating the necessary details. It shall be on JB with Alu minimum sheet with neat finish engraved text
Other Details and requirements	Other details of the poles shall be as per drawing uploaded in the tender. Contractor shall design and submit the final drawing for the approval

	of EIC indicating all details. Necessary changes instructed by EIC shall be carried out. Sample shall be produced and it shall be submitted to EIC for the approval. Drawing details provided for double cross arm same shall be applicable for single cross arm pole

12.3 Erection and Testing

- High Mast shall be erected with all safety precautions as per directions of EIC
- Necessary test certificates for mast, cables etc shall be submitted.

13 Miscellaneous Equipment and Annexure

13.1 Scope of the work

Scope of work Includes SITC of miscellaneous items as per SOQ.

13.2 Details of Equipment

Welding Socket	SITC of IP-65 Enclosure Welding socket Including Suitable input 4 Pole 100A MCB, Socket and Plug TOP as per directions of EIC.
Air conditioning System	Supply and Installation of 1.5 Ton 5 Star (as per BEE-2022 or latest) High Energy efficient Copper coil air conditioners system with all required fixing accessories -- Average length of copper pipes and cable between indoor and outdoor to be considered approximately 10 Meters -- Height of fixing of ODU is up to 14 meters with all safety tools -- necessary ladder/Mobile crane shall be considered -- Cables, Pipe between IDU and ODU shall be Insulated with GI Sheet/Approved material with neat Finish. -- Output drain pipe shall be as per directions of EIC. PVC/CPVC pipe will be measured in Electrical /Civil SOQ as per availability
Desktop computer as per specification	SITC of Desktop Computer with minimum 22 Inch Monitor, Full HD resolution, i7 processor, 16GB RAM, Suitable speed processor, 512 TB HDD complete set etc. as per approval. Shall be supplied with standard/Approved size computer table
Plug Top and Socket with inbuilt MCB as per direction of EIC	Shall have readymade Socket with inbuilt 16Amps DP/SP MCB along with plug top 16A for AC
MS Item for Electrical	Supply, Fabrication and installation of MS items Chequered plate, panel supports, Tools Storage equipment, Any other equipment as per directions of EIC. The fabricate items shall have one coat of red oxide primer and two coats of enamel paints as approved by Engineer in charge
5 Star Remote	Supply and Installation of Decorative type 5 Star BLDC 1200mm

Operated BLDC Fan	Sweep ceiling fan with hanging rods, speed control etc. along with remote operable as applicable as per directions of EIC Model, Color shall be as per directions of EIC
Metal Bird mesh Exhaust Fan as per Specifications	SITC of 300mm Sweep Exhaust Fans, 1400 rpm noise free operation for Washrooms with metal blades and bird mesh with all suitable accessories
Cable trench	Construction of cable trench in ground including hard rock area, work includes excavation in all type of soil at 1000mm depth, 500 mm width for laying of cable/HDPE PLB Pipe
SITC of 50/42mm Self-lubricating PLB Duct Pipe	SITC of 50/42mm Self-lubricating PLB Duct Pipe as per relevant IS standards/ISI mark as applicable Cable shall be laid inside the PLB Pipe as required as per directions of EIC. Suitable openings /End caps shall be installed wherever cable is not laid.
Water Coolers	Supply and Installation of 40 LPH Water Cooler with Inbuilt RO + UV Purifier with a storage tank of 40 Liters with 2 No's of Faucets (1 Plain + 1 Cool) Cooling Capacity – 40 LPH Storage Tank – 40 Liters In built purification System – RO + UV Refrigerant – R-134a Compressor type – Hermetic type with suction gas cooled motor, equipped with overload protection Shall have In-site power saving PUF insulation, Food Grade SS tank and body, Silent operation Suitable inlet and Drain connections of suitable length pipes and necessary civil works to be carried out (1 No's of Spare BSP type connectors shall be handed over) One suitable pre- filter shall be included in the quote SPARES - One set of filters and 2 Numbers of Faucets per Purifier shall be handed over for future use
Supply and	Pumps shall be suitable for lifting water from sump to tank/Gardening

Installation of 1hp/3hp Surface pump with all required accessories	etc. as per directions of EIC Suitable DOL starter shall be supplied

13.3 Annexure for Operational Spares and Other Items

Scope of work Includes Supply of Miscellaneous Items which includes operational spares, day to day maintenance works, testing equipment etc. as per attached details.

Installation Shall be carried out wherever required as per direction of EIC. If any of the equipment is not available/not required EIC may instruct for other material on his own discretion. Contractor shall supply without any deviation.

S.NO	Name of the equipment	Unit	Quantity
1	Panels		
1.1	LED Indicators of approved different colors	No's	10
1.2	MCCB - 160 A ready to replace in Panels	No's	1
1.3	Digital Ammeter	No's	2
1.4	Door Locks Suitable - rotatable	No's	2
1.5	7 Segment THD measuring Meter	No's	1
1.6	Contactor	No's	1
2	UPS		
2.1	Driver PCB Cards etc. as approved	No's	2
2.2	Display	No's	1
2.3	Battery of same installed capacity	No's	1
2.4	External 6A Battery charger 12/24 Suitable	No's	2
3	MCB DB		
3.1	RCBO - 30 ma - 2 Pole	No's	2
3.2	MCB of approved rating Input suitable	No's	2
3.3	SP MCB of approved rating outgoing	No's	5
3.4	DP MCB of approved rating outgoing	No's	2
4	Illumination System		
4.1	LED Drivers up to 40 W various types as approved by EIC	No's	15
4.2	LED Drivers up to 80 W various types as approved by EIC including ballard street light etc.	No's	16

4.3	LED Drivers up to 120 W various types as approved by EIC	No's	6
4.4	Lightning Mast Light of same	No's	2
4.5	LED Driver for the Mast Light	No's	3
5	Other Items as below		
5.01	Up to minimum 3-meter reachable fiber ladder A type	No's	3
5.02	Up to minimum 6-meter reachable Fiber Ladder A type	No's	3
5.03	Supply and fixing in position of 'A' class ELASTOMER insulating mat for protection to operators for working voltages up to 1.1 KV as per IS 15652 - 2006 as per instructions of EIC	No's	10
5.04	Providing danger plates	No's	15
5.05	Safety Electrical Gloves up to 1.1kV	set	10
5.06	Battery Operated Insulation Resistance meter	No's	1
5.07	Ferrule Printing machine	No's	1
5.08	Non-Contact Electric Testers	No's	4
5.09	Electric Tools set as approved with standard equipment	Set	3
5.10	Spanner Set various sizes	Set	3
5.11	Drilling Machine with bits as approved	Set	2
5.12	Vacuum Cleaner for panel cleaning as approved capacity	No's	2
5.13	Blower of suitable capacity for Cleaning Panels	No's	2
5.14	Electrical Safety Chart etc. as per approved Format	No's	6
5.15	High Equality Sheet with text - Equipment Under Maintenance/Authorized Personnel	No's	10

	etc. Tag as approved		
5.16	Digital Wall Clock/Analog wall clocks in Panel room	No's	5
5.17	High Quality Boards of suitable dimensions for Panel Room as per direction of EIC	No's	4
5.18	Multi-functional Electric Extension board with 4 C X 4 Sqmm PVC Cable of 15 Meters with 6A/16A Plug top and at least 3 outgoings 6A/16A with inbuilt MCB	No's	3
5.19	House pipe for water gardening, Removal of water from trench etc. 25mm	RMT	300
5.20	A0 Size Instruction Sheet with Text and Laminated as per approval of EIC	No's	3
5.21	Supply & erection of canopy type MS structure 3 No's of Fire Buckets with complete as approved	No's	2
5.22	Rechargeable hand LED Light of suitable type approved by EIC	No's	4
5.23	Electric Geyser of 10 Liters Capacity	No's	2
5.23	Narrow beam Rechargeable LED torch light	No's	4

14 List of Suggested Makes/Brands of Items

- This section covers the instructions to the contractor for choosing the Make and model of equipment to be supplied and erected in this contract
- All the equipment, spare, consumable shall be of brand new and unused.
- ***Note – Procurement and execution of the work shall comply with Public Procurement & Make in India Policy Guidelines, DPIIT Guidelines and other applicable government orders issued time to time.***
- The makes and brands suggested below are general recommendations and merely for guidance purpose. However, the bidder(s) can prefer any other alternate or equivalent makes and brands which is/are meeting the performance parameters and tender specifications by submitting technical details to substantiate their claims. To ensure equal opportunity, fair treatment for all bidders, and to avoid delays during execution of work, the pre-bid clarification stage is the appropriate time to propose alternate or equivalent makes and brands. The department will review these proposals and recognize them in the pre-bid clarification document after verifying the submitted technical details. Any delays after the award of work due to the time taken to convey acceptance or rejection of alternate or equivalent makes and brands suggested by the contractor (if any) will be the contractor's responsibility. Additionally, any extra costs resulting from superior specifications or performance of items or materials will not be payable. Only make and brands that meet the minimum local content as per the Public Procurement (Preference to Make in India) Order 2017 shall be considered for approval.
- Contractor shall read the SOQ/BOQ description, technical specifications, functional requirement of material, area of functioning, warranty, design drawings etc. as required and suitable make and model shall be chosen. Before the procurement any material, the contractor shall submit the Make, model, catalogues as applicable to EIC for approval. On inspection of various parameter EIC may approve/reject/modify/may recommend equivalent on his own discretion to the contractor as per requirement of site. The contractor shall strictly follow and submit the model as per instruction.
- On Approval of model EIC may inspect/test at factory, or request for samples, or inspection at site. The contractor shall make inspection arrangements at no extra cost. The equipment shall satisfy as per specifications/IS/IEC and other applicable

standards/rules mentioned. The EIC may accept or reject any material on his own desertion, contractor shall accept without any obligation. Technical Specifications summaries suitably for various equipment, however EIC may add or modify or delete any part of the specifications as per actual functional requirement of site on his discretion.

- Any items make not mentioned shall be as per directions of EIC.

Sr. No.	Description	Suggested Makes/Brands
1.	LT Panels Fabricator	OEM and authorized systems house of L&T, Siemens, Schneider Electric, Legrand, ABB and BCH. C&S /Jakson/Arrow Engineers /Adlec/Samcon/ Marine Electricals/Tricolite/Ambit/Tenco/OhmEnergy Management System Pvt. Ltd., Sriperumpudur / Excel Power Switchgear, Chennai/Power Control Equipment, Bengaluru/Jyothi Electro Systems Mumbai
2.	UPS	Schneider/Legrand/Consul Neowatt/Delta/Reillo/ Piller/Socomec/ Vertiv/Dubas/Numeric
3.	LT Cable	Universal / Torrent / Polycab / Finolex / KEI / Havells / NICCO / Apar / LAPP/ KEC / RR Kabel /Ravin/Gloster
4.	Illumination System	Crompton/Bajaj/Philips/havells/Wipro/Panasonic/Schreder/Bi nay/ Jaquar/ C&S/Surya/Halonix/Lighting Technologies
5.	Cable glands / Cable Socket(Lugs)	Braco / Comet / Dowells / Gripper / Prabhat / Jainson /Lotus / HMI / 3D / Hex
6.	Terminal Strip / Connector	Connectwell / Elmex / Phoenix/Wago
7.	G.I Ladder/ Perforated Cabletrays	OBO/ Indiana / Asian / Profab / Sadhana (Steelite group) / Metalman / Patni / PILCO/BEC/ELCON, OM Industries / Globe Electrical
8.	Wire mesh cable tray	Legrand / OBO/ PILCO
9.	Cable Management System	Legrand / MK Electric /OBO / Schneider Electric

10.	MCCB	Schneider Electric / Siemens / ABB / Legrand / L&T / C&S/HAVELLS/BCH
11.	Air Circuit breakers	Schneider Electric / Siemens / ABB / L&T / Legrand/ C&S/HAVELLS/BCH
12.	Switch Disconnecter Fuse/Switch Disconnecter/HRC fuses/ Change Over Switch	Schneider Electric / Siemens / ABB / L&T/ C&S/ HAVELLS/HPL Socomec/BCH
13.	MCB / MCB type isolator /ELCB / Timers / DB's	Legrand / Hager / Schneider Electric / Siemens / L&T /C&S/HAVELLS/ INDO Asian/BCH
14.	Power / Control Air brakeContactors	Schneider / Electric Siemens / ABB/L&T/ Legrand/C&S/Havells/BCH
15.	Numerical/Static/ Electromagnetic Relays	Areva / ABB / L&T / Siemens/ Schneider Electric / Ashida / Easun – Reyrolle / Crompton Greaves/C&S
16.	APFC Relay	Epcos / Beluke / Meher / Schneider/L&T
17.	CT / PT (for LT)	Kappa / AE / Pragati / ECS / Precise / Indcoil
18.	Analogue Ammeter/ Voltmeter / P.F meter	Automatic Electric (AE) / Rishab / L&T / Meco / Imp
19.	Digital Panel meters	Schneider Electric / AE / Rishab / L&T / Siemens
20.	Energy meter / Trivector meter/Graphical Display	Secure/ABB /L&T /Schneider Electric/ Universal/Landis- Gyr
21.	Indication Lamps/Push Buttons	Siemens/L&T(ESBEE) / Teknik / Schneider Electric ABB/BCH/Crompton Greaves/C&S/ Essen Deinki /Jainson
22.	Selector Switches	Kaycee / Siemens / L&T (Slazer)/ Switron
23.	Battery Flooded / SMF	Exide / Amara raja / HBL/Microtex/ AMCO/Tata Group/ Panasonic/Union Batteries Pune
24.	Battery Charger	Chabbi / Calydyne (Chloride) / Amara raja/ Universal /Vertiv /Dubas

25.	PVC (HMS) Conduits & accessories	Precision Plastics / Presto Plast/ RNI/ AKG/ BECPlast /Polycab
26.	MS/GI Conduits& accessories	VIMCO / BEC / BI / AKG/ Vijai Electricals / Hindustan Electric Corporation / ECW
27.	FRLSPVC insulated Cuconductor Wires	Finolex/Havells/Apar/KEI/RR Kabel /Polycab/ BCH/Anchor/KEC/L&T
28.	Fire stop / Fire sealing equipment	HILTI / Lyods/ 3M/ Promat /or approved
29.	MS Items	TATA/JINDAL/Apollo/SAIL/Vizag
30.	Air Conditioning System	Voltas/BlueStar/ Lloyd/Godrej/Whirlpool/Samsung
31.	Fans	Crompton Greaves / Havells / Usha / Orient / Bajaj/Polycab/ Almonard
32.	Maintenance Free Earthing/Lightening System	DEHN/OBO/ERICO/South Asian/JEF/ TEREK(SGI)/ LORESS/JMV/LPS
33.	Modular Switches / Sockets	Legrand (Arteor) / Crabtree (Murano) / L&T (ORIS) / Wipro (North West – Stylus+)/MK (wraparound)/ Anchor-Panasonic (Roma)/ABB Approved Models/
34.	LT Motors	CGL/Siemens/ABB/BBL/Or approved
35.	Street Light Poles and cross arms	Bajaj / Surya Roshni/Valmont/Aster/ Trans Rail Lighting/ Shubham Poles/ Hakke Poles/ Bharath Poles

----- End of technical Specifications for Electrical Works -----

SECTION-V(v)

TECHNICAL SPECIFICATIONS

MATERIAL HANDLING & VENTILATION WORKS

1 TECHNICAL SPECIFICATIONS OF MATERIAL HANDLING EQUIPMENT (MONORAIL)

1.1 SCOPE OF WORK

The scope of work consists of design, fabrication, manufacturing, inspection, assembly, shop testing, painting, supply & transportation to site, unloading at site, safe storage at site, installation, erection, testing & commissioning of equipment as listed below complete with all Mechanical, Electrical & Control components and related standard accessories as covered under this Technical Specification.

Sr. No.	Location	Description	Quantity (Sets)
1	Boiler house	Monorail with Electrical hoist of 2 Ton capacity (Travel length: 18m, Lifting Height: 6.5m)	Two

NOTE:

- (i) The travel length and height of lift indicated are tentative and may undergo slight change based on final dimensions of boiler house building. Contractor shall visit the site to finalize these parameters to prepare detail design, drawing and final technical specifications which will be subject to approval from the BARC.
- (ii) Purchaser shall mean EIC or his authorised representative from BARC.

1.2 TECHNICAL SPECIFICATIONS FOR MONORAIL ELECTRIC HOIST FOR BOILER HOUSE

Sr. No.	Technical feature	Description
1	Lifting capacity	2 Metric Ton
2	Travel length	18 meters
3	Lifting height	6.5 meters.

4	Main building type	Boiler house of Pre-engineered Building type
5	MOC of guide rails and other structural parts	As per IS: 2062 / Applicable standards.

1.2.1 General:

1. The hoist shall be designed in accordance with the latest edition of IS-3938-1983 and International Standards subject to any modifications and requirements specified hereafter. In the event of conflict between this specification and the Indian Standards listed, the following order of precedence will govern:
 - a) This specification.
 - b) Indian Standards mentioned.
2. All trailing cables shall be clamped with PVC or non-metallic lamps.
3. Defects in the materials like fractures, cracks, blowholes, or laminations are not allowed.
4. All parts of the hoist shall be thoroughly cleaned of all loose mill scales, rust or foreign matter & then painted as specified. All parts inaccessible after assembly shall be painted before assembly.
5. The scope of supply of the EPC contractor shall include the required monorails, end stoppers, fixtures, special tools & spares for maintenance etc.
6. Necessary tools and tackles for required for maintenance, testing or inspection of the equipment. List of such tools, instruments shall be furnished along with the Tender.

1.2.2 Mechanical requirements:

The hoist shall be complete with all mechanical systems necessary for proper operation, which includes but not limited to the following:

1. Wheel & Drive:
The electric hoist shall run on two pairs of wheels, a pair of which shall be driven by motor, through reduction gear. The wheels shall be of cast steel/forged steel, single flanged with taper/parallel treads to suit to monorail. The wheels shall be mounted on

anti-friction bearings & shall be easily removable for repair & replacement. The wheel diameter shall be selected such that skidding does not take place even under unloaded condition.

2. Hoist Mechanism:

The hoist mechanism shall consist of a bottom block fitted with a standard forged swivel hook of the specified capacity (i.e. 2 Ton), supported on 4 falls of wire rope. The wire rope shall be wound on a grooved drum which shall be sufficiently long to accommodate in one layer the length of rope requisite for the specified lift and in addition not fewer than two turns at each anchored end & one spare groove at the opposite end. The hoist drum shall be motor driven through gears enclosed in oil filled reduction gearbox.

3. Gearing:

Straight & helical spur gearing shall be used for all motions. Worm & bevel gears shall not be used without approval from the purchaser. Preferably, all first reduction gears shall have single helical teeth. All gears shall be hardened & tempered alloy or carbon steel with machined out teeth. Surface hardening of teeth is not acceptable. All gears shall be enclosed in oil filled gearbox except when not possible.

4. Couplings: Each motor shall be connected to its gear drive by a flexible coupling.

5. Lubrication: All gears & bearings shall be lubricated either by splash lubrication or by grease. If possible, all the lubricating points shall be grouped together in easily accessible positions.

6. Bearings: Ball & roller anti-friction bearings of reputed make shall only be used, with minimum bearing life as per IS: 3938-1983.

7. Brakes: D.C. Electromagnetic brake shall be provided for each motion; however, in case of conical rotor, motors manufacturer's standard brake can be used.

1.2.3 Electrical requirements:

The hoist shall be complete with all electrical items for its proper operation, which includes but not limited to the following:

1. Power Supply Distribution and Connections: Incoming power cable shall be terminated to the supplier's isolator/Control Panel mounted at the hoist bay. All power and control component shall be housed in the supplier's control panel. Cables for hoist and travel

drives and limit switches shall be taken to a fixed junction box. From the fixed junction box flexible cables shall be taken to hoist through suitable festoon system/shrouded bus bar system. Necessary interconnecting cables between Control Panel and Control Desk / pendant unit shall be included.

2. Load break switch,
3. Cabling between load break switch and power supply points of shrouded bus bar.
4. Shrouded bus bar system including accessories. For flame proof hoists festoon power cable arrangement with all accessories for crane power feed including the I-beams & its supporting arrangements.
5. Isolator to terminate purchaser's cable. Location to be provided by the purchaser.
6. Electrical panel housing breakers, fuses, contactor, control transformer with cut-outs on primary & secondary sides, individual mechanism motor control units and set of power & control terminals.
7. Control Panel,
8. Brakes: Separate electromagnetic brakes, operated through direct current shall be provided for each motor driven mechanism. Brakes shall be of approved make & shall be connected so as to apply automatically when power supply fails or when the push button is released or with adjustable delayed time lag preceded by electrical braking when the push button is released. Brakes shall be designed as per the latest edition of IS: 3938-1983/ IS:10913-1984 International Standards.
9. Cable junction box (fixed) at Gantry.
10. Drive motors.
11. Limit switches: Hoist & travel motion shall be provided with limit switches to limit the ultimate positions of the hook & the hoist block. The limit switches shall conform to the requirements specified in IS: 3938-1983/ International Standards.
12. Power & control cables.
13. Pendant Control Unit with indicating lamps and push buttons required for operation of hoist.
14. Earthing of equipment, panels and Other Accessories.

Any systems/system descriptions not mentioned here but required for satisfactory & safe operation of monorail shall be as per IS: 3938-1983.

1.3 LIST OF CODES & STANDARDS

IS: 807 -2006	Code of practice for design, manufacture, erection and testing of cranes and hoists.
IS: 3938 - 1983	Specification for Electric Wire Rope Hoists
IS: 816 -1969	Code of practice for use of metal arc welding for general construction in mild steel
IS: 1323 -1982	Code of practice for oxy-acetylene welding for structural MS.
IS: 7098	Cross-linked polyethylene insulated PVC sheathed cables
IS: 13947 (Part 1-5)	Low-Voltage Switchgear and Control gear
IS: 3443	Specifications for crane rail section
IS: 3815 -1969	Crane hooks with shanks for general engineering purposes
IS: 2365 -1963	Steel works, suspension ropes for lifts and hoists
Interplant standard -steel industry IPSS:202-002-83	Acceptance norms for EOT cranes
AISE (STD no. 6)	General items for O/H cranes for components like drum Reeving system, blocks, controls, electrical, mechanical & structural components.
ASME	Testing, materials and mechanical components.
ASTM	Testing and selection of materials.
AWS D 1.1	American Welding Society – Structural Welding Code Fabrication requirements and standards for crane structure and weldments.
SAE	For wire rope shafting, lubrications, fasteners, material selection, and load stability.

1.4 INSPECTION

1. CONTRACTOR shall prepare and submit Quality Assurance Plan (QAP) in a proper format for every item for PURCHASER's approval. QAP should be established to

include all recommendations of various standards for design, fabrication, installation and testing of crane/hoist handling system.

2. The equipment will be inspected as per the tests pre-identified in the approved QAP, relevant approved drawings, laid out technical specification, data sheet, etc. The crane/hoist shall be tested at manufacturer's works as per the tender specifications in presence of PURCHASER's representative. The CONTRACTOR shall furnish a detailed inspection plan including the timing for purchaser's concurrence.
3. The equipment shall be inspected by the PURCHASER and/or his authorized agency at manufacturer's works prior to despatch.
4. The geometrical accuracies and, the fabrication of structural components shall be strictly within the tolerances specified in the standards.
5. The manufacturer shall furnish all test certificates for inspection of various materials, workmanship and bought out components. Materials shall be tested only in recognized test houses.
6. The CONTRACTOR shall furnish sufficient documentary evidence that the material used is in conformity with the specification. Where necessary, manufacturer's test certificates shall be produced and where such test certificates are not available, sample test shall be got conducted in authorized laboratories as directed by PURCHASER, after the samples are drawn and stamped by PURCHASER. The costs for the test so effected shall be to the account of CONTRACTOR. Should a part of the material/item be manufactured not on CONTRACTOR's own premises, but on other premises, the CONTRACTOR shall obtain permission from PURCHASER to inspect and test the work as if the said material/item were being manufactured on the CONTRACTOR's premises.
7. All deficiencies/defects noticed at the time of inspection shall be promptly made up and rectified to the complete satisfaction of the purchaser's inspector.
8. The contractor shall furnish all internal inspection records for perusal during stage /final inspection.
9. The MHEs shall be dispatched to the purchaser's site by the contractor only after getting clearance from the purchaser. When the inspection / tests have been satisfactorily completed at the CONTRACTOR's or sub-CONTRACTOR's premises, PURCHASER shall issue an inspection and dispatch clearance certificate to that effect.

1.5 ERECTION, TESTING & COMMISSIONING

1.5.1 Erection

1. The Contractor shall remove all packing cases and materials of fire hazardous nature from the place of erection and returned to the PURCHASER's stores.
2. The Contractor shall provide all personnel, (supervisory and working) handling and lifting equipment, scaffolding, testing instruments and equipment, consumables, riveting and welding equipment, tools and tackles, etc. required for the complete erection of the equipment and including the stage of putting into commissioning all equipment of the plant in accordance with the drawings, specification and instructions of the PURCHASER. Suitability and capacity of all the plant, equipment, etc. used for erection shall be to the satisfaction of the PURCHASER.
3. Necessary instruments for checking the correctness of alignment shall be arranged by the Contractor.
4. The complete erection of structural, mechanical and electrical equipment shall be carried out as per recognized standard practice, which is applicable to the erection of the equipment under the specification. Care shall be taken to avoid any damage due to faulty or careless erection procedures.
5. After completion of the erection work, the Contractor shall promptly remove from the premises everything brought in by him, in order to leave the premises in acceptably clean condition.
6. Before the equipment is handed over to the PURCHASER, the equipment will be applied with touch-up finish paint to give an aesthetic look to the equipment.

1.5.2 Testing and Commissioning

1. After the Monorails are completely erected, the equipment will be thoroughly inspected for correctness and completeness of the installation and they shall be subjected to final tests.
2. Contractor to carryout testing of the complete equipment including load testing with regard to its performance and other requirements and get himself satisfied before offering the equipment to the Purchaser for inspection. Inspection call to the Purchaser shall be accompanied by the test certificates conducted by the Contractor.

3. Performance and guarantee tests are to be carried out in the presence of the Purchaser or his representative to demonstrate that the performance of the equipment conforms to relevant standards and specifications and meet the requirements as given in this specification.
4. The Monorail hoist shall be tested for each motion in each direction under the following conditions:
 - i. With no load.
 - ii. With safe working load.
 - iii. With over-load: 25% in excess of safe working load.
5. Brake Test:

Brake shall be tested successively three times with 125% of rated load on hoist. The brake shall be capable of arresting the load immediately without undue overheating of the brake and brake drum.
6. Besides the above, any other observations/ tests felt necessary for assessing the performance of the equipment and mutually agreed between contractor and BARC shall be carried out.
7. The test load in suitable size shall be arranged by purchaser at its facility premises. However, necessary slings and wire ropes, etc. shall be arranged by the contractor. Further, the contractor shall make all necessary arrangements for transport of the above test loads within the purchaser's site and deliver the same back to its original location.

1.6 PERFORMANCE GUARANTEE

1. The CONTRACTOR shall guarantee/warranty against the quality of materials, components safe delivery, installation at purchaser's site and performance.
2. The contractor shall guarantee/warranty suitability of all material selected for their respective duties and requirements.
3. The equipment shall be considered to have performed satisfactorily only when it has functioned over a minimum period of eight (8) hours/day continuously and for a minimum period of 15 days at the rated capacity.

4. If during the test runs, there is an interruption exceeding 2 hours due to any cause other than power failure, the test run shall be discontinued and both the parties shall decide fresh date mutually.
5. If the CONTRACTOR fails to achieve the guarantee/warranty and performance parameters within the period mentioned in the tender document, he shall investigate the causes and shall rectify and/or replace, free of cost to the purchaser. In such cases, the cost of modifications including labour, materials, and cost of additional testing etc. shall be borne by the contractor. Even after the necessary alteration & modifications, if the performance is not acceptable, the PURCHASER reserves the right to reject the equipment. Under such a scenario, the CONTRACTOR shall replace the defective equipment/system. The cost of replacement inclusive of labour, materials, transport, handling, repeat testing, etc. to prove the compliance with the performance guarantees shall be borne by the CONTRACTOR.
6. The contractor shall warrant for satisfactory performance of the equipment and material till the completion of defect liability period.

1.7 DRAWINGS & MANUALS:

The contractor/manufacturer shall submit following documents at time of delivery: (4 hard copies and soft copies in CDs/DVDs (2 Nos.))

1. Drawings:
 - i. Copies of all drawings approved by the PURCHASER.
 - ii. General arrangement of the components with main Technical Specification
 - iii. Hoist gearbox assembly
 - iv. Electrical schematic connection diagram
 - v. Complete wiring diagram
 - vi. Grounding diagram
2. Manuals:
 - i. Performance data
 - ii. Test charts and inspection certificates in bound volume
 - iii. Erection, operating and instruction manuals.,
 - iv. Operation & Maintenance manuals,

- v. Safety manuals,
- vi. Spare parts list,
- vii. Recommendation for lubrication and lubricants,
- viii. Schedules for periodic inspection and checking.

1.8 PAINTING

1. This specification covers the materials, tools, facilities and quality requirement for surface preparation and painting of structures, equipment, etc.
2. The term "painting" referred herein covers rust preventive, preventive and decorative coating along with surface protection.
3. Surfaces made of aluminium, brass, bronze, stainless steel, cast iron and other corrosion resistant alloys are not required to be painted unless specified except for aesthetic purposes or for identification bands.
4. General compatibility between primer and finishing paints shall be certified by the paint manufacturer supplying the paints.
5. Areas which become inaccessible after assembly shall be painted before assembly (after painting clearance has been given by the inspecting authority) after requisite surface cleaning as specified.
6. Surfaces which cannot be painted but require protection shall be given a coat of rust inhibitive grease according to IS 958 - 1975 or solvent deposited compound according to IS 1153 - 1975 or IS 1674 - 1960.
7. The machine finished surfaces shall be coated with white lead and tallow before shipment or before being put out into the open air.
8. The colour code to be followed for the final coat shall be intimated to the successful Tenderer.
9. The complete paint system for any item includes the following activities
 - i. Proper surface preparation
 - ii. Application of primer coats
 - iii. Application of intermediate coats
 - iv. Application of finished coats
10. General Specification for Surface Treatment and paintings is tabulated below.

Sr. No.	Activity	Description	Remark
a)	Surface preparation	Sand Blasting to SA–2.5.	----
b)	First coating	Two-pack zinc rich epoxy paint OR Two-pack zinc rich ethyl silicate paint.	Minimum Dry Film Thickness - 40 microns
c)	Second coating, Third coating & Fourth coating	Two component epoxy paint OR Two component polyurethane paint.	Film thickness- 240 microns

Total dry film thickness of the system shall be minimum 280 Microns.

1.9 LIST OF SUGGESTED MAKES/BRANDS

The makes and brands suggested below are general recommendations and merely for guidance purpose. However, the bidder(s) can prefer any other alternate or equivalent makes and brands which is/are meeting the performance parameters and tender specifications by submitting technical details to substantiate their claims. To ensure equal opportunity, fair treatment for all bidders, and to avoid delays during execution of work, the pre-bid clarification stage is the appropriate time to propose alternate or equivalent makes and brands. The department will review these proposals and recognize them in the pre-bid clarification document after verifying the submitted technical details. Any delays after the award of work due to the time taken to convey acceptance or rejection of alternate or equivalent makes and brands suggested by the contractor (if any) will be the contractor's responsibility. Additionally, any extra costs resulting from superior specifications or performance of items or materials will not be payable. Only make

and brands that meet the minimum local content as per the Public Procurement (Preference to Make in India) Order 2017 shall be considered for approval.

A) Mechanical Equipment		
A.1	Hooks	Herman Mohta / Free Trading Corporation / Haji Moosa Karachiwala
A.2	Flexible geared coupling	Hicliff / Concord / Alliance / Wellman Incandescent / New Allenburry Works
A.3	Wire rope	Usha Martin Black / Fort Williams / JK Steels
A.4	Bearings	SKF / FAG.
B) Electrical Equipment		
B.1	Limit switches (Cam Type)	MARATHON / SIEMENS /KIRLOSKAR (IEC frame size only)
B.2	Limit switches (Track Type)	Electronics & Power Control / Stromkraft/ AG Mechanical / AG Engineering Enterprises / Speed-O-Control
B.3	Resistances (Stainless steel grid)	Electronics & Power Control / Stromkraft/ / Union Engineering / Electromag / Speed-O-Control
B.4	Safety switches	Bharatiya Cutler Hammer/ Stromkraft / Speed-O-Control
B.5	D.C. Brakes - Shoe Type	Siemens / BCH
B.6	DC Brake - Disc Type	BCH/ STORMKRAFT / Speed-O-Control
B.7	Shrouded copper busbar system (DSL)	Emco Lenz / PETHE / BCH
B.8	Hand and Power Sockets	FAFECO / STROMAG ENGINEERS

2 TECHNICAL SPECIFICATIONS OF VENTILATION SYSTEM

2.1 Scope of work

The Scope of Work shall include:

1. Supply (including testing at supplier's site, packing, transportation, safe delivery, unloading, storage at purchaser's site), Installation, Performance Testing & Commissioning of ventilation system includes wall mounted Propeller/Tube Axial (TA) exhaust fans along with all required fixing accessories, Electrics as per the equipment schedule & capacity given below and technical specifications mentioned in this section.

Sr. No.	Area	System Description	Minimum Capacity of each fan (CMH)	Qty.
1	Boiler house	<u>Exhaust system:</u> Wall mounted exhaust Propeller/Tube Axial (TA) Fans	2000	8

Note: Purchaser shall mean EIC or his authorised representative from BARC.

2. Incidental civil / structural works such as making openings in walls / sheet / panels for fitting equipment, taking out cables / supports, providing structural support etc. & making them good, closing of the building openings provided for the passage of ducting etc. are in the scope of contractor. Purchaser site visit is must before starting of any work.
3. The contractor shall note that completeness of the systems for safe, smooth & trouble-free operation is the sole responsibility of Contractor i.e. successful tenderer. With this objective in mind, the tenderer shall include all the items essential for the efficient operation of the systems, including those items which are not specifically appearing in the specifications, but are required to complete the erection and fool proof commissioning and trouble-free continuous operation of the units in all respects.

2.2 Technical Features

2.2.1 Site Conditions and Location of plant:

The outside design conditions for Chitradurga, Karnataka shall be considered as per ASHRAE standard data as follows:

Temperature	Summer	Monsoon	Winter
Dry Bulb Temp. (°C)	36.1 °C	32.2 °C	15.9 °C
Wet Bulb Temp. (°C)	19.7 °C	26.0 °C	--

2.2.2 Inside Design Data:

Inside dry bulb temp. shall not exceed 6°C above prevailing ambient dry bulb temp for all ventilated areas.

2.2.3 Equipment Specifications:

1) Exhaust Fans (Propeller Type):

- a) The Propeller fan shall be heavy duty and wall mounted type.
- b) The fans shall work at an ambient temperature of +55°C during summer and +10°C during winter & shall conform to IS: 2312-1967.
- c) Fans shall be fitted with drilled flanges for fastening with insert plates of the wall opening.
- d) Fan impeller shall be of aerofoil section blades and mounted directly on the motor shaft. The frame of the fan shall be of pressed sheet steel unit of strong but light design. Air entry shall be from motor side.
- e) Cowl with bird screen and gravity louver shall be provided to prevent back draught & bird entry and consequent loss in capacity of fan shall be taken into account while selecting the fan. The regulator system shall be provided for adjusting the speed of the fan.
- f) Fans are to be provided with two coats of anti-corrosive finishing paint over two coats of red oxide primer.

- g) All the wall mounted propeller type exhaust fans shall be mountable and serviceable from outside the building. All wall mounted exhaust fans will be operating on 415V, 3-phase, 50Hz, AC power supply and shall be of low speed and low noise type.
- h) Only the WME fans that will be installed in the toilets shall be of low noise, energy efficient, continuous duty fans with all standard accessories suitable for operating on 230V, 50 Hz. Single phase AC power supply.

2) Exhaust Fans (Tube Axial Type):

- a) The Tube Axial Fans shall be of heavy-duty type and shall conform to IS: 3588 – 1987 (Reaffirmed 1994) and AMCA Standard. All these fans shall be suitable for operating on 415V, 50 Hz, 3 phase AC power supply.
- b) The fans shall have multi-bladed impeller with short duct casing. The fans shall be capable of withstanding the stresses which may be experienced during normal operation under the condition which it is required for and during over speed test. The noise level shall not exceed 85dB(A) at 1m distance.
- c) The first critical speed of the rotating assembly shall be at least 25% above the operating speed. The speed of the fan shall preferably be limited to 960 RPM.
- d) Impeller:

The impeller shall be of cast aluminium alloy construction of high efficiency aerofoil section blades. The fan impellers shall be cast in one piece finished all over and carefully balanced both statically and dynamically as per AMCA Standard. Finally, the assembled rotor shall be dynamically balanced.

- e) Casing:

Axial flow fan casings for wall mounted/roof mounted fans and their components shall be suitable for outdoor installation. The casing shall be minimum 2 mm thick. The casings shall be provided with flanges at inlet and outlet. All nuts & bolts associated with it shall be of zinc or cadmium plated. Easily removable inspection cover having galvanized fly nut shall be provided. The covers shall be located such that the grease nipple for all bearings and also motor terminals are easily accessible through the cover.

