



Government of India Bhabha Atomic Research Centre Mysuru

Notice Inviting e-Tender

Tender Notice No.: BARC/SMFC/CS/03/2024-25/NIT

Date: 26-05-2025

Name of Work: Construction of road network including foot paths, storm water drains, culverts, embankment pitching, kerb stones, street lighting and fencing at BARC-SMF Project, Challakere, Chitradurga, Karnataka.

Sub Section-I

1. Online-Item Rate Tender in two parts i.e., Part A –Techno-commercial Bid and Part B – Financial Bid are hereby invited through e-Tendering mode (through CPP Portal) on behalf of the President of India by Tender Inviting Authority (mentioned in the below table) for the above-mentioned work from eligible bidders.
2. Summary details of NIT are as follows (refer Sub Section-II for full details):

a)	Tender Notice No.	:	BARC/SMFC/CS/03/2024-25/NIT
b)	Name of Work	:	Construction of road network including foot paths, storm water drains, culverts, embankment pitching, kerb stones, street lighting and fencing at BARC-SMF Project, Challakere, Chitradurga, Karnataka.
c)	Work Location(s) & Pin Code(s)	:	Special Materials Facility, BARC, DoddUllarthi Kaval, Challakere, Karnataka-577537
d)	Work/Product Category	:	Construction Works
e)	Tender Inviting Authority	:	Chief Engineer Bhabha Atomic Research Centre, Mysuru For and on behalf of the President of India
f)	Address of Tender Inviting Authority	:	Chief Engineer , Bhabha Atomic Research Centre, Mysuru, P.B No 1, Yelwal, Mysuru 571130.
g)	Estimated cost put to Tender (ECPT)	:	₹31,80,00,000/-+ GST as applicable.
h)	Earnest Money Deposit (EMD) Amount	:	₹47,52,000/-
i)	Cost of Tender Document	:	Nil
j)	Tender Processing Fee	:	Nil
k)	Period of work/ Time allowed for completion of work	:	365 Calendar days including monsoon period.
l)	Validity of Tender	:	180 days from the last date of online submission of the tender (Including extensions, if any).
m)	Important/ Critical Dates		
i.	Period for Downloading / Purchasing the Tender Document.	:	28-05-2025 (1500 Hrs.) to 04-07-2025 (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.
ii.	Period for submission of Pre-bid queries / clarifications and visiting Work Location(s).	:	28-05-2025 (1600 Hrs.) to 11-06-2025 (1500 Hrs.) Pre-bid queries / clarifications are to be uploaded on website https://eprocure.gov.in/eprocure/app .
iii.	Pre-Bid meeting date, time and Place	:	Pre-Bid meeting will be held in both online and offline modes simultaneously at 1500 Hrs. on 12-06-2025. Bidders, who are interested in attending the Pre-Bid



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			meeting, should send their request on or before 11-06-2025 (1500 Hrs.) through e-mail (to the contact details given under “Sl. no. o) v.”, indicating their preference for attending the meeting either in Online or Offline mode. Location for Offline Pre-Bid meeting: Bhabha Atomic Research Centre, Mysuru, P.B No 1, Yelwal, Mysuru 571130
iv.	Start date and time of online submission of tenders (i.e. Bid Submission start date and time)	:	16-06-2025 (1500 Hrs.)
v.	Last date and time of closing of online submission of tenders (i.e. Bid Submission end date and time)	:	04-07-2025 (1500 Hrs.)
vi.	Last date, time & address for submission of original EMD & other documents to be submitted offline (Refer Sub Section-IV)	:	On or before 08-07-2025 (1500Hrs.) addressed to “ 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.
vii.	Date and time of online opening of Part A i.e., Techno-Commercial Bids (along with EMD)	:	09-07-2025 (1500 Hrs.)
viii.	Date of opening of Part - B i.e., Financial Bids 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 of opening)
ix.	Place of opening Tenders/ Bids	:	Bhabha Atomic Research Centre, Mysuru, P.B No 1, Yelwal, Mysuru 571130.
n)	Details of Eligibility and Evaluation Criteria (for full Details refer Sub Section-II):		
i.	Registration in Appropriate Class of Contractors /License / Certification	:	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.
ii.	Average Annual Financial Turnover on Construction Works (during immediate last three consecutive financial years ending 31st March 2025)	:	100 % of Estimated cost put to Tender (ECPT) i.e., ₹37,52,40,000/-
iii.	Profit & Loss	:	Should not have incurred any loss in more than two financial years during last five consecutive financial years ending 31st March 2025.



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iv.	Bank Solvency certificate from a commercial Bank.	:	40 % of Estimated cost put to Tender (ECPT) i.e., ₹15,00,96,000/-
v.	Similar Works Means	:	Construction of bituminous roads or Construction of civil works, including bituminous road work. The bituminous road work should be at least 50% of the contract value.
vi.	Value of Similar Works (i.e. Cost or value of work)	:	(i) Three (3) similar works each of value not less than 40% of ECPT i.e., ₹15,00,96,000/-or (ii) Two (2) similar works each of value not less than 60% of ECPT i.e., ₹22,51,44,000/-or (iii) One (1) similar work of value not less than 80% of ECPT i.e., ₹30,01,92,000/- and One completed work of any nature (either part of above works or a separate one) costing (i.e. “Cost or value of work”) not less than the amount equal to 40% of the estimated cost put to tender (40% of ECPT, i.e., ₹15,00,96,000/-) with some Central Government Department/ State Government Department/ Central Autonomous Body/ State Autonomous Body/ Central Public Sector Undertaking/ State Public Sector Undertaking/City Development Authority/ Municipal Corporation of City formed under any Act by Central/ State Government and published in Central/State Gazette.
vii.	Applicability of Bidding Capacity clause	:	Applicable.
viii.	Bidding Capacity should be equal to or more than	:	₹37,52,40,000/- (100 % of Estimated cost put to Tender (ECPT))
ix.	Applicability of further performance evaluation for Pre-Qualification	:	Applicable, Refer Annexure-I.
o)	Other Details:		
i.	Performance Bank Guarantee (in case of award of work, for details refer Sub Section-II)	:	3% of the Tendered value of work (i.e.value of the entire work as stipulated in the letter of award.)
ii.	Security Deposit (in case of award of work, for details refer Sub Section-II)	:	2.5% of the Tendered value of work (i.e.value of the entire work as stipulated in the letter of award.)
iii.	Applicability of Labour Welfare Cess clause (for details refer Sub Section-II)	:	Applicable.
iv.	Applicability of EPF & ESIC/ Insurance Clause (for details refer Sub Section-II)	:	Applicable.
v.	Contact details for sending request	:	Office of Superintending Engineer, Proj. SMFC



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**for attending Pre-Bid meeting and
Visiting Work Location(s).**

Email: pasmfc@barc.gov.in;
Ph. No.: 0821240 6640/ 6779/ 6214/ 6731/ 6203/ 6232



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Sub Section-II Information, Eligibility Criteria, Evaluation Criteria, Conditions and Instructions

1. Tender document is prepared in two parts viz. Part A and Part B as stated below:

a) Part A (Techno-Commercial Bid Document):

- i. Section – I: Notice Inviting e-Tender
- ii. Section – II: Form of Agreement and General Rules and Directions for the Guidance of contractors, Memorandum.
- iii. Section – III: Conditions of contract, safety code, model rules for the protection of health & sanitary arrangements for workers, contractor's labour regulations and additional conditions
- iv. Section – IV: Special Instructions to Tenderers.
- v. Section – V: General & Technical Specifications
- vi. Section – VI: Tender Drawings
- vii. Section – VII: Proforma of Schedules, pre-qualification/ undertaking forms & forms of bank guarantee bond for bid security/ performance security/ security deposit.

b) Part B (Financial Bid Document):

- viii. Section VIII - Schedule of Quantity (Price Schedule/ Schedule 'B')

The above documents shall form part of the tender document and, furthermore, shall be included in the agreement after the award of the work to the successful bidder. The intending bidders must read the terms and conditions of the tender documents. The intending bidders should only submit bids if they consider themselves eligible and is in possession of all documents required as per the tender document. "Part", "Cover" & "Envelope" means same; they are used interchangeably in this Tender Document. Techno-Commercial Bid (Part A) is also referred as "Fee/ Pre-Qual/ Technical Cover" in CPP Portal.

2. Obtaining of tender documents:

- a) Prospective bidders or members of the general public can view and download the Tender documents in PDF format free of charge from the CPPP website (<https://eprocure.gov.in/eprocure/app>). Additionally, some parts of the tender documents will be available for download from the BARC website at www.barc.gov.in under the section 'Tenders and NITs'.
- b) Bidders must refer to both websites and follow the instructions provided to obtain the complete set of tender documents. Referring to only one site may result in access to a partial tender document.



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3. Earnest Money Deposit (EMD):

- a) Earnest Money Deposit (EMD) in original for the amount mentioned in Sub Section-I should be submitted within the due date & time mentioned in Sub Section-I.
- b) EMD in original is to be submitted in the form of, Account Payee Demand Draft, Fixed Deposit Receipt and Bankers Cheque.
- c) A part of EMD is acceptable in the form of Bank Guarantee also. In such case, minimum 50% of the Earnest Money Deposit or ₹20.00 Lakh, whichever is less, shall be in the form prescribed above and balance can be accepted in the form of Bank Guarantee (Format given in Section-VII (ii)). The Bank Guarantee submitted as a part of EMD shall be valid for a period of 225 days from the originally stipulated “date of opening of Part A”, excluding extensions (i.e. 225 days from the original date of opening of Part A mentioned in Sub Section-I. In case of extension of “date of opening of Part A”, the originally stipulated date is to be considered).
- d) EMD in the forms mentioned above shall be from any of the Scheduled Public / Private Sector Banks.
- e) Cheques for Earnest Money Deposit will not be accepted.
- f) EMD shall be 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.
- g) EMD is not exempted to any organizations, hence EMD submission is mandatory.
- h) EMD in original shall be submitted at address, date and time mentioned in Sub Section-I. Tenders received without original EMD will be summarily rejected and will not be processed further.
- i) EMD not submitted in the prescribed format shall not be accepted, the bid will be summarily rejected and will not be processed further.
- j) The bids of the bidders who have not submitted the EMD (in original) within the due date & time mentioned in Sub Section-I, shall not be opened.
- k) In case the “last date of receipt of original EMD and other documents” (mentioned in Sub Section-I & IV) is declared as holiday, the respective date shall be treated as postponed to the next working day, correspondingly.
- l) Return of EMDs (without any interest):
 - i. EMDs given by all the bidders except the lowest bidder shall be returned/ refunded immediately after the “expiry of stipulated bid validity period” or “after acceptance of Comparative Financial statement

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by competent authority of BARC”, whichever is earlier. Earnest money deposit of bidders unsuccessful during Techno-Commercial Bid evaluation (i.e., Part A) shall be returned/ refunded within 30 days of declaration of result of Techno-Commercial Bid evaluation in CPP Portal.

- ii. EMD of lowest bidder (i.e. L1 Bidder) shall be returned / refunded on receipt of Performance Guarantee (after issuing the letter of acceptance/ Work order), however in case Performance Guarantee is submitted in the form of Bank Guarantee, EMD will be released subsequent to confirmation of verification of the submitted Bank Guarantee from the issuing Bank. If the successful bidder fails to furnish the prescribed performance guarantee on or before stipulated period, the department (BARC) shall without prejudice to any other right or remedy, be at liberty to forfeit the said EMD absolutely. Further, successful bidder shall be debarred from participating in any new procurement or tender in BARC / DAE under Rule 151 & 175 (1) of General Financial Rules 2017 or its amendment(s).
- iii. If letter of acceptance/ Work order is not issued, EMD of lowest bidder (i.e. L1 Bidder) shall be returned / refunded after cancellation of job by BARC or lapse of validity of offer whichever is earlier.

4. Pre-Bid Clarifications/Meeting:

- a) All bidders are requested to go through the entire tender document including tender specifications and list out their deviations, perceptible ambiguities, need of additional clarifications, queries etc. and upload them within “Period for submission of Pre-bid queries / clarifications” mentioned in Sub Section-I.
- b) Pre-bid queries / clarifications are to be submitted/ uploaded in the format given in Section – VII(ii) of the tender document. Each query/clarification must clearly indicate the relevant section/sub section and clause of the Tender Document to which it pertains. Pre-bid queries / clarifications shall be clear, specific, and provide a concise description of the issue or clarification sought.
- c) Pre-bid queries/clarifications that are not submitted in the specified format, are unclear, or do not provide a reference to the relevant section/sub section/ clause of the Tender Document shall not be replied to by the Tender Inviting Authority.
- d) The Tender Inviting Authority reserves the right to disregard queries/clarifications without further notice or explanation.
- e) Pre-Bid Meeting if applicable (refer Sub Section-I) shall be held as per the details mentioned in Sub Section-I. Bidders intending to attend the Pre-Bid Meeting should send their request to the contact details mentioned in Sub Section-I.



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- f) BARC will upload the Pre-Bid clarifications to the queries raised by bidders if any in CPP Portal. The Pre-Bid clarifications uploaded by BARC in CPP Portal, shall form a part of tender document. It shall be deemed that all bidders who submit their bid have accepted Pre-Bid clarifications without any deviation.
 - g) After Pre-Bid Meeting, no additional queries/clarifications shall be entertained by the Tender Inviting Authority.
 - h) The Tender Inviting Authority reserves the right to conduct more than one pre-bid meeting, if deemed necessary.
5. 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 send a request to the contact details mention in Sub Section-I for site visit with details of visitor(s) name, a copy of visitor(s) company Identity card & Government issued identity card (such as Aadhaar Card/ Passport/ Voter ID Card/ Driving License). Visitor(s) must carry original identity card while visiting site. 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.
6. Submission of a bid by a bidder implies that the bidder has read this NIT and all other tender documents (including Pre-Bid clarifications) 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.
7. If the competent authority of BARC decides to revise the tender document or a part thereof, the revised document(s) shall be uploaded by BARC to invite revised financial bids, and the bidder shall upload the revised financial bids within the notified date and time. If no revision of bids is desired by the competent authority, only pre-bid clarifications, if any, shall be uploaded. These clarifications shall also be part of the tender document. The date of opening of the Financial Bid (Part B), as applicable, shall be notified to the bidders qualified in the Techno-Commercial Bid (Part A).
8. Initial Eligibility Criteria:
- The bidder should have the following to be eligible to participate in the bidding process:
- a) Registration in Appropriate Class of Contractors /License / Certification as per the details mentioned in Sub Section-I.



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- b) Registration under Goods & Service Tax (GST) and Permanent Account Number (PAN).
- c) Bidder should be a registered firm in India. Association of any foreign individual/ firm with this work will not be permitted in any manner.
- d) Joint Ventures and or Consortiums are not acceptable.
- e) Compliance to the Public Procurement (Preference to Make in India), Order 2017 (as amended from time to time)
 - 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 (as per format given in Section-VII (ii) i.e. “Undertaking-F”)
 - 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 pre-bid 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 pre-bid 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.
- f) **Average annual financial turnover Criteria: Average Annual Financial Turnover** on Construction Works should be at least **100 % of Estimated cost put to Tender (ECPT)**, during the immediate last three (3) consecutive financial years as mentioned in Sub Section-I. This should be duly audited by a registered Chartered Accountant in Form “A” (format given in the Section-VII (ii) of tender document) with Unique Document Identification Number (UDIN). (Scanned copy of Form “A” from Chartered Accountant with UDIN to be uploaded). Form “A” from registered Chartered Accountant with UDIN shall only be considered as proof of this eligibility.
- g) **Profit and loss Criteria:** Bidder should not have incurred **any loss** in more than **two (2) financial years** during last five consecutive financial years as mentioned in Sub Section-I. This should be duly audited by a registered Chartered Accountant in Form “A” (format given in the Section-VII(ii) of tender document) with Unique Document Identification Number (UDIN).



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(Scanned copy of Form “A” from Chartered Accountant with UDIN to be uploaded). Form “A” from registered Chartered Accountant with UDIN shall only be considered as proof of this eligibility.

h) **Bank Solvency Criteria:** Bidder should have a Banker's Certificate (**Bank Solvency**) from a Scheduled Public / Private Sector Banks (in Form “B”, format given in the Section-VII(ii) of tender document) for minimum **40 % of Estimated cost put to Tender (ECPT)**. The date of the certification shall not be older than one year from the date of opening of Part A i.e., Techno-Commercial Bids.

i) **Similar works criteria:**

i. The Bidder should have satisfactorily completed (based on certification of performance by client of the works) works as mentioned below during the last 7 (Seven) years ending on the previous day of “last date of online submission” of the tender:

aa)

- **Three (3)** similar works each of value not less than **40% of Estimated cost put to Tender (ECPT)**
or
- **Two (2)** similar works each of value not less than **60% of Estimated cost put to Tender (ECPT)**
or
- **One (1)** similar work of value not less than **80% of Estimated cost put to Tender (ECPT)**.

and

ab) One completed work of any nature (either part of ‘Sl.no. aa’ or a separate one) costing (i.e. “Cost or value of work” as defined below) not less than the amount equal to 40% of the estimated cost put to tender (ECPT) with some Central Government Department/ State Government Department/ Central Autonomous Body/ State Autonomous Body/ Central Public Sector Undertaking/ State Public Sector Undertaking/City Development Authority/ Municipal Corporation of City formed under any Act by Central/ State Government and published in Central/State Gazette.

- ii. For the purpose of this eligibility criteria, Similar works shall mean: As per Sub Section-I.
- iii. **The clause at 'Sl. No. ab' mentioned above is applicable only to tenders with an estimated cost put to tender (ECPT) equal to or greater than ₹20 Crore.**
- iv. Bidder has to submit the following documents:

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- List of completed works satisfying the criteria shall be submitted Form “C” (format given in the Section-VII(ii) of tender document).
 - For the works submitted in Form “C”, bidder has to submit Completion certificate or similar documentary evidence(s) containing the name of work, Work order no., Stipulated date of commencement, Actual date of commencement, Stipulated date of completion, Actual date of completion, justified period of extension of time (if applicable), Amount of compensation levied (if applicable), Amount of reduced rate items (if applicable) and final completion cost.
 - Performance Certificates or similar documentary evidence(s) for the completed works listed Form “C” as per Form “E” (format given in the Section-VII(ii) of tender document) from officer not below the rank of Executive Engineer/Project Manager or equivalent authority from the client for whom the work has been done.
 - If the eligible similar works were not carried out in Central Government / State Government / Public Sector Undertaking of Central or State Governments / Central or State Autonomous bodies, then bidder shall submit certificate (as per Form “E-1”, format given in the Section-VII(ii) of tender document) for bill wise payment received by the bidder. This should be duly audited by a registered Chartered Accountant with UDIN.
- v. “Cost or value 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.
- vi. The “Cost or value of work” shall be brought to the current costing level by enhancing the actual “Cost or value of work” at simple rate of Seven Percent (7%) per annum, calculated from the date of completion to last date of online submission of the tender.
- vii. Works executed within India shall only be considered for this criteria.
- viii. **Bidder shall refer to the notes mentioned in the Form “C” & Form “E” and submit all the documents.**
- j) **Bidding Capacity Criteria:**
- i. Bidding Capacity Criteria is applicable only if mentioned in Sub-Section-I.
 - ii. The bidding capacity of the bidder should be equal to or more than the estimated cost put to tender (ECPT).
 - iii. The bidding capacity shall be worked out by the following formula:

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

Where,

A= Maximum turn over in **Construction Works** executed in any one year during the last five years (ending on the previous day of last date of online submission of the tender) taking into account the completed as well as works in progress. The value of executed works shall be brought to current costing level by enhancing the actual value of works at a simple rate of 7% per annum calculated to last date of online submission of the tender.

N= Number of years prescribed for completion of work.

B = Value of existing commitments and ongoing **works** to be completed during the period of completion of work for which tender has been invited.

- iv. Bidder has to submit the details in Form “I”.

9. Evaluation Criteria

- a) Tenders will be received online up to time and date as mentioned in the Sub Section-I. Part A will be opened on the time and date as mentioned in the Sub Section-I. The original EMD will be checked first. If found in order, the bidders will be evaluated for meeting the Initial Eligibility Criteria by Tender Inviting Authority or by a Technical Evaluation Committee constituted by Tender Inviting Authority. To qualify, the bidder must satisfy each of the Initial Eligibility Criteria.
- b) Tender Inviting Authority or Technical Evaluation Committee will first evaluate the bidder's eligibility based on the documents submitted by the bidders and if required Tender Inviting Authority or Technical Evaluation Committee may visit Office/selected work sites of on-going/completed works of the bidders to verify the submitted the documents/ on-going/completed works.
- c) If required, the Tender Inviting Authority or Technical Evaluation Committee may request that all original copies of the submitted documents be presented for verification during the evaluation process.
- d) In case of further performance evaluation (applicable only if mentioned in Sub Section-I) for Pre-Qualification of bidders for the next stage; the procedure/guidelines for Pre-Qualification will be mentioned in Annexure-I. Only those bidders who satisfy Initial Eligibility Criteria shall be evaluated for Pre-Qualification.
- e) During the technical evaluation (i.e., of Part A), the Tender Inviting Authority or Technical Evaluation Committee may request missing documents (if any), additional, alternate, or substituted documents via email correspondence or through the CPP Portal. The requested documents must be submitted by reply email or through the CPP Portal within the allowed time. If the required documents are not submitted within the allowed time, the bid will be liable for rejection.



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- f) If the "date of opening of Part A" and/or the "last date of online submission of the tender" are extended, the periods specified in the eligibility criteria (i.e. one year under Bank Solvency Criteria, seven years under Similar works criteria and five years under Bidding Capacity Criteria) shall be calculated from the both originally stipulated dates and extended dates, as applicable, in accordance with the eligibility criteria.
- g) On opening date, the bidders can login and see the status of Bids after opening.
- h) The bidders who have qualified /not qualified the Initial Eligibility and Pre-Qualification Criteria (if applicable) shall be intimated.
- i) Tender Inviting Authority or Technical Evaluation Committee may also assess the capability and readiness of the bidder to carry out the job based on:
 - i. Technical capabilities of the company in the relation of subject work.
 - ii. Nature of works executed by the bidder during last 7 years.
 - iii. Organizational structure of the company (i.e. bidder).
 - iv. Necessary resource required by company to carry out the subject work.
 - v. Time & quality consciousness.
 - vi. Tendency of the company with regard to making extraneous claims and disputes.
 - vii. Site planning ability.
 - viii. Tendency of the company to award the work on back-to-back / subletting.
- j) The Tender Inviting Authority / Department 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 bidders to any number deemed suitable in case too many bids are received satisfying the Initial Eligibility Criteria/Pre-Qualification criteria. Even though a bidder may satisfy the above requirements, the bidder may be liable to disqualification if the Bidder has:
 - i. 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.
 - ii. Record of poor performance such as abandoning work, not properly completing the contract, or financial failures /weaknesses etc.

10. Financial Bids:

- a) The Financial Proposal/Commercial bid / BoQ format/ Schedule of Quantity (Price Schedule/ Schedule 'B') 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. **All tendered rates quoted in Schedule-B shall be inclusive of all taxes, duties, levy or cess, fee, royalty charges etc. levied under any statute but exclusive of GST (Goods and Services Tax). Bidder shall not tamper/modify downloaded**

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financial bid/ price Schedule/ Schedule 'B' template in any manner. In case if the same is found to be tampered/modified in any manner, tender will be completely rejected and appropriate action will be taken by department.

- b) 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).
- c) If a tenderer quotes nil rates against each item in item rate tender, the tender shall be treated as invalid and will not be considered as lowest tenderer.
- d) The Part B (Financial Bid) of the bidders who have qualified Initial Eligibility and Pre-Qualification (if applicable) Criteria shall be opened at notified date and time. Date of opening of Part B (Financial Bid) will be intimated to all bidders through the CPP Portal website
- e) Financial bid shall be evaluated and approved by the competent authority before placement of work order to the successful bidder. After placement of work order, agreement shall be made with the successful bidder.
- f) The successful bidder/ contractor, on acceptance of their bid by the Accepting Authority shall within 15 days from the stipulated date of start of the work, sign the contract agreement consisting of documents mentioned in the Tender Document along with NIT, all documents submitted by the bidder (as uploaded at the time of invitation of bid), the rates quoted online at the time of submission of bid and acceptance thereof together with any correspondence leading thereto.

11. Documents/Forms/ Excel file to be submitted by the bidder:

- a) List of Documents to be scanned from original & uploaded within the period of bid submission by bidder are mentioned in Sub Section-IV. Bidder's offer is liable to be rejected if they don't upload any of the certificates / documents.
- b) Additionally, bidder is required to fill and upload the following Excel files:
 - i. Techno-commercial Bid Data Sheet (if applicable, refer Sl. No. I-3 of Table at Sub Section-IV).
 - ii. Financial Proposal/ Commercial bid / BoQ format/ Schedule of Quantity (Price Schedule/ Schedule 'B') (i.e. Financial Bid)
- c) The Financial Bid shall be quoted in the prescribed format and submitted in the prescribed location mentioned in the CPP Portal. Any information related to Financial Bid shall not be submitted in Techno-Commercial bid. In case, the Techno-Commercial bid is found to contain any Financial Bid content, such bid shall be rejected.

- d) All information called for in the enclosed forms (given in the Section-VII(ii) of tender document) 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.
- e) References, information and certificates from the respective clients certifying suitability, technical know-how or capability of the bidder should be signed by an officer not below the rank of Executive Engineer or equivalent.
- f) The bidder may furnish any additional information, which he thinks is necessary to establish his capabilities to successfully complete the envisaged work. However, the bidder is advised not to furnish superfluous information. No additional submissions or information will be considered after the deadline for the online submission of tenders (i.e., the Bid Submission end date and time) unless specifically requested by the Tender Inviting Authority.
- g) The bidder shall furnish a declaration (as given in Section VII(ii) of the tender document) stating that they have not been blacklisted or debarred from tendering by any Central Government / State Government / Public Sector Undertaking of Central or State Governments / Central or State Autonomous bodies entity, authority, or agency. If the bidder has been blacklisted or debarred, they must submit a list of such instances along with details in Form "L" (Format provided in Section VII(ii) of the tender document). The Competent Authority of BARC will review the case and determine if any bidding restrictions apply to the current tender.
- h) The bidder shall also submit a list (in Form "L," format provided in Section VII(ii) of the tender document) of instances where contracts awarded to them have been terminated due to poor performance or relinquished before completion by any Central Government / State Government / Public Sector Undertaking of Central or State Governments / Central or State Autonomous bodies entity, authority, or agency. The Competent Authority of BARC will review the case and determine if any bidding restrictions apply to the current tender.

12. Confidentiality Clauses:

- a) 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.



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- b) "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.
- c) 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.

13. Definitions: In this document the following words and expressions have the meaning hereby assigned to them.

- a) Employer: Means the President of India, acting through the Tender Inviting Authority.
- b) Bidder: Means the individual, proprietary firm, partnership firm, limited company private or public or corporation.
- c) ECPT: Estimated cost put to Tender as mentioned in Sub Section-I

14. Method of Application:

- a) If the bidder is an individual, the application shall be signed by him above his full name and current address.
- b) 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.
- c) If the bidder is a partnership firm, 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.
- d) 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.

15. A bidder shall not have a conflict of interest. A bidder may be considered to have a conflict of interest with one or more firms/ parties in this bidding process, if among others, any of the following is present:

- a) A bidder had participated as a consultant in the preparation of the design or technical specifications of the extant bid,



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- b) A bidder was affiliated with a firm or entity that has been hired (or is proposed to be hired) by the department for supervising the work,
- c) If bidders in two different applications have controlling shareholders in common,
- d) If bidder submits more than one application of the tender.

16. Other Conditions:

- a) As per the security procedure in force in Bhabha Atomic Research Centre, the successful bidder shall be vetted by the Security Section of BARC before award of the work.
- b) No modifications in the tender shall be allowed after opening Part 'A'.
- c) Tenders with any condition including conditional rebate shall be rejected. However, tenders with unconditional rebate will be accepted.
- d) If any information furnished by the bidder is found to be incorrect at a later stage, they shall be liable to be debarred from tendering / taking up works in BARC & DAE. Additionally, if such a violation comes to the notice of Department before start of work, the Tender Inviting Authority/ Engineer-in-charge shall forfeit the entire amount of EM along with debarring.
- e) If such a violation comes to the notice of Department after deposit of performance security, the Tender Inviting Authority/ Engineer-in-charge shall forfeit the entire amount of Performance Guarantee, EMD (if not released) along with debarring.
- f) A bidder / contractor shall be debarred from participating in any new procurement or tender in BARC / DAE, for the period determined by the Competent Authority of BARC, if the firm is found to have rendered themselves liable for action under Rule 151 & 175 (1) of General Financial Rules 2017 or its amendment(s); and / or clause 7.5 and sub-clauses (chapter 7) of Manual of Procurement of Works 2022 or its amendment(s) and/or clause 2.4 and sub-clauses (chapter 2) Manual for Procurement of Consultancy & Other Services 2022 or its amendments. The decision of the Competent Authority of BARC in this regard shall be final and binding on the bidder / contractor.
- g) The time allowed for carrying out the work will be reckoned from such time period as mentioned in Schedule "F" (Refer Section-VII(i)). The date of commencement may be modified during award of work which shall be communicated in the work order.
- h) Tender shall be kept valid for the period mentioned in Sub Section-I.
- i) The bidder whose tender is accepted shall be required to deposit an amount equal to "Percentage % mentioned in Sub Section-I" of the tendered value of the

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contract as Performance Guarantee. Refer Clause 1 of Section – III (i) - Conditions of Contract for further details.

- j) If the successful tenderer, fails to furnish the prescribed performance guarantee within the stipulated period, the department (BARC) shall, without prejudice to any other right or remedy, be at liberty to forfeit the said EMD absolutely. Further the bidder / contractor shall be debarred from participating in any new procurement or tender in BARC / DAE under Rule 151 & 175 (1) of General Financial Rules 2017 or its amendment(s).
- k) In addition to Performance Guarantee, the bidder whose tender is accepted will be required to furnish by way of security deposit for the due fulfilment of his contract, such sum as will amount to “Percentage % mentioned in Sub Section-I” of the tendered value of work. The Security Deposit will be collected by deductions @ “Percentage % mentioned in Sub Section-I” of the gross amount of the running bill till the total security deposit recovered will amount to “Percentage % mentioned in Sub Section-I” of the tendered value of work. Refer Clause 1-A of Section – III(i) - Conditions of Contract for further details.
- l) 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.
- m) Canvassing in connection with tenders is strictly prohibited and the tenders submitted by the bidders who resort to canvassing will be liable for rejection.
- n) 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 to the Engineer-In-charge.
- o) The department reserves the right to cancel/ accept or reject, any or all tenders at any time or to allot part of works to different agencies without incurring any liability to the Department and without assigning any reason thereof.
- p) 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.
- q) The particulars of the work given are provisional. These are liable to change and shall be considered only as advance information.
- r) Prospective bidders 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.
- s) Payment of Wages: The bidder whose tender has to pay the wages of his labourers into their respective bank accounts and submit the paid document to the Engineer in charge along with the claim of the Bill.



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- t) Minimum wages: The bidders have to quote taking into consideration the minimum wages applicable as on the last date of online submission of the tender including extension if any. Tenders received lesser than the minimum wages will be summarily rejected. (This clause is applicable in case of tenders where manpower supply is involved).
- u) The successful bidder, whose tender is accepted, will be required to obtain Police Verification Certificate (PVC) at their own cost for all workmen. The PVC shall be valid till completion of work.
- v) No Right to Claim regular appointment: The contractor personnel shall not have any indefeasible right to claim for any regular appointment under BARC, RMP, Mysuru or any other DAE units under any circumstances.
- w) The bidder shall not be permitted to bid for works in BARC Mysuru responsible for award and execution of contracts, in which his/her near relative is posted a Divisional Accountant or as an officer in any capacity between the grades of Superintending Engineer and Engineer (both inclusive). The bidder shall also intimate the names of persons who are working with him in any capacity or subsequently employed by him and who are near relatives to any gazetted officer in BARC or Department of Atomic Energy.
- x) No Engineer of Gazetted Rank or other Gazetted Officer employed in Engineering or Administrative duties in an Engineering Department of the Government of India is allowed to work as a contractor for a period of one year after his/her retirement from Government service, without the prior permission of the Government of India in writing. This contract is liable to be cancelled if either the contractor or any of his employees is found any time to be such a person who had not obtained the permission of the Government of India as aforesaid before submission of the bid or engagement in the contractor's service.
- y) 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.



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- z) The Tender details (such as Organization Name, Location, Date, Tender Value, Title, Work Description, Form of contract, Contract Type etc.) displayed in the CPP portal is to facilitate bidder(s) for searching and participation in the tender. It should be noted that these details shall not be a part of the Tender document. In case of any discrepancy between Tender document and the Tender details displayed in the CPP portal, the Tender document shall take precedence.
- aa) This tender being a works contract no preference/ exemption for MSME/Startup firms is applicable for this tender.
- bb) If there are varying or conflicting provisions made in the tender document, the Accepting Authority (mentioned in Schedule “F”, Refer Section–VII(i)) shall be the deciding authority with regard to the intention of the tender document and his decision shall be final and binding on the bidder(s).
- cc) The Accepting Authority (mentioned in Schedule “F”, Refer Section–VII(i)) shall have the sole authority to interpret the meaning and intent of this Tender Document. The interpretation of the Accepting Authority shall be final and binding on all Bidder(s).
- dd) In case of award of tender, the work shall be executed according to General Conditions of Contract, Special Instructions to tenderers, Specifications, Drawings, and Schedule of Quantities etc. of BARC.

17. Levy/ Taxes Payable by contractor:

- a) All tendered rates quoted in Financial Bid (i.e. Schedule ‘B’/ Price Schedule) shall be inclusive of all taxes, duties, levy or cess, fee, royalty charges etc. levied under any statute **but exclusive of GST (Goods and Services Tax), as applicable on the last date of online submission of the tender including extensions, if any.**
- b) 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.
- c) 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 submission of original documentary proof of GST payment for this work.
- d) The bidders/ tenderers should ensure that they are GST compliant and their quoted tax structure /rates are as per GST Law.
- e) An undertaking (as per format given in Section-VII(ii)) should be submitted for registration under GST and compliance of GST provisions.
- f) TDS under GST: As per the government of Karnataka notification No. (18/2018) FD 47CSL2E17 Dt. 14.09.2018. Tax deduction at source (TDS) under GST has been implemented in the state of Karnataka W.E.F 01.10.2018.



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TDS @ 2% i.e., 1% CGST and 1% SGST for intra state and 2% IGST for interstate procurement will be deducted from your bill.

- g) Labour welfare cess @1% of gross value of work done shall be recovered from each bill paid to the contractor. This clause shall be applicable only when so provided in Sub Section-I.
- h) Income tax as applicable shall be deducted from each bill paid to the contractor.
- i) Any other taxes /cess as per Government directives shall be deducted from each bill paid to the contractor, from time to time.

18. EPF & ESIC/ Insurance for contractor's the employees / workers/ labours working at BARC premises:

- a) This clause shall be applicable only when so provided in Sub Section-I.
- b) The bidder whose tender is accepted should register (if not already registered) under EPF as per Employees' Provident Funds and Miscellaneous Provisions Act, 1952, within 15 days from the date of issue of work order.
- c) The bidder whose tender is accepted should comply with the provisions of the EPF Act, if applicable, in respect of all the eligible employees / workers/ labours and submit the documentary proof regularly with every RA Bill for release of payment.
- d) The bidder whose tender is accepted should ensure that all their employees / workers/ labours (working at BARC premises) should be covered either under Employees Compensation Insurance Policy/ Group Insurance/ Personal Insurance Policy or ESIC. In case of ESIC; bidder whose tender is accepted should register (if not already registered) under The Employees' State Insurance Act, 1948 and should submit the documentary proof regularly with every RA Bill for release of payment.
- e) Employees Compensation Insurance Policy/ Group Insurance/ Personal Insurance Policy should be valid up to the stipulated / extended date of completion plus 60 days beyond that.
- f) The ESI (3.25%) and EPF (12.5%) 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 Department after satisfying that it has been actually and genuinely paid by the contractor. Documentary proof should be submitted for the same. Refer Clause-19L of Section-III(i): Conditions of Contract for further details. The reimbursement of employer contribution of ESI (3.25%) and EPF (12.5%) is restricted to minimum requirements as per Statutory rules. The bidder should not consider ESI (3.25%) and EPF (12.5%) contributions on the part of employer in his offer.



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- g) Amount towards Employees Compensation Insurance Policy/ Group Insurance/ Personal Insurance Policy will not be reimbursed.
 - h) EPF & ESIC/ Employees Compensation Insurance Policy/ Group Insurance/ Personal Insurance Policy related documents including registration certificates are not mandatory while submitting the offer. An undertaking (as per format given in Section-VII (ii)) shall be submitted by the bidder as a mandatory document along with the offer.
19. Bidder has to submit Undertaking (as per format given in Section-VII (ii)) on their letter head pursuant to the Section 206AB (as applicable) of the Income Tax Act, 1961 in prescribed format as enclosed in the tender document.
20. Any Bidder, from a country which shares a land border with India must comply to the Orders “Public Procurement No.1”, “Public Procurement No. 2”, “Public Procurement No. 3” and “Public Procurement No. 4” issued by Public Procurement Division, Department of Expenditure, ministry of Finance, Government of India their amendments/addendum from time to time. Model Clauses mentioned in “Annexure III” of “Public Procurement No. 4” shall be applicable for this tender. Also, the bidder shall provide a certificate as per format given in Section-VII (ii) (“Undertaking-G”). 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.
21. If any bidder 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 the Government shall without prejudice to any right or remedy, be at liberty to forfeit 50 % (Fifty Percent) of the Earnest Money absolutely. Further, the bidder shall not be allowed to participate in the re-tendering process of the work and may be liable to be debarred from tendering / taking up works in BARC& DAE.
22. After award of work to the successful bidder, the successful bidder shall submit time schedule & cash flow statement for approval of Competent Authority which will form part of Agreement.
23. In case of receipt of any adverse charter and antecedent remarks/ notification against the contractor/ 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 contractor 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 contractor to abide/adhere to the Security instruction issued by DAE/ BARC from time to time.

Sub Section-III Guidelines for e-Tendering in CPPP website

1. The bidders should be registered with <https://eprocure.gov.in/eprocure/app>. Those bidders not registered on the website mentioned above, are required to get registered.
2. To participate in the Tendering process on the CPP Portal, prospective bidders require a valid Class III Digital Signature Certificates. 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.
3. The intending bidder must have valid class-III digital signature for request for purchase / Download of Tender Document (excel / word formats). The bid can 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.
4. More information useful for submitting online bids on the CPP Portal may be obtained at: <https://eprocure.gov.in/eprocure/app>.
5. Registration
 - a) Bidders are required to enroll 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 Enrollment” on the CPP Portal which is free of charge.
 - b) As part of the enrolment process, the bidders will be required to choose a unique username and assign a password for their accounts.
 - c) 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.
 - d) 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 / n Code / e Mudhra etc.), with their profile.
 - e) 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.
 - f) 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.
 - g) The applicants, who have already obtained such valid user ID and password from <https://eprocure.gov.in>, for any other project of BARC / DAE/ Any Govt.



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Project, need not obtain fresh user ID and password for the purpose of participation in the present tender.

6. Searching for Tender Documents

- a) 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.
- b) 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.
- c) 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.

7. Preparation of Bids

- a) Bidder should take into account any corrigendum published on the tender document before submitting their bids.
- b) Bidder should 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.
- c) The tender shall be summarily rejected if any financial bid information (i.e. Part B) is disclosed along with EMD or Techno-commercial Bid (Part A).
- d) 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.
- e) 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.

- f) 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.

8. Submission of Bids

- a) Bids shall be submitted online only at CPPP website: <https://eprocure.gov.in/eprocure/app>
- b) 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.
- c) The bidder has to digitally sign and upload the required bid documents one by one as indicated in the tender document.
- d) Bidder has to select the payment option as “offline” to pay the EMD as applicable and enter details of the instrument.
- e) Bidder shall download pre-bid clarifications (if any) related to the tender and upload a scanned copy that is duly signed and sealed.
- f) The revised documents (if any) shall be uploaded to the CPP portal. Submission of a bid by a bidder shall indicate that they have understood the full scope of work and agree to all tender conditions, including amendments made in the pre-bid clarification document uploaded by the department.
- g) Bidder should prepare the EMD as per the instructions specified in the tender document as applicable. The original EMD should be submitted within the due date & time specified in the tender documents and the submission should be made either in person (suggested method of submission) or through post or courier. 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.
- h) The bidder shall submit Pre-Bid Queries as indicated in Sub Section – I.
- i) 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 financial 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.

- j) Bidders 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.
- k) Bid documents may be scanned with 100 dpi with black and white option which helps in reducing size of the scanned document.
- l) 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.
- m) Submission of the tender documents after the due date and time (including extended period) shall not be permitted.
- n) 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 128-bit 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.
- o) Upon the successful and timely submission of bids (i.e., after Clicking "Freeze Bid Submission" In the portal), the portal will give a success full 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.
- p) 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.
- q) 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.

9. Assistance to Bidders



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- a) 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.
- b) Any queries relating to the process of online bid submission or queries relating to CPP Portal in general may be directed to the 24x7 CPP Portal Helpdesk (0120)4001 002, (0120)4001 005, (0120)6277 787. Local Helpdesk - Shri. Bhushan / Shri. Mayur at (022) 25487480, email at support-eproc@nic.in.



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Sub Section-IV

The bidder is required to submit the following:

I. Part-A Techno-Commercial Bid:		
1. The following documents are to be submitted Offline within the due date & time mentioned in Sub Section-I:		
Sl. No.	Name of the Document	
i.	Letter of Transmittal	
ii.	Original EMD	
Note: The above documents should be submitted preferably in person. However, documents sent by post or courier to the address mentioned in Sub Section-I will also be considered, provided they are received within due date & time mentioned in Sub Section-I. Delay in submission of the above documents due to any reason (including the delays caused by postal or courier services) will result in the rejection of the bid.		
2. The following documents are to be scanned from original & uploaded in CPP Portal within the due date & time mentioned in Sub Section-I (Formats are given in Section VII- (ii) of the Tender Document):		
Sl. No.	Name of the Document	Scan Copy to be Uploaded in CPP Portal
i.	Scanned copy of EMD.	Applicable
ii.	Letter of Transmittal.	Applicable
iii.	FORM-A Financial Information. (Profit & Loss statement certified by CA.)	Applicable
iv.	FORM-B Solvency Certificate	Applicable
v.	FORM - B-1Form for Certificate of Net Worth from Chartered Accountant	Not Applicable
vi.	FORM-C Details of all works satisfying the similar works criteria, completed during the last seven years ending on the previous day of “last date of online submission” of the tender. The Scanned copies of the documents mentioned in Form -“C” shall also be uploaded.	Applicable
vii.	FORM-D Details of projects under execution or awarded. The Scanned copies of the documents mentioned in Form-“D” shall also be uploaded.	Applicable
viii.	FORM-E Performance report of works referred to in Form-“C” & Form-“D” (Separate certificate for each work/ Project to be submitted).	Applicable
ix.	FORM – E-1 Certificate giving details of bill wise payment received, TDS for all similar works (mentioned in Form-“C”) executed for clients other than Central Government / State Government / Public Sector Undertaking of Central or State Governments / Central or State Autonomous bodies	Applicable
x.	FORM - F Structure & Organization.	Applicable
xi.	FORM-G Details of Technical & Administrative Personnel to be deployed for the work. Scanned copies of the documents mentioned in Form- G shall also be uploaded.	Applicable
xii.	FORM-H Details of equipment likely to be used in carrying out the	Applicable



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	proposed work. Scanned copies of the documents mentioned in Form- G shall also be uploaded.	
xiii.	FORM-I Calculation of Bidding Capacity. (Applicable if Bidding Capacity requirement is mentioned in Sub Section-I).	Applicable if mentioned in Sub Section-I.
xiv.	FORM-J Assets and Liabilities.	Applicable
xv.	FORM-K Experience in Department of Atomic Energy establishments (if any).	Applicable
xvi.	FORM-L Details regarding Litigation / Arbitration / Debarment/ Blacklisting/ Termination/ Relinquished Contracts.	Applicable
xvii.	FORM-M Particulars of managerial / engineering and construction personal, technicians employed and in service since last five (5) years.	Not Applicable
xviii.	FORM-N Details of sub-contractors (applicable only if subcontracting is allowed as per tender document).	Applicable
xix.	FORM-O Details of consortium/joint venture not applicable to this project.	Not Applicable
xx.	FORM-P Statement of men and machinery (to be filled).	Not Applicable
xxi.	FORM-Q List of offered makes for Materials, Components and Equipment.	Applicable
xxii.	FORM-R Statement of Cash flow for the work.	Not Applicable
xxiii.	UNDERTAKING-A Tender Acceptance Letter.	Applicable
xxiv.	UNDERTAKING-B Declaration confirming filing of Income Tax Return from immediate two preceding Years.	Applicable
xxv.	UNDERTAKING-C As per Clause 11- Conditions of Contract.	Applicable
xxvi.	UNDERTAKING-D That the eligible similar work(s) has/have not been executed through another contractor on back-to-back basis	Applicable
xxvii.	UNDERTAKING-E EPF& ESIC certificate / Work Compensations Policy/ Group Insurance policy	Applicable
xxviii.	UNDERTAKING-F Undertaking for the provisions of Public Procurement (Preference to Make in India), Order-2017 (Amended from time to time)	Applicable
xxix.	UNDERTAKING-G Form of Certificate for Eligible Source Countries	Applicable
xxx.	UNDERTAKING-H Undertaking for registration under GST and compliance of GST provisions.	Applicable
xxxi.	Pre-bid clarifications document (if any uploaded in CPP Portal by department) with sign & seal of the bidder.	Applicable
xxxii.	Certificates: a. Registration in Appropriate Class of Contractors /License / Certification as per the details mentioned in Sub Section-I. b. Certificate of Registration for GST. c. PAN (Permanent Account Number) Registration d. Certificates of Registration for EPF & ESIC (if already registered)	Applicable
3.	Bidder is required to fill the 'Techno-commercial Bid Data Sheet' excel file and upload the excel file in CPP Portal. (Techno-commercial Bid Data Sheet Proforma will be uploaded in CPPP)	Applicable



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II. Part-B Financial Bid:

1. Bidder is required to fill Schedule of Quantity (Price Schedule/ Schedule 'B') Excel file and upload the excel file in CPP Portal.

-SD-

Chief Engineer

Bhabha Atomic Research Centre, Mysuru
For and on behalf of the President of India



Government of India

Bhabha Atomic Research Centre Mysuru

Annexure-I: Criteria for Evaluation of the Performance of Contractors for Pre-Qualification

- The bidder's eligibility as per the "Initial Eligibility Criteria" prescribed in Sub Section-I will be scrutinized first and only the bidders, who satisfy initial eligibility criteria, shall be further evaluated for Pre-Qualification, based on the scoring methodology given below.

Criteria for Evaluation of the Performance of Contractors for Pre-Qualification			
Sl. no	Attribute		Marks
I.	Financial strength (Form 'A' & 'B')	:	Maximum 20 Marks
II.	Experience in similar nature of Work during last seven years (Form 'C')	:	Maximum 20 Marks
III.	Performance on works (Form 'C' & 'E')-Time over run	:	Maximum 20 Marks
IV.	Performance on works (Form 'E')-Quality	:	Maximum 15 Marks
V.	Personnel and Establishment (Form 'G')	:	Maximum 10 Marks
VI.	Plant & Equipment (Form 'H')	:	Maximum 15 Marks
Total			: 100 Marks

- To pre-qualify, the Bidders must obtain at least **Fifty percent (50%)** marks in each **Attribute (I, II, III, IV, V& VI)** and **Sixty Percent (60%)** marks in aggregate.
- The break-up of above scoring method is indicated in the table below:

Criteria for Evaluation of the Performance of Contractors for Pre-Qualification							
Attributes				Evaluation			
(I)	Financial strength	(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.				
	(i) Average annual turnover	16 marks					
	(ii) Solvency Certificate	4 marks					
(II)	Experience in similar class of works	(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 & 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	



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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 and considering the documentary evidences indicated in Form-C.

(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) 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	10
	(iii) Fair	5
	(iv) 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).

(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 having experience of 5 years or more	3 marks for each up to Max. 6 marks
	(ii) Diploma Engineer in Civil Engineering Discipline having experience of 2 years or more.	2 marks for each up to Max. 4 marks
	(iii) Diploma Engineer in Electrical Engineering Discipline having experience of 2 years or more.	2 marks for each up to Max. 4 marks

Notes: (a) Only the Personnel who have completed 1 year of employment in the bidder’s company shall be considered. 1-year employment period shall be considered previous to the last date of online submission of the tender (excluding extensions, if any).

(b) Bidder shall submit the list of Technical Personnel satisfying the above criteria in Form-G along with the Curriculum Vitae (C.V.) signed by the Technical Personnel and countersigned by bidder. Bidder shall also submit the documentary proof for satisfying the qualification, experience and employment requirements mentioned above (Such as Degree certificates, experience certificates, Salary slips etc.).

(c) 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)	2 marks for each up to Max. 2 marks
	(ii) Truck / Tippers / Transit mixer	1 mark for each up to Max. 2 marks
	(iii) Steel shuttering	2 marks for 800 sqm. 3 marks for 1200 sqm. In between 800 sqm & 1200 sqm - on pro-rata basis.
	(iv) Excavator	2 marks for each up to Max. 2 marks
	(v) Vibratory roller	2 marks for each up to Max. 4 marks



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(vi)	Earth Rammer Machine	1 mark for each up to Max. 2 marks
(vii)	Emulsion Pressure Distributor	2 marks for each up to Max. 2 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
Note: (a) Only the Plant & Equipment either owned or under lease (by the bidder) on or before the Tender publishing date (mentioned in CPP Portal) shall be considered. (b) Bidder shall submit documentary proof for showing the ownership or lease of the Plant & Equipment (Such as Invoice copy, Vehicle Registration Certificates, Lease documents etc.). (c) Bidder shall submit the list of Plant & Equipment satisfying the above criteria in Form-H (d) Overall marks shall be restricted to 15 marks.		

4. The Tender Inviting Authority / 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.



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Government of India
Department of Atomic Energy
Bhabha Atomic Research Centre, Mysuru
Project Special Materials Facility, Chitradurga



TENDER DOCUMENT

Name of Work: Construction of road network including foot paths, storm water drains, culverts, embankment pitching, kerb stones, street lighting and fencing at BARC-SMF Project, Challakere, Chitradurga, Karnataka.

Tender Notice No.: BARC/SMFC/CS/03/2024-25/NIT



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SECTION-I

NOTICE INVITING e-TENDERS (N.I.T)
(UPLOADED SEPARATELY)



**Government of India
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SECTION-II

**FORM OF AGREEMENT AND GENERAL RULES AND
SECTIONS FOR THE GUIDENCE OF CONTRACTORS**

MEMORANDUM



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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/ websites 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 amounts 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 drawing and any other documents required in connection with the work signed for the purpose of identifications 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 authorizing 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. a) For e-Tendering

Any person, who submits a tender, must ensure to quote rate of each item in the SOQ downloaded from e-Tendering website. The column meant for quoting rate in figures appears in YELLOW colour and the moment rate is entered, it turns SKY BLUE. In addition to this, while selecting any of the cells a warning appears that if any cell is left blank the same shall be treated as "0". Therefore, if any cell is left blank and no rate is quoted by the bidder, rate of such item shall be treated as "0" (ZERO). 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 condition of any sort including conditional rebates, will be summarily rejected.

- b) For Manual tendering (Offline mode)

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



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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 in 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 office 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. a) For e-Tendering

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. The intending bidder can quote his rates in figures only. The rates in words, amount of each item and total is generated automatically. Therefore, the rate quoted by the bidder in figures is to be taken as correct. In event no rate has been quoted for any item(s), leaving space in figure(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. In Lump sum contracts the amount quoted in figures is to be taken as correct.

b) For Manual tendering (Offline mode)

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 in case the tenderer is unable to provide satisfactory explanation, such a tender is liable to be disqualified and rejected.

12. a) For e-Tendering: Deleted.

b) For Manual tendering (Offline mode)

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 3% (Three 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/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.1,00,000/-) 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 fulfilment of his contract, an amount equal to 2.5% of the tendered value of the work. The security deposit will be collected by deductions from the running bills as well as final bill of the contractor at the rates mentioned above.



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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. 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.
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 installations, 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

Sl. No.	Name of work/project and location	BAR C or spons oring organi sation	Cost of work in Lakhs Rupees	Date of comm- encem- ent as per contract	Stipula- ted date of comple - tion	Upto date percentage progress of work	Slo w pro gres s if any and reas ons ther eof	Name and address / telephon e number of officer to whom referenc e may	Remarks



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								be made	
(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.



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GOVERNMENT OF INDIA

BHABHA ATOMIC RESEARCH CENTRE

MYSORE

Division:

Sub Division:

Item Rate Tender and Contract for Works

(A) Tender for the work of:

.....
.....

(i) To be uploaded by..... hours on to..... /upload
at.....

To be submitted by..... hours on.....to (time) (date) *

(ii) To be opened in presence of tenderers who may be present at hours
on.....in the Office
of.....

Issued to:

Signature of officer issuing the documents*

Designation*

Date of Issue: *

* Note Applicable for e-tendering

TENDER

I/We have read & examined the notice inviting tender, Schedule A, B, C, D, E & F, Specifications applicable & Drawings, General Rules & Directions, Conditions of Contract, clauses of contract, Special Conditions & 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, drawings and instructions in writing referred to in Rule-1 of General



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Rules and directions and in Clause -11 of the conditions of contract and with such materials as are provided for, by and in respect in accordance with such conditions so far as applicable.

We agree to keep the tender open for the period mentioned in the NIT and not to make any modifications in its terms and conditions.

A sum of Rs. _____ is hereby forwarded in 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 any 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 performance guarantee absolutely. The said performance guarantee shall be a guarantee to execute all the works referred to in the tender documents upon the terms and conditions contained or referred to 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 & 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.

Signature of contractor
Postal Address

Dated the day of..... 20.....

Witness

Address

.....

Occupation.....



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ACCEPTANCE

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

The letters referred to below shall form part of this contract agreement.

- a)
- b)
- c)

For & on behalf of the President of India.

Signature.....

Dated.....

Designation.....



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SECTION-III

**CONDITIONS OF CONTRACT, SAFETY CODE, MODEL RULES FOR THE
PROTECTION OF HEALTH & SANITARY ARRANGEMENTS FOR WORKERS,
CONTRACTOR'S LABOUR REGULATIONS AND ADDITIONAL CONDITIONS**



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SECTION-III (i)

CONDITIONS OF CONTRACT



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SECTION – III (i)

CONDITIONS OF CONTRACT

DEFINITIONS:

1. The **‘Contract’** means the documents forming the tender and acceptance thereof and the formal agreement executed between the Bhabha Atomic Research Centre, Mysore on behalf of 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 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.
 - ii) The **‘Contractor’** shall mean the individual, firm or company whether incorporated or not undertaking the works and shall include the legal personnel representative or 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 firms or company.
 - iv) The **‘President’** means the President of India and his successors.
 - v) The **‘Engineer-in-Charge’** means the Engineer Officer who shall supervise and be in charge of the work and who shall sign the contract on behalf of the President as mentioned in Schedule ‘F’ hereunder.
 - vi) **‘Government’** or **‘Government of India’** shall mean the President of India.
 - vii) The term C.E. represents Chief Engineer, of the Bhabha Atomic Research Centre, Mysore.
 - 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 contractors 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



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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 up to the date of receipt of the tender.
 - xii) **Department** means Department means Bhabha Atomic Research Centre (BARC) Mysore, Department of Atomic Energy, Government of India which invites tenders on behalf of President of India as specified in Schedule 'F'.
 - xiii) District specifications mean 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', in accordance with the phasing if any, as indicated in the tender document.
 - xvi) **GST** shall mean Goods and Service Tax – Central, State and Inter State.
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 (relevant schedules) 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 recognised principles.



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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.
 - i) 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 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 enclosed as mentioned in Schedule 'F' consisting of:
 - a) Various standard clauses with corrections up to 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.



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CLAUSES OF CONTRACT

CLAUSE 1: PERFORMANCE GUARANTEE

- i) The contractor shall submit an irrevocable Performance Guarantee of 3% (Three 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/ Work order. 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/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 Lakhs) 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 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:



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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.

All compensation 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 there from, 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 and the final bill of the contractor at the rates mentioned above.

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. Five (5) Lakhs subject to the condition that amount of such bank guarantee, except last one, shall not be less than Rs. Five (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,



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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 along with 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: POWERS OF ENGINEERS-IN-CHARGE:

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:



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- 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 within 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 items and conditions of the contract and does not remedy it or take effective steps to remedy it within Seven (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



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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 or rescinded 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 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 authorised 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'. 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 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 milestones 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 endeavours 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.



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- 5.3 Request for rescheduling of milestones 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 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 milestones 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.



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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.



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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-Charges 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.



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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 any way 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 Asst. Engineer-in-Charge to the effect that the work has been completed up to the level in question make interim advance payments without detailed measurements for work done (other than foundations, items to be covered under finishing items) up to 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: -



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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 Fifteen (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.



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Before taking such action, the Engineer-in-Charge shall give ten days notice in writing to the contractor.

CLAUSE 8B: 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 herein under, the period being reckoned from the date of receipt of the bill by the Engineer-in-Charge or his authorized Asst. 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	-	Three (3) months.
ii)	If the Tendered value of work exceeds Rs.15 Lakhs	-	Six (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 authorisation 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 amount 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.



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As soon as the work is awarded, the contractor shall finalise 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



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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



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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 at least 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.

ii) Mobilisation Advance

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 instalments to be determined by the Engineer-in-Charge at his sole discretion. The first instalment 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 instalment shall be released by the Engineer-in-Charge only after the contractor furnishes a proof of the satisfactory utilization of the earlier instalment to the entire satisfaction of the Engineer-in-Charge.



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Before any instalment 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'.

iii) *Plant Machinery and Shuttering Material Advance*

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.

iv) Interest and Recovery

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 instalment.

- (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 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 variation of rates in GST applicable on such material(s) being considered in this clause) 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 rule 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



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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 material 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 a position to supply.

For this purpose, the labour component of 85% of the value of the work executed during period under consideration shall not exceed 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 mazdoor, fixed under any law, statutory rule or order. The cost of work for which escalation is applicable (W) is same as cost of work done worked out as indicated in sub-para (ii) of clause 10 CC except the amount of full assessed value of secured Advance.

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 and other materials shall be determined by the All India Wholesale Price Indices of materials as published by Economic Advisor to Government of India, Ministry of Commerce and Industry and base price for cement, steel reinforcement, structural steel and other materials as issued under the authority of Chief Engineer / tender approving authority as valid on the last date of receipt of tender, and for the period under consideration. In case, price index of a particular material is not issued by Ministry of Commerce and Industry, then the price index of nearest similar material as indicated in Schedule 'F' shall be followed.

If during progress of work or at the time of completion of work, it is noticed that any material brought at site is in excess of requirement, then amount of escalation if paid earlier on such excess quantity of material shall be recovered on the basis of cost indices as applied at the time of payment of escalation or as prevailing at the time of effecting the recovery, whichever is higher.



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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 materials:

$$V = P \times Q \times \frac{(Cl - Clo)}{Clo}$$

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 Commerce and Industry as valid on the last stipulated date of receipt of tenders including extensions, if any.
- Cl: 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 Commerce and Industry.

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, whichever 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



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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.....(J)

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 /electrical/ instrumentation/ mechanical components etc. of construction “MATERIALS” (except cement, structural steel, reinforcement bars and other materials covered under Clause 10 CA)**

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

where,

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. This will be calculated either for entire SOQ/ particular schedule(s) of SOQ / a group of items as mentioned in Schedule 'F'.

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 /electrical/ instrumentation/ mechanical components etc. of construction materials (Note: Relevant component as indicated in Schedule 'F') 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 Commerce and Industry, and applying weightages to the Individual Commodities / group Items. The price index of nearest similar Individual Commodities / group Items as indicated in Schedule 'F' will be considered.

(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).

MI₀: All India Whole Sale Price Index for civil /electrical/ instrumentation/ mechanical components etc. of construction materials (Note: Relevant component as indicated in Schedule 'F') 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 Commerce and Industry, and applying weightages to the Individual Commodities / group Items. The price index of nearest similar Individual Commodities / group Items as indicated in Schedule 'F' will be considered.

b) **Adjustment for component of “POL”**

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

where,

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: Cost of work done, worked out as indicated in sub para (ii) of clause 10CC. This will be calculated either for entire SOQ/ particular schedule(s) of SOQ / a group of items as mentioned in Schedule 'F'.



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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 (The price index of nearest similar material as indicated in Schedule 'F' will be considered.) for the period under consideration as published by the Economic Adviser to Government of India, Ministry of Commerce and Industry, 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)

FI₀ : All India Whole Sale Price Index for Fuel, Oil and Lubricant (The price index of nearest similar material as indicated in Schedule 'F' will be considered.) as published by the Economic Adviser to Government of India, Ministry of Commerce and Industry, 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 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

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

where,

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. This will be calculated either for entire SOQ/ particular schedule(s) of SOQ / a group of items as mentioned in Schedule 'F'.