3) Electrics

Electrical control box containing contactors for fan motors with control relay and high-low pressure cut outs shall be provided. The electric wiring between the mains (PDB) and control box and between indoor /outdoor units and control box shall be carried out as per standard practice. The power distribution boards shall be designed to carry the rated current continuously without overheating. The power distribution boards shall comply with IS 8623 Part I&II, IEC 439 and other relevant Indian/International Standards.

2.3 List of Codes & Standards

Industrial Ventilation	American Conference of Governmental Industrial Hygienists (ACGIH)
ASHRAE	American Society of Heating, Refrigeration and Air Conditioning Engineering
IS SP 7: 1983 Group4	National Building code –2005 published by Bureau of Indian Standards
BIS	Publications of Bureau of Indian standards
AMCA	Air Movement & Control Association Inc.
SMACNA	Sheet Metal & Air Conditioning Contractor's National Associations
ASME code sec. VIII DIV I and Sec IX	Procedure for welding & welder's qualifications
ASME Sec. V	NDT requirement
BIS 210	Specification for C.I. castings
ISO 14694: 2011	Vibration criteria chart
ISO 1940	Balancing quality requirement
IS 1363 & IS 1367	For all threaded fasteners

IS2062-2011	MS Plate
ASTM A210	SS Plate

2.4 Inspection, Performance Testing

The supplier shall perform routine tests for all the motors and type test for one motor of each rating as per latest version of relevant IS code at the motor manufacturer's works in presence of BARC representative. The test reports shall be submitted to BARC for its review before dispatch. The supplier shall notify to BARC the date and location for the tests giving sufficient time for BARC or his authorized representative to be present. The test procedure shall be approved by BARC.

All the fans shall be tested at supplier's work prior to their dispatch to site as per the codes. The supplier at their works shall make all the necessary testing set up. The entire test setup & the testing procedures shall be approved of by BARC prior to the test.

General Inspection:

The fans shall be subjected to inspection to cover dimensional accuracy material used, workmanship, make and quality of bought out items. The supplier shall furnish the relevant test certificates on bought out items

Inspection of Brought Out Items:

All bought items shall be inspected and test certificates shall be produced for verification to BARC. Basis for selection of bought items along with catalogue and model number shall be submitted for approval.

Mechanical Run Testing:

This test shall be carried out on each fan at manufacturer's work to examine vibration & noise after assembly with Job motor. The amplitude & frequency of vibration shall be measured with stroboscopes at various locations on the fans. The acceptable vibration level shall be as per ISO 14694: 2011. Background level of noise (In dB) & noise level with fan in operation shall be recorded to determine the noise level of the fan. Sound ratings for the fan, based on the data obtained in accordance with AMCA 300 and reported in accordance with AMCA 301 shall be furnished.

Each fan unit shall be run for an hour to check whether any rotating parts foul with the stationary parts. The fan shall then be stopped and all fasteners shall be checked. The fan shall then be run for sufficient duration during which the bearing temperature motor current, supply voltage frequency shall be monitored. At the end of this the various alignments shall be checked.

2.4.1 Documents / Drawings to be submitted by Successful contractor for Approval

Catalogues giving brief description and details of the Equipment including overall dimensions, drawings, technical parameters, power feeding arrangement, motor ratings, maintenance & repair provisions, performance data, test charts & inspection certificates, etc. of Tube Axial Fan, Propeller Fan, and sub unit such as Fire damper, grills etc. as per the schedule of quantities to be submitted.

2.5 Performance Guarantee

The performance tests shall be conducted at site as per ARI (AHRI 1230-2010) / manufacturers' standards to demonstrate their performance guarantee parameters and rectification of defects if any shall be satisfactorily done. If the equipment fails to meet the guarantee parameters in any respect, for any reason whatsoever, and if it is necessary for the successful tenderer to make alterations for the purpose of meeting the guarantees, the alterations shall be made by the tenderer at no expense to the Client. The tenderer shall perform additional tests, as may be required, to show the effects of such alterations. The tenderer shall arrange the necessary test instruments without any additional cost to the Client. These test instruments shall have test certificates from reputed test house, valid for the duration of the performance test.

2.6 Warranty

The contractor shall warrant for satisfactory performance of the system, equipment and material till the completion of defect liability period.

2.7 LIST OF SUGGESTED MAKES/BRANDS

The makes and brands suggested below are general recommendations and merely for guidance purpose. However, the bidder(s) can prefer any other alternate or equivalent makes and brands which is/are meeting the performance parameters and tender specifications by submitting technical details to substantiate their claims. To ensure equal opportunity, fair treatment for all

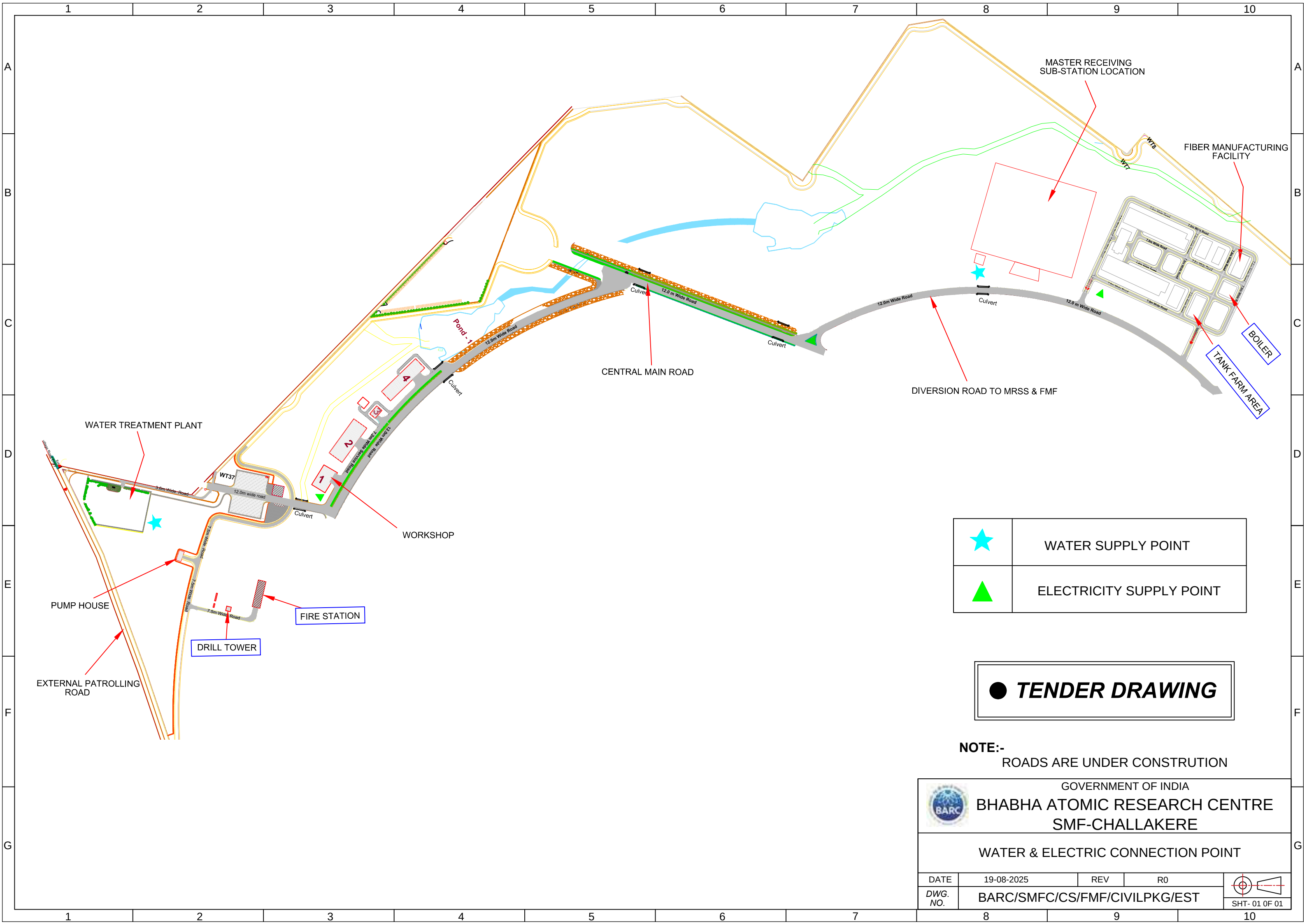
bidders, and to avoid delays during execution of work, the pre-bid clarification stage is the appropriate time to propose alternate or equivalent makes and brands. The department will review these proposals and recognize them in the pre-bid clarification document after verifying the submitted technical details. Any delays after the award of work due to the time taken to convey acceptance or rejection of alternate or equivalent makes and brands suggested by the contractor (if any) will be the contractor's responsibility. Additionally, any extra costs resulting from superior specifications or performance of items or materials will not be payable. Only make and brands that meet the minimum local content as per the Public Procurement (Preference to Make in India) Order 2017 shall be considered for approval.

Sl. No.	System	Suggested makes/ brands
1	TA Fan / Propeller Fan	Flakt wood / HPS / ALMONARD / TCF-NADI / Dustven / Khaitan

End of Technical specifications for Material Handling & Ventilation works

SECTION-VI

TENDER DRAWINGS



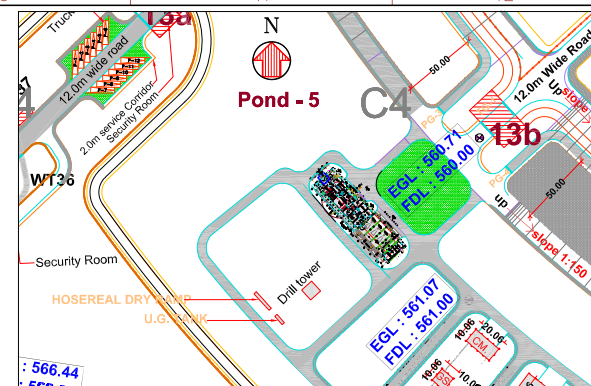
	WATER SUPPLY POINT
	ELECTRICITY SUPPLY POINT

● **TENDER DRAWING**

NOTE:-
ROADS ARE UNDER CONSTRUCTION

 GOVERNMENT OF INDIA BHABHA ATOMIC RESEARCH CENTRE SMF-CHALLAKERE			
WATER & ELECTRIC CONNECTION POINT			
DATE	19-08-2025	REV	R0
DWG. NO.	BARC/SMFC/CS/FMF/CIVILPKG/EST		 SHT- 01 OF 01

TENDER DRAWINGS FOR FIRE STATION & DRILL TOWER



E.L. (±) 0.00 CORRESPONDS TO RL. 558.50 M.

1. 1. FOR GENERAL NOTES REFER DRAWING NUMBER-16L04-12-DWG-A 001-SH1

1. THIS PRELIMINARY ARCHITECTURAL DRAWING IS APPROVED SUBJECTED TO THE APPROVAL OF RESPECTIVE DISCIPLINE USERS.
2. THIS DRAWING IS THE BASE DRAWING FOR FURTHER WORKING ON TENDER DRAWING AND SITE USE DRAWING
3. ANY CHANGES IN ARCHITECTURAL DRAWING DUE TO PROCESS TO BE INTIMATED TO CONCERNED ARCHITECT (BARC) PRIOR IMPLEMENTATION.

SIGNATURE OF USERS:		
SL. NO.	NAME	SIGN.

SMF

ROOF PLAN

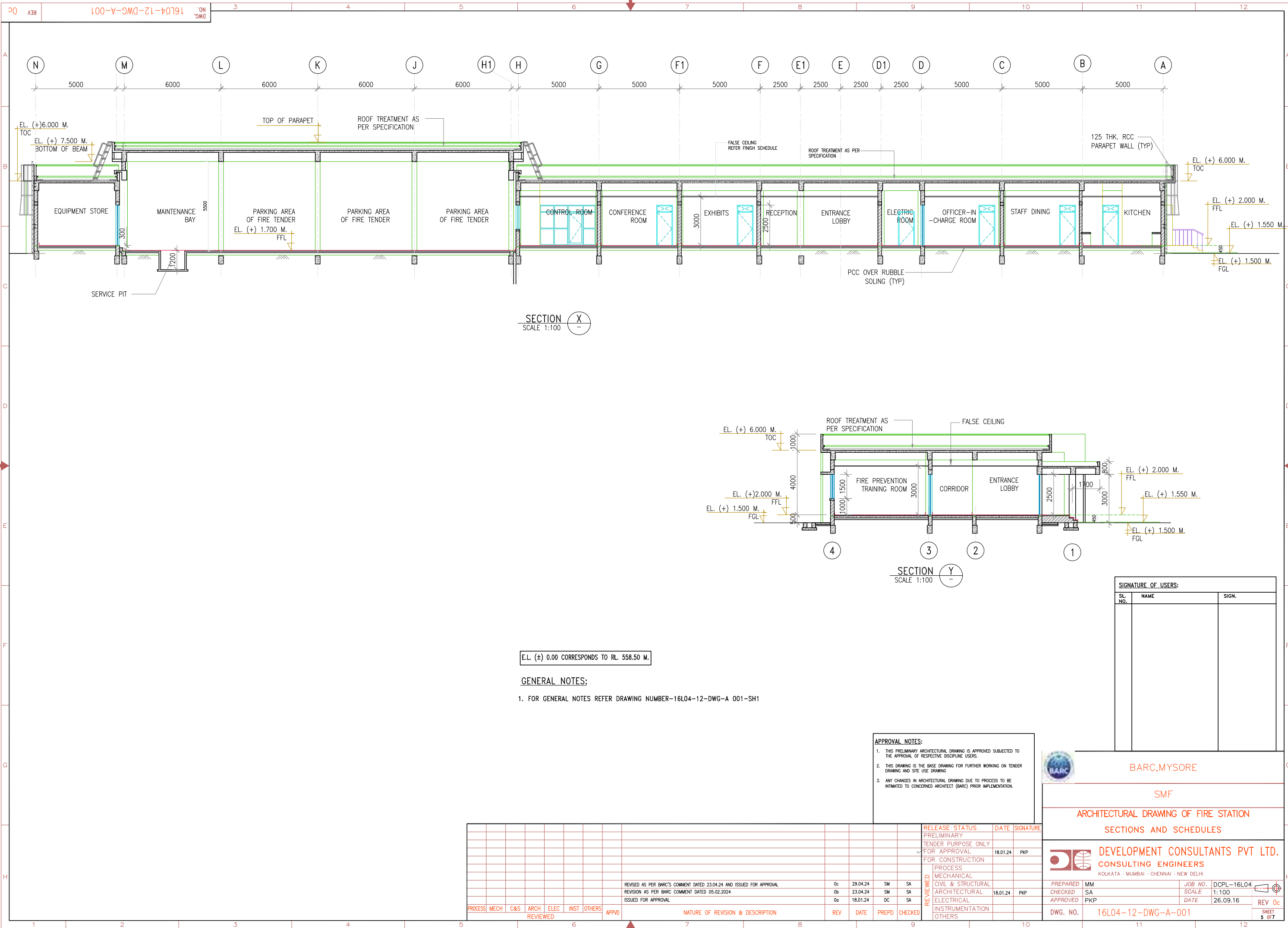


KOLKATA • MUMBAI • CHENNAI • NEW DELHI

PREPARED	M
CHECKED	S
APPROVED	P

16L04-12-DWG-A-00





16L04-12-DWG-A-001

ON DWG

34

00

WINDOW SCHEDULE & LOUVRE SCHEDULE:

FLOOR	WINDOW MARKED	SCHEMATIC ELEVATION	TYPE	QUANTITY	DESCRIPTION	MASONRY/STRUCTURAL OPENING		WINDOW SIZE FROM FIN. SURFACE		MATERIAL		MEMBER SIZES / NOMENCLATURE		REMARKS	
						WIDTH	HEIGHT	WIDTH	HEIGHT	FRAME MATERIAL	GLASS	FRAME SECTION	SHUTTER SECTION		
EL (+) 2.00 M. LEV.	01.	W1		A	14	FULLY GLAZED PARTLY FIXED PARTLY OPENABLE ALUMINIUM WINDOW	3000	1500	2980	1480	ALUMINIUM	6 MM. THK. TOUGHENED GLASS	AS PER ARCH. STANDARD DETAIL	AS PER ARCH. STANDARD DETAIL	
	02.	W2		B	1	FULLY GLAZED PARTLY FIXED PARTLY TOP HUNG ALUMINIUM WINDOW	3000	600	2980	580	ALUMINIUM	-DO-	-DO-	-DO-	
	03.	W3		C	2	FULLY GLAZED PARTLY FIXED PARTLY TOP HUNG ALUMINIUM WINDOW	2270	600	2250	580	ALUMINIUM	-DO-	-DO-	-DO-	
	04.	W4		A	2	FULLY GLAZED FIXED ALUMINIUM WINDOW	3000	1500	2980	1480	ALUMINIUM	-DO-	-DO-	-DO-	
	05.	W5		D	6	FULLY GLAZED TOP HUNG ALUMINIUM WINDOW	600	600	580	580	ALUMINIUM	-DO-	-DO-	-DO-	
	06.	W6		E	1	FULLY GLAZED TOP HUNG ALUMINIUM WINDOW	1500	600	1480	580	ALUMINIUM	-DO-	-DO-	-DO-	

WINDOW TYPE A

WINDOW TYPE B

WINDOW TYPE C

WINDOW TYPE D

WINDOW TYPE E

GROUND FLOOR + 2.00M

						ELEVATION										
						WIDTH	HEIGHT	WIDTH	HEIGHT	FRAME	GLASS					
GROUND FLOOR + 2.00M	FD1	SINGLE LEAF FIRE CHECK 2 HOUR RATING STEEL DOOR	2	A		1200	2500	1180	2490	PRESSED STEEL	6MM THICK CLEAR FLOAT GLASS	SET 1				
	D1	DOUBLE LEAF HOLLOW METAL STEEL FLUSH DOOR WITH VISION PANEL AND LOUVER	2	A		1200	2500	1180	2490	PRESSED STEEL	6MM THICK CLEAR FLOAT GLASS	SET 1				
	D2	DOUBLE LEAF HOLLOW METAL STEEL FLUSH DOOR WITH VISION PANEL	2	A		1500	2500	1480	2490	-DO-	-DO-	SET 1				
	D3	SINGLE LEAF HOLLOW METAL STEEL FLUSH DOOR WITH VISION PANEL	11	B		1000	2500	980	2490	-DO-	-DO-	SET 2				
	D4	SINGLE LEAF GLAZED ALUMINIUM DOOR WITH 8MM THICK GLASS	3	C		1000	2500	980	2490	ALUMINIUM	8MM THICK CLEAR TOUGHENED FLOAT GLASS	SET 3				
	D5	DOUBLE LEAF GLAZED ALUMINIUM DOOR WITH 8MM THICK GLASS	1	D		1800	2500	1780	2490	-DO-	-DO-	SET 4				
	D6	SINGLE LEAF F.R.P FLUSH DOOR	2	E		1000	2500	980	2490	FRP	-	SET 5				
	D6A	SINGLE LEAF F.R.P FLUSH DOOR	1	F		1000	2100	980	2090	-DO-	-DO-	SET 6				DOOR FOR HANDICAPPED TOILET
D7	SINGLE LEAF F.R.P FLUSH DOOR	4	G		750	2100	730	2090	-DO-	-DO-	SET 7					

ACTUAL FRAME HEIGHT FOR STEEL DOOR = DOOR HEIGHT FROM FINISHED FLOOR LEVEL + 50 MM. ALL FIRE DOORS ARE 2 HOUR FIRE RATED DOORS.

DOOR TYPE A

DOOR TYPE B

DOOR TYPE C

DOOR TYPE D

DOOR TYPE E

DOOR TYPE F

DOOR TYPE G

DOOR HARDWARE SET NO. 1

1. 100MM SS BALL BEARING HINGE - 6 NOS (3NOS ON BOTH SIDE)

2. 450MM LONG TOWER BOLT ON INSIDE FACE OF EACH LEAF - 2 NOS

3. HEAVY DUTY AUTOMATIC DOOR CLOSURE ON ACTIVE LEAF.

4. SS DOOR HANDLE ON BOTH SIDE OF INACTIVE LEAF -2NOS

5. 1 SET OF MORTISE LATCH & LOCK WITH SS HANDLE ON ACTIVE LEAF.

6. 2NOS DOOR STOPPER ON INSIDE OF EACH LEAF.

7. RAIN DRIP ON EXTERNAL FACE OF EACH LEAF. (FOR EXTERNAL DOORS)

8. THRESHOLD (FOR EXTERNAL DOORS)

DOOR HARDWARE SET NO. 2

1. 100MM SS BALL BEARING HINGE - 3 NOS

2. 450MM LONG TOWER BOLT ON INSIDE FACE - 1 NOS

3. HEAVY DUTY AUTOMATIC DOOR CLOSURE ON ACTIVE LEAF.

4. 1 SET OF MORTISE LATCH & LOCK WITH SS HANDLE ON ACTIVE LEAF.

5. 1 NO. DOOR STOPPER ON INSIDE FACE

6. RAIN DRIP ON EXTERNAL FACE OF EACH LEAF. (FOR EXTERNAL DOORS)

7. THRESHOLD (FOR EXTERNAL DOORS)

DOOR HARDWARE SET NO. 3

1. 100MM SS BALL BEARING HINGE - 3 NOS

2. 450MM LONG SS TOWER BOLT ON INSIDE FACE - 1 NOS

4. 1 SET OF MORTISE LATCH & LOCK WITH SS HANDLE ON ACTIVE LEAF.

5. HEAVY DUTY FLOOR SPRING ON EACH LEAF.

6. 1 NO. DOOR STOPPER ON INSIDE FACE

DOOR HARDWARE SET NO. 4

1. 100MM SS BALL BEARING HINGE - 6 NOS

2. 450MM LONG SS TOWER BOLT ON INSIDE FACE OF INACTIVE LEAF - 1 NOS

4. 1 SET OF MORTISE LATCH & LOCK WITH SS HANDLE ON ACTIVE LEAF.

5. HEAVY DUTY FLOOR SPRING ON EACH LEAF- 2 NOS.

6. 2 NO. DOOR STOPPER ON INSIDE FACE

7. 2 NOS SS DOOR HANDLE ON BOTH FACES OF INACTIVE LEAF.

DOOR HARDWARE SET NO. 5

1. 100MM UPVC HINGE - 3 NOS

2. 450MM LONG SS TOWER BOLT ON INSIDE FACE - 1 NOS

4. 1 SET OF MORTISE LATCH & LOCK WITH SS HANDLE ON ACTIVE LEAF.

5. HEAVY DUTY AUTOMATIC DOOR CLOSURE ON ACTIVE LEAF.

6. 1 NO. DOOR STOPPER ON INSIDE FACE

DOOR HARDWARE SET NO. 6

1. 100MM UPVC HINGE - 3 NOS

2. 1 SET OF MORTISE LATCH WITH OCCUPANCY INDICATOR ON BOTH SIDE.

DOOR HARDWARE SET NO. 5

1. 100MM UPVC HINGE - 3 NOS

2. 450MM LONG SS TOWER BOLT ON INSIDE FACE - 1 NOS

3. 2 NO. UPVC DOOR HANDEL ON BOTH FACE

APPROVAL NOTES:

1. THIS PRELIMINARY ARCHITECTURAL DRAWING IS APPROVED SUBJECT TO THE APPROVAL OF RESPECTIVE DISCIPLINE USERS.

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3. ANY CHANGES IN ARCHITECTURAL DRAWING DUE TO PROCESS TO BE INTIMATED TO CONCERNED ARCHITECT (BARC) PRIOR IMPLEMENTATION.

SIGNATURE OF USERS:

SL. NO.	NAME	SIGN.

BARC,MYSORE

SMF

ARCHITECTURAL DRAWING OF FIRE STATION

DOOR WINDOW SCHEDULE

DEVELOPMENT CONSULTANTS PVT LTD.
CONSULTING ENGINEERS
KOLKATA - MUMBAI - CHENNAI - NEW DELHI

PREPARED MM

CHECKED SA

APPROVED PKP

JOB NO. DCPL-16L04

SCALE 1:100

DATE 26.09.16

DWG. NO. 16L04-12-DWG-A-001

REV 0c

SHEET 6 OF 7

REVISED AS PER BARC'S COMMENT DATED 23.04.24 AND ISSUED FOR APPROVAL

REVISION AS PER BARC COMMENT DATED 05.02.2024

ISSUED FOR APPROVAL

0c 29.04.24 SM SA

0b 23.04.24 SM SA

0a 18.01.24 DC SA

PROCESS MECH C&S ARCH ELEC INST OTHERS APPVD

NATURE OF REVISION & DESCRIPTION

REV DATE PREPD CHECKED

RELEASE STATUS PRELIMINARY TENDER PURPOSE ONLY FOR APPROVAL FOR CONSTRUCTION PROCESS MECHANICAL CIVIL & STRUCTURAL ARCHITECTURAL ELECTRICAL INSTRUMENTATION OTHERS

DATE 18.01.24 18.01.24

SIGNATURE PKP PKP

FILE LOCATION: \\10.40.0.200\MapData\A-Serve\DC_ARCH\WORKING FOLDER\SUMAN\BARC DWGS FOR DISCUSSION 22-24.04.24\FIRE STATION\FINAL DRAWINGS\16L04-12-DWG-A-001-SH1 TO 7-R00-BARC FIRE STATION_RFC_d1 29.04.24.dwg

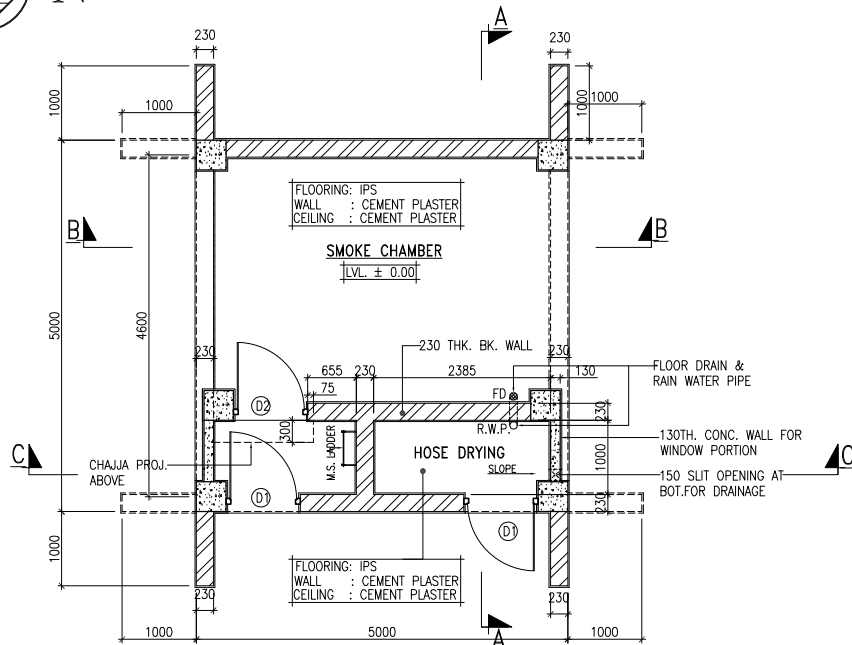
PLOT DATE: 29 April 2024, 5:37 PM

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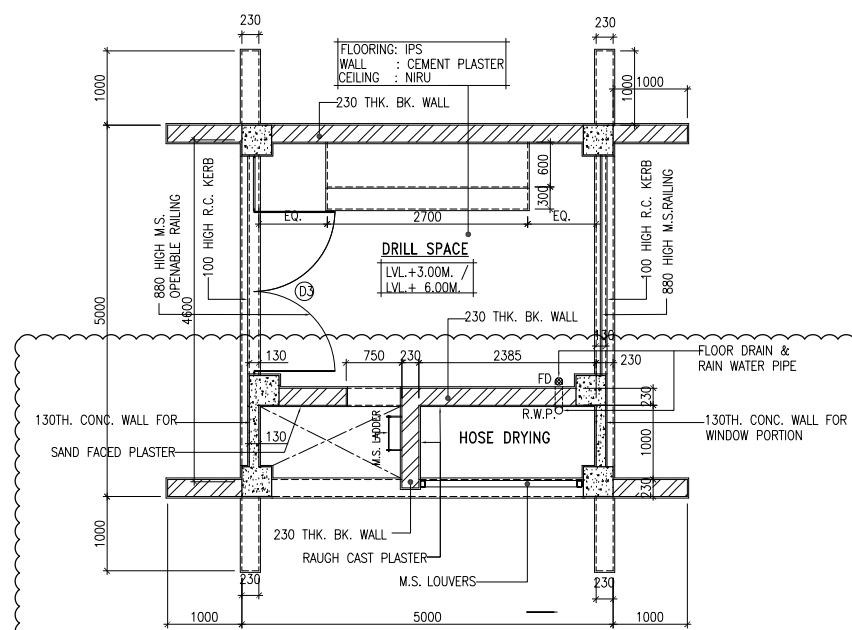
AT [841 x 594]

FILE LOCATION: \\10.40.0.200\ExpData\A-Serve\DC_ARCH\WORKING FOLDER\SUMAN\BARC\BARC DWGS FOR DISCUSSION 22-24.04.24\FIRE STATION\FINAL DRAWINGS\16L04-12-DWG-A-001-SH1 TO 7-R00-BARC FIRE STATION_RFC.dwg
PLOT DATE: 29 April 2024, 5:37 PM

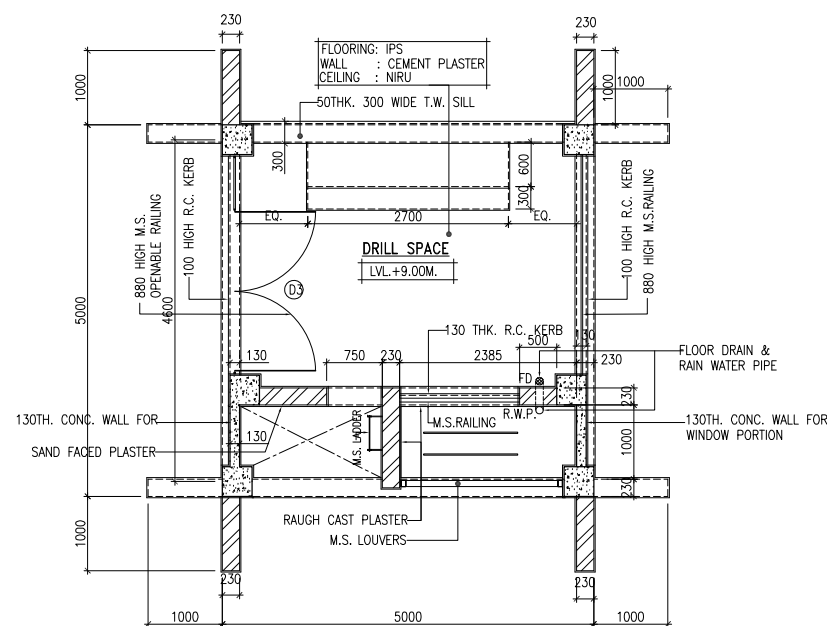
0c	A38	16L04-12-DWG-A-001	ON DWG	3	4	5	6	7	8	9	10	11	12
FINISH SCHEDULE													
LEVEL		ROOM	FLOORING	SKIRTING/DADO	WALL		CEILING		REMARKS				
GROUND FLOOR		KITCHEN	50 MM THICK VITRIFIED TILES FLOORING WITH 300X300 10 THICK TILES	2100MM HIGH DADO WITH MATCHING 5MM THICK GLAZED CERAMIC TILES	ACRYLIC EMULSION PAINT		PRE-COATED ALUMINIUM LINEAR FALSE CEILING						
		STAFF DINING ROOM	50 MM THICK VITRIFIED TILES FLOORING WITH 600X600 10 THICK TILES	150MM HIGH VITRIFIED TILES SKIRTING	ACRYLIC EMULSION PAINT		PRE-COATED ALUMINIUM LINEAR FALSE CEILING						
		OFFICE IN CHARGE ROOM	50 MM THICK VITRIFIED TILES FLOORING WITH 600X600 10 THICK TILES	150MM HIGH VITRIFIED TILES SKIRTING	ACRYLIC EMULSION PAINT		PRE-COATED ALUMINIUM LINEAR FALSE CEILING						
		ELECTRIC ROOM	52MM THICK HEAVY DUTY CONCRETE FLOORING WITH NON-METALLIC HARDENER FINISH ON TOP	150MM HIGH SKIRTING WITH SAME FINISH	ACRYLIC DISTEMPER PAINT		NO PLASTERING,ACRYLIC DISTEMPER ONLY						
		ENTRANCE LOBBY & RECEPTION	50 MM THICK KOTA STONE FLOORING WITH 20MM THICK KOTA STONE SLAB	150MM HIGH KOTA STONE SKIRTING	ACRYLIC EMULSION PAINT		PRE-COATED ALUMINIUM LINEAR FALSE CEILING						
		EXHIBITS	50 MM THICK VITRIFIED TILES FLOORING WITH 600X600 10 THICK TILES	150MM HIGH VITRIFIED TILES SKIRTING	ACRYLIC EMULSION PAINT		PRE-COATED ALUMINIUM LINEAR FALSE CEILING						
		CONFERENCE ROOM	50 MM THICK VITRIFIED TILES FLOORING WITH 600X600 10 THICK TILES	150MM HIGH VITRIFIED TILES SKIRTING	ACRYLIC EMULSION PAINT		PRE-COATED ALUMINIUM LINEAR FALSE CEILING						
		CONTROL ROOM	50 MM THICK VITRIFIED TILES FLOORING WITH 600X600 10 THICK TILES	150MM HIGH VITRIFIED TILES SKIRTING	ACRYLIC EMULSION PAINT		PRE-COATED ALUMINIUM LINEAR FALSE CEILING						
		OFFICE ROOM	50 MM THICK VITRIFIED TILES FLOORING WITH 600X600 10 THICK TILES	150MM HIGH VITRIFIED TILES SKIRTING	ACRYLIC EMULSION PAINT		PRE-COATED ALUMINIUM LINEAR FALSE CEILING						
		DUTY ROOM	50 MM THICK VITRIFIED TILES FLOORING WITH 600X600 10 THICK TILES	150MM HIGH VITRIFIED TILES SKIRTING	ACRYLIC EMULSION PAINT		PRE-COATED ALUMINIUM LINEAR FALSE CEILING						
		RECORD ROOM	50 MM THICK VITRIFIED TILES FLOORING WITH 600X600 10 THICK TILES	150MM HIGH VITRIFIED TILES SKIRTING	ACRYLIC EMULSION PAINT		PRE-COATED ALUMINIUM LINEAR FALSE CEILING						
		STAFF'S REST ROOM/DRIVER'S REST ROOM	50 MM THICK VITRIFIED TILES FLOORING WITH 600X600 10 THICK TILES	150MM HIGH VITRIFIED TILES SKIRTING	ACRYLIC EMULSION PAINT		PRE-COATED ALUMINIUM LINEAR FALSE CEILING						
		FIRE PREVENTION TRAINING ROOM	50 MM THICK VITRIFIED TILES FLOORING WITH 600X600 10 THICK TILES	150MM HIGH VITRIFIED TILES SKIRTING	ACRYLIC EMULSION PAINT		PRE-COATED ALUMINIUM LINEAR FALSE CEILING						
		OFFICE ROOM	50 MM THICK VITRIFIED TILES FLOORING WITH 600X600 10 THICK TILES	150MM HIGH VITRIFIED TILES SKIRTING	ACRYLIC EMULSION PAINT		PRE-COATED ALUMINIUM LINEAR FALSE CEILING						
		CORRIDOR & SPACE FOR WATER COOLER	50 MM THICK VITRIFIED TILES FLOORING WITH 600X600 10 THICK TILES	150MM HIGH VITRIFIED TILES SKIRTING	ACRYLIC EMULSION PAINT		PRE-COATED ALUMINIUM LINEAR FALSE CEILING						
		LOCKER'S ROOM/ FIRE CLOTHING	50 MM THICK VITRIFIED TILES FLOORING WITH 600X600 10 THICK TILES	150MM HIGH VITRIFIED TILES SKIRTING	ACRYLIC EMULSION PAINT		PRE-COATED ALUMINIUM LINEAR FALSE CEILING						
		TOILET	50 MM THICK UNGLAZED CERAMIC TILES (ANTISKID) FLOORING WITH 300X300 10 THICK TILES	2100MM HIGH DADO WITH MATCHING 5MM THICK GLAZED CERAMIC TILES	ACRYLIC EMULSION PAINT		PRE-COATED ALUMINIUM LINEAR FALSE CEILING(CELL 50E)						
		PARKING AREA	80MM THICK INTERLOCKING C.C PAVER BLOCK (M-30) FLOORING WITH 300X300	150MM HIGH CEMENT SKIRTING	ACRYLIC DISTEMPER PAINT		ACRYLIC DISTEMPER						
		MAINTENANCE BAY	80MM THICK INTERLOCKING C.C PAVER BLOCK (M-30) FLOORING WITH 300X300	150MM HIGH CEMENT SKIRTING	ACRYLIC DISTEMPER PAINT		ACRYLIC DISTEMPER						
		EQUIPMENT STORE AND MAINTENANCE & REPAIR SHOP	52MM THICK HEAVY DUTY CONCRETE FLOORING WITH NON-METALLIC HARDENER FINISH ON TOP	150MM HIGH SKIRTING WITH SAME FINISH	ACRYLIC DISTEMPER PAINT		ACRYLIC DISTEMPER						
	OUTDOOR RAMPS	HEAVY DUTY CONCRETE FLOORING WITH ANTI SKID FINISH ON TOP	-	-		-							
E.L. (±) 0.00 CORRESPONDS TO RL. 558.50 M.													
GENERAL NOTES:													
1. FOR GENERAL NOTES REFER DRAWING NUMBER-16L04-12-DWG-A 001-SH1													
APPROVAL NOTES:													
1. THIS PRELIMINARY ARCHITECTURAL DRAWING IS APPROVED SUBJECTED TO THE APPROVAL OF RESPECTIVE DISCIPLINE USERS.													
2. THIS DRAWING IS THE BASE DRAWING FOR FURTHER WORKING ON TENDER DRAWING AND SITE USE DRAWING													
3. ANY CHANGES IN ARCHITECTURAL DRAWING DUE TO PROCESS TO BE INTIMATED TO CONCERNED ARCHITECT (BARC) PRIOR IMPLEMENTATION.													
RELEASE STATUS													
PRELIMINARY													
TENDER PURPOSE ONLY													
FOR APPROVAL													
FOR CONSTRUCTION													
PROCESS													
MECHANICAL													
CIVIL & STRUCTURAL													
ARCHITECTURAL													
ELECTRICAL													
INSTRUMENTATION													
OTHERS													
REVISED AS PER BARC'S COMMENT DATED 23.04.24 AND ISSUED FOR APPROVAL													
REVISION AS PER BARC COMMENT DATED 05.02.2024													
ISSUED FOR APPROVAL													
NATURE OF REVISION & DESCRIPTION													
REV													
DATE													
PREPD													
CHECKED													
DWG. NO.													
16L04-12-DWG-A-001													
SHEET 7 OF 7													
SIGNATURE OF USERS:													
SL. NO.													
NAME													
SIGN.													
BARC,MYSORE													
SMF													
ARCHITECTURAL DRAWING OF FIRE STATION													
FINISH SCHEDULES													
DEVELOPMENT CONSULTANTS PVT LTD.													
CONSULTING ENGINEERS													
KOLKATA · MUMBAI · CHENNAI · NEW DELHI													
PREPARED SP													
JOB NO.													
DCPL-16L04													
CHECKED SA													
SCALE													
1:100													
APPROVED PKP													
DATE													
21.08.23													
REV 0c													
DWG. NO.													
16L04-12-DWG-A-001													
SHEET 7 OF 7													



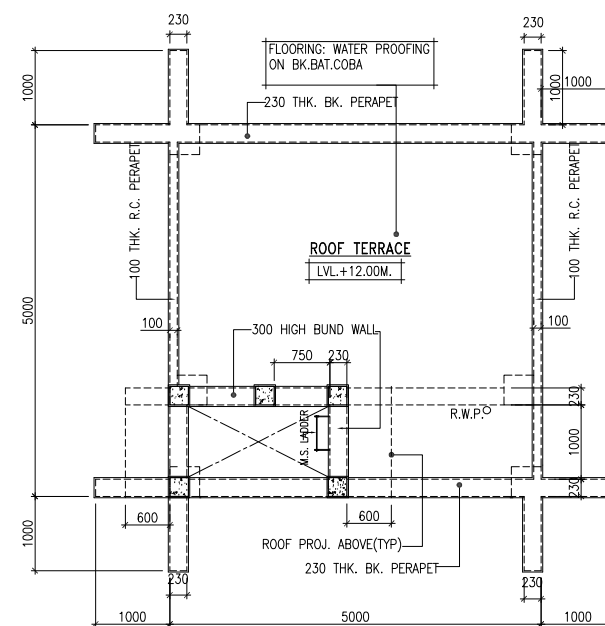
GROUND FLOOR PLAN



FIRST & SECOND FLOOR PLAN
VIEW AT D-D LEV.



THIRD FLOOR PLAN
VIEW AT E-E LEV.



TERRACE PLAN
VIEW AT E-E LEV.

DOOR SCHEDULE				
DOOR MARKED	DESCRIPTION	MASONRY OPENING		REMARKS
		WEIDTH	HEIGHT	
D1	M.S. DOOR	1000	2250	
D2	M.S. DOOR	1000	2100	

WINDOW SCHEDULE				
DOOR MARKED	DESCRIPTION	MASONRY OPENING		REMARKS
		WEIDTH	HEIGHT	
W1	M.S. WINDOW	2970	600	
	M.S. LOUVER	2215	1620	

APPROVAL NOTES:

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3. ANY CHANGES IN ARCHITECTURAL DRAWING DUE TO PROCESS TO BE INTIMATED TO CONCERNED ARCHITECT (BARC) PRIOR IMPLEMENTATION.

SIGNATURE OF USERS:

SL. NO.	NAME	SIGN.

E.L. ($\pm$) 0.00 CORRESPONDS TO RL. 558.50 M.

GENERAL NOTES:

1. EXCEPT OTHERWISE NOTED ALL DIMENSIONS IN MILLIMETER & LEVELS ARE IN METERS
2. FINISHED DEVELOPED LEVEL (FDL)/ FINISHED GRADE LEVEL (FGL) HAS BEEN CONSIDERED AT RL. 560.00 M. AS PER REFERENCE DRAWING NO. 1697/BARC/MASTER PLAN/C/AR/100, REV NIL
3. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH 16L04-12-DWG-A-001-SH1



BARC,MYSORE

SMF

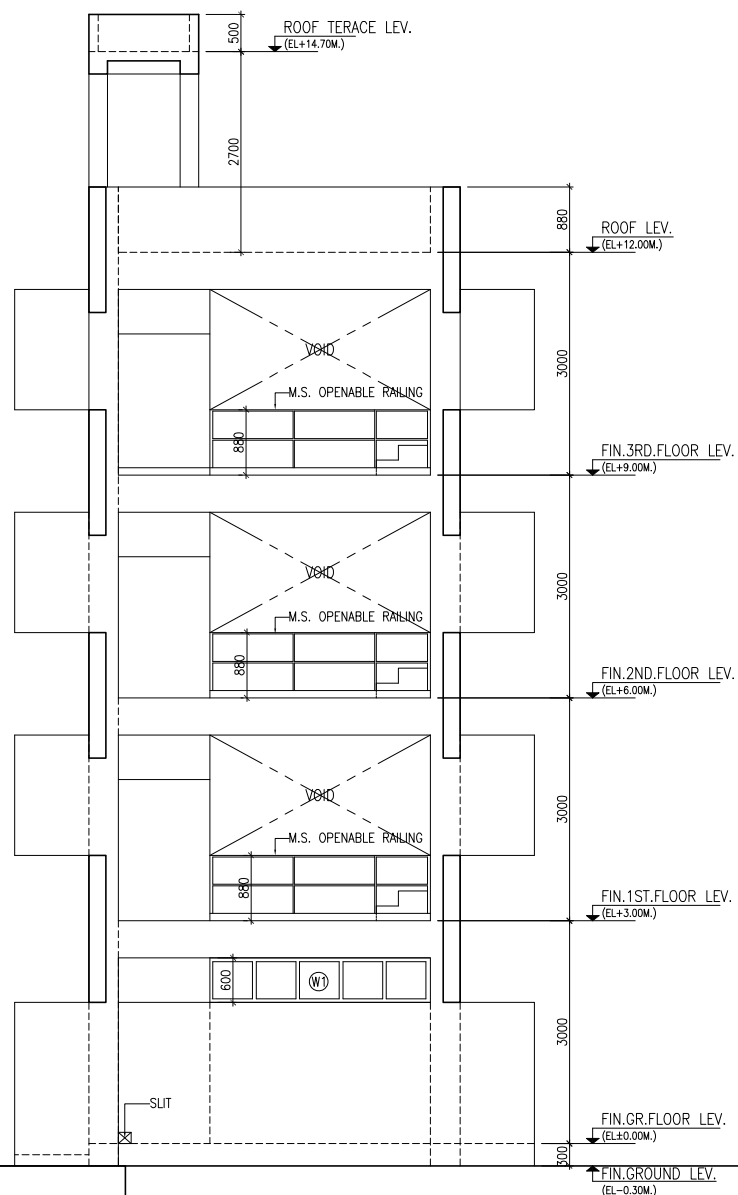
ARCHITECTURAL DRAWING OF DRILL TOWER
PLANS & DOOR / WINDOW SCHEDULE

DEVELOPMENT CONSULTANTS PVT LTD.
CONSULTING ENGINEERS
KOLKATA - MUMBAI - CHENNAI - NEW DELHI

PREPARED	DC	JOB NO.	DCPL-16L04	
CHECKED	SA	SCALE	1:100	
APPROVED	PKP	DATE	30.10.19	

DWG. NO.	16L04-12-DWG-A-002	REV	00
		SHEET	1 OF 3

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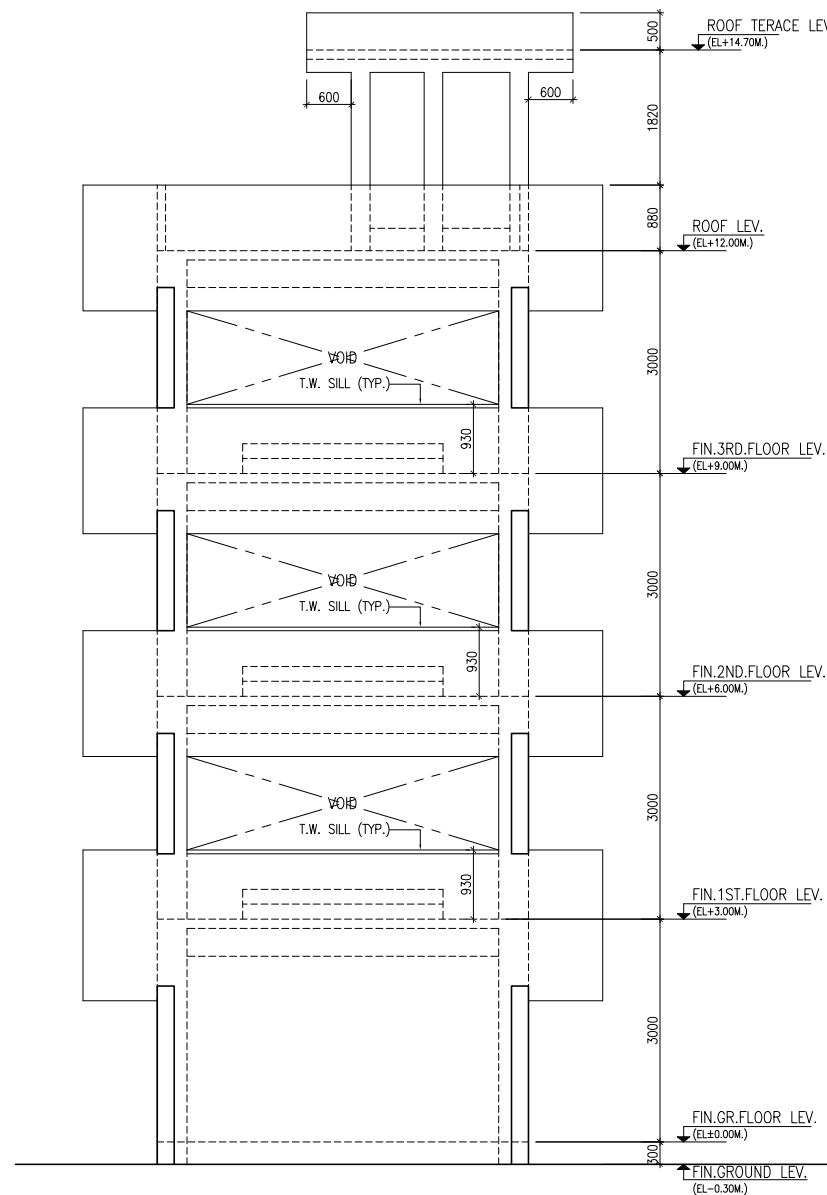
NORTH SIDE ELEVATION
SOUTH SIDE ELEVATION SIMILAR
BUT MIRROR

APPROVAL NOTES:

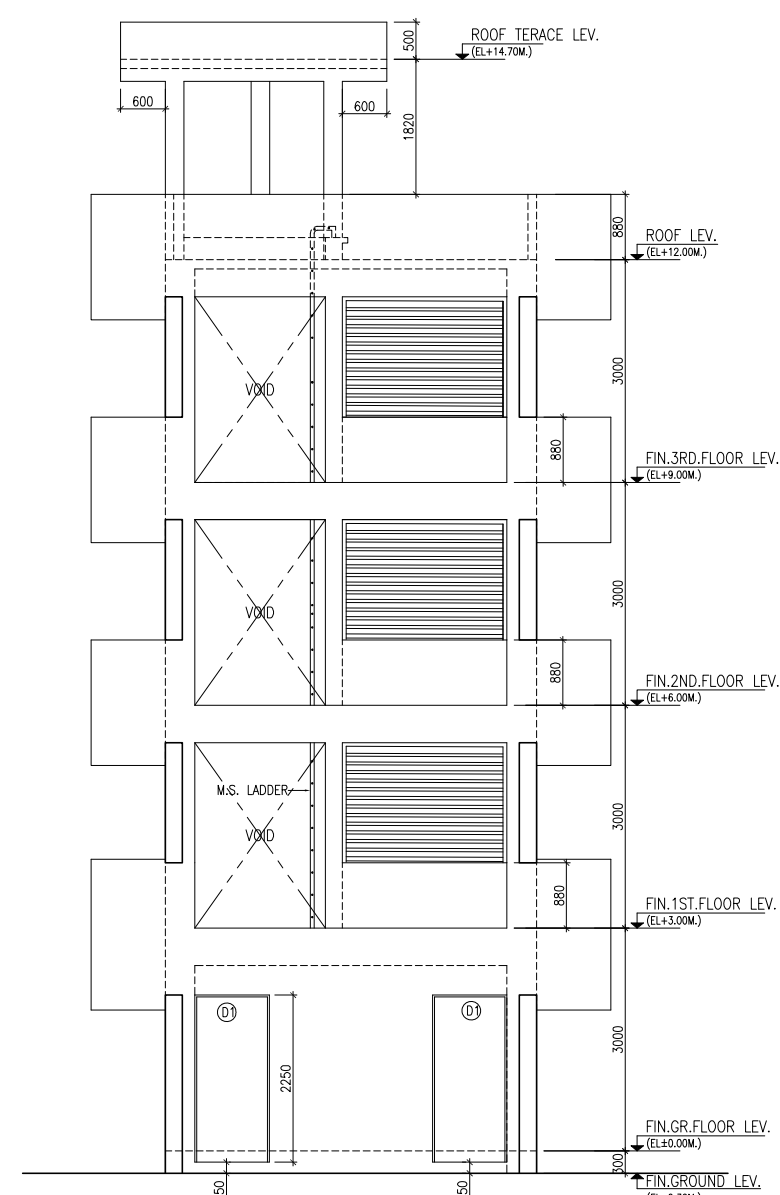
1. THIS PRELIMINARY ARCHITECTURAL DRAWING IS APPROVED SUBJECTED TO THE APPROVAL OF RESPECTIVE DISCIPLINE USERS.
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SIGNATURE OF USERS:

SL. NO.	NAME	SIGN.
G		
H		



WEST SIDE ELEVATION



EAST SIDE ELEVATION

E.L. (±) 0.00 CORRESPONDS TO RL. 558.50 M.

GENERAL NOTES:

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2. FINISHED DEVELOPED LEVEL (FDL)/ FINISHED GRADE LEVEL (FGL) HAS BEEN CONSIDERED AT RL. 560.000 M. AS PER REFERENCE DRAWING NO. 1697/BARC/MASTER PLAN/C/AR/100, REV NIL
3. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH 16L04-12-DWG-A-001-SH1



BARC,MYSORE

SMF

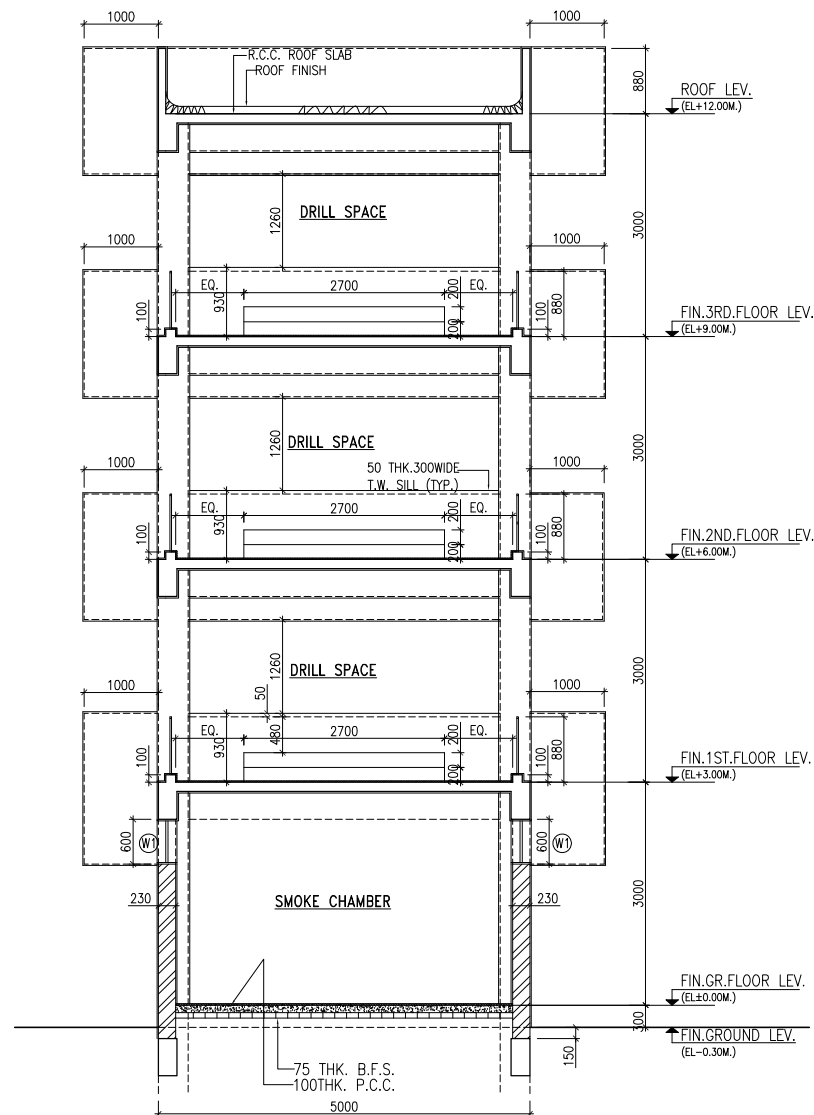
ARCHITECTURAL DRAWING OF DRILL TOWER ELEVATIONS



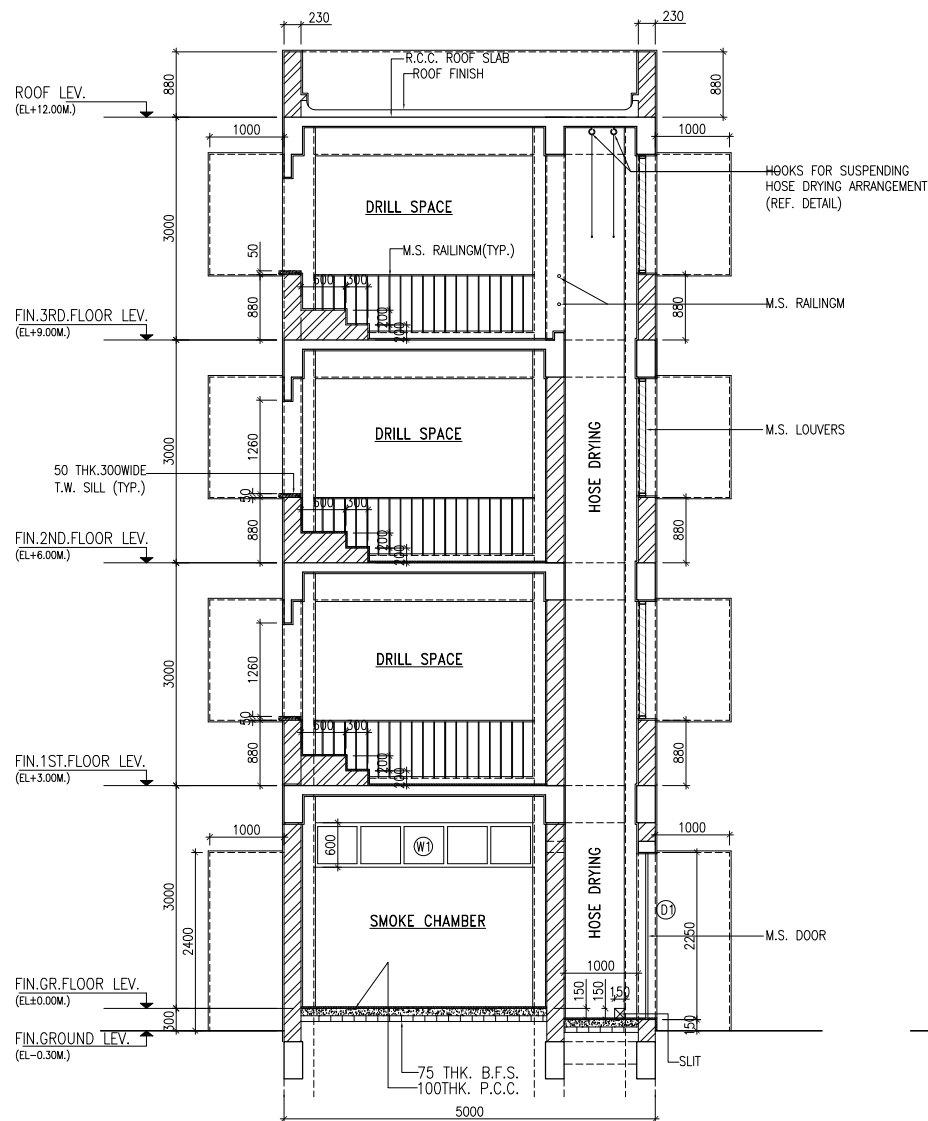
DEVELOPMENT CONSULTANTS PVT LTD.
CONSULTING ENGINEERS
KOLKATA · MUMBAI · CHENNAI · NEW DELHI

PREPARED	DC	JOB NO.	DCPL-16L04	
CHECKED	SA	SCALE	1:100	
APPROVED	PKP	DATE	30.10.19	
DWG. NO. 16L04-12-DWG-A-002				REV 01 SHEET 3 OF 3

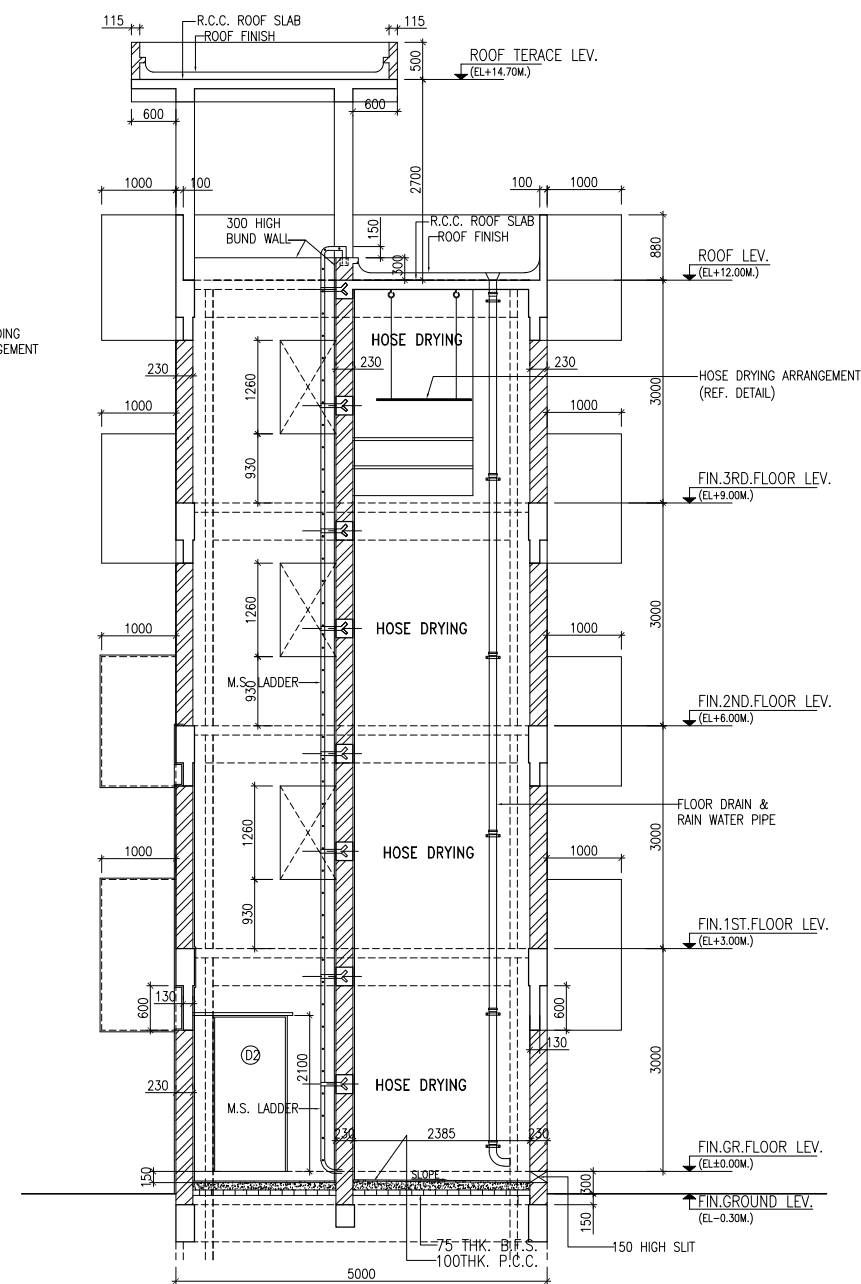
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SECTION-B-B



SECTION-A-A



SECTION-C-C

E.L. (±) 0.00 CORRESPONDS TO RL. 558.50 M.

GENERAL NOTES:

1. EXCEPT OTHERWISE NOTED ALL DIMENSIONS IN MILLIMETER & LEVELS ARE IN METERS
2. FINISHED DEVELOPED LEVEL (FDL)/ FINISHED GRADE LEVEL (FGL) HAS BEEN CONSIDERED AT RL. 560.00M AT RL. AS PER REFERENCE DRAWING NO. 1697/BARC/MASTER PLAN/C/AR/100, REV NIL
3. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH 16L04-12-DWG-A-001-SH1

BARC, MYSORE

SMF

ARCHITECTURAL DRAWING OF DRILL TOWER SECTIONS



DEVELOPMENT CONSULTANTS PVT LTD.

CONSULTING ENGINEERS

	PREPARED	
	CHECKED	
	APPROVED	

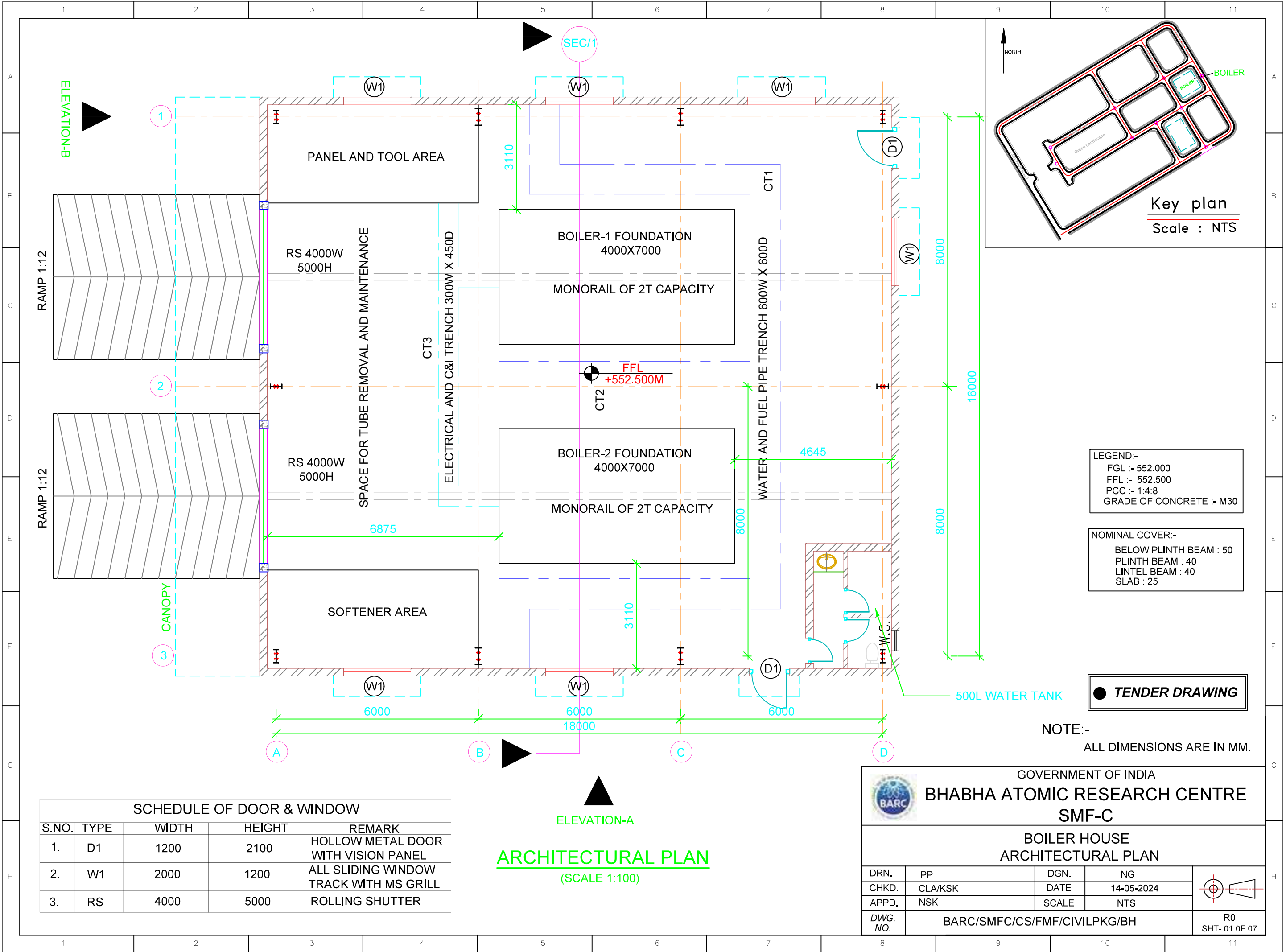
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SA	SCALE	1:100
PKP	DATE	30.10.19

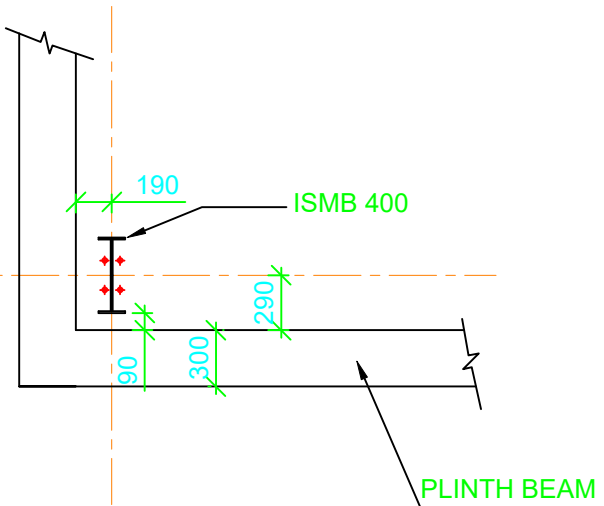
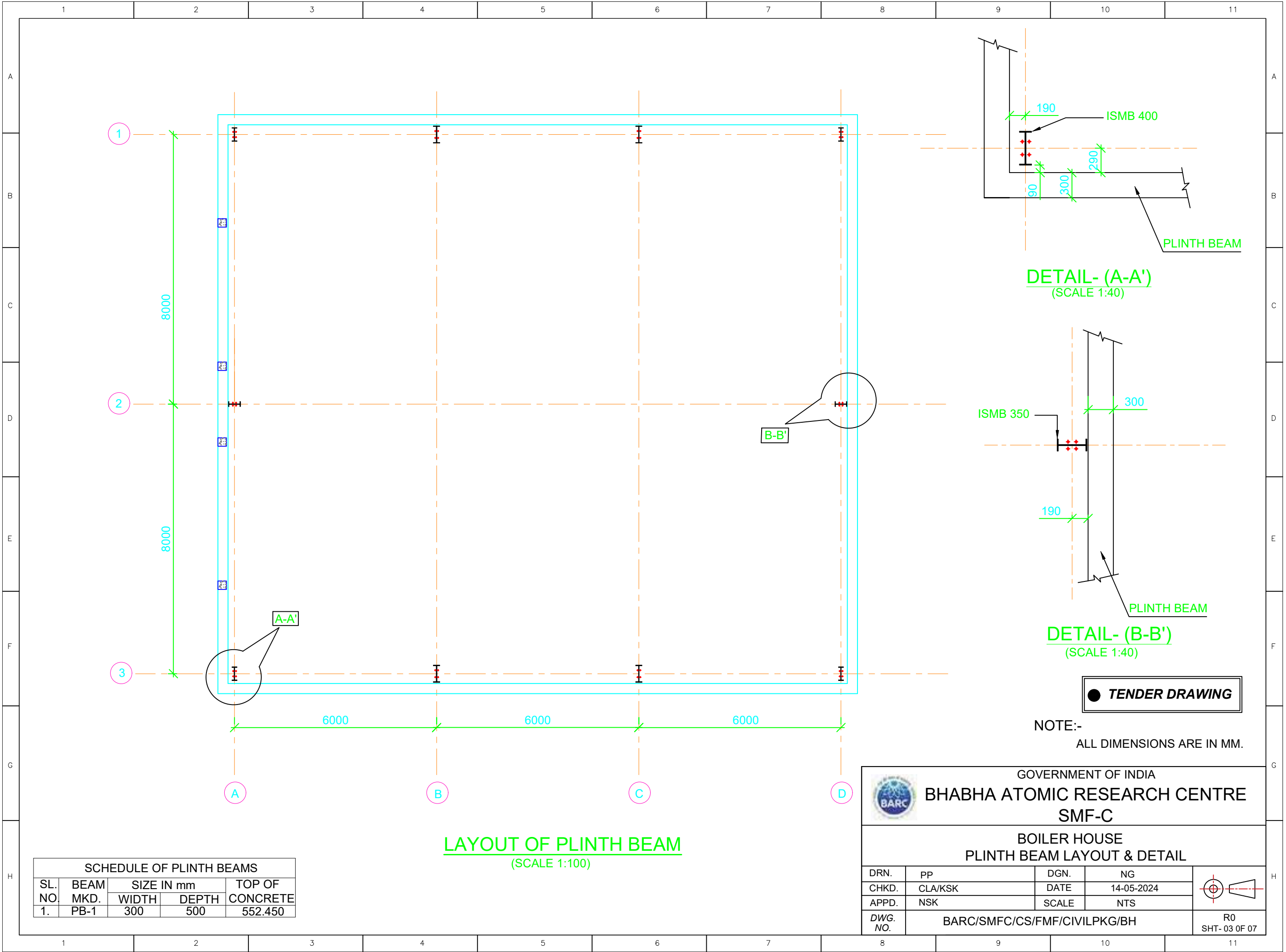
DWG. NO.	16L04-12-DWG-A-002

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3 OF 3	

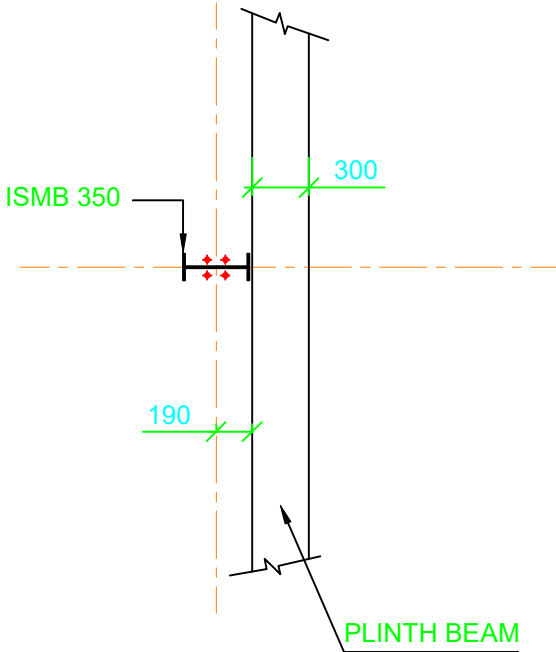
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TENDER DRAWINGS FOR BOILER HOUSE





DETAIL- (A-A')
(SCALE 1:40)



DETAIL- (B-B')
(SCALE 1:40)

TENDER DRAWING

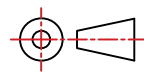
NOTE:-
ALL DIMENSIONS ARE IN MM.