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



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Ll₀: 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.

Ll: 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 variation 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:-



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(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 12 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 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 standard specifications of BARC specified in Schedule 'F' or in any Bureau of Indian Standards 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 necessarily 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, or 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



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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.

12.2 DEVIATION, EXTRA ITEMS AND PRICING

Deviation, Extra items and pricing:

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), 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 item (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 rate 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 rate 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 limit laid down in Schedule 'F', the contractor may within fifteen days of receipt of order or occurrence of the excess, claims revision of the rates, supported by



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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 for 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 authorize consideration of such claims on merits.
- 12.5 Deleted.
- 12.6 Any operation incidental to or necessarily has to be in contemplation of tenderer while filling tenders 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.

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



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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



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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



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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 has 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, 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



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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 in charge of the work or to the Chief Engineer of Quality Assurance or his subordinate officers or the Officer's of the organization engaged by the Department for quality assurance or to the Chief Technical Examiner or his subordinate officers, that any work has been executed with unsound imperfect, or unskilful 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 the case of work costing Rs.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



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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 Twelve (12) months [Six (6) months in the case of work costing Rs. 10,00,000/- (Rs. Ten Lakhs) 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 Twelve (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 Six (6) months and the remaining half after Twelve (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 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 specification 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 portion thereof.

CLAUSE 18A: RECOVERY OF COMPENSATION PAID TO WORKMAN



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In every case in which by virtue of the provisions of 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 Subsection 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 Subsection (1) of Section 20, 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-judicial 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 provision of the Child Labour (Prohibition & Regulation) Act-1998.



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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 fulfil these requirements shall attract the penal provisions of this contract arising out of the resultant non-execution of the work.

CLAUSE 19A: NO LABOUR BELOW THE AGE OF 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 contract, 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-fulfilment 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 to 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 holiday to any labourer, and pay the same to the persons entitled thereto from any money due to the contractor by the Engineer-in-Charge concerned.



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- 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 there under 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.
- vi) 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: SAFETY PROVISIONS FOR LABOUR & PENALTY ON DEFAULT

In respect of all labour directly or indirectly employed in the work for the performance of the contractor's 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.



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Failing which the contractor shall be liable to pay to Government a sum not exceeding Rs. 200/- (Rs. Two Hundred) 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 contractor's 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 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 up to and including the day of delivery and 4 weeks following that day.
- ii) In the case of miscarriage: up to 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 in 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) :



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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 :



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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 & 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 and 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 remodelled 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).



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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 ft x 5 ft) 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 gobri on both sides. The floor may be katcha but plastered with mud gobri and shall be at least 15 cm (6 inches). 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 (8 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. (2 Gallons) of pure and wholesome water per head per day for drinking purposes and 15 Ltrs. (3 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



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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 up to 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 to remove the illegal occupation any time on or before construction and delivery.

CLAUSE 19K: 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



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(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 in charge. Failure on the part of contractor to obtain approval of Engineer-in-Charge or failure to deploy qualified tradesman per 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 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.

CLAUSE 20: MINIMUM WAGES ACT TO BE COMPILED WITH

The contractor shall comply with all the provisions of the Minimum Wages Act, 1948, Contract Labour (Regulation and Abolition) Act, 1970 amended from time to time, and rules framed there under 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



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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 where under the partnership firm would have the right to carry out the work 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 proforma as per Appendix XV as



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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-in-Charge
BARC, P.O Yelwal,
Mysore 571 130

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)



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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 Engineer In charge
BARC, Mysore
2. **Superintending Engineer** – Division
BARC, Mysore

- 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 sub ordinate 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 along with the notice for appointment of arbitrator and giving reference to the rejection by the Chief Engineer-in-Charge 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 term 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 there under and for the time being in force shall apply to the arbitration proceeding under this clause.



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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 there from. Provided that the contractor shall not be liable to indemnify the President of India 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 PROVISION IN TENDER

When the estimate on which a tender is made includes lump sum 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 specification as referred to in Clause 11, such work shall be carried out in accordance with the Bureau of Indian Standards



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Specifications. In case there are no such specifications in Bureau of Indian Standards the work shall be carried out as per manufacturers' 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 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 may at any time thereafter 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.



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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 the 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 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 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 - DELETED.

CLAUSE-31A: DEPARTMENTAL WATER SUPPLY, IF AVAILABLE: - DELETED.

CLAUSE 32: ALTERNATE WATER ARRANGEMENT: - DELETED.

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.



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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-in-Charge 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



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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 charge 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



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Divisional Engineer-in-Charge 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 along 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 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) along with every on account bill / final bill and shall produce evidence if at any time so required by the Engineer-in-Charge.



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- (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

- 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 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.

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

- (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. increases 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 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.



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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) The contractor shall keep necessary books of accounts and other documents for the purpose of this 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 shall also 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 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.

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 grandchildren, brothers and sisters, uncles, aunts and cousins and their corresponding in-laws.

CLAUSE 41: NO GAZETTED ENGINEER-IN-CHARGE /OFFICER ALLOWED AS A CONTRACTOR TILL ONE YEAR OF RETIREMENT

No Engineer-in-Charge 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



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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 and bitumen shall be calculated on the basis of quantity of cement and 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 lappages, 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 GI and CI or other pipes, conduits, wires and cables, pig lead and GI. /MS sheets shall be taken as quantity actually required and measured plus 5% for wastage due to cutting into pieces (except in the case of GI/MS sheets it shall be 10%)such determination and comparison being made diameter wise and category wise
 - (d) For any other material 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 and 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.



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- 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 up to 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 up to 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



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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 till after 3 months after completion of the work and/ or no communication is received from the Labour Officer to this effect till 6 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.



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SECTION-III (ii)
SAFETY CODE &
CONSTRUCTION SAFETY MANUAL



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SECTION-III (ii-a)

SAFETY CODE

a) Construction safety

- 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 overhead support or erected with stationary support shall have a guard rail properly attached, bolted, braced and otherwise secured at least 90 cm. (3 feet) high above the floor or platform of such scaffolding or staging and extending along the entire length of the outside 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. (11/2") 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 defence 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 at least 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 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 progress 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 equipment shall 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 higher Officer.



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- 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 gives 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 a/c of cleaning of blocked manholes and sewer lines should be immediately removed to avoid accidents on a/c 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 vapour proof and of totally enclosed type. No 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 manholes.
- 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.



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- 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 readymade 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 men above the age of 18 are employed on the work of lead painting, the following principles 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.



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- 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 equipment 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 sustained 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-in-Charge 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



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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) In addition to the above, the contractor shall ensure the work as per the Atomic Energy (factories) rules 1996 as given below:
 - a. welding and Gas Cutting as per rule 32 schedule IV
 - b. To keep register of workers employed for work on or near machinery in motions per rule 33
 - c. Hoists and lifts, lifting m/cs, chains, ropes and lifting tackles as per rule 34, 35 & 46
 - d. Temporary Elec. Wiring as per rule 47
 - e. Electrical work & installations as per rule 88 schedule VII
 - f. Flammable and compressed gases as per rule 88 schedule XII
 - g. Notification of accidents as per rule 89
 - h. Register of accidents and dangerous occurrences as per rule 98
 - 17) Notwithstanding the above clauses from (1) to (16) 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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SAFETY WITH SCAFFOLDINGS

INTRODUCTION:

- a) 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.
- b) 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.
- c) 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 lumber used in the construction of scaffolds, should be sound straight grained and 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.



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- 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 sidewalks 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:



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- 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. **OVERHEAD 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 on knock 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 Like 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 someone 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:**



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- 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 PARTICULAR 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 underground cables and equipment. This is especially important when parts of scaffolds for other fasteners have to be driven in the ground.

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SECTION-III (ii-b)

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, installation of equipment etc. 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 Bhabha Atomic Research Centre.

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 program 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:



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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 neighborhood 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 program 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;



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- (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 equipment.
- (e) See that the work environment and the neighborhood 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 equipment 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.



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- (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 organize 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 program 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 recognized 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 recognized 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 analyze 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.



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- 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 /equipment 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:



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- *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.



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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



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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 spillover 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) Signaling 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 signaling. 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



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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 rebars 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.



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- 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 equipment 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 scrapper. No vehicle movement shall be allowed within the radius of movement of scrapper 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.



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- (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



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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.

5.4.7.4.3 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.

5.4.7.5 Dewatering pumps, Concrete pumps, Boom placer pumps:

5.4.7.4.4 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.

5.4.7.6.1 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 signaling 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 signaling 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 equipment 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.



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- 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.



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- 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 5.4.7.2 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 signaling.
- 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



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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 Organizations 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.



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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).



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- 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.
- i) 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.
- j) 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.
- k) 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.
- l) 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.
- m) Iron clad industrial type plug outlets are preferred for additional safety.



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- n)** 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.
- o)** 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.
- p)** 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.
- q)** 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.
- r)** 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.
- s)** 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.
- t)** 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.
- u)** 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.
- v)** 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 equipment 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.



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- 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

equipment. 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.



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- (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.



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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 AEF, 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



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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



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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



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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 AEF, 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 AEF, 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 AEF, 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



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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



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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 checkup 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



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- 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 organization, 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 at least once in a year. However, the contractor shall be prepared for surprise inspections and audits by the department or any third party authorized 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.



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- 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



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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 Firstaid 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 1Scaffolds)
- IS:3696-1991 (Reaffirmed 2002) Safety Code for Scaffolds and Ladders (Part 2Ladders)
- 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



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Annexure 1

FORMAT FOR LEGAL REGISTER

Sl No	Products, Processes or Services	Legislation on OHS	Date of Effect	Validity Date From to	Reference of Applicable Chapter / Sec./ Rule	Person Responsible for Compliance Monitoring	Frequency of Reporting	Reference to procedures and Control	Record to be submitted to External agency



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Annexure 2

FORMAT FOR JOB HAZARD ANALYSIS REPORT

Sl. No.	Activity / Sub-activity	Potential hazards	Causes	Precautions recommended



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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			



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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



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3. Site Supervisor
4. Departmental Representative



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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):
 - a) Blood Pressure _____
 - b) Seizure disorder (Fits / Epilepsy Convulsion) _____
 - c) Flat Foot _____
 - d) Frequent attacks of headache or reeling sensation _____



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- e) Mental depression _____
- f) Limping gait _____
- g) 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. In case 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)



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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 Coordination	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



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3.4	Acrophobia	Yes	No

Investigation:

4.1	Urine
	Albumin:
	Sugar:
4.2	Blood
	CBC:
	Random blood sugar (if age is >35 years.)

4. X-ray:

Required / not required : _____

If required – details of report : _____

(Signature of workman)

(Signature & Rubber stamp)
of Medical Practitioner with
Reg. No.



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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 : _____



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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?			



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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			



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	understood by majority of the workers?			

(Name & Signature of Site Engineer)
Signature of Safety Officer)

(Name &



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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.



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Date of certification:

(Signature & stamp)

(Qualification)

(Name & address of the Person, Company or Association by whom the person conducting test and examination is employed)



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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:	



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	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]



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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.						



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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>



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(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)



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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 mode 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.



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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.



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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.



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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



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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.



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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:



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'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:



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‘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.

Date:

Signature of Safety Engineer.
Name:



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‘F’ AUTHORISATION BY THE ELECTRICAL ENGINEER

Service connection may be/may not be given for the reasons noted hereunder.

Signature of Electrical Engineer.

Name:

Designation:

Date:

'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:

1st copy to Contract Control Engineer

2nd copy to Safety Engineer

and 3rd copy to Electrical Engineer

Note: After all the formalities are completed and Report of Compliance after power supply is given.



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Annexure - 13

FORMAT FOR INJURY REPORT FOR CONTRACT/CASUAL WORKER

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?:



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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)



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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



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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 M□	Y M□	B M□	

(Name & Signature of Contractor)

(Name & Signature of Dept. Representative)



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Annexure 16

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



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SECTION-III (iii)

MODEL RULES FOR THE PROTECTION OF HEALTH AND SANITARY
ARRANGEMENTS FOR WORKERS EMPLOYED BY BARC OR ITS
CONTRACTORS



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SECTION-III (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:**
 - (i) 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.
 - (ii) 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 equipment's:
 - (1) Six (6) small sterilised dressings.
 - (2) Three (3) medium size sterilised dressings.
 - (3) Three (3) large size sterilised dressings.
 - (4) Three (3) large sterilised burn dressings.
 - (5) One (1) (30 ml.) bottle containing a two per cent alcoholic solution of iodine.
 - (6) One (1) (30 ml.) bottle containing salvolatile having the dose and mode of administration indicated on the label.
 - (7) One (1) snake-bite lancet.
 - (8) One (1) (30 gms.) bottles of potassium permanganate crystals.
 - (9) One (1) pair scissors.
 - (10) One (1) copy of the first-aid leaflet issued by the Director General, Factory Advice Service and Labour Institutes, Government of India.
 - (11) One (1) bottle containing 100 tablets (each of 5 gms.) of aspirin.



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- (12) Ointment for burns.
- (13) 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 equipment's:
 - (1) Twelve (12) small sterilised dressings.
 - (2) Six (6) medium size sterilised dressings.
 - (3) Six (6) large size sterilised dressings.
 - (4) Six (6) large size sterilised burn dressings.
 - (5) Six (6) (15 gms.) packets sterilised cotton wool.
 - (6) One (1) (60 ml.) bottle containing a two per cent alcoholic solution of iodine.
 - (7) One (1) (60 ml.) bottle containing Sal-volatile having the dose and mode of administration indicated on the label.
 - (8) One (1) roll of adhesive plaster.
 - (9) One (1) snake-bite lancet.
 - (10) One (1) (30 gms.) bottle of potassium permanganate crystals.
 - (11) One (1) pair scissors.
 - (12) One (1) copy of the First-Aid leaflet issued by the Director General, Factory Advice Service and Labour Institute, Government of India.
 - (13) A bottle containing 100 tablets (each of 5 gms.) of aspirin.
 - (14) Ointment for burns.
 - (15) A bottle of suitable surgical antiseptic solution.
- (iii) Adequate arrangements shall be made for immediate recoupment of the equipment when necessary.
- (iv) Nothing except the prescribed contents shall be kept in the first aid box.
- (v) 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.
- (vi) 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.



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(vii) 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.

(viii) 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:

- (i) 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.
- (ii) 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.
- (iii) 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.
- (iv) 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.



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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 outside 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 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 19H (ii) a, b and 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. Canteen:

- (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.



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- (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 sft) per diner to be accommodated as prescribed in sub-rule 9.
- (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 9.
- (xiii) (a) (1) There shall be provided and maintained sufficient utensils, crockery, furniture and any other equipment necessary for the efficient running of the canteen.
- (2) The furniture, utensils and other equipment 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 equipment.
- (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 equipment provided for the canteen;
- (c) The cost of purchase, repairs and replacement of equipment including furniture, crockery, cutlery and utensils;
- (d) The water charges and other charges incurred for lighting and ventilation;



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(e) The interest and amounts spent on the provision and maintenance and equipment 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 rules shall be incorporated in the contracts and in notices inviting tenders and shall form an integral 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.

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SECTION-III (iv)

DEPARTMENT OF ATOMIC ENERGY CONTRACTORS LABOUR REGULATIONS



Government of India

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SECTION-III (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; or

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.

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.



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- 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 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.
- (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 over time 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.



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- (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.



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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 anyone 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 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.



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- 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 workman 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:



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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.

- i) 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.



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- 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.



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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 _____



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ANNEXURE-B

FORM XIII

Register of workmen employed by contractor

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 and surname of workman	Age and sex	Father's/ husband' Name	Nature of employment	Permanent home address of the workman	Local address	Date of commencement of employment	Signature or impression of the workman	Date of termination of employment	Reasons for termination	Remarks
1	2	3	4	5	6	7	8	9	10	11	12



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ANNEXURE-C

FORM XVI
MASTER 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



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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:

Wage period: Monthly/Fortnightly

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	Amount of wages earned					Deductions if any	Net amount paid	Signature/ Thumb impression of workmen	Initials of contractor or his representative
							Basic wages	Dearness allowance	Over time	Other cash payment	Total				
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16



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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:

Morning		Evening	Rate	Amount	Initial
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					

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



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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



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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



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ANNEXURE-G

FORM - XV
SERVICE CERTIFICATE

Name and address of contractor: _____

Name and location of work: _____

Name and address of workman _____

Age or Date of birth _____

Identification marks _____

Father / husband's Name _____

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

Name and address of principle employer _____

Sl. No	Total period for Which Employed		Nature of work Done	Rate of wage (with particulars of Unit in case of piece work)	Remarks
	From	To			
1	2	3	4	5	6

Signature



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ANNEXURE-H

FORM - XII
REGISTER OF FINES

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	Father's/ Husband's Name	Designation/ nature of employment	Act/ omission for which fine imposed	Date of offence	Whether workman showed cause against fine	Name of person in whose employee's explanation was heard	wages period and wages payable	Amount of fine imposed	Date on which fine realised	Remarks
1	2	3	4	5	6	7	8	9	10	11	12



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ANNEXURE-I

LIST OF ACTS AND OMISSIONS FOR WHICH FINES CAN BE IMPOSED:

In accordance with rule 75 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. Wilful 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 behaviour.
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. Unauthorised use of employer's property for manufacture or making of unauthorised 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 unauthorised 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.



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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 & location of work: _____

Name & address of principal employer: _____

Sl.No	Name of workman	Fathers/ Husband's Name	Designation/nature of employment	Particulars of damage or loss	Date of damage or loss	Whether workman showed cause against deduction	Name of person in whose presence employee's explanation was heard imposed	Amount of deduction	No. of instalment	Date of recovery		Remarks
										First instalment	Last instalment	
1	2	3	4	5	6	7	8	9	10	11	12	13



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ANNEXURE-K

FORM – XXII
REGISTER OF ADVANCES

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: _____

Sl. No.	Name of workman	Fathers/ Husband's Name	Designation/nature of- employment	Wage period and wages payable	Date and amount of advance given	Purpose(s) for which advance made	No. of instalments by which advance to be repaid	Date and amount of each instalment repaid	Date on which last instalment was repaid	Remarks
1	2	3	4	5	6	7	8	9	10	11



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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



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SECTION-III (v)

ADDITIONAL CONDITIONS



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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-in-Charge, 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. Land for erecting Labour Colony for housing the contractor's labour will be made available by the Department if it is mentioned in Schedule 'A' (Refer Proforma of



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Schedules). If not, Labour Camp shall not be erected at the site of the work nor any Labour shall be allowed to live at site.

8. In case the Land for erecting Labour Colony is provided by the department; the contractor will have to make his own arrangements for water & electricity for the labour colony. Additionally, Contractor has to make his own provision for the housing of construction labour with all necessary infrastructure and facilities such as fuel for cooking, mobile toilets, mobile STP, safe drinking water, medical health care, crèche etc. The housing may be in the form of temporary structures & they 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.
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 eighteen (18) on the work of painting with products containing lead in any form. Where ever men above the age of eighteen (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.



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- 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) in case 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, makes 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 equivalent / alternate make / brand shall be acceptable whether so specifically stated or not at the discretion of the Engineer-in-Charge.
 - (b) The Engineer-in-Charge 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-in-Charge for test and / or



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analysis. The quantities of the items in question required for these tests and / or analysis shall be determined by the Engineer-in-Charge.

- ii) During the progress of the work, the Engineer-in-Charge 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.
- iii) No proposed substitute for a specified item shall be used in the work of the contract prior to written authorization by the Engineer-in-Charge, 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-in-Charge changes or modifications in the designing, 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-in-Charge may be deemed necessary to accommodate the substitute materials and / or equipment in the work.



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SECTION-IV

SPECIAL INSTRUCTIONS TO TENDERERS



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SECTION-IV

SPECIAL INSTRUCTIONS TO TENDERERS

1. These special instructions /additional conditions of contract shall be read in conjunction with general conditions of contract, technical specifications or any other document forming part of this contract. In case of any variation between the clauses stipulated in the special instructions /additional conditions of contract and those stipulated in the general conditions of contract etc., the stipulation in the special instructions /additional conditions of contract shall take precedence.
 - a) Location and scope of the Work: Please refer Proforma of Schedules.
2. 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.
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 equipment, 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 off 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. The execution of the works shall commence from such time period as mentioned in Schedule 'F'.

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 (mentioned in Schedule 'F'). 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 BARCs to work in the same area during the grading stage for the construction of buildings, Electrical, Air-conditioning, Services and Public Health and other miscellaneous works.

The contractor shall afford all facilities

- a) 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, drain drawings, fabrication drawings or 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 authorising 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 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 drawing 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 (if available, specified in Schedule 'A') shall be allocated to the contractor free of cost for storing his equipment, plant, materials, etc. and for his site office. He will, however, be solely responsible for watching or guarding his property and materials issued to him by BARC. Contractor shall cover all materials at site with requisite insurance against theft larceny, dacoits, 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 Ten (10) days from the date of completion.

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:** Contractor has to make his own arrangement for water required for the work. If water is made available by the Department (refer Schedule 'A'), 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. Contractor has to make his own arrangement for electricity required for the work. If made available by the Department the rate is specified in Schedule 'A'
16. **Electricity:**

Guidelines for temporary power supply at site and general safety procedure

(B) General:

i) Contractor's License for Electrical works:

The contractor/subcontractor shall possess a license of appropriate competency (Class- I) issued by competent authority and valid in Karnataka jurisdiction for carrying out electrical installation of the type and magnitude covered in this document. Engagement of subcontractor shall be subject to approval by BARC.



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All linemen, wiremen, electrician, supervisors and engineers engaged by the contractor or his sub-contractor shall possess valid license of appropriate competency issued by the statutory authority.

Copy of the licenses referred above shall be made available to the BARC/ for verifications periodically during the execution of work until closure of contract.

The contractor shall take all necessary measures to ensure safety of men and material inside the BARC premises as per the rule of BARC and statutes. contractor shall be solely responsible in this aspect.

- ii) Electrical power supply at medium voltage (415 volts, 3-phase, 4 wires) for construction purposes and general lighting will be made available (if mentioned in Schedule 'A') at the site or near the site of work, at the discretion of the Engineer-in-Charge, at one point. The contractor is responsible for laying the power lines at their own cost, in an approved manner as indicated in the subsequent clauses. The power supply will be made available subject to the following conditions:
 - a) The contractor should submit a list of equipment he proposes to connect for constructional and general lighting purposes indicating his power requirements in appropriate form enclosed (Annexure-I) for approval of Engineer-in-Charge.
 - b) Submit a list of licensed electrical staff he will be posting at site.
 - c) The contractor should pay the minimum charges based on his power demands at Current tariff rates prevailing at site as charged by supply authorities
 - d) Suitably rated KWH meter will be supplied and installed by contractor and test certificates as per ISS from authorised test laboratory or manufacturer is submitted.
- iii) All extension from this point shall be executed in an approved manner with prior permission of Electrical Engineer-in-Charge. 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.
- iv) The entire installation shall be subject to the following tests before energisation of installation including portable equipment.
 - a) Insulation resistance test
 - b) Polarity test of switches
 - c) Earth continuity test
 - d) Earth electrode resistance

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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-in-Charge and submitted in proforma enclosed (Annexure-II).

- v) Double grounding shall be provided for all equipment. 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 Two (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 Electrical Engineer by prior arrangement with Civil Department for normal and preventive maintenance etc., of Departmental equipment 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.

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- 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, equipment 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, equipment 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 equipment should be used. However, the same shall be in a very good condition. ISI marked equipment 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.
- iv) 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 equipment, switches etc. shall be informed to the Electrical Engineer-in-Charge at the time of energisation. Also, the same should be informed as soon as any change is done.

- (E) i) Only PVC insulated & PVC sheathed wires or armoured PVC insulated and sheathed 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 needs, it is preferable to use an extension board with three-pin plugs. This allows you to connect multiple light points as needed, without creating any wire joints.
 - viii) The connection for portable machines shall be taken through Three (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-in-Charge 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 equipment.



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- iv) All three-phase equipment shall be provided with duplicate earthing. All light fixtures and portable equipment 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 equipment, 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-in-Charge reserves 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

A. Installations:

- 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.
- 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.
- 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.
- 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.
- Grounding conductor of wiring system should be copper or other corrosion resistant material. An extra grounding connection should be made in appliances / equipment where chances of electric shock is high.

- 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 rupture capacity (HRC) fuses should be used wherever possible in circuits carrying currents more than 15 amps.
- Open-type distribution boards should be placed only in dry, well-ventilated rooms. They should not be positioned near storage batteries or exposed to chemical fumes.
- 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.
- 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.
- Adequate working space should be provided around electrical equipment which require adjustment or examination during operation.
- As far as possible electrical switches should be excluded from a place where there is danger of explosion. All electrical equipment 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.
- After installation of new electric system and/or other extensive alterations to existing installations, an Electrical Engineer-in-Charge before the new system should make thorough inspection or new extension is put in use.

B. Operation & Maintenance:

- 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.
- 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.
- 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.
- Adequate precautions should be taken in two important aspects that there shall be no danger from any adjacent live part and that there shall be no

chances of re-energisation of the equipment on which the persons are working.

- 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.
- 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.
- Operation of electrical equipment should be avoided when standing on wet floor or when hands are wet.
- 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.
- Pliers, screw drivers, testing lights and other tools for the work should be adequately insulated for voltage involved.
- When two persons are working within reach of each other, they should never work on different phases of the supply.
- 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.
- Temporary electrical connections should be removed as soon as the stipulated work is over.
- 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.
- 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.
- Floors should be kept free from tailing electrical cables to avoid tripping hazard.

C. Portable Electrical Equipment:



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- Portable electrical equipment should be regularly examined, tested and maintained to ensure that the equipment and its loads are in good order.
- 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.
- 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.

D. General Safety Procedure:

- It should be ensured that power supply to equipment is disconnected before any repair work is undertaken.
- Insulated tools shall be used for working on electrical equipment.
- At building constructional sites, helmets and safety shoes shall be used.
- In case of an accident, the security staff on duty shall be informed immediately. The Engineer-in-Charge, Electrical Engineer-in-Charge, Safety Co-ordinator of the Project, Administrative Officer of the Project and BARC, Mysore dispensary shall also be informed.
- 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-in-Charge and the Engineer-in-Charge. Also, resuscitator may be used.
- In case of fire hazard, BARC- EIC shall also be informed immediately.
- The contractor shall keep a first aid kit at site.
- 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.
- 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.
- All safety procedures and practices as informed by Department should be followed.

17. Removal of Workmen and Supervisory Staff: The contractor shall employ only individuals who are careful, skilled, and experienced in their respective trades for the

execution of the work. The Engineer-in-Charge reserves the right to object to and require the contractor to remove any person employed by the contractor if, in the opinion of the Engineer-in-Charge, that person is misconducting themselves, is incompetent, or is negligent in the proper performance of their duties. Such individuals shall not be re-employed on the work without the Engineer-in-Charge's permission.

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: 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), as applicable on the last date of online submission of the tender including extensions, if any.**

Unless otherwise stated in the schedule of quantities, rates for all items shall be for the complete work including supply tools, tackles, machineries, labour 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.

20. Supply of materials: Materials stated in Schedule 'A' will be issued by department depending upon availability as indicated in Schedule 'A'.
21. Withdrawal of Tender: The tender should be valid for the validity period mentioned in the NIT. 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 IS 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-in-Charge or other persons who has been duly authorised 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 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 Engineer s and supervisory staff with their qualifications and experience he proposes to employ for execution of the work covered by this contract.
25. Deleted.

26. One copy of the drawings to be kept at the Site: The contractor shall keep one copy of each drawing at the site. These copies shall be made available for inspection and use by the Engineer-in-Charge and any other persons authorized by the Engineer-in-Charge at all reasonable times.

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 his own cost all lights, guards, fencing and watching 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 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 Site: The Engineer-in-Charge and any persons authorized 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.



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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 19 & 45 of 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 building and other construction workers (Regulation of Employment and conditions of service) Act 1996 and building and other 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



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case BARC) in respect of labour directly engaged by the Principal Employer in the vicinity.

41. Deleted

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. Deleted

44. Security Regulations: (i) The contractor has to follow strictly the security regulations prevailing in BARC 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:

- a) The contractor shall make applications to the Engineer-in-Charge every day for issue of entry permits, photo passes for casual labourers to be deployed on the works.
- b) 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.
- c) The contractor shall make an application for the photo passes to be issued by the Security Department for his regular supervisory staff.
- d) 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.
- e) 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 contractor's 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.
- f) 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



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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/Sub-contractor's Personnel:

- a) Contractors, their employees, workers and casual labourers:
 - i. It will be the responsibility of the contractor to produce Character certificate for himself and his employees / workers before seeking permission for entry into BARC area. Contractor shall give ID card to all employees working inside BARC.
 - ii. 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. Contractor shall give ID card to all labourers working inside BARC.
 - iii. It will be mandatory on the part of the Tenderer to provide Character Certificate for their Engineers, Supervisors and authorised representative, - who are authorised to draw tokens/passes - for day to day works inside BARC Campus.
- 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: (ii) 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.

- a) 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 throughout its movement within the premises.
- b) 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 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.
- c) 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.
- d) 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.
- e) Contractor has to take separate written permission for labours & vehicles for working on holidays in advance from the BARC security/ EIC.



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- f) 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: As per the minimum wages circular issued by Ministry of Labour & Employment, applicable on the last date of submission of tender.
51. Provisions Under Contract Labour (Regulation & Abolition) Act 1970 Required to be Fulfilled by Contractors.
- a) Every Contractor employing Twenty (20) or more workmen on any day should obtain license from Asst. Labour Commissioner, Bangalore or from the required place. They should also obtain Registration under BOCW Act if they are engaged in construction activities. (Rule 12).
 - b) Every Civil Contractor employing 10 or more workmen should obtain a Registration under Building and Other Construction Workers Act from Asst. Labour Commissioner, Bangalore.
 - c) Notice of commencement of contract work should be given to Labour Enforcement Officer by the Contractor in from VI-A. [Rule 1(3)].
 - d) Notice of completion of contract work should be given to Labour Enforcement Officer by the Contractor in Form VI-A. [Rule 81(3)].
 - e) 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)].
 - f) A copy of the above Notice is to be sent to Labour Enforcement Officer.
 - g) Maintain a Register of workmen in Form XIII. (Rule 74).
 - h) Issue Employment Card to workmen in Form XIV. (Rule 76).
 - i) Issue a Service Certificate to workmen in Form XV on termination of employment for any reason whatsoever. (Rule 77).
 - j) Maintain Muster Roll of Workmen in Form XVI. [Rule 78 (1) (a) (i)].
 - k) Maintain Register of wages in Form XVII. Contractors may maintain a Combined Register of Wages-cum-Muster Roll, if the wage period is a fortnight or less.



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- l) Provide Wage slip to workmen in Form XIX. [Rule 78 (1) (b)].
 - m) Maintain a Register of Deduction for Damage/ Loss in Form XX. [Rule 78 (1) (a) (ii)].
 - n) Maintain a Register of Fines in Form XXI. [Rule 78 (1) (a) (ii)].
 - o) Maintain a Register of Advances in Form XXII. [Rule 78 (1) (a) (ii)].
 - p) Maintain a Register of Overtime in Form XXII. [Rule 78 (1) (a) (iii)].
 - q) Send Half Yearly Return in Form XXIV to ALC/ LEO. [Rule 82 (1»)].
 - r) A first Aid Box with essential medical items to be maintained. (Rule 58).
 - s) Every contractor should ensure disbursement of wages to his workmen in the presence of authorized representative of BARC. (Rule 72).
 - t) 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).
52. Contract Price: In consideration of the work, supply and services to be executed/made/performed by the Contractor as per Scope of work and for any other obligations to be met by the Contractor under the contract, the Owner shall pay to the Contractor an estimated Contract Price as stated below
- Rs.....
- (Rupees.....)
- The Contract Price as stated in this Clause has been arrived at based on the quantities and the rates as stated in schedule of items quantities of this Agreement. The Contract Price to be paid to the Contractor shall be adjusted based on the actual quantity installed under various items of work as per the schedule of items / quantities and the unit rates as agreed against those items of works. Any item supplied excess shall be taken back by the contractor.
- The rates quoted in the tender shall include all charges for clearing of site before commencement as well as after completion, water, electric consumption meters, double scaffolding, shuttering, boxing, staging, planking, timbering and pumping out water including bailing, fencing, hoarding, plant and equipment, storage sheds, watching and lighting, by night as well as day including Sundays and Holidays temporary plumbing and electric supply, protection of the public and safety of adjacent roads, streets, cellars, pavements, walls, houses, buildings and all other installations, matters or things and the Contractor shall take down and remove any or all such shuttering, scaffolding, staging, planking, timbering, strutting, shoring etc., as occasion shall require or when ordered so to do, and fully reinstate and make good all matters and things disturbed during the execution of work and to the satisfaction of the Department. The rate quoted shall be deemed to be for the finished work to be measured at site. The rate quoted shall also be firm irrespective of any variation in quantities of items given in the schedule of items.
53. Terms of payment: As per SOQ/ Conditions of Contract/ Specifications. Any other special payments shall be mentioned in Proforma of Schedules.
54. Insurance:
- a) Contractor's All Risk Policy (This provision shall be applicable only when so provided in Proforma of Schedules): The contractor shall obtain CAR policy for the contract value valid for the contract period including extensions if any, from a nationalized insurance company.



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- b) The contractor should ensure that all their employees / workers/ labours working inside the BARC premises are covered either under Employees Compensation Insurance Policy/ Group Insurance/ Personal Insurance Policy or ESIC for the contract period including extensions if any. This clause is also applicable to the Sub-Contractor's employees / workers/ labours working inside the BARC premises.
55. Deduction from contract price: The Contractor shall reimburse to the BARC all costs, charges, damages or expenses which the BARC may have paid or incurred and to the extent to which the Contractor is liable under this Contract to pay within 30 days up on written request from the BARC, failing which such costs, charges, damages or expenses shall be deducted by the BARC from any money due or becoming due by him to the Contractor under this Contract or any other Contract failing which such amounts shall be considered as debt due from the Contractor to the BARC and shall be recoverable accordingly.
56. Approval by the BARC:
- a) Drawings and documents as per technical specification shall be submitted by the contractor and shall be subject to the approval/review of the BARC. All changes from the agreed specifications / drawings shall be subject to the approval of the BARC.
 - b) All sub-contractors hired for design and engineering, manufacture, supplies and any other work/services covered under the Contract shall be subject to prior written approval of the BARC.
 - c) While the contractor shall make/execute / perform supplies, work and services in terms of the Contract, the BARC shall have the right to check and approve design, type, quality, quantity, materials and workmanship of any or all items of supplies, work and services where considered necessary by the BARC to ensure that supplies, work and services made/executed/ performed by the contractor are in accordance with the provisions of this Contract.
 - d) To enable the BARC to accord approval/review, the contractor shall submit back-up data/calculations /assumptions as may be required by the BARC.
 - e) Where approval of the BARC is necessary or implied but is not specifically provided for elsewhere in this Contract, such approval shall also come within the purview of this contract.
 - f) Approval by the BARC in terms of this schedule shall not relieve the contractor of his obligations under this Contract.
57. Sub-Contracting: (This provision shall be applicable only when so provided in Proforma of Schedules.)
- a) The contractor shall not sub-contract the Contract Work in whole to third parties for the performance of this Contract.
 - b) The contractor may sub-contract a portion (s) of the Contract Work as indicated in Proforma of Schedules to third parties with the prior written approval of the BARC. The contractor shall furnish full particulars about the proposed Subcontractor(s) and the details of the work to the BARC while seeking such approval.
 - 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 "Public Procurement No.1", "Public Procurement No. 2", "Public Procurement No. 3" and "Public Procurement No. 4"



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issued by Public Procurement Division, Department of Expenditure, ministry of Finance, Government of India their amendments/addendum from time to time.)

- d) BARC shall give approval or shall refuse approval in writing within 30 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.
- e) 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.
- f) Bought out items, critical components, proprietary items and equipment manufactured and supplied by specialized manufacturers which the contractor intends to incorporate in the Contract Work shall not come within the purview of the provision. The decision of Engineer-in-Charge with regards to the procurement of bought out items, critical components, proprietary items and equipment manufactured and supplied by specialized manufacturers shall be final and binding on the contractor.
- g) In case of sub-contracting, the contractor shall hire the services of manufacturer's installation/commissioning personnel for supervision of installation / commissioning, testing and commissioning of the equipment supplied by them.
- h) 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.
- i) In the event certain obligations extended by a Subcontractor/ manufacturer to the contractor are extended beyond the guarantee period specified in the Contract, the BARC shall automatically be entitled to the benefit thereof.
- j) 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.
- k) 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/ Sub-Contracting.
- l) 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.

58. Secrecy:

- a) All maps, plans, drawings, specifications, schemes and the subject matter contained therein and all other information given to the contractor by the BARC in connection with the performance of the Contract Work shall be held confidential by the contractor and shall remain the property of the BARC and shall not be used or disclosed to third parties by the contractor for any purpose other than for which they have been supplied or prepared. The contractor may disclose to third parties, upon execution of secrecy agreements satisfactory to the BARC, such part of the drawings, specifications or information, if such disclosure is necessary for the performance of the Work.

- b) The contractor shall follow at site all security rules as framed by the Department from time to time regarding removal of material from site, issue of identity cards, control of entry of personnel, and all similar matters. The contractor and his personnel shall abide by all security measures imposed by the Engineer-in-Charge or his duly authorized representative from time to time.
59. Rejection of Defective plant:
- a) If the completed plant or any portion thereof, before it is accepted or taken over, be defective or fails to fulfill the requirements of the Contract, the BARC shall give the contractor notice setting forth particulars of such defects or failure and the contractor shall forthwith make the defective plant good or alter the same to make it comply with the requirements of the Contract. Should he fail to do so within a reasonable time, the BARC may reject and replace at the risk and cost of the contractor, the whole or any portion of the plant, as the case may be, which is defective or fails to fulfill the requirements of the Contract. However, such rejection/replacement by the BARC shall not absolve the contractor of his responsibilities under this Contract.
- b) In the event of such rejection, the BARC shall be entitled to the use the plant in a reasonable and proper manner for a time reasonably sufficient to enable him to obtain other replacement plant.
60. During defect liability period/ Guarantee / Warranty:
- a) For a period of twelve (12) calendar months (Six (6) months in the case of work costing Rs. 10,00,000/- (Rs. Ten Lakhs) and below except road work) from the date of issue of completion certificate,
- b) The contractor shall be responsible for all the defects and deficiencies in the work within the scope of this contract, during the defect liability period. The liability of contractor for defects and deficiencies may arise due to:
- Improper planning and design of the project, if planning and design is in the scope of contract.
 - Works, Tools, Plant & Machinery, Materials or Workmanship not being in accordance with this contract.
 - Improper upkeep & maintenance during construction of the work.
 - Improper upkeep, operation and/or maintenance during defect liability period, if these are in the scope of this contract.
 - Failure by the contractor to comply with any other obligation under this contract.
- c) Such defects and deficiencies shall be made good by the contractor at his own cost after getting instructions/notice from the Engineer-in-Charge within the time period specified in such instructions/notice. However, contractor need not wait for instructions/notice from Engineer-in-Charge for rectification of defects in work which come to his notice and he should initiate action for needful rectification of defect on priority, under intimation to Engineer-in-Charge, to avoid any untoward incident.
- d) Methodology for rectification of defects: The design, methodology and quality of rectification of defects carried out by the contractor shall be as per sound engineering practice and shall be approved by Engineer-in-Charge. The decision of Engineer-in-Charge shall be final and binding on the Contractor.

- e) During defect liability period the contractor shall be liable to replace any parts that may fail or show signs of defects in parts of his own manufacture or those of his Sub-contractors under the conditions as per the Contract and under normal use and arising from faulty designs, materials or workmanship or installation or from any act of omission of the contractor.
 - f) All such replacements of defective parts mentioned above shall be made free of cost at site by the contractor and the return of the defective parts to the contractor's works shall be contractor's responsibility and shall be made at his expense. The BARC will however, render such assistance in this matter as will expedite the same. In the case of defective parts not repairable at site but essential in the meantime for the commercial use of the plant, the contractor shall replace at site but free of cost to the BARC the said defective parts, before the defective parts are removed to his works.
 - g) Manufacturer's Guarantee / Mechanical Guarantee.
 - i. All manufacturers' guarantees for all bought out items / equipment / instruments etc. shall be made available to BARC and shall be valid for the entire defect liability period. If such guarantees are not issued by the manufacturer, the contractor shall guarantee the bought-out items for the entire defect liability period along with his guarantee for the Civil works/ foundations as a whole.
 - ii. Contractor shall guarantee for the period as mentioned elsewhere in the tender document against defective performance of all equipment / instruments / mechanical / electrical parts under contractor's scope of supply. Any defects found in either materials or workmanship shall be rectified / replaced by the contractor at his own expense within the time specified by BARC.
 - iii. The contractor shall guarantee the performance of the foundations & related works to meet the specifications when tested in accordance codes / specification / Exhibits of Technical Documents of this tender.
 - h) In the event that the contractor fails to repair or rectify the defect or deficiency within the period specified by the Engineer-in-Charge, the Engineer-in-Charge shall be entitled to get the same repaired, rectified or remedied at the contractor's cost and recover such amount from any dues like performance guarantee, security deposits etc. available with Engineer-in-Charge. Engineer-in-Charge may take action for debarment of contractor from tendering in the department by following due process. For inaction or failure to rectify the defects (mentioned above) within specified time limit, the Engineer-in-Charge may also initiate legal and/or other actions under other applicable laws in addition to other remedies available in the contract.
61. Rights of BARC to vary or cancel the contract:
- a) The BARC shall have the right, during the performance of the Contract, to make changes in the specifications as may be necessary or desirable subsequent to issue of the order or include extra work resulting from final design changes and miscellaneous modifications. It is obligatory on the part of the Contractor to carry out the changes/ extra work.
 - b) Prior to commencement of any extra work or additional work involving possible claim by the Contractor; additional claim(s) if any, over and above the Contract price, shall be submitted to the BARC with detailed estimate in writing, and approval of BARC shall be obtained by providing all other information / documents



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as may be needed/ requisitioned for substantiating such work. In Estimate/ rate analysis material & labour components shall be as per CPWD schedule of rates.

- c) Any amount to be allowed in respect of any variation and/ or alteration of the contract work effected by the BARC under this article shall be added to or deducted from the Contract Price as the case may be.
 - d) The contractor shall not change any works to be made pursuant to this Contract except as may become necessary to enable him to meet his technical obligations under this Contract, provided however that such changes shall be subject to prior written approval of the BARC.
 - e) If any changes are required for completeness of the work or the contractor himself changes as per above article, the contractor shall not be entitled to extra price or time.
 - f) Any change/modification required by the BARC to correct defective workmanship, non-standard installation and non-compliance of statutory regulation by the contractor, shall be undertaken free of cost by the contractor within the time schedule. For such modification the contractor shall take prior approval of the BARC and shall furnish the revised drawing/corrected print after carrying out the modification. All modifications shall also be incorporated in as-built drawings.
 - g) In the event that a change should affect the guarantees of the process/system, a readjustment of such guarantees shall be agreed upon jointly.
 - h) BARC shall have further power to cancel the Contract if
 - The contractor is not executing the order in accordance or as specified in the Contract.
 - The Contractor is not adhering to the phased program as agreed to or the Contractor is not proceeding fast enough to ensure completion by the time stipulated in the contract or that such time has already expired.
 - The Contractor has refused to carry out reasonable instructions of the BARC for the execution of the work.
 - The Contractor has committed any breach of Contract, BARC may at the cost of the Contractor and without prejudice to any other right of his,
 - ❖ perform himself such portion of the contract to which Contractor has failed to execute, or
 - ❖ take the Contract wholly or in part out of the Contractor and re-contract to any party, or
 - ❖ Cancel the contract.
62. In the event that the contractor fails perform their obligations under the contract, Engineer-in-Charge may take action for debarment of contractor from tendering in the BARC/DAE by following due process.
63. The contract shall intimate the Engineer-in-charge, in case he has been blacklisted/ debarred by any Govt. Department/Public sector undertaking/ entity/ authority / agency during the contract period including extensions if any.
64. Language: All documents, instructions, catalogues, brochures pamphlets, design data, norms and calculations, drawings, operation, maintenance and safety manuals, reports, labels, on deliveries, and any other data shall be in English Language.
65. Inspection and Tests at contractor's premises: Inspection and tests shall be carried out as per approved Quality Assurance Plan (QAP), which shall be based on technical

specifications of this tender document. Various stages of inspection and testing shall be identified after receipt of detail Quality Assurance Plan / Inspection Test Plan from the contractor / manufacturer.

- a) The Engineer-in-Charge shall have the right to inspect and test the contract work or any part thereof at any reasonable time during the manufacture by himself or his authorized representative/agency. On demand from the Engineer-in-Charge, the contractor shall carry out such tests appropriately in the presence of the Engineer-in-Charge and at no charge to BARC/Inspection Agency. If a part of the plant is manufactured not on the contractor's own premises but on other premises, the contractor shall obtain permission for BARC to inspect and test the work as if the said plant were being manufactured on the contractor's premises. The inspection, examination, or testing carried out by the Engineer-in-Charge/Inspection Agency shall not relieve the contractor of any of his obligations under this Contract.
- b) The inspection and tests shall be so conducted as not to unreasonably impede the progress of manufacture.
- c) Contractor shall abide by all inspection procedures as per Technical Specification.
- d) BARC reserves the right to inspect the job at any point of time with respect to quality, progress, safety, quantity measurements. The contractor shall bear all costs of any and all inspections and tests and extend all such facilities to the BARC or his authorized representative to accomplish the same. The contractor / sub - contractor shall provide all instruments, tools, necessary testing and other inspection facilities to inspection engineer of BARC free of cost for carrying out inspection.
- e) Where special tests in addition to agreed tests are required by the BARC, the contractor shall bear the cost of the testing only if such special test proves that the equipment is not in accordance with the specifications.
- f) The contractor shall ensure full and free access to the inspection engineer of BARC at the contractor's or their sub-contractor's premises at any time during contract period to facilitate him to carry out inspection and testing assignments without any extra cost.
- g) All drawings, general arrangement and other contract drawings, specifications, catalogues etc. pertaining to equipment offered for inspection shall be got approved by BARC and copies shall be made available to BARC beforehand for undertaking inspection.
- h) The contractor shall carry out all instructions given during inspection and shall ensure that the work is being carried out according to the technical specifications of tender document.
- i) BARC upon giving 7 days' notice in writing and stating any grounds of objection, shall have the right to reject any or all equipment or demand rectification or replacement thereof.
- j) The contractor shall give BARC a minimum of three weeks clear notice of any work being ready for inspection and testing, specifying the period likely to be required for such inspection and testing. Thereafter, BARC or its inspector shall (unless inspection or test is voluntarily waived) on giving 7 (seven) days prior notice in writing to the contractor, attend at the contractor's or his subcontractor's premises for such inspection and testing. Should the BARC so instruct the contractor, the contractor shall proceed with the inspection and testing, without BARC's presence, which shall be deemed to have been made in BARC's presence. The proforma for the inspection certificate shall be approved by BARC.

- k) When the tests have been satisfactorily completed at the contractor's or sub-contractor's premises, the BARC shall issue inspection certificate accordingly. Six copies of Inspection certificates complete with corresponding documents as per approved QAP shall be submitted to BARC for distribution.
 - l) If Test Certificates submitted by contractor are not satisfactory, material testing shall be carried out by contractor and Laboratory Test Reports shall be submitted for confirmation of specification requirements at no extra cost.
 - m) In case any inspection/test fails, re-inspection/ retest shall be carried out after necessary rectification/ replacement by the contractor.
 - n) No material / consumable shall be allowed to use without proper test certificates. No plant & equipment and material shall be shipped before inspection certificate and dispatch instructions have been issued by the BARC.
 - o) The satisfactory completion of inspection/test or issuance of the certificate by the BARC or his inspector/representative shall not discharge the contractor of his liability should the equipment on further inspection/ test during or after installation, be found not to comply with the requirement of the contract.
 - p) In the case of such plant & equipment, where tests set forth above cannot be conducted either partially or fully in contractor's premises but have to be conducted at site only after assembly/installation, the provisions under this article shall also apply. However, in such cases prior approval of the BARC shall be obtained by the contractor.
 - q) The contractor shall not offer any item for inspection in painted conditions unless otherwise agreed in writing with BARC.
 - r) The contractor shall ensure that the equipment / assemblies / component of the item required to be inspected are not assembled or dispatched before inspection.
 - s) The contractor shall ensure that the items once rejected by the BARC inspection engineer are not used in the subsequent works. Where parts rejected by BARC inspection engineer have been rectified or altered, such parts shall be segregated for separate inspection and approval, before being used in the work.
 - t) Where facilities for testing do not exist in the contractor's / sub-contractor's laboratories, samples and test pieces shall be drawn by the contractor/ sub-contractor in presence of Inspection Engineer of BARC and duly sealed by the latter and sent for tests in Government approved test house or any other testing laboratories approved by BARC Inspection Engineer at the contractor's cost.
 - u) The opinion of BARC on the mode of testing and interpretation of the results thereof shall be final and binding on the contractors and shall be without appeal.
 - v) Final Inspection: After completion of all tests as per specification, the whole work will be subject to a final inspection to ensure that job has been completed as per requirement. If any defect is noticed, the contractor will be notified by BARC, and he shall make good the defects with utmost speed. If, however, the contractor fails to attend to these defects within a reasonable time (time period shall be fixed by BARC) then BARC may have defects rectified at contractor's cost.
66. Safety:
- a) 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. Wherever National Building Code (NBC) requirements are to be incorporated in the design the same shall be considered in the design even if it is not detailed in the specifications.

- b) The contractor 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 the BARC / other contractors particularly to the overhead and underground cables and other service lines.
- c) When the work is carried out at night or in the obscure daylight, adequate flood lighting in the working area shall be made by contractor at his own cost and got approved by the BARC. All permissions from statutory bodies for working shall be obtained by the contractor.
- d) The safety posters/regulation for prevention of accidents shall be displayed by the contractor at appropriate places. Notices and warning signs shall be displayed for all sources of dangers.
- e) All electrical drives and equipment must be equipped with safety devices. The safety provisions shall conform to the recognized standards, safety codes and statutory regulations.
- f) All safety measures as required to be adopted as per the statutory regulations and the safety rules shall be strictly followed by the contractor during the execution of the Contract.
- g) Adequate number of first aid boxes shall be provided and maintained at work site.
- h) The following safety measures should be strictly adhered to during execution of works:
 - Providing the working platform with toe board and handrail for continuous working at heights.
 - Providing safety belt and life line at all times for men working at heights.
 - Providing dust or fume respirator in places where dust and fume concentration exists.
 - Providing goggles and welding screens.
 - Providing acid and alkali proof rubber gloves for handling acid and alkali and chemical which are corrosive.
 - Providing rubber gloves for working on electrical works.
 - Ensuring proper lashing and securing of the components while being transported in vehicles.
 - The vehicles must have side supports or have body to support the materials conveyed.
 - The materials should not be allowed to extend or overflow the sides of the vehicles.
 - Materials should not be allowed to overhang from the rear edge of the body of the vehicle.
 - Driver of the vehicle must possess license.
 - Vehicle must not be overloaded prescribed limits.
 - Red flags and lights for parts projecting from the body of vehicle must be provided.
 - The speed restrictions within the factory premises must be strictly adhered to.
 - The gas cylinders must be always handled on trolleys or kept tied down when not in use. They should never be rolled as roller for conveying.
 - Cylinders should not be used without regulators.
 - All excavations areas must be barricaded and safety/ caution tapes must be provided.
 - All electrical connections must be properly earthed.

- No work should be taken up for execution inside shop floor, without obtaining necessary work permit.
- Providing helmet, safety belt, safety shoes etc., for high level work and sufficient number of Industrial Safety nets at appropriate level to safeguard the persons working at high level particularly in trusses, girders, roofing etc., of industrial and high roof buildings.
- The contractor should maintain a register regarding the driver license particulars.
- All personal protective equipment shall be issued to all workforce and shall be used as per standard industry practice.
- Providing helmet, safety belt, safety shoes etc., for high level work and sufficient number of Industrial Safety nets at appropriate level to safeguard the persons working at high level particularly in trusses, girders, roofing etc., of industrial and high roof buildings.
- Contractor including their sub-contractors, agents and labour engaged on the work are required to scrupulously adhere to the safety regulations, safety precautions and measures.
- Any violation thereof will invite punitive action being taken against them. Also, contractors with frequent violations of safety regulations will not be entrusted with further work in this organization.

i) Safety precautions to be observed while transporting materials:

i. Vehicle:

- Vehicles carrying material should have proper registration documents and must be produced on demand by our Security Staff.
- The light on right side, i.e., over the driver's cabin shall be in working condition.
- Both the head lights as well as park lamps must be in working conditions.
- The vehicles should have valid smoke emission test conducted before entering the BARC premises and should the same should be produced to security/safety personnel if required.

ii. Movement of vehicle:

- The vehicle should not travel at more than 20 kmph in our premises.
- The driver of the vehicle must possess heavy duty license and produce on demand by the Security Staff.
- Vehicles carrying inflammable liquids in the tank containers should have grounding chain or the tank should be coated with insulating material also to avoid Static Electricity.
- In road junctions and speed breakers the speed should be lowered and vehicle should proceed cautiously.
- The driving should 'KEEP TO THE LEFT' at all places.
- The vehicle should not be parked on road which could obstruct the vehicular traffic.
- The vehicle should pass only through the approved routes. Short cuts should be forbidden.
- There must be a safe distance behind another moving truck.
- The driver should avoid making quick starts, jerky stops or quick turns at excessive speed.

67. House Keeping:

- a) It is the responsibility of the contractor to maintain general cleanliness and proper housekeeping at work site. The contractor shall organize disposal of excavated

earth/garbage/ rubbish/ scrape, electrode butts etc. on day-to-day basis to identified disposal areas/safe areas as per BARC.

- b) All rubbish including muck and sludge, as it accumulates from time to time during the progress of the work and at completion, is to be cleared and carted away and all materials condemned by BARC shall be removed from site as and when required during the entire duration of the work.
- c) The contractor shall dispose of the unserviceable materials, debris etc., to the earmarked area within / outside the premises as decided by BARC. No extra payment shall be paid on this account. Serviceable materials shall be stored in designate area separately after obtaining acknowledgement of BARC.
- d) While transporting materials from site and disposal of surplus materials, the spilled-over materials / earth / debris etc. on the road should be got cleaned by the contractors after the day's work is over.
- e) Contractor shall arrange to dispose of debris and any other waste product created while carrying out the work, outside BARC's premises. The contractor shall take due care while disposing of such waste materials and ensure that any rules/regulations laid down by local panchayat/ municipal corporation, BARC, or any other statutory Body are not violated. The contractor shall be responsible and answerable to any complaint arising out of improper disposal of wastage. Quoted rate shall involve the cost of same, and no extra payment shall be made towards this account.
- f) The contractor should ensure proper awareness to workers to maintain a green and clean environment inside / outside the plant. The contractor must collect and dispose of all the waste and scrap materials at the designated place only as directed by Engineer - in - Charge.

68. Protection of Existing Facilities:

- a) The contractor will familiarize himself with and obtain information and details from BARC in respect of all existing structures, overhead lines, existing pipelines and utilities existing at the job site before commencing work. The contractor shall execute the work in such a manner that the said structures, utilities, pipelines etc. are not disturbed or damaged, and shall indemnify and keep indemnified BARC from and against any destruction, damages thereto. In case of any type of damages, contractor shall execute the replacement / rectification work free of cost.
- b) Contractor shall obtain all safety clearance (viz. Excavation, Cold work permit, permit for working on heights) from BARC, as may be required from time to time, prior to start of work.
- c) Despite all precautions, should any damage to any structure / utility etc. occur, the contractor shall contact Engineer-in-charge and contractor shall forthwith carry out repair at his expenses (restored to their original condition) under the direction and to the satisfaction of Engineer-in-charge.

69. Site Facilities: The contractor shall arrange for the following facilities at site, for workmen deployed/ engaged by him at his own cost:

- a) Arrangement for First Aid.
- b) Arrangement for clean & potable drinking water.
- c) A creche where 10 or more women workers are having children below the age of 6 years.
- d) Any other facility/utility as may be required as per the existing laws.



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- e) In addition to above, all workmen working at heights and in adverse weather conditions like under direct sunlight etc, shall be provided with a 50 gm glucose pack per each shift.
 - f) Proper rest facility with drinking water for the lunch period.
 - g) Proper facilities for Toilets.
70. Contractor's Site Office and Stores:
- a) Contractor at his own cost shall construct his Site Office, Stores and Fabrication Shed (in Fabrication Yard). The same shall be dismantled by the contractor prior to submission of Final Bill.
 - b) Contractor or his authorized representative shall be always available in his Office, so that necessary information / instruction could be delivered whenever necessary.
 - c) Before construction of any temporary facility, contractor shall submit proposal with necessary sketches and obtain approval from BARC. Unauthorized construction shall be demolished at the risk and cost of contractor.
 - d) The contractor shall remove all temporary buildings / facilities, etc., before leaving the site after completion of works in all respect.
 - e) The contractor will be responsible for carry out the warehouse management & material control of his supplied items in accordance with approved warehousing & material control procedure, which is to be submitted by the contractor during kick-off meeting. Contractor shall submit the reconciliation list of ordered items, consumed items, and items inventory.
 - f) The contractor shall provide and maintain proper temporary sheds for the storage and protection of materials etc. and other work that may be brought or executed in the site including the tools and materials of contractor.
71. Construction Rules and Regulations: Contractor shall observe in addition to Codes specified in respective specification, all national and local laws, ordinances, rules, and regulations and requirements pertaining to the work and shall be responsible for extra costs arising from violations of the same.
72. On completion of work, contractor shall mark the center lines of equipment foundation N-S & E-W axis and finished levels. A foundation handing over protocol indicating required & achieved values for all dimensions / levels shall be submitted for each foundation (Applicable for machine / equipment foundations also).
73. Security: The contractor shall arrange to obtain, through BARC, well in advance, all necessary entry permits/gate passes for his staff and labor. Entry and exit of his men and materials shall be subject to vigorous checking by the security staff. Workers shall be escorted from the main gate up to the site by designated supervisors of the contractor, and they are not allowed to roam here and there inside the premises.
74. Drawings and Documents: Drawings accompanying the tender document are preliminary, indicative of scope of work, and are issued for bidding purpose only. Purpose of these drawings is to enable the contractors to make an offer in line with the requirements of BARC. The working drawing shall be issued in phased manner at the time of execution.
75. Checking of Levels: Contractor shall be responsible for checking levels / orientation / alignment of all foundations, fixtures, etc. well in advance of taking up erection work, and bring to the notice of Engineer-in-Charge, discrepancies, if any. Necessary rectifications on



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account of any minor variations shall be carried out by the contractor within the contracted rates. Delivery extension shall not be granted for any type of rectification work.

76. Construction Equipment & Mechanization of Construction Activities: The contractor shall without prejudice to his overall responsibility to execute and complete the work as per specifications and time schedule, progressively deploy adequate equipment, and tools & tackles and augment the same as decided by Engineer-in-Charge depending on the exigencies of the work so as to suit the construction schedule. Contractor to ensure deployment of all required tools, tackles & equipment and take all safety precautions during execution of work. The contractor shall mechanize the construction activities to the maximum extent by deploying all necessary construction equipment / machinery in adequate numbers and capacities. The contractor needs to submit the schedule for arrangement of heavy cranes and their mobilization plan.
77. For materials supplied by BARC, if lost or damaged while in charge and custody of the contractor, recovery shall be made by the Department at the rate specified in Proforma of Schedules or the cost there of + 1 % handling charges whichever is higher. For the purpose arriving at the cost of materials, rates at which the articles have been purchased by the Department or the ruling market rates whichever is higher shall be taken into consideration.
78. Site Organization: The Contractor shall furnish the site organization chart indicating deployment plan. The contractor shall without prejudice to his overall responsibility to execute and complete the works as per specifications and time schedule progressively deploy adequate qualified and experienced personnel together with skilled /unskilled manpower and augment the same as decided by BARC depending on the exigencies of work to suit the construction schedule without any additional cost to BARC.
79. Additional / Extra Works: BARC reserves the right to execute any additional works / extra works, during the execution of work, either by themselves or by appointing any other agency, even though such works are incidental to and necessary for the completion of works awarded to the contractor. The contractor identified vide this tender shall not raise any objections, whatsoever to all such steps taken by BARC.
80. It shall be the responsibility of the contractor to obtain the approval for any revision and/or modifications decided by the contractor from BARC before implementation. Also, such revisions and / or modifications if accepted / approved by BARC shall be carried out at no extra cost to BARC. Any change required during functional requirements or for efficient running of system, keeping the basic parameters unchanged and which has not been indicated by the contractor in the data / drawings furnished along with the offer shall be carried out by the contractor at no extra cost.
81. All expenses towards mobilization at site and demobilization, including bringing in equipment, work force, materials, dismantling the equipment, clearing the site etc. shall be deemed to be included in the prices quoted and no separate payments on account of such expenses shall be entertained. It shall be noted that the quoted rates are deemed to include mobilization of workforce equipment, tools & tackles, and working during time extension granted by BARC.