GOVERNMENT OF INDIA
BHABHA ATOMIC RESEARCH CENTRE
SMF-C

BOILER HOUSE
PLINTH BEAM LAYOUT & DETAIL

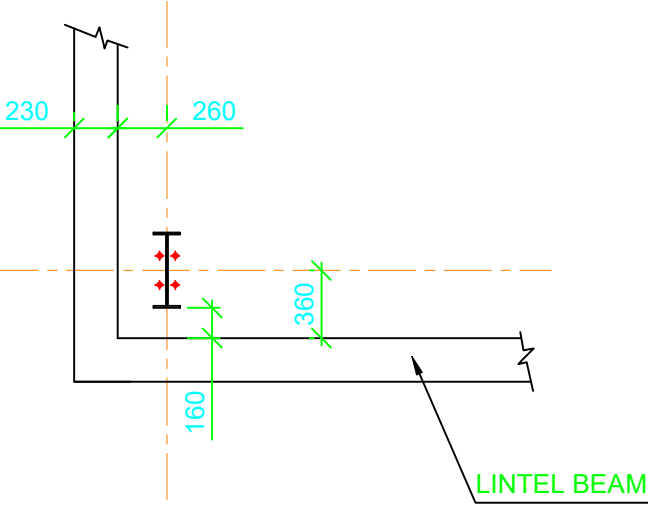
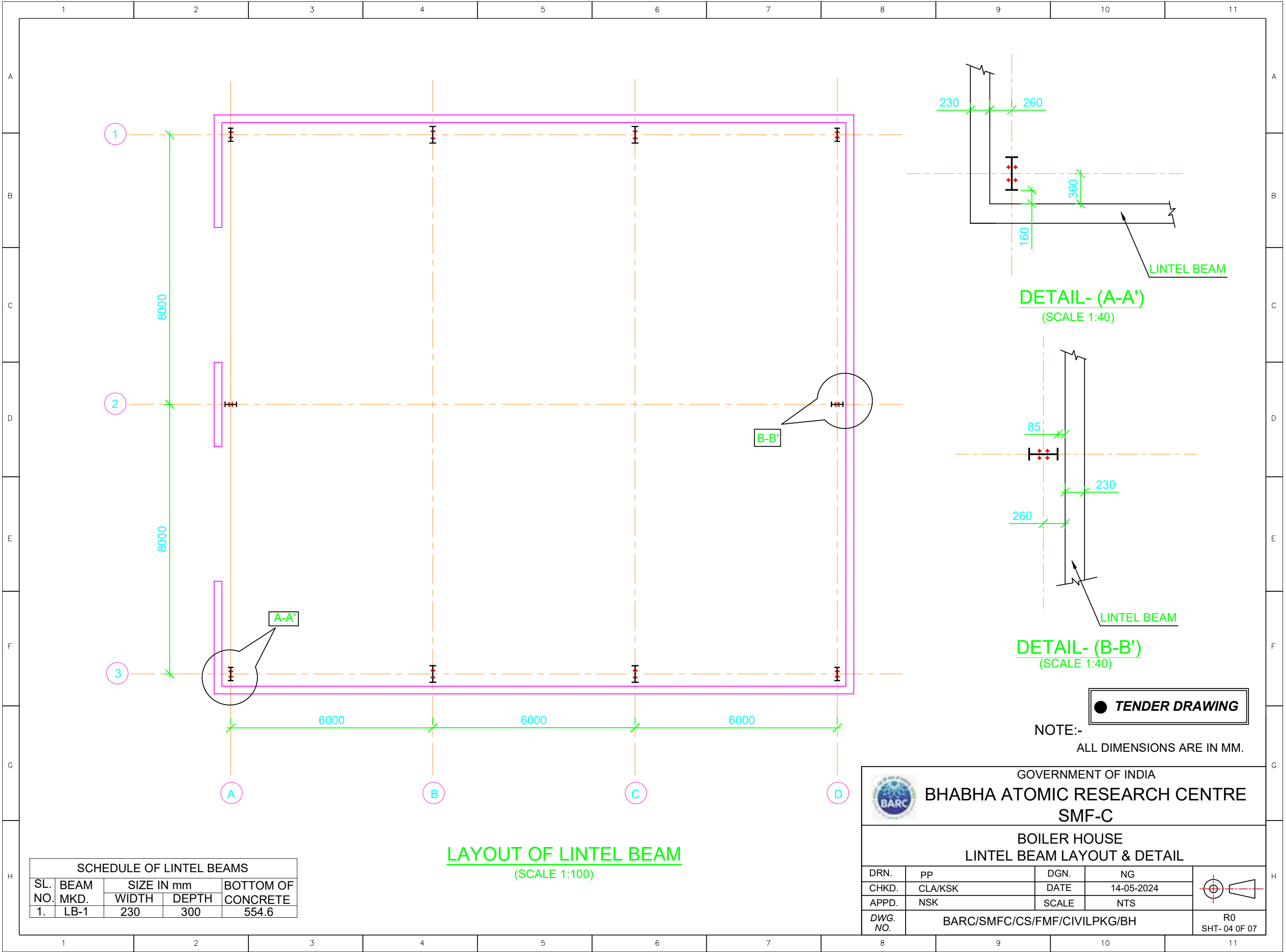
DRN.	PP	DGN.	NG
CHKD.	CLA/KSK	DATE	14-05-2024
APPD.	NSK	SCALE	NTS
DWG. NO.	BARC/SMFC/CS/FMF/CIVILPKG/BH		



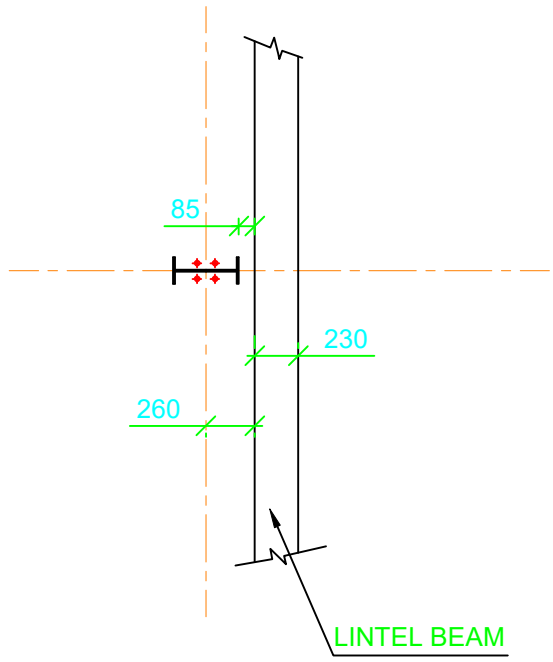
R0
SHT- 03 OF 07

SCHEDULE OF PLINTH BEAMS				
SL. NO.	BEAM MKD.	SIZE IN mm		TOP OF CONCRETE
		WIDTH	DEPTH	
1.	PB-1	300	500	552.450

LAYOUT OF PLINTH BEAM
(SCALE 1:100)



DETAIL- (A-A')
(SCALE 1:40)



DETAIL- (B-B')
(SCALE 1:40)

TENDER DRAWING

NOTE:-
ALL DIMENSIONS ARE IN MM.

SCHEDULE OF LINTEL BEAMS				
SL. NO.	BEAM MKD.	SIZE IN mm		BOTTOM OF CONCRETE
		WIDTH	DEPTH	
1.	LB-1	230	300	554.6

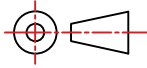
LAYOUT OF LINTEL BEAM
(SCALE 1:100)



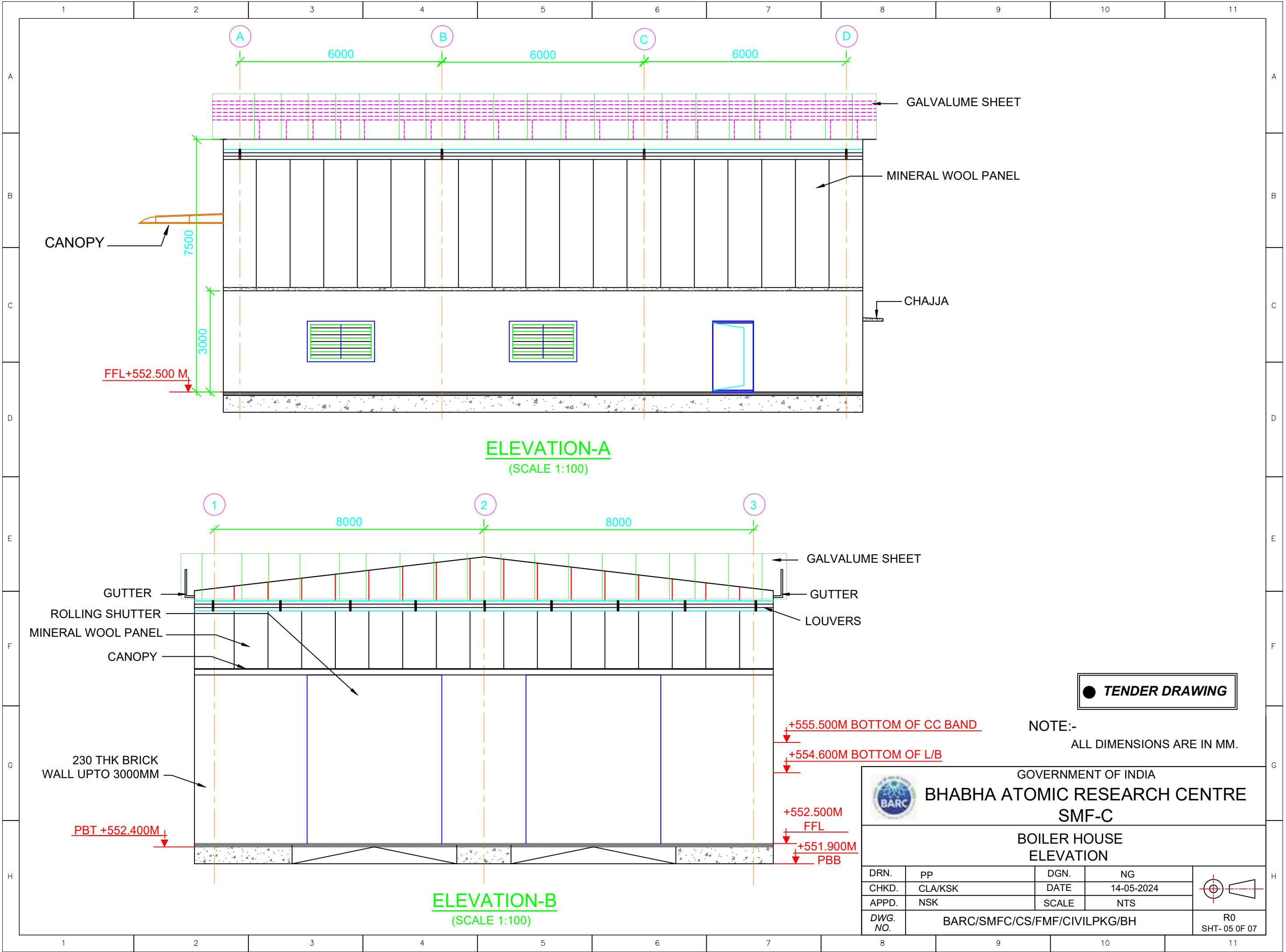
GOVERNMENT OF INDIA
BHABHA ATOMIC RESEARCH CENTRE
SMF-C

BOILER HOUSE
LINTEL BEAM LAYOUT & DETAIL

DRN.	PP	DGN.	NG
CHKD.	CLA/KSK	DATE	14-05-2024
APPD.	NSK	SCALE	NTS
DWG. NO.	BARC/SMFC/CS/FMF/CIVILPKG/BH		



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SHT- 04 OF 07



TENDER DRAWING

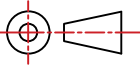
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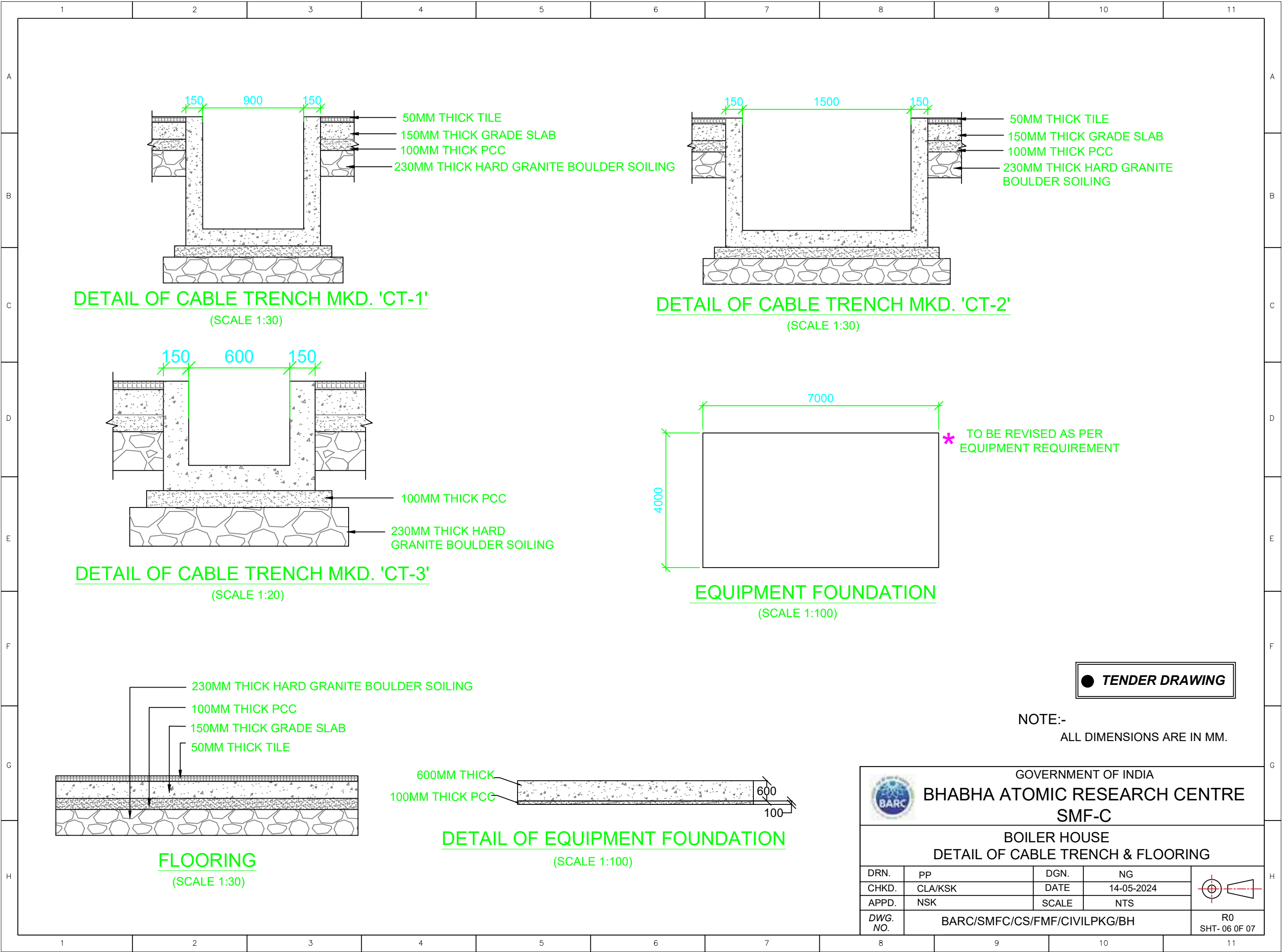


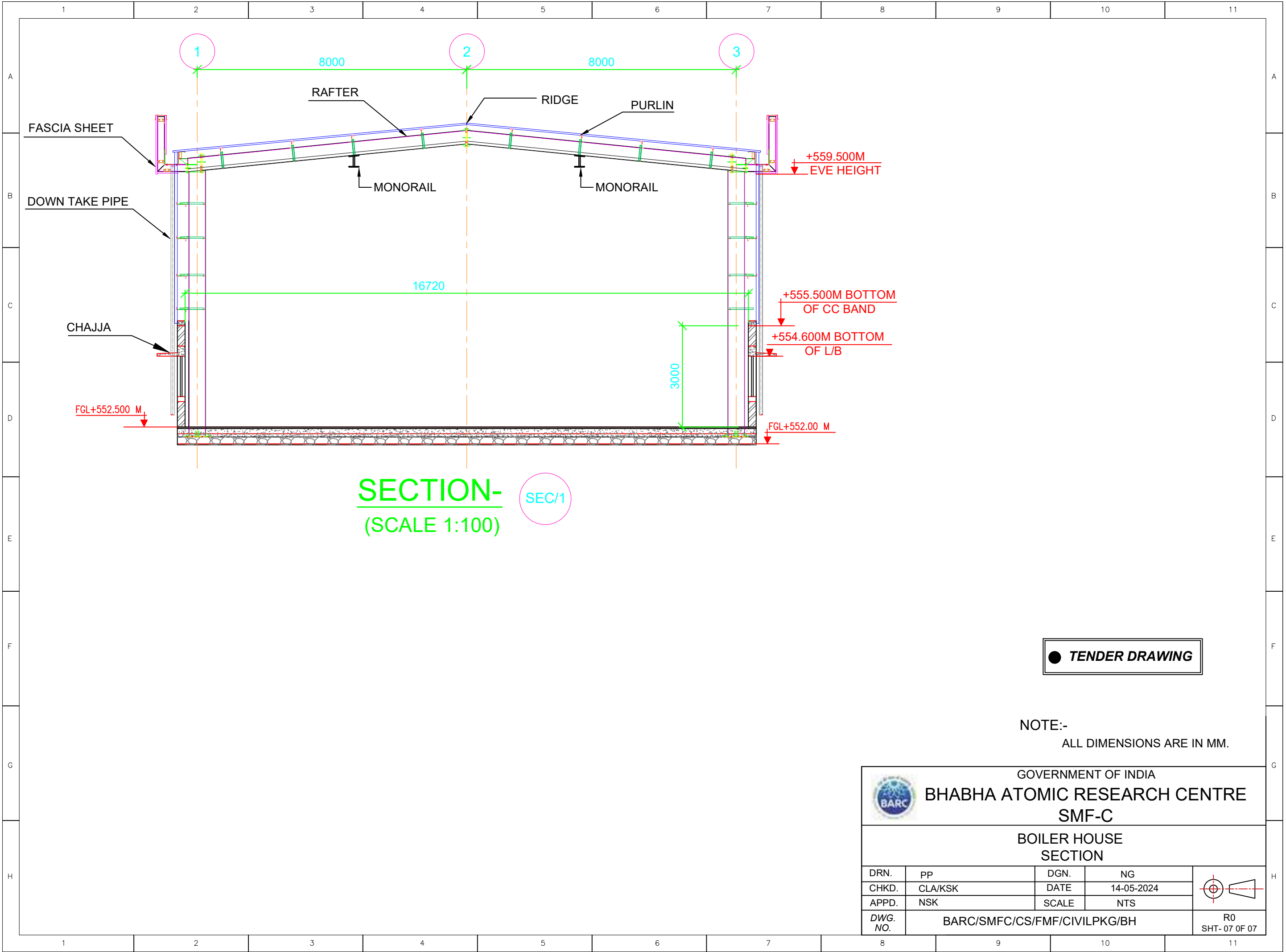
GOVERNMENT OF INDIA
BHABHA ATOMIC RESEARCH CENTRE
SMF-C

BOILER HOUSE
ELEVATION

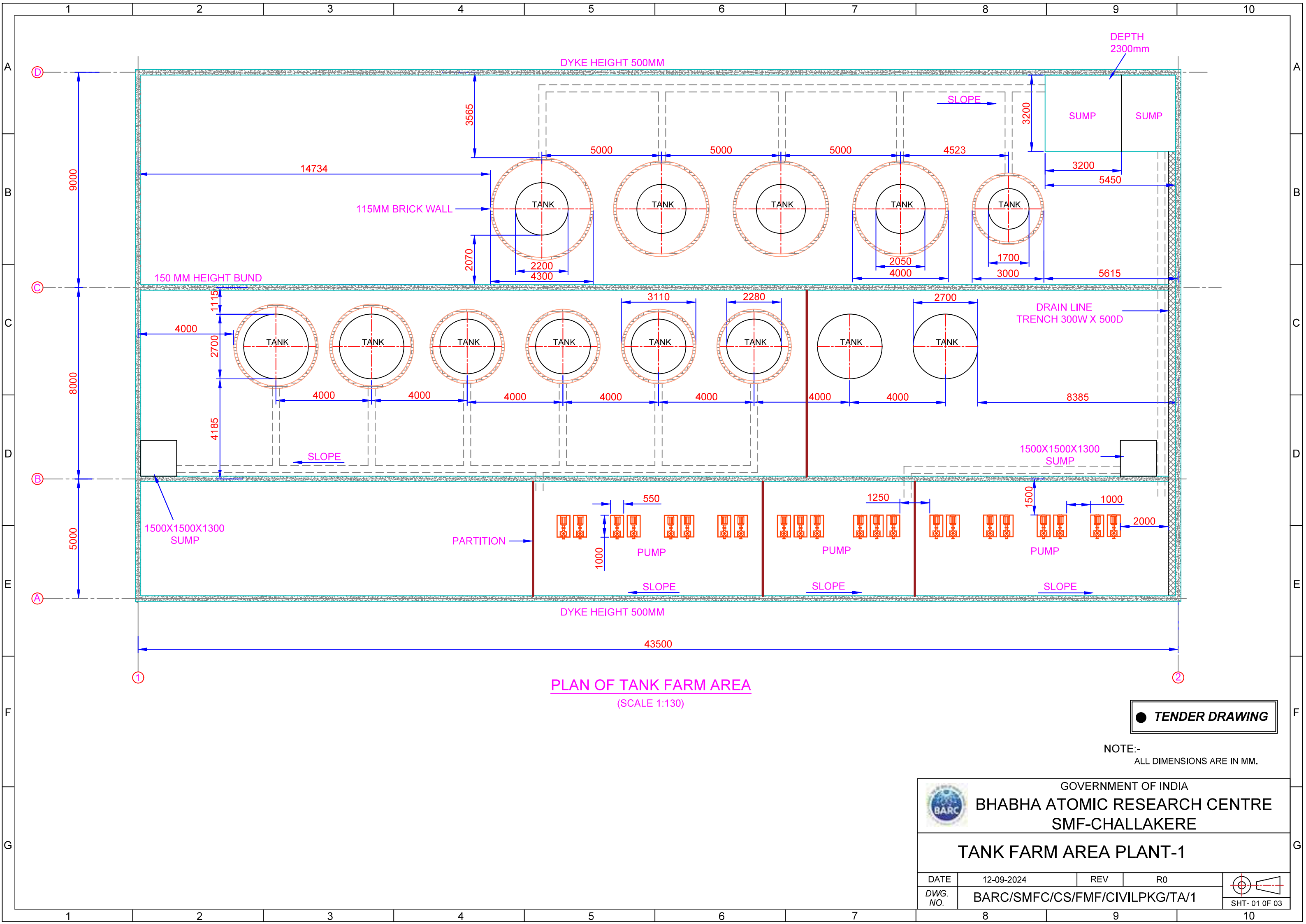
DRN.	PP	DGN.	NG
CHKD.	CLA/KSK	DATE	14-05-2024
APPD.	NSK	SCALE	NTS
DWG. NO.	BARC/SMFC/CS/FMF/CIVILPKG/BH		

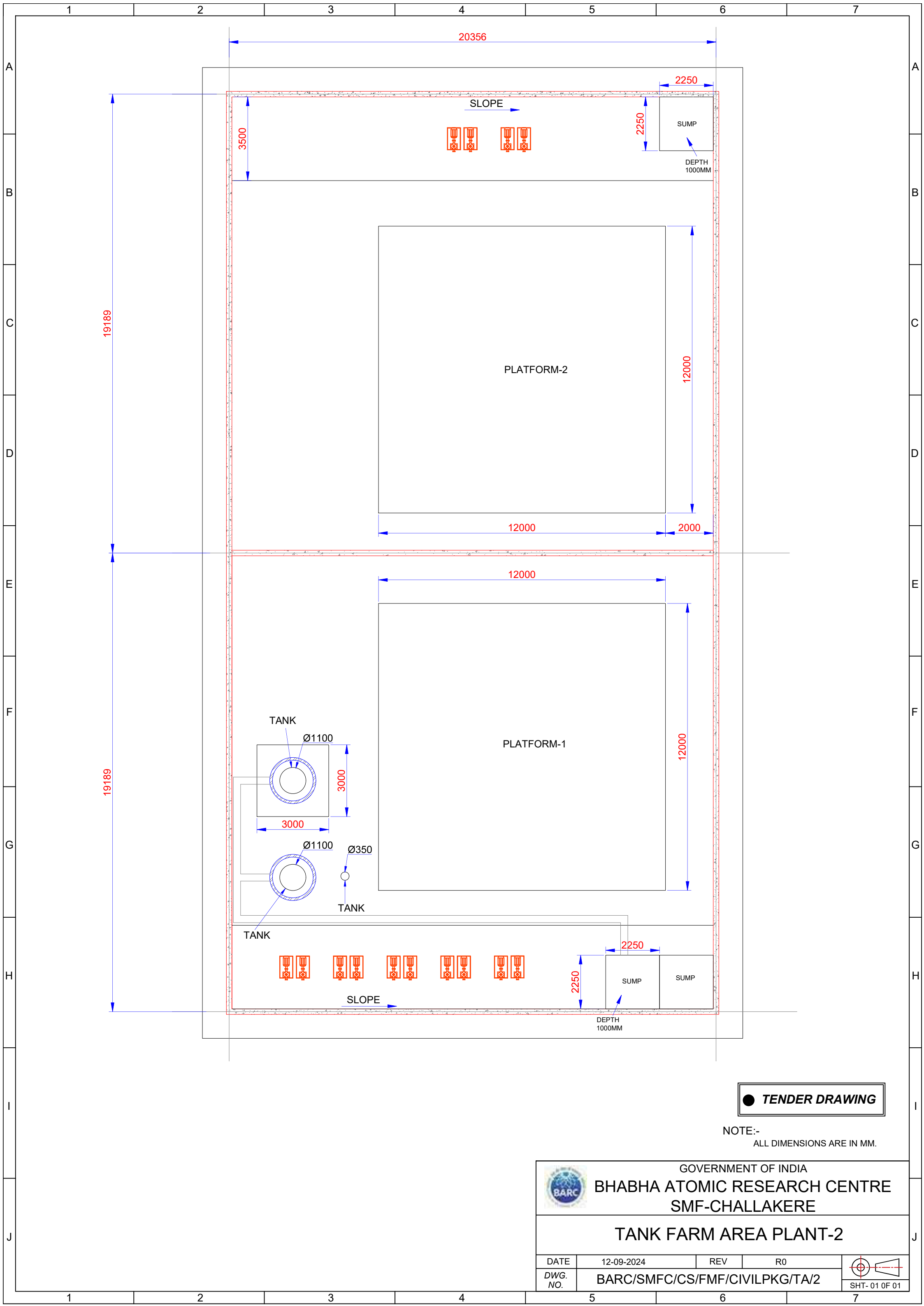

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SHT- 05 OF 07





TENDER DRAWINGS FOR TANK FARM AREAS





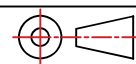
● **TENDER DRAWING**

NOTE:-
ALL DIMENSIONS ARE IN MM.

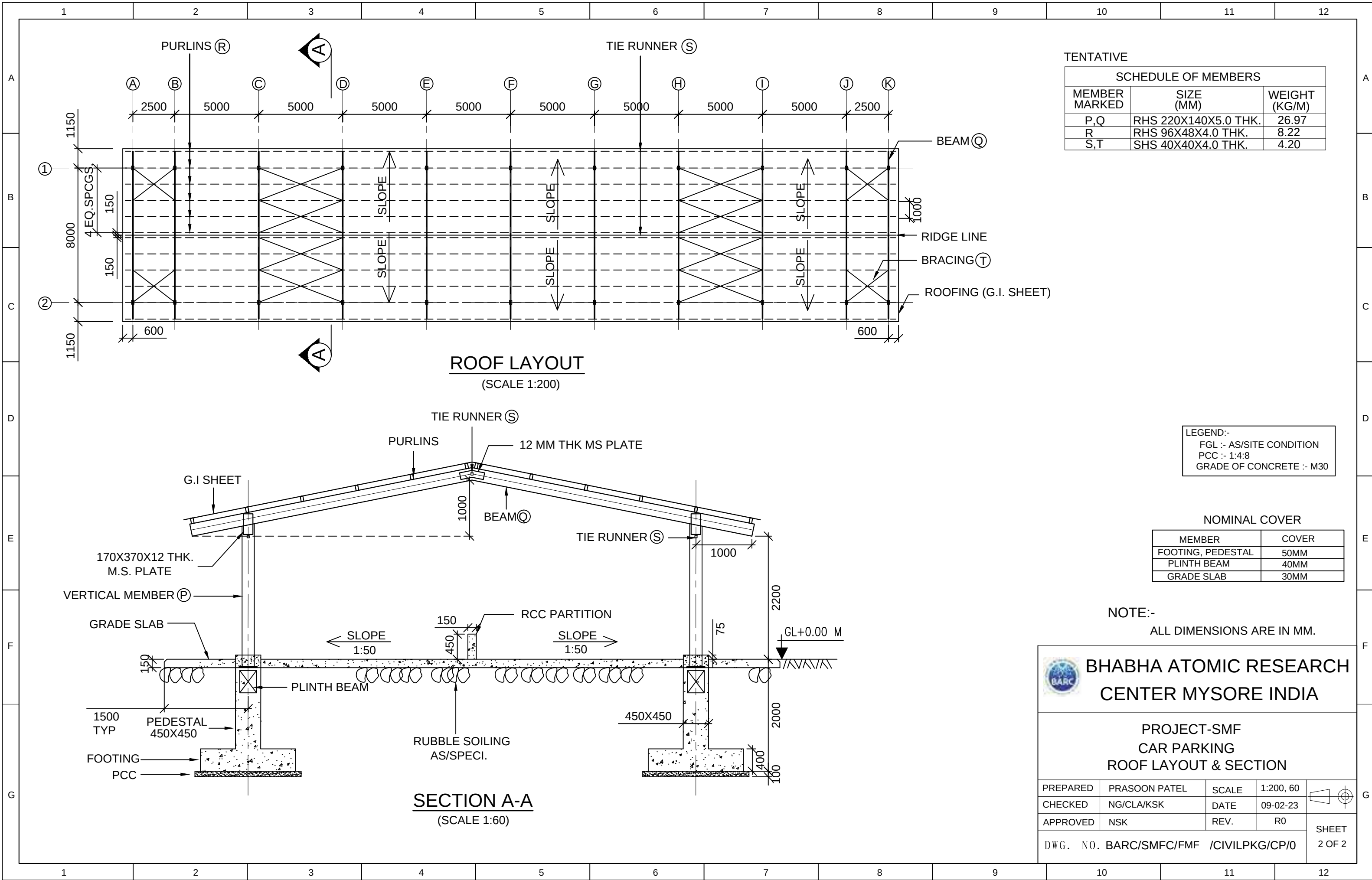


GOVERNMENT OF INDIA
BHABHA ATOMIC RESEARCH CENTRE
SMF-CHALLAKERE

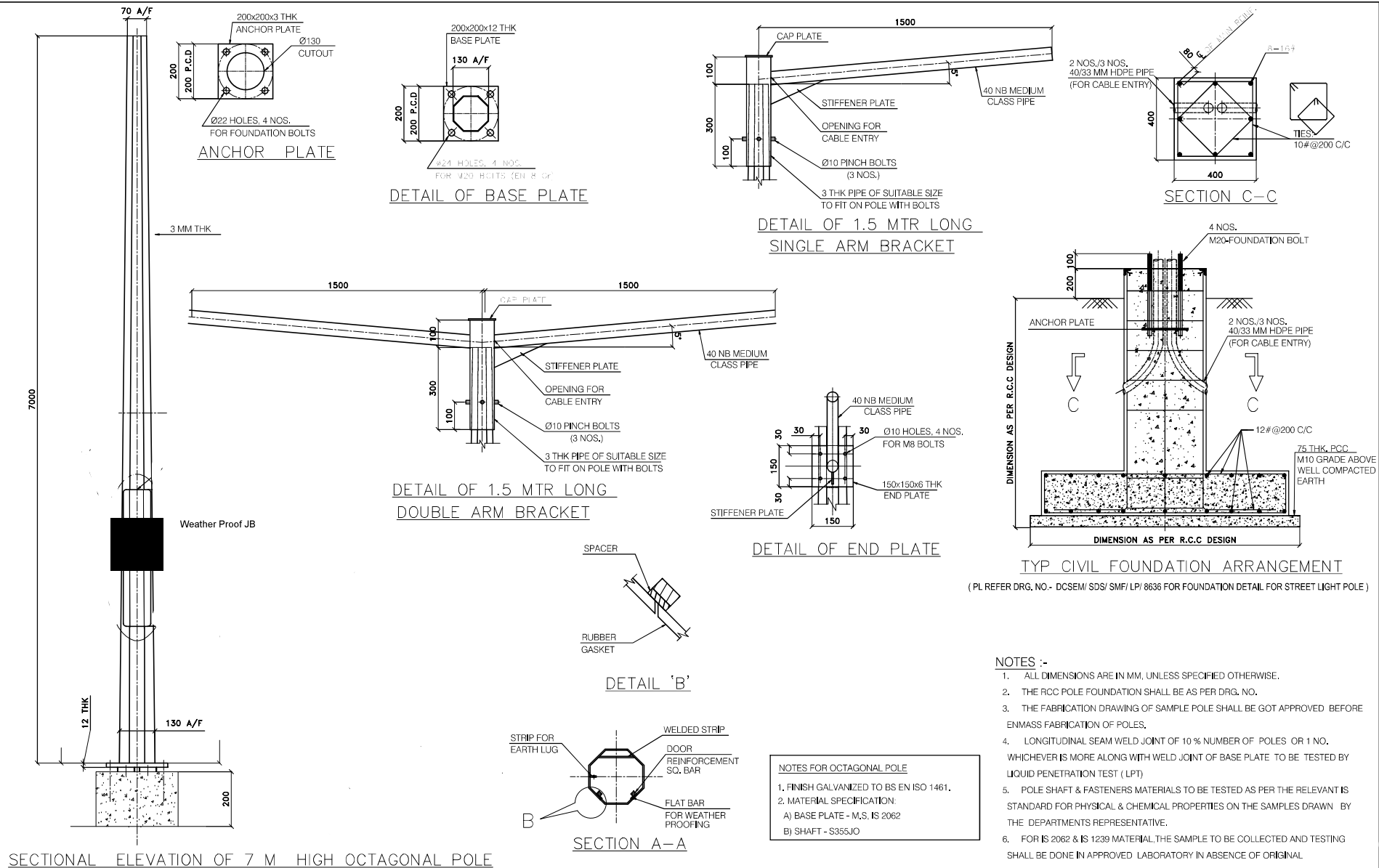
TANK FARM AREA PLANT-2

DATE	12-09-2024	REV	R0	 SHT- 01 OF 01
DWG. NO.	BARC/SMFC/CS/FMF/CIVILPKG/TA/2			

TENDER DRAWINGS FOR VEHICLE PARKING SHEDS



TENDER DRAWINGS FOR ELECTRICAL WORKS



BARC SMFC 7 Meter Octagonal Pole Drawing

PROFORMA OF SCHEDULES					
Name of the Work:		Design & Construction of Fire Station, Drill Tower, Boiler house, Tank farm areas including internal electrical, HVAC and other associated works at SMFC, BARC, Challakere, Karnataka.			
Tender No:		BARC/SMFC/CS/02/2024-25/NIT			
SCHEDULE ‘A’					
Schedule of materials to be issued to the contractor					
Sl. No.	Description of item	Rate at which the materials will be charged to contracted (issue rate & storage charges to be shown separately)			Place of issue
		Approx. Quantity	Unit	Rates	
1	2	3	4	5	6
1	Water for (i) Construction Activities (ii) Labour colony	As required	-	1 % of Gross Value of Work	(a) The locations of water supply points are indicated in the Tender drawings. They are Water Treatment Plant, located at the entrance gate, and the Fire Fighting Pump House at MRSS. (b) The contractor is responsible for arranging the pipe/hoses required to connect the outlet point to the water tanker..
2	Electricity for (i) Construction Activities (ii) Labour colony	As required	kWh	₹10 per kWh	(a) The locations of electricity supply points are indicated in the Tender drawings. They are at Workshop and portable container near MRSS. (b) The contractor is responsible for arranging the cable connection from the supply point to the work locations.
3	Land for (i) Temporary office and storage of Materials (ii) Labour colony	As required	-	At no cost. (During the Stipulated contract period and extended contract period)	Within the BARC site only, exact location shall be intimated by the EIC after placement of Contract.

PROFORMA OF SCHEDULES			
Name of the Work:		Design & Construction of Fire Station, Drill Tower, Boiler house, Tank farm areas including internal electrical, HVAC and other associated works at SMFC, BARC, Challakere, Karnataka.	
Tender No:		BARC/SMFC/CS/02/2024-25/NIT	
Notes: (1) Although the department provides land, water, and electricity, the contractor holds primary responsibility for arranging these utilities for both construction activities and the labour colony. The department shall not be held liable for any non-availability of land, water, or electricity during the contract period. In case of unavailability, the contractor must make alternative arrangements on their own. (2) The contractor shall barricade the labour colony with a 3-meter-high GI sheet providing sufficient illumination around the periphery, and having single entry/ exit gate. (3) The contractor shall provide round-the-clock security, with one Security personnel assigned for each 8-hour shift. (4) The facilities in the labour colony shall be provided by the contractor in accordance with the conditions mentioned in "Model Rules for the Protection of Health & Sanitary Arrangements for workers" and the "Safety code" of the Tender Document. (5) The contractor shall deploy a supervisor at all times in the labour colony to assist the department for security related issues. (6) Consumption of liquor and smoking are strictly prohibited in the construction site and labour colony. The contractor shall submit an undertaking to ensure compliance with this policy. (7)The Contractor will have to dismantle the labour colony, Temporary office, vacate the land after the receipt of due notice from Engineer-in-Charge., if the same is obstructing any work. (8) The contractor must immediately dismantle the labour colony, temporary office, vacate the land, and demobilize upon completion of the work. (9) The Existing water supply pipelines and Electricity cables shall not be disturbed by the contractor during execution of the work.			
SCHEDULE ‘B’			
Schedule of quantities		: Attached separately	
SCHEDULE ‘C’ (Not Applicable)			
Tools and plants to be hired to the contractor			
Sl. No.	Description of item	Hire charges per day	Place of issue
1	2	3	4
SCHEDULE ‘D’ (Not Applicable)			
Extra schedule for specific requirements / document for the work, if any.			

PROFORMA OF SCHEDULES	
Name of the Work:	Design & Construction of Fire Station, Drill Tower, Boiler house, Tank farm areas including internal electrical, HVAC and other associated works at SMFC, BARC, Challakere, Karnataka.
Tender No:	BARC/SMFC/CS/02/2024-25/NIT
SCHEDULE 'E'	
Name of the Work:	Design & Construction of Fire Station, Drill Tower, Boiler house, Tank farm areas including internal electrical, HVAC and other associated works at SMFC, BARC, Challakere, Karnataka.
Location:	: BARC, DoddUllarthi Kaval, Challakere, Karnataka-577537
Scope of work	: For detailed scope of work refer Technical Specification.
(i) Estimated cost of work	: ₹ 15,50,00,000.00 (+) GST as applicable.
(ii) Earnest money	: ₹ 28,29,000.00
(iii) Performance Guarantee	: 3% of tendered value (i.e. value of the entire work as stipulated in the letter of award.)
(iv) Security Deposit	: 2.5% of tendered value (i.e. value of the entire work as stipulated in the letter of award.)

PROFORMA OF SCHEDULES

Name of the Work:	Design & Construction of Fire Station, Drill Tower, Boiler house, Tank farm areas including internal electrical, HVAC and other associated works at SMFC, BARC, Challakere, Karnataka.		
Tender No:	BARC/SMFC/CS/02/2024-25/NIT		
SCHEDULE 'F'			
GENERAL RULES & DIRECTIONS		: Chief Engineer, BARC Mysuru	
Definitions:			
2(v) Engineer-in-Charge	: Officer-In-Charge appointed by Chief Engineer, BARC Mysuru		
2(viii) Accepting Authority	: Chief Engineer, BARC Mysuru		
2(x) Percentage on cost of materials and Labour to cover all overheads and profits	: 15%		
2(xi) Standard Schedule of Rates	: BARC Schedule of Rates		
2(xii) Department	: Bhabha Atomic Research Centre (BARC), Department of Atomic Energy, Government of India		
Clause 1			
Time allowed for submission of Performance Guarantee from the date of issue of letter of acceptance or Work Order	: 15 days		
Maximum allowable extension with late fee of 0.1% per day of Performance Guarantee amount beyond the period provided above	: 15 days		
Clause 2			
Authority for fixing compensation under Clause 2	: Chief Engineer, BARC Mysuru		
Clause 2A			
Whether Clause 2A shall be applicable	: No		
Clause 5			
Number of days from the date of issue of Work Order for reckoning date of start of Completion Period	: 15th day, after date of written order to commence the work. The date of commencement may be modified during award of work which shall be communicated in the work order.		
Table of Mile Stone(s) :			
SI No.	Description of Milestone	Time Allowed in days (from date of start)	Amount to be with-held in case of non achievement of milestone
1	1/8 th (of whole work) as assessed from the running payments	1/4 th (of Stipulated Completion period)	

PROFORMA OF SCHEDULES			
Name of the Work:		Design & Construction of Fire Station, Drill Tower, Boiler house, Tank farm areas including internal electrical, HVAC and other associated works at SMFC, BARC, Challakere, Karnataka.	
Tender No:		BARC/SMFC/CS/02/2024-25/NIT	
2	3/8 th (of whole work) as assessed from the running payments & Completion, handing over of Boiler House, in all aspects	2/4 th (of Stipulated Completion period)	In the event of non-achieving the necessary progress as assessed from the running payments, 1% of the tendered value of work will be withheld for failure of each milestone
3	3/4th (of whole work) as assessed from the running payments	3/4 th (of Stipulated Completion period)	
4	Full (of whole work) as assessed from the running payments	Full	
Time allowed for execution of work : 730 Calendar days including monsoon period.			
Authority to decide:			
(i) Extension of time		: Chief Engineer, BARC Mysuru	
(ii) Rescheduling of mile stones		: Superintending Engineer, BARC Mysuru	
Clause 6, 6A			
Clause applicable – (6 or 6A)		: Applicable	
Clause 7			
Gross work to be done together with net payment/ adjustment of advances for material collected, if any, since the last such payment for being eligible to interim payment		: RA Bill shall be paid monthly	
Clause 10A (Applicable)			
List of testing equipment to be provided by the contractor at site laboratory.			
1. Cube Moulds – 24 Nos.		2. Slump Cones -1 No.	
3. Micrometer Screw 25mm gauge-1 No		4. Steel tapes - 3m & 30m 3 Nos. each	
5.Vernier calipers -1 Nos.		6. Pycnometer-1 set	
7.Lab balance-5 kg , 2 Kg 1 Kg – 1 set		8. I.S. Sieves- for coarse aggregates and fine aggregates – 1 set	
9. Glass Flasks and metal container –As required		10 .Approved quality Plumb Bob – 1 Nos.	
11. Sprit Level Minimum 30 cm long with 3 bubbles for horizontal vertical- 1 Nos.		12. Wire gauge (Circular Type) Disc.-2 Nos.	

PROFORMA OF SCHEDULES		
Name of the Work:		Design & Construction of Fire Station, Drill Tower, Boiler house, Tank farm areas including internal electrical, HVAC and other associated works at SMFC, BARC, Challakere, Karnataka.
Tender No:		BARC/SMFC/CS/02/2024-25/NIT
13. Foot Rule.- 2 Nos.		14. Long Nylon thread – As required
15. Rebound hammer for testing concrete - 1 set		16. Proctor Density Test equipments-1 set
17.Magnifying Glass- As required		18. Screw driver 30CM Long- As required
19. Ball Pin hammer 100gm-1 set		20. Plastic Bags for taking samples- As required
21. Meggar (for Electrical Works)- 1 set		22. Concrete Cube Testing Machine with up to date calibration chart- 1 Set
23. Earth Resistance Test (For Electrical Works)- 1 set		24. Electric Oven with Thermostat - 1 set
25. Electrical Kit – 1 set.		26. Smoke test kit – 1 set
27. Thermometer – 1 No		28. Misc. equipment: As required
Note.: Contractor can either establish a complete field testing laboratory or shall tie up with an NABL accredited laboratory (Lab shall be approved by Engineer-in-Charge) for sample collection and testing as per the approved Quality Assurance Plan.		
Clause 10B(ii)		
Whether Clause 10B(ii) shall be applicable		: No
Clause 10C (Not Applicable)		
Component of labour expressed as percent of value of work		: - ----
Clause 10CA (Applicable)		
Materials covered under this clause (10 CA)	Nearest Materials for which All India Wholesale Price Index to be followed	Base Price of all the Materials covered under clause 10CA
Cement	Ordinary Portland cement	Rs. 5,400 per MT
Steel reinforcement bars	MS Wire Rods	Rs. 53,300 per MT
Note: Base price for materials given above are for regulating operation of clause 10-CA. The tenderers are requested to consider prevailing market rates while quoting the rates.		
Clause 10CC (Applicable)		
Clause 10CC to be applicable in contracts with stipulated period of completion exceeding the period shown in next column		: 365 Calendar days
Schedule of component of other Materials, Labour, P.O.L. etc. for price escalation.		

PROFORMA OF SCHEDULES				
Name of the Work:		Design & Construction of Fire Station, Drill Tower, Boiler house, Tank farm areas including internal electrical, HVAC and other associated works at SMFC, BARC, Challakere, Karnataka.		
Tender No:		BARC/SMFC/CS/02/2024-25/NIT		
Description of Component	Calculation of "W" (Cost of work for which escalation is applicable) will be based Schedule/ Group of Items	% Component expressed as percentage of Schedule/ Group of Items based on which "W" was calculated		Nearest Material/Commodity for which All India Wholesale Price Index to be followed/Labour Rates
Civil construction Materials (Other than Paid under Clause-10 CA)	Entire SOQ	Xm	: 35%	All commodities (MI/MI0)
Labour	Entire SOQ	Y	: 25%	Minimum daily wage in rupees of an unskilled adult male mazdoor (LI/LI0)
Clause 11 Specifications to be followed For execution of work : Technical Specifications as given in the Tender Document.				
Clause 12 12.2 & 12.3 Deviation Limit beyond which clauses 12.2 & 12.3 shall apply				
Schedule/ Group of Items		Deviation Limit %		
(i) Part - I - Civil Works -SOQ Item No.: 8 to 14 (Earthwork Items)		100%		
(ii) Part - I - Civil Works- rest of the SOQ Items (iii) Part - III - Electrical works (iv) Part - IV - Material Handling & Ventilation Works		30%		
Clause 16 Competent Authority for deciding reduced rates : Chief Engineer , BARC Mysuru				
Clause 18 List of mandatory machinery, tools & plants to be deployed by the contractor at site:				
1. Transit Concrete Mixer Plant with weight batching (AJAX or Equivalent)- 1 Nos		2. JCB / Poclain/ Excavator – 1 Nos		
3. Earth Rammer Machine- 2 Nos.		4. Tipper/Dumper- 1 Nos.		
5. Concrete mixer– 2 Nos.		6. Grinding / Polishing Machine – 1 No.		
7. Mortar mixing trough-2 Nos.		8. Centering & Shuttering Material – Minimum 1500 Sqm.		

PROFORMA OF SCHEDULES						
Name of the Work:		Design & Construction of Fire Station, Drill Tower, Boiler house, Tank farm areas including internal electrical, HVAC and other associated works at SMFC, BARC, Challakere, Karnataka.				
Tender No:		BARC/SMFC/CS/02/2024-25/NIT				
9. Needle vibrators- 4 Nos.			10. Bar bending/Cutting Machine-2 nos			
11. Building Hoist - 2 nos			12. All necessary safety PPE			
13. Misc. machineries, tools & plants - as required.						
Note: (i) The above mentioned list of machinery, tools & plant to be deployed by the contractor at site are the minimum mandatory requirements. The contractor shall deploy additional machinery, tools & plant in order to maintain the progress of the work without any extra cost to the department. (ii) Also the above mentioned list of machinery, tools & plant shall be available at appropriate stage of execution. The decision of the Engineer in Charge regarding this matter shall be final and binding						
Clause 36 (i)						
Requirement of Technical Representative(s) and recovery rate						
Sl. No.	Minimum Qualification n of Technical Representative	Discipline	Designation (Principal Technical/ Technical representative)	Minimum experience	Nos	Rate per month at which recovery shall be made from the contractor in the event of not fulfilling provision of clause 36(i)
1	Graduate Engineer	Civil Engineering	Project Manager	10 (and having experience of one similar nature of work)	1	Rs. 30,000/- per month
2	Post Graduate Engineer	Structural Engineering	Coordinator for design activities	5 (and having experience of one similar nature of work)	1	Rs. 30,000/- per month
3	Graduate Engineer or Diploma Engineer	Civil Engineering	Project / site engineer	5 or 10 Years Respectively.	1	Rs. 25,000/- per month
4	Graduate Engineer or Diploma Engineer	Civil Engineering	Project Planning /quality/ billing Engineer	2 or 5 Years Respectively.	1	Rs. 15,000/- per month

PROFORMA OF SCHEDULES						
Name of the Work:		Design & Construction of Fire Station, Drill Tower, Boiler house, Tank farm areas including internal electrical, HVAC and other associated works at SMFC, BARC, Challakere, Karnataka.				
Tender No:		BARC/SMFC/CS/02/2024-25/NIT				
5	Graduate Engineer or Diploma Engineer	Electrical Engineer	Project Planning /quality/ billing Engineer	2 or 5 Years Respectively.	1	Rs. 15,000/- per month
6	Diploma Engineer	Civil Engineering	Quality Assurance Engineer	2 Years	1	Rs. 15,000/- per month
7	Diploma Engineer	Safety	Safety supervisor	2 Years	1	Rs. 15,000/- per month
8	ITI	Instrumentation	Quality Assurance Engineer	2 Years	1	Rs. 15,000/- per month
9	ITI	Civil Draftsman	Civil Draftsman	2 Years	1	Rs. 12,000/- per month
Note: i) Assistant Engineers retired from Government services that are holding Diploma will be treated at par with Graduate Engineers. ii) This is the mandatory minimum strength required and shall be progressively deployed as per the instructions of the Engineer-in-Charge. iii) The Contractor can deploy more than the mandatory minimum strength (i.e adequate Nos. of technicians, site supervisors, accounts & office staff), considering the contractual obligations. iv) The contractor has to submit deployment schedule of all the Technical Representatives before commencement of the work to the Engineer in Charge.						
Clause 42 (Applicable)						
(I) Schedule / statement for determining theoretical quantity of cement & bitumen shall be on the basis of Technical Specifications/ BARC Schedule of Rates.						
(II) Variations permissible on theoretical quantities						
(a) Cement						
For works with estimated cost put to tender not more than Rs.5 Lakhs				: 3% plus / minus		
For works with estimated cost put to tender more than Rs.5 Lakhs				: 2% plus / minus		
(b) Bitumen all works				: 2.5% plus only & nil on minus side		
(c) Steel Reinforcement and structural steel Sections for each diameter, section and category				: 2% plus / minus		

PROFORMA OF SCHEDULES			
Name of the Work:		Design & Construction of Fire Station, Drill Tower, Boiler house, Tank farm areas including internal electrical, HVAC and other associated works at SMFC, BARC, Challakere, Karnataka.	
Tender No:		BARC/SMFC/CS/02/2024-25/NIT	
(d) All other materials		: Nil	
RECOVERY RATES FOR QUANTITIES BEYOND PERMISSIBLE VARIATION			
Sl. No.	Description of item	Rates in figures and words at which recovery shall be made from the contractor	
		Excess beyond permissible variation	Less use beyond the permissible variation
1	Cement	Nil	Rs. 10,800.00 per MT
2	Steel reinforcement bars	Nil	Rs.1,06,600.00 per MT

LETTER OF TRANSMITTAL
(on Letter Head of the Bidder)

From:

To
Chief Engineer,
Bhabha Atomic Research Centre,
Yelwal,
Mysore –571 130

Subject : Submission of Pre-qualification documents for “**Design & Construction of Fire Station, Drill Tower, Boiler house, Tank farm areas including internal electrical, HVAC and other associated works at SMFC, BARC, Challakere, Karnataka.**”

TENDER NOTICE No. : **BARC/SMFC/CS/02/2024-25/NIT;**

Sir,

Having examined the details given in Notice Inviting Tender and pre-qualification document for the above work, I/We hereby submit the pre-qualification document along with Techno-Commercial bid and other relevant information.

1. I/We hereby certify that all the statements made and information supplied in the uploaded forms “A” to “I” and accompanying statements are true and correct.
2. I/We have furnished all information and details necessary for Eligibility/ pre-qualification and have no further pertinent information to supply.
3. I/We submit the requisite certified solvency certificate and authorise the Chief Engineer to approach the Bank issuing the solvency certificate to confirm the correctness thereof. I/we also authorise BARC officials to approach individuals, employers, firms and corporation to verify our competence and general reputation.
4. I/We have uploaded scanned copy of the required affidavit to meet the requirement of the Notice Inviting Tender.
5. I/We submit the following certificates in support of our suitability, technical knowledge and capability for having successfully completed the following works:

Sr. No.	Name of work	Certified by/from

Date of submission/ Uploading

Signature of the Bidder(s), with seal

Form 'A'
FINANCIAL INFORMATION

I. Financial Analysis - Details to be furnished duly supported by figures in balance sheet/ profit and loss account for the last five years duly certified by the Chartered Accountant, as submitted by the applicant to the Income Tax Department (copies to be attached).

Particulars					
	FY:	FY:	FY:	FY:	FY:
i) Annual turnover Rupees (In Lakhs)					
ii) Profit/Loss Rupees (In Lakhs)					
iii) Certified by					

II. Financial arrangements for carrying out the proposed work. (Line of Credit, working capital, Liquid capital, fixed deposited etc.- Upload Scanned Copy)

III. Solvency Certificate from bankers of the bidder in the prescribed Form “B”

Name and address of Chartered Accountant

Unique Document Identification Number (UDIN)

Signature of Chartered Accountant, Date and Seal

Signature of the Bidder(s), with seal

Note: (1) Further details if required may be asked from the contractor after opening of the bids. There is no need to upload the entire voluminous balance sheet. (2) All the ten financial figures (i.e. Annual turnover & Profit/Loss) are to be mentioned on the UDIN Portal.

Scanned copy on Banker's letter head to be uploaded

FORM “B”

FORM OF BANKER’S CERTIFICATE FROM A NATIONALIZED BANK / SCHEDULED BANK

This is to certify that to the best of our knowledge and information that M/s / Shri _____
(with address) a customer of our bank are / is respectable and can be treated as good for any engagement upto a
limit of Rs. _____ (Rupees _____).

This certificate is issued without any guarantee or responsibility on the bank or any of the officers.

Signature & Seal of the bank officer

Date

E-Mail ID :

**(Please give domain specific email id, example :
sample@sbi.co.in)**

Phone. No.:

NOTE:

- (1) Bankers certificates should be on letter head of the Bank.
- (2) In case of Partnership firm, certificate should include name of all partners as recorded with the Bank.
- (3) The date of the certification should not be older than one year from the date of opening of tender

Signature of the Bidder(s), with seal

FORM 'C'
(on Letter Head of the Bidder)

DETAILS OF ALL SIMILAR WORKS COMPLETED IN ALL RESPECTS DURING THE LAST SEVEN YEARS

S No.	Name of work /project and location	Owner or sponsoring organisation	Cost of work Rupees (in Lakhs)	Date of commencement as per contract	Stipulated date of completion	Actual date of completion	Litigation / arbitration pending /in progress with details*	Name, Address, e-mail** & Phone No. of officer to whom reference may be made.	Remarks
1	2	3	4	5	6	7	8	9	10

* Indicate gross amount claimed and amount awarded by the Arbitrator.

**Bidder shall provide domain specific e-mail id (for example: sample@barc.gov.in) of the client to whom reference may be made.

Notes:-

a. Applicant may submit separate form for giving details of work (completed) for each year to fill up the details as above. Separate sheets if any shall be numbered in sequence.

b. The scanned copies of the work orders for each work along with completion certificate shall be uploaded.

c. Certified that the above list of works is complete and no work has been left-out and the information given is correct to my knowledge and belief.

Signature of the Bidder(s), with seal

FORM 'D'
(on Letter Head of the Bidder)

PROJECTS UNDER EXECUTION OR AWARDED

Sl. No.	Name of work/ project and location	Owner or sponsoring organisation	Cost of work in Lakhs Rupees	Date of commencement as per contract	Stipulated date of completion	Up to date percentage progress of work	Slow progress if any and reasons thereof	Name and address / telephone number of officer to whom reference may be made	Remarks

Certified that the above list of works is complete and no work has been left out & that the information given is correct to my knowledge and belief.

Signature of the Bidder(s), with seal

Scanned copy of certificates containing following information from the clients to be uploaded

FORM 'E'

PERFORMANCE REPORT OF WORKS REFERRED TO IN FORM "C"

(Separate certificate for each work/ Project)

1. Name of work/Project & Location

2. Agreement No.

3. Contract Value:

4. Cost of work i.e. Final

Completed Contract value

5. Date of start

(i) Stipulated date of commencement as per the contract

(ii) Actual date of commencement

6. Date of completion

(i) Stipulated date of completion

(ii) Actual date of completion

(iii) Present position of work, if in progress.

7. Justified period of Extension of Time (If applicable)

8. Amount of compensation levied for delayed completion, if any.

9. Amount of reduced rate items, if any.

10. Performance Report.

(1) Quality of work

Very Good/Good/Satisfactory/Fair/Poor

(2) Financial soundness

Very Good/Good/Satisfactory/Fair/Poor

(3) Technical Proficiency

Very Good/Good/Satisfactory/Fair/Poor

(4) Resourcefulness

Very Good/Good/Satisfactory/Fair/Poor

(5) General behaviour

Very Good/Good/Satisfactory/Fair/Poor

(6) Time Consciousness

Very Good/Good/Satisfactory/Fair/Poor

11. Contract terminated/foreclosure if any:

Dated:

**Executive Engineer or equivalent
Signature with Seal**

FORM 'F'
(on Letter Head of the Bidder)

STRUCTURE & ORGANISATION

1 Details of the bidder: Name, Postal Address, Ph. No. & E-mail for correspondence:

2 Registered Address of the bidder(s):

3 Legal status of the applicant (Please tick and attach attested copies of original document
(a) An individual; (b) A proprietary firm; (c) A firm in partnership
(d) A limited company or Corporation

4 Particulars of registration with various Government bodies (attach attested photocopy)

Dept./Organisation & Place of registration		Registration No.
1		
2		
3		

5 Names and Titles of Director & Officers with designation proposed to be concerned with this work

6 Designation of individuals authorised to act for the organisation

7 Was the applicant ever required to suspend construction for a period of more than six months continuously after you commenced the construction? If so, give the name of the project and reasons of suspension of work.

8 Has the applicant or any constituent partner in case of partnership firm, ever abandoned the awarded work before its completion? If so, give name of the project and reasons for abandonment.

9 Has the applicant, or any constituent partner in case of partnership firm, ever been debarred / black listed for tendering in any organisation at any time? If so give details.

- 10 Has the applicant, or any constituent partner in case of partnership firm , ever been convicted by a court of law? If so, give details.

- 11 In which fields of Engineering construction the applicant has specialisation and interest?

- 12 Any other information considered necessary but not included above.

Signature of the Bidder(s), with seal

FORM 'G'
(on Letter Head of the Bidder)

DETAILS OF TECHNICAL & ADMINISTRATIVE PERSONNEL TO BE EMPLOYED FOR THIS WORK

[illegible]

**Signature of the Bidder(s),
with seal**

FORM 'H'
(on Letter Head of the Bidder)

DETAILS OF CONSTRUCTION PLANT AND EQUIPMENT LIKELY TO BE USED IN CARRYING OUT THIS WORK

Sr. No	Name of Equipment/ Plant	Nos.	Capacity or Type & make	Age	Condition	Ownership status				Current Location	Remarks
						Presently owned	Leased	To be purchased	Proposed to be hired		
1	2	3	4	5	6	7	8	9	10	11	12
1	Transit Concrete Mixer Plant with weight batching (AJAX or Equivalent) or Concrete batching plant										
2	Truck / Tippers / Transit mixer										
3	Steel shuttering										
4	JCB / Poclain/ Excavator										
5	Vibratory roller										
6	Earth Rammer Machine										
7	Building Hoist										
8	Needle vibrators										
9	Bar bending/Cutting Machine										
10	Any other plants/ equipment										

**Signature of the Bidder(s),
with seal**

FORM – I								
BIDDING CAPACITY								
I. Maximum Value of works executed in any one year during the last five years ending on 31st March __, taking into account the completed as well as works in progress. (A):								
S.No.	Name of Work / Project & Location	Owner or Sponsoring Organization	Cost of work in Rupees	Date of commencement as per Contract	Stipulated date of completion	Actual date of completion	Work Completed in one year	
							Percentage	Value in Rupees
[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
1)	FROM FY TO FY							
2)	FROM FY TO FY							
3)	FROM FY TO FY							

4)	FROM FY TO FY							
5)	FROM FY TO FY							
Maximum Value of works executed in any one year during the last five years ending on 31st March 2024, taking into account the completed as well as works in progress (A):								

II.Value of existing commitments and ongoing works to be completed during the period of Completion of work for which bids have been invited.:

S.No.	Name of work /project and location	Owner or sponsoring organization	Contract Value of work in Rupees	Date of commencement as per contract	Stipulated date of completion	Up to date percentage progress of work.	Remaining work in percentage (100- Column 7)	Existing commitments (((Column 4 x Column 8) /100))	Name and address/ telephone number of officer to whom reference may be made	Remarks
[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]
a)Total (B) =										
III. Period of Completion of Work for Which Tender has been invited (No of years (N)) =										
IV. Bidding Capacity = ((AXNX2) –B) =										
Name and address of Chartered Accountant:										
Unique Document Identification Number (UDIN): (Note.: Values of A & B are to be mentioned on the UDIN Portal)										
Date of certification:										

Part-B

(Financial Bid/ Schedule of Quantity/ Price Schedule/ Schedule 'B'/ BOQ)

Name of Work : Design & Construction of Fire Station, Drill Tower, Boiler house, Tank farm areas including internal electrical, HVAC and other associated works at SMFC, BARC, Challakere, Karnataka.

Tender Notice No.: BARC/SMFC/CS/02/2024-25/NIT

General instructions to bidders

1) The Schedule of Quantity (Price Schedule/ Schedule 'B')/ BOQ is to be read for the purpose of pricing in conjunction with all other Tender documents.

2) **Rates to be quoted by the bidders should be inclusive of all taxes, duties, cess, Fee, royalty charges etc. levied under any statute but exclusive of GST for all the items.**

3) The makes and brands suggested in the tender document are general recommendation and for guidance of bidders to match performance parameters and tender specifications. The list is merely for guidance purpose. However, the bidder(s) can prefer any other alternate or equivalent makes and brands which is/are meeting the performance parameters and tender specifications by submitting technical details to substantiate their claims. To ensure equal opportunity, fair treatment for all bidders, and to avoid delays during execution of work, the pre-bid clarification stage is the appropriate time to propose alternate or equivalent makes and brands. The department will review these proposals and recognize them in the pre-bid clarification document after verifying the submitted technical details. Any delays after the award of work due to the time taken to convey acceptance or rejection of alternate or equivalent makes and brands suggested by the contractor (if any) will be the contractor's responsibility. Additionally, any extra costs resulting from superior specifications or performance of items or materials will not be payable. Only make and brands that meet the minimum local content as per the Public Procurement (Preference to Make in India) Order 2017 shall be considered for approval.

4) Payment terms:

a) For Part - I - Civil Works, the mode of measurement & payment shall be as per SOQ/ Conditions of Contract/ Specifications.

b) Part - II - Pre-Engineered Building works:

i) Against approval of architectural drawings from BARC: 1% of the Tendered value for Part - II - Pre-Engineered Building works.

ii) Against approval of structural drawings, DBR, DR, GA drawings etc. (Including civil foundations & Pre-Engineered Building portion). This should also include third party vetting from IIT/NIT/IISc/Approved Govt. Engg. College. as per specifications: 3% of the Tendered value for Part - II - Pre-Engineered Building works.

iii) Against submission of Good For Construction Drawings, submission of As-Built drawings.: 1% of the Tendered value for Part - II - Pre-Engineered Building works.

iv) On delivery of structural steel members, bracings, sag rods, coldform structural members like purlins & wall girths etc. at construction site and acceptance by BARC: 25% of the Tendered value for Part - II -Pre-Engineered Building works.

v) After supply of rockwool panels, flashings, cage ladder, rainwater pipes and other items required for completion of building as per tender document and acceptance at site by BARC: 15% of the Tendered value for Part - II - Pre-Engineered Building works.

vi) After completion of erection of structural steel members, (viz., columns, beams, bracings, tie rods, rafters etc.): 20% of the Tendered value for Part - II - Pre-Engineered Building works.

vii) After completion of erection of rockwool panels flashings, cage ladder: 20% of the Tendered value for Part - II - Pre-Engineered Building works.

viii) On completion of fittings of architectural items like, facia, rainwater pipes, rolling shutter, windows, corner beads, fits and finishes of all panels etc. including commission of the building: 15% of the Tendered value for Part - II - Pre-Engineered Building works.

c) For Part - III - Electrical works, Part - IV -Material Handling & Ventilation Works; the payment terms shall be as follows:

i) 70% of the SOQ item rate will be paid on pro-rata basis on receipt of materials at site in good condition and against submission of following documents: Contractor Invoice, packing list, Test certificate, Pre-dispatch inspection certificate / waiver of inspection, Warranty certificate, Dispatch clearance certificate issued by BARC (if applicable).

ii) 20% of the SOQ item rate be will be paid on pro-rata basis on after successful installation and test commissioning of the item and acceptance of the same by BARC.

iii) 10% of the SOQ item rate be will be paid on pro-rata basis after successful completion and final acceptance of the respective SOQ Part (i.e. Part-III/IV) by BARC.

5) With the approval of the Engineer-in-Charge, the successful bidder may subcontract the following portions of the work:

- (i) Design Activities, i.e. Item No. 1 of Part I – Civil Works
- (ii) Geo-technical Works, i.e. Item No. 2 to 7 of Part I – Civil Works
- (iii) Part II – Pre-Engineered Building Works
- (iv) Part III – Electrical Works
- (v) Part IV – Material Handling & Ventilation Works

Note: (a) The successful bidder shall be permitted to subcontract up to 25% of the total tendered value for the portions mentioned above, subject to approval by the Engineer-in-Charge. (b) The subcontractor must have successfully completed at least one work of similar nature, with a value not less than 40% of the portion to be subcontracted. Additionally, for Part III – Electrical Works, the subcontractor should have Electrical Class-I License/ Electrical Super Grade Contractor license or license issued by any government/ Aided officials in India, suitable for execution of the electrical works of the tender. (c) The contractor shall not be allowed to sub-contract works to any contractor from a country which shares a land border with India unless such contractor is registered with the competent authority. (Refer orders issued by Public Procurement Division, Department of Expenditure, ministry of Finance, Government of India their amendments/addendum from time to time.). (d) The details of subcontractors shall be submitted to BARC for approval within 15 days from the date of issue of work order. (e) Further refer to clauses/conditions mentioned in Section-V(i) of the Tender Document.

6) Intending bidders are advised to inspect and examine the site and its surroundings and satisfy themselves before submitting their bids as to the nature of the ground and sub-soil (so far as is practicable), the form and nature of the site, the means of access to the site, the accommodation they may require and in general shall themselves obtain all necessary information as to risks, contingencies and other circumstances which may influence or affect their bid.

7) The normal working hours will be from 0900 Hrs. to 1730 Hrs. on normal working days from Monday through Saturday and excluding Sundays and holidays. Depending upon the requirement, time schedule and the targets set to complete the job in time, the works may have to continue beyond normal working hours to the extent of round the clock and Holidays also, for which no extra claim shall be entertained. Permission for working beyond 1730 Hrs. on normal working days from Monday through Saturday and for working on Sundays & Holidays may be permitted by BARC based on written request by contractor, provided contractor complied with all statutory, safety requirements and applicable labour laws. Any permission to be obtained for the same is in the scope of contractor. It is therefore imperative that the contractor mobilizes sufficient manpower and tools & tackles to complete the work within 0900 Hrs. to 1730 Hrs. from Monday through Saturday only excluding Sundays & holidays.

Validate

Print

Help

Item Rate BoQ

Tender Inviting Authority: Chief Engineer, Bhabha Atomic Research Centre, Mysuru.

Name of Work: Design & Construction of Fire Station, Drill Tower, Boiler house, Tank farm areas including internal electrical, HVAC and other associated works at SMFC, BARC, Challakere, Karnataka.

Tender Notice No.: BARC/SMFC/CS/02/2024-25/NIT

Name of the Bidder/ Bidding Firm / Company :					
<u>PRICE SCHEDULE</u> <u>Abstract</u> (Note : (i) This BOQ template must not be modified/replaced by the bidder and the same should be uploaded after filling the relevent columns, else the bidder is liable to be rejected for this tender. Bidders are allowed to enter the Bidder Name and Values only. (ii) Bidders are requested to read the "General Instructions to Bidders" sheet and quote the rates accordingly. (iii) Rates to be quoted by the bidders should be inclusive of all taxes, duties, cess, Fee, royalty charges etc. levied under any statute but exclusive of GST for all the items.)					
NUMBER #	TEXT #	TEXT #	NUMBER #	NUMBER #	TEXT #
Sl. No.	Item Description	Item Code / Make	Quantity	TOTAL AMOUNT in Rs. P	TOTAL AMOUNT In Words
1	2	3	4	53	55
1	Part - I - Civil Works		1.000	0.00	INR Zero Only
2	Part - II -Pre-Engineered Building Works		1.000	0.00	INR Zero Only
3	Part - III - Electrical Works		1.000	0.00	INR Zero Only
4	Part - IV- Material Handling & Ventilation Works		1.000	0.00	INR Zero Only

Total in Figures			0.00	INR Zero Only

Tender Inviting Authority: Chief Engineer, Bhabha Atomic Research Centre, Mysuru.

Name of Work: Design & Construction of Fire Station, Drill Tower, Boiler house, Tank farm areas including internal electrical, HVAC and other associated works at SMFC, BARC, Challakere, Karnataka.

NIT No:- BARC/SMFC/CS/02/2024-25

Name of the Bidder/ Bidding Firm / Company :						
PRICE SCHEDULE Part - I - Civil Works (Note : (i) This BOQ template must not be modified/replaced by the bidder and the same should be uploaded after filling the relevant columns, else the bidder is liable to be rejected for this tender. Bidders are allowed to enter the Bidder Name and Values only. (ii) Bidders are requested to read the "General Instructions to Bidders" sheet and quote the rates accordingly. (iii) Rates to be quoted by the bidders should be inclusive of all taxes, duties, cess, Fee, royalty charges etc. levied under any statute but exclusive of GST for all the items.)						
NUMBER #	TEXT #	NUMBER #	TEXT #	NUMBER #	NUMBER #	TEXT #
Sl. No.	Item Description	Quantity	Units	RATE In Figures To be entered by the Bidder in Rs. P	TOTAL AMOUNT in Rs. P	TOTAL AMOUNT In Words
1	2	4	5	13	53	55
1	Architectural and Structural design activities:				0.00	INR Zero Only
1.1	Architectural designs and development of detailed drawings consisting of the following: a) development of detailed Architectural drawings, b) Working Drawings, all floor Plans, all Elevations, Sections through both the directions (X&Y) Door & Window Drawings including window grill drawings, detailed toilet drawings, Staircase drawings with railing details, Reflective ceiling plans/ false ceiling plans, Flooring pattern drawings, signages, c) detailed 3D Views indicating elevational details from all sides of buildings including colour schemes, walk through videos, d) Generation of drawings for all connected building elements & services such as structural, Civil finishes, plumbing, sanitary, Electrical installations, and HVAC: e) Support in obtaining all necessary statutory clearances from BARC authorities for construction clearance related to architectural aspects, along with documentation work and the supply of six sets (sizes not less than A-1) of all Good for Construction drawings. For Fire Station (RCC framed structure with only Ground floor) & Drill tower (RCC framed structure with Ground+3 floors).	1200.00	sqm			
1.2	Architectural designs and development of detailed drawings consisting of the following: a) development of detailed Architectural drawings, b) Working Drawings. c) Generation of drawings for all connected elements & services such as structural, Civil finishes (if any), Electrical installations. d) Support in obtaining all necessary statutory clearances from BARC authorities for construction clearance related to architectural aspects, along with documentation work and the supply of six sets (sizes not less than A-1) of all Good for Construction drawings. For Tank farm areas (Chemical Storage area with foundations for tanks and underground sumps.)	1740.00	sqm			
1.3	Architectural designs and development of detailed drawings consisting of the following: a) development of detailed Architectural drawings, b) working Drawings, all Elevations, Sections c) Generation of drawings for all connected elements & services such as structural, Civil finishes (if any), Electrical installations. d) Support in obtaining all necessary statutory clearances from BARC authorities for construction clearance related to architectural aspects, along with documentation work and the supply of six sets (sizes not less than A-1) of all Good for Construction drawings. Vehicle Parking sheds (=8 no's of vehicles & 1 no of fire tender)	480.00	sqm			
1.4	Structural Analysis & Design consisting of the following: a) Detailed Structural Analysis & Design including seismic analysis b) Preparation of detailed structural & Fabrication drawings. c) Obtaining approval for all the analysis & designs documents, drawings from any IIT/ NIT/ IISC/Approved Govt. Engg. College. All the documents/ drawing shall be signed by a person not below the rank of a professor. d) Support in obtaining all necessary statutory clearances from BARC authorities for construction clearance related to structural aspects, along with documentation work and the supply of six sets (sizes not less than A-1) of all Good for Construction structural drawings. For Fire Station (RCC framed structure with only Ground floor) & Drill tower (RCC framed structure with Ground+3 floors).	1200.00	sqm			
1.5	Structural Analysis & Design consisting of the following: a) Detailed Structural Analysis & Design including seismic analysis b) Preparation of detailed structural & Fabrication drawings. c) Obtaining approval for all the analysis & designs documents, drawings from any IIT/ NIT/ IISC/Approved Govt. Engg. College. All the documents/ drawing shall be signed by a person not below the rank of a professor. d) Support in obtaining all necessary statutory clearances from BARC authorities for construction clearance related to structural aspects, along with documentation work and the supply of six sets (sizes not less than A-1) of all Good for Construction structural drawings. For Tank farm areas (chemical storage area with foundations for tanks and underground sumps.)	1740.00	sqm			
1.6	Structural Analysis & Design consisting of the following: a) Detailed Structural Analysis & Design including seismic analysis b) Preparation of detailed structural & Fabrication drawings. c) Obtaining approval for all the analysis & designs documents, drawings from any IIT/ NIT/ IISC/Approved Govt. Engg. College. All the documents/ drawing shall be signed by a person not below the rank of a professor. d) Support in obtaining all necessary statutory clearances from BARC authorities for construction clearance related to structural aspects, along with documentation work and the supply of six sets (sizes not less than A-1) of all Good for Construction structural drawings. Vehicle Parking sheds (=8 no's of vehicles & 1 no of fire tender)	480.00	sqm			
1.7	Note for Item No.1: Tender drawings are enclosed. Please refer to the Technical Specifications for details regarding inputs to be provided by BARC, support for statutory clearances required, timeline for completion of design activities, duration for issuance of clearances/comments by statutory authorities, mode of measurement, and payment terms, etc.					