82. It shall be entirely the contractor's responsibility to provide, operate and maintain all necessary construction equipment, safety gadgets, lifting tackles, tools and appliances to perform the work in a workman like and efficient manner and complete all the jobs as per time schedule.
83. Preparing approaches and working area for the movement and operation of the lifting equipment, levelling the areas for assembly and erection shall also be responsibility of the contractor. The contractor shall acquaint himself with access availability facilities, local labour etc., to provide suitable allowances in his quotation. The contractor may have to build temporary access roads to aid his own work, which shall also be taken care of while quoting for the work.
84. The procurement and supply in sequences and at the appropriate time of all materials, and consumables shall be entirely the contractor's responsibility and his rates for execution of work will be inclusive of supply of all these items.
85. Work shall be carried out in shifts to achieve committed targets. For smooth progress of work in all shifts, contractor shall ensure availability of adequate resources (manpower, machinery including supervision) on site as directed by BARC.
86. 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 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.
87. Coordination with other agencies: The contractor shall be responsible for proper coordination with other agencies operating at the site of work so that work may be carried out concurrently, without any hindrance to others. BARC shall resolve disputes, if any, in this regard, and the decision shall be final and binding on the contractor.
88. Documentation:
- a) Completion Documents: The following documents, as-build drawings shall be submitted by the contractor in Triplicate & one soft copy in CD; as part of completion documents:
- Test certificate for materials supplied by the contractor.
 - Certified records of field tests on materials / equipment, as applicable.
 - Material appropriation statement as required.
 - Inspection Certificates/ Reports.
 - Catalogues, Operating & maintenance manual.
 - Guarantee certificates.
 - Other documents as mentioned in Technical Specification.



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- viii. No Claim certificate in the format prescribed by BARC.
 - ix. Return of all drawings and documents issued to the Contractor.
 - x. “AS BUILT” Drawings: Upon completion of work, the contractor shall complete all drawings to "As built" status (including all sub-contractor's/ vendor / Sub - vendor's drawings for bought out items, with details of embedded and covered works, incorporating all additions and alterations) and shall submit for the approval of BARC. This shall be duly certified by BARC.
- b) Others:
- i. Project Scheduling and Monitoring: The following schedules / documents / reports shall be prepared and submitted by the contractor for review / approval at various stages of the contract.
 - Contract shall submit the following with 15 days of placement of Work Order:
 - Detailed PERT/Bar Chart, which shall include materials procurement plans, mobilization plan for men (man-hour histogram), machinery and materials.
 - Site Management plan showing location of office, store yard, Site laboratory, labour colony and other Temporary facilities.
 - Job hazard analysis, quality assurance plan, Emergency Evacuation Procedure (including fire order), Storm water Management Plan, Heavy transport and heavy lifting plan (Rigging Plan), Monsoon counter measures and preparation plan, site organization chart etc.
 - Project Review Meetings: The contractor shall present the program and status at various review meetings as required. Contractor will provide his authorized nominee at site to take participation in weekly meeting to sign the Records of Meeting. Weekly co-ordination meetings / Weekly Review Meeting shall be done at venue as decided by BARC.
 - Weekly site co-ordination meetings shall be attended by the contractors working on site & proper intimation should be given to the BARC in order to monitor the project more efficient way. The relative decision for the execution of tender items shall be given in these meetings by BARC by producing working drawings/hand-made sketches if any.
- c) Progress Reports:
- Monthly Progress Report: Scheduled vs Actual progress shall be reported on a monthly basis. Necessary catch-up plan for any lags noticed shall be formulated by contractor and submitted for BARC's review & approval. The catch-up plan shall be duly implemented by the contractor.
 - This report shall be submitted in three copies on a monthly basis within five calendar days from cut-off date as agreed upon, covering overall scenario of the work. The report shall include but not be limited to the following:
 - Brief introduction of the work Activities executed /
 - Achievements during the month.
 - Scheduled vs actual percentage progress and progress curves for sub-ordering, manufacturing / delivery, sub-contracting, construction activities and overall quantum wise status of purchase orders against scheduled.
 - Areas of concern / problems / hold ups, impact and action plans.
 - Resource deployment status
 - Summary for Material Requisitions and deliveries, subcontracting and construction



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- Distribution: BARC Two copies & One at Site.
 - i. Weekly Report: This report (3 copies) will be prepared and submitted by the contractor on weekly basis and will cover following items:
 - Activities programmed and completed during the week.
 - Resources deployment status (manpower and machineries)
 - Progress achieved against target in construction.
 - Areas of concern
 - Construction percentage progress scheduled and actual.
 - Distribution: BARC Two Copies & One at Site.
 - ii. Daily Report: Contractor will submit on daily basis Progress Report to be generated at site in electronic form or hard copy and shared through E- Mail at the address provided by BARC giving all the details including valid reasons for delay if any vis-a-vis to commitment i.e. weekly plan /monthly plan /approved bar chart.
- d) Coding/Numbering Scheme: A coding scheme for identifying the drawings, equipment, structures, spares and shipping shall be adopted by the contractor in a sequential manner. The objective shall be to provide the following:
- i. Streamlined archives management.
 - ii. Effective control with respect to identification of equipment and drawings to be supplied.
 - iii. Identification of the spare parts for easier inventory control.
 - iv. The scheme will be finalized with the successful contractor during detailed engineering/ initial planning.
89. Typographical or Clerical Errors: Accepting Authority's (mentioned in Schedule "F", Refer Section-VII (i)) clarifications regarding partially omitted particulars or typographical or clerical errors shall be final and binding on the contractor.
90. The bidder who has been awarded the contract (referred to as the 'L1 Bidder') must maintain their status as the lowest bidder throughout the duration of the contract. Should the 'L1 Bidder' be unable to maintain this status, they are required to provide a sufficient rebate on their quoted rates to ensure that their bid remains the lowest.
91. W.r.t escalation clauses of GCC (10CA, 10CC), in case there is change in the Wholesale Price Index (WPI) series & the WPI data as per the series existing at the time of submission of tender is discontinued by "Office of the Economic Adviser"; then the linking factor between new series & old series will be decided by Engineer-in-Charge. The price index of nearest similar Material/ Individual Commodities / group Items in the new series will also be decided by Engineer-in-Charge. The decision of the Engineer-in-Charge shall be final and binding on the contractor.
92. The rates quoted by the tenderer in the bill of quantities will be deemed to be for the finished work and shall include all charges for the following (if applicable):
- a) Plant, double scaffolding, frame work, ladders, ropes, nails, spikes, tools, materials and workmen, protection from weather, temporary supports, platform and the maintenance of the same.
 - b) All temporary canvas, lights, tarpaulin, barricade, office & store set-up etc. All such temporary weather-proof sheds at such places and in a manner approved by the Engineer-in-Charge.



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- c) All testing of materials and destructive samples as per standards & QAP/ITP.
- d) Rates quoted by contractor are deemed to include deployment of competent Quality Control Engineers from start to completion of work for upkeep and maintain all QA/QC records in accordance to ITP/QAP/Relevant codes/any other requirement as specified in Tender.
- e) Transit insurance of material covered under this tender will be in scope of contractor at his cost.

93. General:

- a) Failure to submit the BG in proper format within the time stipulated will not entitle the Contractor for seeking any change in the Effective Date of Contract.
- b) All progress payments except the last payment shall be regarded as payments by way of advance against the final payment only and not as payment for work actually completed and shall not preclude defective/imperfect/incomplete work to be removed. It will not be considered as an admission of the due performance of the Contract, or any part thereof nor shall it include, determine or affect in any way the powers of the BARC under these conditions or in any other way vary or affect the Contract.
- c) The BARC reserves the right to encash Bank Guarantees if sufficiently convinced of negligence and lack of dedication to work on the part of the Contractor.
- d) It shall be distinctly understood that notwithstanding the reviews and suggestions if any, by BARC, the sole and ultimate responsibility for the safety, stability and performance of the form work and staging and all other temporary works shall be that of the contractor.
- e) The contractor has to ensure efficient use of natural resources like water, fuel oil and lubricants.
- f) The partners or Directors of the contractor shall meet the officers of BARC at the site of works or at their respective offices whenever requested to do so.
- g) BARC reserves the right to use the premises and any portion of site for execution of any work not included in this contract which BARC may desire to get executed by other agencies. The contractor shall allow all reasonable facilities for the execution of such work but shall not be required to provide any plant or material for which work except by special arrangement with BARC in such a manner as not to impede the progress of the works included in this contract and the contractor shall not be responsible for any damage or delay which may happen or be occasioned by such work.
- h) The contractor shall be represented at site at all times during the tenure of the contract by responsible and qualified engineers approved by BARC. Such engineers shall form the contractor's project management and site supervisory team. They shall be in constant attendance upon all activities of the work. Contractor's Personnel shall be available at all reasonable working hours to receive instructions, notices or communications and clear away on completion and make good all works distributed.
- i) The contractor shall at all times give access to the staff of the statutory bodies as well as other agencies associated with the project and shall provide them all facilities like scaffolding, water, lighting etc. at site for discharging their duties.
- j) The contractor shall provide at his cost all temporary lighting arrangement required for the works to enable the contractor to complete the work in the specified time.
- k) No concreting shall be done during the absence of BARC representative.



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- l) The portions of the site to be occupied by the contractor shall be defined and/or marked on the site plan, failing which these shall be indicated by BARC at site and the operations beyond the areas are not permitted. In respect of any land permitted by BARC for the use of the contractor for the purpose of or in connection with the contract, the same shall be subject terms and condition as may be imposed by BARC. Such use or occupations shall not confer any right of tenancy of the land to the contractor.
- m) The contractor shall have no right to put up any construction of his own of any nature or type on BARC's land, except temporary constructions as provided in the contract. Such construction will be erected at the contractor's own cost. The contractor shall at his own cost demolish all such constructions, remove the all his materials, equipment and debris, clean and level the site, before handing over the completed work to BARC.
- n) The contractor shall provide if necessary or if required for the site all temporary access thereof and shall alter adapt and maintain the same as required from time to time and shall take up and clear them away as and when no longer required and as and when ordered by BARC and make good all damages done to the site. The contractor shall note that the final bill will not be certified for payment till the action as above is completed by the contractor to the entire satisfaction of BARC.
- o) All documents, drawings, tracings, photo prints and writing (except letters) shall be the sole property of BARC and must be returned to them on completion of work. The drawings maintained on the site are to be carefully mounted on boards of appropriate size. They are to be protected from ravages from termites, ants, silverfish and other insects.
- p) The Time schedule includes monsoon period also, hence request for time extension due to monsoon will not be entertained by BARC. Any extra charges / rate amendment shall not be entertained due to delay in execution of contract where delay is attributable to the contractor or in Force majeure conditions.
- q) During the execution of the work contractor must check his work with his drawings. The contractor shall be responsible for all the errors in this connection and shall have to rectify all defects and / or error at his own cost failing which BARC reserves the rights to get the same rectified at the risk and cost of the contractor.
- r) 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.
- s) During inclement weather the contractor shall suspend concreting and plastering for such time as BARC may direct and shall protect from injury all works in the course of erection.
- t) Should the work be suspended by reason of rain, strike, lockouts or other cause the contractor shall take all precautions necessary for the protection of the work at his own expense shall make good any damages arising from any of this cause.
- u) The contractor shall build temporary benchmarks in the form of concrete pedestals.
- v) The contractor shall provide requisite protection for the executed work from adverse weather conditions. Any damage caused must be made good by the contractor at his own expense.
- w) Safety & Security of the materials brought by the contractor and the portion of executed work, will be Contractor's responsibility till final bill and hand over. BARC shall not be held responsible in any manner.
- x) This Tender/ Contract is subject to Mysuru jurisdiction only.



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ANNEXURE – I (Claim A(ii)) (Under Clause 51.15)

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 are as follows:

	Description	H.P./KW	Type of Starting	Single Phase or 3Phase
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:



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Number and Wattage.

1. 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 :
2. Total maximum demand for our layout will not exceed _____KW/KVA.
 3. We shall be providing our own KWH meter and test certificate for the KWH meter will be submitted before effecting power supply.
 4. 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.
 5. The installation shall be executed conforming to I.S. Code of practice and Indian Electricity Rules with their latest revision.
 6. We shall be submitting required test reports in proforma enclosed every month and before on set of monsoon.
 7. 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



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ANNEXURE – II (Claim A (vii) & B (I)) Under Clause 51.15

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 writing

(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:



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- i) Description of earthing electrode.
- ii) No. of earth electrodes.
- iii) State of main earth load.
- (i) 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
_____mega ohms.
- ii) Insulation resistance between the phase conductor and neutral.
Between Phase R and neutral _____mega ohms
Between Phase Y and neutral _____mega ohms
Between Phase B and neutral _____mega ohms.
- iii) Insulation resistance between the phase conductors in case of polyphase supply.
Between phase R and Phase Y _____mega ohms.
Between phase Y and Phase B _____mega ohms.
Between phase B and Phase R _____mega ohms.
- iv) Insulation resistance of motor/other plants.
- | S.No. | Equipment | Capacity | I.A. Test Result |
|-------|-----------|----------|------------------|
| _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ |
- 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. _____



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Signature of Electrical Supervisor/Contractor
License No. & Class

Signature of the Contractor
Name &Address:



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SECTION-V

GENERAL & TECHNICAL SPECIFICATIONS
(UPLOADED SEPARATELY)



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SECTION-VI

TENDER DRAWINGS
(IF APPLICABLE-UPLOADED SEPARATELY)



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SECTION-VII (i)

PROFORMA OF SCHEDULES
(UPLOADED SEPARATELY)



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SECTION-VII (ii)

PRE-QUALIFICATION/ UNDERTAKING FORMS & FORMS OF BANK
GUARANTEE BOND FOR BID SECURITY/ PERFORMANCE SECURITY/
SECURITY DEPOSIT



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LETTER OF TRANSMITTAL (on Letter Head of the Bidder)

Date:

From:

To
Chief Engineer/ Superintending Engineer
Bhabha Atomic Research Centre,
Yelwal,
Mysore –571 130

Subject: Submission of Tender document for

Tender No: _____

Name of the Work: _____

Sir,

Having examined the details given in tender documents(s) for the above work, I / We hereby submit the relevant information.

1. I/We hereby certify that all the statements made and information supplied in the enclosed Forms, Undertaking and other accompanying documents / 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 submit.
3. I/We submit the requisite certified solvency certificate and authorize the Chief Engineer/ Superintending Engineer, BARC, Mysuru to approach the Bank issuing the solvency certificate to confirm the correctness thereof. I/we also do not have any objection in, BARC officials to approach individuals, employers, firms and corporation to verify our competence and general reputation.
4. I/We submit the following certificates in support of our suitability, technical knowledge and capability for having successfully completed the following works:

S. No.	Name of work	Certified by/from

Enclosures. 1.

2.

5. **Certificate:** (i) It is certified that the information given in the enclosed Eligibility/ Pre-Qualification bid are corrects. (ii) It is also certified that I/ WE shall be liable to be debarred, disqualified in case any information furnished by me/us is found to be incorrect and also Tender Inviting Authority/ Engineer-in-charge shall be free to forfeit the entire amount of EMD & Performance Guarantee. (iii) It is also certified that I/ WE shall be liable to be debarred, if the tender is withdrawn or modified by us within the validity period and before award of work whichever is earlier.

Date of submission:

Signature of the Bidder(s), with seal

Name of the Authorised person submitting the Bid:

Designation of the Authorised person submitting the Bid:



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FORM - A
FINANCIAL INFORMATION
(To be given on Letter Head of Chartered Accountant)

- 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 (Upload Scanned Copy).

Particulars	Financial Year				
	FY:	FY:	FY:	FY:	FY:
i) Gross Annual turnover on Construction works (In Rupees Lakhs)					
ii) Profit / Loss (In Rupees Lakhs)					
Certified by					
Name and address of Chartered Accountant with seal					

- 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”

Unique Document Identification Number (UDIN)

Signature of Chartered Accountant

Name of Chartered Accountant

Membership No. of ICAI

Date and Seal

Signature of the Bidder(s), with seal



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FORM - B

FORM OF BANKERS CERTIFICATE FROM A SCHEDULED PUBLIC / PRIVATE
SECTOR BANK

(To be given on Letter Head of the Bank)

This to certify that to the best of our knowledge and information that M/s /Shri. _____ having marginally noted address, _____ as a customer of our bank are/is respectable and can be treated as good for any engagement up to 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

Note:

1. Bankers Certificate Should be on the letter head of the Bank, addressed to tendering authority.
2. In case of Partnership firm, certificate should include name of all partners as recorded with the Bank.
3. The date of the certification shall not be older than one year from the “date of opening of Part A” i.e., Techno-Commercial Bids.
4. **The scanned copies of following certificates are to be uploaded along with Form-B:**
 - (a) Profit & Loss account certified by CA & as submitted to Income Tax Department.

Signature of the Bidder(s), with seal



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FORM- B-1

FORM FOR CERTIFICATE OF NET WORTH FROM CHARTERED ACCOUNTANT (To be given on Letter Head of Chartered Accountant)

"It is to certify that as per the audited balance sheet and profit & loss account during the financial year[#] (1ST April to 31st March), the Net Worth of M/s (Name & Registered Address of individual/firm/ company), as on **31st March**[#] is Rs. after considering all liabilities. It is further certified that the Net Worth of the company has not eroded by more than 30 % in the last three consecutive financial years ending **31st March**[#]."

Unique Document Identification Number (UDIN)

Signature of Chartered Accountant

Name of Chartered Accountant

Membership No. of ICAI.....

Date and Seal.....

Signature of the Bidder(s), with seal

Notes:

1. [#] Financial year shall be as specified in the Tender Documents.



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FORM – C

(on Letter Head of the Bidder)

**DETAILS OF ALL WORKS SATISFYING THE SIMILAR WORKS CRITERIA
COMPLETED DURING THE LAST SEVEN YEARS ENDING PREVIOUS DAY OF
LAST DAY OF ONLINE SUBMISSION OF THE TENDER.**

S. No.	Name of work /project and location	Owner or sponsoring organization	Final completion cost of the work	Stipulated date of commencement as per the contract	Actual date of commencement	Stipulated date of completion as per contract	Actual date of completion	Justified period of Extension of Time (If applicable)	Litigation /arbitration cases pending /in progress with details*	Name & Address / Phone No. of officer to whom reference may be made.	Remarks
[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]

Signature of the Bidder(s), with seal

*indicate gross amount claimed and amount awarded by the Arbitrator.

Notes:

- Bidder shall upload the following (along with Form-C) for each work:
 - Scanned copies of the work order along with bill of quantities and rates
 - Scanned copies completion certificate or similar documentary evidence(s). The Completion certificate or similar documentary evidence(s) should contain the name of work, Work order no., Stipulated date of commencement, Actual date of commencement, Stipulated date of completion, Actual date of completion, justified period of extension of time (if applicable), Amount of compensation levied (if applicable), Amount of reduced rate items (if applicable), performance report (Format as per Form E). and final completion cost of the work. The completion certificate issued by the client shall be for individual Work Order.
 - For Work orders where the client is other than Central Government / State Government / Public Sector Undertaking of Central or State Governments /

Central or State Autonomous bodies, the bidder shall upload –

- i. Certificate for bill wise payment (Format as per Form E-1) received by the bidder, which shall be signed with seal by Chartered accountant on letter head with Membership no & UDIN, and their respective TDS amount & TDS certificate number.
2. Clubbing two or more Work Orders in one completion certificate shall not be considered for evaluation. Bidder shall upload completion certificate for each individual Work Order.
3. The Works listed by the bidder without uploading the documentary proof shall not be considered. The documentary proof of Works uploaded without listing the same in Form-C shall not be considered.
4. Composite Works where only a part of a completed composite works satisfies similar works criteria, value of that part only shall be considered under similar works criteria. The bidder shall also upload the following details and documents:
 - a. Statement of final bill showing quantity of all items executed under the Work order and final bill value should be matching with the amount mentioned under final contract value in completion certificate or similar documentary evidence(s) certifying completeness of contract issued by client.
 - b. Statement (signed by the bidder) of all items and their quantities segregated from final bill which are fulfilling the similar works criteria and their total amount for consideration under the similar works criteria.
5. The above desired information can be uploaded as part of one or more document.
6. Separate sheets if any shall be numbered in sequence.



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FORM – D

(on Letter Head of the Bidder)

DETAILS OF WORKS UNDER EXECUTION OR AWARDED

(No works shall be left out)

Sl. No.	Name of work / Project and location	Owner or Sponsoring organization	Cost of work in Lakhs as per contract	Stipulated date of commencement as per the contract	Actual date of commencement	Stipulated date of completion	Up to date % progress of work	Slow progress if any and reasons thereof	Justified period of Extension of Time (If applicable)	Name & Address / Phone no. of officer to whom reference may be made	Remarks
[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]

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

Notes:

1. Bidder shall upload the following for each work:
 - a. Scanned copies of the work order along with bill of quantities and rates.
2. Separate sheets if any shall be numbered in sequence.



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FORM - E
PERFORMANCE REPORT OF WORKS REFERRED TO IN FORM “C” & “D”

(Separate certificate for each work/ Project to be submitted)

Name of the Contractor:

1. Name of work/Project & Location
2. Agreement No.
3. Contract Value:
4. Cost of work i.e. Final Completed Contract value (with breakup of GST Amount, for works that are completed after the implementation of GST Act):
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/Fair/Poor
(2) Financial soundness	Very Good/Good/Fair/Poor
(3) Technical Proficiency	Very Good/Good/Fair/Poor
(4) Resourcefulness	Very Good/Good/Fair/Poor
(5) General behaviour	Very Good/Good/Fair/Poor
(6) Time Consciousness	Very Good/Good/Fair/Poor

11. Contract terminated/ foreclosure if any:

Dated:

Signature of the client with Seal
Name of the Authorised person:

Designation of the Authorised person (Executive Engineer or equivalent):

Note:

- 1) Bidder shall upload Separate certificate for each work referred to in Form “C” & “D”.
- 2) Performance Attribute “Satisfactory” shall be considered as “Good”.



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Bhabha Atomic Research Centre Mysuru

FORM – E-1

(To be given on Letter Head of Chartered Accountant)

**Certificate giving details of bill wise payment received, TDS for all similar works executed
for clients other than Central Government / State Government / Public Sector
Undertaking of Central or State Governments / Central or State Autonomous bodies.**

Company Name	: M/s
Name of Contract	:
Contract Order no. / agreement no.	:
Contract Order / agreement date	:
Completion Certificate Number/ similar documentary evidence certifying completeness of Contract issued by client (Only for the Completed Contracts)	:
Client's Name, Address & Contact Details	:
PAN no. of client	:
PAN no. of bidder	:

Sr. No.	Bill No.	Bill Period	Rate of TDS	Bill Amount	TDS Amount	Details of TDS Certificate as per Form 26AS/Form 16 A/AIS Annual Information System relating to the work only	
						Date	TDS certificate Number.

I/We have obtained all the information from the bidder which is necessary for the purpose of certification. It is certified that the all information are correct to the best of our knowledge and belief. The certification process involves examining the supporting documents.

Unique Document Identification Number (UDIN)



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Signature of Chartered Accountant

Name of Chartered Accountant

Membership No. of ICAI

Date and Seal

Signature of the Bidder(s), with seal

Notes:

1. The number of rows may be increased to suit the requirement.
2. The above format shall be uploaded separately for each Work referred in Form "C", where the client is other than Central Government / State Government / Public Sector Undertaking of Central or State Governments / Central or State Autonomous bodies.
3. Bidder shall take out the print of this format and get it filled and certified by Chartered Accountant under his signature and seal having membership no./FRN and UDIN.
4. Executed Value of the contract shall be commensurate with value of TDS certificate.
5. This form need to be supported with Form-26 as taken in HTML format or form 16-A.
6. In case of multiple contracts taken from a client, details of TDS/Form -26AS/AIS (Annual Information System) for each work need to be segregated and given separately.



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FORM - F **STRUCTURE & ORGANISATION** **(on Letter Head of the Bidder)**

- 1 Name of the bidder(s)
- 2 Registered Address of the bidder(s):
- 3 Legal status of the bidder (Please tick and attach attested copies of original document defining the legal status)
 - (a) An individual; (b) A proprietary firm; (c) A firm in partnership
 - (d) A limited company or Corporation
- 4 Postal Address of the bidder(s) along with Ph. No. & E-mail for correspondence:
- 5 Name and designation of the Authorised person of the bidder(s) for correspondence:
- 6 Particulars of registration with various Government bodies if applicable as per NIT (attach attested photocopy)

Dept. /Organisation & Place of registration

Registration No.

- 1.
- 2.
- 7 Names and Titles of Director & Officers with designation proposed to be Deputed on this work
- 8 Designation of individuals authorised to act for the organization.
- 9 Was the bidder ever required to suspend 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.
- 10 Has the bidder 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.
- 11 Has the bidder, 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.
- 12 Has the bidder or any constituent partner in case of partnership firm, ever been convicted by a court of law? If so, give details.
- 13 Please indicate below or attach the organization chart showing the company structure Including communication and responsibilities structure of engineering group, production Group, erection group (project group), Construction management, finance group and QA group, the positions of



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Directors and relevant key personnel (by name, educational qualification and experience),
Specifically bring out the line of reporting.

- 14 In which fields the bidder has specialization and interest?
- 15 Any other information considered necessary but not included above.

Signature of the Bidder(s), with seal



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Bhabha Atomic Research Centre Mysuru

FORM - G

DETAILS OF TECHNICAL & ADMINISTRATIVE PERSONNEL TO BE DEPLOYED FOR THE WORK

Sl. No	Designation	Total Number of staff	Number Available/ proposed for this work	Name of the staff	Qualifications	Professional experience and details of work carried out	How these would be involved in this work	Remarks
[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]

Signature of the Bidder(s), with seal

Note: The key professional staff, listed in the offer, shall be available for the entire duration of the execution of the Assignment. These shall preferably be the permanent employees of the firm.

- i) Proposed staff must have relevant educational qualification and experience as per the tender document.
- ii) No alternative to key professional staff may be proposed and only one curriculum vitae (CV) may be submitted/uploaded for each position. The firm's personnel shall have a good working knowledge of English.
- iii) Curriculum Vitae (C.V.) recently signed by the proposed key professional staff and countersigned by an authorized officer of the Contractor. Key information should include: (a) years with the firm/entity (b) degree of responsibility held in various assignments during the last ten years (c) permanent or temporary.
- iv) **In cases where the evaluation of the performance of Contractors (for Pre-Qualification, Refer NIT) shall be done as per the above "Form-G", the details mentioned in the evaluation criteria (Refer NIT) shall be submitted in separate sheets as per the above format, along with the supporting documents.**



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FORM - H

DETAILS OF EQUIPMENT LIKELY TO BE USED IN CARRYING OUT THE PROPOSED WORK

Sl. No	Name of Equipment	Nos	Capacity or Type	Age	Condition	Ownership status			Current Location	Remarks
						Presently owned (Invoice No. / Registration No. is to be mentioned)	Leased (Agreement no & Date is to be mentioned)	To be purchased		
[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]
1										
2										
3										
4.										



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5.									
6									
7									
8									
9									



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10										
11										

Note:

- i. Details of any other plant & equipment required for the work not included in the above form & available with the applicant may also be indicated.
- ii. In cases where the evaluation of the performance of Contractors (for Pre-Qualification, Refer NIT) shall be done as per the above “Form-H”, the details mentioned in the evaluation criteria (Refer NIT) shall be submitted in separate sheets as per the above format, along with the supporting documents.

Signature of the Bidder(s), with seal



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Bhabha Atomic Research Centre Mysuru

FORM – I

(To be submitted on Letter Head of Chartered Accountant)

CALCULATION OF BIDDING CAPACITY

I. MAXIMUM VALUE OF CONSTRUCTION WORKS EXECUTED IN ANY ONE YEAR DURING THE LAST FIVE YEARS TAKING INTO ACCOUNT THE COMPLETED AS WELL AS WORKS IN PROGRESS. (A):

Sl. 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]
FROM FY TO FY								
1)								
2)								
FROM FY TO FY								
1)								
2)								
FROM FY TO FY								
1)								
2)								
FROM FY TO FY								
1)								
2)								



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FROM FY TO FY

1)								
2)								
Maximum turn over in Construction Works executed in any one year during the last five years (ending on the previous day of last date of online submission of the tender) taking into account the completed as well as works in progress. The value of executed works shall be brought to current costing level by enhancing the actual value of works at a simple rate of 7% per annum calculated to last date of online submission of the tender (A):								



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II. VALUE OF EXISTING COMMITMENTS AND ON-GOING WORKS TO BE COMPLETED DURING THE PERIOD OF COMPLETION OF WORK FOR WHICH TENDER HAS BEEN INVITED

Sl. No.	Name of Work / Project & 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) =										

Certificate: I certify that all the awarded and ongoing works have been included in the above list

Signature of the Bidder(s), with seal



Government of India
Bhabha Atomic Research Centre Mysuru

I/We have obtained all the information from the bidder which is necessary for the purpose of certification. It is certified that the all information are correct to the best of our knowledge and belief. The certification process involves examining the supporting documents.

Unique Document Identification Number (UDIN)

Signature of Chartered Accountant

Name of Chartered Accountant

Membership No. of ICAI.....

Date and Seal.....



Government of India Bhabha Atomic Research Centre Mysuru

FORM-J

ASSETS AND LIABILITIES

ASSETS AND LIABILITIES (in Rs. Cores)	Financial Year				
Total assets					
Current assets					
Total liabilities					
Current liabilities					
Profits before taxes					
Profits after taxes					
Total annual turnover					
Total annual turnover from					
- Design/Engineering - Manufacturing if any - Construction (including Material Content) - Construction (Labour Content) - Electrical Supply & Installation - Any other					

Signature of the Bidder(s), with seal



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Bhabha Atomic Research Centre Mysuru

FORM-K

EXPERIENCE IN DEPARTMENT OF ATOMIC ENERGY ESTABLISHMENTS (IF ANY)

Sl. No.	Name of the DAE Units	Year of execution	Work Reference to work order No.	Contract Value Rs. Lakhs	Scheduled completion period	Actual completion period

Signature of the Bidder(s), with seal



Government of India Bhabha Atomic Research Centre Mysuru

FORM-L

DETAILS REGARDING LITIGATION / ARBITRATION / DEBARMENT/ BLACKLISTING/ TERMINATION/ RELINQUISHED CONTRACTS

Name of Bidders(s) or partner in a Joint Venture/ Consortium:

1. Bidders(s) (including each of the partners of a Joint Venture/ Consortium) should provide information on any history of litigation or arbitration resulting from contracts executed in the last ten years or currently under execution, as required in this tender document. A separate sheet should be used for each partner of a /consortium.

LITIGATION HISTORY					
Year	Name of client	Cause of Litigation	Matter Under Dispute	Award for or Against the Applicant	Disputed Amount

2. Has the applicant ever defaulted or been declared in default on a contract?
3. List of occasions of
 - a. debarment/ blacklisting
 - b. Termination of contract due to poor performance of the bidder by any client firm (including any Central, State, or other government agency of entity).
 - c. Awarded contracts relinquished by client (including any Central, State, or other government agency of entity) firm before completion.
4. If no such adverse case a 'Nil' list to be enclosed. If no list is submitted, it shall be considered that the bidder confirms they have not encountered any such adverse occasion.
5. Within the last ten years, has the applicant (including individual persons thereof) including any partner, been charged with, or convicted of, any serious crime of felony or for corrupt practice?

Signature of the Bidder(s), with seal



Government of India
Bhabha Atomic Research Centre Mysuru

FORM-M

PARTICULARS OF MANAGERIAL / ENGINEERING AND CONSTRUCTION

PERSONAL, TECHNICIANS EMPLOYED AND IN SERVICE SINCE LAST FIVE (5)

YEARS

Sl. No	Name	Age	Qualification	Experience		Nature of work Handled	Previous Employment	Projects Handled
				In Organization	Previous			
[1]	[2]	[3]	[4]	[5a]	[5b]	[6]	[7]	[8]

Signature of the Bidder(s), with seal



Government of India Bhabha Atomic Research Centre Mysuru

FORM-N

DETAILS OF SUB CONTRACTORS

(APPLICABLE ONLY IF SUBCONTRACTING IS ALLOWED AS PER TENDER

DOCUMENT)

If it is foreseen that any part of the contract will be sub-contracted, state the type of work to be undertaken by the sub-contractor(s) and give below name and address of the probable sub-contractor(s) to be used along with their scope and financial and man-power resources.

Sl. No.	Work to be sublet	Name and address of Proposed Sub-Contractor

Notes:

1. Attach additional sheets to provide information regarding financial, qualified man-power and other resources of the proposed sub-contractor. If the sub-contractors have not been finalized, give details of all prospective sub-contractors.
2. More than one sub-contractor's name can be given.
3. Sub-contractor evaluation will be done by BARC. If found unsuitable for the job, can be rejected.
4. Attach list of engineering, manufacturing, erection, inspection and testing facilities available at sub-contractors with their signatures appended to it.
5. Man-power (Qualified) available with main Contractor to supervise and guide Sub-contractors work should also be given.

Signature of the Bidder(s), with seal



Government of India
Bhabha Atomic Research Centre Mysuru

FORM-O

DETAILS OF CONSORTIUM/JOINT VENTURE

**(APPLICABLE ONLY IF CONSORTIUM/JOINT VENTURE IS ALLOWED AS PER
TENDER DOCUMENT)**

If the Bidder intends to set-up a consortium for the project, please give the following information, otherwise state "NOT APPLICABLE".

1. Name s and addresses of consortium partners and / or their sub-contractor(s).

[indicate the scope of work of each partner and sub-contractor(s)].

2. Name of the company leading the consortium.

3. Name and addresses of bankers to the consortium.

Signature of the Bidder(s), with seal



Government of India
Bhabha Atomic Research Centre Mysuru

FORM-P

STATEMENT OF MEN AND MACHINERY (to be filled)

Sl. No.	Description	Manpower to be deployed by tenderer
1.	Have the tenderer visited the site	Yes / No
2.	Manpower Deployment:	
a.	Masons.	
c.	Fitter / Bar bending	
d.	Welders.	
e.	Labour	
f.	Semiskilled for Carpenter/Fitter.	
g.	Electrician.	
h.	Mechanical Operation	
i.	Safety Supervisor	
3.	Technical Staff Deployment:	
a.	Graduate Engineers.	
b.	Diploma Engineers.	
c.	Supervisors.	
d.	Quality Control Engineer.	
4.	Machinery Deployment:	
a.	Hoist / Tower Crane.	
b.	Scaffolding Materials.	
c.	Mechanical Rammer.	
d.	Welding Machines.	
e.	Material Testing Lab. Equipment.	

NOTE: 1) It is noted that the above deployment is minimum. After detailed programming and actual condition at site, additional deployment shall be done as necessary for completion of the work within the stipulated time period.

2) It is mandatory to fill up ANNEXURE – A, B & C by the tenderer. Non-compliance of the same, tender may be rejected.

Date: _____

Signature of the Bidder(s), with seal



Government of India
Bhabha Atomic Research Centre Mysuru

FORM-Q

List of offered makes for Materials, Components and Equipment: The Bidder has to fill the makes of the items, Materials, Components and Equipment as per the approved makes listed in Technical Specification of Tender Document. Bidder has to specifically fill the offered makes. The bidder may suggest any make/ brand meeting technical parameters during pre-bid stage and before technical bid submission.

Sl. No.	Description Materials, Components and Equipment	Make/ Brand / Model No etc.

Date: _____

Signature of the Bidder(s), with seal



Government of India
Bhabha Atomic Research Centre Mysuru

FORM-R

STATEMENT OF CASH FLOW FOR THE WORK.

Sl. No.	Months	Cash Flow %	
1	1 st		%
2	2 nd		%
3	3 rd		%
4	4 th		%
5	5 th		%
6	6 th		%
7	7 th		%
8	8 th		%
9	9 th		%
10	10 th		%
11	11 th		%
12	12 th		%

Date: _____

Signature of the Bidder(s), with seal



Government of India Bhabha Atomic Research Centre Mysuru

UNDERTAKING-A

TENDER ACCEPTANCE LETTER
(To be submitted on Bidder's Letter head)

To,
Chief Engineer/ Superintending 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: _____

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> , www.barc.gov.in & press Notice 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) (including Pre-bid clarifications, if any) issued from time to time by your department/ organization 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/ entity/ authority / agency.
or
Instances of debar/blacklisting 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 / organization 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 as taken by Department.

Yours Faithfully,
(Signature of the Bidder (s), with Seal)



Government of India Bhabha Atomic Research Centre Mysuru

UNDERTAKING-B

(To be submitted on Bidder's 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 ____ & FY ____ within due date as per Section 139 (1) of the Income-tax Act, 1961 - Yes/No (strike out whichever is not applicable).
4. 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.			

5. 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 authorized signatory >>

<< Designation >>

Name of the Entity:

Date:



Government of India Bhabha Atomic Research Centre Mysuru

UNDERTAKING-C

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



Government of India Bhabha Atomic Research Centre Mysuru

UNDERTAKING-D

(To be submitted on Bidder's Letter head)

I/We _____ (Name of bidder) undertake and confirm that the eligible similar work(s) has/have not been 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 bidding in Department 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 Earnest Money Deposit and Performance Guarantee.

Place:

Date:

Signature of the Bidder(s), with seal



Government of India Bhabha Atomic Research Centre Mysuru

UNDERTAKING-E

(To be submitted on Bidder's Letter head)

If work is awarded to me, I/ we shall obtain EPF and ESIC registration / Employees Compensation Insurance Policy/ Group Insurance/ Personal Insurance Policy, as applicable to all the employees / workers/ labours working at BARC premises/ failing which Tender Inviting Authority/ Engineer-in-charge shall be free to forfeit the entire amount of EMD & Performance Guarantee submitted against this tender.

Signature of the Bidder(s), with seal



Government of India Bhabha Atomic Research Centre Mysuru

UNDERTAKING-F

(To be submitted on Bidder's Letter head)

Undertaking for the provisions of Public Procurement (Preference to Make in India), Order-2017, Order No. P-45021/2/2017-B.E. –II, Revision, dated 16/09/2020 and as amended from time to time.

NIT No. : -----
NAME OF WORK: -----

In reference to above mentioned Tender reference, I/we M/s..... (Bidder name) hereby certify that the Works/products/ Services offered ----- (Name of the Work) meet the requirement of the minimum local content as prescribed for "Class -1 Local Supplier" as mentioned in DPIIT order of Public Procurement (Preference to Make in India), Order-2017, Order No. "P-45021/2/2017- B.E. –II, Revision, dated 16/09/2020 and as amended from time to time.

We hereby confirm that the Local content for above mentioned work is..... % of total value of Work order.

Signature of the Bidder(s), with seal

Note: In case Procurement cost exceeds Rs. 10 Crore, this Percentage of Local content shall be certified statutory auditor/ cost auditor of company/ practicing cost accountant /practicing chartered accountant as defined in the above order.



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UNDERTAKING-G FORM OF CERTIFICATE FOR ELIGIBLE SOURCE COUNTRIES (To be submitted on Bidder's Letter head)

1. 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 evidence of valid registration by the Competent Authority.
2. 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.
3. 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**.
4. 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.
5. 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(s), with seal



Government of India Bhabha Atomic Research Centre Mysuru

UNDERTAKING-H

GST UNDERTAKING BY FIRMS/ AGENCY (To be submitted on Bidder's Letter head)

Tender Reference No: _____

Name of Tender / Work: - _____

Dear Sir,

1. That the bidder(s) is registered under GST and compliant to GST provisions.
2. In case non-compliance of GST provisions and blockage of any input credit, the bidder(s) shall be responsible to indemnify BARC.
3. That all the input credits have been passed on to BARC by the bidder.

Place:

Date:

Signature of the Bidder(s), with seal



Government of India Bhabha Atomic Research Centre Mysuru

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, Mysore-571130 for the sum of ` _____ (1) for which payment will and truly be made to be said BARC, Mysore, the Bank binds itself, his successors and assigns by these presents.

SEALED with the common seal of the said Bank this _____ day of 20--.

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, Mysore, **OR**
- (2) If the Bidder having been notified of the acceptance of his Bid by BARC, Mysore 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 up to the above amount upon receipt of their first written demand, without BARC, Mysore 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 _____



Government of India Bhabha Atomic Research Centre Mysuru

(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 225 days from the date opening of Part A mentioned in Sub Section-1. In case of extension of “date opening of Part A”, the originally stipulated date is to be considered.



Government of India Bhabha Atomic Research Centre Mysuru

APPENDIX – ‘B’

FORM OF BANK GUARANTEE BOND FOR PERFORMANCE SECURITY (GUARANTEE)/ SECURITY DEPOSIT

In consideration of the President of India (hereinafter called “The Government”) having offered to accept the terms and conditions of the proposed agreement between..... and (hereinafter called “the said contractor(s)”) for the work (hereinafter called “the said agreement”) having agreed to production of an 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.

1. We (indicate the name of bank) (hereinafter referred to as the “the Bank”) hereby undertake to pay to the Government an amount not exceeding Rs.....only) on demand by the Government.
2. We (indicate the name of the bank) do hereby under take to pay the amounts due and payable under this Guarantee without any demure, 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.....(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 certified that 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.....(Name of Bank) further agree with the Government that the Government shall have the fullest liberty without our consent and without effecting 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 forbear or



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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.....(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 the Bank)



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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 : Karnataka

Administration : Department of Atomic Energy

Division : BARC, Mysore

THIS INDENTURE made the.....day of 20.....
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:



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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 Engineer-in-Charge 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 that 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.



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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



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has not been herein before expressly provided for the same shall be referred to the Chief Engineer, BARC, Mysore, 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:

{
Signature
Name
Address

Witness

Signed by

by the order and direction of the President in the presence of:

{
Signature
Name
Address

Witness



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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 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 GOVERNMENT of the other part, whereby the Contractor, inter alia, undertook to render the buildings and structures such as roof of buildings, overhead water tanks, underground tanks, lift pits, basement, toilets etc. in the said contract recited completely water and leak proof.

AND WHEREAS THE GUARANTOR agreed to give a guarantee to the effect that the said 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 leak proof 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 any 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 of the roof 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-



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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 there-under 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 supplementary 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.



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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 _____. 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.



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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.



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APPENDIX- 'F'

Format for Submission of Pre-Bid Queries (To be submitted on Bidder's Letter head)

Sl. No.	Refer Section, clause no. Page no. of the Tender Document	Clause mentioned in the Tender Document	Pre-bid Query

Date:

Signature of the Bidder(s), with seal



Government of India
Bhabha Atomic Research Centre Mysuru

PART 'B'
SECTION-VIII

SCHEDULE OF QUANTITY (SCHEDULE 'B')
(UPLOADED SEPARATELY)



Government of India
Bhabha Atomic Research Centre Mysuru

SECTION-V
GENERAL & TECHNICAL SPECIFICATIONS



Government of India
Bhabha Atomic Research Centre Mysuru

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:

2.1.1. Designing the pavement according to IRC-37 standards, based on site conditions (such as traffic conditions and subgrade characteristics etc.), and in accordance with the Schedule of Quantities.

2.1.2. Designing the storm water drains.

2.1.3. Structural design of civil structures such as foundations, culverts etc.

2.1.4. Preparation of Good For Construction Drawings (for entire scope of work) based on tender drawings, drawing issued by BARC & site conditions etc. and getting the drawings approved by Engineer-in-Charge.

2.1.5. Construction of internal road network along (of various road widths) with drainages, culverts, fencing, street lighting, footpaths, parking, gates, utilities etc., as per the approved Good For Construction Drawings, Schedule of Quantities and technical specifications.

2.1.6. Construction of external patrolling road of ≈ 11 Km length & ≈ 3.75 m width along with associated works such as Kerb stone, drainage and slope stability works along the road.

Note: The external patrolling road has a compound wall and chain-link fencing on adjacent sides, which restricts the movement of construction vehicles. The patrolling road must be constructed without damaging the compound wall or chain-link fencing. Bidders are requested to visit the site, inspect the area, and quote accordingly.

2.1.7. Construction of Chain-link fencing for 2.5 Km length (along the ISRO boundary).

Note: The existing barbed wire fencing (along with the stones) of 2.5 km length is to be removed by the successful bidder during the execution of the chain-link fencing. The removed barbed wire fencing (along with the stones) is to be transported and stored at a location specified by the EIC.

3. Following Technical specifications are attached with this document:

3.1. Section-V (ii) Technical Specifications for Civil Works

3.2. Section-V(iii) Technical Specifications Electrical Works

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. No clarification from Contractor shall be entertained during execution of work and interpretation/ decision of Accepting Authority (mentioned in Schedule “F”, Refer Section–VII (i)) in writing on such issues shall be final and binding to the Contractor and all concerned, without any implication on cost and time of completion of work.
6. The makes and brands suggested in the specifications are general recommendations and guidelines for bidders to match performance parameters and tender specifications. However, bidders may propose alternate or equivalent makes and brands, provided they meet 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 makes or 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 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.
- 7. Drawings**
 - 7.1. The drawings are provided Section – VI of this tender document.
 - 7.2. Aforesaid drawings are preliminary for Tender purpose only and are not complete.

SECTION-V (ii)
TECHNICAL SPECIFICATIONS
Civil Works

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"S P E C I F I C A T I O N S"

- 1.0 GENERAL :
- 1.1 The detailed specifications given hereafter 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.
- 1.2 It may also be noted that the specification are of generalized nature and these shall be read in conjunction with the description of item in schedule of quantities and drawings.
- 1.3 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.
- 1.4 The Chief Engineer, shall be the sole deciding authority as to the meaning, interpretations and implication for various provisions of the specifications and his decision in writing shall be final and binding on all concerned.
- 1.5 In case any difference or discrepancy between the specifications and the description in the schedule of quantities, the schedule of quantities shall take precedence.
- 1.6 In case any difference or discrepancy between the specifications and the drawing, the specification shall take precedence.
- 1.7 Unless specifically otherwise mentioned, all the applicable latest codes and standards published by the Bureau of Indian Standards and all other standards, shall govern in all respects of design, workmanship, quality, properties of materials, method of testing and method of measurements.

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"SPECIFICATIONS FOR PILE FOUNDATION"

TECHNICAL SPECIFICATIONS FOR BORED CAST-IN-SITU R.C.C. PILES

- 1.0 SCOPE :
- 1.1 This specification covers construction of load bearing concrete bored cast-in-situ piles of appropriate diameter which can transmit the load of the structure to the soil by both resistance developed at the tip by end bearing and along the surface of the pile shaft by friction.
- 1.2 Tenderer shall be responsible for the construction of the entire pile foundation system as proposed by the Department in its tender drawing and schedule and shall guarantee the stability of the pile foundation system offered against the risks of settlement and other type of damage to the structure.
- 1.3 The Tenderer shall submit his offer as per Department's schedule of work, specifications and drawings.
- 2.0 EQUIPMENT & ACCESSORIES:
- 2.1 The equipment and accessories shall depend on the type of bored cast-in-situ piles chosen for the job and shall be selected giving due consideration to the sub-soil strata, ground water conditions, type of founding materials and the required penetration, manner of operation etc. For Bored cast-in-situ piles percussion boring by suitable drilling rigs using direct mud circulation (DMC) methods is to be adopted and the size of the cutting tool shall not be less than the diameter of the pile by more than 75 mm. Bentonite shall be used as drilling mud and its basic properties shall conform to Appendix - 'A' of I.S. 2911 (Part I/Section-2) (LR). Tremie shall be used for placing concrete into the bore holes.
- 3.0 GENERAL CONSIDERATIONS:
- 3.1 The construction of pile foundation shall be in such a way that the load from the structure it supports, can be transmitted to the soil without causing any soil failure & without causing such settlement, differential or total under permanent transient loading as may result in structural damage and/or functional distress to the buildings.
- 3.2 When working near the existing structures, any damage to such structures shall be made good at no extra cost to the Department. The contractor shall, therefore, take adequate care to avoid any damage to the existing structures.
- 3.3 In case of deep excavations adjacent to piles proper shoring or other suitable arrangement shall be done at no extra cost to the Department to guard against the lateral movement of soil or releasing the confining soil stress.
- 3.4 As per loading details. piles will be required to withstand vertical load axial or otherwise and horizontal load associated with moments. Axial load from a pile should be transmitted to the soil through skin friction along the shaft and end-bearing at its tip. A horizontal load shall be transmitted to the sub-soil by horizontal sub-grade reaction generated in the upper part of the pile shaft.

- 3.5 Coarse Aggregate Fine Aggregate & Water:
- 3.5.1 Coarse aggregate fine aggregate and water shall conforming to IS 456 (L.R) and I.S 383 (L.R).
- 3.5.2 Concrete: Concrete to be used for the pile shaft shall be as specified. Materials and method of manufacture for cement concrete shall, in general, be in accordance with the method of concrete under the condition of pile installation. Consistency of concrete mix for cast-in-situ piles shall be suitable to the method of installation of piles. Concrete mix shall be so designed as to have a homogeneous mix having a flowable character consistent with the method of concreting of pile. The slump of concrete shall range between 150 to 180 mm depending on the method/manner of concreting. Minimum cement content shall be 400 kg per cubic metre. In case of piles where concreting is done under water or drilling mud using methods other than tremie 10% extra cement over that required for the design grade of concrete at specified slump shall be used subject to minimum quantities of cement specified above. Cost of excess cement over the minimum quantity specified shall be borne by the contractor. For mix design, manufacture, placing etc. specification for cement concrete given hereinafter shall be referred.
- 4.0 **WORKMANSHIP:**
- 4.1 Control of piling installation: Bored cast-in-situ piles shall be installed by employing suitable drilling rigs using a combination of bailer and a suitable chisel with DMC method. Bore hole shall be stabilized by bentonite as drilling mud and concreting shall be done by use of tremie only.
- 4.2 Control of Alignment: Piles shall be installed as accurately as possible as per the designs and drawings. Greater care should be exercised in respect of installation of single pile or piles in two pile groups. The piles shall be installed vertically with tolerance as stipulated by IS: 2911 (Part-1/Section-2) (Latest revision). Piles shall not deviate by more than 75 mm or $D/6$ whichever is less in case of piles having diameter less than 600 mm, 75 mm or $D/10$ whichever is more in the case of piles having diameters more than 600 mm from their designed positions at the working level. In the case of a single pile in a column, positional tolerance should not be more than 50 mm or $D/6$ whichever is less (100 mm in case of piles having diameter more than 600 mm). In case of piles deviating beyond these limits, contractor shall carry out necessary remedial measures duly approved by the Department at no extra cost. Piles that are deviated to such an extent that the resulting eccentricity cannot be taken care of by a redesign of the pile cap or plinth beams, the piles should be re-placed or supplemented by one or more additional piles at no extra cost to the Department.
- 4.3 A minimum length of two/three metres of temporary guide casing up to piling platform shall be inserted in each bored pile after completion of bailer driving. Additional length or temporary casing may be used depending on the condition of the strata, ground water level etc.
- 4.4 Founding level: The bore hole shall be advanced by chisel and direct mud circulation method after installation of guide casing till the required founding level is reached. The founding level shall be as per the drawings and as directed by the Engineer-in-Charge.

- 4.4.1 In case, drilling mud within the hole stabilizes a bored pile, the bottom of the hole shall be cleaned very carefully before concreting work is taken up. The cleaning of the hole shall be ensured by careful operation of boring tool and/or flushing of the drilling mud through the bottom of the hole by tremie for half an hour minimum.
- 4.4.2 In case, a hole is bored by use of drilling mud, the specific gravity of the mud suspension near about the bottom of the hole shall, wherever practicable, be determined by suitable, slurry sampler and recorded. Consistency of the drilling mud suspension shall be controlled throughout the boring as well as concreting operations in order to keep the hole stabilized as well as to avoid concrete getting mixed up with the thicker suspension of the mud. The concreting operations should not be taken up when the specific gravity of Bentonite slurry is more than 1.2.
- 4.4.3 In addition to the normal precautions to be taken in tremie concreting, the following requirements shall be applicable to the use of tremie concrete in piles:
 - 4.4.3.1 The concrete should be coherent, rich in cement (not less than 400 kg/cum) & of slump not less than 150mm.
 - 4.4.3.2 When concreting is carried out under water, a temporary casing should be installed to the full depth of the bore hole or 2 to 3 M into the top stratum, so that fragments of ground cannot drop from the sides of the hole into the concrete as it is placed.
 - 4.4.3.3 The hopper & tremie should be a closed system embedded in the placed concrete, through which water can't pass.
 - 4.4.3.4 The first charge of concrete should be placed with a sliding plug pushed down the tube ahead of it 01 with a steel plate of adequate charge to prevent mixing of concrete and water. However, the plug should not be left in the concrete as a lump.
 - 4.4.3.5 The tremie pipe should always penetrate well into the concrete with an adequate margin of safety against accidental withdrawal of the pipe is surged to discharge the concrete.
 - 4.4.3.6 The pile should be concreted wholly by tremie and the method of deposition should not be changed part way up the pile, to prevent the laitance from being entrapped within the piles.
 - 4.4.3.7 All tremie tubes should be scrupulously cleaned after use.
 - 4.4.3.8 Normally concreting of the piles should be uninterrupted. In the exceptional case of interruption of concreting, but which can be resumed within 1 or 2 hours, the tremie shall not be taken out of the concrete. Instead it shall be raised and lowered slowly, from time to time to prevent the concrete around the tremie from setting. Concreting should be resumed by introducing a little richer concrete with a slump of about 200 mm for easy displacement of the partly set concrete.

- 4.4.3.9 If the concreting cannot be resumed before final set of concrete already placed, the pile so cast may be rejected.
- 4.4.3.10 In case of withdrawal of tremie out of the concrete either accidentally or to remove a choke in the tremie may be reintroduced in the following manner to prevent impregnation of laitance or scum lying on the top of the concrete already deposited in the bore.
- 4.4.3.11 The tremie shall be gently lowered on to the old concrete with very little penetration initially. A vermiculite plug should be introduced in the tremie. Fresh concrete of slump between 150mm and 175 mm should be filled in the tremie, which will push the plug forward and will emerge out of the tremie displacing the laitance/scum. The tremie will be pushed further in steps making fresh concrete sweep away laitance/scum in its way. When tremie is buried by about 60 to 100 cm, concreting may be resumed.
- 4.4.3.12 During installation bored cast-in-situ piles, the convenience of installation may be taken into account while determining the sequence of piling in a group.
- 4.4.3.13 The top of concrete in a pile shall generally be brought above the cut-off level, up to ground level to permit removal of all laitance and weak concrete before capping and to ensure good concrete at the cut-off level for proper embedment into the pile cap. When concrete is placed by tremie method, concrete shall be cast to the piling platform level at ground level to permit overflow of concrete for visual inspection.
- 4.5 Defective Pile: In case defective piles are formed, they shall be removed or left in place whichever is convenient without affecting, performance of the adjacent piles or the cap as a whole without any extra cost to the Department. Additional piles shall be provided to replace them as directed.
- 4.5.1 Any deviation from the designed location alignment or load capacity of any pile shall be noted and adequate measures taken well before the concreting of the pile cap and plinth beam if the deviations are beyond the permissible limit.
- 4.5.2 During chipping of the pile top manual chipping maybe permitted after three days of pile casting, pneumatic tools for chipping shall not be used before seven days after pile casting.
- 4.5.3 After concreting the actual quantity of concrete shall be compared with the average obtained from observations actually made in the case of a few piles initially cast. If the actual quantity is found to be considerably less, special investigations shall be conducted and appropriate measures taken.

5.0 ROUTINE LOAD TEST:

5.1.1 The contractor shall be required to carry out routine load tests as directed by the Engineer-in-charge on an individual pile or on a group of piles or on both. The routine load tests shall be carried out generally as per IS 2911 (part-IV) - 1985. Report on routine load tests shall be submitted in an approved format for Department's approval at no extra cost. In case the tests on the routine piles reveal safe capacity less than specified, the contractor shall, at his own cost, provide suitable modifications to the pile or other remedial measures after obtaining approval of the Engineer-in-Charge. In case of an unsatisfactory results being revealed on any routine tests it shall be the contractor's responsibility to carry out additional routine tests, at his own cost till the criteria laid down are fulfilled.

5.2 Rate for routine load test shall be inclusive of providing kentledges, making other arrangements for the test loading platforms, providing tools and plants, equipments like hydraulic jack, dial gauges etc. other measuring instruments and all labour involved in carrying out tests. Cost of pile shall, however, be paid for by the Department at the rates accepted in the tender since the piles are working piles.

6.0 MODE OF MEASUREMENT OF PILES:

6.1 The piles shall be measured in running metres from the pile cut-off level to the founding level. The rates quoted for piling work shall include the cost of concrete, hire charges of tools and plants, bailing out of water, breaking of pile heads to required level and shape, breaking, cutting through and removing the boulders or any other obstructions, if met with before reaching the required founding level etc. complete and as specified.

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**“S P E C I F I C A T I O N S”
FOR
(E A R T H W O R K)**

- 1.0 SCOPE :
- 1.1 This specification covers the general requirements of earth work 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 material, 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.
- 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 6 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.
- 2.1.1 IS : 965 Equivalent metric units for scale, dimensions and quantities in general construction work.
- 2.1.2 IS : 1200 Method of measurement of building work (Earth work).
(Part-1)

2.1.3	IS : 2720 (Part-2)	Method of test for determination of moisture content.
2.1.4	IS : 2720 (Part-7)	Method of test for determination of moisture content dry density relation using light compaction.
2.1.5	IS : 2720 (Part-8)	Method of test for determination of moisture content dry density relation using heavy compaction.
2.1.6	IS : 2720 (Part-25)	Method of test for determination of consolidation properties.
2.1.7	IS : 2720 (Part-28)	Method of test for determination of dry density of soils by the sand replacement method.
2.1.8	IS : 2720 (part-29)	Method of test for determination of dry density of soils by the core cutter method.
2.1.9	IS : 3385	Code of practice for measurement of Civil Engineering works.
2.1.10	IS : 3764	Safety code for excavation work.
2.1.11	IS : 4081	Safety code for blasting and related drilling operations.
2.1.12	IS : 4082	Recommendations of stacking and storage of construction materials at site.

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 follow strictly 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 ore, 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 mm in any one of the other two directions. Masonry to be dismantled will also be measured under this item.

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. Concrete work both reinforced and unreinforced to be dismantled will be measured under this item, unless a separate provision is made in the schedule of quantities.

7.0 EXCAVATION :

7.1 All excavation work shall be carried out by mechanical equipments 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 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 equipments 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 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.
- 7.7 STRIPPING LOOSE ROCK :
- 7.7.1 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.
- 7.8 EXCAVATION IN HARD ROCK :

- 7.8.1 Unless otherwise stated herein , I.S. specification "IS:4031 (Safety Code for Blasting and Related Drilling Operations)" shall be followed. After removal of overburden, if any, excavation shall be continued in 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. 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 specified 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 the Engineer-In-charge shall be taken during the blasting operations and care shall be taken that no damage is caused to adjoining buildings or structures as a result of blasting operations. In case of damage to permanent or temporary structures the contractor shall repair the same to the satisfaction of the Engineer-In-charge at his 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.
- 7.8.2 Specific written permission of the Engineer-In-charge will have to be taken by the contractor for blasting rock. The contractor shall also obtain a valid blasting license from the authorities concerned. If permission for blasting is refused by the Engineer-In-charge the rock shall be removed by wedging, pick, barring, heating and quenching or other approved means. All loose or loosened rock in the sides shall be removed by barring, wedging, etc. The unit rates for excavation in hard rock shall include the cost of all these operations.
- 7.8.3 The contractor shall also obtain necessary license for storage and use of explosives for the work from the authorities dealing with explosives. The fees, if any, required for obtaining such license shall be borne by the contractor. The contractor shall have to make necessary storage facilities for the explosives as per rules of local, state and central government authorities and statutory bodies/ regulations. Explosives shall be kept dry and shall not be exposed to direct rays of sun or be stored in the vicinity of fire, stoves, steam pipes or heated metal etc. No explosive shall be brought near the work in excess of quantity required for a particular amount of firing to be done and surplus left after filling the holes shall be removed to the magazine. The magazine should be built as far as possible from the area to be blasted. The Engineer-In-charge's prior approval shall be taken for the location proposed for the magazine.
- 7.8.4 In no case blasting shall be allowed closer than 30 metres 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.
- 7.8.5 For blasting operation the following points shall be observed :
- 7.8.5.1 The contractor shall employ competent and experienced supervisor an licensed Blaster-In charge of each set of operation who shall be held personally responsible to ensure that all safety regulations are carried out.
- 7.8.5.2 Before any blasting is carried out the contractor shall intimate the Engineer-In-charge and obtain his approval in writing for resorting to such operations. He shall intimate the hours of firing charges, he nature of explosive to be used and the precautions taken for ensuring safety.