2	Mobilisation of suitable boring and drilling plant and all other allied equipment like boring rigs and all in-situ tests, equipment necessary to do the work under scope of this contract etc. including all skilled and unskilled personnel required for the work etc. complete and demobilisation of same on completion and removal from site as per the instruction of the Engineer-in-Charge. Note: (i) Contractor to mobilise sufficient equipment to the site in order to complete the work within the stipulated time frame. Drilling rigs must be capable of vertical drilling through all kinds of soils and all kinds of soft to basaltic /granite rock etc. all complete as per drawing and as directed by the Engineer-in-Charge. (ii) Prospective bidders shall visit the work site before quoting the for tender.	1.00	L.S.		0.00	INR Zero Only
3	Setting up boring rigs at each location for each borehole location including moves between borehole positions, locating and marking the location on the ground by actual survey, setting up of all field test equipment and bringing all personnel to the location to facilitate geotechnical investigation. Note: (i) Any criss-cross or back and forth movement of the rig can take place all as per directions and as directed by the Engineer-in-Charge. (ii) Location of borehole shall be furnished by the Engineer-in-Charge.	6.00	Nos.		0.00	INR Zero Only
4	Boring vertically through all kinds of soils for the following depths, weathered rock and soft rock, boulders met during drilling with suitable and adequate equipment of diameter 150 mm or more as required for depths as measured below existing ground level at rig location inclusive of casing pipes, wherever necessary, conducting Standard Penetration Test (SPT) including collection and logging of samples, placing them in approved wooden core boxes coated with a coat of anti-termite chemical in a proper sequence, numbering each sample, noting the lithology and transporting the boxes to core store etc., all complete as per direction of the Engineer-in-Charge. Note: (i) Rate of this item shall include conducting SPT at regular interval of 1.0m to 1.5m & where there is change in sub-surface profile and collecting, packaging and labelling disturbed samples therefrom. (ii) Rate also includes the cost of wooden core boxes. (iii) Depth will be measured below existing ground level (EGL) at rig location. (iv) Rock Quality Designation (RQD) of 25% and less shall be considered under this item.					
4.1	Depth from 0.00 m up to 10.00 m from EGL	60.00	Metre		0.00	INR Zero Only
4.2	Depth above 10.00 m and up to 20.00 m from EGL	60.00	Metre		0.00	INR Zero Only
4.3	Depth above 20.00 m and up to 30.00 m from EGL	60.00	Metre		0.00	INR Zero Only
5	Backfilling of boreholes with 1:1 cement : bentonite grout as per specification and direction of the Engineer-in-Charge.	6.00	Nos.		0.00	INR Zero Only
6	Conducting Plate Load Test (PLT) at founding level / weathered rock level /top of back-filling at locations identified by the Engineer-in-Charge for plate size of 600 mm (square/diameter) including cost of excavation, dewatering etc., all complete as per Specification and direction of the Engineer-in-Charge. Up to 160 T/sqm or failure whichever occurs earlier	7.00	Nos.		0.00	INR Zero Only
7	Preparation and submission of two (2) copies of Draft Reports as specified followed by five (5) copies of Final Report of Geotechnical Investigations as detailed in Specifications along with a soft copy of the same on the CD. Note: (i) All the field data shall be recorded in the Proforma in the relevant Indian Standard Codes / International Codes and the records shall be verified and countersigned by the Departmental engineer. (ii) The Geotechnical Investigation Report shall be accepted by the Engineer-in-Charge only if deliverables are reported by the Contractor as per above-mentioned formats. (iii) Deliverables shall include but not limited to the Formats mentioned above and any other site related specific data shall be furnished as per the requirements of the Engineer-in-Charge without any implication.	1.00	L.S.		0.00	INR Zero Only
8	Earthwork in excavation in foundations, trenches, pits, plinth beams etc. in cutting to proper lines, slopes and levels by mechanical means/manual means in ordinary and hard soils , for following depths including periodic survey and taking initial levels over the original ground prior to starting actual excavation work and final levels, supply of labour / tools & tackles / instruments / equipment / fuel, temporary work as necessary, dewatering including pumping if required, dressing of sides and ramming of bottom to proper level, clearing Jungle (for entire construction area), preservation of precious objects / relics / objects of antiquity etc. and delivery/handling over of the same to authorised persons/agencies appointed by BARC, supervision, fixing permanent points and markers, maintaining proper quality control, taking proper precautions to avoid slips of excavated edges as per the recommendations of slope stability analysis including shoring/strutting etc., and loading, transporting and disposing excavated soils in designated areas within a lead of 50 m etc., all complete as per specifications and as directed by the Engineer-in-Charge.					
8.1	For depth up to & including 1.50 m	1996.00	Cum		0.00	INR Zero Only
8.2	For depth beyond 1.50 m and up to & including 3.00 m	323.00	Cum		0.00	INR Zero Only
8.3	For depth beyond 3.00 m and up to & including 4.50 m	30.00	Cum		0.00	INR Zero Only
9	Earthwork in excavation in foundations, trenches, pits, plinth beams etc. in cutting to proper lines, slopes and levels by mechanical means/manual mean like picks, hammers, crow bars, wedges, etc. in soft / decomposed rock (without blasting) for following depths, including periodic survey and taking initial levels over the original ground prior to starting actual excavation work & final levels, supply of labour / tools & tackles / instruments / equipment / fuel, temporary work as necessary, dewatering including pumping if required, dressing of sides and bottom to proper level, clearing Jungle (for entire construction area), preservation of precious objects / relics / objects of antiquity etc. and delivery/handling over of the same to authorised persons/agencies appointed by BARC, supervision, fixing permanent points and markers, maintaining proper quality control, taking proper precautions to avoid slips of excavated edges as per the recommendations of slope stability analysis including shoring/strutting etc., and loading, transporting and disposing excavated rock in designated areas to a lead of 50m etc. all complete as per specifications and as directed by the Engineer-in-Charge.					
9.1	For depth up to & including 1.50 m	1069.00	Cum		0.00	INR Zero Only

9.2	For depth beyond 1.50 m and up to & including 3.00 m	472.00	Cum		0.00	INR Zero Only
9.3	For depth beyond 3.00 m and up to & including 4.50 m	84.00	Cum		0.00	INR Zero Only
10	Earthwork in excavation in foundations, trenches, pits, plinth beams etc. in cutting to proper lines, slopes and levels by means of Chiselling, wedging, use of rock hammers, pneumatic breaking equipment & cutters or any other agreed method in hard rock (without blasting) for following depths, including periodic survey and taking initial levels over the original ground prior to starting actual excavation work & final levels, supply of labour / tools & tackles / instruments / equipment / fuel, temporary work as necessary, dewatering including pumping if required, dressing of sides and bottom to proper level, clearing Jungle (for entire construction area), preservation of precious objects / relics / objects of antiquity etc. and delivery/handing over of the same to authorised persons/agencies appointed by BARC, supervision, fixing permanent points and markers, maintaining proper quality control, taking proper precautions to avoid slips of excavated edges as per the recommendations of slope stability analysis including shoring/strutting etc., and loading, transporting and disposing excavated rock in designated areas to a lead of 50m etc. all complete as per specifications and as directed by the Engineer-in-Charge.					
10.1	For depth up to & including 1.50 m	1988.00	Cum		0.00	INR Zero Only
10.2	For depth beyond 1.50 m and up to & including 3.00 m	641.00	Cum		0.00	INR Zero Only
10.3	For depth beyond 3.00 m and up to & including 4.50 m	106.00	Cum		0.00	INR Zero Only
11	Earthwork in backfilling with suitable earth obtained from excavation (in the above mentioned earth work items) in sides of foundations, trenches, pits, plinth etc. including loading, unloading transporting for lead up to 50 m and for all lifts including surveying and taking initial levels at bottom of excavation / over the original ground prior to starting actual filling work & final levels, supply of labour / tools & tackles / instruments / equipment / fuel, temporary work as necessary, dewatering including pumping if required, clearing debris, breaking clods, filling earth in layers not exceeding 250 mm (loose thickness), watering, ramming and compacting each layer to 95% of modified Proctor Density at optimum moisture content, carrying out field compaction tests at different stages of filling at designated locations as decided by the Engineer-in-Charge and also after filling is completed up to the entire height, carrying out field density tests, dressing of filled up area, supervision, fixing permanent points and markers on filled-up areas, maintaining proper quality control, etc., all complete as per specification and direction of the Engineer-in-Charge. Note: Payment shall be made for consolidated thickness only.	2948.00	Cum		0.00	INR Zero Only
12	Lead charges for 1st 1 KM or part thereof, by mechanical transport including loading unloading, stacking / levelling etc. For Soil Note: The rates are applicable for NET Quantities arrived at after making deduction for voids @ 20% in respect of soil from corresponding Stack / Truck Measurement.	2810.00	Cum		0.00	INR Zero Only
13	Filling available earth within the plant boundary (excluding rock) in trenches, plinth, sides of foundations, roads etc. in layers not exceeding 20cm in depth, consolidating each deposited layer by ramming and watering, lead up to 50 m and lift up to 1.5 m.	2810.00	Cum		0.00	INR Zero Only
14	Lead charges for 1st 1 KM or part thereof, by mechanical transport including loading unloading, stacking / levelling etc. For Rock Note: The rates are applicable for NET Quantities arrived at after making deduction for voids @ 50% in respect of Rock from corresponding Stack / Truck Measurement.	1995.00	Cum		0.00	INR Zero Only
14.1	Note : Applicable to all Items from 8 to 14 (1) For item no 8, 9 & 10, the Contractor shall take into account in his rate the provision for excess excavation for necessary working space, slope stability, safety etc., required for excavation and other allied works. The Measurement for payment shall be for the theoretical volume only i.e., the volume of the block of the excavation having maximum bottom dimension of the foundation (PCC dimension) as per drawing and mean depth measured from original ground level. (2) For item no 11 and item no 13, to the Measurement for payment shall be for the theoretical volume only i.e., the volume of the block of the excavation having maximum bottom dimension of the foundation (PCC dimension) as per drawing with deduction of volume of concrete structures as per drawing. (3) The contractor shall visit the site and acquaint himself and note that all jungle clearance work including cutting of trees carried out for construction of buildings, temporary structures like site office, stores, approach roads and additional area required for any survey etc. is deemed to be included in the respective items and no separate payment will be made on this account. (4) The dewatering, if any, required during excavation & any side slope / ramp made for contractor's own convenience shall not be measured nor paid for separately.					
14.2	(5) Lead to be measured from the nearest boundary of the building up to the respective point of disposal by shortest motorable route/ as per the Instruction of Engineer-in-Charge (6) A site management office to be located inside the site. Before the site work starts, a site management plan should be executed in order to manage site systematically. The site management plan should show the location of site office, stores, material storage area, movement path for vehicles, dust bins for site wastes, disturbed areas and non-disturbed area. In addition to this, rules and regulations as high lighted in the site planning report should be taken into account.					
15	Supplying and providing stone boulder soling below ground floor slab-on-grade and other areas in substructure below ground floor finished floor level over compacted fill with 63 mm and down graded stone having interstices filled with sand including spreading, hand picking, ramming, watering, compacting to specified thickness, supply of all materials / labour / equipment / instruments etc., supervision, maintaining proper quality control etc., all complete as per drawing and instruction of the Engineer-in-Charge.	1108.00	Cum		0.00	INR Zero Only
16	Supplying and injecting with approved quality chemical emulsion at the rates and concentrations as per IS : 6313-2001 (Part - II) for preconstruction ant termite treatment and creating a chemical barrier under and all around the masonry pits, masonry foundations, wall trenches, plinth filling, junctions of wall and floor, expansion joints, surfaces of RCC works for a depth of min. 500mm from the finished ground level, surrounding of pipes, conduits etc., walls retaining soil above floor level, apron and drain along the perimeter of the building including all by works complete as per specification / IS 6313:2001 and direction of Engineer-in-Charge only ground floor plinth area of the building will be measured for the payment in the following three stages: i) 20% after completion of the foundations ii) 50% after completion of the ground floor flooring iii) 30% after completion of all treatment works including ground floor doors & windows. Note : Work has to be executed by approved agency and specified guarantee for 10 (ten) years shall be furnished by the tenderer. Final Payment will be cleared only after submission of Guarantee.	5951.00	Sqm		0.00	INR Zero Only

17	Supplying and laying in position below foundations, trenches, pits, ground floor slabs, plinth protection etc. including all work in substructure and superstructure and in filling plain cement concrete of following nominal mixes using crushed stone as coarse aggregate including mixing, transporting, spreading and compacting to proper thickness and level, curing, maintaining proper quality control, supervision, supply of materials / electricity / water / labour / tools & tackles / instruments / equipment / fuel etc., excluding cost of shuttering work , all complete as per drawings, Specifications and direction of the Engineer-in-Charge. Note : (i) No extra payment will be made in case concrete is brought from approved RMC (Ready Mix Concrete) plant on account of breakdown of batching plant at site (ii) Manufactured sand used in concrete mixes shall conform to requirements of IS:383.					
17.1	Mix 1:4:8/M7.5 with minimum cement content of 170 Kg/Cum	824.00	Cum		0.00	INR Zero Only
17.2	Mix 1:3:6/M10 with minimum cement content of 220 Kg/Cum	28.00	Cum		0.00	INR Zero Only
17.3	Mix 1:2:4/M15 with minimum cement content of 320 Kg/Cum	40.00	Cum		0.00	INR Zero Only
18	Supplying and laying in position machine batched and machine mixed design mix M30 Grade concrete (conforming to IS 456) for reinforced cement concrete work in foundations, plinth beams, trenches, pits, duct-banks, ground floor slab-on-grade, minor equipment foundations etc. and all other work in substructure below and including ground floor finished floor level in all kinds of work using 20 mm and down graded crushed stones as coarse aggregate with minimum 340 kg/cum cement content including mixing with admixtures in recommended proportions as per IS:9103 to accelerate/retard setting of concrete and improve workability without impairing strength and durability, pumping of concrete in site of laying, spreading / laying, compacting to proper size / thickness and level, curing, maintaining proper quality control, supervision, supply of materials / electricity / water / labour / tools & tackles / instruments / equipment / fuel etc., trial mix and laboratory testing, rendering treatment at construction joints by using surface retarder in the form of thixotropic gel as per manufacturer's specification but excluding cost of shuttering and reinforcement, all complete as per drawings, specifications and directions of the Engineer-in-Charge.	2886.00	Cum		0.00	INR Zero Only
19	Supplying and laying in position machine batched and machine mixed design mix M 30 Grade concrete (conforming to IS 456) for reinforced cement concrete work in superstructure at all levels above ground floor finished floor level in all kinds of work using 20 mm and down graded crushed stones as coarse aggregate with minimum 340 kg/cum cement content as per approved design mix including mixing with admixtures in recommended proportions as per IS:9103 to accelerate/retard setting of concrete and improve workability without impairing strength and durability, pumping of concrete in site of laying, spreading / laying, compacting to proper size / thickness and level, curing, maintaining proper quality control, supervision, supply of materials / electricity / water / labour / tools & tackles / instruments / equipment / fuel etc., trial mix and laboratory testing, rendering treatment at construction joints by using surface retarder in the form of thixotropic gel as per manufacturer's specification but excluding cost of shuttering and reinforcement, all complete as per drawings, specifications and directions of the Engineer-in-Charge.	567.00	Cum		0.00	INR Zero Only
19.1	Note for item no. 18 & 19: (i) Cost of shuttering and reinforcement shall be paid in respective items. (ii) Rendering of treatment at construction joint shall be carried out under supervision of manufacturer, cost of which shall be included in rate of this item. (iii) Excess cement, if required in design mix, with respect to the minimum cement content mentioned above, shall be paid through respective item. (iv) Concreting of floor slabs has to be done with using concrete produced from RMC (Ready Mix Concrete) plant, no extra payment will be made on this account. (v) Manufactured sand used in concrete mixes shall conform to requirements of IS:383.					
20	Supplying and laying precast reinforced cement concrete elements with design mix M 30 grade (as per IS : 456) of concrete at various elevations in all kinds of works using 20 mm and down graded crushed stones as coarse aggregate with minimum 340 Kg/cum cement content as per approved design mix including supply of materials / electricity / labour / tools & tackles / instruments / equipment / fuel as required etc., formwork, mixing, laying, compacting to proper size and thickness, curing, storing, handling, transporting, erection without damage, setting in position with cement sand mortar 1:3 (1 cement : 3 coarse sand by volume) , grouting / welding as required etc. but excluding cost of reinforcement, all complete as per drawings, specifications and direction of the Engineer-in-Charge. Note : (i) Cost of reinforcement shall be paid in respective items. (ii) Excess cement, if required in design mix, with respect to the minimum cement content mentioned above, shall be paid through respective item. (iii) No extra payment will be made in case concrete is brought from approved RMC (Ready Mix Concrete) plant on account of breakdown of batching plant at site. (iv) Manufactured sand used in concrete mixes shall conform to requirements of IS :383.	30.00	Cum		0.00	INR Zero Only
21	Supplying and placing in position 25 mm thick bitumen impregnated fibre board conforming to IS:1838 in expansion / isolation / dry joints in concrete at ground floor and other levels including cost of primer, sealing compound Grade-A (IS:1834), supply of materials / electricity / labour / tools & tackles / instruments / equipment / fuel as required etc., placing in position, supervision, maintaining proper quality control, all complete as per drawings, specifications and direction of the Engineer-in-Charge.	132.00	Sqm		0.00	INR Zero Only
22	Supplying and installing following PVC ribbed water stops conforming to IS:12200 at construction / expansion joints between two RCC members and fixed to the reinforcement with binding wire before pouring concrete including supply of materials / labour / tools & tackles etc., placing in position, supervision, maintaining proper quality control, all complete as per drawings, specifications and direction of the Engineer-in-Charge :					
22.1	Serrated with central bulb (225 mm wide, 10 mm thick)	10.00	Rm		0.00	INR Zero Only
22.2	Dumb bell with central bulb (180 mm wide, 8 mm thick)	10.00	Rm		0.00	INR Zero Only
23	Grouting with M 35 Grade grout with minimum cement of 350 Kg/cum using 12 mm and down graded coarse aggregate including mechanical mixing, mixing plasticizer, preparation of concrete surfaces by chipping & cleaning, providing approved quality formwork as required, laying, compacting to proper shape / thickness and level, finishing the exposed surfaces, curing, maintaining proper quality control, supervision, supply of materials / electricity / water / labour / tools & tackles / instruments / equipment / fuel etc., all complete as per drawings, specification and direction of the Engineer-in-Charge. Note : Manufactured sand used in concrete mixes shall conform to requirements of IS : 383.	20.00	Cum.		0.00	INR Zero Only
24	Supplying and providing with cement based non-shrink compound free flow grout (ready mixed) of approved quality and manufacturer including mechanical mixing, surface cleaning, backing, furnishing side forms for exposed surfaces with chamfering (if necessary), laying, compacting to proper shape / thickness and level, curing, maintaining proper quality control, supervision, supply of materials / labour / tools & tackles / instruments etc., all complete as per drawing, manufacturer's specifications and direction of the Engineer-in-Charge.	20.00	Cum.		0.00	INR Zero Only

25	Extra rate for consumption of additional cement, if required, over the minimum cement content mentioned in respective design mix concrete work in item nos. 17, 18, 19 & 22 mentioned above both in substructure and superstructure. Note : (i) Payment shall be on the basis of actual quantity of cement used in mix concrete executed. (ii) The requirement of additional cement with respect to the minimum cement content mentioned against respective items of approved design mix of concrete by the Engineer-in-Charge during mix design stage based on laboratory test results.	162.00	M.T.		0.00	INR Zero Only
26	Providing and fixing unplasticised PVC (PVC)-Heavy duty pipes (12kg/cm²) of following diameters in RCC encased duct-banks below plinth level with pipe fittings including supply of all materials / labour / equipment, supervision, maintaining proper quality control, testing etc., all complete as per drawing and direction of the Engineer-in-Charge.					
26.1	100 mm diameter	50.00	Rm		0.00	INR Zero Only
26.2	150 mm diameter	50.00	Rm		0.00	INR Zero Only
26.3	200 mm diameter	50.00	Rm		0.00	INR Zero Only
26.4	250 mm diameter	50.00	Rm		0.00	INR Zero Only
27	Supplying & providing injection of cement mortar with approved waterproof expanding epoxy grouting compound of approved quality at construction joints / cracks / honey-comb areas in concrete under pressure through nozzles along the joint including installation of 12 / 18 mm dia threaded nozzles in concrete, grouting, sealing the nozzles with suitable admixture after the injection is over, supply of materials / labour / tools & tackles etc., supervision, maintaining proper quality control etc., all complete as per drawing, manufacturer's specification and direction of the Engineer-in-Charge. Note : The entire operation shall be carried out as per specification and supervision of manufacturer. The cost of such supervision by the manufacturer shall be included in rate.	50.00	Rm		0.00	INR Zero Only
28	Providing and mixing approved Liquid water proofing compound , as per the manufacturer's specification including cost of material complete with all by works as per drawing, manufacturer's specifications and instruction of the Engineer In charge.	476.00	Litre		0.00	INR Zero Only
29	Supplying, installing, dismantling and removing shuttering using good quality densified film faced plywood of approved make so as to produce neat form finished concrete surfaces for foundations & sub-structures up to ground floor finished floor level in all kinds of RCC work (footing, column, beams, trenches, pits, duct-banks, equipment foundations, ground floor slab-on-grade etc.) for all leads and lifts including necessary rendering of concrete surfaces after exposure, maintaining proper quality control, supervision, supply of materials / electricity / labour / tools & tackles / instruments / equipment / fuel as required etc., as per drawings, specification and direction of the Engineer-in-Charge. Note: (i) Only steel staging will have to be used for all structural / RCC work for all levels / heights. (ii) All surfaces adjacent to embedded parts etc., shall be in true line and level & irregularities, if any, shall be rounded by mechanical grinding, chiselling, finishing the same using epoxy silica sand mortar at no extra payment. (iii) The Design of Formwork shall be submitted for approval before commencement of work.	7015.00	Sqm		0.00	INR Zero Only
30	Supplying, installing including centering / strutting / propping etc., dismantling and removing shuttering using good quality densified film faced plywood of approved make so as to produce neat form finished concrete surfaces for superstructure at all levels above ground floor finished floor level in all kinds of RCC work (columns, beams, slabs, chajjias, walls, parapets, stairs, brackets, pergolas, overhead tanks equipment foundations etc.) for all leads and lifts including staging for all heights, forming pockets / chases / cut-outs in RCC work, necessary rendering of concrete surfaces after exposure, maintaining proper quality control, supervision, supply of materials / electricity / labour / tools & tackles / instruments / equipment / fuel as required etc., as per drawings, specification and direction of the Engineer-in-Charge. Note: (i) Only steel staging will have to be used for all structural / RCC work for all levels / heights. (ii) All surfaces adjacent to embedded parts etc., shall be in true line and level & irregularities, if any, shall be rounded by mechanical grinding, chiselling, finishing the same using epoxy silica sand mortar at no extra payment. (iii) The Design of Formwork shall be submitted for approval before commencement of work	4350.00	Sqm		0.00	INR Zero Only
31	Supplying, straightening, cutting, bending, binding with 2 nos. 20 gauge annealed soft iron wire and placing in position following types of reinforcement, of all diameters to all types of RCC members in substructure up to ground floor finished floor level including all lifts and leads, maintaining proper quality control, supervision, supply of materials / electricity / water / labour / tools & tackles / instruments / equipment / fuel etc., provision of necessary chairs/spacers, tying and bending of dowel bars, cover blocks of same grade of concrete, all complete as per drawings, specification and direction of the Engineer-in-Charge. Thermo-Mechanically Treated (TMT) bars of Grade Fe-500D conforming to IS:1786 Notes : (i) TMT bars to be supplied by the contractor shall be from the plants only using virgin materials. (ii) TMT bars/Reinforcement steel bars from rollers will not be accepted. (iii) No extra payment shall be made on account of rolling margin and wastage. (iv) Contractor shall supply copies of the documentary evidence of purchase of steel, test certificates from these manufacturers (steel either directly purchased or through their dealers) and also tests from third party, if required, to be arranged at no extra cost. (v) Welding weights, weight of binding wires etc. shall not be measured for payment but the cost of the same shall be deemed to have been included in the quoted rate. (vi) Chairs and spacers provided will also be measured for payment. (vii) Thermo-Mechanically Treated (TMT) bars of Grade Fe-550D conforming to IS:1786, will also be allowed without additional financial implications, at the same quoted rates.	247.00	M.T.		0.00	INR Zero Only

32	Supplying, straightening, cutting, bending, binding with 2 nos. 20 gauge annealed soft iron wire and placing in position following types of reinforcement, of all diameters to all types of RCC members in superstructure above ground floor finished floor level including all lifts and leads, maintaining proper quality control, supervision, supply of materials / electricity / water / labour / tools & tackles / instruments / equipment / fuel etc., provision of necessary chairs/spacers, tying and bending of dowel bars, cover blocks of same grade of concrete, all complete as per drawings, specification and direction of the Engineer-in-Charge. Thermo-Mechanically Treated (TMT) bars of Grade Fe-500D conforming to IS:1786 Notes : (i) TMT bars to be supplied by the contractor shall be from the plants only using virgin materials. (ii) TMT bars/ Reinforcement steel bars from rerollers will not be accepted. (iii) No extra payment shall be made on account of rolling margin and wastage. (iv) Contractor shall supply copies of the documentary evidence of purchase of steel, test certificates from these manufacturers (steel either directly purchased or through their dealers) and also tests from third party, if required, to be arranged at no extra cost. (v) Welding weights, weight of binding wires etc. shall not be measured for payment but the cost of the same shall be deemed to have been included in the quoted rate. (vi) Chairs and spacers provided will also be measured for payment. (vii) Thermo-Mechanically Treated (TMT) bars of Grade Fe-550D conforming to IS:1786, will also be allowed without additional financial implications, at the same quoted rates.	79.00	M.T.		0.00	INR Zero Only
33	Taking delivery from BARC, handling, transporting and installing in cement concrete in substructure and superstructure at all elevations Anchors, Anchor bolts, Sleeves, Inserts, Hangers, Conduits, Pipes and any other miscellaneous embedded fixtures; including supply of labour / tools & tackles / equipment for installation / necessary templates / cost of scaffolding/welding wherever necessary, as required, supervision, erection without damage, placing in position, maintaining proper quality control, all complete as per drawings, specifications and direction of the Engineer-in-Charge. Note : (i) The fabricated embedded items including lugs etc. shall be supplied by BARC. (ii) Jigs and other fixtures required for support shall be measured under respective item.	10.00	M.T.		0.00	INR Zero Only
34	Supply, fabrication and erection of structural steelwork conforming to IS : 2062 (Grade E250, Quality B0) for structures of following categories in substructure and superstructure in all kinds of work at all elevations including straightening of raw steel (if required), cutting, making edge preparation, making connections at fabrication yard by welding / bolting, hoisting, fixing in position by welding / bolting, supply of all materials / permanent bolts (property class 8.8) / erection bolts (property class 4.6) / nuts (property class 8) / fasteners / washers / welding electrodes and all other consumables / shims / packs / putty / gas / electricity / labour / tools & tackles / instruments / equipment / fuel etc., cleaning and preparation of all steel conforming to St-2 grade to Swedish Standard, storing, loading, transportation, unloading, delivery at erection site, maintaining proper quality control, supervision etc., surface preparation for painting, supplying and applying two (2) coats of protective primer of approved quality and shade to steelwork at shop / fabrication yard, touch-up painting / making good any damaged shop painting / completing any unfinished portion of the shop coat, erection, alignment and connections of all structures true to line, level, plumb and dimension including rectification if any, splicing, applying two (2) coats of final painting (finish coat before erection and final finish coat after completion of erection and final alignment), preparation of design drawing, fabrication drawings and erection marking drawings including bill of material, supplementary sketches, erection sequence drawings, all complete as per drawing, specification and direction of Engineer-in-Charge.					
34.1	Rolled sections and Built-up sections	22.00	M.T.		0.00	INR Zero Only
34.2	Chequered plates	5.00	M.T.		0.00	INR Zero Only
34.3	Gratings	1.00	M.T.		0.00	INR Zero Only
34.4	Handrails (MS pipes, medium duty) for steel ladder railing, balcony railing, staircase railing and similar works	4.00	M.T.		0.00	INR Zero Only
34.5	Note for Item No.: 34 (i) All steel materials shall be from plants only using virgin materials. (ii) Welding weights, connections, bolts and nuts etc. shall not be measured for payment but the cost of which shall be deemed to have been included in the quoted rate. (iii) Contractor shall supply copies of the documentary evidence of purchase of steel, test certificates from these manufacturers and also tests from third party, if required, to be arranged at no extra cost. (iv) All holes will be made by drilling only. Gas cutting of holes will not be permitted. (v) Painting: Primer coats : Epoxy resin based zinc rich primer of 35 micron DFT in each coat (total DFT of primer coats shall be 70 mm). Finish coat and Final finish Coat : Epoxy based paint of 40 micron DFT each. Total Dry Film Thickness (DFT) of painting shall not be less than 150 micron.					
35	Providing 50 mm thick damp proof course in cement concrete 1:2:4 using (1 cement : 2 Manufactured sand : 4 - 12.5mm max. size & down graded stone aggregate), mixed with approved water proofing compound at 3% by weight of cement or as per manufactures specifications to produce water tight concrete, laid to levels slopes etc. including applying a coat of hot bitumen of grade VG -10 at 1.7 kg/m² at all leads including cost of formwork, curing etc. complete all as per specifications, drawings and directions of the Engineer-in-Charge. Note: Payment for water proofing compound shall be paid under relevant item.	154.00	Sqm		0.00	INR Zero Only
36	Providing brickwork using best quality bricks with frog/indent, conforming to a minimum of class designation 5.0 as per IS:1077, in cement mortar 1:4 using Ordinary Portland cement in all types of substructure, drains; below and including ground floor finished floor level; including cut work, curing, double scaffolding, including filling of joints with CM 1:4 using Ordinary Portland cement and raking of joints, etc. with all bye-works, as per specifications, drawings and directions of the Engineer-in-Charge.	206.00	Cum		0.00	INR Zero Only

37	Providing brickwork using best quality bricks with frog/indent, conforming to a minimum of class designation 5.0 as per IS:1077, in cement mortar 1:4 using Ordinary Portland cement in superstructure at all levels above ground floor finished floor level in all kinds of work, including bands, pillars, ornaments of any shape, cornices, all complete including cut work, curing, double scaffolding, including filling of joints with CM 1:4 using Ordinary Portland cement and raking of joints, etc. with all bye-works, as per specifications, drawings and directions of the Engineer-in-Charge.	397.00	Cum		0.00	INR Zero Only
38	Providing brickwork (110 + 5) mm thick at all leads and lifts using bricks conforming to a minimum of class designation 5.0 as per IS:1077 in 1:4 cement mortar using Ordinary Portland cement, in superstructure at all levels above ground floor finished floor level in all kinds of work including providing horizontal RCC stiffeners with reinforcement at every fourth course with 2 M.S. bars of 6 mm dia in 1:2:4 concrete (as per requirement) at all locations and heights all as per drawing, specifications and as directed by Engineer-in-Charge including raking of joints.	387.00	Sqm		0.00	INR Zero Only
39	Providing and laying size stone masonry in cement mortar 1:6 in all types of substructures; below and including ground floor finished floor level including rough dressing and providing bond stones in each course at 2 m apart including curing, double scaffolding, raking of joints etc. complete all as per specifications & directions of the Engineer-in-Charge.	60.00	Cum		0.00	INR Zero Only
40	Providing and laying size stone masonry in cement mortar 1:6 in superstructure at all levels above ground floor finished floor level in all kinds of work, including rough dressing and providing bond stones in each course at 2 m apart including curing, double scaffolding, raking of joints etc. complete as per specifications & directions of the Engineer-in-Charge.	30.00	Cum		0.00	INR Zero Only
41	Providing cement pointing to stone work with cement mortar 1:3 including raking out joints, pointing neatly & finishing the joints as specified, curing, double scaffolding etc. at all leads and lifts, all complete as per specifications and directions of the Engineer-in-Charge.	100.00	Sqm		0.00	INR Zero Only
42	Providing drip mould of size 20mm x 8mm over cement plastering of chajias, roof projections etc. at all heights and levels in cement mortar 1:3 Ordinary Portland cement, hacking, curing, double scaffolding at all heights and lifts, etc. complete all as per specifications and directions of the Engineer-in-Charge.	357.00	Rm		0.00	INR Zero Only
43	Providing and making 10mm x 8mm grooves in at the junctions of heterogeneous construction material joints like concrete / masonry junctions etc. hacking, curing, scaffolding at all heights and lifts, etc. complete all as per specifications and directions of the Engineer-in-Charge.	713.00	Rm		0.00	INR Zero Only
44	Providing and fixing of 300mm wide chicken wire Plaster mesh made out of galvanized iron of nominal thickness 0.35 mm with a Zinc coating of 120 gms per Sqm at the junctions of Masonry and concrete works, chasing Works, diagonal fixing at corners of Doors & Windows openings including tying in position with suitable nails / screws etc. complete all as per manufacturer specification. The rate shall include for preparation of surface, cleaning, curing, double scaffolding etc. complete all as per specifications and directions of the Engineer-in-Charge.	544.00	Rm		0.00	INR Zero Only
45	Providing sand faced plaster 20 mm thick in 2 coats over external surfaces of masonry & concrete surfaces at all leads and lifts with base coat in cement mortar 1:4 using Ordinary Portland cement, 12 mm thick & finishing coat in cement mortar 1:3 , 8 mm thick final, double scaffolding wherever necessary, hacking of concrete surfaces, curing etc.; with water proofing compound at 2% by weight of cement or as per manufactures specification in the backing coat; complete with bye works as per drawings, technical specifications and instructions of the Engineer-in-Charge.	2785.00	Sqm		0.00	INR Zero Only
46	Providing 12 mm thick cement plaster 1:4 (1 cement : 4 fine sand) using Ordinary Portland cement smooth finish at all depths and heights in one layer on internal faces of walls, pillars, projection, bands, cornices etc., including necessary dabbng, curing, double scaffolding, etc., complete with all bye works at all heights as per specification and drawings.	4046.00	Sqm		0.00	INR Zero Only
47	Providing 6 mm thick cement plaster 1:3 (1 cement : 3 Fine sand) using Ordinary Portland cement to ceiling of slabs, chajias including drip course, bands, beams, columns, loft slabs, staircases, fins, roof projections etc. and any other location at all heights wherever required with all bye works such as dabbng, curing, scaffolding, etc., complete at all heights and levels as per specification and drawings.	4422.00	Sqm		0.00	INR Zero Only
48	Providing and applying white cement based putty of average thickness 2 mm of approved brand and manufacturer over the plastered wall surface to prepare the surface even and smooth complete with all bye works, double scaffolding, etc. at all heights and levels all as per specification, drawings and as directions of the Engineer-in-Charge.	200.00	Sqm		0.00	INR Zero Only
49	Providing and applying of painting on internal plastered surfaces with two coats of acrylic emulsion of approved shade over one coat of approved cement primer including preparing the surfaces by applying putty of approved brand (Fine finish) 2 coats, surface preparation, cleaning and all by works; filling hair cracks with putty / approved filler wherever required, double scaffolding & cleaning, cost of all materials, labour etc. at all heights and lifts, all as per drawing, specifications and as directed by Engineer-in-Charge.	7662.00	Sqm		0.00	INR Zero Only
50	Providing and applying two coats of water based 100% acrylic exterior emulsion over a coat of cement primer which in turn shall be applied over a coat of colourless bio wash over external concrete/masonry/plastered surfaces as antifungal treatment including prior washing of the surface with clean water, removal of dirt, debris etc. at all heights and levels, including surface preparation, scaffolding at all locations and heights with all by works; complete all as per drawings, specifications and as directed by Engineer-in-Charge.	3026.00	Sqm		0.00	INR Zero Only

51	Providing and applying two coats of acrylic oil bound washable distemper over internal plastered surfaces of approved shade over one coat of approved cement primer consisting of volatile organic compounds less than 250g/L, including preparing the surfaces by applying putty of approved brand (Fine finish) 2 coats, surface preparation, cleaning and all by works, filling hair cracks with putty / approved filler wherever required, double scaffolding & cleaning, cost of all materials, labour etc. at all heights and lifts, all as per drawing, specifications and as directed by Engineer-in-Charge.	99.00	Sqm		0.00	INR Zero Only
52	Providing and applying of painting on steel surfaces with two coats of Poly Urethene paint (PU Paint) of approved shade over one coat of approved steel primer including preparing surfaces wherever required, double scaffolding & cleaning cost of all materials, labour etc. at all heights and lifts, all as per drawing, specifications and as directed by Engineer-in-Charge.	200.00	Sqm		0.00	INR Zero Only
53	Providing and fixing Fiber Glass Reinforced plastic (F.R.P.) Door Frames of approved colour and finish, minimum cross-section 90 mm x 45 mm having single rebate of 32 mm x 15 mm to receive shutter of 30 mm thickness. The laminate shall be moulded with fire resistant grade unsaturated polyester resin and chopped mat. Door frame laminate shall be 2 mm thick and shall be filled with suitable wooden block in all the three legs. The frame shall be covered with fiberglass from all sides. M.S. stay shall be provided at the bottom to steady the frame. The work shall be carried out as per drawing, specifications and as directed by Engineer-in-Charge.	124.00	Rm		0.00	INR Zero Only
54	Providing and fixing 30 mm thick Fiberglass Reinforced Plastic (F.R.P.) flush door shutter of approved colour and finish made with fire retardant grade unsaturated polyester resin, moulded to 3 mm thick FRP laminate all around with suitable wooden blocks inside at required places for fixing of fittings and polyurethane foam (PUF) Polystyrene foam to be used as filler material throughout the hollow panel, casted monolithically with testing parameters of F.R.P. laminate conforming to table - 3 of IS: 14856. The work shall be carried out as per drawing, specifications and as directed by Engineer-in-Charge.	66.00	Sqm		0.00	INR Zero Only
55	Supplying and fixing Rolling shutters as per ISI standards made out of required size of MS lathes 18 gauge interlocked together throughout entire length and jointed together at the end by end locks mounted on specially designed pipes shaft with brackets, side guides and arrangements for inside & outside locking with push and pull operation complete including the cost of providing and fixing necessary springs of required size and M. S top cover of required thickness for rolling shutters. Rolling shutters PULL and PUSH type including top hood 0.90 mm thick	40.00	Sqm		0.00	INR Zero Only
56	Extra rate over the cost of rolling shutters for providing and fixing motorized arrangements (with remote & manual operation) including designing, control panels, limit switches, required wiring and cables from panel to motor and required size of shaft etc. all as per standard specifications including commissioning and testing complete as directed by the Engineer-in charge. (only power supply point will be provided) For rolling shutters above 15.00 Sq.m and up to 30.00 sq.m opening area.	3.00	Each		0.00	INR Zero Only
57	Providing and fixing of Hollow metal doors made of pressed galvanized steel conforming to IS : 277 with the following specification. Doors shall be with vision glass and louver as a part of complete assembly. Door frame shall be single rebate grooved profile of minimum size 125 x 60 mm made out of minimum 1.60 mm (16 gauge) thick galvanized steel sheet. Frames shall be mitred and field assembled with self tabs. Frames to have in build grooved sealing system and shall be site fitted with PVC seal as standard. All provision should be mortised, drilled and tapped for receiving appropriate hardware. Frames should be provided with back plate bracket and anchor fasteners for installation on a finished plastered masonry wall opening. Frames shall be filled with fire rated puff. Door leaf shall be minimum 46mm thick fully flush double skin door, with or without vision lite as per approved shop drawing. Door leaf shall be manufactured from minimum 1.2mm (18 gauge) thick galvanised steel sheet. The internal construction of the door should be rigid reinforcement pads for receiving appropriate hardware. The infill material shall be resin bonded honeycomb core. All doors shall be factory prepared for receiving appropriate hardware and provided with necessary reinforcement for hinges, locks, and door closers etc. The edges should be interlocked with a bending radius of 1.4mm. For pair of doors integrated astragals has to be provided on the meeting stile for both active and inactive leaf. Vision lite wherever applicable should be provided as per manufacturers recommendation with a clip-on arrangement. The glass should be 6mm clear borosilicate fire rated glass of relevant rating of the door. All doors and frames shall be finished Powder with approved colour and shall have passed minimum 250 hours of salt spray test. Note: (i) Shop drawing has to be submitted for approval of Engineer-in-charge. (ii) Clear opening in masonry shall be measured for payment. (iii) Rate is inclusive of the following fixtures such as hinges (S.S. 304 Ball bearing butt hinges 100mm X 75mm X 3mm - 4 nos. for each shutter), locks (Mortice dead lock- one for each door), door closers (heavy duty - one for each shutter), S.S. Handles (D-type Pull handle - 200mm long, 25mm dia. - both sides for each shutter), Concealed flush bolt from door manufacturer, any other fixtures etc. of approved brand.	57.00	Sqm		0.00	INR Zero Only
58	Providing and fixing of 120 minutes fire rated doors as per IS 3614 part-1 & part-2 for stability and integrity using Pressed Galvanized steel conforming to IS : 277. The vendor shall submit test certificate (tested at CBRI or ARAI or as approved) confirming for maximum rating of 2hrs with vision panel. Test certificates should be available for vision lites /panels as part of the fire door assembly. Independent glass test certificates will not be accepted. Manufacturer test certificate shall cover doors both single and double leaf and all doors supplied should be within the tested specimen, deviation in specification and sheet thickness other than what is mentioned in the test certificates are not allowed. Proper label confirming the type of door and the hourly rating is mandatory. Door frame shall be double rebate frame profile of size minimum 143 mm x 57mm made out of 1.60 mm (16 gauge) minimum thick galvanized steel sheet. Frames shall be Mitred and field assembled with self tabs. All provision should be mortised, drilled and tapped for receiving appropriate hardware. Frames should be provided with back plate bracket and anchor fasteners for installation on a finished plastered masonry wall opening. Once frame installed should be filled with PUF or with cement & sand slurry as recommended by the manufacturer of the engineer Door leaf shall be 46mm thick fully flush double skin door with or without vision lite. Door leaf shall be manufactured from 1.2 mm (18 gauge) minimum thick galvanised steel sheet. The internal construction of the door should be rigid reinforcement pads for receiving appropriate hardware. The infill material shall be resin bonded honeycomb core.	16.00	Sqm		0.00	INR Zero Only
58.1	All doors shall be factory prepped for receiving appropriate hardware and provided with necessary reinforcement for hinges, locks, door closers etc. The edges should be interlocked with a bending radius of 1.4mm. For pair of doors integrated astragals has to be provided on the meeting stile for both active and inactive leaf. Vision lite wherever applicable should be provided as per manufacturers recommendation with a clip-on arrangement. The glass should be 6mm clear borosilicate fire rated glass of relevant rating of the door. All doors and frames shall be finished with polyurethane aliphatic grade powder coating minimum 50 microns of approved colour. The door leaf and frame shall have passed minimum 250 hours of salt spray test. Note: (i) Shop drawing has to be submitted for approval of Engineer-in-charge. (ii) Clear opening in masonry shall be measured for payment. (iii) Rate is inclusive of the following fixtures such as hinges (S.S. 304 Ball bearing butt hinges 100mm X 75mm X 3mm - 4 nos. for each shutter), locks (Mortice dead lock- one for each door), door closers (heavy duty - one for each shutter), S.S. Handles (D-type Pull handle - 200mm long, 25mm dia. - both sides for each shutter), Concealed flush bolt from door manufacturer, any other fixtures etc. of approved brand.					

59	Providing & fixing in position 15 micron (grade AC 15) anodized aluminium sections of approved colour in partitions, doors, windows, ventilators, louvers, fixed glazing, sliding windows, structural glazing, aluminium rough ground etc. using anodised Aluminium sections, anodised Aluminium beadings, anodised Aluminium profile panel sheets, manufactured to relevant I.S. codes & using heavy sections (thickness as specified) from approved manufacturer; including cost of providing and fixing required no. of approved door and windows handles, pivots, EPDM Gasket, PVC/Neoprene Gasket Lining, Stainless steel screws, mastic filling, weather strips, handles, nuts, washers, etc. as required and as per approved shop drawing, all complete at all heights and as directed by the Engineer-in-Charge. The rate shall also include giving a coat of bitumastic paint on the aluminium surfaces in contact with masonry / concrete and closing the gaps around the frame and the adjoining surface with approved silicone sealant on both faces to achieve water tightness. Note: i. Payment will be made on the basis of weight of aluminium members/sections fabricated & actually installed in position without extra allowance for wastages. No extra payment will be made for all non-aluminium consumable items like screws, gasket, weather strips, PVC/Neoprene lining, other fixtures etc. ii. Glazing, Particle Boards, aluminium grills, mesh etc. will be measured and paid separately under relevant item. iii. All fitting shall be of matching colour anodized aluminium sections. iv) Design/shop drawing has to be submitted for approval of Engineer-in-charge.	2197.00	Kg		0.00	INR Zero Only
60	Providing and fixing double action hydraulic floor spring of (weight capacity up to 100 Kg) conforming to IS : 6315 with stainless steel cover plate including pivot having brand logo embossed on the body / plate with double spring mechanism and door weight up to 125 kg. for doors including cost of cutting floors, embedding in floors as required, making good the same matching to the existing floor finishing, fixing cover plates to single piece M.S. sheet outer box etc. complete as per the direction of Engineer-in-Charge.	50.00	Each		0.00	INR Zero Only
61	Providing and fixing satin finished S.S. hardware fittings with approved quality, fixed with SS screws including all by works complete at all leads and lifts as per specification, drawing and instructions of Engineer-in-Charge(Fittings shall not be paid separately in composite items which specify inclusion of fittings).					
61.1	Door handles (PH combo dot)-D' type profile - made from AISI 316 grade- 400mm long, 25mm dia.	4.00	Each set		0.00	INR Zero Only
61.2	Floor Door stopper	30.00	Each		0.00	INR Zero Only
61.3	Heavy duty automatic Door closer (Up to 90Kg)	30.00	Each		0.00	INR Zero Only
61.4	Stainless steel Cylindrical lock-Keyed	13.00	Each		0.00	INR Zero Only
61.5	Stainless steel Cylindrical lock-Keyless	10.00	Each		0.00	INR Zero Only
62	Providing & fixing satin finished S. S. Tower bolts (made from S.S.-304 grade) with approved quality, fixed with S.S. screws including all bye-works complete at all leads and lifts as per specification, drawing and instructions of Engineer-in-Charge. 250mm length x 33mm (base plate width) x 10mm (shoot rod dia)	49.00	Nos.		0.00	INR Zero Only
63	Providing and fixing IS:12817 marked stainless steel butt hinges of size 75 x 50 x 2.5mm (heavy weight) with stainless steel screws etc. complete as directed by the Engineer-in-charge	59.00	Nos.		0.00	INR Zero Only
64	Providing and fixing aluminium aldrops of size 250 X 16 mm ISI marked anodised transparent or dyed to required colour or shade with necessary screws, bolting from rear side complete as per specifications and as directed by the Engineer-in-charge	20.00	Nos.		0.00	INR Zero Only
65	Providing and fixing anodized aluminium tower bolts of size 200 X 12 mm ISI marked, transparent or dyed to required colour or shade with necessary screws etc.	50.00	Nos.		0.00	INR Zero Only
66	Providing and fixing anodised aluminium baby latch of size 75 X 12 mm ISI marked, transparent or dyed to required colour or shade with necessary screws etc.	50.00	Nos.		0.00	INR Zero Only
67	Providing and fixing 7 Lever Night latch including necessary screws etc. in wooden doors complete all as directed at site .	23.00	Nos.		0.00	INR Zero Only
68	Providing and fixing glazing in aluminium door, window, ventilator shutters and partitions etc. with EPDM rubber / neoprene gasket etc. complete as per the architectural drawings and the directions of Engineer-in-Charge. Note : The cost of aluminium snap beading shall be paid under relevant item.					
68.1	With Toughened tinted reflective float/ toughened float glass panes of 8.0 mm thickness	14.00	Sqm		0.00	INR Zero Only
68.2	With Toughened float glass panes of 6.0 mm thickness	273.00	Sqm		0.00	INR Zero Only
69	Providing and fixing mortice dead lock with rings for aluminium doors etc.; with necessary screws; complete at all leads and lifts; as per specifications, drawings and directions of the Engineer-in-Charge.	10.00	Nos.		0.00	INR Zero Only
70	Providing and fixing 12 mm thick prelaminated particle board with lamination on both sides flat pressed three layer or graded wood particle board conforming to IS: 12823 Grade I (Type II) in panelling fixed in aluminium doors, windows shutters and partition frames with C.P. brass/stainless steel screws etc. Complete as per specifications, drawings and directions of the Engineer-in-Charge.	80.00	Sqm		0.00	INR Zero Only

71	Providing and fixing approved quality and shape Locks cum Handle for Sliding shutters; complete as per specifications, drawings and directions of the Engineer-in-Charge.	65.00	Nos.		0.00	INR Zero Only
72	Providing and fixing approved quality Stain less steel Body Roller wheels for Sliding shutters; complete as per specifications, drawings and directions of the Engineer-in-Charge.	130.00	Each set		0.00	INR Zero Only
73	Providing and laying 50 mm thick cement concrete flooring with non-metallic floor hardener topping ; under layer 38 mm thick cement concrete 1:2:4 and top layer 12 mm thick consisting of mix 1:2 (1 cement hardener mix : 2 graded stone aggregate 6 mm nominal size) , wearing surface with approved non-metallic floor hardener @ 2 litre per 50 kg of cement or as per manufacturer's specifications. This includes cost of cement slurry, supplying, fixing 3mm thick aluminium strip for full depth, chequering in floor finish if required, rounding, sloping, curing, finishing, etc.; at all leads and lifts, as per specifications, drawings and directions of the Engineer-in-Charge. Note : The cost of providing and fixing 3mm thick aluminium strip shall be paid under respective item.	6754.00	Sqm		0.00	INR Zero Only
74	Providing and laying Glazed Vitrified floor tiles (Lapato finish / Matt finish / Satin finish-double charged) in different sizes with water absorption less than 0.08% and conforming to IS :15622, in all colours and shades, including grouting the joints complete at all levels and locations in flooring/skirting/Dado as shown in the drawing, laid over a bedding of cement mortar bed of mix 1:4 using Ordinary Portland cement to achieve overall flooring thickness as 50mm/laid using approved tile fixing adhesive (conforming IS 15477 Type I & II and BS 5980 Class AA Type) and joints filled with cement grouting material with matching pigment; complete with all by works, curing etc. at all leads and lifts and as per drawings, specification, instructions of the Engineer-in-Charge. Using 600 mm x 600 mm size	667.00	Sqm		0.00	INR Zero Only
75	Providing and laying Interlocking C.C. paver block (80 mm thick, M-30) made by block making machine with strong vibratory compaction, of approved size, design & shape, laid in required colour and pattern; over and including 50mm thick compacted bed of coarse sand, filling the joints with fine sand etc. all complete as per the direction of Engineer in-Charge.	360.00	Sqm		0.00	INR Zero Only
76	Providing and laying at or near ground level factory made kerb stone, edgings etc. of M-25 grade cement concrete in position to the required line, level and curvature, jointed with cement mortar 1:3 (1 cement: 3 coarse sand), including making joints with or without grooves (thickness of joints except at sharp curve shall not to more than 5mm), including making drainage opening wherever required complete etc. as per direction of Engineer-in-charge (length of finished kerb edging shall be measured for payment). (Precast C.C. kerb stone shall be approved by Engineer-in-charge).	10.00	Cu.M		0.00	INR Zero Only
77	Providing and laying anti-skid ceramic tiles of approved shades of size 300 mm x 300 mm in flooring conforming to IS :15622 having water absorption capacity less than 0.08%, of approved colour/Shade and brand at all levels and locations like in flooring of toilets, pantry etc. and as shown in the drawing laid over a bedding of cement mortar of mix 1:4 using Ordinary Portland cement to achieve overall flooring thickness as 50mm, with all joints filled with white cement mixed with matching shade of pigment etc. at all leads and lifts, complete with all by works as per specification and direction of Engineer-in-Charge.	206.00	Sqm		0.00	INR Zero Only
78	Providing and laying first quality ceramic tiles ranging from 300 mm- 600 mm long and 300 mm - 600 mm wide conforming to IS:15622 having water absorption capacity less than 0.08%, for dado work of colour/Shade and brand, with necessary bedding of minimum 12 mm thk. cement mortar of mix 1:3 using Ordinary Portland cement backing at all levels and locations as shown in the drawing with fixing the tiles, joints filled with white cement mixed with matching shade of pigment etc. complete with all by works as per specification and direction of Engineer-in-Charge.	672.00	Sqm		0.00	INR Zero Only
79	Providing and laying skirting of 15mm thickness in cement mortar of mix 1:3 using Ordinary Portland cement including rounding, sloping, curing, finishing etc., at all leads and lifts, all as per specifications, drawings and directions of the Engineer-in-Charge.	42.00	Sqm		0.00	INR Zero Only
80	Providing and laying Kota stone slab in flooring/threads using minimum 25 mm thick slabs laid over 25 mm thick cement mortar 1:4 , resulting in a total thickness of 50mm and jointed with grey cement slurry mixed with pigment to match the shade of the slab, including rubbing, polishing complete as per drawing, specification and as per directions of Engineer-in-Charge.	116.00	Sqm		0.00	INR Zero Only
81	Providing and laying Kota stone slabs 20 mm thick in risers of steps, skirting , dado and pillars laid on 12 mm thick cement mortar 1:3 and jointed with grey cement slurry mixed with pigment to match the shade of the slabs; including rubbing, polishing; including providing groove at the junction of stone and plaster finish; complete as per specifications, drawings and directions of the Engineer-in-Charge.	20.00	Sqm		0.00	INR Zero Only
82	Providing & laying/ fixing in position minimum 17 - 18 mm thick machine polished granite slabs in flooring, threads, shelves, for counter top of wash basin, sills, jambs, facias etc. of approved colour & quality including polishing, buffing/making grooves as per drawing at the edges all in line, level, laid over cement mortar 1:3 resulting in a total thickness of 50mm with best workmanship, jointed with white cement slurry @ 3.3 kg/sqm, including pointing with white cement slurry admixed with pigment of matching shade, finishing, curing, complete; as per drawings, specification and directions of Engineer-in-Charge.	50.00	Sqm		0.00	INR Zero Only
83	Providing and laying minimum 17 - 18 mm thick polished granite slabs in skirting, risers of steps, dado etc. over 12 mm thick cement mortar 1:3 using Ordinary Portland cement backing and pointing with white cement slurry admixed with pigment of matching shade, including rubbing, polishing, complete at all leads and lifts, as per drawings, specifications and directions of Engineer-in-Charge.	50.00	Sqm		0.00	INR Zero Only
84	Providing and laying acid and alkali resistant tiles conforming to IS : 4457 at all heights and levels using bedding comprising of 6 mm thick acid and or alkali resistant mortar conforming to IS : 4441 above a 8-10mm thk bitumen mastic layer, sealing the joints with epoxy resin, including preparation of the surface and application of two coats of 80/25 grade bitumen, at all leads and lifts, as per recommendation of the manufacturer, complete as per specification and direction of Engineer-in-Charge. The work shall be carried out by approved agency as per manufactures specification, drawings, technical specification and as per instructions of the Engineer-in-Charge.					
84.1	300 mm x300 mm x 20 mm thk. tiles for flooring	240.00	Sqm		0.00	INR Zero Only
84.2	300 mm x 300 mm x 12 mm thick tiles for skirting / dado	265.00	Sqm		0.00	INR Zero Only

85	Providing and fixing 600mm high, cavity/removable raised/false access flooring with system and its components with possible height adjustment up to minimum 50 mm (as required) , comprising of modular load bearing floor panels supported on G.I. rectangular stinger frame work and G.I. Pedestal etc. all complete, as per the architectural drawings, as technical specified and as directed by Engineer-in-Charge consisting of: a) Providing at required spacing to form modular framework, pedestals made out of GI tube of thickness minimum 2 mm and 25 mm outer diameter, fully welded on to the G.I. Base plate of minimum size 100mm x 100mm x 3mm at the bottom of the pedestal tube, G.I. pedestal head of minimum size 75mmx75mmx3.5 mm welded with GI fully threaded stud 16mm (minimum) outer diameter with two GI Check nuts screwed on the stud for level adjustment up to 50mm, locking and stabilizing the pedestal head in position at the required level. The pedestals shall be fixed to the subfloor (base) through base plate using epoxy based adhesive of approved make or the machine screw with rawl plug. b) Stringers system in all steel construction hot dipped galvanized of rectangular minimum size 570x20x30x0.80mm thick having holes at both ends for securing the stringers on to the pedestal head using fully threaded screws ensuring maximum lateral stability in all directions, the grid formed by the pedestal and stringer assembly shall receive the floor panel, this system shall provide adequate solid, rigid support for access floor panel, the system shall provide a minimum clear uninterrupted clearance between the bottom of the floor for electrical conduits and wiring etc. all complete as per the architectural drawings, as specified and as directed by the Engineer-in-Charge. c) Providing and fixing Access Floor panel of 600x600x32 mm medium grade Filled Steel anti static high pressure Lamination of 800H grade (FS800H). Access Floor panel shall be steel welded construction with an enclosed bottom pan with uniform pattern of 64 hemispherical cones. The top and bottom plates of Steel Gauges: top 0.6 mm and bottom 0.7 mm fused spot welded together (minimum 64 welds in each dome and 20 welds along each flange). The panel should be corrosion resistant epoxy coated for lifetime rust protection and cavity formed by the top and bottom plate is filled with Pyrogrip non-combustible Portland cementitious core mixed with lightweight foaming compound. The access floor shall be factory finished with Anti-static High Pressure laminate with Non Warp technology up to 1mm thickness for superior adhesion and Surface flatness within 0.75mm. The panel is to withstand a Concentrated Load of 363 kgs applied on area 25mm x 25mm without collapse in the centre of the panel which is placed on four steel blocks. The panel should be capable to withstand Uniformly Distributed Load (UDL) minimum 1250 kg/sqm and an impact load of 50kg all complete as per the approved manufacturers specification and as per the direction of Engineer-in-Charge. All specification must be printed on the side of the panel to ensure the quality of the product as per manufacturer's specification. The cost includes supply of 1% spare tiles and pedestals, lifting tools and the whole system shall have a fire rating of two hours. The work shall be carried out by approved agency as per manufactures specification, drawings, technical specification and as per instructions of the Engineer-in-Charge.	410.00	Sqm		0.00	INR Zero Only
86	Providing and fixing in position seamless false ceiling with 12.5 mm thk calcium silicate board, with standard and approved GI supporting arrangement suspended from RCC slab with all accessories such as screws, cleats, adjustable suspension rods, runners and Tees etc., including making suitable openings for air-conditioning grill, light fittings, troughs etc., and painting false ceiling board with two coats and shade acrylic emulsion paint over and a coat of cement primer complete with all bye works at all locations and heights including corbelling/ moulding etc. with extra runners, using tape etc. to give a seamless look and as per drawings and manufacturers specifications and instructions of Engineer-in-Charge.	100.00	Sqm		0.00	INR Zero Only
87	Providing and fixing in true horizontal level 600 mm x 600 mm false ceiling system using hot dipped galvanized steel section, exposed surface with pre coated capping, main tee of size 38 mm x 24 mm x3600 mm centre to centre maximum and cross tee of size 28 mm x 24mm x 600 mm, at every 600 mm c/c and sub cross tee of size 28mm x 24 mm at 1200 mm c/c and wall angle of size 23mm x 23 mm x3050 mm fixed to the periphery of the wall. The above grid is suspended at every 1200 mm c/c in both directions using 2.0 mm thick pre-strengthened GI wire, laying Polyester fibre acoustic board 9mm thk size 600 mm x 600 mm x 9 mm. Gap between true ceiling and 9mm thick polyester fibre board shall be filled up with 2 layers of polyester wool insulation (50 mm thick) as per technical specification/approval of Engineer-in-Charge. The ceiling tiles should have NRC 0.8, Light reflectance of 88%, Thermal conductivity 0.034 w/m.k, Humidity Resistance of 99% and Fire performance class A as per ASTM – E84.V. The work shall be carried out by approved agency as per manufactures specification, drawings, technical specification and as per instructions of the Engineer-in-Charge.	100.00	Sqm		0.00	INR Zero Only
88	Providing and laying integral cement based water proofing treatment including preparation of surface as required for treatment of roofs, balconies, terraces, chajias etc. consisting of following operations. (i) Injecting the top slab as required with cement and approved water proof compound solution to fill up all inherent holes, voids honey combs etc. in the concrete slab. (ii) setting "autoclaved aerated light weight block bats" cota in waterproof mortar with necessary gradient for easy flow of water & continue the treatment along the inner faces of parapet or other adjoining wall up to a height of 300 mm in the shape of vatas. (iii) Finishing the surface with 20 mm thick jointless cement mortar of mix 1:4 (using river / crushed sand) admixed with proprietary water proofing compound conforming to IS 2645 and approved by Engineer-in-charge including mixing 'polyester fibre' at the rate of 125 grams per 50 kg of cement in top layer of plaster. (iv) Finally finishing the surface with trowel with neat cement slurry and making pattern of 300 X 300 mm square, 3 mm deep (v) Whole terrace so finished shall be flooded with water for a minimum period of 2 weeks for curing and for final test. All above operations to be done in order and as directed and as specified by the Engineer-in-charge 120 mm Average thickness for terraces using river sand / crushed sand	1280.00	Sq.M		0.00	INR Zero Only
89	Providing and applying integral crystalline slurry of hydrophilic in nature for waterproofing treatment to the RCC structures like retaining walls of the basement, water tanks, roof slabs, podiums, reservoir, sewage & water treatment plant, tunnels / subway and bridge deck etc., prepared by mixing in the ratio of 5 : 2 (5 parts integral crystalline slurry : 2 parts water) for vertical surfaces and 3 : 1 (3 parts integral crystalline slurry : 1 part water) for horizontal surfaces and applying the same from negative (internal) side with the help of synthetic fiber brush. The material shall meet the requirements as specified in ACI 212-3R-2010 i.e. by reducing permeability of concrete by more than 90% compared with control concrete as per DIN 1048 and resistant to 16 bar hydrostatic pressure on negative side. The crystalline slurry shall be capable of self-healing of cracks up to a width of 0.50mm. The work shall be carried out all complete as per specification and the direction of the engineer-in-charge. The product performance shall carry guarantee for 10 years against any leakage.					
89.1	For vertical surface two coats @ 0.70 kg per sqm	358.00	Sq.M		0.00	INR Zero Only
89.2	For horizontal surface one coat @1.10 kg per sqm.	233.00	Sq.M		0.00	INR Zero Only
90	Providing and fixing inner corner tile beading/external round edge tile beading of nominal thickness 1.2 mm of suitable colours and width of about 10mm made out of PVCU/PVC co-extrusion as protector for tile inner corners and external edges for all vertical and horizontal corners and edges at all leads and lifts as per manufacturer's specifications. The work shall be carried out as per drawings, technical specification and as per instructions of the Engineer-in-Charge.	150.00	Rm		0.00	INR Zero Only
91	Providing edge moulding/nosing to granite, Kota stone slabs including providing 3 numbers of 3 mm x 3 mm anti slip groove lines for threads of stair case, machine polishing to edge to give high gloss finish etc. complete as per drawings, technical specification and as per instructions of the Engineer-in-Charge.	100.00	Rm		0.00	INR Zero Only

92	Providing and fixing 3 mm thick, 50 mm wide aluminium strip in joints of cement concrete floors etc. at all leads and lifts complete with all by works all as per drawings, technical specification and as per instructions of the Engineer-in-Charge.	3938.00	Rm		0.00	INR Zero Only
93	Providing and fixing at all heights and levels Clip- in (3mm) or approved equivalent false ceiling using aluminium unperforated bevelled edge tiles, polyester based, powder coated in approved colour and of size 600mm x 600mm x 0.5mm thk ceiling system. Tile shall be clipped into clip in profile of 0.5mm thk. Gl. and the system shall be supported from slab by means of rigid suspension of 4mm GI rod, hold on clamps with clip. All works shall be complete as per manufacturer's specifications drawings, technical specification and as per instructions of the Engineer-in-Charge. Measurement shall be made from wall to wall without any deductions for lights, diffusers, columns etc. The false ceiling work shall be as per profile designs indicated in drawings and as per instructions of the Engineer-in-Charge.	500.00	Sqm		0.00	INR Zero Only
94	Structural steel in door, window, ventilator, louvers, cover frames, gates, Grills, Guard bars, fencing, pergolas and other similar works using M.S. angles, flats, channels, tubular square sections, etc. of required sizes, including cutting, fabrication, welding, erecting & fixing in position with necessary M.S. holdfasts, embedding in 1:2:4 concrete (rate inclusive), painting all steel work with a coat of approved steel primer and two coats of approved PU paint; complete at all heights and levels, as per drawings, specifications and instructions of the Engineer-in-Charge. Note (i) Design/Shop drawing has to be submitted for approval of Engineer-in-Charge.	3511.00	kg		0.00	INR Zero Only
95	Supplying and fixing anticorrosive high grade SS hand railing works using squares, flats, bars, rounds etc. of AISI 316 grade; including welding, grinding, buffing, polishing, making curvature (wherever required) and fixing rigidly to the floor / wall / concrete surface with necessary accessories & stainless steel dash fasteners, stainless, MS lugs and plate embedded in concrete 1:2:4 etc. complete at all heights and levels as per drawings, specifications and instructions of the Engineer-in-Charge. Note (i) Shop drawing has to be submitted for approval of Engineer-in-Charge. (ii) For measurement only weight of stainless steel members shall be considered excluding fixing accessories such as nuts, bolts, fasteners etc.	100.00	kg		0.00	INR Zero Only
96	Providing and fixing PVC (SWR) floor trap with SS grating-75 mm , the trap shall be embedded in cement concrete, wherever required cutting and making good the floor/walls including jointing with solvent cement etc. complete at all leads and lifts as per drawings, specifications and instructions of the Engineer-in-Charge.	64.00	Nos.		0.00	INR Zero Only
97	Providing and fixing white vitreous china European type Water Closet with 'P' or 'S' Trap with solid seat and lid of approved make, 10 litre low level white PVC flushing cistern with manually controlled device (handle lever) conforming to IS:7231, flush bend, fixing EWC with C.P brass screws, 15mm PVC heavy quality inlet connection of 450mm long, including testing, commissioning & cleaning etc. complete all as per drawings and specifications and as directed by the Engineer-in-charge E.W.C. pan in White colour with ISI marked white solid plastic seat and lid.	18.00	Each		0.00	INR Zero Only
98	Providing and fixing white vitreous China universal pedestal water closet (Anglo Indian type W.C. pan) with seat and lid, 10litre low level white PVC flushing cistern with manually controlled device (handle lever) conforming to IS:7231, flush bend, fixing EWC with C.P brass screws, 15mm PVC heavy quality inlet connection of 450mm long, including testing, commissioning & cleaning etc. complete all as per drawings and specification sand as directed by the Engineer-in-charge	1.00	Each		0.00	INR Zero Only
99	Providing and fixing white glazed vitreous china front lipped standing urinal of size about 590 mm x 390 mm x 375 mm, superior quality of Flat back large model, with push valve, 15 mm dia CP brass spreaders, CP brass bottle trap with 300mm and 190mm long call connection pipe and 32 mm dia concealed PVC waste pipe up to floor at all leads and lifts as per drawings, specifications and instructions of the Engineer-in-Charge.	24.00	Each		0.00	INR Zero Only
100	Supplying, fitting and fixing under the counter, white glazed vitreous china round shaped wash basin of size about 440 mm dia without tap holes with ISI mark - Installation under the counter with 15 mm CP brass bib cock, 32 mm CP brass waste coupling, CP brass bottle trap with 300 mm & 190 mm long wall connection pipe, 15mm PVC inlet water pipe connection, CI cantilever brackets, 15 mm CP brass angular stopcock model, 32 mm dia concealed PVC waste pipe up to floor etc. all complete at all leads and lifts as per drawings, specifications and instructions of the Engineer-in-Charge.	25.00	Each		0.00	INR Zero Only
101	Providing and fixing white glazed vitreous china recessed toilet paper roll holder including roller at all leads and lifts as per drawings, specifications and instructions of the Engineer-in-Charge.	21.00	Each		0.00	INR Zero Only
102	Providing & fixing stainless steel sink with drain board of overall size about 1145 mm x 510 m with Bowl size about 560 mm x 410 mm x 250 mm with 15mm CP brass bib cock, 15 mm CP brass angular stopcock, 15 mm PVC inlet water pipe connection, CI cantilever brackets, PVC 32 mm waste pipe & CP brass coupling, CP brass bottle trap with 300mm & 190mm long wall connection pipe; mounting on platform, necessary grouting into walls, gaps finished with white / matching cement etc. complete at all leads and lifts as per drawings, specifications and instructions of the Engineer-in-Charge.	2.00	Each		0.00	INR Zero Only
103	Providing and fixing vitreous china white glazed soap tray at all leads and lifts as per drawings, specifications and instructions of the Engineer-in-Charge.	9.00	Each		0.00	INR Zero Only
104	Supplying and fixing CP brass liquid soap container at all leads and lifts as per drawings, specifications and instructions of the Engineer-in-Charge.	7.00	Each		0.00	INR Zero Only
105	Providing minimum 6 mm thick polished float glass mirror , bevelled edge, fixed to with cement fibre board/FRP sheet, fixing arrangements all complete at all leads and lifts as per drawings, specifications and instructions of the Engineer-in-Charge.	33.00	Sqm		0.00	INR Zero Only
106	Providing and fixing CP brass towel rail 600 mm long, 20 mm dia with CP brackets fixed to wall with CP brass screws and wooden rawl plug, at all leads and lifts as per drawings, specifications and instructions of the Engineer-in-Charge.	18.00	Each		0.00	INR Zero Only
107	Providing and fixing 15 mm CP brass bib cock with wall flange, at all leads and lifts as per drawings, specifications and instructions of the Engineer-in-Charge.	8.00	Each		0.00	INR Zero Only
108	Providing and fixing 15mm CP brass concealed stop cock with adjustable wall flange , at all leads and lifts as per drawings, specifications and instructions of the Engineer-in-Charge.	12.00	Each		0.00	INR Zero Only
109	Providing and fixing 15 mm CP brass 2 in 1 bib cock with wall flange, at all leads and lifts as per drawings, specifications and instructions of the Engineer-in-Charge.	21.00	Each		0.00	INR Zero Only