- 7.8.5.3 The contractor shall ensure that all workmen and the personnel at site are excluded from an area within radius of 200 metres from the firing point at least 15 minutes before firing time by sounding warning siren. The area shall be encircled by red flags. Clearance signal shall also be sounding a distinguishing siren.
- 7.8.5.4 The blasting of rock near any existing buildings, equipment or any other property shall be done under cover and the contractor has to make all such necessary muffling arrangements as stated hereinafter under "Controlled Blasting". Blasting shall be done with small charges only and where directed by the Engineer-In-charge. A trench shall have to be cut by chiseling prior to the blasting operation separating the area under blasting from the existing structures.
- 7.8.5.5 The firing shall be supervised by a supervisor. If the blasts do not tally with the number fired, the misfired holes shall be carefully located after half an hour and when located, the same shall be exploded by drilling a fresh hole along the misfired hole (but not nearer than 600 mm from it) and by exploding a new charge.
- 7.8.5.6 A wooden tamping rod with a flat shall be used to push cartridges home and metal rod or hammer shall not be permitted. The charge shall be placed firmly into place and not rammed or pounded. After a hole is filled to the required depth, the balance of the hole shall be filled with stemming which may consist of sand or stone dust or similar inert material.
- 7.8.5.7 The contractor shall preferably fire the explosives electrically.
- 7.8.5.8 Holes for charging explosive shall be drilled with pneumatic drills, the drilling pattern being so planned that rock pieces after blasting will be suitable for handling without secondary blasting.
- 7.8.5.9 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 225 mm shall be filled up as instructed by the Engineer-In-charge with concrete of mix 1:3:6. The cost of filling such excess depth shall be borne by the 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.
- 7.8.5.10 The contractor shall be responsible for any accident to workmen, public or department's property due to blasting operations. Contractor shall also be responsible for strict observance of rules laid down by Inspector of Explosives or any other Authority duly constituted under the state and/ or central government.
- 7.8.6 CONTROLLED BLASTING INSTRUCTIONS :
- 7.8.6.1 Rock 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.

- 7.8.6.2 Material for the charge shall be either gun powder or gelatin. 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.
- 7.8.6.3 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 : Fuse end shall be embedded to a depth of
Inside charge : $\frac{1}{2}$ to $\frac{2}{3}$ of the depth of the charge.
- Distance of firing end of the Fuse from the charge : 15 to 30 metres.
- 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 and Maximum
Up per blast : 20 Numbers.
- 7.8.6.4 Protective Measures :
- 7.8.6.4.1 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.
- 7.8.6.4.2 A steel mesh made out of reinforcement rods of not less than 20 mm diameter @ 150 mm centers both way shall be placed over the steel plates.
- 7.8.6.4.3 Six to eight layers of sand filled bags shall be placed over the mesh suitably covering the whole region under blasting operations.
- 7.8.6.4.4 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.
- 7.8.6.5 FEEDING THE CHARGE :
- 7.8.6.5.1 At the bottom of the hole 50 to 75 mm depth shall be filled with dry powder.
- 7.8.6.5.2 Then the gun powder shall be fed into the hole to the desired length and lightly tamped with a rod.
- 7.8.6.5.3 The fuse wire shall then be inserted to a depth of $\frac{1}{2}$ to $\frac{2}{3}$ of the charge.

- 7.8.6.5.4 The rest of the hole shall then be filled with dry brick powder or dry murrum.
- 7.8.6.6 Precautions to be taken when the water table is encountered :
 - 7.8.6.6.1 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.
 - 7.8.6.6.2 In case the contractor prefers to use gelatin 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.
- 7.8.7 Particular care should taken to preserve rock below and beyond excavation limits in soundest possible manner. Rough excavation should be carried out 150 to 300 mm above the final excavation level. The excavation shall then be done to the specified level with special care. Over break in the hard rock at bottom beyond 225 mm shall not be permitted and if it is exceeded the same shall have to be made good by the contractor at his own cost by filling the same with cement concrete of grade not less than 1:3:6.
- 7.8.8 After removal of overburden and thereafter excavation of soft rock if excavation is required to be continued in rock to such width, lengths, depths and profiles as shown on the drawing or such other lines and grades as may be specified by the Engineer-In-charge, the excavation in hard rock shall be done by chiseling if in the opinion of Engineer-In-charge blasting cannot be permitted.
- 7.8.9 The contractor shall also at his own expenses and without any extra charges make provision of pumping, bailing and draining water at the ground level to the safe distance so as not to cause any flooding at site. He shall also keep all foundation pits free of water while the concreting work is in progress and till the Engineer-in-charge considers it necessary.
- 7.8.10 The rate quoted by the contractor for item of excavation in foundation / excavation over areas includes removing and disposing off vegetation, grass, cut plantation, shrubs, bushes, plants, trees of whose girth is not more than 600mm diameter when measured at 1.0 meter height above ground level. No extra payment / measurement on account of this made.
- 8.0 **FILL AND BACK FILLING :**
 - 8.1 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 off as directed by the Engineer-In-charge after the fill work is complete.
 - 8.2 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.

- 8.3 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.
- 8.4 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.
- 8.5 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 150 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.
- 8.6 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.
- 8.7 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 80 mm. 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 150 mm.
- 8.8 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 150 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 150 mm mixed with fine material as available to fill up the voids.

- 8.9 The filling in the trenches shall be carried out simultaneously on the sides of the pipe to avoid unequal pressure on the pipes.
- 8.10 Plinth filling shall be carried out with approved material as described hereinbefore in layers not exceeding 150 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 specified the level, slope etc.
- 8.11 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:
- 8.11.1 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 225 mm and leveled uniformly and compacted as indicated in the specifications given above before the next layer is deposited.
- 8.11.2 To ensure that the fill has been compacted as specified, if required field and laboratory tests shall be carried out by owner.
- 8.11.3 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.
- 8.11.4 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.
- 8.11.5 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.
- 8.11.6 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 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.

- 8.11.7 If so specified the rock as obtained from excavation may be used for filling and leveling to indicated grades without further breaking. In such event filling shall be done in layers not exceeding 500 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.
- 9.0 SAND FILLING :
- 9.1 At some of the places backfilling may have to be carried with local 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.
- 9.2 Construction of floors or other structures on sand fill shall not be started until the Engineer-In-charge has instructed and approved the fill.
- 10.0 FILL DENSITY :
- 10.1 The compaction only where so called for in the schedule of quantities/ items shall comply with the specified (proctor/ modified proctor) density at moisture content differing not more than 4 percent from the optimum moisture content. Contractor shall demonstrate adequately by field and laboratory tests that the specified density has been obtained.
- 11.0 LEAD :
- 11.1 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 shortest straight line route on the plan and not the actual route taken by the contractor. No extra compensation is admissible on the grounds that the lead including that for borrowed material had to be transported over marshy or 'Katcha' land/route.
- 12.0 MODE OF MEASUREMENT :
- 12.1 Excavation in all strata's 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 accordance with drawings or as per actual whichever is minimum.

- 12.2 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.
- 12.3 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.
- 12.4 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 concentrating 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.
- 12.5 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.
- 12.6 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.
- 12.7 Unless otherwise specified the unit rates quoted for excavation in different types of materials shall also account for the basic class 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 after deducting the voids as specified in the items.
- 12.8 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.
- 12.9 The rate to the quoted in hard rock excavation shall also be inclusive of all explosive and additional cost, if any, involved in protective measures as stipulated above in the specifications.
- 12.10 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 50 meters unless otherwise directed by the Engineer-In-charge.

- 12.11 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 a event the fill shall be leveled/ finished to the profiles as directed at no extra cost.
- 12.12 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.
- 12.13 Actual quantity of consolidated sand filling shall be measured and paid in cubic metres.
- 12.14 Lead to be measured from the nearest boundary of the building up to the respective point of disposal by shortest motorable route.
- 12.15 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.

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“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 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.

2.2 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.
	IS: 6313 (Part II)	Pre-constructional Chemical Treatment Measures
	IS: 8944	Specification for Chloropyrifos Emulsifiable Concentrates
	IS: 4015 (Part I)	Guide for Handling cases of Pesticide Poisoning First Aid Measures
	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 sub-terranean 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.

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 at least to 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 one of 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.	Chlorpyrifos 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.

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“SPECIFICATION FOR REINFORCED CONCRETE AND ALLIED WORKS”

1.0 GENERAL:

- 1.1 The quality of materials, method, control of manufacture and transportation of all concrete work in respect of mix whether reinforced or other wise shall confirm to the applicable portion of these specification.
- 1.2 The Engineer-In-Charge shall have the right to inspect the source of materials, the layout and operation of procurement and storage of materials, the concrete batching and mixing equipments and the quality control system. Such an inspection shall be arranged by the contractor and the Engineer-In-Charge's approval shall be obtained prior to starting of concrete work.

2.0 SCOPE:

- 2.1 This specification covers the general requirements for concrete to be used on jobs using on-site production facilities including requirements in regard to the quality, quantity, handling, storage of ingredients, proportioning, batching, mixing, and testing of concrete and also requirements in regard to the quality, storage, cutting, bending and fixing of reinforcement in position. This also covers the transportation of concrete from mixer to the place of final deposit and placing, curing, protecting, repairing and finishing of concrete.

3.0 APPLICABLE CODES & SPECIFICATION:

- 3.1 The following specifications, standards and codes are made a part of this specification. All standards, tentative specifications, codes of practices referred to herein shall be the latest edition including all applicable official amendments, revisions and additional publications. In case of discrepancy between this specification and those referred to herein this specification shall govern.

3.2 List of Indian Standards:

No.	I.S. No.	I. S. Name
1.	I.S. 269	Specification for ordinary, rapid hardening and low heat Portland cement.
2.	I.S. 383	Specification for coarse & fine aggregate from natural source or concentrate.
3.	I.S. 456	Code of practice for plain and reinforced concrete.
4.	I.S. 457	Code of practice for plain and reinforced concrete for dams and other massive structures.
5.	I.S. 515	Specification for natural and manufactured aggregate for use in mass concrete.
6.	I.S. 516	Method of test for strength of concrete.
7.	I.S. 650	Specifications for standard sand for testing of cement.
8.	I.S. 1199	Method of sampling and analysis of concrete.
9.	I.S. 1200 (Part-II)	Method of measurement of building works.
10.	I.S. 1791	Specification for batch type concrete mixers.
11.	I.S. 2386 (Part-I)	Method of test for aggregates for concrete : Particle size and shape.

12.	I.S. 2386 (Part-II)	Method of test for aggregates for concrete : Estimation of deleterious materials and organic impurities.
13.	I.S. 2386 (Part-III)	Method of test for aggregates for concrete : Specific gravity, density, voids, absorption and bulking.
14.	I.S. 2386 (Part-IV)	Method of test for aggregates for concrete : Mechanical properties.
15.	I.S. 2386 (Part-V)	Method of test for aggregates for concrete : Soundness.
16.	I.S. 2386 (Part-VI)	Measuring mortar making properties of fine aggregates.
17.	I.S. 2386 (Part-VII)	Method of test for Alkali aggregates reactivity.
18.	I.S. 2386 (Part-VIII)	Petrographic examination of aggregates.
19.	I.S. 2438	Specification for roller pan mixer.
20.	I.S. 2505	Specification for immersion type concrete vibrators.
21.	I.S. 2506	Specification for screed board concrete vibrators.
22.	I.S. 2514	Specification for concrete vibrating table.
23.	I.S. 2645	Specification for integral cement water proofing compound.
24.	I.S. 2722	Specification for portable swing weigh batcher for concrete.
25.	I.S. 3025	Methods of sampling and test (physical and chemical) for water used in industry.
26.	I.S. 3366	Specification for pan vibrator.
27.	I.S. 3370 (Part-I)	Code of practice for concrete structures for the storage of liquids : General.
28.	I.S. 3370 (Part-II)	Code of practice for concrete structures for the storage of liquids : Reinforced concrete structure.
29.	I.S. 3385	Code of practice for measurement of Civil Engineering works.
30.	I.S. 3414	Code of practice for design and installation of joints in buildings.
31.	I.S. 3558	Code of practice for use of immersion vibrators for consolidating concrete.
32.	I.S. 3935	Code of practice for composite construction.
33.	I.S. 4031	Method of physical test for hydraulic cement.
34.	I.S. 4656	Specification for form vibrator.
35.	I.S. 7861 (Part-I)	Code of practice for extreme weather concreting (for hot weather concreting).
36.	I.S. 8112	Specifications for high strength ordinary Portland cement (Grade 43).
37.	I.S. 10262	Code of practice for design mix.
38.	I.S. 12269	Specifications for high strength ordinary Portland cement (Grade 53).
39.	I.S. 13311 (Part-I)	Non-destructive testing of concrete: Method of test for ultrasonic pulse velocity.
40.	I.S. 13311 (Part-II)	Non-destructive testing of concrete: Method of testing by rebound hammer.

4.0 MATERIALS FOR STANDARD CONCRETE:

4.1 The ingredients to be used in the manufacture of standard concrete shall consist solely of a standard type Portland cement; clean sand, natural coarse aggregate, clean water, ice, an admixture, if specifically called for on drawings or schedule of quantities.

4.1.1 Cement:

4.1.1.1 Unless otherwise specified or called for by the Engineer-In-Charge cement shall be ordinary Portland cement / Portland Pozzolana cement (Fly ash based meeting the 28 day strength requirement of OPC 43 grade cement) 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.

4.1.1.2 If demanded a certified report attesting to the conformity of the cement to I.S. specifications by the cement manufacturer's chemist shall be furnished to the Engineer-In-Charge.

4.1.1.3 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 Engineer-In-Charge. Consignment of cement shall be stored as received and shall be consumed in the order of their delivery.

4.1.1.4 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.

4.1.2 Aggregates :

4.1.2.1 Aggregate in general designates both fine and coarse inert materials used in the manufacture of concrete. Fine Aggregate is aggregate most of which passes through 4.75 mm I.S. sieve. Coarse Aggregate is aggregate most of which retained on 4.75 mm I.S. sieve.

4.1.2.2 All fine and coarse aggregate proposed for use in the work shall be subjected to Engineer- In-Charge's approval and after specific materials have been accepted the source of supply of such materials shall not be changed without prior approval of the Engineer-In-Charge.

- 4.1.2.3 Aggregates shall consist of natural sand, crushed stone and gravel from source known to produce satisfactory aggregate for concrete and shall be chemically inert, strong, hard, durable against weathering, of limited porosity and free from deleterious materials that may cause corrosion of the reinforcement or may impair the strength and/ or durability of concrete. The grading of aggregate shall be such as to produce a dense concrete of specified strength and consistency that will work readily into position without segregation and shall be based on the "mixed design" and preliminary test on concrete specified herein after.
- 4.1.3 Sampling and Testing:
- 4.1.3.1 Samples of the aggregates for mixed design and determination of suitability shall be taken under the supervision of the Engineer- In-Charge and delivered to the laboratory, well in advance of the scheduled placing of concrete. Records of tests, which have been made on proposed aggregates and on concrete made from this source of aggregates shall be furnished to the Engineer- In-Charge in advance of the work for use in determining the aggregate suitability.
- 4.1.4 Deleted
- 4.1.5 Storage of Aggregates:
- 4.1.5.1 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 specified quality not only at the time of receiving at site but more so at the time of loading into 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. Rejected material after re-mixing may be accepted, if subsequent tests demonstrate conformity with required gradation.
- 4.1.6 Specific Gravity:
- 4.1.6.1 Aggregate having a specific gravity below 2.60 (saturated surface dry basis) shall not be used without special permission of the Engineer- In-Charge.
- 4.1.7 Fine Aggregate:
- 4.1.7.1 Fine aggregate except as noted above and for other than lightweight concrete shall consist of natural river sand (suitable for concrete, preferably from Mahad or screened sand from Khanwada or Vaitharna), crushed stone sand or crushed gravel sand stone dust confirming to I.S. 383. The sand shall be clean, sharp, hard, durable, chemically inert and free from dust, vegetable substances, adherent coating, clay, organic matter, alkalis, mica, salt or other deleterious substances which can be injurious to the setting qualities/ strength/ durability of concrete. No creek / sea sand shall be allowed.

- 4.1.7.2 Machine made sand will be acceptable provided the constituent rock/ gravel composition is sound, hard, dense, non-organic, uncoated and durable against weathering.
- 4.1.7.3 Sand shall be prepared for use by such screening or washing or both as necessary to remove all objectionable foreign matter while separating the sand grains to the required size fractions. Sand with silt content more than 3 % will not be permitted for use unless the same is washed and silt content is brought within 3% by weight.
- 4.1.7.4 The percentage of deleterious substances in sand delivered to the mixer shall not exceed the following:

Sl. No.	Substances	Percent by weight Uncrushed : Crushed
1.	Material finer than 75 micron I.S. sieve	3.00% : 15.00%
2.	Shale	1.00% ---
3.	Coal and Lignite	1.00% : 1.00%
4.	Clay lumps	1.00% : 1.00%
5.	Total of all above substances including items 1 to 4 for uncrushed sand and items 3 & 4 for crushed sand.	5.00% : 2.00%

- 4.1.7.5 Unless otherwise directed or approved, the grading of sand shall be within the limits indicated hereunder:

Sl. No.	I.S. Sieve Designation	Percentage passing for			
		Zone - I	Zone - II	Zone - III	Zone - IV
1.	10 mm	100	100	100	100
2.	4.75 mm	90-100	90-100	90-100	95-100
3.	2.36 mm	60-95	75-100	85-100	95-100
4.	1.18 mm	30-70	55-90	75-100	90-100
5.	600 micron	15-34	35-59	60-79	80-100
6.	300 micron	5-20	8-30	12-40	15-50
7.	150 micron	0-10	0-10	0-10	0-15

- 4.1.7.6 Where the grading falls outside the limits of any particular grading zone of sieves, other than 600 micron I.S. sieve by total amount not exceeding 5% (five percent), it shall be regarded as falling within the grading zone. This tolerance shall not be applied to percentage passing the 600-micron I.S. sieve or to percentage passing any other sieve size on the coarser limit of Grading Zone-I or the finer limit of Grading Zone-IV. Fine aggregates conforming to Grading Zone-IV shall not be used unless mix designs and preliminary tests have shown its suitability for producing concrete of specified strength and workability.
- 4.1.7.7 The sand shall have a fineness modulus of not less than 2.2 or more than 3.2. The fineness modulus is determined by adding the cumulative percentage retained on the I.S. sieve (4.75 mm, 2.36 mm, 1.18mm, 600 micron, 300 micron and 150 micron) and dividing the sum by 100.

4.1.8 Coarse Aggregate :

- 4.1.8.1 Coarse aggregate for concrete except as noted above and for other than lightweight concrete shall confirm to I.S. 383. This shall consist of natural or crushed stone and gravel, and shall be free from elongated, flaky or laminated pieces, adhering coatings, clay lumps, coal residue, clinkers, slag, alkalis, mica, organic matter or other deleterious matter.
- 4.1.8.2 The coarse aggregate and fine aggregate shall be tested from time to time as required by the Engineer- In-Charge to ascertain its suitability or use in construction and the charges for testing aggregate shall be born by the contractor as specified herein after.
- 4.1.8.3 Crushed rock shall be screened and/or washed for the removal of dirt or dust coating if so demanded by the Engineering- In-Charge.
- 4.1.8.4 Coarse aggregates shall be either in single size or graded. In both cases grading shall be within the following limits:

(a) "Table – I"

Sl. No.	I.S. Sieve Designation	Percentage passing for single sized aggregate of nominal size				
		40 mm	20 mm	16 mm	12.5 mm	10 mm
1.	63 mm	100	--	--	--	--
2.	40 mm	85-100	100	--	--	--
3.	20 mm	0-20	85-100	100	--	--
4.	16 mm	--	--	85-100	100	--
5.	12.5 mm	--	--	--	85-100	100
6.	10 mm	0-5	0-20	0-30	0-45	85-100
7.	4.75 mm	--	0-5	0-5	0-10	0-20
8.	2.36 mm	--	--	--	--	0-5

(b) "Table – II"

Sl. No.	I.S. Sieve Designation	Percentage passing for graded aggregate of nominal size			
		40 mm	20 mm	16 mm	12.5 mm
1.	63 mm	100	--	--	--
2.	40 mm	95-100	100	--	--
3.	20 mm	30-70	95-100	100	100
4.	16 mm	--	--	90-100	--
5.	12.5 mm	--	--	--	90-100
6.	10 mm	10-35	25-55	30-70	40-85
7.	4.75 mm	0-5	0-10	0-10	0-10
8.	2.36 mm	--	--	--	--

- 4.1.8.5 The pieces shall be angular in shape and shall have granular or crystalline surfaces. Friable, flaky and laminated pieces, mica and shale if present shall be only in such quantities that will not in the opinion of Engineer-In-Charge affect adversely the strength and / or durability of concrete. The maximum size of coarse aggregate shall be the maximum size specified above but in no case greater than $\frac{1}{4}$ of the minimum thickness of the member provided that the concrete can be placed without difficulty so as to surround all reinforcement thoroughly and fill the corners of form. Plums above 160 mm and up to any reasonable size can be used in plain mass concrete work of large dimensions up to a maximum limit of 20% by volume of concrete when specially approved by the Engineer-In-Charge. For heavily reinforced concrete members the nominal maximum size of the aggregate shall be 5 mm less than the minimum clear distance between the main reinforcing bars or 5 mm less than the minimum cover to the reinforcement whichever is smaller. The amount of fine particles occurring in the free state or as loose adherent shall not exceed 1% when determined by laboratory sedimentation tests as per I.S. 2386. After 24 hours immersion in water, a previously dried sample shall not have gained more than 10% of its oven dry weight in air as determined by I.S. 2386.

- 4.1.8.6 The percentage of deleterious substances in the coarse aggregate delivered to the mixer shall not exceed the following:

Sl. No.	Substances	Percentage by weight of aggregates	
		Uncrushed	: Crushed
1.	Material finer than 75 micron I.S. sieve.	3.00	3.00
2.	Coal and lignite.	1.00	1.00
3.	Clay lumps.	1.00	1.00
4.	Sift fragments.	3.00	--
5.	Total of all above substances.	5.00	5.00

- 4.1.9. Water:

- 4.1.9.1 Water used for both mixing and curing shall be free from injurious amounts of oils, acids, alkalis, salts, sugar, organic materials or other substances that may be deleterious to concrete or steel. Potable water is generally satisfactory for mixing and curing of concrete. In case of doubt the suitability of water for making concrete shall be ascertained by the compressive strength and initial setting time test specified in I.S. 456. The sample of water taken for testing shall be typical for the water proposed to be used for concrete, due account being paid to seasonal variation. The sample shall not receive any treatment before testing other than that envisaged in the regular supply of water proposed for use in concrete. The sample shall be stored in a clean container previously rinsed out with similar water.
- 4.1.9.2 Average 28 days compressive strength of at least three 150 mm size concrete cubes prepared with water to be used shall not be less than 90% of the average strength of three similar concrete cubes prepared with distilled water. The cubes shall be prepared, cured and tested in accordance with the requirements of IS: 516.

- 4.1.9.3 The initial setting time of test block made with the appropriate test cement and the water proposed to be used shall not be less than 30 minutes and shall not differ by more than ± 30 minutes from the initial setting time of control test block prepared with the appropriate test cement and distilled water. The block shall be prepared and tested in accordance with the requirements of IS: 4031 (Part 5).
- 4.1.9.4 Where water can be shown to contain an excess of acid, alkali, sugar or salt, Engineer-In-Charge may refuse to permit its use. As a guide the following concentration represent the maximum permissible values:
- 4.1.9.4.1 To neutralize 100 ml sample of water, using Phenolphthalein as an indicator, it should not require more than 5 ml of 0.02 normal NaOH. The details of test shall be as given in 8.1 of IS: 3025 (Part 22).
- 4.1.9.4.2 To neutralize 100 ml sample of water, using Methyl Orange as an indicator, it should not require more than 25 ml of 0.02 normal H_2SO_4 . The details of test shall be as given in 8 of IS: 3025 (Part 23).
- 4.1.9.5 The percentage of solids, when tested in accordance with the IS: 3025 shall not exceed the following:

Sl. No.	Substances	Tested as per	Permissible percentage
1.	Organic	IS: 3025 (Part 18)	0.02% (200 mg/litre)
2.	Inorganic	IS: 3025 (Part 18)	0.30% (3000 mg/litre)
3.	Sulphates (as SO_3)	IS: 3025 (Part 24)	0.04% (400 mg/litre)
4.	Chlorides (as Cl)	IS: 3025 (Part 32)	0.20% (2000 mg/litre) for concrete not containing embedded steel and 0.05% (500 mg/litre) for reinforced concrete works.
5.	Suspended matter	IS: 3025 (Part 17)	0.20% (2000 mg/litre)

- 4.1.9.6 P.H. value of water shall generally be not less than 6.

5.0 DESIGN MIX CONCRETE:

- 5.1 All reinforced concrete in the work shall be "Design Mix Concrete" as defined in IS: 456 considering as 'severe' environment and cost of design mix shall be included in the item rate and no separate payment shall be made on account of this. All "Design Mix Concrete" work to be carried out under these specifications shall be in grades designated as per table below.

Use of mineral admixtures like fly ash, GGBFS, etc. shall not be permitted in the design mix unless otherwise special permission is given by the Engineer-in-Charge. Cement shall be Ordinary Portland Cement – 43 grade or Portland Pozzolana Cement (Fly ash based meeting the 28 day strength requirement of OPC 43 grade cement) only.

Group	Grade Designation	Specified Characteristic Compressive Strength of 150 mm Cube at 28 days in N/mm ²
Ordinary Concrete	M - 10	10
	M - 15	15
	M - 20	20
Standard Concrete	M - 25	25
	M - 30	30
	M - 35	35
	M - 40	40
	M - 45	45
	M - 50	50
	M - 55	55
High Strength Concrete	M - 60	60
	M - 65	65
	M - 70	70
	M - 75	75
	M - 80	80

- Note : 1) The Characteristic strength is defined as the strength of material below which not more than 5% of the test results are expected to fall.
- 2) In the designation of a concrete mix, letter 'M' refers to the mix and the number to the specified characteristic compressive strength of 150 mm size cube at 28 days in N/mm².
- 3) The mix shall be designed to produce the grade of concrete having the required workability and characteristic strength not less than appropriate value given in the table above.

5.2 Mix Design:

5.2.1 This is to investigate the grading of aggregates, water cement ratio, workability and the quantity of cement required to give works cubes of the characteristic strength specified. The proportions of the mix shall be determined by weight. Adjustment of aggregate proportions due to moisture present in the aggregate shall be made. Mix proportioning shall be carried out according to the ACI standard designation 'ACI-613' or Design of concrete mixes - Road Research Note No.4, Department of Scientific and Industrial Research U.K. or I.S. 10262.

5.2.2 Since different cements and aggregates of different maximum size, grading, surface texture, shape and other characteristics may produce concretes of different compressive strength for the same free water cement ratio, the relationship between strength and free water cement ratio should preferably be established for the materials actually to be used. In the absence of such data, the preliminary free water cement ratio (by mass) corresponding to the target strength at 28 days may be selected from the relationship shown in Fig.1 of I.S. 10262 at page 7.

- 5.2.3 Alternately, the preliminary free water cement ratio (by mass) corresponding to the target average strength may be selected from the relationship in Fig. 2 of I.S. 10262 page at 8, using the curve corresponding to the 28 days cement strength to be used for the purpose. Other relevant items to be used with design of mix should strictly confirm to the relevant clauses and appendices of I.S. 10262. The calculated mix proportions shall be checked by means of trial batches. The contractor should refer to the item No.4 at page 12 and the Appendix 'D' (clause No. 4.1) of I.S. 10262 for neat illustration. The contractor may refer Appendix 'C' (clause 3.8) at page 16 of I.S. 10262 for an example illustrating the mix design of M-20. The free water cement ratio selected as above should be checked against the limiting water cement ratio for the requirement of durability and the lower of the two values should be adopted.
- 5.2.4 Whenever there is a change either in required strength of concrete or water cement ratio or workability or the source of aggregates and/ or cement fresh tests shall be carried out to determine the revised proportion of the mix to suit the altered conditions. While designing mix proportions over wet mixes shall always be avoided.
- 5.2.5 While fixing the value for water cement ratio for 'Design Mix' assistance may be derived from the standard graph showing the relationship between the 28 days compressive strength of concrete mixes with different water cement ratios and the 7 days compressive strength of cement tested in accordance with I.S. 269 and I.S. 8112.
- 5.2.6 It will be contractor's sole responsibility to establish the concrete mix designs for different grades of concrete specified in the work consistent with the workability required for nature of work and also taking into consideration the assumed standard deviation which will be expected at site or by establishing the standard deviation based on 30 test results at site for each grade of concrete so as to produce concrete of required strength, durability and surface finish. The materials and proportions used in making the tests to be carried out either at site or under laboratory, conditions shall be similar in all respects to those to be actually employed in the works as the object of these tests is to determine the proportions of cement, aggregates and water necessary to produce the concrete of the required consistency to give such specified strength.
- 5.3 Standard Deviation:
- 5.3.1 Standard deviation of concrete of each grade shall be determined separately. When results of sufficient number of tests (at least 30) are not available, then the value of standard deviation given in the table below may be assumed for design mix in the first instance. As soon as the results of the samples are available, actual calculated standard deviation shall be used and the mix designed properly.

5.3.2 Assumed Standard Deviation:

No.	Grade of Concrete	Assumed Standard Deviation in N/mm ²
1.	M – 10	3.5
2.	M – 15	
3.	M – 20	4.0
4.	M – 25	
5.	M – 30	5.0
6.	M – 35	
7.	M – 40	
8.	M – 45	
9.	M – 50	

Note:- the above values correspond to the site control having proper storage of cement; weigh batching of all materials; controlled addition of water; regular checking of all materials; aggregate grading and moisture content; and periodical checking of workability and strength. Where there is deviation from the above, the values given in the above table shall be increased by 1 N/mm².

5.3.3 Standard Deviation Based On Test Results:

5.3.3.1 The total number of test results required to constitute an acceptable record for calculation of standard deviation shall be not less than 30. Attempts should be made to obtain the 30 test results as early as possible when a mix is used for the first time.

5.3.3.2 The calculation of the standard deviation shall be brought up to date after every change of mix design and at least once in a month.

5.3.4 Determination Of Standard Deviation :

5.3.4.1 Concrete of each grade shall be analyzed separately to determine its standard deviation.

5.3.4.2 The standard deviation of concrete of given grade shall be calculated using the following formula from the results of individual tests of concrete of that grade obtained as specified for test strength of sample :

$$\text{Estimated Standard Deviation (S)} = \sqrt{\sum X^2 / (n-1)}$$

Where X = Deviation of the individual test strength from the average strength of a sample and

n = Number of sample test results.

5.3.4.3 When significant changes are made in the proportion of concrete (for example changes in materials used, mix design, equipments or technical control), the standard deviation value shall be separately calculated for such batches of concrete.

- 5.4 Proportioning:
- 5.4.1 The proportions which shall be decided by conducting preliminary tests, shall be by weight. These proportions of cement, fine and coarse aggregates shall be maintained during subsequent concrete batching by means of weigh batchers conforming to I.S. 2722, capable of controlling the weights within one percent of the desired value. Except where it can be shown to the satisfaction of the Engineer-In-Charge that supply of properly graded aggregate of uniform quality can be maintained over the period of work, the grading of aggregate shall be controlled by obtaining the coarse aggregate in different sizes and blending them in the right proportions. The different sizes shall be stacked in separate stock piles. The grading of coarse and fine aggregates shall be checked as frequently as possible, as determined by the Engineer-In-Charge, to ensure maintaining of grading in accordance with samples used in preliminary mix design. The material shall be stock piles well in advance of use.
- 5.4.2 The cement shall be measured by weight for design mix. Every facility should be provided to the Engineer-In-Charge for sampling and inspection of stored cement at site of work.
- 5.4.3 Only such quantity of water shall be added to the cement and aggregate in the concrete mix as to ensure dense concrete, specified surface finish, satisfactory workability, consistent with strength stipulated for each class of concrete. The water added to the mix shall be such as not to cause segregation of materials or the collection of excessive free water on the surface of the concrete.
- 5.4.4 The water cement ratio (W/C) is defined as the weight of water in mix (including the surface moisture of the aggregate) divided by the weight of cement in the mix. The actual water cement ratio to be adopted shall be determined in each instance by the contractor and approved by the Engineer-In-Charge.
- 5.4.5 The water cement ratio specified for use by the Engineer-In-Charge shall be maintained. The contractor shall determine the water content of the aggregate as frequently as directed by the Engineer-In-Charge as the work progresses and as specified in I.S. 2386 (Part-III) and the amount of mixing water added at the mixer shall be adjusted as directed by the Engineer-In-Charge so as to maintain the specified water cement ratio. To allow for the variation in their moisture content, suitable adjustments in the weights of aggregates shall also be made.
- 5.5 Consistency and Slump :
- 5.5.1 Concrete shall be of a consistency and workability suitable for the conditions of the job. After the amount of water required is determined the consistency of mix shall be maintained through out the progress of the corresponding parts of the work and approved tests e.g. slump tests, compacting factor test etc. in accordance with I.S. 1199, shall be conducted from time to time to ensure the maintenance of such consistency.

- 5.5.2 The following tabulation gives a range of workability which shall generally be used for various types of construction unless otherwise instructed by the Engineer-In-Charge:

5.5.2.1 Workability of Concrete :

Placing Conditions	Degree of workability	Value of Workability
Blinding concrete' shallow sections, pavements using pavers.	Very low	0.75 - 0.80 compacting factor.
Mass concrete; lightly reinforced sections in slabs, beams, walls, columns, floors, hand placed pavements, canal lining; strip footings.	Low	Slump of 25 – 75 mm.
Heavily reinforced sections in slabs, beams, walls, columns, Slip form work; Pumped concrete	Medium	Slump of 50–100 mm. Slump of 75 – 100 mm.
Trench fill; In-situ piling. Tremie concrete	High Very high	Slump of 100 – 150 mm.

5.6 Batching and Mixing of Concrete :

- 5.6.1 The material and proportions of concrete ingredients as established by the preliminary tests for the mix design shall be rigidly followed for all concrete works on the project and shall not be changed except when specifically permitted by Engineer-In-Charge.
- 5.6.2 Concrete shall be produced only by weigh batching the ingredients. The mixer and weigh batcher shall be maintained in clean serviceable condition. The accuracy of weigh batcher shall be periodically checked. They shall be set up in level on a firm base and the hopper shall be loaded evenly. The needle shall be adjusted to zero when the hopper is empty. Fine and coarse aggregates shall be weighed separately unless other wise stated.
- 5.6.3 Volume batching will not permitted. However Engineer-In-Charge may permit volume batching by subsequent conversion of weights of ingredients into their equivalent volumes in respect of their bulk densities only in the case of small and less important pours involving concrete of not more than 0.25 cubic metre on the day when other pours involving weigh batching are not likely to be taken up.
- 5.6.4 The concrete shall be of strength as stipulated in the respective items. All concrete shall be mixed in mechanically operated batch mixers complying with I.S. 1791 and of approved make with suitable provision for correctly controlling the water delivered to the drum.
- 5.6.5 The quantity of water actually entering the drum shall be checked with the reading of the gauge or valve setting when starting a job. The test should be made while the mixer is running.

- 5.6.6 The volume of the mixed material shall not exceed the manufacturer's rated mixer capacity. The batch shall be charged into the mixer so that some water will enter the drum in advance of cement and aggregate. All water shall be in the drum by the end of the first 15 seconds of the specified mixing time. Each batch shall be mixed until the concrete is uniform in colour for a minimum period of two minutes after all ingredients are in the drum.
- 5.6.7 The entire contents of the drum shall be discharged in one operation before the raw materials for the succeeding batches are fed into the drum.
- 5.6.8 Each time the work stops the mixer shall be cleaned out and when next commencing the mixing the first batch shall have 10% addition cement to allow for sticking in the drum.

6.0 SAMPLING AND TESTING OF CONCRETE :

- 6.1 If the Engineer-In-Charge desires facilities required for sampling materials and concrete in the field shall be provided by the contractor at no extra cost. The following equipments (in serviceable condition) with operator shall be made available at Engineer's request :

No.	Equipments	Requirement
1.	Cast Iron cube moulds of 150 mm size	As required
2.	Slump cone complete set with tamping rod	1 set
3.	Laboratory balance to weight up to 5 kg. With sensitivity of 10 gm.	1 No.
4.	Laboratory balance of 2 kg. Capacity and sensitivity of 1 gm.	1 No.
5.	I.S. sieves for coarse and fine aggregates	1 set.
6.	A set of measure from 0.1 litre to 5 litres.	1 set.
7.	Electric oven with thermostat up to 120 degree centigrade.	1 No.
8.	Flakiness gauge	1 No.
9.	Elongation index gauge	1 No.
10.	Sedimentation pipette	1 No.
11.	Pyconometer	1 No.
12.	Calibrated glass jar of 1 litre capacity	2 Nos.
13.	Glass flasks and metal containers	As required.
14.	Chemical reagents like Sodium Hydroxide, Tannic Acid, Litmus papers etc.	As required.

- 6.2 The concrete test cubes will be tested at Department's or site laboratory. The contractor shall make all arrangements to cure, store of concrete cubes and transport the same to the laboratory at his own cost as directed by the Engineer-In-Charge.
- 6.3 Sampling and Strength Test of Concrete:
- 6.3.1 The samples from fresh concrete shall be taken as per I.S. 1199 and cubes shall be made, cured and tested at 28 days in accordance with I.S. 516.

- 6.3.2 In order to get a relatively quicker idea of the quality of concrete optional test on beams for modulus of rupture at 72 (+/-)2 hrs. or at 7 days or compressive strength tests at 7 days may be carried out in addition to 28 days compressive strength tests. For this purpose the value given in table below may be taken for general guidance in case of concrete made with ordinary Portland cement. In all cases, the 28 days compressive strength specified shall alone be the criterion for acceptance or rejection of the concrete. If however, from test carried out in particular job over a reasonably long period, it has been established to the satisfaction of the Engineer-In-Charge that a suitable ratio between 28 days compressive strength and the modulus of rupture at 72 (+/-)2 hrs. or 7 days or compressive strength at 7 days may be accepted. The Engineer-In-Charge may suitable relax the frequency of 28 days compressive strength, provided the expected strength values at the specified early age are consistently met.

6.3.3 Optional Test Requirement of Concrete:

No.	Grade of Concrete	Minimum Compressive Strength on 150 mm Cube	Min. Modulus of Rupture By Beam Test at	
			72 (+ / -) 2 hrs.	7 days
1.	M-10	7.00 N/m ²	1.20 N/mm ²	1.70 N/mm ²
2.	M-15	10.00 N/m ²	1.50 N/mm ²	2.10 N/mm ²
3.	M-20	13.50 N/m ²	1.70 N/mm ²	2.40 N/mm ²
4.	M-25	17.00 N/m ²	1.90 N/mm ²	2.70 N/mm ²
5.	M-30	20.00 N/m ²	2.10 N/mm ²	3.00 N/mm ²
6.	M-35	23.50 N/m ²	2.30 N/mm ²	3.20 N/mm ²
7.	M-40	27.00 N/m ²	2.50 N/mm ²	3.40 N/mm ²

6.3.4 Frequency of Sampling:

- 6.3.4.1 A random sampling procedure shall be adopted to ensure that each concrete batch shall have a reasonable chance of being tested, i.e. the sampling should be spread over the entire period of concreting and cover all mixing units.

- 6.3.4.2 The minimum frequency of sampling of concrete of each grade shall be in accordance with the following:

No.	(c) Quantity of concrete	(d) Number of Samples
1.	1.00 to 5.00 m ³	One
2.	6.00 to 15.00 m ³	Two
3.	16.00 to 30.00 m ³	Three
4.	31.00 to 50.00 m ³	Four
5.	51.00 m ³ and above	Four Plus one additional sample for each additional 50 m ³ part thereof.

At least one sample shall be taken from each shift. Where concrete is produced at continuous production unit, such as ready-mixed concrete plant, frequency of sampling may be agreed upon mutually by suppliers and purchasers.

- 6.3.4.3 Three test specimens shall be made from each sample for testing at 28 days. Additional cubes may be required for various purposes such as to determine the strength of concrete at 7 days or at the time of striking the formwork or to determine the duration of curing or to check the testing error. Additional cubes may also be required for testing cubes cured by accelerated methods as described in I.S. 9013. The specimen shall be tested as described in I.S. 516.
- 6.3.5 The test strength of the samples shall be the average of the strength of three specimens. The individual variation should not be more than (+/-) 15 percent of the average.
- 6.3.6 Slump test shall be carried out as often as demanded by the Engineer-In-Charge and invariably from the same batch of concrete from which the test cubes are made. Slump test shall be done immediately after sampling.
- 6.3.7 Standard Deviation shall be vide clause '5.3' of this specification.
- 7.0 ACCEPTANCE CRITERIA:
- 7.1 The concrete shall be deemed to comply with the strength requirement if:
- 7.1.1 The mean strength determined from any group of four consecutive test results complies with the appropriate limits in col. 2 of table below.
- 7.1.2 Any individual test result complies with the appropriate limits in col. 3 of table below.

Specified Grade	Mean of the Group of 4 Non-overlapping consecutive test results in N/mm ²	Individual Test Results in N/mm ²
(1)	(2)	(3)
M 15	$\geq f_{ck} + 0.825 \times \text{established standard deviation (rounded off to nearest } 0.5 \text{ N/mm}^2) \text{ or,}$ $f_{ck} + 3 \text{ N/mm}^2$, whichever is greater	$\geq f_{ck} - 3 \text{ N/mm}^2$
M 20 or above	$\geq f_{ck} + 0.825 \times \text{established standard deviation (rounded off to nearest } 0.5 \text{ N/mm}^2) \text{ or,}$ $f_{ck} + 4 \text{ N/mm}^2$, whichever is greater	$\geq f_{ck} - 4 \text{ N/mm}^2$

- 7.2 If the concrete is deemed not to comply pursuant to 7.0 above, the structural adequacy of the part affected shall be investigated and any consequential action as needed shall be taken.
- 7.3 Concrete of each grade shall be assessed separately. Concrete shall be assessed daily for compliance.

- 7.4 Concrete of each grade shall be liable to be rejected if it is porous or honey-combed, its placing has been interrupted without providing a proper construction joints, the reinforcement has been displaced beyond the tolerances specified or construction tolerances have not been met. However, the hardened concrete may be accepted after carrying out suitable remedial measures to the satisfaction of the Engineer-In-Charge.
- 8.0 ADMIXTURES:
- 8.1 Admixture may be used in concrete only with the approval of the Engineer-In-Charge based upon evidence that with the passage of time neither the compressive strength nor its durability reduced. Calcium chloride shall not be used for accelerating set of the cement for any concrete containing reinforcement or embedded steel parts. When calcium chloride is permitted to be used such as in mass concrete works it shall be dissolved in water and added to the mixing water in an amount not exceed 1.5 percent of the weight of the cement in each batch of concrete. When admixtures are used the designed concrete mix shall be corrected accordingly. Admixtures shall be used as per manufacturer's instructions and in the manner and with the control specified by Engineer-in-Charge. The cost of admixtures shall be included in the item rate and no extra amount shall be paid on this account.
- 8.2 Where specified and approved by Engineer-In-Charge neutralized vinsol resin or/ and other approved air entraining agent may be used to procedure the specified amount of air in the concrete mix and these agents shall conform to the requirements of ASTM standard 6-260 air entraining admixture of concrete. The recommended total air content in the concrete is $4\% \pm 1\%$. The method of measuring air content shall be as per I.S. 1199.
- 8.3 Retarding Admixtures:
- 8.3.1 Where specified and approved by the Engineer-In-Charge retarding agents shall be added to the concrete mix in quantities specified by Engineer- In-Charge.
- 8.4. Water Reducing Admixtures:
- 8.4.1 Where specified and approved by Engineer- In-Charge water reducing lignosulfonate mixture shall be added in quantities specified by Engineer- In-Charge. The admixtures shall be added in the form of a solution.
- 8.5 Water Proofing Agent:
- 8.5.1 Where specified and approved by Engineer-In-Charge chloride and sulphide free waterproofing agent shall be added in the quantities specified by Engineer-In-Charge.
- 8.6 Other Admixtures:
- 8.6.1 Engineer-In-Charge may at his discretion instruct contractor to use any other admixture in the concrete.

9.0 OPTIONAL TESTS:

9.1 If the Engineer-In-Charge desires he may order tests to be carried out on cement, sand, coarse aggregate, water etc. in accordance with the relevant Indian Standards. Tests on cement shall include :

- (i) Fineness test,
- (ii) Test for normal consistency,
- (iii) Test for setting time,
- (iv) Test for soundness,
- (v) Test for compressive strength,
- (vi) Test of heat of hydration (by experiment and by calculation) in accordance with I.S. 269.

9.2 Tests on sand shall include :

- (i) Sieve test,
- (ii) Test for organic impurities,
- (iii) Decantation test for determining clay and silt content,
- (iv) Specific gravity test,
- (v) Test for unit weight and bulkage factor,
- (vi) Test for sieve analysis and fineness modulus.

9.3 Tests on coarse aggregate shall include:

- (i) Sieve analysis,
- (ii) Specific gravity and unit weight of dry, loose and rodded aggregate,
- (iii) Soundness and alkali aggregate reactivity,
- (iv) Petrographic examination,
- (v) Test for deleterious materials and organic impurities,
- (vi) Test for aggregate crushing value.

9.4 Tests on aggregate would normally be ordered to be carried out only if Engineer-In-Charge feels the materials are not in accordance with the specifications or if the specified concrete strengths are not obtained and shall be performed by the contractor at an approved test laboratory.

10.0 INSPECTION AND TESTING OF STRUCTURES:

10.1 Immediately after stripping the form work all concrete shall be carefully inspected and any defective work or small defects either removed or made good before the concrete has thoroughly hardened as instructed by the Engineer-In-Charge.

10.2 In case of doubt regarding the grade of concrete used either due to poor workmanship or based on results of cube strength tests the contractor may be asked to carry out compressive strength test of concrete on the basis of core test, ultrasonic test and/ or load test.

10.3 In case of results of cube strength are observed to be lower than the required designed strength at 28 days as per specifications, ultrasonic test shall be carried out by the digital ultrasonic concrete tester by an approved agency at the cost of the contractor.

- 10.4 In case the ultrasonic test do not satisfy the requirement as above the department will be at liberty to reject the concrete and the contractor has to dismantle and redo the same or carry out such remedial measures as approved by the department at the contractor's own cost.
- 10.5 The unit rate for concrete shall be all inclusive of making preliminary mix design and test cubes, works cubes, testing them as per specifications, slump test, optional tests etc. However, the department will test the same departmentally the contractor will have to make arrangement for transportation of the cubes to the departmental laboratory.
- 10.6 In case cube tests give unsatisfactory results the contractor should also conduct conclusive tests such as ultrasonic pulse test, core test etc. to prove the suitability of concrete. The cost of the conclusive tests shall have to be borne by the contractor.
- 10.7 If the results of any test prove unsatisfactory or the structure shows signs of weakness, undue deflection or faulty construction the contractor shall remove and rebuild the member(s) involved or carry out such other remedial measures as may be required by the Engineer-In-Charge. The contractor shall bear the cost of so doing unless the failure of the member(s) to fulfill the test conditions is approved to be solely due to faulty design. The cost of all tests shall be borne by the contractor.
- 11.0 PREPARATION PRIOR TO CONCRETE PLACEMENT, FINAL INSPECTION AND APPROVAL:
- 11.1 Before the concrete is actually placed in position the insides of formwork shall be inspected to see that they have been cleaned and oiled. Temporary openings shall be provided to facilitate inspection especially at bottom of columns and wall forms to permit removal of saw dust, wood shavings, binding wire, rubbish, dirt etc. Such openings/ holes shall be later suitably plugged.
- 11.2 The various traders shall be permitted ample time to install drainage and plumbing lines, floor and trench drain, conduits, hangers, anchors, inserts, sleeves, bolts frames and other miscellaneous embedment to be cast in the concrete as indicated on the drawing or as necessary for the proper execution of the work. All such embedment shall be correctly positioned and securely held in the forms to prevent displacement during depositing and vibrating of concrete.
- 11.3 Slots, openings, holes, pockets etc. shall be provided in concrete work in the positions indicated in the drawings or as directed by the Engineer-In-Charge.
- 11.4 Reinforcement and other items to be cast in concrete shall have clean surfaces that will not impair bond.
- 11.5 Prior to concrete placement all works shall be inspected and approved by the Engineer-In-Charge and if found unsatisfactory concrete shall not be poured until all defects have been corrected at contractor's cost.

- 11.6 Approval of Engineer-In-Charge for any and all materials and work as required herein shall not relieve contractor from his obligations to produce finished concrete in accordance with the drawings and specifications.
- 11.7 Rain or Wash Water:
 - 11.7.1 No concrete shall be placed in wet weather or on a water covered surface. Any concrete that has been washed by heavy rains shall be entirely removed if there is any sign of cement and sand having been washed away from the concrete mixture.
 - 11.7.2 Before leaving unattended the work shall be covered with tarpaulins immediately after the concrete has been placed and compacted to safe guard against damages, which may be caused by rain.
 - 11.7.3 Any water accumulating on the surface of the newly placed concrete shall be removed by approved means and no further concrete shall be placed thereon until such water is removed. To avoid flow of water over / around freshly placed concrete suitable drains and sumps shall be provided.
- 11.8. Bonding Mortar:
 - 11.8.1 Immediately before concrete placement begins prepared surfaces except formwork which will come in contact with the concrete to be placed shall be covered with a bonding mortar of the same strength of concrete.
- 11.9 Transportation:
 - 11.9.1 All buckets, containers or conveyers used for transport the concrete shall be mortar tight. All means of conveyance shall be adopted to deliver the concrete of the required consistency and plasticity without segregation or loss of slump whatever method for transportation is employed.
 - 11.9.2 Chute shall not be used for transport of concrete without the written permission of the Engineer-In-Charge and concrete shall not be re-handled before placing.
- 11.10 Contaminated Concrete:
 - 11.10.1 Concrete must be placed in its final position before it become too stiff to work.
 - 11.10.2 On no account water shall be added after the initial mixing.
 - 11.10.3 Concrete which has become stiff or has been contaminated with foreign materials and which has not been placed within half an hour of mixing water with cement shall be rejected and disposed off as directed by the Engineer-In-Charge.
 - 11.10.4 All equipments used for mixing, transporting and placing of concrete shall be maintained in clean condition. All pans, buckets, hoppers, chutes, pipe lines and other equipments shall be thoroughly cleaned after each period of placement.

- 12.0 PROCEDURE FOR PLACING OF CONCRETE:
- 12.1 Before any concrete is placed the entire placing programme consisting of equipment, layout, proposed procedures and methods shall be submitted to Engineer-In-Charge for approval if so demanded by the Engineer-In-Charge and no concrete shall be placed until Engineer-In-Charge's approval has been obtained. Equipment for conveying concrete shall be of such size and design as to ensure a practically continuous flow of concrete during depositing without segregation of materials considering the size of the job and placement location.
- 12.2 Concrete shall be placed in its final position before the cement reaches its initial set and concrete shall normally be compacted in its final position within 30 minutes of leaving the mixer and once compacted it shall not be disturbed.
- 12.3 In all cases the concrete shall be deposited as nearly as practicable directly in its final position and shall not be re-handled or caused to flow in a manner which may cause segregation, loss of materials, displacement of reinforcement, shuttering or embedded inserts or impair its strength. For locations where direct placement is not possible and in narrow forms contractor shall provide suitable drop and Elephant Trunks to confine the movement of concrete. Special care shall be taken where concrete is dropped from a height especially if reinforcement is in the way particularly in columns and thin walls.
- 12.4 Except when otherwise approved by Engineer-In-Charge concrete shall be placed in the shuttering by shovels or other approved implements and shall not be dropped from a height more than one metre or handle in a manner which will cause segregation.
- 12.5 The following specification shall apply when placing of concrete by use of mechanical equipment is specifically called for while inviting bids or is warranted considering the nature of work involved:
- 12.6 Concrete placed in restricted forms by borrows, buggies, cars, sort chutes or hand shoveling shall be subjected to the requirement for vertical delivery of limited height to avoid segregation and shall deposited as nearly as practicable in it's final position.
- 12.7 Concreting once started shall be continuous until the pour is completed. Concrete shall be placed in successive horizontal layers of uniform thickness ranging from 150 mm to 900 mm as directed by the Engineer-In-Charge. These shall be placed as rapidly as practicable to prevent the formation of cold joints or planes of weakness between each succeeding layers within the pour. The thickness of each layer shall be such that it can be deposited before the previous layer has stiffened. The bucket loads or other units of deposit shall be spotted progressively along the face of the layer with such overlap as will facilitate spreading the layer to uniform depth and texture with a minimum of shoveling. Any tendency to segregation shall be corrected by shoveling stones into mortar rather than mortar onto stones. Such a condition shall be corrected by redesign of mix or other means as directed by Engineer-In-Charge.
- 12.8 The top surface of each pour and bedding planes shall be approximately horizontal unless otherwise instructed.

13.0 COMPACTION:

- 13.1 Concrete shall be compacted during placing with approved vibrating equipment until the concrete has been consolidated to the maximum practicable density, is free of pockets of coarse aggregate and fits tightly against all form surfaces, reinforcement and embedded fixtures. Particular care shall be taken to ensure that all concrete placed against the form faces and into corners of forms or against hardened concrete at joints is free from voids or cavities. The use of vibrators shall be consistent with the concrete mix and caution is to be exercised not to over vibrate the concrete to the point that segregation results.
- 13.2 When placing in layers, which are advancing horizontally as the work progresses great care shall be exercised to ensure adequate vibration, blending and melding of the concrete between the successive layers.
- 13.3 The immersion vibrator shall penetrate the layer being placed and also penetrate the layer below while the under layers is still plastic to ensure good bond and homogeneity between the two layers and prevent the formation of cold joints.
- 13.4 Care shall be taken to prevent contact of immersion vibrators against reinforcement steel. Immersion vibrators shall not be allowed to come in contact with reinforcement steel after start of initial set. They shall also not be allowed to come into contact with forms or finished surfaces.
- 13.5 Formation of stone pockets or mortar pondages in corners and against faces of forms shall not be permitted. Should these occur they shall be dug out, reform and refilled to a sufficient depth and shape for thorough bonding as directed by Engineer-In-Charge.
- 13.6 Bleeding or free water on top of concrete being deposited into the forms shall be caused to stop the concrete pour and the condition causing this defect corrected before any further concreting is resumed.

14.0 CONSTRUCTION JOINTS AND KEYS :

- 14.1 Concrete shall be placed without interruption until completion of the part of the work between predetermined construction joints as specified therein after. Time laps between the pouring of adjoining units shall be as specified in the drawings or as directed by the Engineer-In-Charge.
- 14.2 If stopping of concreting becomes unavoidable anywhere a properly formed construction joints shall be made where the work is stopped.
- 14.3 Joints shall be either vertical or horizontal unless otherwise shown on drawing. In case of an inclined or curved member the joints shall be at right angles to the axis of the member. Vertical joints in walls shall be kept to a minimum.
- 14.4 Vertical joints shall be formed against a stop board and horizontal joints shall be level and wherever possible arranged so that the joint lines coincide with the architectural features of the finished work.

- 14.5 Batten shall be nailed to the form work to ensure a horizontal line and if directed shall also be used to form a grooved joint. For tank walls and similar work joints shall be formed as per I.S. 3370.
- 14.6 Concrete that is in the process of setting shall not be disturbed or shaken by traffic either on the concrete itself or upon the shuttering.
- 14.7 Horizontal and vertical joints and shear keys shall be located and shall conform in details to the requirements of the plans unless otherwise directed by the Engineer-In-Charge.
- 14.8 Column Joints :
- 14.8.1.1 In a column joints shall be formed 75 mm below the lowest soffit of the beam including haunches if any. In flat slab construction the joint shall be 75 mm below the soffit of column capital. At least 2 hours shall elapse after depositing concrete in columns, piers or walls before depositing in beams, girders or slabs supported thereon.
- 14.9 Beam and Slab Joints :
- 14.9.1 Concrete in beam shall be placed throughout without a joint but if the joint is unavoidable the same shall be vertical and at the centre or within the middle third of the span unless otherwise shown on drawings. Where a beam intersects a girder the joints in the girder shall be offset a distance equal to twice the width of the beam and additional reinforcement provided for shear. The joint shall be vertical throughout the full thickness of the concrete member. A joint in a slab shall be vertical and parallel to the principal reinforcement. Where it is unavoidably at right angles to the principal reinforcement the joint shall be vertical and at the middle of the span.
- 14.10 Vertical construction joints in water tight construction will not be permitted unless indicated on the drawings. Where a horizontal construction joint is required to resist water pressure special care shall be taken in all phases of its construction to ensure maximum water tightness.
- 15.0 DOWELS :
- 15.1 Dowels for concrete works not likely to be taken up in the near future shall be wrapped in tar paper and burlap.
- 16.0 MASS FOUNDATIONS:
- 16.1 Mass foundation shall be poured in lifts not exceeding 1.5 m in height unless otherwise indicated on the drawings or approved by Engineer-In-Charge.
- 17.0 TREATMENT OF CONSTRUCTION JOINTS ON RESUMING CONCRETING :
- 17.1 A dryer mix shall be used for the top lift of horizontal pours to avoid laitance. All laitance and loose stones shall be thoroughly and carefully removed by wire brushing/ hacking and surface wash.
- 17.2 Just before concreting is resumed the roughened joint surface shall be thoroughly cleaned and loose matter removed and then treated with a thin layer of cement grout of proportion specified by Engineer-In-Charge and worked well into the surface. The new concrete shall be well worked against

the prepared face before the grout mortar sets. Special care shall be taken to obtained thorough compaction and to avoid segregation of the concrete along the joint plane.

18.0 CURING, PROTECTING, REPAIRING AND FINISHING:

18.1 All concrete shall be cured by keeping it continuously damp for a period of time required for complete hydration and hardening to take place. Preference shall be given to the use of continuous sprays or by ponding of water, continuously saturated coverings of sacking, canvas, hessian (especially on vertical structural members) or other absorbent materials or approved effective curing compounds applied with spraying equipment capable of producing a smooth even textured coat. Extra precautions shall be exercised in curing concrete during cold and hot weather as outlined hereinafter.

18.2 Certain type of finish or preparation for overlaying concrete must be done at certain stages of the curing process and special treatment may be required for specific concrete surface finish.

18.3 Curing With Water :

18.3.1 Fresh concrete shall be kept continuously wet for a minimum period of 10 days from the date of placing of concrete following a lapse of 10 to 12 hours after laying of concrete in normal weather and in hot weather not more than lapse of 4 hours. Date of casting shall have to be marked, as directed by Engineer-in-charge, on the exposed surfaces of the concrete so as to enable easy monitoring of the curing period.

18.3.2 The curing of horizontal surface exposed to the drying winds shall be however begin immediately after the concrete has hardened. Water shall be applied to unformed concrete surfaces within one hour after concrete has set. Water shall be applied to formed surface immediately upon removal of forms. Quantity of water applied shall be controlled so as to prevent erosion of freshly placed concrete.

18.3.3 The quality of curing water shall be the same as that used for mixing concrete.

18.3.4 Curing shall be assured by use of an ample water supply under pressure in pipes with all necessary appliances of hose, sprinklers and spraying devices. Continuous fine moist spraying or sprinkling shall be used unless otherwise specified or approved by the Engineer-In-Charge.

18.3.5 For curing of concrete in pavements, side-walks, floors flat roofs or other level surfaces the ponding method of curing is preferred. The method of containing the ponded water shall be approved by the Engineer-In-Charge. Special attention shall be given to edges and corners of the slab to ensure proper protection to these areas. The ponded areas shall be kept continuously filled with water during the curing period.

18.3.6 All equipments and materials required for curing shall be on and ready for use before concrete is placed.

19.0 FINISHING OF CONCRETE :

- 19.1 This specification is intended to cover the treatment of concrete surface for all structures. Areas requiring special finish not covered by this specification shall be clearly indicated on the drawings and special specification shall be furnished.
- 19.2 When specified on the drawings an integral cement concrete finish of specified thickness for floors and slabs shall be applied either monolithic or bonded as specified on the drawings and as per I.S. 2571.
- 19.3 The surface shall be compacted and then floated with a wooden float or power floating machine. The surface shall be tested with a straight edge and any high and low spots eliminated.
- 19.4 Floating or trowelling of the finish shall be permitted only after all surface water has evaporated. Dry cement or a mixture of dry cement and sand shall not be sprinkled directly on the surface of the concrete finish to absorb moisture or to stiffen the mix.
- 19.5 A rubbed finish shall be provided only on exposed concrete surfaces as specified on the drawings.
- 19.6 Upon removal of forms all fins and other projections on the surfaces shall be carefully removed, offsets leveled, voids and /or damaged sections immediately saturated with water and repaired by filling with concrete or mortar of the same composition as was used in the concrete.
- 19.7 The finished surfaces shall present a uniform and smooth appearance.
- 19.8 All concrete shall be protected against damage until final acceptance by the Engineer-In-Charge.
- 20.0 CONCRETE FINISHES :
- 20.1 Unless otherwise specified concrete finishes shall conform to the following specifications :
- 20.1.1 Finish F1, F2 and F3 shall describe formed surfaces.
- 20.1.2 Finish U1, U2 and U3 shall describe unformed surfaces.
- 20.1.3 Offsets or fins caused by disposed or misplaced from sheathing, lining or form sections or by defective form lumber shall be referred to as abrupt irregularities.
- 20.1.4 All other irregularities shall be referred as gradual irregularities. Gradual irregularities shall be measured as deviation from a plane surface with a template 1500 mm long for formed surface and 3000 mm long for unformed surfaces.
- 20.2 Formed Surfaces :
- 20.2.1 Finish F1 shall apply to all formed surfaces for which finish F2 and F3 or any other special finish is not specified and shall include filling up all form tie holes.

- 20.2.2 Finish F2 shall apply to all formed surfaces as shown on the drawings or specified by the Engineer-In-Charge. This shall include filling all form tie holes, repair of gradual irregularities exceeding 6 mm removal of ridges and abrupt irregularities by grinding.
- 20.2.3 Finish F3 shall apply to all formed surfaces exposed to view or where shown in the drawings or specified by the Engineer-In-Charge. Finish F3 shall include all measures specified for Finish F2 and in addition filling air holes with mortar and treatment of the entire surface with sack rubbed finish. It shall also include clean up of loose and adhering debris. Where a sack rubbed finish is specified the surfaces shall be prepared within two days after removal of the forms.
- 20.2.3.1 The surface shall be wetted and allowed to dry slightly before mortar is applied by sack rubbing. The mortar used shall consist of one part of cement to one and half parts of fine sand (minus No.16 mesh) by volume. Only sufficient mixing water to give the mortar a workable consistency shall be used.
- 20.2.3.2 The mortar shall then be rubbed over the surface with a fine burlap or linen cloth so as to fill all the surface voids.
- 20.2.3.3 The mortar rubbed in the voids shall be allowed to stiffen and solidify after which the whole surface shall be wiped clean so that the surface presents a uniform appearance without air holes, irregularities etc.
- 20.2.4 Curing of the surface shall be continued for a period of ten days.
- 20.3 Unformed Surfaces :
- 20.3.1 Finish U1 shall apply to all unformed surfaces for which the finish U2, U3 or any other special finish is not specified and shall include screeding the surface of the concrete to the required slope and grade.
- 20.3.1.1 Unless the drawing specifies a horizontal surface or shows required the slope the top of the narrow surfaces such as stairs, treads, walls, curbs and parapets shall be sloped approximately 10 mm per 300 mm width.
- 20.3.1.2 The surfaces to be covered by back fill or concrete sub floors to be covered with concrete topping, terrazzo and similar surfaces shall be smooth screeded and leveled to produce even surface, irregularities not exceeding 6 mm.
- 20.3.2 Finish U2 shall apply to all unformed surfaces as shown in the drawing or specified by the Engineer-In-Charge and shall include screeding and applying a wood float finish to the surface of the concrete to the required slopes and grade.
- 20.3.2.1 Repair of abrupt irregularities unless a roughened texture is specified. Repair of gradual irregularities exceeding 6 mm.
- 20.3.3 Finish U3 shall apply to unformed surfaces for which a high degree of surface smoothness is required where shown on the drawing or as specified by the Engineer-In-Charge. This shall include screeding, floating and applying a steel trowel finish to the surface of the concrete to the required slopes and grade.

20.3.3.1 Repair of abrupt irregularities and gradual irregularities exceeding 6 mm, finishing joints and edges of concrete with edging tools.

21.0 MODE OF MEASUREMENTS :

21.1 The concrete as actually done shall be measured for payment. Any work done excess over the specified dimensions for the section shown in the drawing or as required by the Engineer-In-Charge shall not be measured for payment.

21.2 Dimensions of length, breadth and thickness shall be measured correct to nearest centimeters except for the thickness of slab, which shall be measured to nearest 5 mm.

21.3 Areas shall be worked out to nearest 0.01 square metre and the cubic contents of consolidated concrete shall be worked out to nearest 0.001 cubic metres.

21.4 For the purpose of measurements and payments for all concrete works I.S. 1200 (Part-II) shall be referred.

22.0 Control Joint / Dummy Joint:

These joints shall be founded at 5 M to 6 M intervals. The width of the joint shall be 8 to 10 mm and the depth shall be 25 mm. The edges shall be rounded with an edging tool.

The joint shall be filled with the joint sealing compound of IS:1834-1961 for hot applied sealing compounds for joints in concrete.

The unit of measurement will be running metre including cost of sealing compound.

PLAIN CEMENT CONCRETE FOR GENERAL WORK:

For plain cement concrete work, the specifications for materials viz., cement, sand, fine and coarse aggregates and water shall be the same as that specified in reinforced work specification.

But the proportion of mix will be nominal and the ratio of fine and coarse aggregate may be slightly adjusted within limits keeping the total volume of aggregates to a given volume cement constant, to suit the sieve analysis of the aggregates. Cement shall on no account be measured by volume, both it shall always be used directly from the bags (i.e., 50 Kg/bag).

The proportion of cement, sand, aggregate for concrete of proportion 1:4:8, 1:3:6, 1:2:4 by volumes shall generally consist of quantities as given below:

Proportions of ingredients	Quantity of materials used per bag of Cement			
	Cement	Sand	Coarse aggregate	Water
1:4:8	1	130 ltrs.	272 ltrs.	39 ltrs.
1:3:6	1	102 ltrs.	204 ltrs.	34 ltrs.
1:2:4	1	68 ltrs.	136 ltrs.	30 ltrs.

The quantity of water used shall be such as to produce concrete of consistency required by the particular class or work and shall be decided by the use of slump cone. Sufficient care should be taken to see that no excess quantity of water is used. The final proportion of the aggregates and the quantity of water shall be decided by the Engineer on the basis of test in each case. The slump shall be specified for each class of work and shall in general be as follows:-

<u>Type of Concrete</u>	<u>Mix slump (Millimetres)</u>
Mass Concrete	50
Roads and pavements, hand finished	100
Roads and pavements, machines finished	25
Floor paving	50

All plain concrete shall be preferably mixed in a drum type power driven machine with a loading hopper, which will permit the accurate measure of various ingredients. If hand mixing is authorized, it should be done on a watertight platform.

The mixing of each batch in the concrete mixer shall continue for not less than 2 minutes after the materials and water are in the mixer. The volume of mixed materials per batch shall not exceed the manufacturer's rated capacity of the mixer. The mixer shall rotate at a peripheral speed of about 60 metres per minute.

Concrete shall be poured and consolidated in its final position within half an hour of mixing. The re-tempering of concrete, which has partially hardened, that is remixing with or without additional cement, aggregate or water shall not be permitted. Concrete in c.c. 1:2:4 will be required to be vibrated if specified and directed by the Engineer. In case if the thickness of concrete is more than 150 mm in thickness, it may be vibrated if directed by the Engineer.

The concrete shall be cured for 10 days in ordinary weather and 15 days in cold weather. Measurements for the work done shall be exact length, breadth and depth shown or figured on the drawings or as instructed by the Engineer and after the concrete is consolidated. No extra shall be paid for excess quantity resulting from faulty workmanship.

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"SPECIFICATIONS FOR READY MIXED CONCRETE (R.M.C.)"

1.0 SCOPE

The supply of ready-mixed concrete shall be as specified in IS: 4926-1976. The strength of RCC design mix shall be specified in the item.

2.0 TERMINOLOGY

2.1 For the purpose of this standard the definitions in 2.2 to 2.5 shall apply.

2.2 Ready-mixed Concrete – Concrete delivered at site in plastic condition and requiring no further treatment before being placed in the position in which it is to set and harden.

2.3 Agitation – The process of continuing the mixing of concrete at a reduced speed during transportation to prevent segregation.

2.4 Agitator – Truck mounted equipment designed to agitate concrete during transportation to the site of delivery.

2.5 Truck – Mixer – A mixer generally mounted on a self-propelled chassis capable of mixing the ingredients of concrete and of agitating the mixed concrete during transportation.

3.0 TYPES OF MIXING

3.1 For the purpose of this standard, the ready-mixed concrete shall be of the following type, according to the method of production and delivery as specified in 3.2

3.2 Centrally Mixed Concrete – Concrete produced by completely mixing cement, aggregates, admixtures, if any and water at a central mixing plant and delivered in containers fitted with agitating devices.

4.0 MATERIALS

4.1 Materials such as cement, coarse & fine aggregates, water & admixture, etc. shall conform to the specifications mentioned in the RCC works. Use of mineral admixtures like fly ash, GGBFS, etc. shall not be permitted unless otherwise specifically permitted by Engineer-in-charge. Cement shall be Ordinary Portland Cement – 43 grade/ Portland Pozzolana cement (Fly ash based meeting the 28 day strength requirement of OPC 43 grade cement) only.

5.0 BASIS OF SUPPLY

5.1 The ready-mixed concrete shall be manufactured and supplied on the following basis:

a) Specified strength based on 28 days compressive strength of 15 cm cubes tested in accordance with IS: 456-2000.

5.2 The responsibility for the design of mix shall be that of the manufacturer and the concrete shall conform to the requirements as specified in 7.

6.0 GENERAL REQUIREMENTS

6.1 The ready-mixed concrete shall generally comply with the requirements of IS: 456 considering as 'severe' environment.

6.2 Minimum quantity of cement and the details regarding proportionary works control shall be in accordance with IS: 456.

- 6.3 The concrete shall be delivered to the site of work and discharge shall be complete within ½ hour (when the prevailing atmospheric temperature is above 20° C) and within 2 hours (when the prevailing atmospheric temperature is at or below 20° C) of adding the mixing water to the mix of cement and aggregate or of adding the cement to the aggregate whichever is earlier.
- 6.4 Sampling and Testing :
- 6.4.1 Adequate facilities shall be provided by the manufacturer for purchaser to inspect the materials used, the process of manufacture and methods of delivery of concrete. He shall also provide adequate facilities for the purchaser to take samples of the materials used.
- 6.4.2 Sampling and Testing – The sampling and testing of concrete shall be done in accordance with the relevant requirements of IS: 456-2000, IS: 1199-1959 and IS: 516-1959.
- 6.4.3 Consistency or Workability – The testes for consistency or workability shall be carried out in accordance with the requirements of IS: 1199-1959 or by such other method as may be agreed to between the purchaser and the manufacturer.
- 6.4.4 Strength Test – The compressive strength and flexural strength tests shall be carried out in accordance with requirements of IS: 516-1959 and the acceptance criteria for concrete supplied on the basis of specified strength shall conform to the requirements of IS: 456.
- 6.4.5 Cost of Testing – The cost of the tests carried out in accordance with requirements of this specification shall be borne by the contractor.
- 6.4.6 Manufacturer's Records and Certificates - The manufacturer shall keep batch records of the quantities by mass of all solid materials, of total amount of water used in mixing and of the results of all tests. If required by the purchaser, the manufacturer shall furnish certificate, at agreed intervals, giving this information.
- 7.0 CONCRETE MANUFACTURED AND SUPPLIED ON THE BASIS OF SPECIFIED STRENGTH
- 7.1 The manufacturer shall supply the following information for guidance of the supplier for approval:
- a) The type of cement to be used.
 - b) The maximum size and type of aggregates.
 - c) The type of admixtures to be used.
 - d) The minimum accepted compressive strength or flexural strength or both, determined from samples of plastic concrete taken at the place and time of delivery, in accordance with requirements of IS: 456-2000.
 - e) The slump or compacting factor or both, or other requirement for consistency or workability at the place and time of delivery of the concrete.
 - f) The ages at which the test cubes or beams are to be tested and the frequency and number of tests to be made shall be as required by the purchaser.

7.2 Tolerances – The concrete shall be deemed to comply with the requirements of this specification, if the results of the tests where applicable, lie within the tolerances specified in 7.2.1.

7.2.1 Consistency or Workability – The slump (average of two tests) shall not differ from the specified value by ± 10 mm for a specified slump of 75 mm or less and ± 25 mm when the specified slump is greater than 75 mm. The compacting factor average of two tests shall be within ± 0.03 of the value specified. The test for consistency or workability shall be completed within 15 minutes of the time of receipt of the ready-mixed concrete at site.

8.0 PLACING OF READY-MIXED CONCRETE:

The ready-mixed concrete shall be placed in the required location/position, level, heights, etc. by using pumping arrangement method/mechanically as directed by the Engineer-in-Charge.

SPECIFICATION FOR FORM WORK

1.0 SCOPE:

- 1.1 The formwork shall consists of shores, bracings, side of beams 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 APPLICABLE CODES AND SPECIFICATIONS:

- 2.1 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.

No.	I.S. 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. If so instructed, 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.
- 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 TOLERANCES:

4.1 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 -

4.1.1 Tolerance for R.C. Building:

4.1.1.1 Variation from the plumb:

No.	Building Members	Tolerances
1.	In the line and surface of columns, piers, walls and buttresses	5 mm per 2.50 M but not more than 25 mm
2.	For exposed corner columns and other conspicuous lines	In any bay or 5 M maximum: (+/-) 5 mm. In 10 M or more: (+/-) 10 mm

4.1.1.2 Variation from the level or from the grade indicated in the drawings:

No.	Building Members	Tolerances
1.	In slab soffits, ceilings, beam soffits and staircases	In 2.50 M : (+/-) 5 mm In any bay or 5 M maximum: (+/-) 8 mm. In 10 M or more: (+/-) 15 mm
2.	For exposed lintels, parapets, horizontal grooves and other conspicuous lines	In any bay or 5 M maximum: (+/-) 5 mm. In 10 M or more: (+/-) 10 mm

4.1.1.3 Variation of the linear building lines from established position in plan and related position of columns, walls and partitions:

No.	Building Members	Tolerances
1.	In any bay or 5 M maximum	(+/-) 5 mm
2.	In 10 M or more	(+/-) 20 mm

4.1.1.4

No.	Building Members	Tolerances
1.	Variation in the sizes and locations of sleeves, openings in walls and floors except in the case of anchor bolts	(+/-) 5 mm

4.1.1.5

No.	Building Members	Tolerances
1.	Variation in cross sectional dimensions of columns and beams and thickness of slabs and walls	(-) 5 mm and (+) 10 mm.

4.1.1.6: Footings:

No.	Building Members	Tolerances
1.	Variation in dimension in plan	(-) 5 mm and (+) 50 mm.
2.	Misplacement or eccentricity in the direction of misplacement	0.02 times the width of the footing in the direction of the deviation but not more than 50 mm

3.	Reduction in thickness	(+/-) 0.05 times the specified thickness

4.1.1.7.1 Variation in steps:

No.	Building Members	Tolerances
1.	In a flight of stairs riser	(+/-) 3 mm
2.	In a flight of stairs tread	(+/-) 5 mm
3.	In consecutive steps riser	(+/-) 1.5 mm
4.	In consecutive steps tread	(+/-) 3 mm

4.1.2 Tolerances in other Concrete structures:

4.1.2.1.1 All structures:

No.	Building Members	Tolerances
1.	Variation of the constructed linear outline from established position in plan	(+/-) 10 mm in 5 M (+/-) 15 mm in 10 M or more
2.	Variation of dimensions to individual structure features from established positions in plan	(+/-) 25 mm in 20 M or more (+/-) 50 mm in buried construction
3.	Variation from plumb, specified batter or curved surfaces of all structures	(+/-) 10 mm in 2.50 M (+/-) 15 mm in 5 M (+/-) 25 mm in 10 M or more (+/-) Twice the above amounts in buried construction
4.	Variation from level or grade indicated on drawings in slabs and beams soffits, horizontal grooves and visible arises	(+/-) 5 mm in 2.50 M (+/-) 10 mm in 7.5 M or more (+/-) Twice the above amounts in buried construction
5.	Variation in cross sectional dimensions of columns, beams, buttresses, piers and similar members	(-) 5 mm and (+) 10 mm
6.	Variation in the thickness of slabs, walls, arch sections and similar members	(-) 5 mm and (+) 10 mm

4.1.2.2 Footings for columns, piers, walls, buttresses and similar members:

No.	Building Members	Tolerances
1.	Variation in dimension in plan	(-) 10 mm and (+) 50 mm.
2.	Misplacement or eccentricity in the direction of misplacement	0.02 times the width of the footing in the direction of the deviation but not more than 50 mm
3.	Reduction in thickness	(+/-) 0.05 times the specified thickness

4.1.2.3 Tolerances in other types of structures shall generally conform to those given in clause 2.4 of recommended Practice for Concrete Formwork (ACI 347).

5.0 TYPE OF FORMWORK:

- 5.1 Formwork may be of timber, plywood, metal, plastic or concrete. 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

6.0 FORMWORK REQUIREMENTS:

- 6.1 Forms shall conform to the shapes, lines, grades and dimensions including camber of the concrete as called for on the drawings. Ample studs, waler 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. The shuttering shall be close boarded. Timber shall be well seasoned, free from sap, shakes, loose knots, worm holes, warps or other surface defects in contact with concrete shall be free from adhering grout, plaster, paint, projecting nails, splits or other defects. Joints shall be sufficiently tight to prevent loss of water and fine material from concrete.
- 6.2 Plywood shall be used for exposed concrete surface where called for. Sawn and wrought timber may be used for unexposed surfaces. 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.
- 6.3 All new and used form timber shall be maintained in a good condition with respect to shape, strength, rigidity, water tightness, smoothness and cleanliness of surfaces. Form timber unsatisfactory in any respect shall not be used and if rejected by the Engineer-in-charge shall be removed from the site.
- 6.4 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.
- 6.5 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.
- 6.6 Excessive construction camber to compensate for shrinkage settlement etc. that may impair the structural strength of the members will not be permitted.
- 6.6.1 Forms for substructure concrete may be omitted 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.

- 6.7 Forms shall be designed and constructed that they can be stripped in order required and their removal do not damage the concrete. Face form work shall provide true vertical and horizontal joints conforming to the architectural features of the structure as to location of joints and be as directed by the Engineer-in-charge.
- 6.8 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.
- 7.0 **BRACINGS, STRUTS AND PROPS:**
- 7.1 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. Bamboos shall not be used as props or cross bracings.
- 7.2 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.
- 7.3 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 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.
- 7.4 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 one meter or as directed by the engineer-in-charge.
- 8.0 **FORM OIL:**
- 8.1 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.
- 8.2 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.
- 9.0 **CHAMFERS AND FILLETS:**
- 9.1 All corners and angles in the finished structure shall be formed with mouldings to form chamfers or fillets on the finished concrete. The standard dimensions of chamfers and fillets unless otherwise specified shall be 20 mm x 20 mm. Care shall be exercised to ensure accurate mouldings. The diagonal face of the moulding shall be planed or surface to the same texture as the forms to which it is attached.
- 9.2 Vertical construction joints on faces which will be exposed at the completion of the work shall be chamfered as above except where not permitted by Engineer-in-charge for structural or hydraulic reasons.

10.0 WALL TIES:

10.1 Wall ties passing through the walls shall not be allowed. Also through bolts shall not be permitted.

For fixing of formwork alternate arrangements such as coil nuts shall be adopted at the contractor's cost.

11.0 REUSE OF FORMS:

11.1 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 timber shall be resized. Contractor shall equip himself with enough shuttering to complete the job in the stipulated time.

12.0 REMOVAL OF FORMS:

12.1 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.

12.2 In no circumstances shall form 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 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.

12.3 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).

12.4 Striking shall be done slowly with utmost care to avoid damage to arise and projections and without shock or vibration by gentling easing the wedges. If after removing the formwork it is founds that timber has been embedded in the concrete, it shall be removed and made good as specified earlier.

12.5 Reinforced temporary openings shall be provided as directed by the Engineer-in-charge to facilitate removal of formwork which otherwise may be inaccessible.

- 12.6 Tie rods, clamps, form bolts, etc. which must be entirely removed from walls or similar structure shall be loosened not sooner than 16 hours not later than 24 hours (in case the conditions in 12.3 are satisfied) 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.
- 13.0 **MODE OF MEASUREMENT:**
- 13.1 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.
- 13.2 The dimensions of the formwork shall be measured correct to a centimeter.
- 13.3 No deductions shall be made from the shuttering for openings/obstructions up to an area of 0.10 m² and nothing extra shall be paid of forming such opening.
- 13.4 For the purpose of measurements for formwork IS: 1200 (Part V) shall be referred.
- 14.0 **SPECIFICATION FOR STAGING WORK:**
- 14.1 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 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 months 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.

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SPECIFICATION
FOR
RUBBER / P.V.C. WATER STOPS

1.0 GENERAL:

- 1.1 The corrugated Rubber/PVC water stops with centre bulb of specified width, shall be of approved manufacture and shall satisfy all the normal tests such as tensile strength, elongation etc.

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 as 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 centimetre.
- 4.2 Rate shall include supply, transport, fixing, welding, supporting arrangements, cleaning etc. all as described above.

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SPECIFICATIONS FOR STEEL REINFORCEMENT

1.0 GENERAL:

- 1.1 Steel reinforcement bars, if supplied or arranged by the contractor, shall be either plain round mild steel bars grade – I or medium tensile steel bars as per IS: 432 or hot rolled mild steel and medium tensile deformed as per IS: 1139 or Thermo-mechanically treated (TMT) bars - high yield strength deformed bars as per IS: 1786 as shown and specified on the drawings and shall be manufactured by M/s SAIL or TISCO or RINL only and shall be rolled from their own plants and from virgin material. 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 directed in line with the relevant Indian standards and cost of which shall be included in the item rate and no separate payment shall be made on account of this.
- 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:

- 3.1 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. The reinforcement shall be coated with cement wash before stacking to prevent scale and rust. 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 relevant IS. 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 precaution 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. 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:

- 7.1 All bars shall be accurately bent according to the size and shape shown on the detail working drawing / bar bending schedule. They shall be gradually bent by machine or approved means.
- 7.2 Reinforcing bars shall not be straightened and re-bend in the manner that will injure the material. Bars containing cracks and splits shall be rejected. They shall be bent cold except bars above 25 mm in diameter which may be bent hot, if specifically approved by Engineer-in-charge.
- 7.3 Bars which depend for their strength on cold working shall not be bent hot. Bars bent hot shall not be heated beyond cherry-red color (not exceeding 645 °C) and after bending shall be allowed to cool slowly without quenching.
- 7.4 Bars incorrectly bent shall be used only if the means used for straightening and re-bending be such as shall not in the opinion of the Engineer-in-charge injure the material.

- 7.5 No reinforcement bars shall be bent when in position in the work without approval, whether or not it is partially embedded in hardened concrete. Bars having kinks or bends other than those required by the design shall not be used.
- 8.0 **FIXING:**
- 8.1 The reinforcement shall accurately be fixed by any approved means and maintained in the correct position as shown in the drawing by use of blocks, spacers and chairs as per IS: 2502 to prevent displacement during placing and compaction of concrete.
- 8.2 Bars intended to be in contact at crossing point shall be securely bound together at all such points with 1.6 mm diameter annealed soft iron wire.
- 8.3 The vertical distance required between successive layers of bars in beams or similar members shall be maintained by provision of mild steel spacer bars at such intervals that the main bar do not perpetually sag between adjacent spacer bars.
- 9.0 **COVER TO REINFORCEMENT:**
- 9.1 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.
- 10.0 **INSPECTION:**
- 10.1 Erected and secured reinforcement shall be inspected and approved by the Engineer-in-charge prior to placement of concrete.
- 11.0 **MODE OF MEASUREMENT:**
- 11.1 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.
- 11.2 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.
- 11.3 Wastage, unauthorized overlap and annealed steel binding wires shall not be measured for payment.
- 11.4 Pins, chairs and spacers wherever required shall be provided As directed by the Engineer-in-charge and measured separately and paid for.
- 11.5 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.

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SPECIFICATION FOR STRUCTURAL STEEL

1.0. SCOPE :

- 1.1. This specification covers requirements for the supply wherever, fabrication and delivery of structural steel and miscellaneous steel items for the work.
- 1.2. This specification also covers redesign wherever necessary, design of all connections and published members, preparation of all shop fabrication drawings, inspection and painting of structures by the fabricators.

2.0. APPLICABLE CODES AND SPECIFICATIONS :

- 2.1 Unless otherwise specified herein, the design, materials and workmanship shall conform to the latest edition of the one or as many as applicable of the following standards or their approved equivalents.
- 2.2. All standards, specifications and code of practices, referred to herein shall be the latest edition including all applicable amendments, revisions and additional publications.
- 2.3. List of Indian Standards :

No.	I.S. No.	I.S. Particular
1.	I.S. 226	: Structural steel (standard quality)
2.	I.S. 808	: Rolled steel beams, channel and angles sections.
3.	I.S. 1099	: Structural steel (ordinary quality)
4.	ASTM 06	: General requirements for delivery of rolled steel plates, sheet piling and bars for structural use.
5.	I.S. 1367	: Technical supply conditions for threaded fasteners.
6.	I.S. 3757	: High tensile friction grip fasteners for structural engineering purposes.
7.	I.S. 814	: Specifications for covered electrodes for metal arc welding for mild steel.
8.	I.S. 3613	: Acceptance tests for wire flux combination for submerged-arc welding.
9.	B.S. 639	: Covered electrodes for the manual metal arc welding of mild steel and medium tensile steel
10.	AWS. A-5.1	: Specification for mild steel covered arc welding electrodes.
11.	AWS.A-5-17	: Specification for hard mild steel electrodes and submerged arc welding.
12.	I.S. 1052	: Specification for rolling and cutting tolerances for hot rolled steel products.
13.	I.S. 2074	: Ready mixed paint, red oxide zinc chrome, priming.
14.	I.S. 102	: Ready mixed paint, brushing, red lead, non-setting, priming.
15.	I.S. 300	: Code of practice for use of structural steel in general building construction.
16.	I.S. 875	: Code of practice for structural safety of building : Loading standards.
17.	I.S. 1893	: Recommendations for earthquake resistant design of structures.
18.	B.S. 449	: The use of structural steel in building.
19.	I.S. 816	: Code of practice for use of metal arc welding for general construction.

20.	I.S. 4353	:	Recommendations for submerged arc welding of mild steel and low alloy steel.
21.	I.S. 823	:	Code of procedure for manual metal arc welding of mild steel.
22.	I.S. 817	:	Codes of practice for training and welding of metal arc welders.
24.	I.S. 1182	:	Recommended practice for radiographic examination of fusion-welded butt joints in steel plates
25.	I.S. 5334	:	Codes of practice for magnetic particle flaw detection of welds
26.	ASTM E. 94	:	Recommended practice for radiographic testing.
27.	ASTME. 109	:	Dry powder magnetic particle inspection.
28.	ASTME. 130	:	Wet magnetic particle inspection.
29.	ASTME. 165	:	Liquid penetrant inspection.
30.	I.S. 1477	:	Code of practice for painting of ferrous metals in building all allied finishes.
31.	I.S. 1161	:	Steel Tubes for structural purposes
32.	IS:1363	:	Hexagon Head Bolts, Screws and Nuts of product (Part I to III)
33.	I.S. 1852	:	Rolling and Cutting Tolerances for Hot Rolled Steel Products
34.	I.S. 3502	:	Steel Chequered Plate
35.	I.S. 3757	:	High Strength Structural Bolts
36.	I.S. 1200	:	Method of Measurement

3.0. STEEL MATERIALS :

- 3.1. Structural steel shall be procured by the contractor conforming to relevant IS codes and manufactured by M/s SAIL or TISCO or RINL only and shall be rolled from their own plants and from virgin material. 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 directed in line with the relevant Indian standards and cost of which shall be included in the item rate and no separate payment shall be made on account of this.
- 3.2. Contractor shall take proper care of the steel supplied by department and protect the same from weathering and damage. Any such materials rendered unserviceable or damaged while in the contractor's custody shall be replaced by contractor at his own cost as directed by the Engineer-in-Charge.
- 3.3. Contractor's stock material may be used provided the mill test reports identified with the materials, satisfactorily demonstrate specified grade and quality. Also all such materials supplied by contractor shall be in a sound condition of recent manufacture, in full length, free from defects, loose mill scale, slag intrusions, laminations, pitting, flaky rust etc. and be of full weight of thickness specified.

- 3.4. Unidentified steel material may be used only with prior permission from Engineer-in-charge, in writing, for short sections of minor importance or for small unimportant welds and connections where in the opinion of the Engineer-in-charge the quality of such material would not adversely affect the strength and / or durability of the structure. Engineer-in-charge may also permit use of such material for other work if adequate and random samples taken out and tested to demonstrate conformity with specification & requirement for work in view.
- 3.5. Contractor shall submit the fabrication drawing for the Engineer-in-charge's approval before fabrication commences and make any modification therein as directed by the Engineer-in-charge. Approval by the Engineer-in-charge of any of the drawings shall not relieve the Contractor from the responsibility for correctness of engineering & design of connections, workmanship, fit of parts, details, material, errors or omissions of any and all work shown thereon. The Engineer-in-charge's approval shall constitute approval of the size of members, dimensions and general arrangement but shall not constitute approval of the connections between members and other details.
- 3.6. Approved design drawings will be furnished to the contractor and all drawings so furnished shall form a part of this specification. Contractor shall consult these in detail for all the information contained therein; which pertains to and is required for his work.
- 3.7. The Engineer-in-Charge reserve the right to make changes, revisions to drawings even after release for preparation of shop drawings are very likely to be made to reflect additional data/details received and more updated requirements.
- 3.8. Revisions in drawings and any new drawings made to include additional work by the Engineer-in-charge shall be considered a part of this specification and contract and the contractor shall have no extra claims on this account.
- 3.9. Unless otherwise specified, the drawings and specifications are intended to include every thing obviously requisite and necessary for the proper and entire completion of the work and job shall be carried out accordingly for the completeness as required.
- 3.10. Design drawings prepared by the Engineer-in-Charge will show all the dimensions and if necessary clearance of structure, landings where necessary, size of each member, definite location of openings at various levels and all other information necessary to enable the contractor in prepare drawings for fabrication and erection.
- 3.11. It shall be clearly understood that the Engineer-in-charge's drawings are design drawing and are not intended to show connection details, thickness of members, cuts, notches, bends and such other details.
- 3.12. In the case of variation in drawings and specifications the decision of the Engineer-in-Charge shall be final.
- 3.13. Should contractor in the execution of his work, find discrepancies in the information furnished by the Engineer-in-charge he shall refer such discrepancies to the Engineer-in-Charge before proceeding with the work.
- 4.0. **FABRICATION :**
- 4.1. All workmanship and finish shall be of the best quality and shall conform to the best-approved method of fabrication.
- 4.2. All materials shall be finished straight and shall be machined true and square where so specified. All holes and edges shall be free of burrs.

- 4.3. Shearing and chipping shall be neatly and accurately done and all portions of work exposed to view shall be neatly finished.
- 4.4. Standard fabrication clearance as detailed in American Institute of steel construction manuals shall generally be followed unless otherwise directed approved.
- 4.5. Material at the shops shall be kept clean and protected from weather.
- 4.6. Shop connections shall be effected by welding as specified on the Engineer-in-Charge's design drawings.
- 4.7. Rolled materials before being worked shall be straightened unless otherwise required/specified.
- 4.8. If straightening or flattening is necessary it shall be done by methods that will not injure the material. Long plates shall be straightened by passing through a mangle or leveling rolls and structural shapes by the use of mechanical or hydraulic bar straightening machines.
- 4.9. Heating or forging shall not be resorted to without the prior approval of the Engineer-in-charge in writing.
- 4.10. Cutting may be by shearing, cropping, sawing or machine flame cutting. All re-entrant corners shall be shaped notch-free to a radius of at least 12 mm. Sheared or cropped edges shall be dressed to a neat workmanlike finish and shall be free from distortion and burrs.
- 4.11. The korf on machine flame cut edges shall be removed. Where machine flame cutting is permitted for high tensile steel, special care shall be taken to leave sufficient metal and all flame hardened material shall be removed by machining/edge planning.
- 4.12. Hand flame cutting shall be undertaken only if so permitted by Engineer-in-charge and only be carried out by an expert in such work. Hand flame cut edges shall be ground smooth and straight.
- 4.13. Edge planning of sheared, chopped or gas cut edges is not intended unless the sheared, chopped or gas cut edges are such as to warrant it or specifically called for.

5.0. WELDING :

- 5.1. Welding procedure shall be submitted to Engineer-in-charge for approval. Welding shall be entrusted to only qualified and experienced welders who shall be periodically tested and graded as per IS 817, IS: 7310 (Part 1) and IS: 7318 (Part 1).
- 5.2. Electrodes for structural welding works shall comply with the requirements of IS: 226 and / or BS: 634 or AWS: A-5.1 and shall be of approved make.
- 5.3. The electrodes shall be suitable for use in the position and type of work as laid down in the above specifications and as recommended by the manufacturer.
- 5.4. Electrodes of classification AWS E 60 XX and C 70 XX shall be used for welding steel conforming to I.S. 226 and I.S. 2062 and of classification AWS E 70 XX for steel conforming to I.S. 961. Electrodes other than low-hydrogen electrodes shall not be permitted for thickness of 32 mm and above.
- 5.5. Joints in materials above 20 mm thick and all the important connections shall be made with low Hydrogen electrodes of AWS E 7016 or E 7010 classification.

- 5.6. The filler wire and flux combination for submerged arc welding shall conform to the requirements for the desired application as laid down in I.S. 3613. The weld metal deposited by the submerged arc process shall have mechanical properties not less than that specified for American Welding Society's classification 5.17 E 60 for steel to I.S. 226 and I.S. 2042 and AWS classification 5.17 E 70 for steel to IS: 961.
- 5.7. 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 to 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.
- 5.8. Electrodes larger than 5mm diameter shall not be used for root-runs in butt welds.
- 5.9. Welding plants and accessories shall have capacity adequate for the welding procedure laid down and shall satisfy appropriate standards and be of approved make and quality. Contractor shall maintain all welding plants in good working conditions. All the electrical plants in connection with the welding operation shall be properly and adequately earthen and adequate means of measuring the current shall be provided.
- 5.10. 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.
- 5.11. All welds shall be free from defects like blowholes, slag inclusions, lack of penetration, under cutting, cracks etc. All welds shall be cleaned of slag or flux and show uniform sections, smoothness of weld metal, feathered edges without overlap and freedom from porosity.
- 5.12. Fusion faces and surfaces adjacent to the joint for a distance of at least 50 mm 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.
- 5.13. Joint surfaces shall be smooth, uniform and free from fins, tears, laminations etc.
- 5.14. 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 8 mm.
- 5.15. 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 reinforcement interiors with proper fit-up between components to be assembled for welding, these welds shall be ground flush prior to assembly.
- 5.16. The 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 3 mm. If the separation is 1.5 mm or greater the fillet weld size shall be increased by the amount of separation. This shall only apply if the surfaces are completely sealed by welds. In all other cases the fit-up shall be close enough to exclude water after painting.
- 5.17. The separation between faying surfaces of lap joints and butt joints with backing plate shall not exceed 1.5 mm. A butting part to be butt-welded shall be carefully aligned and the correct root gap maintained throughout the welding operation.
- 5.18. Misalignments greater than 25 percent of the thickness of the thinner plate or 3 mm whichever is smaller shall be corrected and in making the correction the parts shall not be drawn into a shape sharper than 2 degrees (1 in 27.5).

- 5.19. Pre-qualified procedures recommended for appropriate welding standards and known to provide satisfactory welds shall be followed. For non-standard procedures, qualification testes are prescribed in IS: 823 shall be made to verify the adequacy of the procedures. A welding procedure shall be prepared by the contractor and submitted to the Engineer-in-charge for approval before the welding starts. This shall include all the details of welding procedures with reference to the provisions of IS: 823 and IS: 4353. Approval of the welding procedure by the Engineer-in-charge shall not relieve the contractor from his responsibility for correct & sound fabrication without distortion to the finished structure.
- 5.20. Submerged arc automatic or semi automatic welding shall generally be employed. Only where it is not practicable to use submerged arc welding manual arc welding may be resorted.
- 5.21. 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 suitability to thickness of material, joint form etc.
- 5.22. The work shall be positioned for flat welding wherever practicable and overhead weld shall be avoided.
- 5.23. No welding shall be done when the surface of the member is wet nor during periods of high wind unless the welding operator and the work are properly protected.
- 5.24. In joints connected by fillet welds the minimum sizes of single run fillet welding or first runs and minimum full sizes of fillet welds shall conform to the requirement of IS: 816 and IS: 823.
- 5.25. All complete 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 8 mm 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 and 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 core section.
- 5.26. Butt welds shall be terminated at the ends of joint in a manner that will ensure their soundness. Where abutting parts are 20 mm or more in thickness run-on and run-off plates with similar edge preparation and having a width not less than the thickness of the thicker part joined shall be used. These extension pieces shall be approved 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 20 mm 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.
- 5.27. Each layer of a multiple layer weld except root and surface runs may be moderately peened with light blows from a blunt tool. Care shall be exercised to prevent scaling or flaking of weld and base metal from overpeening.
- 5.28. No welding shall be done on base metal at a temperature below 5°C. Base metal shall be preheated as required to the temperature given in the table below prior to tack welding or welding. When base metal not otherwise required to be preheated is at a temperature below zero degree centigrade it shall be preheated to at least 20°C prior to tack welding or welding. Preheating shall bring the surface of the base metal within 75 mm of the point of welding to the specified preheat temperature and this temperatures shall be maintained as minimum inter pass temperature while welding is in progress.

5.29. Thickness of thickest part at point of welding	Min. Preheat & Inter pass Temp.				
	Other than low Hydrogen welding electrodes		Low Hydrogen welding electrodes		
	I.S : 226 I.S : 2062	Steel conforming to IS : 961 IS: 226 IS: 2062			
Up to 20 mm.	None	Welding with this process not allowed	None	10 D.C	
20 mm to 40 mm.	65 D.C		10 D.C.	65 D.C.	
40 mm to 63 mm.	110 D.C.		95 D.C.	110	
Over 63 mm.	150 D.C.		110 D.C	D.C.	
				150	
				D.C.	

- 5.30. Minimum preheat for I.S. 226 steel in thickness up to 80 mm shall be 10 degree centigrade.
- 5.31. Electrodes other than low-hydrogen electrodes shall not be permitted for thickness of 75 mm and above.
- 5.32. Before commencing fabrication of a member or structure in which welding is likely to result in distortion and or locked up stresses a complete programme of fabrication, assembly and welding shall be made and submitted to the Engineer-in-charge for approval. Such a programme shall include, besides other appropriate details, full particulars in regard to the following:
- 5.33.1 Proposed preheating in components such as flanges and presetting of joints to offset expected distortion.
- 5.33.2 Make up of sub-assemblies proposed to be welded before incorporation in final assembly.
- 5.33.3 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.
- 5.33.4 Proposed number, spacing and type of strong backs and details of jigs and fixtures for maintaining proper fit-up and alignment during welding.
- 5.33.5 Any other special features like assembling similar members back to back or stress relief.
- 5.34. If so desired by the Engineer-in-Charge mock-up welding shall be carried out at contractor's cost to establish the efficiency of the proposed programme, with any modification suggested by the Engineer-in-charge in limiting distortion or/ and residual stress to acceptable levels.
- 5.35. All welds shall be inspected for flaws by any of the methods described under the clause of 'Inspection' given below in this specification. The choice of the method adopted shall be determined by Engineer-in-charge.

- 5.36. Contractor shall quote separately for carrying out such tests as called for in the schedule of quantities. Contractor shall be paid only for tests, which establish soundness of welds. In case the tests wherever defective work such tests will be at the contractor's cost and contractor shall correct such defects at his own cost and prove the soundness of rectified work.
- 5.37. 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 weld is removed, magnetic particle inspection or any other equally positive means as prescribed by the Engineer-in-charge shall be used to inspect that the whole of the crack and material up to 25 mm beyond each end of the crack has been removed. Cost of such test & operation incidental to correction shall be on contractor's account.

6. TOLERANCES :

- 6.1. The dimensional and weight tolerances for rolled shapes shall be in accordance with I.S. 1852 and / or ASTM A6.
- 6.2. No rolled or fabricated member shall deviate from straightness by more than $1/1000^{\text{th}}$ of the length or 10 mm whichever is smaller.
- 6.3. The length of members with both ends finished for contact shall have a tolerance of $(\pm) 1$ mm.
- 6.4. Members without ends finished for contact bearing shall have a tolerance of $(\pm) 1.5$ mm for members up to 10 metres long and a tolerance of $(\pm) 3$ mm for members over 10 metres in length.
- 6.5. Lateral deviation between center line of web plates and center line of flange plate at contact surface in the case of built up sections shall not exceed 6 mm.
- 6.6. The combined warpage and fillet of flanges in welded built up sections shall not exceed $1/200^{\text{th}}$ of the flange width or 3 mm whichever is smaller.
- 6.7. The deviation from flatness of welded plate girder web in the length between stiffeners or a length equal to the depth of the girder shall not exceed $1/150^{\text{th}}$ of each length.
- 6.8. Deviations from the specified depth of welded girders measured at the center line of the web shall not exceed $(\pm) 3$ mm up to a depth of 1000 mm, $(\pm) 5$ mm for depths above 1000 mm up to 2000 mm and $(+)$ 0 mm and $(-)$ 5 mm for depths over 2000 mm.

7. END MILLING :

- 7.1. Column ends bearing on each other or resting on base plates and compression joints designed for bearing shall be milled true and square to ensure proper bearing and alignment.
- 7.2. Base plates shall also have their surfaces milled true and square.

8. INSPECTION :

- 8.1. The Contractor shall give due notice to the Engineer-in-charge in advance of the works 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 conform to the requirements of these specifications, to be in proper condition or has fabrication inaccuracies which prevents proper assembly nor shall it invalidate any claim which the department may make because of defective or unsatisfactory materials and/or workmanship.
- 8.2. No materials shall be painted or despatched to site without inspection and approval by the Engineer-in-charges unless such inspection is waived in writing by the Engineer-in-charge.
- 8.3. Shop inspection by the Engineer-in-charge or his authorized representative on submission of test certificates and acceptance thereof by the Engineer-in-charge shall not relieve 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 of workmanship.
- 8.4. Contractor shall provide all the testing and inspection services and facilities for shop work except where otherwise specified. Contractor's inspection work shall be under the control of a competent Chief Inspector whose primary responsibility is inspection reporting to management and not to production departments.
- 8.5. For fabrication work carried out in the field the same standard of supervision and quality control shall be maintained as in shop fabricated work. The inspection and testing shall be conducted in a manner satisfactory to the Engineer-in-charge.
- 8.6. The inspection and tests on structural steel members shall be as set forth below:
- 8.7 Deleted.
- 8.8.1 If mill test reports are not available to any steel material the same shall be got tested by contractor to the Engineer-in-charge's satisfaction to demonstrate conformly with the relevant specification.
- 8.8.2. The under mentioned tests are not generally required for the work and if required will be paid extra.
 - 8.8.2.1. **Magnetic Particle Test:** Where root and intermediate passes of weld is examined by magnetic particle testing such testing shall be carried out throughout. Its entire length in accordance with ASTM specification E-109. In the case of completed welds such tests shall be carried out in accordance with ASTM specification E-109 Or E-130 as decided by the Engineer-in-charge. If heat treatment is performed the completed weld shall be examined after the heat treatment. All defects shall be replaced and retested. Magnetic particle tests shall be carried out using alternating current. Direct current may be used with the permission of the Engineer-in-charge.
 - 8.8.2.2. **Liquid Penetrant Inspection :** In the case of welds examined by liquid penetrant inspection such tests shall be carried out in accordance with ASTM E-164 or I.S. 3650. All defects shown shall be repaired and rechecked.

- 8.8.2.3. **Radiographic Inspection :** All full strength butt welds shall be fully radiographed in accordance with the recommended practice for radiographic testing as per ASTM E-94 and Part U.W. 51 ASME Code Section VIII.

8.8.3. **Dimension, Workmanship & Cleanliness :**

- 8.8.3.1. The structural steel members shall be inspected at all stages of fabrication and assembly to verify that dimensions, tolerances, alignment and surface finish, painting where specified are in accordance with the requirements shown on contractor's approved shop drawings and Engineer-in-charge's drawings.

8.8.4 **Inspection or Test failure :**

- 8.8.4.1. In the event of any failure of structural steel members to meet an inspection or test requirement, contractor shall notify Engineer-in-charge or his authorized representative. Contractor must obtain permission from Engineer-in-charge before repair is undertaken.
- 8.8.4.2. The quality control procedures to be followed to ensure satisfactory repair shall be subject to approval by Engineer-in-charge.
- 8.8.4.3. Engineer-in-charge has a right to specify additional inspection or testing, as he deems necessary and the additional cost of such testing will be borne by the department.
- 8.8.4.4. Contractor shall maintain records of all inspection and testing which shall be made available to Engineer-in-charge or his authorized representative.
- 8.9. Some steel work particularly columns along with the tie beams/bracings may have to be shop assembled to ensure satisfactory fabrication, obtaining of adequate bearing areas etc.; if so desired by Engineer-in-charge at no extra cost to purchaser.

9. **DRILLING HOLES FOR OTHER WORKS :**

- 9.1. Holes in members required for installing equipment or steel furnished by other manufacturers or other contractors shall be drilled in contractor's shop as part of this contract. The information for which will be supplied by Engineer-in-charge before fabrication of the steel.

10.0. **HANDLING AND STORAGE :**

- 10.1. No dragging of steel shall be permitted. All steel shall be stored 300 mm above ground on suitable packing to avoid damage in the order required for erection and with erection marks visible. All storage areas shall be prepared and maintained by contractor.
- 10.2.1. Steel shall not be stored in the vicinity of area where the excavation or grading will be done and if stored temporarily, this shall be removed by contractor well before such excavation and /or grading commence in a safe distance to avoid burial under debris.

- 10.3. Scratched or abraded steel shall be given a coat of the primer specified on drawings for protection after unloading and handling prior to erection. All milled and machined surfaces shall be properly protected from rust/corrosion by suitable coating and also from getting damaged.
- 10.4. 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 20 mm high and to such optimum depth as to be clearly visible.
- 10.5. Structural steel frames shall be erected plumb and true. All steel columns and beams shall be checked for plumb and level individually before and after connections are made. Temporary bracings may be introduced wherever necessary to take care of all loads to which the structure may be subjected including erection equipment and the operation thereof. Such bracings shall be left in place as long as may be required for safety and stability.
- 11.0. INSPECTION AT SITE :
- 11.1. Engineer-in-charge or their authorized representatives shall have free access to all parts of the job during erection and all erection shall be subject to their approval. In case of faulty erection all such dismantling and re-erection required will be at contractor's cost. No paint shall be applied to field welds until these have been approved by Engineer-in-charge.
- 12.0. PAINTING :
- 12.1. All fabricated steel material except those galvanized shall receive protective paint coating as specified on design drawings.
- 12.2. The surface of steel work to be painted shall be thoroughly cleaned of all mill scale, rust, grease, dirt and other foreign matter by hand tool cleaning, power tool cleaning, flame cleaning or sand/ shot blasting as indicated on drawings. In power brushing sufficient care shall be taken not to burnish mill scale to a slick finish to which paint may not adhere properly.
- 12.3. The paint treatment as specified on drawings shall be applied either by brushing or spraying on the thoroughly cleaned and dry surface. Airless spraying shall be done if so specified.
- 12.4. Surfaces inaccessible after assembly shall receive an additional coat of the specified paint prior to assembly.
- 12.5. Paint shall be stirred frequently to keep the pigment in suspension. All paint delivered to the fabrication shop shall be ready mixed in original sealed containers as packed by the paint manufacturers and no thinners shall be permitted. No painting shall be done in frosty / foggy weather or when the humidity is high enough to cause condensation of the surface to be painted. Paint shall not be applied when the temperature of the surface to be painted is 5 degree centigrade or lower.

13.0. MODE OF MEASUREMENTS :

- 13.1. For the purpose of payment the weight of the actual completed structures shall be calculated from the approved drawings for different items of work.
- 13.2. The allowances will be permitted for galvanizing, welding or for cutting margins. One Tonne for the purpose of payment shall mean **One Metric Tonne i.e., 1000 Kg.**
- 13.3. The weight of member made out of standard rolled section such as beam, channels, angles, etc. shall be based on the standard IS: 800. The weight of member shall be considered without deducting for holes, notches, bevels cuts etc. Where a component consists of a cut joist or channels, the full weight of the rolled section shall be considered only if more than half the depth of the original section is used. Otherwise, only half the section unit weight shall be considered for calculation of the weight of plates for skew cuts and notches of 900 square centimeter or larger.
- 13.4. The weight of any built-up member shall be separated into weight of each component.

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SPECIFICATION FOR BRICKWORK

1.0 GENERAL:

- 1.1 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 more than 20% of water by weight after immersion in water for 24 hours and shall have a compressive strength of 3.5 N/mm² as per IS: 1077-1992.
- 1.2 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.
- 1.3 Before starting the brick masonry, the concrete surfaces e.g., plinth beams, columns, slabs, chajjas, 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 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.
- 1.4 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.
- 1.5 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.
- 1.6 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.
- 1.7 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.
- 1.8 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). 230 mm (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 to both sides.

- 1.9 Half brick or 115 mm thick brickwork shall be carried out in panels and with horizontal stiffeners of 115 x 75 mm with two bars of 10 mm diameter and spacers of 6 mm diameter at 900 mm center to center and vertical stiffeners of 115 x 75 mm with two bars of 10 mm diameter and spacers of 6 mm diameter at 2M center to center laid in 1:2:4 concrete properly filled 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.
- 1.10 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 and finished neatly after the installation of all these services at no extra cost.
- 1.11 The rate for brickwork for both 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 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 –
 - 1.11.1 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.

2.0 MORTAR:

- 2.1 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.
- 2.2 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.
- 2.3 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.
- 2.4 All the brickwork shall be built tightly against column, floor slabs or other structural members.

SPECIFICATION FOR STONE MASONRY

1.0 SCOPE OF WORK :

- 1.1 The work covered under this specifications consists of supplying and erecting stone masonry walls with available best quality of stone in strict compliance with this specifications and applicable drawings.

2.0 RANDOM RUBBLE MASONRY :

- 2.1 **Material :** The rubble shall be of the best quality trap/granite/ballast 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.
- 2.2 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.
- 2.3 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.

- 2.4 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.

3.0 KHANDKI FACING STONE MASONRY :

- 3.1 The specifications for Random rubble masonry as given in item No. 10.2 shall generally apply to these for quality of stones, workmanship etc. except for the following:
- 3.2 The face of the stones shall be square/ rectangular in shape and shall be so dressed around that those can be set on proper bases and shall render uniform joints. The stones may have bushing on the face but shall not project more than 40 mm. The external faces shall be laid in courses of about 200 mm. height or as specified and the internal face shall be finished with rubble backing.
- 3.3 The other specifications, mode of measurements etc. shall be same as per specifications for R.R. Masonry mentioned above.

4.0 MODE OF MEASUREMENT :

- 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 P.H. 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, corner stones, bond stones, scaffolding, labour, curing, forming or leaving holes for fixing or building in hold fasts, forming chases and grooves and all operations including tools & appliances of any sort or kind requisite for the completion of the work. etc.

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"SPECIFICATIONS"
FOR
(RUBBLE STONE HARD CORE)

1.0 SCOPE :

- 1.1 The work covered under this specification includes all type of soling work by rubble stone laid under floor or foundations.

2.0 RUBBLE SOLING :

- 2.1 Rubble used for soling under floors, foundations etc. shall be hard, durable rock, free from veins, flaws and other defects. The quality and size of the rubble shall be subject to the approval of the Engineer-In-charge.
- 2.2 Rubble shall be hand packed as directed by Engineer-In-charge. This shall be laid closely in position on the well prepared sub grade. All interstices between the stones shall be wedged in with smaller stones of suitable size well driven to ensure tight packing and complete filling of interstices. Such filling shall be carried out simultaneously with the placing in position of rubble stones and shall not lag behind.
- 2.3 Small interstices shall be filled with murrum and well watered and rammed with mechanical (heavy) rammer or hand rammer as approved by the Engineer-In-charge. Care shall be exercised to avoid damage to the grade beams and columns and trench wall edges while ramming.

3.0 MEASUREMENT :

- 3.1 The unit rate measurement shall be square meter for the specified thickness of rubble soling.
- 3.2 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 square metre.
- 3.3 Plan areas of soling work actually done limiting to the dimensions as per drawings shall be measured for payment.
- 3.4 The rate shall include all the materials, labour, preparation of surfaces, watering, consolidation etc.

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**“SPECIFICATIONS”
FOR
(KOTA STONE FLOORING)**

1.0 SCOPE :

- 1.1 The work covered under this specification consists of providing and laying at all levels and floors kota stone tiles in flooring, skirting, dado and Sills in accordance with these specifications and relevant drawings.

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 amendment, revisions and additional publications.

2.2 List of Indian Standards :

No.	I.S. No.	I.S. Particulars
1.	I.S. 1200 (Part-XI)	Method of measurements building and civil engineering work.

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 20 mm thick with cement mortar (1:4) 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 close 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 filled with matching cement and finished neatly.
- 3.10 The entire surface of flooring shall be re-polished with machine to 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 include 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 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 including of cost of material, double scaffolding if required, laying, finishing, making grooves, curing and cleaning of splashes 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.

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SPECIFICATION FOR

MARBLE STONE FLOORING, TREADS, RISERS, SILLS, CLADDING, DADO

1.0 MARBLE STONE SLABS :

- 1.1 The colour and quality of marble slabs shall be of the kind of marble specified in item/drawings/as directed by the Engineer-in-charge. The marble 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 marble slabs approved by the Engineer-in-charge. All slabs which goes into work shall strictly conform to the samples, failing which the entire materials are likely to be rejected.
- 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.

2.0 DRESSING OF SLABS:

- 2.1 Every stone shall be cut to the required size 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.
- 2.2 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. Marble 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.
- 2.3 Any opening of required size and shape at any desired place in flooring, bands, borders etc. shall be made in such a way that marble bounded by number of marble stones/slabs. No broken or defaced stone shall be permitted in the work.

3.0 BEDDING/BACKING MORTAR:

- 3.1 The bedding/backing shall be of cement mortar/lime mortar of mix and thickness as specified in the description of the item.
 - 3.1.1 Mixing : The mixing of mortar shall be done in mechanical mixer or hand mixing as specified/as directed by the Engineer-in-Charge.
 - 3.1.1.1 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.
 - 3.1.1.2 Only the quantity of mortar, which can be used within 30 minutes of its mixing shall be prepared at a time.
 - 3.1.1.3 Mixer shall be cleaned with water each time, before suspending the work.

- 3.1.2 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 Department. 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 of 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.
- 3.1.3 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.

4.0 LAYING - FLOORING:

- 4.1 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. shall be laid evenly and to the required slopes as directed / specified. The marble 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./sq.m. 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 line 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 marble 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.

5.0 MARBLE SILLS, TREADS ETC. :

- 5.1 Marble 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. Marble 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.

6.0 MARBLE STONE DADO & CLADDING :

- 6.1 Only machine cut and machine polished marble 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 marble slabs both ways horizontally and vertically. The brass cramps shall be provided at the places approved by the Engineer-in-Charge. Marble 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 marble stone shall be similar as stated above as far as applicable.

7.0 POLISHING AND FINISHING :

- 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.

8.0 MEASUREMENT :

- 8.1 Marble 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 marble 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.

9.0 RATE :

The rate shall include the cost of all materials, transport tools, plants, scaffolding and labour involved in all operations described above.

10.0 GRANITE STONE FLOORING, TREADS, RISERS, SILLS, CLADDING, DADO ETC. :

- 10.1 The specifications mentioned for Marble stone flooring shall be generally applicable for this item. In case of granite stones available in different shades, the samples shall be submitted for approval of Engineer-in-Charge.

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SPECIFICATIONS
FOR
TERRAZZO / PLAIN TILE FLOORING, SKIRTING, TREADS & RISERS

1.0 SCOPE :

- 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.

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 amendment, revisions and additional publications.

2.2 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 (Part-XI)	Method of measurement building and civil engineering work (paving, floor finish, dado and skirting).
3.	I.S. 2114	Code of practice for laying in-situ terrazzo floor finish.
4.	I.S. 1237	Specifications for cement concrete flooring tiles
5.	I.S. 1443	Code of practice for laying and finishing of cement concrete flooring tiles

3.0 TERRAZZO TILE FLOORING :

- 3.1 Terrazzo tiles shall be of size specified in the item hydraulically pressed and shall be 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.
- 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.

- 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 specified thickness 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.
- 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 woollen 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.
- 4.0 TERRAZZO TILE SKIRTING :
- 4.1 Terrazzo tiles in skirting shall be 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 and shade 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 20 mm thick bedding of cement mortar (1:3) to the full height of skirting. 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.
- 4.2 The skirting shall be cured for 7 days.
- 4.3 The skirting shall be polished with hand to attain the same finish as for the flooring.
- 4.4 The specifications for dados will be the same as for skirting. The tile size however, will be 250 mm x 500 mm x 20 mm or as specified.
- 5.0 TERRAZZO TILE TREADS & RISERS:
- 5.1 The specifications mentioned for Terrazzo stone flooring shall be generally applicable for this item.

6.0 MODE OF MEASUREMENT :

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.

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.

7.0 PLAIN CEMENT TILE FLOORING & SKIRTING :

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.

8.0 IN-SITU TERRAZZO FLOORS,SKIRTING, TREADS OF STAIRCASE, WINDOW SILLS, ETC.

8.1 FLOORING :

8.1.1 In situ terrazzo flooring, the under layer shall consists of cement concrete mix 1:2:4 (the maximum size of aggregate used shall not exceed 10 mm.) the thickness of which shall be as specified in item of schedule of quantities.

8.1.2 The terrazzo topping shall consist of white cement or grey cement wherever specified in the schedule of quantity with or without pigment and marble chips of best approved quality, shade and grade all mixed in proper proportion as provided in I.S. 2114 and/ or approved by the Engineer-in-charge. The total combined thickness of the under layer and topping shall as provided in the I.S. Specification and as specified and approved by the Engineer-in-Charge.

8.1.3 The floor surface shall be thoroughly cleaned of all dirt, dust, laitance and loose material, thoroughly wet with water and then smeared with cement slurry. Cement concrete under layer immediately be laid in regular bays not exceeding 1.5 sq.m. in area or as directed and allowed to harden. The surface of screed shall be well scratched whilst it is not sufficiently hard to form key for terrazzo topping. 25 x 1.5 mm. aluminium dividing strips or 3mm. thick glass dividing strips or whichever specified in the item of schedule of quantities shall be placed to form bays as directed. When the screed has sufficiently hardened but not later than 24 hours, it shall be thoroughly cleaned down, washed with water and brushed over with neat cement slurry of about the consistency of thick cream. Terrazzo top layer shall then be laid in alternative bays in plastic condition, well troweled into position. Surplus moisture and cement slurry from surface shall be removed and allowed to set sufficiently hard to stand machine or hand grinding, thoroughly cleaned to reveal surface voids, and grouted with neat cement of the same tint as used in terrazzo. When dry and hard, machine grinding with grit blocks as per specifications for terrazzo tiles shall be done with 3 to 5 days between successive grinding during which the terrazzo shall be cured and grouted with neat cement of same tint, if required. The entire surface shall then be kept wet for at least seven days. The edges of treads and window sills shall have straight edges and corners properly rounded up. In case of window sills, only top layers is covered under the relevant item and concrete base layer under RCC item. The window sills and treads of staircase shall be hand polished instead of machine polished.

8.1.4 Cleaning and applying oxalic acid shall be same as specified for terrazzo tile flooring.

8.2 IN-SITU SKIRTING & DADO ETC. :

8.2.1 In situ skirting and dado shall be as specified in the schedule of finishes.

8.2.2 The surface shall be prepared as per plastering work where required by the architects, the dado or skirting shall be sectionalised as for in situ floor. If shown and required, the junction of the floor and dado shall be rounded to a proper, neat and uniform round to the satisfaction of the Engineer-in-charge. After the work is complete, the surface shall be kept continuously wet for 7 days. Unless otherwise specified, skirting and dado shall match the floor.

8.2.3 Terrazzo skirting and dado shall consist of under coat of 1:4 cement- sand plaster of the thickness specified. This shall be laid simultaneously with the borders of the flooring and same joints as in the floor shall continue. The topping shall be terrazzo as per specifications for in-situ terrazzo flooring except that in-situ polishing shall be done by hand to the satisfaction of Engineer-in-charge. 1.5 mm. thick aluminium strip joint (wherever mentioned 3mm. glass strips or as specified shall be fixed) shall be provided in situ terrazzo in both direction or as directed. Care shall be taken to see that the terrazzo in skirting and dado matches the floors. The dado work in columns shall be done in one operation for the full height of the column. The shape of the finished surface shall be uniform for all such columns treated and checked for its accuracy during the progress of work.

8.3 MODE OF MEASUREMENT :

8.3.1 Mode of measurement for cast-in-situ terrazzo flooring and dado shall be same as per terrazzo tile flooring and skirting.

8.3.2 The rate shall include all materials, curing, rounding of junctions, labour, scaffoldings etc.

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SPECIFICATIONS
FOR
CERAMIC TILE FLOORING AND DADO

1.0 SCOPE :

- 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.

2.0 APPLICABLE CODES AND 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 latest edition including all applicable amendments, revisions and additional publications.

2.2 List of Indian Standards.

No.	I.S. No.	I.S. Particulars
1.	I.S. 777	Specification glazed earthen ware wall tiles.
2.	I.S. 1200 (Part-XI)	Method of measurement building and civil engineering works.
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.