110	Providing and fixing 15 mm CP brass angular stop cock , at all leads and lifts as per drawings, specifications and instructions of the Engineer-in-charge.	8.00	Each		0.00	INR Zero Only
111	Providing and fixing of CP brass health Faucet with 1.2 m long PVC tube and wall hook , at all leads and lifts as per drawings, specifications and instructions of Engineer-in-Charge.	19.00	Each		0.00	INR Zero Only
112	Providing and fixing fully stainless steel bodied automatic hand drier of sensing range 160mm, at all leads and lifts as per drawings, specifications and instructions of the Engineer-in-Charge.	13.00	Each		0.00	INR Zero Only
113	Providing and fixing CP brass robe hook complete at all leads and lifts as per drawings, specifications and instructions of the Engineer-in-Charge.	12.00	Each		0.00	INR Zero Only
114	Providing and fixing CP brass wall mixer with wall flange having provision for over head shower, at all leads and lifts as per drawings, specifications and instructions of the Engineer-in-Charge.	4.00	Each		0.00	INR Zero Only
115	Providing and fixing CP brass three flow massage over head shower with shower arm & wall flange, at all leads and lifts as per drawings, specifications and instructions of the Engineer-in-Charge.	8.00	Each		0.00	INR Zero Only
116	Supplying, fitting and fixing superior quality gun metal gate valve (full way) of with ISI mark as per specifications at all leads and lifts as per drawings, specifications and instructions of the Engineer-in-Charge.					
116.1	50 mm dia	13.00	Each		0.00	INR Zero Only
116.2	40 mm dia	20.00	Each		0.00	INR Zero Only
116.3	32 mm dia	32.00	Each		0.00	INR Zero Only
116.4	20 mm dia	8.00	Each		0.00	INR Zero Only
117	Providing PVC gully trap of size 160 mm x 100 mm seated in cement concrete 1:2:4 including brick masonry in CM (1:4) plastered neatly with 15 mm thick CM (1:4) on both faces, 150mm thick PCC bed of grade 1:4:8, necessary excavation, dewatering, backfilling, curing etc. complete with all by works, at all leads and lifts as per drawings, specifications and instructions of the Engineer-in-Charge.	10.00	Each		0.00	INR Zero Only
118	Providing and fixing brass ball valve with high pressure copper floats (horizontal plunger type) conforming to IS 1703 of the following nominal bore along with necessary socket, backnut, reducers etc. complete with all by works at all leads and lifts as per drawings, specifications and instructions of the Engineer-in-Charge.					
118.1	50 mm dia	6.00	Each		0.00	INR Zero Only
118.2	40 mm dia	12.00	Each		0.00	INR Zero Only
118.3	32 mm dia	15.00	Each		0.00	INR Zero Only
118.4	25 mm dia	15.00	Each		0.00	INR Zero Only
119	Construction of brick masonry inspection chamber having inside dimensions 455 mm x 610 mm and 45 cm deep with full bricks, in CM 1:4 over 150 mm thick PCC bedding of 1:4:8 grade, provided with a light duty (LD-2.5) CI cover conforming to IS :1726, 450 mm x 610 mm size, embedding the CI frame in 100 mm thick RCC top slab (1:2:4), neatly finished including 12 mm thick plastering on both faces in CM 1:3 with water proofing compound mixed at the rate of 2% by weight of cement, benching and rounding with PCC 1:2:4, float coat of neat cement finish on the inner side, etc., all complete including excavation, dewatering and backfilling, shuttering, curing etc., as per drawings, specifications and instructions of the Engineer-in-Charge. Note: Payment for excavation and C.I cover with frame will be paid under respective items.	6.00	Each		0.00	INR Zero Only
120	Extra rate over above item for additional depth of inspection chamber including providing and fixing 20 mm rungs (foot rests) at 300mm c/c, made of copolymer polypropylene, steel reinforced plastic, all as per drawings, specifications and directions of the Engineer-in-Charge.	3.00	Rm		0.00	INR Zero Only
121	Construction of brick masonry circular type manhole with bricks of designation 5.0, in CM 1:4, side cement plaster 12 mm thick in cement mortar 1:3 (1 cement : 3 coarse sand) mixed with water proofing compound at 0.2% of weight of cement, finished with a floating coat of neat cement, foundation concrete 1:3:6 mix (1 cement : 3 coarse sand : 6 graded stone aggregate 40mm nominal size), and necessary channel in cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20mm nominal size) finished with a floating coat of neat cement all complete as per standard design, as per IS : 4111, complete with all by works, at all leads and lifts as per drawings, specifications and instructions of the Engineer-in-Charge. Note: Payment for excavation and C.I cover with frame will be paid under respective items.					
121.1	900 mm dia at bottom; 0.56 m dia at top manhole for depths up to and including 0.91 m from GL.	24.00	Nos.		0.00	INR Zero Only
121.2	Extra depth for circular type manhole of 900 mm internal dia (at bottom) beyond, for depth from 0.91 m to 1.67 m	10.00	Rm		0.00	INR Zero Only
121.3	1200 mm dia at bottom; 0.56 m dia at top manhole for depths up to and including 1.68 m from GL.	4.00	Nos.		0.00	INR Zero Only

121.4	Extra depth for circular type manhole 1.2 m internal dia (at bottom), for depth from 1.68 m to 2.29 m	3.00	Rm		0.00	INR Zero Only
121.5	1500 mm dia at bottom; 0.56 m dia at top manhole for depths up to and including 2.25 m from GL.	3.00	Nos.		0.00	INR Zero Only
121.6	1500 mm dia at bottom; 0.56 m dia at top manhole for depths up to and including 2.25 m from GL.	3.00	Rm		0.00	INR Zero Only
122	Making soak pit 2.5 m diameter 3.0 metre deep with 45 x 45 cm dry brick honey comb shaft with bricks and S.W. drain pipe 100 mm diameter, 1.8 m long complete with as per standard design/ specifications. (inclusive of the cost of excavation, backfilling all the materials, labour etc.) With common burnt clay F.P.S. (non modular) bricks of class designation 7.5.	2.00	each		0.00	INR Zero Only
123	Providing and fixing Chlorinated Polyvinyl Chloride (CPVC) pipes of SDR 11, having thermal stability for hot & cold water supply, including all CPVC plain & brass threaded fittings, including fixing the pipe with clamps at 1.00 m spacing. This includes jointing of pipes & fittings with one step CPVC solvent cement and testing of joints complete as per direction of Engineer in Charge. Work shall be executed as per CPWD specifications -2019, Clause: 18.9 Mode of Measurement: The net length of pipes as laid or fixed shall be measured in running meters correct to a cm for the finished work, which shall include CPVC pipe and fittings including plain and Brass threaded fittings and jointing solvent cement. Internal work - Exposed on wall.					
123.1	50 mm nominal dia Pipes	155.00	Rm		0.00	INR Zero Only
123.2	32 mm nominal dia Pipes	90.00	Rm		0.00	INR Zero Only
124	Providing and fixing Chlorinated Polyvinyl Chloride (CPVC) pipes of SDR 11, having thermal stability for hot & cold water supply, including all CPVC plain & brass threaded fittings, i/c fixing the pipe with clamps at 1.00 m spacing. This includes jointing of pipes & fittings with one step CPVC solvent cement and the cost of cutting chases and making good the same including testing of joints complete as per direction of Engineer in Charge. Work shall be executed as per CPWD specifications -2019, Clause: 18.9 Mode of Measurement: The net length of pipes as laid or fixed shall be measured in running meters correct to a cm for the finished work, which shall include CPVC pipe and fittings including plain and Brass threaded fittings and jointing solvent cement. Concealed work, including cutting chases and making good the walls etc.					
124.1	32 mm nominal bore	85.00	Rm		0.00	INR Zero Only
124.2	20 mm nominal bore	180.00	Rm		0.00	INR Zero Only
124.3	15 mm nominal bore	140.00	Rm		0.00	INR Zero Only
125	Supplying of UPVC pipes for rain water system (Type-A pipes) , soil and waste discharge system (Type-B pipes) of maximum thickness in accordance to IS : 13592 and laying below ground including jointing with sockets using solvent cement in accordance to IS : 7634 (Part 3 - 2003), with all necessary fittings such as bends, tees, elbows, reducers, unions, nipples, plugs etc., inclusive of excavation in soil, removal of sharp objects / stones etc., testing for water tightness, anchoring, if required with concrete anchor blocks of 1:2:2 proportion, backfilling with suitably good soil in layers of 75mm, watering, compacting, placing of marker plates to show location etc. complete as per drawings, specification and direction of the Engineer-in-Charge. Note : Payment for excavation and backfilling shall be paid in the respective item.					
125.1	Type A Pipes - 160 mm dia	20.00	Rm		0.00	INR Zero Only
125.2	Type B pipes - 160 mm dia	40.00	Rm		0.00	INR Zero Only
126	Supplying and laying UPVC pipes for rain water system (Type-A pipes), soil and waste discharge system (Type-B pipes) of maximum thickness in accordance to IS : 13592, laid over ground on walls/floors with straps / clamps at 1.00 m spacing, jointing with sockets using solvent cement as per IS : 7634 (Part 3 - 2003), with all necessary fittings such as bends, tees, elbows, reducers, unions, nipples, plugs etc. testing for water tightness complete as per drawings, specification and direction of the Engineer-in-Charge.					
126.1	Type A Pipes - 110 mm dia	293.00	Rm		0.00	INR Zero Only
126.2	Type B pipes - 75 mm dia	130.00	Rm		0.00	INR Zero Only

126.3	Type B pipes - 110 mm dia	130.00	Rm		0.00	INR Zero Only
127	Supplying, fitting and laying concealed GI pipes of heavy class conforming to IS : 1239 with all necessary fittings such as bends, tees, elbows, reducers, unions, nipples, plugs, clamps, fixtures, etc., in masonry / concrete works/ under floors etc., necessary painting with two coats of anticorrosive black bitumastic paint over a coat of approved primer etc., complete (including chasing, concealing in walls/floors and making good the wall); complete at all leads and lifts as per drawings, specifications and instructions of the Engineer-in-Charge.					
127.1	50 mm nominal bore	20.00	Rm		0.00	INR Zero Only
127.2	40 mm nominal bore	20.00	Rm		0.00	INR Zero Only
127.3	32 mm nominal bore	20.00	Rm		0.00	INR Zero Only
128	Supplying, fitting and laying exposed GI pipes of heavy class conforming to IS : 1239 with all necessary fittings such as bends, tees, elbows, reducers, unions, nipples, plugs, clamps, fixtures, etc., for fixing to the wall with clamps at 1 m spacing, including necessary painting with two coats of oil paint over a coat of approved primer complete at all leads and lifts as per drawings, specifications and instructions of the Engineer-in-Charge.					
128.1	50 mm nominal bore	100.00	Rm		0.00	INR Zero Only
128.2	40 mm nominal bore	100.00	Rm		0.00	INR Zero Only
128.3	32 mm nominal bore	100.00	Rm		0.00	INR Zero Only
129	Supplying, fitting and laying GI pipes of heavy class of 50 mm nominal bore conforming to IS : 1239 with all necessary fittings such as bends, tees, elbows, reducers, unions, nipples, plugs, etc., below ground level , including necessary painting with two coats of anticorrosive black bitumastic paint over a coat of approved primer, excavation in soil, removal of sharp objects / stones etc., testing for water tightness, anchoring, if required with concrete anchor blocks of 1:2:2 proportion, backfilling with suitably good soil in layers of 75mm, watering, compacting, placing of marker plates to show location etc. complete as per drawings, specification and direction of the Engineer-in-Charge. Note : Payment for excavation and backfilling shall be paid in the respective item.	260.00	Rm		0.00	INR Zero Only
130	Providing and fixing in position in concrete, 100 mm dia heavy duty GI pipe 500 mm long with 6 mm thk. MS plate welded at appropriate places projecting 50 mm all-round to act as puddle flange and at one end welded 100 / 150mm NB MS slip on flange with holes drilled in accordance with IS : 1538 for connecting rainwater downtake pipes including painting exposed surfaces with 2 coats of synthetic enamel paint over a coat of primer at all leads and lifts, all complete as per drawings, specifications and instructions of the Engineer-in-Charge.	26.00	Each		0.00	INR Zero Only
131	Providing, fixing, lowering & laying factory made RCC hume pipe (SOCKET AND SPIGOT JOINT) (Class NP3 of ISI), for sewer lines, including all incidentals like specials, jointing with CM 1:2 (1 cement: 2 fine sand), curing, testing of joints, at all lifts etc., as per drawings, specification and directions of Engineer-in-Charge.					
131.1	150 mm DIA Class NP3	550.00	Rm		0.00	INR Zero Only
131.2	300 mm DIA Class NP3	340.00	Rm		0.00	INR Zero Only
131.3	600 mm DIA Class NP3	40.00	Rm		0.00	INR Zero Only
132	Providing and fixing in position Cast Iron covers (with frame) of various sizes, Cast Iron Steps, weight and duty; including painting the exposed CI surfaces with three coats of black bitumastic paint; at all leads and lifts as specified in the drawings specification and directions of Engineer-in-Charge.	4000.00	kg		0.00	INR Zero Only
133	Providing, hoisting and installing at required elevation moulded HDPE cylindrical vertical water storage tanks of approved make of the following capacities with WHITE SILICON coated and with suitable S. M. C cover at top including the cost of labour for making hole in the storage tank for inlet, outlet, scour and overflow, providing and fixing necessary G.I nipples ranging from 15 mm to 50 mm n.b of average 150 mm length with double check nuts, washers etc. complete as directed by the Engineer-in-charge.					
133.1	HDPE Cylindrical vertical storage water tank 500 lit capacity	3.00	Each		0.00	INR Zero Only
133.2	HDPE Cylindrical vertical storage water tank 1000 lit capacity	5.00	Each		0.00	INR Zero Only
134	Supplying and installing in position Safety Shower and Eyewash made of S.S. 304 pipes and fittings , operates independently by pull rod, push lever and foot lever with extra-large drench S.S. shower head, shower tray, ball valve, receptor S.S. Bowl resistant to acid and alkali, twin soft flow atomiser head with aerator to control the stream straightness and diameter, 1 ¼ inch water inlet and drain connection, as per IS : 10592 (1982), complete in all respect, including making necessary connection to plumbing and waste lines as per manufactures specification, drawings, technical specification and as per instructions of the Engineer-in-Charge.	5.00	Each		0.00	INR Zero Only

135	Supplying and fixing Stainless Steel signage board (1.5 mm thk. sheet conforming to AISI 304 grade with matt finish) with vinyl computerised cut letters of approved shade and size , fixing over walls etc. with SS screws, all complete as per drawings, specifications and instructions of the Engineer-in-Charge.	20.00	Sqm		0.00	INR Zero Only
136	Providing and fixing (inclusive of all nuts, bolts and welding etc.) Welded steel wire fabric of required width having rectangular mesh painted with two coats of enamel paint of approved shade over a coat of primer as per the directions of Engineer-in-charge.	100.00	kg		0.00	INR Zero Only
137	Providing and fixing concertina barbed tape coil of following dia. made from M.S galvanized ribbon tape of 0.5 mm thickness, 19 mm width stretching the coil to 9 m approximate, fixing the coil with clips between "Y" armed and MS angle posts 2.44 m high from ground level, including supplying and fixing MS galvanized clips etc. complete as per manufacturer's specification and including painting by dipping method the concertina tape coil with two coats of synthetic enamel paint of approved shade and make over a coat of approved primer at fabrication shop, before bringing the material to the site and fixing in position etc. complete as directed by the Engineer-in-charge. 450 mm Dia Concertina coils	100.00	Rm		0.00	INR Zero Only
138	Demolishing C.C / R.C.C works by mechanical means and stock piling at designated locations carefully without damaging adjacent structures and disposal of dismantled materials up to a lead of 100 m, stacking serviceable and unserviceable materials separately including cutting reinforcement bars all as directed at site.	141.00	Cum		0.00	INR Zero Only
139	Dismantling brick work in Cement mortar carefully without damaging adjacent structures including stacking of materials and disposal of unserviceable materials within 100 m lead as per direction of Engineer-in-charge	100.00	Cum		0.00	INR Zero Only
140	Providing and fixing precoated Galvalume Roofing profile sheets of approved size, shape and pitch up to and including single length of 12.00 met. The sheet shall be fixed using self drilling / self tapping screws of size (5.5 X 55 mm) with EPDM seal or with polymer coated J or L hooks, bolts and nuts 8 mm diameter with bitumen and G.I. limpet washers filled with white lead complete up to any pitch in horizontal / vertical or curved surfaces excluding the cost of purlins, rafters and trusses and including cutting to size and shape wherever required as directed by the Engineer-in-charge. Galvalume sheet roofing 0.50 mm Thickness in Single sheet	768.00	Sqm		0.00	INR Zero Only
141	Providing and fixing precoated Galvalume roofing accessories using self drilling / self tapping screws or with polymer coated J or L hooks, bolts and nuts and or G.I. seam bolts and nuts, G.I. plain and bitumen washers complete. Roofing accessories of Galvalume sheet up to 600 mm total width for ridges, gutters, aprons, and flashings	327.00	Rm		0.00	INR Zero Only
142	Providing & fixing in position 1 mm thick stainless steel (S.S. 304 grade) flats / angles / tees (of required size) for covering the expansion joints in walls, floors, ceiling & columns etc. including drilling slotted holes on both sides, chasing the surfaces wherever required, fixing with wooden gutties, rawl plugs & C.P. brass screws, making good the surface etc. complete at all heights and levels as per drawings, specifications and instructions of the Engineer-in-Charge.	100.00	Kg		0.00	INR Zero Only
Total in Figures					0.00	INR Zero Only

Tender Inviting Authority: Chief Engineer, Bhabha Atomic Research Centre, Mysuru.

Name of Work: Design & Construction of Fire Station, Drill Tower, Boiler house, Tank farm areas including internal electrical, HVAC and other associated works at SMFC, BARC, Challakere, Karnataka.

NIT No:- BARC/SMFC/CS/02/2024-25/NIT

Name of the Bidder/ Bidding Firm / Company :							
PRICE SCHEDULE Part - II -Pre-Engineered Building Works (Note : (i) This BOQ template must not be modified/replaced by the bidder and the same should be uploaded after filling the relevent columns, else the bidder is liable to be rejected for this tender. Bidders are allowed to enter the Bidder Name and Values only. (ii) Bidders are requested to read the "General Instructions to Bidders" sheet and quote the rates accordingly. (iii) Rates to be quoted by the bidders should be inclusive of all taxes, duties, cess, Fee, royalty charges etc. levied under any statute but exclusive of GST for all the items.)							
NUMBER #	TEXT #	NUMBER #	TEXT #	NUMBER #	NUMBER #	TEXT #	
Sl. No.	Item Description	Quantity	Units	RATE In Figures To be entered by the Bidder in Rs. P	TOTAL AMOUNT in Rs. P	TOTAL AMOUNT In Words	
1	2	4	5	13	53	55	
1	For Boiler House building: Architectural designs and development of detailed drawings consisting of the following: a) development of detailed Architectural drawings, b) Working Drawings, floor Plans, all Elevations, Sections through both the directions (X&Y), Door & Window Drawings including window grill drawings, detailed toilet drawings. c) detailed 3D Views indicating elevational details from all sides of buildings including colour schemes, walk through videos. d) Generation of drawings for all connected building elements & services such as structural, Civil finishes, plumbing, sanitary, Electrical installations, MHE, and HVAC. Structural Analysis & Design consisting of the following: a) Detailed Structural Analysis & Design including seismic analysis b) Preparation of detailed structural & Fabrication drawings. c) Obtaining approval for all the analysis & designs documents, drawings from any IIT/ NIT/ IISC/Approved Govt. Engg. College. All the documents/ drawing shall be signed by a person not below the rank of a professor. d) Support in obtaining all necessary statutory clearances from BARC authorities for construction clearance related to Architectural & structural aspects, along with documentation work and the supply of six sets (sizes not less than A-1) of all Good for Construction drawings. Manufacture, supply and erection of Pre-Engineered Building System, Mineral wool wall system, Standing seam roof (SSR) system, Natural day lighting, Ventilators, Louvers, Gutter, rainwater down take system, Trims, Flashings, Fascia all-round the building, Canopies/ Chajja for all windows, doors & rolling shutters, internal Mineral wool partitions, Anchor Bolts, Eave Gutters, cage ladders including accessories all complete along with civil works as required for the successful and satisfactory completion of the Boiler House Building as per drawings and specifications and as directed by the Engineer-in-charge. Note: Cost of civil works for Boiler House Building such as Earth work, Cement concrete works (with reinforcement & shuttering), Masonry work, Plastering works, Flooring Works, Painting of masonry walls, Doors, Windows & Rolling shutters, Water supply and Sewage Works shall be paid under Civil Works (Part-I of SOQ).	1.00	Lumpsum		0.00	INR Zero Only	
Total in Figures					0.00	INR Zero Only	

Tender Inviting Authority: Chief Engineer, Bhabha Atomic Research Centre, Mysuru.

Name of Work: Design & Construction of Fire Station, Drill Tower, Boiler house, Tank farm areas including internal electrical, HVAC and other associated works at SMFC, BARC, Challakere, Karnataka.

NIT No:- BARC/SMFC/CS/02/2024-25/NIT

Name of the Bidder/ Bidding Firm / Company :						
PRICE SCHEDULE Part - III - Electrical Works (Note : (i) This BOQ template must not be modified/replaced by the bidder and the same should be uploaded after filling the relevent columns, else the bidder is liable to be rejected for this tender. Bidders are allowed to enter the Bidder Name and Values only. (ii) Bidders are requested to read the "General Instructions to Bidders" sheet and quote the rates accordingly. (iii) Rates to be quoted by the bidders should be inclusive of all taxes, duties, cess, Fee, royalty charges etc. levied under any statute but exclusive of GST for all the items.)						
NUMBER #	TEXT #	NUMBER #	TEXT #	NUMBER #	NUMBER #	TEXT #
Sl. No.	Item Description	Quantity	Units	RATE In Figures To be entered by the Bidder in Rs. P	TOTAL AMOUNT in Rs. P	TOTAL AMOUNT In Words
1	2	4	5	13	53	55
1.00	LT AC Class-IV Distribution Panels as per Clause-3 of Electrical Specifications					
1.01	SITC of Mains Class IV Panel Type - 1 as per specification	1.00	Nos		0.00	INR Zero Only
2.00	SITC of Seven Segment and MCB DB's, Conduit, Wires as per Clause-5 of Electrical Specifications					
2.01	Seven Segment TPN IP-43 8 Way Distribution Board	4.00	Nos		0.00	INR Zero Only
2.02	Seven Segment TPN IP-43 12 Way Distribution Board	1.00	Nos		0.00	INR Zero Only
2.03	Enclosures for above 8 way - DB with MCCB	4.00	Nos		0.00	INR Zero Only
2.04	Enclosures for above 12 way - DB with MCCB	1.00	Nos		0.00	INR Zero Only
2.05	MCB DB Type - 1	3.00	Nos		0.00	INR Zero Only
2.06	MCB DB Type - 2	2.00	Nos		0.00	INR Zero Only
2.07	MCB DB Type - 3	2.00	Nos		0.00	INR Zero Only
2.08	20 MM, 16 SWG, GI Conduit	1200.00	RM		0.00	INR Zero Only
2.09	25 MM, 16 SWG, GI Conduit	1500.00	RM		0.00	INR Zero Only
2.10	40 MM, 14 SWG, GI Conduit	200.00	RM		0.00	INR Zero Only
2.11	25/40mm PVC Casing and capping or pipe suitable for electrical wiring along the wall surface with all necessary fixing arrangements	300.00	RM		0.00	INR Zero Only
2.12	PVC insulated FRLSH as per IS 694:2010 2 Runs of 1.5 Sqmm + 1 Run of 1.5 Sqmm	800.00	RM		0.00	INR Zero Only
2.13	PVC insulated FRLSH as per IS 694:2010 2 Runs of 2.5 Sqmm + 1 Run of 1.5 Sqmm	1500.00	RM		0.00	INR Zero Only
2.14	PVC insulated FRLSH as per IS 694:2010 2 Runs of 4.0 Sqmm + 1 Run of 2.5 Sqmm	800.00	RM		0.00	INR Zero Only
2.15	PVC insulated FRLSH as per IS 694:2010 2 Runs of 6.0 Sqmm + 1 Run of 2.5 Sqmm	500.00	RM		0.00	INR Zero Only
3.00	SITC of Modular type approved model Switches, Sockets as per Clause-5 of Electrical Specifications					
3.01	2 Modular Plate + Frame+ White/Graphite Polycarbonate cover with Suitable Metal Flush Box	30.00	Nos		0.00	INR Zero Only
3.02	4 Modular Plate + Frame+ White/Graphite Polycarbonate cover with Suitable Metal Flush Box	30.00	Nos		0.00	INR Zero Only
3.03	6 Modular Plate + Frame+ White/Graphite Polycarbonate cover with Suitable Metal Flush Box	10.00	Nos		0.00	INR Zero Only
3.04	8 Modular Plate + Frame+ White/Graphite Polycarbonate cover with Suitable GI Box	15.00	Nos		0.00	INR Zero Only

3.05	12 (6 X 2) Modular Plate + Frame+ White/Graphite Polycarbonate cover with Suitable GI/Metal Flush Box	20.00	Nos		0.00	INR Zero Only
3.06	1 Module Modular Dummy Plate White/Graphite to suitable for above	100.00	Nos		0.00	INR Zero Only
3.07	1 Module Modular Switch White/Graphite	100.00	Nos		0.00	INR Zero Only
3.08	1 Module Modular 2 way Switch White/Graphite	20.00	Nos		0.00	INR Zero Only
3.09	6A or 16 A 5 Pin Socket of 2 Module with safety Shutter suitable for above	100.00	Nos		0.00	INR Zero Only
3.10	16 A Switch with ON/OFF with Indicator suitable for above	30.00	Nos		0.00	INR Zero Only
4.00	1.1kV FRLS grade Un armoured PVC LT Power Cables as IS:7098 - Copper Clause-6 of Electrical Specifications					
4.01	3C X 2.5 Sqmm, PVC - Supply part	500.00	RM		0.00	INR Zero Only
4.02	3C X 2.5 Sqmm PV - Installation , Testing and Commissioning Part Including lugs and Glands as required	500.00	RM		0.00	INR Zero Only
4.03	3C X 4 Sqmm, PVC - Supply part	500.00	RM		0.00	INR Zero Only
4.04	3C X 4 Sqmm, PVC - Installation , Testing and Commissioning Part Including lugs and Glands as required	500.00	RM		0.00	INR Zero Only
4.05	4C X 6 Sqmm, PVC - Supply part	500.00	RM		0.00	INR Zero Only
4.06	4C X 6 Sqmm, PVC - Installation , Testing and Commissioning Part Including lugs and Glands as required	500.00	RM		0.00	INR Zero Only
5.00	1.1kV FRLS Power XLPE Armoured Cables as per specifications					
5.01	3C X 2.5 Sqmm, Copper - Supply part	500.00	RM		0.00	INR Zero Only
5.02	3C X 2.5 Sqmm, Copper - Installation , Testing and Commissioning Part Including lugs and Glands as required	500.00	RM		0.00	INR Zero Only
5.03	2C X 4 Sqmm, Copper - Supply part	500.00	RM		0.00	INR Zero Only
5.04	2C X 4 Sqmm, Copper - Installation , Testing and Commissioning Part Including lugs and Glands as required	500.00	RM		0.00	INR Zero Only
5.05	2C X 10 Sqmm, Copper - Supply part	500.00	RM		0.00	INR Zero Only
5.06	2C X 10 Sqmm, Copper - Installation , Testing and Commissioning Part	500.00	RM		0.00	INR Zero Only
5.07	4C X 16 Sqmm, Aluminium - Supply part	500.00	RM		0.00	INR Zero Only
5.08	4C X 16 Sqmm, Aluminium - Installation , Testing and Commissioning Part	500.00	RM		0.00	INR Zero Only
5.09	4C X 50 Sqmm, Aluminium - Supply part	500.00	RM		0.00	INR Zero Only
5.10	4C X 50 Sqmm, Aluminium - Installation , Testing and Commissioning Part	500.00	RM		0.00	INR Zero Only
5.11	3.5C X 240 Sqmm, Aluminium - Supply part	500.00	RM		0.00	INR Zero Only
5.12	3.5C X 240 Sqmm, Aluminium - Installation , Testing and Commissioning Part	500.00	RM		0.00	INR Zero Only
5.13	Only Installation, Testing and Commissioning of Cable issued as FIM as per approved drawing from up to 240 Sqmm AL XLPE Armoured cable	500.00	RM		0.00	INR Zero Only
6.00	SITC of Terminations and Double compression Glands as per specifications					
6.01	Suitable Lugs as Set for above cables from 10Sqmm -50 Sqmm - Supply Part	20.00	Nos		0.00	INR Zero Only
6.02	Suitable Lugs as Set for above cables from 51Sqmm -240 Sqmm - Supply Part	30.00	Nos		0.00	INR Zero Only
6.03	Double Compression Brass Glands Suitable for above cables from 10 Sqmm -50 Sqmm	20.00	Nos		0.00	INR Zero Only
6.04	Double Compression Brass Glands Suitable for above cables from 51Sqmm -240 Sqmm	20.00	Nos		0.00	INR Zero Only
6.05	Fire Retardant paint as per relevant IS standards	15.00	Kg		0.00	INR Zero Only
6.06	LT Cable root markers with GI rod, Double arrow indicating including PCC as per relevant IS Standards IS 1239 1:2:4 PCC 32 NB GI Medium class	25.00	Nos		0.00	INR Zero Only
7.00	SITC Of Earthing and Lightning Protection System as per Clause-8 & 9 of Electrical Specifications					

7.01	Type -1 Earth Pits	15.00	Nos		0.00	INR Zero Only
7.02	Type -2 Earth Pits	5.00	Nos		0.00	INR Zero Only
7.03	GI earth Strip / Wire as per direction of EIC	300.00	Kg		0.00	INR Zero Only
7.04	Copper Earth Strip / Wire as per direction of EIC	200.00	Kg		0.00	INR Zero Only
7.05	Air Termination System: Supply of air termination rod of 2 mtr length of Copper Bonded Steel Rod 16mm Dia .The rod shall be mounted with fixing accessories	10.00	Nos		0.00	INR Zero Only
7.06	Down Conductor/Earth Pits - Supply of 8mm Dia Copper Bonded steel round conductor for air termination system Cross sectional area of conductor should be 50 mm² to meet the requirement of IS/IEC - 62305. Tested as per IEC 62561-2	1000.00	RM		0.00	INR Zero Only
7.07	Lightening Counter as per TSS	2.00	Nos		0.00	INR Zero Only
7.08	Clips, Clamps as per TSS for all buildings etc	1.00	Lumsum		0.00	INR Zero Only
7.09	Aviation Lamp	3.00	Nos		0.00	INR Zero Only
8.00	SITC of Illumination System as per Clause-10 & 11 of Electrical Specifications					
8.01	Minimum 30W Recess - Indoor	50.00	Nos		0.00	INR Zero Only
8.02	Minimum 20W Recess - Indoor	30.00	Nos		0.00	INR Zero Only
8.03	Minimum 36W Surface hanging/Pendant type - Indoor	20.00	Nos		0.00	INR Zero Only
8.04	Minimum 36W Batten - Indoor	30.00	Nos		0.00	INR Zero Only
8.05	Minimum 18W Batten - Indoor	30.00	Nos		0.00	INR Zero Only
8.06	Minimum 18 W Batten with inbuilt battery up to 2 Hrs backup and self charging	20.00	Nos		0.00	INR Zero Only
8.07	Minimum 5W Batten - Indoor	5.00	Nos		0.00	INR Zero Only
8.08	Minimum 3W spot lamps - Indoor	15.00	Nos		0.00	INR Zero Only
8.09	Minimum 36W Batten - IP65 Outdoor	30.00	Nos		0.00	INR Zero Only
8.10	Area Light - Minimum 70 Watt	30.00	Nos		0.00	INR Zero Only
8.11	Area Light - Minimum 120 Watt	10.00	Nos		0.00	INR Zero Only
8.12	Medium bay Light minimum 60/80 watts	60.00	Nos		0.00	INR Zero Only
8.13	EXIT sign LED with In built Battery minimum 2 Hrs Backup	10.00	Nos		0.00	INR Zero Only
8.14	2 X 18W LED flameproof batten with Twin LED tube suitable for Gas/Vapor group of IIA & IIB and Zone 1 & 2 with IP65	10.00	Nos		0.00	INR Zero Only
8.15	Digital Timer with time setting having in built battery with suitable enclosure ready to fix in wall surface	10.00	Nos		0.00	INR Zero Only
9.00	SITC of Lighting Mast and Street Lights Clause-10 & 11 of Electrical Specifications					
9.01	Lighting Mast as per specification and approved Drawing Complete with 8No's 200 watts LED Lights	1.00	Set		0.00	INR Zero Only
9.02	Street Light Pole Type -1 including 3C X 2.5 Sqmm Double Sheath Cable	15.00	Set		0.00	INR Zero Only
9.03	Cross Arm	15.00	Nos		0.00	INR Zero Only
9.04	Street Light Control Panel at Field	1.00	Nos		0.00	INR Zero Only
9.05	Street Light LED as per specs Type - 1	15.00	Nos		0.00	INR Zero Only
9.06	Post Top lantern light as per specs	4.00	Nos		0.00	INR Zero Only
9.07	Bollard light as per specifications	10.00	Nos		0.00	INR Zero Only
10.00	SITC of Perforated GI Cable Trays with perforation not more than 17.5% Clause-11 of Electrical Specifications					
10.01	100 mm width X 50 mm depth X 1.6 mm thickness	100.00	RM		0.00	INR Zero Only

10.02	150 mm width X 50 mm depth X 1.6 mm thickness	300.00	RM		0.00	INR Zero Only
10.03	300 mm width X 62.5 mm depth X 2.0 mm thickness	500.00	RM		0.00	INR Zero Only
10.04	450 mm width X 62.5 mm depth X 2.0 mm thickness	200.00	RM		0.00	INR Zero Only
10.05	G.I Bends Suitable for above up to 100 mm width	4.00	Each		0.00	INR Zero Only
10.06	G.I Bends Suitable for above up to 150 mm width	4.00	Each		0.00	INR Zero Only
10.07	G.I Bends Suitable for above up to 300 mm width	4.00	Each		0.00	INR Zero Only
10.08	G.I Bends Suitable for above up to 450 mm width	2.00	Each		0.00	INR Zero Only
10.09	G.I Tee Suitable for above up to 100 mm width	3.00	Each		0.00	INR Zero Only
10.10	G.I Tee Suitable for above up to 150 mm width	1.00	Each		0.00	INR Zero Only
10.11	G.I Tee Suitable for above up to 300 mm width	3.00	Each		0.00	INR Zero Only
10.12	G.I Tee Suitable for above up to 450 mm width	2.00	Each		0.00	INR Zero Only
10.13	Covers and supporting thread rods etc Suitable for above	200.00	Kg		0.00	INR Zero Only
11.00	SITC of Miscellaneous Items as per Specifications (Refer relevant clauses in Electrical Specifications)					
11.01	Welding Socket	2.00	Nos		0.00	INR Zero Only
11.02	Air conditioning System with 5 Yrs warranty as per TSS	15.00	Nos		0.00	INR Zero Only
11.03	Plug Top and Socket with inbuilt MCB as per direction of EIC	15.00	Nos		0.00	INR Zero Only
11.04	MS Item for Electrical	2000.00	Kg		0.00	INR Zero Only
11.05	Desktop computer	1.00	Nos		0.00	INR Zero Only
11.06	Operational Spares and Others as per Annexure in Specifications	1.00	Lumpsum		0.00	INR Zero Only
11.07	5 Star Remote Operated BLDC Fan	25.00	Nos		0.00	INR Zero Only
11.08	Metal Bird mesh Exhaust Fan as per Specifications	10.00	Nos		0.00	INR Zero Only
11.09	Wall Mounted/Self Standing Fan as per specifications	10.00	Nos		0.00	INR Zero Only
11.10	Wire mesh for Windows for stoppage of entry of birds etc	10.00	Sqm		0.00	INR Zero Only
11.11	Supply and fixing of electric schematic as built drawing (A0 size) in AUTOGLO with AI frame & as per instructions of EIC	3.00	Nos		0.00	INR Zero Only
11.12	Construction of cable trench in ground including hard rock area, work includes excavation in all type of soil at 1000mm depth, 500 mm width	1000.00	RM		0.00	INR Zero Only
11.13	SITC of 50/42mm Self lubricating PLB Duct Pipe	1000.00	RM		0.00	INR Zero Only
11.14	Supply and Installation of 1hp Surface pump with all required accessories	2.00	Nos		0.00	INR Zero Only
11.15	Supply and Installation of 3hp Surface pump with all required accessories and starter as per requirement of site	2.00	Nos		0.00	INR Zero Only
Total in Figures					0.00	INR Zero Only

Tender Inviting Authority: Chief Engineer, Bhabha Atomic Research Centre, Mysuru.

Name of Work: Design & Construction of Fire Station, Drill Tower, Boiler house, Tank farm areas including internal electrical, HVAC and other associated works at SMFC, BARC, Challakere, Karnataka.

NIT No:- BARC/SMFC/CS/02/2024-25/NIT

Name of the Bidder/ Bidding Firm / Company :							
PRICE SCHEDULE <u>Part - IV- Material Handling & Ventilation Works</u> (Note : (i) This BOQ template must not be modified/replaced by the bidder and the same should be uploaded after filling the relevent columns, else the bidder is liable to be rejected for this tender. Bidders are allowed to enter the Bidder Name and Values only. (ii) Bidders are requested to read the "General Instructions to Bidders" sheet and quote the rates accordingly. <u>(iii) Rates to be quoted by the bidders should be inclusive of all taxes, duties, cess, Fee, royalty charges etc. levied under any statute but exclusive of GST for all the items.)</u>)							
NUMBER #	TEXT #	NUMBER #	TEXT #	NUMBER #	NUMBER #	TEXT #	
Sl. No.	Item Description	Quantity	Units	RATE In Figures To be entered by the Bidder in Rs. P	TOTAL AMOUNT in Rs. P	TOTAL AMOUNT In Words	
1	2	4	5	13	53	55	
1	Supply, Installation, Testing, commissioning of Monorail with Electrical hoist, each of 2 Ton capacity complete with all Mechanical, Electrical, Control components and related standard accessories as covered under the Technical Specifications (Refer Section-V(v)).	2.00	Lumpsum		0.00	INR Zero Only	
2	Supply, installation, testing, and commissioning (SITC) of wall-mounted exhaust fans along with all required fixing accessories and electrical works, as per the technical specifications (Refer Section-V(v)).	8.00	set		0.00	INR Zero Only	
Total in Figures					0.00	INR Zero Only	