3.0 CERAMIC TILE FLOORING :

- 3.1 Ceramic tiles shall be of specified size, best quality and of approved make and colour.
- 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.
- 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.
- 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.
- 3.5 Unless and until the surface is approved by Engineer-In-charge laying of tiles in flooring or dado shall not be started.
- 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.
- 3.7 A bedding of cement mortar (1:3) and 20 mm thick for flooring shall be laid evenly to levels or slope as directed.

- 3.8 The glazed tiles shall then be laid on the bedding with a backing of thin cement paste. 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 slaggered or continuous as directed.
- 3.9 The other specials like corner edges, elephant foots, bull eyes etc. shall be used at the proper place wherever required and as directed.
- 3.10 The entire finished surface shall thoroughly be cleaned to remove all cement stains etc.
- 3.11 The joints shall be then pointed with a neat cement of matching colour.
- 3.12 The flooring shall be kept wet for 7 days.
- 3.13 The flooring shall be thoroughly cleaned with suitable hydrochloric acid before handing over.
- 4.0 DADO :
- 4.1 The prepared surface-shall be plastered with cement mortar (1:3) to get a backing of 20 mm thick. The plastered surface shall be even, uniform and true to plumb.
- 4.2 The white glazed / ceramic tiles shall be fixed in position with a backing of cement paste.
- 4.3 The specifications for workmanship regarding joints, specials, cleanings, paintings, curing etc. shall be exactly similar to ceramic tile flooring.
- 5.0 MODE OF MEASUREMENT :
- 5.1 Length and breadth of flooring shall be measured correct to a centimeter before laying skirting, dado or wall plaster.
- 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.
- 5.3 No deductions shall be made for opening not exceeding 0.2 square metre.
- 5.4 Length and height of skirting/ dado shall be measured along the finished face of the skirting/ dado correct to a centimeter.
- 5.5 In case of skirting height shall be measured correct to 5 mm.
- 5.6 The area of flooring / skirting/ dado shall be calculated in square metre correct to two places of decimal.
- 5.7 The specials such as coves, cornices, beads etc. shall be measured separately and paid for in running metre.
- 5.8 The rates shall include the cost all material and labour involved in all the operations described above.

“SPECIFICATIONS”
FOR
‘CEMENT CONCRETE FLOORING (IPS)’

1.0 SCOPE :

- 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.

2.0 APPLICABLE CODE & 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 amendment, revisions and additional publications.

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 concrete flooring.

3.0 CEMENT CONCRETE FLOORING :

- 3.1 The specifications for cement, sand and aggregate etc. shall be same as stated for reinforced concrete work.
- 3.2 The concrete flooring shall be 50 mm thick with plain concrete mix of proportion as specified.
- 3.3 The sand shall be screened and thoroughly washed to remove all dust and silt.
- 3.4 The coarse aggregate shall be of approved quality, well graded and shall not exceed 10 mm size. The coarse aggregate shall be also washed thoroughly to remove all dust and dirt.
- 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.
- 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.
- 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.

- 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.
- 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.
- 3.10 The laying and finishing shall conform to I.S. 2571.
- 3.11 The paving shall be laid in alternate bays of size 1.5 m x 1.5 m with Aluminium / glass dividing strips of specified size. The form work required for setting the bays shall not be paid extra.
- 4.0 **MODE OF MEASUREMENT :**
- 4.1 Measurement for flooring shall be for the actual area covered between the faces of skirting.
- 4.2 Deductions will be made for columns, projections, equipment foundation, trenches, opening etc.
- 4.3 Unit of measurement will be square metre.

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SPECIFICATION
FOR
IRONITE (OR HARDONATE) FLOORING

1.0 GENERAL :

- 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:

2.0 METALLIC CONCRETE HARDENING COMPOUND :

- 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.

3.0 CEMENT CONCRETE UNDER LAYER :

- 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.

4.0 METALLIC CONCRETE HARDENER TOPPING :

- 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 0.4.

- 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. The concrete shall be compacted well mechanically. 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.

5.0 CURING, PRECAUTIONS, MEASUREMENTS ETC. :

- 5.1 Specifications for curing, precautions, quantity measurements etc. shall be same as specified for cement concrete flooring.

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SPECIFICATION
FOR
CEMENT CONCRETE FLOORING WITH TOPPING OF RED OXIDE OF IRON

1.0 GENERAL :

1.1 Red oxide of iron when used, gives an improved appearance to concrete flooring. The specifications shall be as under.

2.0 RED OXIDE OF IRON :

2.1 Red oxide powder as the name indicates is a fine powder of iron oxide, red in colour normally available in market shall be obtained in adequate quantity and stores in clean dry place.

3.0 PREPARATION OF BASE :

3.0 The specifications for cement concrete flooring (I.P.S.) shall be followed for this work also.

4.0 UNDER LAYERS :

4.0 The under layer of flooring of specified thickness shall be of cement concrete 1:2:4 mix using 10mm. maximum size coarse aggregate. The dividing strips of Aluminium or glass if required to be retained shall not be removed and kept in position properly. After the consolidation is over, the top surface shall be left rough by drawing diagonal lines 2 mm. deep at 75 mm. centres both ways.

5.0 TOP LAYER :

5.1 Mortar: The top layer shall consist of uniform and smooth layer of specified thickness and of mix 1:3 (1 cement: 3 coarse sand) and finished with a floating coat of neat cement. The cement shall be mixed dry with red oxide powder in the proportion of 3.5 kg. of red oxide to 50kg. (1 bag) of cement. This mixture shall be used in both the cases i.e. for mixing mortar for top layer and also for floating coat. Full quantity of materials required for one room shall be mixed and kept ready to ensure uniform colour. Net mortar shall be prepared in usual manner.

6.0 Laying of Top Layer :

6.1 The top plaster shall be done the following day after the under layer is laid. The plaster shall be done to specified thickness (normally 10 mm.) and finished smooth with cement and red oxide slurry at 2.2 kg. of cement red oxide mix per sqm. The surface shall be polished smooth with polishing stones.

6.2 Alternate panels shall then be taken in hand for laying under layers, top layers as process repeated. Rounding at the junction with the wall shall be done, if required, to a radius of 25 mm.

7.0 CURING : As specified in cement concrete flooring shall be followed.

8.0 MODE OF MEASUREMENT :

8.1 As specified in cement concrete flooring shall be followed.

SPECIFICATIONS
FOR
ACID RESISTANT FLOORING & SKIRTING

1.0 MATERIALS:

- 1.1 Acid resistant stones shall be of best quality and obtained from approved sources. Acid resistant stone shall be of Himacid or Mandena or equivalent variety and all stones shall be of the same shade and uniform colour. The stones shall be of 30 mm thick for flooring and 25 thick for skirting and shall be of size 300 X 300 mm for flooring and 300 mm X 300 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.

- 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.

- 1.3 A bedding of Accocid mortar (Accocide, acid proof cement manufactured by Associated Cement Company and Khasalia sand mixed in 1:1 proportion) 20 mm thick shall then be laid evenly to levels or slopes as required. The accocid cement mortar shall be prepared strictly as per manufacturers specifications. The acid resistant stones shall then be truly and evenly get over the beddy. The stone shall then be tapped down with a wooden mallet until they are exactly in true plane and line with adjacent stones. The paste that is squeened out of the joint should be clicked with a trowel. All stones shall be extended upto the masonry wall and underside of plaster. The stones shall be necessarily open jointed, with 5 mm (min) wide joints. All the joints shall be raked to a depth of 5 mm (min) to remove accocid mortar from the joints. After raking all the joints shall be cleared with 5 mm wide X 5 mm deep (min) groove in the flooring for every stone. Allow the finished surface to dry for about 72 hours. The joints shall then be cured with 25% hydrochloric acid solution. Apply with a brush hydrochloric acid made up of one part by volume of concentrated acid and 3 parts by volume of water to the joints. Repeat the application every 3 to 4 hours for 2 days. All the surface to dry out completely for about 3 days, clean all the joints thoroughly to remove all loose materials, mortar sticking to the sides of the stones in portable air blower or vacuum cleaner may be used if directed by the Engineer-in-Charge.

- 1.4 All the joints 5 mm wide X 5 mm depth shall then be filled with Nobles Liquid epoxy (solvent free) or rubber solvent or as directed by the Engineer-in-Charge. The solvent free filling compound shall be prepared by mixing 10 parts of special solvent less epoxy resin (clear) with 6 parts of Noble's special hardener. The proposed solvent free compound shall be filled in the joints immediately after mixing with great care and skill. The joints shall be trowelled flush with the acid proof stone surface. The filling compound will harden in about six hours, during this time, the joints shall not be disturbed and no persons shall be allowed to enter the area. The surface shall be protected for few days, till it hardens and ready for use. The entire flooring shall be machine polished to make the surface perfectly plain. All due care shall be taken for fixing, filling in the joints all as per manufacturer's specifications and recommendations.
- 1.5 The solvent free epoxy resin shall be coloured or pigmented to any required approved shade as directed by the Engineer-in-Charge and shall be highly resistant to all concentrations of sulphuric, hydrochloric, nitric, phosphoric acids and alkalies solutions.
- 2.0 MEASUREMENTS:
- 2.1 Measurements for flooring shall be taken between the finished (plastered) surface, deductions shall be made for columns projections, equipment foundations, trenches, openings, etc. Unit of measurement shall be on square meter basis.
- 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.
- 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 square meter basis.
- 2.4 The rate for flooring and skirting / dado shall be inclusive of bitumen coating, accocid mortar bedding, acid resistant stones, acid curing, filling the joints with liquid epoxy (solvent free) polishing and all labour required etc. complete.

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SPECIFICATIONS
FOR
PVC SHEET / TILES FLOORING

1.0 GENERAL:

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.

2.0 MATERIALS:

- 2.1 The PVC flooring material shall conform IS: 3462. It may be in the form of tiles, sheets or rolls as specified. It shall consist 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 1.5, 2.0, 2.5, 3.0 or 4.0 mm.

- 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.

- 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.

2.4 Tolerances:

(a)	In Thickness	(+/-) 0.15 mm
(b)	In Width: as under:	
(i)	300 mm square tiles	(+/-) 0.2mm
(ii)	600 mm square tiles	(+/-) 0.4mm
(iii)	900 mm square tiles	(+/-) 0.6mm
(iv)	Sheets and rolls	(+/-) 0.1 per cent

- 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.

3.0 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.

4.0 LAYING AND FIXING:

- 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.
- 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, there after.
- 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.
- 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.
- 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.

- 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.
- 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.
- 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.
- 4.9 The alignment should be checked after laying of each row of sheet is completed. If the alignment is not perfect, the sheets may be trimmed by using a straight edge.
- 4.10 The tiles shall be fixed in exactly the same manner as for the sheets. It is preferable to start laying of 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.
- 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 butylacetate and three parts of turpentine oil is a suitable solvent for the purpose.
- 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.
- 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).
- 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.

5.0 PRECAUTION FOR MAINTENANCE:

- 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.
- 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 cloth frequently rinsed in clean water and finally rubbed dry.

6.0 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.

7.0 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.

8.0 PVC ASBESTOS FLOOR TILES:

Material, Dimensions and Tolerance, colour and finish, physical requirements and test shall be as per IS: 3461 and the rest shall be as per specification for "PVC Sheet / Tile Flooring" as described above.

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**SPECIFICATIONS
FOR
VITRIFIED TILE FLOORING, DADO / SKIRTING / FACIA**

1.0 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	< 0.50%
6	Mohs. 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

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.

2.0 PREPARATION OF SURFACE FOR FLOORING:

Following procedure shall be followed:

Sub grade concrete or RCC slab or side brick wall / or plastered surfaces on which tiles are to be laid shall be cleaned, wetted and mopped as specified for terrazzo tile flooring.

Mortar and bedding: Cement mortar for bedding shall be prepared of mix 1:4 or as specified in the schedule of items, to a consistent paste and shall conform to the specification for materials, preparations etc. as specified under cement mortar. The amount of water added while preparing mortar shall be the minimum necessary to give sufficient plasticity for laying. Care shall be taken in preparation of the mortar to ensure that there are no hard lumps that would interfere with even bedding of the tiles. Before spreading the mortar bed the base shall be cleaned off all dirt, scum or laitance and loose materials and well wetted without forming any pools of water on the surface. The mortar of specified proportion and thickness shall then be evenly and smoothly spread over the base by use of screed battens to proper level or slope.

Once the mix is prepared, no further water be added and the same shall be used within one hour of adding water. Apply on an average 20 mm thick bedding of mortar over an area of 1 sqm. at a time over surface of the area for laying tiles, in proper level and allowed to harden sufficiently to offer a fairly good cushion for the tiles to set.

3.0 LAYING OF TILES FOR FLOORING:

The tiling work shall be done as per the pattern shown in the drawing or as directed by the Engineer-in-Charge. As a general practice laying of tiles shall be commenced from the centre of the area and advanced towards the walls. Cut tiles, if any, shall be laid along wall with necessary border pattern as shown / directed by the Engineer-in-Charge. Tiling work shall be completed by pressing tiles firmly into place along the wall / floor. A white cement slurry to the back of the tile to be applied to ensure proper and full bedding. The tiles shall be laid on the bedding mortar when it is still plastic but has become sufficiently stiff to offer a fairly firm cushion for the tiles. Tiles, which are fixed on the flooring adjoining the wall, shall be so arranged that the surface on the round edge tiles shall correspond to the skirting or dado. Press gently the tile with wooden mallet for even adherence at the back of the tile. Do not use an iron hammer or some heavy material to press the tile.

The edges of the tiles shall be smeared with neat white cement slurry and fixed in this grout one after the other, each tile being well pressed and gently tapped with a wooden mallet till it is properly bedded and in level with the adjoining tiles. There shall be no hollows in bed or joints. The joints shall be kept as close as possible and in straight line. Unless otherwise specified, joint-less tiling shall be done butting the tiles with each other. If joint is specified, the same shall not exceed 1.00 mm. in width. The joint shall be grouted with white / matching colour cement slurry. After fixing the tiles, finally in an even plane or slope, the flooring shall be covered with wet sand and allowed undisturbed for 14 days.

4.0 FIXING TILES FOR DADO & SKIRTING / FACIA:

The fixing of tiles on wall surfaces shall be done only after completing fixing of the tiles on the floor. Following procedure shall be followed:

The back of tiles shall be cleaned off and covered with layer of approved adhesive like BAL-ENDURA or equivalent with proper toweling as per manufacturer's recommendations.

The edges of the tiles shall be smeared with the adhesive and fixed on the wall one after the other, each tile being well pressed and gently tapped with a wooden mallet till it is properly fixed in level with the adjoining tiles. There shall be no hollows on the back or in joints. Unless otherwise specified, joint-less tiling shall be done butting the tiles with each other. If joint is specified, the same shall not exceed 1.00 mm. in width. The joint shall be grouted with approved adhesive. The joints shall be kept in straight line or as per the approved pattern.

While fixing tiles in dado / skirting work, care shall be taken to break the joints vertically. The top line shall be touched up neatly with the rest of the plaster above. If doors, windows or other openings are located within the dado area, the corners, sills, jambs etc. shall be provided with true right angles without any specials. The contractor will not be entitled to any extra claims on this account for cutting of tiles if required.

The fixing shall be done from bottom of wall to upward without any hollows in the bed of joints. Each tile shall be as close as possible to one adjoining. All tiles faces shall be in one vertical plane.

5.0 GROUTING OF JOINTS IN FLOOR / SKIRTING / DADO:

The joints, if specified, shall be cleaned off and all dust and loose particles removed. Joints shall then be filled with approved adhesive like BAL-ENDURA or equivalent grouts. After finishing the grouting process, after 15 minute, wipe off excess grout with a damp sponge and polish the tiles with a soft & dry cloth for a clean surface. The Finished work shall not sound hollow when tapped with a wooden mallet.

6.0 CLEANING:

As directed by the Engineer-in-Charge, the tiles shall be cleaned by mild acid (However, Hydrofluoric acid and its derivatives should not be used). After the tiles have been laid in a room or the days fixing work is completed, the surplus cement grout / adhesive that may have come out of the joints shall be cleaned off before it sets. The dado / skirting shall be thoroughly cleaned. In the case of flooring, once the floor has set, the floor shall be carefully washed clean and dried. When drying, the floor shall be covered with oil free dry sawdust. It shall be removed only after completion of the construction work and just before the floor is used.

7.0 MODE OF MEASUREMENT AND RATE:

Dado / flooring / skirting shall be measured in sqm correct to two places of decimal. Length and breadth shall be measured correct to 1 cm. between the exposed surfaces of skirting or dado. No deductions shall be made nor extra paid for any opening of area upto 0.1 sqm. The rate shall include all the cost of labour and materials involved.

8.0 CLEANING AGENTS FOR VITRIFIED TILES:

Vitrified tiles are resistant to all chemicals (except hydrofluoric acid and its derivatives), hence commercially available detergents and cleaning agents can also be used for regular maintenance. Any spills and stains must be removed immediately. If left dry they may leave stains, which may be difficult to remove completely.

CLEANING AGENTS FOR VITRIFIED TILES

STAINS	CLEANING AGENT
Robin Blue	Household detergent / Warm water
Marker ink	Turpentine / Acetone / Trichloroethylene
Pen ink	Acetone / Isopropyl alcohol
Methylene blue	Isopropyl alcohol / Acetone
Sauce	Ammonia solution
Cement	Turpentine / Acetone / Trichloroethylene / Conc. HCL
Tea	Hydrochloric acid / Bleaching powder
Coffee	Sodium hydroxide / Potassium hydroxide
Beer	Sodium hydroxide / Potassium hydroxide
Diesel	Acetone / Petrol
Lab indicator	Acetone / Isopropyl alcohol
Cement and grouting	Hydrochloric acid
Pencil mark	Benzene or Toluene or Xylene
Plaster of Paris (POP)	Ammonium sulphate solution
Iodine (Tincture iodine)	Sodium hydroxide / Potassium hydroxide
Hair dye	Per chloric acid
Paan	Lemon juice or citric acid
Marker pen	Acetone

9.0 TANDUR STONE/CUDDAPPA STONE/POLISHED SHAHABAD STONE / BLUE WADI STONE FLOORING / SKIRTING / DADO:

The specifications for Tandur, Cudappa, polished Shahabad and blue Wadi stone flooring / skirting / dado shall be similar to those respecting specifications for Kotah stone flooring / skirting / dado specified herein before in all respects.

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SPECIFICATIONS
FOR
CHEQUERED TILES IN STAIR TREADS AND LANDINGS

1.0 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.

2.0 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.

3.0 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.

4.0 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.

5.0 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.

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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 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.	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 engineering works. (Wood work and joinery)
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. 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. M.S. 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 m.s. flat 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.

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., AS SPECIFIED.

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“SPECIFICATIONS”
F O R
FLUSH DOOR SHUTTER

1.0 SCOPE:

The work covered under this specification consist of providing and fixing block flush door shutter in accordance with the specification and drawings.

2.0 APPLICABLE CODES & SPECIFICATIONS:

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.	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 resign adhesives for plywood.
6.	I.S. 1200 (Part – XXI)	Method of measurement of building and civil engineering works. (Wood work and joinery)
7.	I.S. 1341	Specification for 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 (Part – I)	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.

3.0 BLOCK BOARD FLUSH DOOR SHUTTER:

Flush door shutter shall have a solid core and may be of the decorative or non-decorative type 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. 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. 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 through out 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 I.S. 848.

Samples of flush door shutters shall be subjected to following tests in accordance with I.S. 2202 (Part – I & II):

End immersion test.**Knife test.****Glue adhesion test.**

All the sample shutters when tested shall satisfy the requirements of the tests as laid down in I.S. 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.

Fittings shall be provided to the contractor free of cost by the Department as decided by Engineer-In-charge. Screws for fixing these fittings shall be provided by the contractor and nothing extra shall be paid for the same.

4.0 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.

5.0 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.

6.0 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.

7.0 GLAZING:

Glazing shall be generally with 4 mm. thick plain sheet glass/bajra glass unless otherwise mentioned in the schedule of quantities. The detailed specifications for glazing given hereafter shall be followed generally.

8.0 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 around the glass. The glass shall be 4 mm. thick or as specified of best quality (M/s. Triveni, I.A.G., Shree Vallabh or equivalent approved), 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 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. lipping around the meeting shall not be less than 35 mm. deep. The meeting stiles shall be in single piece.

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.

9.0 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, labour for provision of glass for vision panel, 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.

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SPECIFICATIONS
FOR
FACTORY MADE PARTICLES BOARD PANELLED DOOR SHUTTERS

1.0 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 I.S. 2202 (Part-I). The contractor shall inform well in advance to the Engineer-in-Charge the name and address of the factory where from 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 of the shutters at factory of the Engineer-in-Charge or his authorized representative. 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.

2.0 TIMBER:

The timber to be used in door shutters shall generally conform to relevant I.S. 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.

3.0 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 Department 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.

4.0 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.

5.0 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.

6.0 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 cartage 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.

7.0 PRIMER COAT:

All factory-made panel door shutters with seasoned teak wood/hard wood frame shall be painted with approved Primer coat as per I.S. specifications 1003 (Part-I).

8.0 TESTS:

Tests shall be conducted if required by the Department at the contractors cost. All shutters shall have manufacturers trade marks.

9.0 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 through out with a variation not exceeding 1 mm., when measured at two points.

10.0 SAMPLES:

Sample of door shutter shall be got approved before manufacturing on large scale.

11.0 FIXING:

The shutter shall be fixed to teak wood or rolled M.S./EZ 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.

12.0 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).
- ii) painting/polishing as specified and as directed by the Engineer-in-charge.

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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 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 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. 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.

Fittings shall be of Mild steel, Stainless steel, aluminium, brass or as specified. The fittings shall be well made, smooth, and free from sharp edges and corners, flaws and other defects.

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 less than grade AC 10 of IS: 1868

Stainless steel fittings shall be 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. M.S. butt hinges shall be cranked and manufactured from M.S. sheets. All butt hinges shall conform to latest I.S. specifications 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 sprig 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 (M.S.) 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.

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 I.S. 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 or as specified shall have smooth sliding action. MS Latch shall be copper oxidised (black finish) or as specified. Brass Latch shall be finished bright, CP or oxidised or as specified

8.0 ALDROPS:

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 (aldrop) shall be made from rolled brass generally confirming 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 and nuts of square or hexagonal shape. All components shall be smooth and polished. The leading dimensions of aldrop 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 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 I.S.

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.

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.

This should be of H.D.-66 for external/main doors and elegant - 63 for all internal doors.

The overall height should not be more than 170 mm. for H.D.-66 and 160 mm. for elegant - 63, base shall be 110 x 60 mm. for H.D.-66 and 100 x 55 mm. for elegant - 63 weighing not less than 4.5 kg. for H.D.-66 and 4 Kg. for elegant - 63. 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.

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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 or steel doors and windows, strictly in accordance with these specifications and drawings.

2.0 MATERIALS:

2.1 Glass: The glass shall be special selected/selected ordinary quantity of M/s. Shree Vallabh/Triveni/I.A.G. 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 properly 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 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 sashbars 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 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 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.

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“SPECIFICATIONS”
F O R
ALUMINIUM GLAZED DOORS & WALL SPANS

0.0 SCOPE:

0.1 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.

1.0 APPLICABLE CODES & SPECIFICATIONS:

1.1 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.

1.2 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.	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.

2.0 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-Incharge 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 INDAL/ JINDAL or other approved equivalent sections.

- 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.
- 3.3 The frame work, style, mullions, ebadings, transome 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.
- 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 special selected quality of Hindustan Pilkington or other approved equivalent as specified in the schedule.
- 3.7 Glazing shall be done with neoprene dry set glazing gasket of best quality and approved make with snam-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 mortice 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, discolouration 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 3 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-Incharge shall be final and binding on the contractors.
 - 4.5.6 Each lock shall be supplied with 2 keys and each keys 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-Incharge.
 - 4.5.9 Approved samples of hardware shall be kept in the custody of the Engineer-Incharge. 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 All joints between metal and masonry shall be fully caulked with mastic in order to ensure water tightness.
- 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 Hindustan Pilkington make or other equivalent approved sheet glass of special selected quality and of thickness as specified.
- 6.2 The glazing shall be either transparent or ground or figured 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 around 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-In-charge.
- 6.9 All the doors and wall-spans/ fixed glazing shall be tested for water tightness. Any leakages found during testing, it is the responsibility of the contractor to rectify the same without any extra claim.
- 7.0 ALUMINIUM 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 M/s Toshi Automatic System or other equivalent approved make.

- 7.2 The sliding door unit shall have double leaves of sliding shutter including all accessories as per manufacturer's specifications 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 Micro computer 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 micro computer.
- 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 pullies, 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 MESUREMENTS:
- 8.1 The unit of measurement shall be Kg or as specified in the item for all types of doors and wall spans.
- 8.2 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.

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SPECIFICATIONS
FOR
ALUMINIUM GLAZED & LOUVERED WINDOWS

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 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.

2.2 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.	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 INDAL/ JINDAL or other approved equivalent sections.

- 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.
- 3.3 The frame work, mullions, beadings, transome 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.
- 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 special selected quality of Hindustan Pilkington or other approved equivalent as specified in the schedule.
- 3.7 Glazing shall be done with neoprene dry set glazing gasket of best quality and approved make with snam-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 metred 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 3 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.
- 5.1.7 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 All joints between metal and masonry shall be fully caulked with mastic in order to ensure water tightness.

- 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, lime, dirt, mortar, dust etc. by suitably covering them during plastering work.
- 7.0 GLAZING WORK :
- 7.1 The glazing shall be done with Hindustan Pilkington make or other equivalent approved 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 around 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. Any leakages found during testing, it is the responsibility of the contractor to rectify the same without any extra claim.
- 7.10 The contractor shall also remove all lacquer paint and PVC cover and clean the windows thoroughly before handing over them to the Engineer-In-charge.
- 8.0 MODE OF MEASUREMENTS :
- 8.1 The unit of measurement shall be in Kg or as specified in the item.

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SPECIFICATIONS FOR PRESSED STEEL DOORS

1.0 SCOPE :

- 1.1 The work covered under this specification consist of fabricating, supplying and installing in position steel doors in strict accordance with these specifications and drawings.

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.

3.0 List of Indian Standards :

No.	I.S. No.	I.S. Particulars
1.	I.S. 1038	Steel doors, windows and ventilators
2.	I.S. 1081	Code of practice for fixing and glazing of steel and aluminium doors, windows and ventilators.
3.	I.S. 1200 (Part-VIII)	Method of measurement of building and civil engineering works.
4.	I.S. 4351	Specification for steel door frames.

4.0 GENERAL :

- 4.1 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.
- 4.2 The contractor shall submit shop drawings for all types of steel doors, for approval of Engineer-In-charge.
- 4.3 Fabrication of door shall be commenced only after the drawings are approved.
- 4.4 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.
- 4.5 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.
- 4.6 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.

5.0 FABRICATION :

- 5.1 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.
- 5.2 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.
- 5.3 All the joints shall be continuously reinforced at the back, fitted and continuously welded along the abutting edges.
- 5.4 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. The anchor plates shall be paid separately.
- 5.5 The pressed sheet of steel frames for opening wider then one metre 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 templated for securing butts, strikes checks and other hardware.
- 5.6 Necessary hardware fittings and fixtures such as butt hinges mortice lock with handles, tower bolts, etc. will not be supplied by the department.
- 5.7 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.
- 5.8 The contractor shall also see properly that the stains, grease, rust etc. is thoroughly removed before application of one coat of steel primer.
- 5.9 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.
- 5.10 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.
- 6.0 **MODE OF MEASUREMENT :**
- 6.1 The length and breadth of the doors in complete finished position shall be measured for outside dimensions of the frame.
- 6.2 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.
- 6.3 Where there are no thresholds the height shall be measured from the finished floor levels.

"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.

2.0 MATERIALS:

2.1 Rolling shutters complete with 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 inter locked 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 MODE OF MEASUREMENT:

4.1 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.

5.0 RATE:

The rate shall include the cost of materials, labour involved in all the operations described above.

SPECIFICATIONS
FOR
M. S. GRILLS/RAILINGS

1.0 GENERAL:

- 1.1 The contractor shall submit 6 copies of shop drawings covering all types of work under this specifications before manufacture. 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 I.S. 226 sections for grills and shall be free from loose mill scales, rusts, pittings or any other defects affecting its strength and durability.

3.0 FABRICATION:

- 3.1 The grill shall be fabricated to the design and pattern shown in the 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 M.S. 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 M.S. grills 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 shall be made good by grouting with cement mortar/packing/repairing properly at the contractors cost.

6.0 PAINTING:

- 6.1 Painting shall be done as per the specifications specified under painting.

7.0 MODE OF MEASUREMENT:

- 7.1 Actual area of m.s. grill manufactured and fixed in position shall only be measured in square metre for payment. All measurements shall be taken to two places of decimal of a metre and area shall be calculated to second place of decimals of a square metre.
- 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.

9.0 MODE OF MEASUREMENTS (HAND RAILS):

Hand railing shall be measured for payment in running metre. 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.

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SPECIFICATIONS FOR PLASTERING WORK

1.0 SCOPE:

- 1.1 The work covered under this specification consist of supplying all materials and redering 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.

2.2 List of Indian Standards:

No.	I.S. No.	I.S. Partculars
1.	I.S. 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-lime plaster 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 time/ neeru to be used on the work shall conform to the approved sample.
- 3.3 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.
- 3.4 The scaffolding members shall not be tied to windows or door frames and other members provided in the walls.
- 3.5 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.
- 3.6 No extra will be paid for making groovers 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 can 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 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.
- 4.8 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.
- 4.9 The plastering shall not be commenced until the preparatory work is approved by the Engineer-In-charge.
- 4.10 The cement mortar for the plaster work shall be as specified in the item of schedule.
- 4.11 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.
- 4.12 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.
- 4.13 The surface shall be kept continuously damp for at least two days immediately following its applications. It shall then be allowed to dry.
- 4.14 Fine sand of approval quality shall be used for finish coat. The finish coat shall be about 5 mm thick.
- 4.15 There shall be at least a 3 days interval between application of the first coat and finish coat. Before applying the finishing coat, dampen the first coat evenly by fog spray wherever possible and the coat shall be applied from top to bottom in one operation eliminating joining marks.
- 4.16 The plaster shall be well pressed into the joints and the surface rubbed smooth after floating it with a coat of pure cement.
- 4.17 The use of dry cement shall not be permitted.

- 4.18 All plaster work shall be kept damp continuously for a minimum period of 10 days after the application of finishing coat.
- 4.19 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.
- 4.20 Should the plaster crack through neglect of watering or for any other fault of the contractor the work shall be remove and redone at the contractors expenses.
- 4.21 Should the contractor fail to water the work to the satisfaction of the Engineer-In-charge the latter may engage requisite men to water the work properly at the cost of the contractor.

5.0 WHITE WASHING:

- 5.1 White was shall be prepared from fresh burnt lime stone or shell lime. The lime shall be of 'C' type as mentioned in I.S. 712.
- 5.2 The lime shall be dissolved in a tub with sufficient quantity of water (about 4.5 litres per kg of lime) and thoroughly mixed and stirred until it attains the consistency of thin cream.
- 5.3 The white was so prepared shall then be taken out in small quantities and strained through a clean coarse cloth. Alternatively ready made whiting complying with I.S. 63 may also be used.
- 5.4 Clean gum dissolved in hot water shall then be added in suitably proportion of 2 gm of gum Arabic to a litre of lime or whiting to prevent the white was coming off easily when rubbed. Rice size may be used instead of gum.
- 5.5 The surface shall be prepared by removing all mortar dropping and foreign matter and thoroughly cleaned with wire or fine brush or other means as may be ordered by the Engineer-In-charge to produce a clean and even surface;
- 5.6 All loose pieces and scales shall be scraped off and holes filled with mortar which shall be cued after.
- 5.7 On the surface so prepared the white wash shall be applied. Each coat shall be applied with a brush.
- 5.8 The first stroke of the brush shall be from the top downwards and another from bottom upwards over the first stroke and similarly.
- 5.9 One stroke from the right and other from the left over the first brush before it dries. This will form one coat. In all three coats of white wash or as specified in the schedule shall be applied and should be approved by the Engineer-In-charge.
- 5.10 Each coat must be allowed to dry and shall be subjected to inspection before the next coat is applied.
- 5.11 When dry the surface shall show no signs of cracking. It shall present a smooth and uniform finish free from the brush marks and it should not come off easily when rubbed with fingers.

5.12 Doors, floors, windows etc. shall be protected from being splashed upon. Splashing and dropping if any, shall be removed and the surface cleaned.

5.13 The white wash shall be applied to surfaces of neeru plaster immediately after the neeru plaster is completed and cured.

6.0 WATER PROOF CEMENT PLASTER:

6.1 The same specification as detailed for 'Cement Plaster With Cement Finish' shall apply to this plaster also.

6.2 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.

6.3 The water proofing 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.

7.0 SAND FACED CEMENT PLASTER :

7.1 Surface preparation shall be done in the same manner as for 'Cement Plaster With Cement Finish'.

7.2 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.

7.3 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.

7.4 The sand shall be thoroughly washed to remove all dust and silt.

7.5 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.

7.6 Backing coat of 12 mm thick with cement mortar 1:4 shall be applied first. Approved water proofing compound @ 2% by weight of cement shall be added in the backing coat.

7.7 No extra shall be paid for mixing the water proofing compound in the cement mortar as directed.

7.8 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.

7.9 The backing coat should then be thoroughly cured for at least 7 days before the finishing coat is taken in hand.

7.10 The finishing coat of 8 mm thick in cement mortar 1:3 should then be applied uniformly with wooden float.

7.11 The entire surface should then be rubbed with approved sponges to expose the sand grains uniformly and predominantly.

7.12 The surface shall be cured again for at least 10 days.

8.0 GROOVES IN SAND FACED PLASTER :

8.1 The horizontal and vertical grooves shall be exactly to the required depth and width as shown in the drawings.

8.2 The grooves shall be neatly finished with extreme care.

8.3 All horizontal and vertical grooves shall be imperfect straight lines without any break in the continuity.

8.4 Only such grooves as specified in the drawing shall be paid for.

9.0 MODE OF MEASUREMENT :

9.1 The unit of measurement for all the plaster items shall be square metre.

9.2 The measurement shall be taken on un plastered surfaces.

9.3 The areas of doors, windows, and all other openings shall be deducted and areas of jambs, reveals, soffits of openings and sills shall be measured and paid for.

9.4 The unit of measurement for grooves in sand faced cement plaster shall be running metre.

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SPECIFICATIONS
FOR
ROUGH CAST PLASTER

1.0 MATERIALS:

- 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 3 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 10 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.
- 1.2 General workmanship, scaffolding, preparation of surface, curing etc. shall conform to the specification already laid down under sand faced plastering.
- 1.3 The contractor shall take special care at the time of plastering or pointing to keep the M. S./aluminium window/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.

2.0 MODE OF MEASUREMENT:

- 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. All openings more than 0.1 sqm. shall be deducted and all jambs, soffits, sills of these openings if done, will be measured to arrive to the net area for payment. No opening less than 0.1 sqm. shall be deducted and no jambs etc. for such openings shall be measured for payment. The rate shall include the cost of finishing all the edges, corners, cost of all materials, labours, scaffolding, transport, curing etc.
- 2.2 The rate shall include the cost of finishing all the edges, corners, cost of all materials, labour, transport, scaffolding, curing etc. and grooves if so specified in the item of schedule of quantities.

- 2.3 The rate for plastering should include the cost of work towards the following items for co-ordination with electrical item:
- 2.4 Neatly plastering around DBs, junction boxes, M.S. boxes etc. should be done and made matching with the wall finish after installation of electrical equipments.
- 2.5 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.
- 2.6 For fixing M.S. boxes, DBs etc. Thiyya should be given such that the required face of the M.S. box, DB covers etc inline with final finished plastered surface.
- 2.7 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.
- 3.0 ROUGH CAST PLASTER:
- 3.1 The area of surfaces actually plastered will be measured net and shall be paid for. The measurements of length and height of wall plastered shall be correct to a centimeter taken between walls or projections including the width of corner edge strips including the areas of grooves. All the openings more than 0.1 sqm. shall be deducted and all jambs, soffits and sills of these openings, if plastered will be measured to arrive at the net area for the payment. No opening less than 0.1 sqm. shall be deducted and no jambs etc. for such openings shall be measured for payment. Corner/edges finishing will not be measured separately and the rate shall include the cost of finishing all the edges, corner strips in addition to the cost of all materials, labour, transport, scaffolding, curing etc. and grooves if so specified in the item of schedule of quantities.

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SPECIFICATIONS
FOR
WATER PROOFING TREATMENT

1.0 SCOPE :

1.1 This work covered under this specification consist of providing and laying 'cement based water proofing treatment' to horizontal and vertical surfaces of various components like under ground trenches, lift well, roof terraces, chajjas, water tank etc. of the building.

1.2 This specification also covers the guarantee to be given by the executing agency for leak proof ness of the treatment for a period of ten years.

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.

2.2 List of Indian Standards :

No.	I.S. No.	I.S. Particulars
1.	I.S. 1200 (Part-IX)	Method of measurement of building and civil engineering works. (Roof covering)
2.	I.S. 2645	Specification for integral cement water proofing compound.

3.0 GENERAL :

3.1 The work of water proofing treatment shall be executed through a specialized agency having sufficient experience in the field of all types of cement based water proofing works.

3.2 The contractor shall submit the detailed specifications and the agency to be appointed for water proofing works for approval of the Engineer-Incharge before commencement of work.

3.3 The contractor shall provide at site a competent supervisor who should be able to advise the requirements of the lean concrete base course for horizontal water proofing.

3.4 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.

3.5 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.

- 3.6 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 in appendix 'B'.
- 4.0 CEMENT BASED 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 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 slurry shall be laid to provide necessary gradient for easy flow of rain water.
- 4.6 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.
- 4.7 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 Engineer-In-charge.
- 4.8 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.
- 4.9 The construction joints shall be taken at ridges and should be made properly watertight and monolithic.
- 4.10 Care shall be taken to finish the rain water inlets etc. properly so that no leakage occurs.
- 4.11 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 'Cetroof' 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 under ground 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 roughen. 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.
- 7.7 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.
- 7.8 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.
- 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/ damp ness noticed under side the ceiling should be treated again as detailed above.
- 7.11 Water proof brick bat coba 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 days.
- 8.0 MODE OF MEASUREMENTS :
- 8.1 The measurement shall be for the actual area covered by the treatment.
- 8.2 The length and breadth shall be measured along the walls before the treatment is laid.
- 8.3 The height of vata shall be considered for measurement after deduction of the average thickness of the treatment laid horizontally over the terrace.
- 8.4 The areas of all openings, cutouts etc. shall be deducted.
- 8.5 Water proof brick bat coba shall be measured in cubic metre as actually laid.

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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 fortnights 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 pieces, 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, 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 C.M. 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 The external surfaces of the buildings under reference including the R.C.C. Jalli, fins and the panels above and below the window etc. shall be finished in different colours of approved shade. The contractor will make suitable samples at site for Departments approval before taking up the work in hand and they will be allowed to proceed with the work only after getting Departments approval for the same.
- 5.3 The painting shall be laid on 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 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 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. Perspect 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 shall be completely cleaned off paint and linseed oil by rinsing with turpentine. A brush 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 upto 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 side)
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)
III.	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.		
21	Corrugated iron sheeting in roofs, side cladding etc.	1.14 (for each side)
22	A.C. Corrugated sheeting in roofs, side cladding etc.	1.20 (for each side)
23	A.C. Semi-corrugated sheeting in roofs, side cladding etc. or Nainital pattern using plain sheets.	1.10 (for each side)
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) over all including chowkhats or frames, where provided. Where chawkhats 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 terllis 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. In the case of asbestos cement corrugated or semi-corrugated sheeting and iron corrugated sheeting in roofs, side cladding etc., the work shall be measured flat (not girthed) as fixed.
- 8.15. 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.
- 8.16. 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.
- 8.17. 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.
- 8.18. 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.

11.1.2 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, Aluminium and galvanised Steel work:	Zinc chromate primer conforming to I.S. 104-1962.
d	Plastered surfaces, cement brick work, Asbestos surfaces 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) in para 32.2 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 I.S. 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 appearance¹ 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 top coat 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 over night. 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 manufacturers 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 This shall be polyvinyl based Acrylic/plastic emulsion paint of approved manufacture of the required shade, conforming to I.S.5411-1969.
- 14.2 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.
- 14.3 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.
- 14.4 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 on net surface area actually painted, unless otherwise specified. Deduction will be made from the areas for fixtures, grills, ventilation, outlets, electrical boxes and such obstructions not painted, if they are individually more than 0.05 sqm.
- 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. The Department shall reserve the option to delete or increase quantities in full or part from the scope of contract during progress of work.
- 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 WHITE WASHING WITH LIME

- 15.1 Preparation of Surface : Before new work is white washed, the surface shall be thoroughly brushed free from mortar droppings and foreign-matter.
- 15.2 In the case of old work, all loose pieces and scales shall be scrapped off and holes in plaster as well as patches of less than 0.05 sqm. area each shall be filled up with mortar of the same mix. Where so specifically ordered by the Engineer-in-charge, the entire surface of old white wash shall be thoroughly removed by scrapping and this shall be paid for separately.
- 15.3 Preparation of lime wash : The wash shall be prepared from fresh stone white lime "Katani" or equivalent. The lime shall be thoroughly slaked on the spot, mixed and stirred with sufficient water to make a thin cream. This shall be allowed to stand for a period of 24 hours and then shall be screened through a clean coarse cloth. 40 gm. of gum dissolved in hot water, shall be added to each 10 cubic decimetre of the cream. The approximate quantity of water to be added in making the cream will be 5 litres of water to one kg. of lime.
- 15.4 Indigo (Neel) up to 3 gm. per kg. of lime dissolved in water, shall then be added and wash stirred well. Water shall then be added at the rate of about 5 ltrs. per kg. of lime to produce a milky solution.
- 15.5 The lime shall be tested in a chemical laboratory and test certificate submitted, to conform the quality of lime with regard to its physical and chemical properties. The cost of testing lime shall be borne by the contractor.
- 15.6 White Washing `` : The white wash shall be applied with brushes or by spray in the specified number of coats. The operation for each coat in the case of brush application shall consist of a stroke of the brush given from the top downwards, another from the bottom upwards over the first stroke, and similarly one stroke horizontally from the right and another from the left before it dries.
- 15.7 Each coat shall be allowed to dry before the next one is applied. Further each coat shall be inspected and approved by the Engineer-in-charge before the subsequent coat is applied. No portion of the surface shall be left out initially to be patched up later on.
- 15.8 For new work, three or more coats shall be applied till the surface present a smooth and uniform finish through which the plaster does not show. The finished dry surface shall not show any sign of cracking and peeling nor shall it come off readily on the hand when rubbed.
- 15.9 For old work, after the surface has been prepared as described here-in-before, a coat of white wash shall be applied over the patches and repairs. Then a single coat or two or more coats of white wash as stipulated in the description of the item shall be applied over the entire surface. The white washed surface should present a uniform finish through which the plaster patched do not appear. The washing on ceiling should be done prior to that on walls.

15.10 Protective Measures : Doors, windows, floors, articles of furniture etc. and such other parts of the building not to be white washed shall be protected from being splashed upon. Splashings and droppings, if any, shall be removed by the contractor at his own cost and the surfaces cleaned. Damages if any to painted surfaces, furniture or fittings and fixtures etc. shall be recoverable from the contractor.

15.11 Measurements : All measurements for payment shall be taken on net surface areas actually white washed, unless otherwise specified. Deductions will be made from the areas for fixtures, grills, ventilation, outlets, electrical boxes and such obstruction 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 metre and areas so worked out shall be correct up to two places of decimals of a square metre.

15.11.1 Corrugated surfaces shall be measured flat as fixed and the area so measured shall be increased by the following percentages to allow for the girthed area.

Corrugated asbestos cement sheets:	20%
Semi-corrugated asbestos cement sheets:	10%

15.11.2 The number of coats of each treatment shall be stated. The item shall include removing nails, making good holes, cracks, patches etc. not exceeding 0.05 sqm. each with materials similar in composition to the surface to be prepared.

15.11.3 Rate : The rate shall include the cost of all materials and labour involved in all the operations described above.

16.0 COLOUR WASHING:

16.1 In the case of colour washing, mineral colours, not affected by lime, shall be added to white wash with proper glue. No colour wash shall be done until a sample of the colour wash to the required tint or shade has been got approved from the Engineer-in-Charge. The colour shall be of even tint or shade over the whole surface. If it is patchy or otherwise badly applied, it shall be redone by the contractor, at no extra cost to the Department.

16.2 For new work, the priming coat shall be of white wash lime or with whiting as specified in the description of the item. Two or three coats, shall then be applied as specified on the entire surface till it represents a smooth and uniform finish. Each coat after applying shall be got approved from the Engineer-in-Charge.

16.3 The finished dry surface shall not be powdery and shall not readily come off on the hand when rubbed.

16.4 Other specifications as detailed for Whitewashing with lime shall be applicable. Indigo (Neel) shall however, not be added.

17.0 DRY DISTEMPERING :

17.1 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 atleast 30 minutes before use. The mixture shall be invariably well stirred before and during use to maintain an even consistency.

17.2 Preparation of surface : This shall be as for Painting work mentioned here-in-before in so far as it is applicable.

17.3 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.

17.3.1 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.

17.3.2 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.

18.0 OIL EMULSION (OIL BOUND) DISTEMPERING :

18.1 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.

18.2 Preparation of surfaces : The surface shall be prepared as described here-in- 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.

18.3 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.

- 18.4 Other details : The specifications for "Painting (General)" mentioned here-in-before shall hold good as far as it is applicable.
- 19.0 WATER PROOFING CEMENT BASED PAINT :
- 19.1 Material: Cement based paint (IS:5410-1969) of approved manufacture, quality, shade and colour only shall be used.
- 19.2 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.
- 19.2.1 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.
- 19.2.2 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.
- 19.3 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 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.
- 19.4 Other details : The specifications for Painting (General) mentioned here-in-before shall hold good as far as they are applicable.
- 19.5 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.
- 19.5.1 Corrugated surfaces shall be measured flat as fixed and the area so measured shall be increased by the following percentage to allow the girthed area: a) Corrugated asbestos cement sheets - 20%; b) Semi corrugated asbestos cement sheets - 10%.

- 19.5.2 The number of coats of each treatment shall be 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.
- 19.6 Rates: The rate shall include cost of all materials and labour involved in all the operation described above.
- 20.0 BEES WAXING OR POLISHING WITH READY MADE WAX POLISH :(NEW WORK):
- 20.1 Materials: The polishing shall be done with bees waxing prepared locally or with ready made 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 63o 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.
- 20.2 Preparation of surface: Preparation of surface will be as mentioned here-in-under para 32.20.2 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.
- 20.3 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.
- 20.4 Other details: The specifications for painting (General) as mentioned here-in-before shall hold good as far as they are applicable.
- 21.0 FRENCH SPIRIT POLISHING: (ON NEW WORK WITH A COAT OF WOOD FILLER):
- 21.1 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.

- 21.2 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 1.5 kg. of whiting per litre of spirit. The surface shall again be rubbed down perfectly smooth with glass paper and wiped clean.
- 21.3 Application: The number of coats of polish to be applied shall be as described in the Iem.
- 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.
- 21.4 Measurement, Rate and other Details: These shall be as for Painting (General) mentioned here-in-before as far as they are applicable.
- 22.0 RESIN BASED THERMO PLASTIC PAINT (DECORATIVE AND PROTECTIVE FINISH):
- 22.1 Materials: Resin based thermo plastic paint such as Sandtex Matt or other equivalent approved manufacture, colour and shade shall only be used.
- 22.2 Preparation of Surface & General: The Specifications for Painting (General) described here-in-before shall hold good as far as they are applicable.
- 22.3 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.
- 22.4 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.

- 22.5 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.

- 22.6 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 0.05 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.

- 22.7 Rate: The rate shall include the cost of all materials and labour involved in all the operations described above.

23.0 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.		

24.0 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	White Wash : Note : Following things to be added in lime (i) Adhesive (DDL/SDL) - 5% of lime, (ii) Neel (Blue) - 3 gm per kg of lime, (iii) Water - 5 kg of water per kg of lime	5m ² per kg of Lime	3.5m ² per kg of Lime	10m ² per kg of Lime
6	Cement based paint	4.5 m ² per kg	2 m ² per kg	6 m ² per kg
7	Aluminium paint	20 m ²	12.5 m ²	28 m ²
8	Bitumen paint / Black Japan	14 m ²	14 m ²	28 m ²
9	Neeru (or lime punning with slacked lime) over plaster	0.5 m ² per kg of slacked lime		
10	Red oxide metal primer	16 m ²		
11	Cement primer	12 m ²		
12	Wood primer	13 m ²		
13	Wax polishing of new wood work with ready made polish	20 m ² per kg	20 m ² per kg	20 m ² per kg
14	French or spirit polish	10.5 m ²		
15	Varnish	14 m ²	8.5 m ²	18 m ²
16	Requirement of paint per coat in Structural steel work on tonnage basis			
	Truss and Lattice girder work - 4.5 litres per tonne. Plane Beam/plane girder work			
	- 2.5 litres per tonne			

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Specifications for Epoxy Painting

- 1.0 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.
- 2.0 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.
- 3.0 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.
- 4.0 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.
- 5.0 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.

- 6.0 The paints to be used on the job shall be of very good quality and shall be procured from approved manufacturers. In his tender, the tenderer shall clearly indicate the name of the manufacturer of the paint and other materials he proposes to use. Acceptance of the paints and other materials of any manufacturer shall be left to the discretion of the Engineer-in-Charge and the same shall be binding on the contractor. The contractor shall obtain from department a detailed finishing schedule showing the types of paints desired, finish colour, shades for various areas etc. after award of work and proceed with the work accordingly.
- 7.0 Contractor shall submit manufacturer's test certificate along with each supply of paint brought to site.
- 8.0 The tenderer 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.
- 9.0 The successful tenderer 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.
- 10.0 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. In this respect contractor is requested to refer the clause No.46 of "Special Instructions to Tenderers".
- 10.1 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.
- 11.0 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. In case, any tenderer refuses to carry out sample painting as stated above, the department reserves the right to reject his tender and to with-hold the EMD of such tenderers.
- 12.0 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.

- 13.0 The tenderers should note that the colour schemes and shades of paints required are to be finalized in consultation with the Project Group/Architect and that after award of work 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.
- 14.0 The tenderers 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.
- 15.0 Tenderers 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.
- 16.0 Tenderer 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.
- 17.0 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 Chief Engineer, [REDACTED] Bhabha Atomic Research Centre before submitting their tender. No claim on account of any ambiguity will be entertained after submission of Tender.
- 18.0 Preparing of Surfaces : The different types of surfaces shall be prepared prior to application of the epoxy paint as follows:~
- 18.1 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 Shun as far as possible when using power tools.
- 18.2 The resultant surface obtained after preparation of the Surface as per above will be subjected to chemical cleaning by either of the following processes.

- 18.3 Degreasing : The surface should be degreased with 2% solution of Trisodium Phosphate, rinsed with water and allowed to dry.
- OR
- 18.4 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.
- 18.5 Concrete/Plastered Surfaces: All surfaces requiring painting shall be cleaned of oil, grease and other foreign matter as directed by the Engineer-in-Charge.
- 18.6 The sack rubbed form finished R.C. concrete ceiling and wall surfaces shall be sand papered, wire brushed and cleaned by water Jet or acid itched as per item or as recommended/specified by paint manufacturer.
- 18.7 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.
- 18.8 All deep cuts, pockets, offsets etc. shall be filled with approved putty and trovelled smooth.
- 18.9 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.
- 18.10 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.
- 18.11 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.

- 18.12 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.
- 19.0 **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 prepared by the project group. 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.
- 20.0 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.
- 21.0 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.
- 22.0 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.
- 23.0 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.
- 24.0 Paint shall not be applied to any surface which is likely to have a temperature less than 10⁰ 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.

- 25.0 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 (Schedule 'B'). The contractor shall submit a painting procedure for approval .
- 26.0 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.
- 27.0 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.
- 28.0 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.
- 29.0 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.
- 30.0 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.
- 31.0 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.
- 32.0 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.
- 33.0 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.
- 34.0 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.
- 35.0 The surrounding area of painting in progress should be kept clean with vacuum cleaner or other approved measures every day before starting the work.

- 36.0 The light should be adequate in the painting area. In no case, painting will be allowed if the light is not sufficient and satisfactory.
- 37.0 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.

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SPECIFICATIONS FOR
EPOXY RESIN SYSTEM FOR GROUTING, MORTAR AND COATING
APPLICATION

1.0 MATERIALS:

- 1.1 Only such resins having a low shrinkage coefficient, high adhesive strength, water impermeability, high abrasion resistance, good bonding characteristics even in presence of moisture shall be used. Generally phenolics, polyesters, acrylics etc do not satisfy well the above requirements and are not considered suitable for the works. Epoxy adhesive shall conform to ASTM C881. The multiple component epoxy system selected shall have the required consistency & viscosity for overhead application and sufficient pot life and shall have no volatile components likely to cause an explosion. It should be stable under varying climatic conditions and should not show any sign of loss of bond under extreme climatic conditions. The chemical and physical characteristics of the resin and hardener shall be as follows:

1.1.1 Resin:

Chemical type	Diglycidyl ether of bisphenol
Epoxy value	5.2 – 5.5 eq/kg
Viscosity @ 25 deg C	9000 – 12000 mPas
Specific gravity	1.00 – 1.16
Visual appearance	Clear liquid
Flash point	>200 deg C
Shelf life	1 year minimum

1.1.2 Hardener I:

Chemical type	Reactive Polyamide
Amine value	6.6 – 7.5 eq/kg
Viscosity @ 25 deg C	10000 – 15000 mPas
Specific gravity	0.95 – 0.98
Visual appearance	Clear liquid
Flash point	>200 deg C
Shelf life	1 year minimum

1.1.3 Hardener II:

Chemical type	Aromatic polyamine adduct
Amine value	4.7 – 5.1 eq/kg
Viscosity @ 25 deg C	3800 – 5800 mPas
Specific gravity	1.11 – 1.12
Flash point	>180 deg C
Shelf life	1 year minimum

1.1.4 Hardener III:

Chemical type	Aromatic amine adduct
Amine value	4.4 – 4.8 eq/kg
Acid value	24 – 30
Viscosity @ 25 deg C	15000 – 21000 mPas

Specific gravity	1.12 – 1.14
Flash point	>160 deg C
Shelf life	1 year minimum

1.1.5 Filler Material:

A heterogenous combination of minerals with a coarse grained microstructure of hard particles cemented by a slightly softer matrix can be used as a filler material. Examples are carborandum rich materials employed by the grinding wheel industry such as calcined bauxite and emery, well cemented sandstones and certain metamorphised sandstone such as metagreywacke. Clean quartz sand confirming to the following sieve analysis is generally recommended.

BS sieve	% retained
36	10
52	25
72	20
100	10
150	15
240	20

Moisture content of the filler shall not exceed **0.15%** when tested in accordance with ASTM C566.

(e) 1.2 Mixing Ratios (Recommended):

Components	P a r t s b y w e i g h t					
Araldite GY 250	100					
Araldite GY 253		100				
Araldite GY 255			100			
Araldite GY 257				100		
Araldite GY 260					100	
Araldite GY 266						100
Hardener HY 848	70	75	70	70	70	70
Viscosity at 25 deg C (mPa s) (ISO 9371B)	3840	1680	2560	1350	5280	4960
Gel time (min) Tecam, 100 ml, 20 deg C, 65% RH)	175	227	200	333	170	178

2.0 EPOXY MORTAR:

The epoxy resins for use in the mortar form shall confirm to the following requirements:

- i) Pot life: 90 minutes at 25 deg C
60 minutes at 30 deg C
45 minutes at 35 deg C
- ii) Bond to stone masonry: min 12 Mpa
- iii) Tensile strength: min 16 Mpa

Article II. 3.0 SOLVENT-LESS EPOXY COATING SYSTEM:

Solvent free transparent epoxy coating system has been proposed since it is characterized by thick non-porous and highly resistant films compared to the conventional solvent containing paints which give thin films with inherent porosity. Silica flour upto 20pbw shall be added in the top coats to increase the abrasion resistance. A flow control agent like butylated urea formaldehyde resin can be used in the top coats to ensure proper spreading of the system without any surface defects like cratering or fish eyes. In order to prevent sagging or flowing off the vertical surface , a thixotropic agent like Aerosil (DT 075 or XY 36) may be incorporated to the extent of 1-3 % of the total binder. The primer & top coat shall satisfy the following requirements at 25deg C & 65 % RH :-

3.1.1 Primer coat:

Viscosity	10000mPa s.
Pot life	3hours.
Curing time (touch dry)	about 8 hours.

3.1.2 Top coat:

Viscosity	11000 – 17000 m Pa s.
Pot Life	2 hours.
Curing time	about 6 hours.

The pot life of the system depends upon the ratio of the hardeners to the resin and may be adjusted to suit the ambient temperature.

The top coat shall have the following characteristics :-

Accelerated Weathering (ASTM E-42-57)	: Passes 500 hours.
Corrosion salt spray (ASTM E-117-61)	: Passes 100 hours.
Stain resistance	: After 10 minute lamp black in oil completely removed.
Hot water @ 90 deg C for 10 minutes: No effect.	
Following formulations are suggested for trial at site and adoption.	

Article III. 3.2 PRIMER:

One brush coat of the following system is recommended as primer on the pretreated surface :

- Name of manufacturer : HUNTSMAN OR APPROVED EQUIVALENT.
- Product recommended : i) Araldite GY 257 = 100 pbw.
ii) Hardener HY 840 = 50 pbw.

The primer should be allowed to be just tack free prior to the application of the top coats.

Article IV. 3.3 TOP COATS:

- Name of manufacturer :- HUNTSMAN OR APPROVED EQUIVALENT.
- Product recommended :-

(a) For chemical resistance

i) Araldite GY 250	= 100pbw.
ii) Hardener HY 830	= 45 pbw.
iii) Hardener HY 850	= 15 pbw.
iv) Silica fluor	= 20 pbw.
v) Flow control agent	= 2 pbw.

(a) For other than chemical resistance

i) Araldite GY 257	= 100pbw.
ii) Hardener HY 840	= 50 pbw.
iv) Silica fluor	= 20 pbw.
v) Flow control agent	= 5 pbw.

Silica fluor upto 10-20 pbw may be added in the above to reinforce the coating and abrasion resistance.

Flow control agent shall be used depending on the site requirement.

The DFT of primer and 2 top coats shall not be less than 400 microns. The temporary protection against corrosion shall be provided by the contractor in an approved manner and which will not hinder the bond with epoxy coating.

4.0 SPECIFICATION FOR EPOXY MORTAR & APPLICATION:

4.1 Proportioning and Mixing:

The resin and hardener shall be mixed before adding the dry filler. The mixed ready to use mortar should not contain lumps of un-wetted filler and should be uniform in colour. For a total weight of 1kg or less, hand mixing will be sufficient. For quantities in excess of 1kg the component shall be mixed for 3 minutes with slow speed 400-600 rpm. electric drill with a Jiffy mixer. The stirrer shall be moved up and down and along the sides until an even streak free color is obtained. Whipping in an excessive amount of air shall be avoided. If no power is available, a flat putty knife may be used to reach into the corners of the can and hand mixing done for at-least 5 minutes.

4.2 Surface preparation:

Surface upon which epoxy is to be placed shall be free of rust, grease, oil, paint, asphalt, loose materials, unsound concrete, dust or any other deleterious materials. Since cured epoxy does not provide adequate bond with any material, all overlay, whether epoxy or cement based, shall be carried out within pot life of the base epoxy layer. Contaminants, such as oil, grease, tar, asphalt, paint, wax, curing compounds or surface impregnants like linseed oil or silicones, including laitance and weak or loose concrete shall be removed. When bonding to asphalt, the surface should be roughened so that clean aggregate is exposed. Epoxy bonding agents shall not be applied when it rains, or in standing water. The surface must be dry.

Two general methods of surface preparation shall be followed:

- a) Mechanical that includes grinding, grit blasting, water blasting and scarification, impact and vibration on the structure shall be avoided.

- b) Chemical that includes acid etching with 15% by weight of hydrochloric solution, followed by repeated flushing with high pressure stream of water.

4.3 Application:

Epoxy primer coat shall be applied with the help of stiff nylon bristle brushes or hard rubber rollers or spray gun depending upon nature of surface and extent of work area. As far as possible, the coating shall be uniformly thick.

Before the primer coat is fully cured, epoxy mortar shall be applied by means of trowels and floats. The interval between the application of primer coat and epoxy mortar shall be approximately 15/ 30 minutes depending upon the ambient temperature.

Seal coat shall be applied after 24 hours curing, after mild roughening of the surface of the mortar. Seal coat shall be applied on area, which are not to be covered with liner plate.

4.4 Products Recommended:

- Name of manufacturer :- HUNTSMAN OR APPROVED EQUIVALENT.
- Formulation for Bond coat between old concrete and epoxy mortar

- i) Resin Araldite GY 250 = 100pbw.
- ii) Hardener HY 840 = 50pbw.

- Formulation for epoxy mortar :-

- i) Resin Araldite GY 257 = 100pbw.
- ii) Hardener HY 840 = 50pbw.
- iii) Quartz Sand Mix No 10 = 800pbw.

Formulation for seal coat over epoxy mortar :

- Primer / Bond coat

- i) Resin Araldite GY 257 = 100pbw.
- ii) Hardener HY 840 = 50pbw.

- Seal Coat (One coat)

- i) Resin Araldite GY 250 = 100pbw
- ii) Hardener HY 840 = 50pbw.
- iii) Hardener HY 850 = 15pbw.
- iv) Silica Flour = 20pbw.

5.0 SAFETY PRECAUTIONS:

5.1 CLEANING AND MAINTAINANCE OF EQUIPMENT:

Tools and equipment are best cleaned immediately after use since the removal of cured resin is difficult and time consuming. The bulk of resin shall be removed using a scraper and remainder washed away completely using solvents such as toluene, Xylene or acetone.

5.2 HANDLING PRECAUTIONS:

Epoxy resins can cause irritation of skin in sensitive persons if incorrectly handled. The resin and hardener should not be allowed to come into direct contact with skin. The most effective protection is achieved by wearing rubber or polythene gloves.

5.3 PERSONAL AND ENVIRONMENTAL SAFETY;

Any skin contact with epoxy materials, solvents and epoxy systems should be avoided. Epoxy resins and particularly epoxy hardeners (B component) may cause a rash on the skin. The official toxicity classification on the container labels may be looked for before starting work.

Rubber gloves, with a cloth liner, and protective clothing shall be worn. Barrier creams are recommended but are not substitutes for protective clothing. Eyes shall be protected where splashing could occur while spraying or mixing. Good ventilation shall be ensured and inhalation of vapors avoided. If materials are sprayed, a respirator shall be used.

If skin contact occurs, it shall be immediately washed with a cleaner, followed by soap and water. Should eye contact occur, it shall be flushed immediately with plenty of water for 15 minutes and a doctor called for.

If contact occurs with the clothing, it shall be immediately changed to prevent further skin contact, and if the contact occurs with components A or B, the clothing shall be thrown away. Hardened epoxy is not harmful but will break the clothing.

All emptied, used buckets, rags and containers shall be removed from site. These shall be stored in waste disposal bags and suitably disposed.

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SPECIFICATION
FOR
FALSE CEILING WITH FLEXO BOARDS / A.C. SHEETS

1.0 SCOPE OF WORK:

The work envisaged under these specifications refer to supplying and fixing in position false ceiling at any floor, any location and at any height.

2.0 MATERIAL:

The plain A.C. sheet or flexo board shall be of the thickness as mentioned in the relevant items of the schedule of quantities and the size of panels and the arrangement of panels etc. for different area of the building shall be as indicated by the Engineer-in-Charge. Plain A.C. sheet or flexo board shall be of approved quality and shall be free from cracks, bends and other defects. Samples of materials to be used on the work shall first be furnished by the contractor and got approved by the Engineer-in-Charge. All materials which are used on the works shall strictly conform to the samples, other-wise the materials shall be summarily rejected.

The plain A.C. sheet or flexo board shall be fixed to the angle iron frames (frame work paid separately) work by means of suitable counter sunk brass self tapping screws not more than 200 mm. centre to centre or as directed, and all holes after fixing the screws be filled with approved filler. Necessary openings in the ceiling shall be left for trap doors, ducts etc.

3.0 ERECTION:

The flexo boards/A.C. sheets when brought to site shall be stacked carefully on floor over wooden sleeper supports. The boards shall be cut to required sizes either by sawing or by score and snap method. The edges shall be smoothened by wood rasp file or with emery paper. Wherever required the edges of each panel may require bevelling which also shall be done carefully to the correct line and dimensions.

The flexo boards/A.C. sheets shall be fixed to ridge frames either wooden or metallic or mentioned in the item description. In case of metallic frame, the flexo boards are held to the frame by means of self tapping screws or by the ordinary machine screws and nuts, as directed by the Engineer-in-Charge.

Teak wood or aluminium beadings if required to be fixed shall be as mentioned in the item description and shall be carried out in best workman-like manner.

Any other treatment for finishing such as gluing of wall papers, cement or oil based paint etc. shall be as specified in the item description and shall be done as per relevant specifications.

4.0 MODE OF MEASUREMENT:

Unless otherwise mentioned, the wooden or metallic-frame work shall be separately measured and paid for. The flexo board/A.C. sheet false ceiling shall be measured in square metre as actually laid over the frame work. The area being worked out correct to two places of decimal with length and breadth measured correct to a centimeter. The rates shall include the cost of all materials, labour, scaffolding etc. as mentioned above and in item description, unless otherwise specified.

5.0 A.C.SHEET FALSE CEILING AND MASKING ETC. WITH PRESSED STEEL FRAME WORK/ANODIZED ALUMINIUM FRAME WORK:

5.1 GENERAL:

The work covered by these specifications shall consist of furnishing all labour, materials and equipment necessary for installation of the suspended false ceiling and vertical masking, with A.C. sheet on pressed steel frame work, inter locking, Aluminium frame work suspended by adjustable M.S. suspenders with necessary cut outs in the A.C. sheet for lighting fixtures, trap doors, A.C. grills etc., providing m.s. lighting troughs etc., erecting to proper line and level in the specified areas, floors and levels as indicated in the drawing and as directed by the Engineer-in-Charge.

5.2 MATERIALS:

All materials which are to be in-cooperated in work shall be got approval prior to bulk procurement.

- 5.2.1 Fabrication of Pressed Steel Frame : The frame work for "snap grid" false ceiling shall be made out of tested special springs grade steel or approved cold rolled sheets of specified gauge as per schedule, accurately formed and die cuts with identical ends in automatic machine with precision tools. All workmanship shall be best quality as followed in a modern sheet metal shops equipped with all machines such as press, dies, spot welding machine, baking oven etc. All materials shall be done by a process approved by the Engineer-in-Charge and in a manner that will not damage the materials. All work shall be accurately formed to the required dimensions, true to line, level and plane in all directions and properly sized to suit the exact dimension within permissible tolerances. Twisted or bent sections shall not be permitted to be used on work. Main runners and cross tees shall be of sizes as specified in the schedule/shown in the drawing. The main runners shall be slotted for cross tees and punched for hangers/suspenders. Cross tees shall have identified die formed ends accurately cut for easy, correct and proper fit assembly. Shearing, cropping shall be clean, reasonably square and free from distortion. Surfaces and joints to be welded shall be free from loose scale, slag, rust, grease, paint and any other foreign materials. The surface shall be wire brushed vigorously. Welding sequence shall be followed to avoid needless distortion and minimise shrinkage stresses. Holes to be made in pressed M.S. sheet shall not be made by flame cutting. The flame cut or unfair holes are not acceptable connection of supported members with erection clearance for all members. Where for practical reasons greater clearance is necessary, suitable designed seating should be provided. Any damages done to the walls/ceiling shall be reinstated to original condition. The contractor shall not be entitled for any extra cost on this account.

5.2.1.1 Suspended Aluminium Grid system : Aluminium grid system shall be of BESTLOK/EEZILOCK or equivalent approved standard suspended aluminium grid system. The suspended ceiling grid shall be of self interlocking anodised aluminium T bars for main runners and cross runners of specified section and pattern as required to suit the span as per drawing.

- 5.2.2 A.C. Sheets : A.C. sheet shall be plain and of specified thickness, approved best quality and shall conform in all respect to the relevant Indian Standard Specifications.

The sheets shall be free from cracks, chipped edges or corners, twist dents, rough patches and other damages etc.

5.2.3 M.S. Works: All m.s. works shall conform to relevant specification mentioned under Structural Steel here in before.

5.2.4 Fastening : All bolts, nuts, screws, fittings and fixtures shall be of best quality and of approved manufacture.

5.3 FIXING:

The contractor shall take all necessary field measurements before the commencement of the frame work to ensure proper fittings of the work to actual condition of work at site. Particular care should be taken to examine the positions of all recessed lighting, trap doors and other openings indicated on drawings or as directed by the Engineer-in-Charge. The correct panel sizes shall be decided to suit each location. The false ceiling levels shall then be marked on walls. Mark the position of the runners to suit the span of the area. Fix up the wall angles with approved metal fasteners and level then correctly. The position of suspender shall then be marked on the R.C. slab as per the sizes of the panels decided for each area with due consideration to location of air-conditioning ducts, grills etc. Suspenders of type and design fabricated as per drawing and approved by the Engineer-in-Charge, shall then be securely fixed at correct points with approved metal fasteners/expansion bolts of specified dia., as per manufacturers specifications. It shall be ensured that the hanger/suspender shall remain perpendicular and not pulled by the suspension system to any side. Fix up the runner to the suspenders and lock up the runners at the joints, complete the leveling starting from the fixed points and proceed towards the other end. Fix up the cross tees to every runner joints to have stability while leveling. Neoprene rubber gasket shall then be fixed all along the frame work with approved type of adhesive. Approved A.C. sheets cut to correct sizes shall then be placed on the runner, starting from the centre of the width and work side wards. Connect all cross tees and put on the approved spring type hold down clip/pins as per drawing. Holes if required to be provided in A.C. sheets shall be drilled and on no account holes shall be punched. Lock the runner tees and tiles with hold down clips/pins as required. Wherever grouting for frame work, suspenders etc. is required to be done in masonry walls columns/beams etc., the same shall be done after the entire frame work is properly leveled.

The contractor shall take into consideration all wastage in the A.C. sheets, aluminium grid system frame work/pressed steel frame work, M.S. suspenders, screws, nuts, bolts, washers etc. required for fixing A.C. sheet false ceiling and vertical masking while quoting his rates. A.C. sheet false ceiling and vertical masking shall be fixed to pressed steel frame or Aluminium grid system by means of spring clip (brass counter sunk machine screws in case of masking) of approved size, make and at approved spacing or as shown in drawing or as instructed. After fixing the A.C. sheets, all holes of screws etc. shall be filled with approved putty, leveled with the A.C. sheets and sand papered, so that no sign of screw is visible on the A.C. sheets. For all the A.C. sheets false ceiling and vertical masking work, the A.C. sheet of required size and shape shall be cut as per approved panel size shown in drawing and fixed on pressed steel frame in the best workman like manner.

Trap doors/lighting recesses/troughs of approved size and shape with approved matching work, shall be provided in the false ceiling and vertical masking at the specified places.

Any damage done to the walls/columns/ceilings/plasters/floors etc. shall be made good to the original condition at his own cost. The contractor shall not be entitled

for any extra cost on this account. During the execution of this work, the contractor shall take all the precautions to prevent damage to the painted surface, plaster, floor tiles, doors etc. Contractor should specifically note that the area where the false ceiling is required to be provided will be in advance stage of completion with various finishing items such as painting, floor polishing etc. Any damage to these finishes will have to be made good by him at no extra cost to the Department.

5.4 SAFETY PRECAUTIONS:

No person other than workman employed by the false ceiling contractor shall be permitted access to any area over which the sheeting is being laid. The contractor should take protective measures during the progress of work. Cat ladders or roof boards, scaffolding etc. should invariably be used by men working on the roof/false ceiling/masking etc.

5.5 WORK TO INCLUDE:

Cost of all approved A.C. sheets with anodized aluminium/pressed steel frame work, adjustable m.s. suspenders m.s. cleats, nuts, bolts, washers, screws, all labour, materials, tools, plants, approval scaffoldings, providing m.s. cleats and fixing them with metal fasteners/expansion bolts, nuts, washers, screws etc. to the concrete/wall surfaces and then fixing the adjustable suspenders in m.s. clamps, painting two coats of synthetic enamel paint on m.s. work as directed/as shown in drawing.

5.6 MODE OF MEASUREMENT:

A.C. Sheet false ceiling with snap grid pressed steel/anodized aluminium internal grid system frame work completed and accepted as per above specifications shall be measured in square metre upto two places of decimals. The line measurements shall be taken upto two places of decimal of a metre. The width shall be measured, from wall angle to wall angle and length shall be measured as per actual. Areas of trap doors, lighting troughs, Air conditioning diffusers, Air conditioning grills and other openings shall be deducted and net areas of false ceiling so computed shall be paid for unless other wise specified.

Areas of false ceiling with additional horizontal M.S. angle supports as per relevant drawing shall be measured separately between such additional supports. Mode of measurement for this item shall also be in square metre as described above.

6.0 LIGHTING TROUGHS/FIXTURES:

Lighting troughs/fixtures shall be fabricated out of anodized aluminium sheet or out of m.s. sheet of specified gauge and shall be free from scale, blisters, laminations, cracked edges, defects of any sort and shall conform to relevant I.S. specifications.

Lighting troughs shall be fabricated in a modern, well equipped workshop, as per the size and profile given in the drawing. The M.S. lighting trough shall be stove enamelled in the shop with approved type of colour & shade on both the surfaces. Aluminium troughs shall be anodized as per standard practice. Sample of lighting trough fabricated as per drawing shall be got approved by the Engineer-in-Charge before manufacturing on large scale. Aluminium/M.S. frame work sections and sizes, as per drawing, shall be fabricated and got approved before fixing in position.

The m.s. lighting troughs along with m.s. frame or aluminium lighting troughs with aluminium frame shall be fixed in position to correct line and level with m.s. suspenders as per drawings. One or more sample lighting troughs shall be fixed in position and got approved before fixing all the lighting troughs. The end of the lighting troughs on both sides shall be provided with m.s. covers of the same gauge as per drawings.

The materials and fabrication of lighting trough, m.s. aluminium frame and suspenders shall conform to the relevant specification given in this tender. The m.s. work shall be painted with two coats of synthetic enamel paint of approved make and shade over a coat of approved primer as per specification under relevant head.

6.1 MODE OF MEASUREMENT:

The lighting troughs along with m.s. or aluminium frame work, suspenders, end covers etc. duly fixed in position shall be measured along the length of the trough in running metres upto two places of decimal of a metre and paid for unless otherwise specified in schedule of work.

7.0 TRAP DOORS:

The materials viz. M.S. frame, aluminium frame and A.C. sheet and fabrications shall conform to the relevant specification given in this tender.

The trap doors shall be fixed in position with necessary M.S. angle frame out of M.S. angle of size 40 x 40 x 6mm. for the shutter and fixed to M.S. wall angle of size 40 x 25 x 6 mm. which is to be fixed by means of 40 x 25 x 6 mm. M.S. angle cleats, fixed to wall by means of M.S. hold fasts out of M.S. flats of size 40 x 6mm., 150 mm. long and grouted with cement concrete 1:2:4 in case of brick wall and with 100 mm. long M.S. coach screws and rawl plugs in case R.C. columns etc. M.S. angle of size 40 x 25 x 5 mm. shall be provided for receiving the lever of the locking arrangement. This angle shall be supported by 40 x 6 mm. M.S. flat suspenders from ceiling fixed with 3/8" diameter metal fasteners/expansion bolts. This angle, meant to receive the lever of the lock, shall be supported by two numbers of M.S. angle of size 40 x 25 x 5 mm. on either side. The two angles also shall be provided with M.S. flat (40 x 6 mm.) suspenders @ 800 mm. centers at all other convenient spacing as per drawing and as approved by the Engineer-in-Charge.

Sample of trap doors of single, double and multi panels shall be fabricated and fixed in position and got approved before taking up fabrication of trap doors on large scale.

All the exposed surfaces of M.S. work including the suspenders shall be painted with two coats of synthetic enamel paint of approved make and shade over a coat of approved primer.

8.0 MODE OF MEASUREMENT :

The area of trap door visible from underside of the false ceiling only shall be measured in square metres for payment. The m.s. angles to be provided for locking arrangements and supporting M.S. angles which shall not be seen from underneath shall not be measured for payment and are supposed to be included in the rate quoted for trap door, unless otherwise specified in the schedule of work.

9.0 FIBRE GLASS THERMAL INSULATION WORK AT CEILING WITH T.W. BATTENS FRAME WORK AND COVERING WITH A.C. SHEET:

9.1 SCOPE OF WORK :

The work envisaged under these specification covers providing and fixing fibre glass thermal insulation to ceiling at any floor, location and height as specified including T.W. battens frame work in required grid and insulation work covered with A.C. sheet/flexo board of specified thickness.

9.2 MATERIALS:

9.2.1 T.W. battens for frame: Battens required for frame work shall be as specified here-in-before.

9.2.2 Thermal insulation media : The thermal insulation media shall be of fibre glass Crown 150 or equivalent approved make with K value of 0.0285 K. Cal/sqm. hr.0C, 50 mm. thick and density of 24 kg/cum. or as specified in the description of item/ in drawing. Sample of fibre glass to be used on the work shall first be furnished by the contractor and got approved from Engineer-in-Charge before mass procurement.

9.2.3 A.C./Flexo board sheet covering : The plain A.C. sheet or flexo board shall be as specified here-in-before.

9.2.4 Fire resisting paint: The fire resisting paint shall be of M/s. Garware Paints Ltd. or any other approved equivalent make and shall conform to I.S. 163. Sample of fire resisting paint to be used on work shall first be got approved from Engineer-in-Charge before bulk procurement. Ready mixed paint as received from the manufacturer without any admixture shall be used.

9.3 ERECTION/FIXING OF INSULATION:

9.3.1 Frame work: The workmanship shall be of best quality. All wrought timber is to be sawn, drilled or otherwise machine worked to the correct sizes and shall be as indicated in drawing or as specified. All joinery work shall fit truly and without wedging or filling. All necessary mortising, tenoning, grooving, matching, tonguing, housing rebate and other necessary work for correct jointing shall be carried out in the best workmanship like manner. The frame work shall be made in required grid as specified in schedule item and in drawing. The frame work shall be rigidly screwed to the ceiling with 100 mm. long G.I. wood screws and rawl plugs @ 300 mm. centre to centre (or as specified) both ways by drilling holes in ceiling through frame work. The wood work shall be painted all over with fire resisting paint of M/s. Garware Paints Ltd. or any other approved equivalent make before erection of the same in position as per manufacturers specifications and as directed by Engineer-in-Charge.

If after fixing the frame work in position, any shrinking or substandard material or bad workmanship is detected, the contractor shall forth with remove them and replace the same at his own cost.

- 9.3.2 Sticking of insulation material & fixing of A.C./flexo board : After fixing of the frame work as above, a thick coat of bitumen of approved grade shall be applied as vapour barrier in the grids of frame work and then fibre glass of required thickness shall be stuck to ceiling and panel of grids as directed by the Engineer-in-Charge. The panels of fibre glass shall be cut exact to grid size and evenly pressed.

Approved A.C./flexo board sheets cut to correct sizes as specified in item description shall then be placed on the frame works starting from the centre of the width and work side-wards. Holes required in A.C. sheet/flexo board shall be drilled and on no account holes shall be punched. A.C. sheet shall be fixed to wooden frame work with suitable size of C.P. brass screws @ 300 mm. c/c. 4 mm. wide groove or as shown in the drawing shall be kept to correct line, level and plane at the junctions of sheets.

Any damage done to the finishes and to walls, columns, ceilings, plasters, floors etc. shall be made good to the original condition by the contractor at his own cost. The contractor should take protective measures during the progress of work. Cat ladders or roof boards scaffolding should invariably be used by men working on the thermal insulation work.

9.4 MODE OF MEASUREMENT:

This work shall be measured on square metre basis. The length and width shall be measured between plastered surfaces of walls upto two places of decimal of a metre for working out the area.

9.5 RATES:

Rates quoted by the contractor for the work shall include cost of all materials and labour required to complete the work as per item description, as per above specifications and as shown in the drawing.

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SPECIFICATION
FOR
METAL FALSE CEILING SYSTEM & THERMAL INSULATION

METAL FALSE CEILING SYSTEM (LUXALON 150 C / EQUIVQLENT):

1.0 MATERIALS

1.1 False ceiling

Manufacturing and Product: Hunter Douglas India Private Ltd. or equivalent

1.1.1 PRODUCT : Luxalon 150 C lineal aluminium false ceiling or equivalent

1.1.2 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 OR Equivalent and as per manufacturer's specification.

2.0 LUXALON 150 C METAL CEILING:

2.1 PANEL: The panel shall be cold roll formed panels 150mm 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.

2.2 CARRIER: The carrier on which the panels shall be clipped on to will be 32mm wide, 39mm 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.

2.3 WALL TRIM: The wall trim shall be 15mm deep x 30mm wide x 15mm deep x 0.4mm thick Aluminium Alloy AA5050 with square edges and length of 5 mtr.

2.4 ROD HANGER: The rod hanger of suitable length shall be made of 4mm dia. galvanized steel (Zinc coating 120 gms/Sqm.).

2.5 SUSPENSION CLIP: The adjustment suspension clip shall be made of galvanized spring steel V shaped with two holes to accommodate the rod hanger.

2.6 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.

2.7 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 'J' hooks and Anchor Fasteners.

2.8 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 + 4 units Colour diff. Within one batch + 2 units.
Colour Uniformity	: Maximum allowable deviation is 2 NBS units.
Specular Glose.	: □ 10 deg/00 (matt) ; □ 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.

2.9 **FIXING:** The panels shall be clipped on to a carrier. The carriers to be suspended with an adjustment spring of galvanised spring steel, V shaped with two holes to accommodate the rod hanger. The rod hanger to be made of 4mm dia, galvanised steel and suspended form the ceiling by J hooks fixed at 1.5mm centre to centre.

2.10 **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.

2.11 **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 BS 476. Part 6 and should have a fire propagation classification of Class as per BS 476. Part 6.

3.0 THERMAL INSULATION:

3.1 UNDERDECK INSULATION:

3.1.1 METHOD OF APPLICATION:

- 3.1.1.1 Clean the surface and make it free from dust and loose particles.
- 3.1.1.2 Apply a coat of Shalicoat to the underside of the roof.
- 3.1.1.3 Apply CPRX compound to the underside of each prelaminated Phenolic Foam panel and press the slabs in position. Butt the joints well together.
- 3.1.1.4 Secure panel in position with the help of screws, rawl plug and washers.
- 3.1.1.5 Deal all the joints with the help of self adhesives Aluminium tapes.

- 3.2 INSULATION ABOVE FALSE CEILING:

- 3.2.1 The insulation tiles shall be placed above the A1 carriers, which are a one meter c/c.
- 3.2.2 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.
- 3.2.3 The rate quoted shall be inclusive of cutting to the required size, wastage etc.
- 3.2.4 The tiles shall abut each other to provide a continuous barrier for effective thermal insulation.

- 3.3 GENERAL:

- 3.3.1 Extremely low 'K' value 0.018 Kcal/hr M.C.
- 3.3.2 Low water vapour transmission level.
- 3.3.3 Should be available in a single component system.
- 3.3.4 should be approved by both TAC and NIC.
- 3.3.5 Should be mildly antiseptic with resistance to fungal and bacterial growth and should not attract rodents/insects.
- 3.3.6 Should have good acoustic properties.
- 3.3.7 Temperature Range: + 125 degrees C to - 190 degrees C.
- 3.3.8 Material shall be classified as P [not easily ignitable] - BS 476 Part 5.
- 3.3.9 Material should conform to Building Classification "O" based on the propagation index BS 476 Part 6.
- 3.3.10 Material shall have a Class I surface spread of flame, the highest rating possible BS 476 Part 7.
- 3.3.11 Lowest smoke obscuration 5% (almost negligible) - BS 5111 Part 1.
- 3.3.12 Toxicity index of 0.04478 - Naval Engineering Standards 713 (NES) Ministry.

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SPECIFICATIONS
FOR
DISMANTLING AND DEMOLITION

1.0 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.

2.0 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.

3.0 PRECAUTIONS:

Necessary propping, shoring and/or underpinning shall be provided for the safety of the adjoining work or property, which is to be left in tact, 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.

4.0 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.

5.0 MODE OF MEASUREMENT:

- 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.

5.2 Doors and Windows : Dismantling of doors and windows (wooden or steel) shall be enumerated. Removal of chowkhats (frame works) shall include (unless otherwise separately mentioned for removing shutters only), the removal of shutters along with architraves, beadings, fittings and fastenings along with frames.

5.3 Roof Terracing: Dismantling of roof waterproofing treatment shall be measured in square metre area. Length and breadth shall be measured correct to a centimeter between parapets. No separate measurement shall be taken for gola and khurrah etc.

6.0 RATES:

The rate shall include cost of all such operations mentioned above including necessary labour, materials, transport, scaffolding, stacking the serviceable materials, disposing the unserviceable materials within the lead specified, all as directed by the Engineer-in-charge.

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SPECIFICATIONS OR R.C.C. SPUN PIPES

1.0 SCOPE:

- 1.1 The work covered under this specification consist of providing, laying, jointing and testing RCC spun pipes in accordance with these specifications and drawings.

2.0 APPLICATION CODES & SPECIFICATIONS:

- 2.1 The relevant I.S. 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.

2.2 List of Indian Standards :

No.	I.S. No.	I.S. Particulars
1.	I.S. 458	Precast concrete pipes (with/without reinforcement)

3.0 R.C.C. SPUN PIPES:

- 3.1 The pipes shall be R.C.C. spun pipes NP2 class, conforming to I.S. 458 and shall be approved by the Engineer-In-charge for soundness before incorporation in the work.

4.0 LAYING OF RCC SPUN PIPES:

- 4.1 R.C.C. spun pipes shall be laid in alignment and gradient as shown in the drawing. Invert levels are generally to be followed as per drawing but changes can be made as required for the site conditions and as decided by Engineer-In-charge.
- 4.2 Pipes shall be lowered gradually into the trenches over the concrete cradle or bed, if necessary. Holes for collars shall be made at every joint. These holes will be made depending upon the particular length of the pipes being laid. The pipe drain shall rest on the bed at every point throughout its length.
- 4.3 To ensure this, the space between the underside of the pipes and the invert of the cradle shall be carefully grouted solid with thin cement slurry consisting of one part of cement to three parts of clean washed sand in such manner that no voids shall be left. This is to ensure that the load of the pipes and the superimposed load of the earth filling shall be evenly distributed on the cradle or bed.
- 4.4 The contractor shall take precautions to see that no earth, dirt or other foreign matter is allowed on the surface of the cradle or of the pipe resting whereas. All precautions shall be taken to the full satisfaction of the Engineer-In-charge and the pipes shall gradually be lowered on the cradle.
- 4.5 After the alignment of the pipe is checked by the authorized representative of the Department, the grouting shall be done without any extra charges by the Contractor. The cradle of concrete shall be allowed to set atleast for three days, before any pipe is placed on it and the contractor shall take due care in setting the pipe in the cradle of concrete shall be allowed to set atleast 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 to the cradle shall occur.

- 4.6 If any damage to the cradle occurs, it shall be rectified to the satisfaction of the Engineer-In-charge and in any particular case where the damage in the opinion of the Engineer-In-charge has adversely affected the structural strength of the cradle, the contractor shall replace it at his own expense to the complete satisfaction of the Engineer-In-charge.
- 4.7 No pipe shall, therefore, be laid or placed till the alignment of the pipe drawn and its levels and gradients have been carefully checked and tested and found correct.
- 5.0 JOINTS:
- 5.1 The joints for the pipes 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 better grip.
- 5.2 The two adjacent pipe ends will be so designed and manufactured that when abutted together concentrically, a dowel will be left between the two ends.
- 5.3 In this dowel, cement mortar of 1:1 proportion or as specified in the schedule shall be filled and then between the ends, a paste of cement mortar of the same proportion will be placed, the space remaining between the pipe ends and the collar being then caulked with cement mortar 1:1 proportions so that an even space appears all round the external diameters of the pipes.
- 5.4 Even joints shall be finished of smooth at an angle of 45 degree with the longitudinal axis of the pipe on either side of the collars.
- 6.0 TESTING OF R.C.C. SPUN PIPES:
- 6.1 After a sufficient interval has been allowed for the joints to set, the pipe drains will be tested under ahead of at least 1.20 m and in no case under head greater than 6.00 m of water above the top of the pipes.
- 6.2 In addition the pipe drains shall be examined for leaks of land water making its way through the joints. The contractor shall make the pipe drains water tight against the increase of land water from outside and also against the leakage of water from the inside of the pipe drains at the test heads above specified to the full satisfaction of the Engineer-In-charge.
- 6.3 All defective or leaking pipes or joints shall be cut out and replaced and made good by the contractor at his own cost and charges or in the case of joints that may be defective and cannot be made good, they shall be entirely surrounded externally with cement concrete of 1:2:4 proportions, to render the joints water tight and this shall be allowed to set before encasing or backing filling is done.
- 6.4 A strong colour shall be added to the water used for testing of the pipes, in order that any leakage may be easily detected. The cost of testing of the pipe drain shall be borne by the contractor and this is deemed to be included in the rates quoted by the contractor.
- 7.0 MODE OF MEASUREMENT:
- 7.1 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.

- 7.2 Fittings/ specials shall not be measured separately.
- 7.3 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.
- 7.4 Excavation, back filling, shoring and timbering in trenches and cement concreting wherever required shall be measured separately under relevant items of work.

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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 I.S. 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 storm water to the main nallah 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 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, 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.

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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 tender schedule 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 schedule. 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. These shall be casted 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, as directed by Engineer-in-Charge and 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 posts, last but one end posts, corner posts, 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.

5.2 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 (in gm./m.)
	Line wire (in mm.)	Point wire (in mm.)		
1.	2.50 (12G)	2.50 (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 (12G)	216	302	444
2.24 (13G)	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 M.S. 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 manufacturers 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.

10.2.2 The rate shall include the cost of labour and material involved in all the operation described above including the cost of barbed wire, turn buckle, straining bolts and 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.

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**SPECIFICATIONS
FOR
M.S GATE**

1.0 MATERIALS:

All structural steel work, shall be of sizes and sections as per drawings. 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 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.

4.0 MODE OF MEASUREMENT:

4.1 The gate shall be measured on area basis.

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.

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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 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 drawing. 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 m.s. 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 m.s. 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.

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SPECIFICATIONS FOR ROAD AND PAVEMENTS

1.0 SCOPE OF WORK:

The work contemplated under these specifications refers to Earth work in Excavation, Forming Embankments, Proof rolling, Soling, W.B.M., Bituminous Macadam, Bituminous concrete, Macadam grouting, Wearing Course/Sealing Coat etc. for road and pavement works.

2.0 EARTH WORK EXCAVATION:

The specifications for "Excavation, Fill and Back fill" specified here-in-before shall hold good as far as they are applicable.

2.1 Earth work excavation for road sections :

The work under this item will include excavation in all types of soil, murrum, etc. and in loose boulders not longer than one metre in any direction and not more than 200 mm in any one of the other two directions. The excavated material shall be disposed off as directed by the Engineer. Payment will be made for theoretical section. No claim for extra cutting in any direction is permissible unless otherwise agreed upon by Engineer-in-Charge. The contractor shall also clean of all vegetation before starting the work of excavation for the entire width and length of the road and no extra shall be paid for this. Black agricultural soil wherever met with, shall also be removed to the required depth as directed by the Engineer. The excavation for roads shall be carried out to the gradients and cambers and subgrade levels as indicated in plans or as decided by the Engineer. The excavated areas should be kept free of water at no extra cost, while work is in progress.

3.0 FORMING EMBANKMENT:

3.1 The work shall include preliminaries of clearing site, setting out and preparing the ground and there after forming embankment for the roads, paths etc. with approved material available from excavations under this contract (excavation paid separately under respective items) or elsewhere, spreading in layers, watering and compacting to the required density and lines, curves, grades, camber and cross section and dimensions shown in the plan or as directed by the Engineer-in-Charge. When the embankment is to be laid on hill sides or slopes, the existing slopes are to be ploughed deeply. If the cross slopes are steeper than 1 in 3, steps with reverse slope shall be cut into the slopes to give proper hold and seating to the bank as directed by the Engineer-in-Charge. The top 15 cm. of soil shall be scarified and watered if directed and compacted to the same density as specified for the embankment before any material is laid for the embankment work.

3.2 Only the approved excavated earth shall be placed in the embankments in successive horizontal layers not exceeding 150 mm. extending to the full width of the embankment including the slopes at the level of the particular layer and 30 cm. more on both sides to allow compaction of the full specified section. The extra loose stuff at the edges shall be trimmed later after completion of the bank work without extra cost leaving the correct section fully compacted. On resuming work after one interval if the previous compacted surface has dried up or hardened, it shall be moistened and scarified before any fresh material is placed on it.

- 3.3 Keeping the width of the bank initially less and widening it later by dumping loose earth on the slopes shall not be permitted as the additional width and slopes will remain loose and un compacted. Similar procedure to extend the embankment by dumping the material longitudinally shall also not be allowed. Each layer of the embankment shall be watered, leveled and compacted as specified here-in-after, before the succeeding layers are placed. The surface of the embankment shall at all times during construction, be maintained in such a manner so as to prevent ponding. Water to be used shall be free from all harmful elements and approved by the Engineer-in-Charge.
- 3.4 If the material for embankment contains moisture less than the optimum moisture, water shall be added in the 100 mm. layers of the embankment to bring moisture uniformly upto requirement. If the excavated material contain more than required moisture, it shall be allowed to dry until the moisture is reduced to required extent. If due to the wetness, the moisture content of the soil cannot be reduced to the appropriate amount by exposure, embankment work shall be suspended till suitable conditions prevail at no extra claim/compensation.
- 3.5 When loose layer is levelled manually or mechanically and moistened or dried to a uniform moisture content suitable for maximum compaction, it shall be compacted by 8 to 10 tonne power roller or sheep foot rollers or heavy hauling or dozing equipment to give the specified 90% of the proctor density. If on testing, the density is found to be less than 90% of the proctor density, the contractor shall do additional compaction necessary to get the specified density after adding water if required. Test shall be made to determine the maximum density of the material to be used by the proctor method before starting the work. Density test shall be carried out for the embankment work during the progress of the work. One set of three core samples for every 1000 sqm. (about 1000 sq.yd.) area of each layer of embankment work shall be taken and tested. The average density shall not be less than 90% of the proctor density, obtained in the laboratory.
- 3.6 Arrangement for obtaining the samples and transporting the same to laboratory, shall be made by the contractor at his own cost.
- 3.7 Embankment not accessible to rollers, such as those adjoining bridges, culverts and other works shall be carried out independently of the main embankments and shall have the layers placed in 150 mm. to 200 mm. height and each layer shall be moistened and thoroughly compacted with mechanical or manual tamper. Before placing the next layer, the surface of the under layer shall be moistened and scarified so as to provide a satisfactory bond with the next layer.
- 3.8 The embankment shall be finished and dressed smooth and even, in conformity with the alignment levels and cross sections and dimensions shown on the drawing. On curves, section shall be provided with super elevation and increased width, as shown on the plans as directed by the Engineer-in-Charge. The last layer shall be finished off with a suitable camber etc. all as per drawing and as directed to receive the soling.
- 3.9 Joining of old and new embankments shall be done by stepping in an overall slope of about 1 to 5.
- 3.10 The contractor shall be responsible for maintaining the embankment work in satisfactory conditions at his own cost till finally accepted including making good any damage.
- 3.11 MEASUREMENT AND RATE OF EMBANKMENT:

The contract rate shall be per cubic metre of the finished embankment. Measurements shall normally be taken by taking cross sections at suitable intervals. The measurements of the section shall be limited to the dimensions shown on the drawing or those ordered by the Engineer-in-Charge in writing. The sectional area shall be worked out correct up to two places of decimal of square metre and the quantity worked out to two places of decimal of cubic metre on lines similar to those specified for earth work here-in-before.

4.0 SUB GRADE:

4.1 Preparation of Sub-Grade: The surface of the formation for a width of sub-base, which shall be as per drawing shall first be cut to a depth equal to the combine depth of sub-base and surface courses below the proposed finished level (due allowance being made for consolidation). It shall then be cleaned of all foreign substances. Any ruts or soft yielding patches that appear due to improper drainage conditions, traffic hauling or from any other cause, shall be corrected and the sub-grade dressed off parallel to finished profile to the required gradient and camber.

4.2 Proof rolling and Consolidation: The sub-grade shall be adequately watered and consolidated with a power road roller of 8 to 10 tonnes. The roller shall run over the sub-grade till the soil is evenly and densely consolidated and behaves as an elastic mass (the roller shall pass a minimum of but not limiting to 5 runs on the sub-grade). All undulations in the surface that develop due to rolling shall be made good with fresh material or quarry spoils as the case may be and the sub-grade is rerolled.

4.3 Surface Regularity: The finished surface shall be uniform and conform to the lines, grades and typical cross sections shown in the drawings. When tested with the template and straight edge, the variation shall be within the tolerances specified in the Table below:

PERMISSIBLE TOLERANCES OF SURFACE REGULARITY

Longitudinal profile	Cross profile
Maximum permissible undulation when measured with a 3 metre straight edge template.	Maximum permissible variation from specified profile when measured with a camber-
24 mm	15 mm

4.4 Where the surface irregularity of the sub-grade falls outside the specified tolerances, the contractor shall be liable to rectify these with fresh material or quarry spoils as the case may be, and the sub grade rerolled to the satisfaction of the Engineer-in-charge.

4.5 MEASUREMENT & RATE OF SUB-GRADE:

The excavation will be measured in cubic metres, correct to two places of decimal. The length and width shall be measured correct to a cm. The measurement for proof rolling shall be worked out in square metre, correct to two places of decimal. The rate shall include the cost of materials and labour required for all the operations mentioned above, unless specified otherwise.

5.0 Rubble Soling :

- (a) Material for soling shall be trap stone of approved variety. It shall be hard, durable and free from defects and shall be got approved by the Engineer-in-Charge before incorporation in the work. Spotted rubble stone shall not be used for the work.
- (b) On the sub-grade prepared as specified hereinbefore, soling shall be laid in regular lines. The stone shall be set as closely as possible and packed well. The stones shall be laid so as to have their bases or the largest areas resting on the sub-grade.
- (c) Soling shall be laid in one layer of 15 cm thickness (or as specified) and no stone shall be less in depth than the specified thickness of Soling.
- (d) After packing the stone properly in position, the interstices between them shall be carefully wedged with quarry spalls or stone chips. These shall be hammered well to obtain a hard and compact surface. Spreading stone chips of loose spalls or stone chips is prohibited.
- (e) The entire surface shall then be examined for any protrusions and the same shall be knocked off by a hammer.
- (f) Soling shall be laid to proper gradient and camber which shall all be checked frequently to ensure accuracy.
- (g) Rolling shall then be carried out by a 8 to 10 ton power roller and soling consolidated properly. Water shall be lightly sprinkled during rolling if ordered by the Engineer-in-Charge.
- (h) The surface thus prepared shall first be passed by the Engineer-in-Charge after which 40 to 50 mm thick layer of hard murrum or stone screenings shall be spread over the soling and rolled again such that the hard murrum or stone screening get into the interstices. It shall, however, be ensured that a thin layer of murrum or screenings shall remain on the finished surface of soling.

6.0 Water Bound Macadam Road :

- (a) Metal required for water bound macadam shall conform to I.R.C. specifications in all respects. It shall be broken from first class rubble, hard, sound trap metal, free from decay and weathering and obtained from approved quarries, and shall be 50 mm standard size. Spotted rubble stone shall not be used for this purpose.

Collection of metal :

Metal shall be collected in stacks on level ground and stacked on the sides of the road as directed. The metal shall be free from all earth, rubbish and vegetable matter and graded before stacking and closely packed in stacks. The measurement shall be taken for the collected metal before spreading. No deduction will be made for voids. The size of stack shall be 1.00 m wide at top and 2.00 m wide at bottom and 0.60 m in height. The length shall be as directed by the Engineer-in-Charge.

The contractor shall provide the templates required to ensure the compliance with size of stack stipulated.

(b) Collection of murrum :

Approved grade murrum 10 mm down to dust (but not silt) as directed by the Engineer-in-Charge shall also be collected in stacks on level ground alongside to the road. This shall be measured before using it for binding. No deductions for voids will be made.

(c) The stacks shall be measured in cubic metre for payment before using the same.

(d) Laying and preparing water bound macadam :

(i) After preparation of the surfaces as specified above 50 mm size metal collected in stacks shall be spread to a uniform thickness over the prepared surface and consolidated to 75 mm thickness as specified hereinafter.

(ii) Templates properly made in full width gauge or templates fitted with central plumb each edge fixed with it must be used. The depth of the plank forming the gauge shall be the thickness of the metal layer in loose state so that when the metal has been properly spread the gauge are buried just flush with the surface. The intermediate work shall be tested with chord stretched between the gauges. Three templates shall be provided and used with a distance of about 7.50 m between each but not exceeding 15.00 m. A spirit level shall invariably be used with the template to ensure that the edges of metalling are truly level. The metal shall be spread and rolled dry with 8 to 10 ton power roller until well compacted and there is no appreciable movement in the surface when walked upon and no appreciable movement in front of the advancing roller. Rolling shall be done by a roller preferably by a Tandem roller till proper inter locking of adjacent pieces of stones has been achieved. Excessive dry rolling shall be avoided.

(iii) Rolling shall commence from one edge of the road to the centre and from the other to the centre. On portions where the gradient is steeper than 1 to 60 the roller shall be run upgrade that is rolling shall be started from lower level and to upward for the first rolling.

(iv) When rolling, the surface in two or more parts a strip 23 cm to 30 cm along the predetermined longitudinal section shall be left unrolled while consolidating the first half. This shall be properly jointed while the metal is being spread on the second half and consolidated with it. Care must be taken to avoid the occurrence of a continuous longitudinal furrow along the ridge of the road. Full width of the road shall be rolled at a time.

(v) The metalling shall be moderately kept saturated and rolling continued until consolidation is completed. Just enough watering shall be done so as to flush the metal slurry into the interstices. Care shall be taken to avoid excess water softening, the subsoil. The full consolidation stage shall be tested by :-

(a) Putting a piece of metal about the size of a walnut on the surface & roller passed over it. If it is crushed the surface shall be deemed as well consolidated.

(b) There shall be no creeping of a stone ahead of the roller.

(vi) Until the above conditions are satisfied no blindage or surfacing material shall be put on the surface. No rolling shall be done where sign of metal crushing are noticed or rolling causes wave like motions in the base course of sub-grade. Over-rolling shall not be done. About 20 to 30 trips of the roller shall normally suffice to make the surface well compacted. Before starting roller the metal shall be dressed accurately to camber. No fresh metal shall be added, once dry consolidation has started. If new metal must be added after consolidation has commenced, the part of the road must be fully raked up so that the metal is thoroughly incorporated into the body of the road.

(vii) Blinding Course :

When the first consolidation has been completed material of approved graded murrum shall be spread over it and brushed backwards and forwards to fill in the surface voids and watering continued to such an extent that the blinding material formed into a slurry and is grouted into the interstices. After the road has been fully consolidated, the surface shall be covered with 12.5 mm layer of murrum and the road opened to traffic after 4 days. The road shall be kept watered for 14 days or such other period as specified by the Engineer-in-Charge. Where tracks are formed by the traffic on the road, barriers for e.g. tree branches etc. shall be put on such roads to divert traffic. After fifteen days, light watering and rolling shall be done. For joints across the road the end of each layer shall be given a flat slope and well consolidated together and hump formation must be avoided.

(viii) Damages to the Department's Property: Any damage to the Deptt's property due to negligence of the contractor while executing the work shall be made good to the original condition at his own cost.

(ix) MODE OF MEASUREMENT:

The areas of water bound macadam road surfaces of required thickness actually completed as per above specifications limiting to the areas as per drawing shall be measured in square metre up to two places of decimal, for payment.

The item includes laying, spreading, watering, consolidation, blinding etc. but excluding the cost of 50 mm size I.R.C. metal and graded murrum which will be paid

under relevant item. However Murrum obtained from excavation work under this contract and used as blinding material as above on instructions/approval of the Engineer-in-charge shall not be paid.

7.0 BITUMINOUS MACADAM & BITUMINOUS CONCRETE SURFACING FOR ROAD (GENERAL):

7.1 SCOPE OF WORK:

- (a) The work covered under these specifications provides for bituminous treatment for roads consisting of providing specified thickness of bituminous macadam, bituminous concrete and seal coat as in item in the schedule of quantities.
- (b) The contractor shall make at his own cost, all the arrangements for controlling the traffic during the execution of the work. All arrangements such as proper barricading of road, diversion of road if necessary, red and green flags during the day, red lights at nights shall be made by the contractor at his own cost to control and safeguard the traffic.

7.2 BITUMINOUS MACADAM OVER WATER BOUND MACADAM:

- (a) Preparation of Existing Water Bound Macadam Surface : The existing water bound macadam surface shall be brushed, cleaned properly with wire brushes and coir brooms, so as to free from all loose materials, murrum, earth, silt and caked mud etc. The surface shall then be dusted clean with gunny bags etc. If during the process of cleaning the sub grade (water bound macadam), soft spots and pockets, hollows etc. are found, such spots/pockets will be filled with approved precoated bituminous chips, consolidated and finished to proper level, rolled with power roller if necessary. The pot holes shall be excavated properly in a rectangular or rhomboidal shape with vertical edges. The bottom and sides shall be cleaned as stated above. The sides and bottom shall then be thoroughly painted with heated 60/70 (or of specified grade) penetration bitumen. The pot holes shall thereafter be filled with premixed bituminous chips so that after thorough tamping and rolling, the surface is flush with surrounding road surface all as directed by the Engineer-in-Charge. It shall be the responsibility of the contractor to ensure that the subgrade is even and is finished to camber and slope as shown on the drawings or as directed by the Engineer-in-Charge.
- (b) The surface of the subgrade shall be checked for its trueness by means of the scratch template set to the exact profile of the base course. The template shall be drawn along the forms at right angles to the road.
- (c) Unevenness of the surfaces as indicated by the scratch points shall not exceed 10 mm. in 30 m. The area of depression shall then be painted or sprayed with 60/70 (or of specified grade) penetration bitumen at the rate of 0.75 kg. per sqm. and the leveling course applied by hand or machine to grade and camber and rolled. If the depressions are deeper than 50 mm., the levelling course shall be applied in two or more layers and rolled as directed by the Engineer-in-Charge.
- (d) The prepared surface shall be closed to traffic and maintained fully clean and no asphaltting work shall be started unless this prepared surface is approved by the Engineer-in-Charge. The rate quoted by the tenderer against the item of bituminous macadam shall be inclusive of preparation of surfaces, to receive the bituminous macadam as detailed above and no extra payment is admissible on account of the same.
- (e) MATERIALS:
Representative samples of materials proposed to be used shall be submitted to the Engineer-in-Charge and got approved. No material shall be used unless it is approved by the Engineer-in-Charge.

HOT MIXED HOT LAID BITUMINOUS MACADAM:

- (f) Coarse Aggregate : It shall consist of crushed hard trap stone metal, free from coatings of clay, silt and any objectionable material. Metal brought by contractor for different items of work shall strictly conform to I.R.C. specifications in all respects. The aggregate shall be obtained by crushing approved stones of specified type in mechanical crusher and shall be hard, close grained, sound trap stone metal, free from decay and weathering and obtained from approved quarries.

Metal shall be collected in stacks on level ground and neatly stacked at site of mixing. The metal shall be free from all earth, rubbish, vegetation and other foreign matter and graded before stacking and closely packed in stacks.

Tests considered necessary shall be carried out in an approved laboratory when the Engineer-in-Charge considers the quality to be doubtful or there is a dispute about the quality. The cost of testing shall be borne by the contractor.

AGGREGATE GRADING: The requirements of base course shall be as under:

B.S. Sieve Designation	Equivalent I.S. Sieves	Passing percentage
32 mm. (about 1.25")	40 mm. (1.5")	100
20 mm. (about 3/4")	20 mm.	50 – 100
12 mm. (about 1/2")	12.5 mm.	30 - 60
6 mm. (about 1/4")	6.3 mm.	18 - 30
No. 10	1.7 mm.	10 - 20
No. 200	75 micron	0 - 5

Note: The aggregate/chips shall be entirely dry at the time of mixing.

- (g) Bitumen: Bitumen to be used shall conform to I.S. 73-1992 for paving bitumen, with 60/70 (or of specified grade) penetration and shall be from approved manufacturers.

The contractor on demand by the Engineer, obtain and furnish a laboratory test certificate to the effect that the material conforming to the requirement of the specified grade, to the satisfaction of the Engineer-in-Charge. Bitumen (60/70 penetration or as specified) specified content by weight of the total mix, shall be used in the mixture.

- (h) Tack Coat : Bitumen of the same grade as that used for premix shall be heated to a temperature of 163⁰ C to 177⁰ C (325⁰ F to 350⁰ F) in a bitumen boiler and the hot bitumen shall be applied evenly to the thoroughly cleaned and prepared road surface (as specified here-in-before) @ 7.5 kg. per 10 sq.m. or as specified leaving no part of the surface unpainted. Application shall be done by a mechanical pressure sprayer or if permitted, by perforated pouring cans. The tack coat shall be applied just before the macadam is laid. Application of tack coat shall be only slightly in advance of laying premixed chips.

- (i) Premixing Chips: The bitumen shall be heated to 163° C to 177° C (325° F to 350° F) in boiler. The aggregate of the approved grading or as decided by the preliminary tests shall be dried and heated in an aggregate drier to a temperature of 149° C to 177° C (300° F to 350° F) and fed into a twin shaft peddle type mixer at a temperature not less than 149° C (about 300° F). The bitumen, the approved aggregate and the filler shall be measured separately and accurately to the proportions in which they are to be mixed and mixed intimately till all the particles are completely coated with bitumen. The bitumen content in the mix shall not be less than 3.5 % by weight of total mix. Asphalt/bituminous mixing plant proposed to be used by the contractor for the preparation of Asphalt/bituminous mixing shall conform to all of the requirements of the job, which shall produce uniform mixtures of the required quality, and got approved by the Department before mixing.
- (j) The temperature of the premix bituminous macadam when leaving the mixer shall not be less than 130° C (about 280° F) and it shall not be less than 121° C (about 250° F) at the time of laying.
- (k) Bituminous macadam shall be transported to site of work in suitable tipping vehicle properly insulated and covered with canvas or other suitable materials to protect the mixture from weather conditions and to retain the heat. The road surface shall be suitably marked to ensure correct and uniform application. Width of macadam to be laid shall be slightly more (not exceeding 50 mm. on each side) than the required carriage way as per drawing. Excess on either side shall be neatly cut after full compaction to get final width of carriage way as per drawing. The premixed bituminous macadam shall be laid by a mechanical self powered spreader and compactor and finished to correct line, level, & final consolidation done by means of power roller not less than 10 tonne. Any irregularities shall be corrected during rolling.
- (l) Compaction : The base bituminous macadam course shall be compacted thoroughly and evenly with 10 to 12 tonne power roller immediately after it is laid. Compacted thickness shall be as specified in schedule of quantity.
- (m) The surface shall be checked for correct grade during and after rolling. Any irregularities shall be corrected by adding precoated chips or removing the surplus. The disturbed surface shall be well compacted again. If necessary, the roller wheel shall be coated with oil to prevent the coated chip from sticking to the wheels. Rolling shall be continued till no wheel marks are left on the surface. The speed of the roller shall be sufficiently slow to prevent any pushing under the wheels.

7.3 Specifications for Asphaltic Concrete Road Surfacing :

- a) Nature and scope of work : Specifications under the "Asphaltic Macadam" shall apply to the "Asphaltic Concrete" also as far as cleaning existing road surfaces, mixing, weighing, transporting, laying and rolling are concerned.

The dust, dirt, debris, etc. collected from the cleaning operations shall be disposed of to an approved site and levelled to the satisfaction of the Engineer-in-Charge. The road surface should be cleaned and screened properly before laying asphaltic concrete. It may be noted that the rate to be quoted by the tenderer against the item of Asphaltic concreting shall be inclusive of preparation of surfaces, to receive the Asphaltic concrete as detailed above and no extra payment is admissible on account of the same.

- b) Hot mix hot laid asphaltic concrete : Bituminous concrete shall consist of mixture of mineral aggregate, and filler, graded to fill the voids, mixed with a bituminous binder to obtain maximum stability and durability spread and compacted on a prepared base of sub-grade on conformity with the lines, grades and cross sections shown in the drawings. The aggregate shall be pre-heated to the temperature specified for the bitumen and the mixture shall be prepared and laid hot.

c) Materials :

- i) Bitumen - The bitumen shall be of 60/70 penetration or such other grade as specified by the Engineer-in-Charge and shall conform to IS:73 latest edition.
- ii) Filler - The filler added shall be dry and clean lime stone powder or hydrated lime having CaO content of not less than 60%.
- iii) Sand - The sand shall be clean, natural, river sand, duneer pits and or quarry sand produced in a crushing plant, as specified.
- iv) Coarse aggregate - The coarse aggregate shall consist of clean trap stone of approved quality free from dust, angular but not flacky.

The grading, composition and characteristic of the asphaltic concrete mixture shall be approximately as given below :

(d) Grading of Aggregate

<u>I.S. Sieve No.</u>	<u>Percentage passing</u>
20 mm	100
15 mm	80 - 100
10 mm	70 - 90
4.75 mm	50 - 70
2.36 mm	35 - 50
1.18 mm	26 - 38
600 micron	18 - 29
300 micron	13 - 23
150 micron	8 - 16
75 micron	4 - 10

Bitumen 7.75% plus or minus 0.25% by weight of total mix, with voids to a maximum of 2% to 4% by volume and specific gravity not less than 2.3 ; all properties conforming to respective IS codes, latest edition.

The tenderer shall indicate the exact grading, bitumen content voids, specific gravity, Marshall stability, etc. which they propose to adopt for the work offered by them.

The contractor shall also be responsible to see that the surface to receive asphaltic concrete is properly consolidated so as to give uniform and adequate support to the asphalt carpet for the period of its usual life.

A thin layer of sand or stone dust should be spread over the compacted base and rolled before the asphaltic concrete carpet is laid where the base is water bound macadam, otherwise base should be swept clean.

- (e) **Mixing** : The aggregate shall be dried and heated to the temperature specified for application of bitumen (350° F to 370° F) screened into the necessary sizes for producing the desired grading, free from dust and deposited in bathing bins. The coarse aggregates shall then be measured or weighed into the mixer at the specified temperature and in the correct proportions and thoroughly mixed dry. Approximately $\frac{2}{3}$ the quantity of bitumen shall then be weighed into the mixer at the correct temperature. After addition the bituminous binder the mixing shall be continued till a homogeneous mix is produced. The required quantity of sand at correct temperature shall be weighed into the mixture and the remaining quantity of bitumen added. Mixing shall be continued to produce homogeneous mix in which all the particles are uniformly coated. Finally the correct quantity of filler shall be added in a dry condition and thoroughly incorporated in the mix. As hot mix bituminous concrete must be spread, shaped and compacted while hot, it shall not be stored but used on the work immediately following the mixing operations.
- (f) **Formwork** : Necessary formwork of a design approved by the Engineer-in-Charge shall be used to retain the asphaltic concrete in position at the sides to required lines, levels and gradients during the entire progress of work.
- (g) **Spreading** : The asphaltic mix will be laid by a mechanical compactor and finisher, the final consolidation being by means of a power roller.

Before wearing coarse mixture is laid a tack coat of 0.75 Kg of bitumen per m^2 shall be applied.

- (h) **Testing** : The contractor shall have a well equipped testing laboratory with a competent laboratory staff. Daily tests shall be made by them on the asphalt mixes produced to ensure compliance with this specification and a copy of the test results shall be submitted to the Engineer-in-Charge for record. Tests shall include water absorption, stability, filler content, grading of aggregates, bitumen content, specific gravity, void content etc. The contractor shall give all facilities at all times to the Engineer-in-Charge or his representative to inspect the work of testing done by them.
- (i) **Weighing** : Each lorry leaving the plant must be weighed on a weigh bridge in the presence of the representative of the Department and a challan must be issued along with the lorry in duplicate showing the weight of the material loaded in the lorry, as and when required by the Engineer-in-Charge the said lorries will be reweighed and verified with challans and the expenses for such weighing shall be borne by the contractor.
- (j) **Testing of surface** : The completed surface when ready for acceptance shall be thoroughly compacted, smooth, true to line, grade, camber and free from irregularities. When tested by means of a straight edge of 3.0 m long laid on the finished surface parallel with the centre line of the road, the surface shall vary in no place more than 6.0 mm from the working edge.

- (k) Maintenance : It will be binding on the contractor to maintain the road free of cost for a period of 1 year from the date of completion of the work. The defects in the asphalt paving which the contractor may be called upon to rectify are of the following types :

- I. Deformation of asphalt resulting in waves or ruts.
- II. Cracking of the asphalt resulting in admission of the sub-grade and the deterioration of the asphalt adjoining the cracks provided that if such cracking results from defective foundations and department shall at their own cost carry out the necessary remedial work before the defective foundations are rectified.
- III. Unravelling the asphalt resulting in the formation of pot holes.
- IV. Polishing of the asphalt under traffic resulting in a surface which the vehicles are liable to skid.
- V. Defects in area of asphalt under guarantee where they shall exceed the limits specified below be remedied immediately by the contractor.

The limiting values of defects shall be the following :

- I. Deformation, 25 mm in 3.0 metres.
 - II. Cracks, exceeding 1.5 m length or 3.0 mm in width.
 - III. Unravalled patches exceeding 194 sq. cms. in area and or 13 mm in depth.
 - IV. Polishing to the extent greater than that of a sample to as a representative border line case by the contractor and the Engineer-in-Charge cut from the road, divided into two approximately equal portions and retained for reference by the Engineer-in-Charge and contractor.
- (m) Permitting traffic : Traffic may be allowed on the road after a lapse of 24 to 48 hours after laying.

8.0 HOT MIXED HOT LAID BITUMINOUS CONCRETE WEARING COURSE (SEAL COAT):

- 8.1 Bituminous concrete: shall consist of mixture of mineral aggregate, sand and filler, graded to fill the voids, mixed with bitumen binder to obtain the maximum stability and durability. It shall be spread and compacted on a prepared bituminous macadam base in conformity with lines, grades and cross section shown in the drawings. The aggregate shall be preheated the temperature specified for the bitumen and the mixture shall be prepared and laid hot.
- (a) Coarse Aggregate : The coarse aggregate brought by contractor shall be I.R.C. hard black trap, crushed in mechanical crushers and shall be clean, strong, tough, dense, close grained, angular but not flaky, and free from soft, decayed, weathered portion, coating of dust, dirt or other objectionable matter. Maximum size of the aggregate shall be suitable for the thickness of the seal coat (12mm./15mm. or as specified).

The aggregate grading composition and characteristics of surface (wearing course mix) shall conform to standard code of practice. The mix shall satisfy the following requirements:

Bitumen :	7.25 (+/-) 0.25% by weight of total mix.
Voids of air in total mix :	2% by weight of mix and 4% by volume.
Specific gravity	Not less than 2.3.
Marshall stability :	453.6 kg (1000 lb.) minimum
Flow :	1020.
Water absorption :	0.50%

- (b) Fine Aggregate : The fine aggregate shall be clean, natural, river bank or pit sand or quarry sand produced in a crushing plant and satisfying the requirement of the grading of aggregate for the bituminous concrete as stated above or as determined by the preliminary tests.
- (c) Filler: The filler shall be dry and clean lime stone powder hydrated lime having calcium oxide content of not less than 60% both passing B.S. sieve No.8. It shall be free from lumps and loosely bonded aggregation. When tested by laboratory sieves, 100% shall pass through B.S. sieve No.14, 80% shall pass through B.S. sieve No.8. Fillers shall be added to the aggregate to give the above grading determined by preliminary tests.
- (d) Bitumen: Bitumen shall be of 60/70 penetration or such other grade specified by the Engineer-in-Charge and shall conform to I.S. 73 – latest edition.
- (e) The tenderers shall indicate the exact grading, bitumen content, voids, specific gravity etc. which they propose to adopt for type of treatment offered by them.
- (f) Preparation of Base : Dirt, dust and other foreign materials if accumulated shall be cleared off leaving the surface entirely clean. The prepared surface shall be closed to traffic and so maintained fully clean till the seal coat is applied.
- (g) Mixing and Laying Wearing Course : Grade 60/70 (or of specified grade) bitumen shall be heated to a temperature of 163 °C to 177 °C (325 °F to 350 °F) in a boiler. The aggregate of the suitable approved grading or as decided by preliminary tests, shall be dried and heated in an aggregate drier to a temperature of 149 °C to 177 °C (300 °F to 350 °F) and fed into a twin shaft paddle type mixer at a temperature not less than 149 °C (300 °F). The bitumen, the aggregate and the filler shall be measured separately and accurately to the proportions in which they are to be mixed and mixed intimately till all the particles are completely coated with bitumen. The quantities of aggregate, bitumen and the filler shall be such as to obtain the percentage of each as specified above or decided after tests. Continuous batching and mixing plant shall be used. Asphalt/bituminous mixing plant proposed to be used by the contractor for the preparation of asphalt/bituminous mixes shall conform to all of the requirements of the job, which shall produce uniform mixtures of the required quality.

- (h) The temperature of bituminous concrete when leaving the mixer shall not be less than 138 °C (280 °F) and it shall not be less than 121 °C (250 °F) at the time of laying.
- (i) The bituminous concrete shall be transported to the site of work in suitable tipping vehicles properly insulated and covered with canvas or other suitable materials to protect the mixture from weather conditions and to retain the heat.
- (j) The mixture shall be spread with mechanical self powered spreader. The bituminous concrete shall be laid to the specified line, curve, grade and camber. Any irregularities shall be corrected immediately before rolling is started. Before laying the mixture, the faces of the joints shall be painted with a uniform coating of hot bitumen. The bituminous concrete shall be laid to such loose depth as to give a compacted layer of specified thickness as per item in the schedule of quantities.
- (k) Compaction : The bituminous concrete layers shall then be allowed to cool sufficiently such that it does not spread under wheel load of 10/12 tonne power roller. The compaction shall be done by the roller till no wheel mark are left on the surface and no further compaction is possible. The road shall be opened to traffic on cooling of the concrete to the atmospheric temperature or after a lapse of 24 to 40 hr. after laying.

9.0 GENERAL REQUIREMENTS FOR BITUMEN MACADAM, CONCRETE & SEAL COAT:

- 9.1 Testing: The contractor shall have a well equipped testing laboratory with a competent laboratory staff. Daily tests (not less than two specimen per day) shall be made by them on the bituminous mixture produced to ensure compliance with these specification and copy of the test results duly signed by the competent authority shall be submitted to Engineer-in-Charge for record. Tests shall include water absorption, stability, filler content etc.
- 9.2 The contractor shall give all facilities at all times to the Engineer-in-Charge or his representative to inspect the work or testing done by him.
- 9.3 Weighing: Each lorry leaving the plant must be weighed on a weigh bridge in the presence of the representative of the Department and a challan must be issued along with the lorry in duplicate showing the weight of the material loaded in the lorry. As and when required, the said lorries shall also be weighed at the Departments weigh bridge or any other weigh bridge approved by the Engineer-in-Charge to check the tonnage of the material stated on the challans. In case of short fall, the same shall be made good by the contractor without extra cost.
- 9.4 Testing Surface : The completed surface when ready for acceptance shall be thoroughly compacted, smooth, true to line, grade, camber and free from irregularities when tested by means of a straight edge of 3 m. long, laid on the finished surface parallel with the centre line of the road, the surface shall in no place vary more than 6mm. from the working edge.
- 9.5 MODE OF MEASUREMENT:

(a) Measurement for bituminous macadam including filling in pot holes and depressions shall be paid by weight measured in metric tonne used on the job (or as specified in the schedule of quantities), completed satisfactorily, measured up to second place of decimal including preparing surface, applying tack coat, mixing, transportation and compacting by roller etc. complete as specified.

(b) Measurement for bituminous concrete and seal coat shall also be paid by weight as measured at site of work, irrespective of the thickness laid, in Metric tonne used on the job (or as specified in the schedule of quantities), compacted satisfactorily, measured up to second place of decimal including all the relevant items of work specified, complete.

10.0 Dry Rubble stone pitching & grouting :

Rubble shall be of selected quality and shall be got approved by the Engineer-in-Charge before use. The stone used shall be perfectly sound and regular in shape as possible and with lengths equal to the thickness of the required pitching. The stone shall be as far as practicable, selected as to size and shape to secure fairly large flat surface stones, which will lay with an even surface and minimum of voids. The stones shall be placed on edges with broadest base down and face normal to the slope. Beginning at the bottom of the slopes stones shall be laid compactly with broken joints and so matched and interlocked that they shall be keyed together with a minimum of joint space. Rock fragments and spalls shall be lightly driven in to the interstices to wedge the pitching in place and close direct openings to underlying slope. The thickness of pitching shall be as mentioned in schedule of quantities.

The joints of the pitching thus laid shall be grouted and flush pointed with cement mortar as specified in item of work and kept constantly wet for 10 days. The measurements for pitching and grouting shall be on of area laid in square metres and paid separately under relevant item. Deductions shall be made for openings in pitching, if any.

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SPECIFICATIONS
FOR
PRECAST REINFORCED CEMENT CONCRETE JALLI

1.0 GENERAL:

The item refers to manufacturing, supplying and fixing in position reinforced cement concrete jalli with thickness, proportion, design and pattern as specified in the description of item of schedule of quantities.

2.0 MATERIALS:

The concrete shall consist of a mix as specified in the item and specifications for cement concrete shall be similar to that specified under cement concrete. Reinforcement shall be as specified in the item description or as shown in the drawing or as directed by the Engineer-in-charge.

3.0 MANUFACTURE:

Precast jalli of approved design and thickness as specified in description of item shall be cast at site and fixed in position at all floors and levels by the contractor. Steel moulds to manufacture approved size, design and thickness of reinforced jalli as per drawings shall be manufactured and got approved before starting large scale casting. Reinforced jalli shall be cast at site. M.S. reinforcement of 6 mm. dia. or as specified shall be bent to the exact shape of jalli to run vertically and horizontally along centre of all walls and suitably kept in position. Use of teak wood/shuttering plywood moulds can be allowed at the discretion of the Engineer-in-charge. Precast Jalli shall be made by filling the moulds of the approved design, pattern with complete batch of 1:2:2 (using 10 mm. down graded stone aggregate) cement concrete so that the entire work may set in one time. If one batch is sufficient to complete a unit, each succeeding batch should follow the preceding batch as quickly as possible. The specifications for reinforced cement concrete shall conform to I.S. 456-2000 and as specified earlier. The jalli shall be cast according to drawing, design and as approved by the Engineer-in-charge. Necessary holes and keys for M.S. dowels to house in the jalli shall be left for fixing. Jallies shall be cured in a curing tank for a minimum period of 14 days. All the imperfection in surfaces and edges shall be repaired with neat cement paste to finish with sharp and smooth edges. The jalli so manufactured shall be perfectly at right angles when checked with straight edge. Jallies which are not approved due to defective pattern, shape, finish etc. shall be removed forthwith from the site of work.

4.0 FIXING:

The jalli shall be fixed in position in cement mortar 1:2 in preformed opening true to line, level and plumb with 6 mm. M.S. pins, all as per drawing or as directed by the Engineer-in-charge. Jalli with damaged edges of surfaces shall not be fixed. The joints shall be cured for a minimum period of 7 days. After grouting the sides with cement mortar etc., the jalli shall be rechecked for its levels and alignment. Finally the jambs, sills and soffits shall be plastered embedding the jalli uniformly on sides. The jalli shall be cleaned off all the mortar splashes, dirt etc.

5.0 MODE OF MEASUREMENT:

The jalli shall be measured in square metre and shall be measured between the limiting dimensions of unplastered sides, base and top. Any portion of jalli embedded in the supporting wall shall not be measured for payment. Dimensions shall be measured correct upto two places of decimal of a metre and the area worked out upto two places of a decimal of square metre. No deduction shall be made for the openings in the jalli. The thickness shall not be less than that specified.

6.0 RATES:

Rate to include the cost of the following :

- 6.1 Providing the precast jalli of approved design conforming to specifications detailed above including concrete reinforcement, moulds etc.
- 6.2 All materials, equipment, labour for handling, transporting, hoisting and fixing the jalli in position including scaffolding, forming grooves if necessary, touching up all sides wherever necessary as per drawing and specifications.

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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, aluminium plates etc. strictly as per these specifications and relevant drawings.

2.0 MATERIALS:

- 2.1 Materials for expansion joint filler boards shall be of best quality bitumen impregnated performed non-extruding, resilient type of specified thickness in the standard sizes available.
- 2.2 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.
- 2.3 The aluminium plates for fixing at floor level shall be of specified size and out of extruded sections, free from any rolling defects.
- 2.4 The aluminium sheet for fixing at bottom of beams or sides of columns shall be of specified size without any defects.

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 deshuttering, the surface shall be cleaned off all grit, mortar, cement plaster etc. and edges filled with the sealing compound, and properly pressed to render smooth and uniform surface.
- 4.3 If desired by the Engineer-in-charge, the aluminium 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.

4.4 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.

4.5 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 horizontal flat board is laid to the extent of 150 mm., or so as shown in drawing as per procedure laid down here- in- before.

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 aluminium 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.

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SPECIFICATIONS
FOR
ROUGH/NATURAL FACED SHAHABAD STONE PAVEMENT

1.0 MATERIALS:

- 1.1 Hand cut rough/natural faced shahabad stone shall be of the best quality and of the specified thickness, size etc. and shall be got approved by the Engineer-in-Charge. The sizes given in schedule of quantities are tentative and can vary only slightly as per the availability in the market. At its thinnest, no stone shall be thinner than specified thickness. The stone shall be hard, sound, durable, tough, free from flaws, cracks, decay & weathering. The edges shall be hand cut and dressed true and squares. The evenness of surfaces and edges of the slabs shall not be marred by careless dressing or handling and no patching up shall be allowed for the slab. The edges shall be reasonably straight. The under face may be left as required or rough dressed. Before taking up the work, samples of stone slabs to be used and their dressing shall be got approved by the Engineer-in-Charge. The work shall be carried out strictly in accordance with the approved samples.

2.0 BEDDING/BACKING COAT:

- 2.1 In case of plinth protection or other pavements over concrete sub base, the mortar bedding shall be of cement mortar of thickness and mix specified in the item of tender schedule.
- 2.2 In case of pavement work for footpaths, approaches and other similar works, to be laid directly over levelled and consolidated ground, the bedding shall be of 150 mm. thick quarry spoil and 60 mm. thick stone grit or as specified/directed by the Engineer-in-Charge.

3.0 LAYING AND FIXING THE STONE SLABS/ TILES:

- 3.1 The specifications for Kotah stone flooring/skirting/facia described here-in-before shall hold good as far as it is applicable except that the joints shall be pointed with C.M. 1:3 or with other specified mix, finished flush/with grooves as specified/directed. The joints shall be raked out uniformly to a depth of not less than 12 mm. before grouting and pointing the same.

4.0 CURING:

- 4.1 The pavement work shall be kept well wetted for atleast seven days.

5.0 CLEANING:

- 5.1 When the bedding and joints have completed, set and attained required strength, the surface shall be thoroughly cleaned and handed over free from any mortar stains, dust, dirt etc.

6.0 MODE OF MEASUREMENT:

- 6.1 The above pavement work shall be measured in square metre correct to two places of decimal. The length and breadth shall be measured net correct to a centimetre. The pavement under skirting/dado/wall plaster, if any, shall not be measured for payment.
- 6.2 No deduction shall be made nor extra paid for any opening of area up to 0.10 sqm. Nothing extra shall be paid for use of cut tiles/slabs nor for laying the pavement at different levels.

NOTE : Wastage in obtaining the required sizes as specified from the commercial sizes available in market is deemed to be taken in to consideration by the contractor while quoting the rate. The work shall be measured as above and no extra claim on this account will be entertained.

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SPECIFICATIONS
FOR
INTERLOCKING PAVER BLOCK

1.0 SCOPE:

The work covered under this specification includes all interlocking tiles will be fixed on min 50 mm thick compacted sand.

2.0 GENERAL:

This item shall be carried out generally as described in the relevant item of schedule and as directed by the Engineer – in – charge.

All the materials required for making the paver blocks shall be of approved quality and procured by the contractor at his own cost. The color and pattern of the paver blocks proposed to be used in the work shall be got approved by the Department prior to manufacturing. The thickness of the paver blocks shall be not less than 60 mm. The thickness of the wearing surface shall not be less than 7 mm. The mix proportion of the wearing surface and backing layer shall be got approved prior to start of manufacturing. The blocks shall have a compressive strength of not less than 350 Kg. per square centimeter. The block shall be procured from the approved manufacturers only. The paver blocks, after manufacturing shall be got inspected by the Departmental Engineers before dispatching the site. The blocks shall be got tested at an approved testing laboratory as specified by the department at the cost of contractor. Manufacturing and testing shall be carried out in accordance with IS: 1247 (Latest revision). The blocks approved by the Engineer-in-charge after duly testing at laboratory shall only be dispatched to the site.

3.0 MAKING:

The sub base, either PCC or other, shall be properly cleaned, leveled and prepared to lay the paver blocks. The blocks shall be fixed between the kerb stones and walls or as the case may be at site as per the approved design, pattern and drawings. The blocks shall be fixed over a bed of 50 mm thick sand properly compacted and leveled as required. The interlocking blocks shall be fixed by the skilled and experienced labourers only. Necessary cutting of blocks as required shall be done without any extra cost at the edges, ends of walls, kerb stones and as per site conditions. No extra cost shall be paid for wastage by the Department. After laying the blocks, the finished job shall be thoroughly compacted/vibrated by means of mechanical vibration. If any settlement /dislocation is found after vibration, the same will be got rectified without any extra cost. After vibration, the excess sand shall be removed and the pavements shall be made neat and clean. The cost of sand bed shall be deemed to be included in the cost of item and no extra shall be paid for the same.

4.0 MODE OF PAYMENT:

The mode of measurements shall be on square metre bases only. The actual area of work done between kerb stones / walls shall be measured to the nearest centimeter and paid. Any opening /chamber etc. whose area is more than 0.25 square metres shall be deducted.

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 generalised 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 bye-laws of the Municipal Committee/Municipal Corporation/Development Authority/Improvement Trust etc. under the jurisdiction of which the work is to be executed 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.

The Chief Engineer, BARC, DAE, shall be the sole deciding authority as to the meaning, interpretations and implications for various provisions of the specifications and his decision in writing shall be final and binding on all concerned.

In case 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 any difference or discrepancy between

the specifications for Civil works and specification for Public Health Engg. works, specifications for Civil works shall take precedence.

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 on the latest approved list of Mumbai Municipal Corporation/Local bodies if any, 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 encounter 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 tenderer 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 floor 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 work shall be carried out in a manner complying in all respects with requirement of relevant bye-laws of the Municipal Committee/Municipal Corporation/Development Authority/Improvement Trust under the jurisdiction of which the work is to be executed 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

Indian Standard	Reaffirmation	Subject
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 01	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

Indian Standard	Reaffirmation	Subject
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 (M S 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.

Indian Standard	Reaffirmation	Subject
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

Indian Standard	Reaffirmation	Subject
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 2001	Specification for concrete porous pipes for 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 steels 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 1999	Butterfly valves
4927- 1992	Reaffirmed 2002	Unlined flax canvass hose for fire fighting
4947 – 1985	Reaffirmed 2000	Specification for gas cartridge for use in Fire extinguishers.
4984- 1995	Reaffirmed 2002	Specifications for HDPE pipes for water supply

Indian Standard	Reaffirmation	Subject
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 2001	Equipment for grit removal
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

Indian Standard	Reaffirmation	Subject
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 unplasticised 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 ⁰ elbows
7834- 1987 (Pt. III)	Reaffirmed 2003	Specific requirements for 90 ⁰ elbows
7834- 1987 (Pt. IV)	Reaffirmed 2003	Specific requirements for 90 ⁰ tees
7834- 1987(Pt.V)	Reaffirmed 2003	Specific requirements for 45 ⁰ 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 03	Specific requirements for caps
8008 (Pt. I to VII)		Injection moulded HDPE fittings for potable water supplies
8008- 2003 (Pt. I)	--	General requirements for fittings
8008- 1976 (Pt. II)	Reaffirmed 1997	Specific requirements for 90 ⁰ bends
8008- 2003 (Pt. III)	--	Specific requirements for 90 ⁰ tees
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 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

Indian Standard	Reaffirmation	Subject
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 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 fittings.
12183- 1987 (Pt. I)	Reaffirmed 2004	Code of practice for Plumbing in multi-storied 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	Glassfiber 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 & sewage.

Indian Standard	Reaffirmation	Subject
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 2004	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 FITTINGS:

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(outlet)	1729-2002/ 3989- 1984	6.50 Kg.
9 b	C.I. Floor Trap 100 mm inlet dia.	75mm(outlet)	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	(rectangular 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		275 Grams
15	Cast Iron surface box for sluice valve (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 Department'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 I.S. 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	Frequency of sampling	Remarks
1	2	3	4	5	6	7
G.I. pipes	Physical Dimensional Nominal unit wt. Tensile, Elongation Chemical Mass of zinc coating Sulphur, Phosphorus	Field/lab Field/lab Lab Lab Lab Lab	IS 4736 IS 228 IS 228	>20 tubes >20 tubes >1000/ 500 up to 25 mm bore >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	Dimensional Unit weight Hammer test Hydrostatic test Hardness & grade	Field/lab Field/lab Field/lab Field/lab -----		> 20 copies > 20 copies -----	Sampling & Conformity as per IS 1536/2001 IS1500	Hardness & grade shall be optional

C.I. pipe Soil quality	Dimensional Unit weight Hammer test Hydrostatic test Hardness & grade	Field/lab Field/lab Field/lab Field/lab ----- -		> 20 pipes > 20 pipes -----	Sampling & Conformity as per IS 3981, IS1729 IS 1500	Hardness & grade shall be optional
Pig lead	Chemical Analysis	Lab	IS 1817	Lot > 1000 kg, if less Mfr. test report to be furnished	Each lot > 1000 kg.	
Stone ware pipes	Hydraulic Test, Absorption Test, Test for Acid Resistance Test for Alkali Resistance, Crushing strength Test For Alkali Resistance crushing strength test	Lab	IS 651	3no for lot of 150 5 no. for 151 to 1200 8 no. for 1201 to 10000		
Cement / Bricks	As per Civil specification					
PreCast 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)	
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
CI man hole frame & covers	Dimension Load test	Lab	IS 1726	>50 frame & covers/ gratings	Sampling as per IS 1726	
Humepipe 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	Manufacturer's Test certificate To be produced 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, the payment shall be made based on the actual unit weight as determined by testing at random sampling.

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 sub standard, 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 foundations, 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 upto 30 cm. measured at a height of one metre above ground and rubbish removed upto 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 Department 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 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 mounds, pits or undulations are met with, 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 m. 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, BOULD : 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 BLASTING : Where blasting is permitted the excavation in rock shall be done by means of blasting. No heavy blasting will be permitted and only controlled/muffled blasting will be permitted at the discretion of the Engineer-in-Charge. The Contractor shall be governed by the relevant statutory laws, rules and regulations on explosives, pertaining to the acquisition, transport, storage, handling and use of explosive which shall be rigidly followed and shall obtain himself all necessary materials and equipment for blasting. Blasting shall be executed through a licensed blaster with prior permission from police authorities. Prior to blasting sufficient notice shall be given to concerned parties to avoid danger to people, materials and nearby structures. All the damages caused by careless blasting if any shall be made good by the contractor at his own expenses.

e) 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 mudmat 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.
- e)

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 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 90% 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 200 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 around 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 upto 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 shall be measured from ground level. Excavation up to 1.5 m depth below ground level and depositing excavated material on the ground shall be included in the item of earthwork for various kinds of soil. Extra lift shall be measured in unit of 1.5 m or part thereof. Obvious lift shall only be measured; that is lifts inherent in the lead due to ground slope shall not be measured except for lead upto 250 m. All excavation shall be measured in successive stages of 1.5 m stating the commencing level. This shall not apply to cases where no lift is involved as in hill side cutting.

2.1.13 MODE OF MEASUREMENTS:

2.1.13.1 All excavation in areas having depth more than 30 cm. 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. Only such approved slopes not exceeding 3:1 or as per the actual excavation whichever is less shall be measured and paid for. Safety of excavation work shall be the responsibility of the contractor. Excavation in areas having depths less than 30 cms. shall be measured as surface excavation on square metre basis, mentioning the average depth of excavation.

Reasonable working space beyond concrete dimension required for waterproofing and shuttering where considered necessary in the opinion of Engineer-in Charge will be allowed in execution and considered for payment for underground water tank, sump, septic tank etc.

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.

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 upto 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 earth work 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 INSTALLATIONS

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 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 100 mm 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 C.I. 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 SCI 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.
3. Testing the entire system and rectification of defects, if any.
4. 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 IS2548 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 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. 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 RCC platform with stone tapping either fully sunk in stone top or flush with stone topping.

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 BOWL TYPE (WITH FLUSHING RIM) : Urinal basin shall be flat back or corner wall type lipped in front. The vitreous china conforming to IS 2556 (Part VI). Urinal shall have an 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 BOWL TYPE 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 in side 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 tank	Size of C.P. brass Flush pipe	
		Main	Distribution
One	5 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 BOAL TYPE 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 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. There shall be of 100 mm dia white glaze 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 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 unit of marble/granite partition fixed.

3.6.06 MODE OF PAYMENT The contract rate shall be for each unit 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 MEASUREMENT : 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 as per 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 rawl plug embedded in the wall. Vitreous china toilet paper roll holder shall 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 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 end 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 confirming 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 IS: 775.

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 s.s. sink fixed.

3.13.06 MODE OF PAYMENT : The contract rate shall be for each unit s.s. 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 sheet 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 lid 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 600 x 125 mm or 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 around 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 :

3.18.01GENERAL:The item includes prdg. 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 STOP COCKS :

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)

<u>Size</u>	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 with stand 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 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 I.S. 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 BATH TUB (Enamelled steel sheet) :

3.25.1 GENERAL : Item includes providing sheet steel bath tub of size and without side panel as specified in the schedule of quantities including fixing or placing.

3.25.2 MATERIAL : The bath tub shall conform to IS 3489. The bath tub shall be constructed of the fewest practicable number of sections which shall be such as to ensure a suitable finished surface for the reception of the enamel coating. Any welded surface shall be adequately cleaned off inside and outside the bath tub. The necessary surface shall be free from undulations, drawing line and other defects deleterious to the provision of a satisfactory enamel coating.

The interiors of the bath tub shall be adequately and evenly coated with vitreous enamel. The enamelling shall conform to IS : 772. Thickness of the enamel shall not be less than 0.2 mm and not more than 0.5 mm, External surface of the bath tub shall be given one ground or primer enamel coating. Gloss, colour & opacity shall be uniform and visually satisfactory. The finish shall be free from crazing, dimples, rundown sagging tilters not more than two in number on the interior surface, pinholes not more than two in number for coloured bath tubs and not more than four for white enamelled bath tubs, specks shall be less than one mm in size and max. five in number and there shall be no grouping of pinholes and specks. Warpage of edges set against wall or floor and edges of roll rims shall not exceed 5 mm/m., warpage of all other edges shall not exceed 7.5 mm/m.

In forming the roll the outer edges shall be flanged or rolled back underneath sufficiently to prevent exposure of sharp edges. The vertical height of the flanged or rolled edges shall be not more than 30 mm. At the tap end of the roll, there shall be a level area within a radius of at least 25mm from the centre of each tap hole.

3.25.3 FIXING : The bath tubs shall be as flat bottomed as practicable. The fall (slope) long the bottom head end to outlet shall be adequate for complete emptying. The waste hole shall be so formed as to be suitable for receiving 40 mm waste fitting. The bath tubs shall be provided at the tap end, with effective means of attaching an earth continuity conductor. With each bath tub, two spacing washers of suitable thickness to take up the difference between the thickness of the metal of the bath tub and the depth of the seating on pillar taps shall be supplied. In addition, two fibre or lead washers for each tap shall be supplied for fitting above and below the tap roll to prevent the enamel from erasing when the taps are tightened in position.

3.25.4 THE RATES INCLUDES FOR :

1. Enamelled sheet steel bath tub.
2. Placing/fixing the tub on C.I./MS supports.
3. Fixing the side panel if specified in schedule of quantities.
4. All necessary labour, material and use of tools.

3.25.5 MODE OF MEASUREMENT :- The measurement shall be for each unit of bath tub fixed or placed.

3.25.6 MODE OF PAYMENT : The contract rate shall be for each unit of bath tub fixed or placed.

3.26 BATH TUB : (Gel coated G.R.P. resin)

3.26.1 GENERAL : Item includes providing gel coated glass fibre reinforced polyester resin bath tub of size and with or without panel as specified in the schedule of quantities including fixing or placing.

3.26.2 MATERIAL : The bath tub shall conform to IS 6411. The fibre glass used in the manufacture of bath tubs shall be non alkaline conforming to 'E' type or 'A' type Grade. The proportion of the glass fibre shall not be less than 25% of the glass fibre reinforced polyester layer including gel coated layer. Unsaturated polyester resin used in the manufacture of bath tubs shall be resistant to not water and weathering. When filler and colouring materials are used, their quality and proportion should be compatible to the polyester and the materials shall not have any harmful effect on the quality and performance of bath tubs. The bath tub shall possess a uniform gel-coat on the working surface. The resin used in the gel-coat shall be isophthalic grade of polyester or epoxy resin or any equally suitable chemical resistant grade of resin. The get-coat shall not be less than 0.25 mm thickness nor more than 1.00 mm thickness.

In forming the roll, the outer edges shall be flanged or rolled back underneath sufficiently to prevent exposure of sharp edges. The vertical height of the flanged or rolled edges shall be not more than 30 mm. At the tap end of the roll, there shall be a level area within a radius of at least 25mm from the centre of each tap hole.

3.26.3 FIXING : The bath tub shall be one piece unit with an opening for waste outlet with floor sloping towards the outlet. An overflow shall normally be provided on the side near the waste outlet. An apron (side panel) may be provided, integrally or separately with the bath tub as specified in schedule of quantities. The waste opening shall be suitable for the proper installation of waste fittings which are ordinarily used for the purpose. The bath tub shall be provided with a supporting structure integral to the unit in between the space between the bottom of the bath tub and the floor of the building on which the bath tub rests unless otherwise specified. The materials of the supporting structure shall be at least equal to the material of the bath tub in resistance to deterioration with age and shall meet the requirement of fungus and vermin.

3.26.4 THE RATES INCLUDES FOR :-

1. Gel-coated G.R.P.R. bath tub.
2. Placing/fixing the tub on supports.
3. Fixing the side panel if specified in schedule of quantities.
4. All necessary labour, material and use of tools.

3.26.5 MODE OF MEASUREMENT : The measurement shall be for each unit of bath tub fixed or placed.

3.26.6 MODE OF PAYMENT : - The contract rate shall be for each unit of bath tub fixed or placed.

3.27 WASTE COUPLING :

3.27.01 GENERAL : The item pertains to provide chromium plated brass waste coupling including fixing.

3.27.02 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 below, 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.

3.27.03 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.

3.27.04 THE RATE INCLUDES FOR :

1. Waster coupling with necessary specials.
2. All necessary labour, material and the use of tools.

3.27.05 MODE OF MEASUREMENT : The measurement shall be for each unit of waste coupling fixed.

3.27.06 MODE OF PAYMENT : The contract rate shall be for each unit of waste coupling fixed.

3.28 BOTTLE TRAP :

3.28.01 GENERAL : The item pertains to provide chromium plated brass bottle trap including fixing.

3.28.02 MATERIAL : Bottle trap shall be of C.P 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 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.

3.28.03 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.

3.28.04 THE RATE INCLUDES FOR :

1. Bottle trap with necessary specials.
2. All necessary labour, material and the use of tools.

3.28.05 MODE OF MEASUREMENT : The measurement shall be for each unit of bottle trap fixed.

3.28.06 MODE OF PAYMENT : The contract rate shall be for each unit of bottle trap fixed.

3.29 COAT AND HAT HOOK :

3.29.01 GENERAL : The item pertains to provide chromium plated brass coat and hat hook including fixing

3.29.02 MATERIAL : Coat & Hook shall be of three way type of approved and heavy quality. Coat & Hat Hook shall be CP brass and three way hook type or minimum six way patti type of 125 mm x 30 mm x 6mm size. CP coating shall not be less than service grade No.2 of IS 4827.

3.29.03 FIXING : The Coat and hat hook shall be fixed to proper line & level as indicated in drawing with CP brass screws.

3.29.04 THE RATE INCLUDES FOR :

1. Coat and hat hook with CP screws etc.
2. All necessary labour, material and the use of tools.

3.29.05 MODE OF MEASUREMENT : The measurement shall be for each unit of coat and hat book fixed.

3.29.06 MODE OF PAYMENT : The contract rate shall be for each unit of coat and hook fixed.

3.30 FLUSHING CISTERN :

3.30.01 GENERAL : The item pertains to provide white or colour glazed chinaware / PVC / Cast Iron flushing cistern with all inside syphonic fitting including fixing.

3.30.02 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 cast iron, vitreous china, enamelled pressed steel conforming to IS 774 for Flushing Type and 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 section, 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 confirm of IS 1703. The flat shall be made of polyethylene as specified in IS 9762. A high level cistern is intended to operate with minimum height of 125 cm and a low level cistern with maximum height of 30 cm between the top of the pan and under side of the cistern. A G.I chain strong enough to sustain a sudden applied pull of 10 kg or a dead load of 50 kg without any apparent or permanent deformation of the chain rings shall be attached to the ring or hook of the level manually operated high level C.I 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 5 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 confirming to IS 3076 or high density confirming to IS 4984 or UPVC pipe confirming 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 1.25 mm dia.

3.30.03 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.

3.30.04 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.

3.30.05 MODE OF MEASUREMENT : The measurement shall be for each unit of flushing cistern fixed as a whole.

3.30.06 MODE OF PAYMENT : The contract rate shall be for each unit flushing cistern fixed as a whole.

3.31 BRACKET :

3.31.01 GENERAL : The item pertains to provide a pair of bracket for wash basin, sink, Flushing, cistern etc. including fixing.

3.31.02 GENERAL : The item pertains to provide a pair of bracket for wash basin, sink, cistern etc, including fixing.

3.31.03 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.

3.31.04 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.

3.31.05 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.

3.31.06 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 nom. 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-I). 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. The pipe

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-1) 2004

Nominal Bore	Class	Outside Diameter		Wall thickness	Nominal Weight (Kg/M)	
		Maximum.	Minimum		Plain Ended	Screwed & Socketed
		Mm	Mm	in mm		
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	2.3	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

Mark	Class	Colour Code	TOLERANCES					
			THICKNESS		WEIGHT			
					For Single Tube		For 10 tones load	
			(+)	(-)	(+)	(-)	(+)	(-)
L	"Light " class	Yellow Band	Not limited	8.0%	10.0 %	8.0%	7.5%	5.0%
M	"Medium" class	Blue Band	Not limited	10.0 %	10.0 %	10.0%	7.5%	7.5%
H	"Heavy" class	Red Band	Not limited	10.0 %	10.0 %	10.0%	7.5%	7.5%
Random length of tube:- unless otherwise specified 4.0 to 7.0 m includes one socket for screwed & socketed tubes				COATING:- Zinc coating as per IS 4736 (latest revision)				

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
20 mm to 32 mm	2.5 M	3.0 M
40 mm to 50 mm	3.0 M	3.5 M
65 mm to 80 mm	3.5 M	5.0 M

No joints shall be located inside the wall. If the pipe is required to be cut and the end threaded, the ends of the cut end shall be filed smooth and any obstruction in bore shall be entirely eliminated, dwn take line shall be provided with union of 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 shall be taken over the threaded end of the pipe and socket screwed home using the pipe wrench, pipe 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 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 of paying 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.

4.1.08 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

4.1.09 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.

4.1.10 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 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. 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 burns 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 TESTING : Please refer clause No.4.1.07

4.2.11. 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.

4.2.12 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.

4.2.13 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 under ground, 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.

The pipe shall be laid into the trench and screwed with sockets, elbows, tees, bends etc. as necessary. The pipe line laid near electric train lines, power transmission lines, electric railway, power houses etc. should be provided with insulating joints at frequent intervals to guard against electrolysis.

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 4.1.07

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 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.

4.3.10 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 measured along the center line of the pipe line.

4.3.11 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 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.

4.4.05 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 plate at the required temperature around 205, + or - 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 time the working pressure of the pipes.

Pressure shall be applied either by hand pump or power driven pump. Pressure guages 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. 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 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.

4.4.11 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 centre line of pipe. No measurement shall be recorded separately for fitting, making joint, painting if mentioned in schedule of quantities and testing.

4.4.12 MODE OF PAYMENT : The contract rate shall be for unit running meter length of pipe line laid.

4.5 PVC PIPING WORK FOR WATER SUPPLY :

4.5.01 GENERAL : The item includes supplying of PVC 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 4985-1978, PVC 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 PVC 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
25 mm	750 mm	1125 mm
32 mm	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 pipe line 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 TESTING : Please refer clause No.4.4.09

4.5.13 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 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.

4.5.14 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.

4.6 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 C.I. 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 :

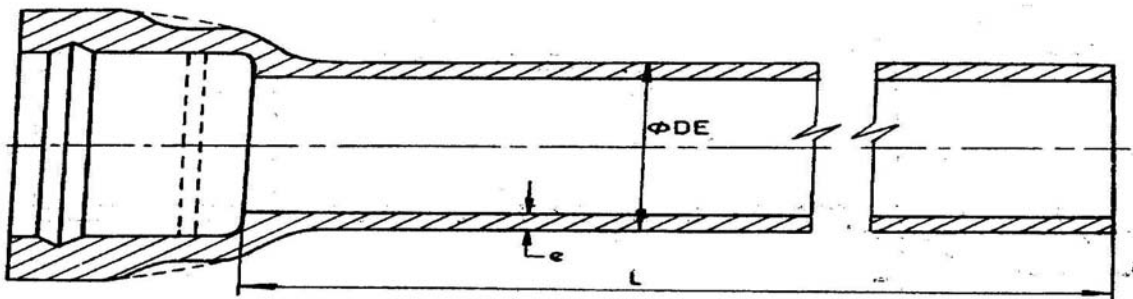
4.9.01 GENERAL : The item includes the provision of supplying water quality cast iron pipe of specified diameter including cutting, laying, fixing, and painting the pipe line.

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 ± 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 Mm		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	237.0	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	52.1	16.8	207.0	225.0	251.0	278.0	304.0	329.0
250	LA	274	271	10.0	59.3	22.9	240.0	260.0	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	70.6	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	450.0	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	519.0	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	610.0	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	973.0	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	20.2	348.9	131.7	1409.0	1527.0	1702.0	1876.0	2051.0	2225.0
	B	790	787	22.0	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	1704.0	1899.0	2093.0	2288.0	2482.0
	B	842	839	23.0	423.1	147.8	1696.0	1840.0	2052.0	2263.0	2475.0	2686.0
900	LA	945	942	20.8	421.8	182.6	1763.0	1910.0	2126.0	2342.0	2558.0	2773.0
	A	945	942	22.9	474.3	182.6	1918.0	2080.0	2317.0	2554.0	2791.0	3028.0
	B	945	942	25.0	516.6	182.6	2073.0	2249.0	2507.0	2766.0	3024.0	3282.0
1000	LA	1048	1045	22.5	518.3	222.3	2119.0	2295.0	2555.0	2814.0	3073.0	3392.0
	A	1048	1045	24.8	570.0	222.3	2308.0	2502.0	2787.0	3072.0	3357.0	3642.0

	B	1048	1045	27.0	619.2	222.3	2489.0	2699.0	3009.0	3318.0	3621.0	3938.0
1050	LA	1124	1118	23.6	583.4	309.6	2445.0	2643.0	2935.0	3227.0	3518.0	3810.0
	A	1124	1118	26.0	641.2	309.6	2656.0	2874.0	3195.0	3516.0	3836.0	4157.0
	B	1124	1118	29.0	713.3	309.6	2920.0	3163.0	3519.0	3876.0	4233.0	4589.0

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 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 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 stoney 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 Pag or driven into ground and other end hold by men which when slowly released till lower the pipe into 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 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. 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 through out their whole length. The entire length of pipe shall be supported on bed of the trench evenly 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 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 C.I. 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. M.S. 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 300. 10 mm thick for pipe above 300 mm.

4.10.02 A : M.S. specials shall be treated with Anticorrosive coating of Bituminous based coro coat.

4.10.03 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.

4.10.04 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.

4.10.05 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.

4.10.06 LOWERING : The specials shall then be placed in trenches by means of proper sheer legs, chains and other tacts and shall be properly driven home.

4.10.07 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.

4.10.08 TESTING : Joints shall be tested to a hydraulic pressure of 10 kg/cm² alongwith testing of pipe line and shall be maintained for minimum two hours. All leakages, defects etc. shall be rectified.

4.10.09 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, springs or any other cause till the completion of work.

4.10.10 THE RATE INCLUDES FOR :

1. Supplying spigot and socket or monolithic double flanged C.I. or M.S. 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.

4.10.11 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.

4.10.12 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 3114 : 1994

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 pipe are jointed on large scale, three a 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.

4.11.09 MODE OF MEASUREMENT : The measurement shall be for each unit of lead joint made.

4.11.10 MODE OF PAYMENT : The contract rate shall be for each unit of lead joint made.

4.12 G M 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./G.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 allround 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 casted 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 1000 x 1000 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 casted alongwith galvanised M.S. 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 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 road surface of prescribed weight shall be fixed to the cover slab during casting the slab for key rod operation.

Road surface box shall be of size 100x125x150 mm conforming to IS 3950 having hinged 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./ M.S. flanges shall be conforming to I.S.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, 4° for 350 to 400 mm nom bore and 3° 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 pulle

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),PN0.6 (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 C.I. 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. C.I. 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, C.I. 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 C.I. 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, C.I. 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 C.I. Sluice valve fixed.

4.22 FERRULE CONNECTION :

4.22.01 GENERAL : The item includes making ferrule connection with existing C.I. or G.I. water supply line including fittings and fixtures.

4.22.02 MATERIAL : The ferrule shall be of gun metal or hard brass of diameter as specified in the schedule. It shall be fitted with screwed plug or valve capable of completely shutting off water supply. Coupling shall be casted in one piece with cast iron bell mouth cover.

4.22.03 FIXING : The ferrule shall be fixed to the water supply pipe line of specified diameter without protruding inside including making hole in the water main and covering with cast iron bell mouth cover. The ferrule shall be fitted water tight.

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 : Ferrule 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. Ferrule, coupling and cast iron bell mouth cover.
2. Boring hole in the water main and fixing ferrule.
3. Dewatering the trench or pit till completion of work.
4. All necessary labour, materials use of tools.

4.22.07 MODE OF MEASUREMENT : The measurement shall be for each unit of ferrule connection.

4.22.08 MODE OF PAYMENT : The contract rate shall be for each unit of ferrule connection.

4.23 MAKING CONNECTION WITH WATER MAIN:

4.23.01 GENERAL : The item includes connection with the existing C.I. or G.I. water supply line including fittings & fixtures.

4.23.02 MATERIAL : C.I. or G.I. specials shall be conforming to relevant IS code and flange joint or lead joint shall be as per specifications described herein before.

4.23.03 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.

4.23.04 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.

4.23.05 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.

4.23.06 THE RATE INCLUDES FOR :

1. Cutting, disjointing the C.I. or G.I. water supply line.
2. Supplying of C.I. 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.

4.23.07 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.

4.23.08 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.

4.24 MAKING CONNECTIONS WITH MUNICIPAL WATER MAIN :

4.24.01 GENERAL : The item includes connection with existing C.I. or G.I. water supply line including fittings and fixtures.

4.24.02 MATERIAL : C.I. of G.I. specials shall be conforming to relevant IS code and flange joint or lead joint shall be as per specifications described herein before.

4.24.03 MUNICIPAL CHARGES : If the connection shall be made with the water supply line of Municipal Corporation, the contractor shall obtain necessary permission from the concerned municipal authorities. He shall pay all the necessary charges towards the connection being permitted by the Municipality.

4.24.04 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 CI or GI. specials as per site requirement including making flanged joint or lead joint.

4.24.05 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.

4.24.06 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.

4.24.07 THE RATE INCLUDES FOR :

1. Cutting, disjoining the C.I. or G.I. water supply line.
2. Supplying C.I. or G.I. specials.
3. Making flanged joint, lead joint or screwed joint including providing new flange.
4. Dewatering the trench or pit till completion of work.
5. All necessary labour, material and use of tools.

4.24.08 MODE OF MEASUREMENT : The measurement shall be for one job of 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.

4.24.09 MODE OF PAYMENT : The contract rate shall be for one job of making connection with existing water supply line.

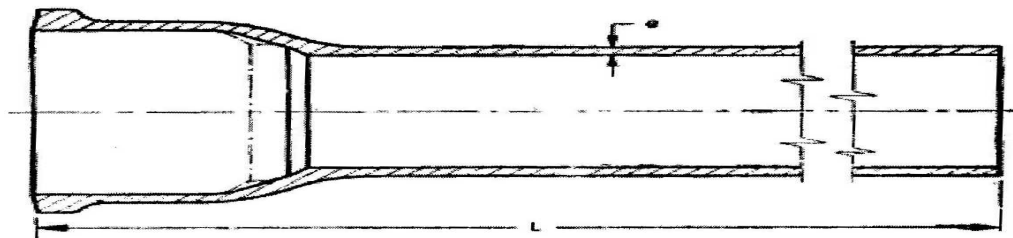
5.0 DRAINAGE SYSTEM

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 (+ / -) 10 mm

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 m	0.90 m	0.75 m	0.6 m	0.45 m	0.3 m
			kg.	kg.	kg.	kg.	kg.	kg.	kg.	kg.	kg.
1.	50 mm	5 mm	12.65	11.41	9.56	7.9	6.0	5.1	4.2	3.3	2.4
2.	75 mm	5 mm	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	2.5m	2.0m	1.8m	1.5m
			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 M.S. 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 day's 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 M.S. 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 day's 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 G.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 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 the 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 of 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./M.S. 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

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 under ground 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 bowl 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 G.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 PVC PIPING WORK :

5.4.01 GENERAL : The item includes supplying of PVC 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, PVC 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 G.I./M.S. 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 S.W. 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 230 mm thick in cement mortar 1:6 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 C.I. 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 out let of spout. G.I. Pipe and fitting shall be as per specifications under section IV.

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 G.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 under Section-V.

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 C.I. 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 C.I. spout fixed.

5.10.07 MODE OF PAYMENT : The contract rate shall be for each unit of C.I. spout fixed.

5.11 GARBAGE CHUTE :

5.11.01 GENERAL : The item include supplying of A.C. garbage chute of specified diameter including fixing & cutting.

5.11.02 MATERIAL : Garbage chute shall be of asbestos cement of dimension as mentioned in the schedule. The refuse disposal system shall consist of A.C. pipes, A.C. refuse junction, A.C. adapter of suitable size and M.S. or Aluminum hopper of 18 gauge suitably capped with vent covers and providing the AC junction at terrace floor opening for periodical flushing / cleaning purpose. Inlet hopper which is to be located at each floor shall be closed with rubber seal along the shutter and shall be of 18 gauge aluminum / M.S. sheet and suitable for all diameter of shafts.

5.11.03 FIXING : A.C. refuse junction shall be fixed at convenient height and it should not exceed 75 cms. From floor level or as directed by the Engineer-in-charge.

Square opening of refuse junctions shall be embedded in masonry or in cement concrete and M.S. Aluminum hoppers shall be fitted with nuts and bolts to the square junction opening and the frame shall flush with the wall.

The refuse disposal system shall be supported by M.S. flats not less than 20 mm x 3 mm thick encircling the pipe or junction below the socket and fixed to the wall with two screws of suitable length on each end of M.S. flats. The entire fixing of the garbage chute shall be carried out as directed by the Engineer-in-charge.

5.11.04 JOINTING : Joints of sockets and spigot shall be caulked to about 25 mm in depth with bitumastic jointing compound and remaining gap may be grouted with 1:2 cement mortar.

5.11.05 THE RATE INCLUDES FOR :

1. The A.C. garbage chute with all fittings
2. Fixing the garbage chute and joining with 1:1 cement mortar.
3. All necessary materials, labour and use of tools.

5.11.06 MODE OF MEASUREMENTS : The measurement shall be for per running meter length of garbage chute fixed.

5.11.07 MODE OF PAYMENT : The contract rate shall be for per running meter length of garbage chute fixed.

5.12 INSPECTION CHAMBER :

5.12.01 GENERAL : The item includes provision of brick masonry Inspection Chamber of internal size as specified in the schedule.

5.12.02 MATERIAL : Concreting, 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 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 1:1 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 in side surfaces.
2. Cutting existing stoneware/RCC Hume 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.

5.12.06 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.

5.12.07 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.

5.13 CIRCULAR MANHOLE :

5.13.01 GENERAL : The item includes provision of brick masonry Circular manhole of internal size as specified in the schedule.

5.13.02 MATERIAL : Concreting, Brick work, plastering etc. shall be as per specification as given in general specification.

5.13.03 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. 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.
5. 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.

5.13.04 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. 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.

5.13.06 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.

5.13.07 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.

5.14 EXTRA DEPTH FOR INSPECTION CHAMBER AND MANHOLE :

5.14.01 GENERAL : The item includes provision for extra depth of Inspection Chamber and manholes of brick masonry.

5.14.02 MATERIAL : Concreting, Brick work, plastering etc. shall be as per specification as given in general specification.

5.14.03 CONSTRUCTION : Extra depth for inspection chamber and manhole shall be constructed under the clause 5.12.00 & 5.13.00 of the Section - 5.

5.14.04 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.

5.14.05 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.

5.14.06 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 lesser depth shall be measured in R.M.

5.14.07 MODE OF PAYMENT : The contract rate shall be for unit meter depth of inspection chamber / circular manhole constructed.

5.15 DROP CONNECTION :

5.15.01 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.

5.15.02 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.

5.15.03 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.

5.15.04 LAYING, FIXING, JOINTING, CLEANING, TESTING : Above shall be done as specified in clause 5.18.00 i.e. salt glazed stone ware piping work.

5.15.05 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.

5.15.06 DEWATERING : The contractor 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.

5.15.07 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.

5.15.08 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.

5.15.09 MODE OF PAYMENT : The Contract rate shall be for one drop connection of specified nominal diameter & depth as specified in the schedule & drawings.

5.16 EXTRA OVER DEPTH FOR DROP CONNECTION :

5.16.01 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 all round square in shape all as specified in drawings & schedule.

5.16.02 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.

5.16.03 DAMAGE / MATERIALS : This clause shall be as per clause 5.21 salt glazed stone ware piping work.

5.16.04 LAYING, FIXING JOINTING, CLEANING AND FIXING : This clause shall be as per clause 5.21 i.e. salt glazed stone ware piping work.

5.16.05 ENCASING THE PIPE LINE : This clause shall be as per clause 5.15.00 as i.e. Drop connection.

5.16.06 DEWATERING : This clause shall be as per clause 5.15.00 as i.e. drop connection.

5.15.07 THE RATE INCLUDES FOR :

1. S.W. 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.

5.16.08 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.

5.16.09 MODE OF PAYMENT : Contract rate shall be for unit meter depth or part thereof for drop connection

5.17 DROP PIPE CLEANING CHAMBER :

5.17.01 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.

5.17.02 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.

5.17.03 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.

5.17.04 RCC PRECAST/CAST IRON COVERS**5.17.04.1 RCC PRECAST COVER (for chambers of size upto 600 x 600 mm) :**

Chamber cover shall be casted 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.

5.17.04.2 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.

5.17.05 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.

5.17.06 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.

5.17.07 MODE OF MEASUREMENT : The measurement shall be for each unit of chamber of specified internal size and depth constructed.

5.17.08 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 1720 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) Notwithstanding (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 5meter 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 S.W. 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	33
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. S.W. 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 S.W. 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 "AA" 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 has 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 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.

5.23 CONNECTION WITH DOMESTIC SEWER :

5.23.01 GENERAL : The item includes the provisions of connecting sewer line with existing sewer line chamber or manhole including cutting, breaking of masonry, road surface and making good to the original condition of the damages.

5.23.02 MATERIAL : Concreting, Brick work, plastering etc. shall be as per specification as given in general specification of section II.

5.23.03 MAKING CONNECTION :

1. Breaking or cutting the road surface for sewer connection.
2. Restoring all the excavated items in proper manner as directed by the Engineer-in-charge
3. Cutting the brick masonry wall to required size of existing manhole or inspection chamber.
4. Connecting the sewer line to the chamber or manhole.
5. Making good to the original condition all the damages after completion of sewer connection.
6. Disposing off all the superfluous material as directed.

5.23.04 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.

5.23.05 THE RATE INCLUDES FOR :

1. Cutting the road surface as required and making good.
2. Restoring all the excavated materials and disposal of superfluous materials.
3. Cutting the manhole masonry, making good masonry and other damages to the original condition according to the bye-laws.
4. Dewatering if found necessary till completion of work.
5. All the necessary labour, materials and use of tools.

5.23.06 MODE OF MEASUREMENT : The measurement shall be for one job.

5.23.07 MODE OF PAYMENT : The contract rate shall be for one job.

5.24 CONNECTION WITH MUNICIPAL SEWER LINE :

5.24.01 GENERAL : The item includes the provisions of connecting sewer line with existing municipal sewer line chamber or manhole including cutting, breaking of masonry, road surface and making good to the original condition of the damages.

5.24.02 MATERIAL : Concreting, brick work, plastering etc. shall be as per specification as given in general specification .

5.24.03 MAKING CONNECTION :

1. Breaking or cutting the road surface for sewer connection.
2. Restoring all the excavated items in proper manner as directed by the Engineer-in-charge.
3. Cutting the brick masonry wall to required size of municipal manhole or inspection chamber.
4. Connecting the sewer line to the chamber or manhole of Municipal sewer line.
5. Making good to the original condition all the damages after completion of sewer connection.
6. Disposing off all the superfluous materials as directed.
7. All necessary labour, materials and use of tools.

5.24.04 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.

5.24.05 MUNICIPAL CHARGES : The contractor shall obtain the necessary permission for connecting the sewer line to the municipal sewer from the concerned authorities. He shall pay all necessary charges towards the connection given by the municipality.

5.24.06 THE RATE INCLUDES FOR :

1. Cutting the road surface as required and making good.
2. Restoring all the excavated materials and disposal of superfluous materials.
3. Cutting the manhole masonry, making good masonry and other damages to the original condition according to the bye-laws.
4. All the municipal charges towards connection.
5. Dewatering if found necessary till completion of work.
6. All necessary labour, material and use of tools.

5.24.07 MODE OF MEASUREMENT : The measurement shall be for one job

5.24.08 MODE OF PAYMENT : The contract rate shall be for one job.

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 Municipality

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 kilogram's. 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 M.S. 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-D-4101 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 / M.S. / 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, G.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. 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 proof ness. 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.

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.

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 occur, 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 E-in-Ch.

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 than 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/recalked.

6.11.08 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 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

ADDITIONAL SPECIFICATIONS FOR CIVIL WORKS

1. WET MIX MACADAM (WMM) SUB-BASE/BASE

1.1. Scope

This work shall consist of laying and compacting clean, crushed, graded aggregate and granular material, premixed with water, to a dense mass on a prepared subgrade/sub-base/base or existing pavement as the case may be in accordance with the requirements of these Specifications. The material shall be laid in one or more layers as necessary to lines, grades and cross-sections shown on the approved drawings or as directed by the Engineer-in-charge.

The thickness of a single compacted Wet Mix Macadam layer shall not be less than 75 mm. When vibrating or other approved types of compacting equipment are used, the compacted depth of a single layer of the sub base course may be increased to 200 mm upon approval of the Engineer-in-charge.

1.2. Materials

1.2.1. Aggregates

1.2.1.1. Physical requirements Coarse aggregates shall be crushed stone. If crushed gravel/shingle is used, not less than 90 per cent by weight of the gravel/shingle pieces retained on 4.75 mm sieve shall have at least two fractured faces. The aggregates shall conform to the physical requirements set forth in Table 16.46 of CPWD specification-2019.

If the water absorption value of the coarse aggregate is greater than 2 per cent, the soundness test shall be carried out on the material delivered to site as per IS:2386(Part-5).

1.2.1.2. Grading requirements: The aggregates shall conform to the grading given in Table 16.47 of CPWD specification-2019. Materials finer than 425 microns shall have Plasticity Index (PI) not exceeding 6. The final gradation approved within these limits shall be well graded from coarse to fine and shall not vary from the low limit on one sieve to the high limit on the adjacent sieve or vice versa.

1.3. Construction Operations

1.3.1. Preparation of base:

The surface of the sub grade / sub base / base to receive the Wet Mix Macadam shall be prepared to the specified lines and crossfall (Camber) as necessary and made free of dust and other extraneous materials. Any ruts or soft yielding places shall be corrected in an approved manner and rolled with 80-100 kN smooth wheeled roller until firm surface is obtained if necessary by sprinkling water. Weak places shall be strengthened, corrugations removed and depressions and pot holes made good with suitable materials, before spreading the aggregate for WMM. Where the existing surface over which the sub base of WMM is to be laid is black topped, to ensure effective internal drainage, furrows 50 mm x 50 mm (depth of furrows increased to reach bottom of bituminous layer where necessary) at one metre intervals shall be cut in the existing bituminous surface at 45 degrees to the central line of the carriageway at one metre intervals in the existing road before the WMM is laid.

1.3.2. Provision of lateral confinement of aggregates:

While constructing wet mix macadam, arrangement shall be made for the lateral confinement of wet mix. This shall be done by laying materials in adjoining shoulders along with that of wet mix macadam layer.

1.3.3. Preparation of mix:

Wet Mix Macadam shall be prepared in an approved mixing plant of suitable capacity having provision for controlled, addition of water and forced/positive mixing arrangement like pugmill or pan type mixer of concrete batching plant. For small quantity of wet mix work, the Engineer may permit the mixing to be done in concrete mixers.

Optimum moisture for mixing shall be determined in accordance with IS:2720 (Part-8) after replacing the aggregate fraction retained on 22.4 mm sieve with material of 4.75 mm to 22.4 mm size. While adding water, due allowance should be made for evaporation losses. However, at the time of compaction, water in the wet mix should not vary from the optimum value by more than agreed limits. The mixed material should be uniformly wet and no segregation should be permitted.

1.3.4. Spreading of mix:

Immediately after mixing, the aggregates shall be spread uniformly and evenly upon the prepared subgrade/sub- base/base in required quantities. In no case

should these be dumped in heaps directly on the area where these are to be laid nor shall their hauling over a partly completed stretch be permitted.

The mix may be spread either by a paver finisher.

The paver finisher shall be self-propelled of adequate capacity with the following features:

- (i) Loading hoppers and suitable distribution system. So as to provide a smooth uninterrupted material flow for different layer thickness from the tipper to the screed.
- (ii) Hydraulically operated telescopic screed for paving width upto 8.5 metre and fixed screed beyond this. The screed shall have tamping and vibrating arrangement for initial compaction of the layer.
- (iii) Automatic leveling control system with electronic sensing device to maintain mat thickness and cross slope of mat during laying procedure. In exceptional cases where it is not possible for the paver to be utilized mechanical means like motor grader may be used with the prior approval of the Engineer-in-charge. The motor grader shall be capable of spreading the material uniformly all over the surface.

The surface of the aggregate shall be carefully checked with templates and all high or low spots remedied by removing or adding aggregate may be required. The layer may be tested by depth blocks during construction. No segregation of larger and fine panicles should be allowed. The aggregates as spread should be of uniform gradation with no pockets of fine materials.

The Engineer-in-charge may permit manual mixing and / or laying of Wet Mix Macadam, where small quantity of WMM is to be executed. Manual mixing / laying in inaccessible / remote locations and in situations where use of machinery is not feasible can also be permitted. Were manual mixing / laying is intended to be used, the same shall be done with the approval of the Engineer-in-charge.

1.3.5. Compaction:

After the mix has been laid to the required thickness, grade and crossfall/camber the same shall be uniformly compacted, to the full depth with suitable roller. If the thickness of single compacted layer does not exceed 100 mm, a smooth wheel roller of 80 to 100 kN weight may be used. For a

compacted single layer upto 200 mm, the compaction shall be done with the help of vibratory roller of minimum static weight of 80 to 100 kN with an arrangement for adjusting the frequency and amplitude. An appropriate frequency and amplitude may be selected. The speed of the roller shall not exceed 5 km/h.

In portions having unidirectional cross fall/superelevation, rolling shall commence from the lower edge and progress gradually towards the upper edge. Thereafter, roller should progress parallel to the centre line of the road, uniformly over-lapping each preceding track by at least one-third width until the entire surface has been rolled. Alternate trips of the roller shall be terminated in stops at least 1 m away from any preceding stop.

In portions in camber, rolling should begin at the edge with the roller running forward and backward until the edges have been firmly compacted. The roller shall then progress gradually towards the centre parallel to the centre line of the road uniformly overlapping each of the preceding track by at least one-third width until the entire surface has been rolled.

Any displacement occurring as a result of reversing of the direction of a roller or from any other cause shall be corrected at once as specified and/or removed and made good.

Along forms, kerbs, walls or other places not accessible to the roller, the mixture shall be thoroughly compacted with mechanical tampers or a plate compactor. Skin patching of an area without scarifying the surface to permit proper bonding of the added material shall not be permitted.

Rolling should not be done when the subgrade is soft or yielding or when it causes a wave-like motion in the sub-base/base course or subgrade. If irregularities develop during rolling which exceed 12 mm when tested with a 3 metre straight edge, the surface should be loosened and premixed material added or removed as required before rolling again so as to achieve a uniform surface conforming to the desired grade and crossfall. In no case should the use of unmixed material be permitted to make up the depressions.

Rolling shall be continued till the density achieved is at least 98 per cent of the maximum dry density for the material as determined by the method outlined in IS: 2720 (Part-8)

After completion, the surface of any finished layer shall be well-closed, free from movement under compaction equipment or any compaction planes, ridges, cracks and loose material. All loose, segregated or otherwise defective areas shall be made good to the full thickness of the layer and recompacted.

1.3.6. Setting and drying: After final compaction of wet mix macadam course, the road shall be allowed to dry for 24 hours.

1.4. Opening to Traffic

No vehicular traffic of any kind should be allowed on the finished wet mix macadam surface till it has dried and the wearing course laid.

1.5. Surface Evenness

All work perform shall confirm to the lines, grades, cross sections and dimensions shown on the drawings or as directed by the Engineer-in-charge, subject to the permitted tolerances described herein after

1.5.1. Horizontal Alignment

Horizontal alignments shall be reckoned with respect to the centre line of the carriageway as shown on the drawings. The edges of the carriage way as constructed shall be correct within a tolerance of ± 10 mm there from. The corresponding tolerance for edges of the roadway and lower layers of pavement shall be ± 25 mm.

1.5.2. Surface Levels

The levels of the Sub-base / base course as constructed, shall not vary from those calculated with reference to the longitudinal and cross-profile of the road shown on the drawings or as directed by the Engineer-in-charge beyond the tolerances mentioned as below:

TOLERANCES IN SURFACE LEVELS OF WMM

Sub-base

- (a) Flexible pavement ± 10 mm
- (b) Concrete pavement ± 06 mm

Base course flexible pavement

- (a) Bituminous Base / Binder Course ± 06 mm
- (b) Granular
 - (i) Machine laid ± 10 mm
 - (ii) Manually laid ± 15 mm

For checking compliance with the above requirement for sub-base / base courses, measurements of the surface levels shall be taken on a grid of points placed at 6.25 m longitudinally and 3.5 m transversely.

The longitudinal profile shall be checked with a 3 metre long straight edge / moving straight-edge as desired by the Engineer-in-charge at the middle of each traffic lane along a line parallel to the centre line of the road.

1.6. Measurements

Wet Mix Macadam shall be measured as finished work in position in cubic metres. The length and breadth shall be measured to the nearest centimetre. The depth of consolidated layer shall be computed to nearest half centimetre by taking average of depths at the centre and at 30 cm from the left and right edges at a cross section taken at 100 metre interval or less as decided by the Engineer in-Charge by making small pits. The consolidated cubical contents shall be calculated in cubic metres correct to two places of decimal.

1.7. Rates

The contract unit rate for Wet Mix Macadam shall be payment in full for carrying out the required operations including all labour, tools, equipments machinery and incidentals to complete the work to the specification as described above.

2. GRANULAR SUB-BASE

2.1. Scope

This work shall consist of laying and compacting well-graded material on prepared subgrade in accordance with the requirements of these Specifications. The material shall be laid in one or more layers as sub-base or lower sub-base and upper sub-base (termed as sub-base hereinafter) as necessary according to lines, grades and cross-sections shown on the drawings or as directed by the Engineer-in-charge.

2.2. Materials

2.2.1. The material to be used for the work shall be natural sand, crushed gravel, crushed stone, crushed slag or combination thereof depending upon the grading required. Use of materials like brick metal, Kankar and crushed concrete shall be permitted in the lower sub-base. The material shall be free from organic or other deleterious constituents and shall conform to the grading given in Table 16.44 of CPWD specification-2019 and physical requirement given in Table 16.45 (of CPWD specification-2019) Gradings III and IV shall preferably be used in lower

sub-base. Grading V and VI shall be used as a sub-base-cum-drainage layer. The grading to be adopted for a project shall be as specified in the Contract. Where the sub-base is laid in two layers as upper sub-base and lower sub-base, the thickness of each layer shall not be less than 150 mm.

- 2.2.2. If the water absorption of the aggregate determined as per IS : 2386 (Part 3); if this value is greater than 2 per cent, the aggregate shall be tested for Wet Aggregate Impact Value (AIV) (IS: 5640). Soft aggregates like Kankar, Brick ballast and laterite shall also be tested for Wet AIV (IS: 5640).

2.3. Construction Operations

2.3.1. Preparation of Sub-Grade:

The surface of the sub grade to receive the Granular Sub-base shall be prepared to the specified lines and crossfall (Camber) as necessary and made free of dust and other extraneous materials. Any ruts or soft yielding places shall be corrected in an approved manner and rolled with 80 – 100 kN smooth wheeled roller until firm surface is obtained if necessary by sprinkling water. Weak places shall be strengthened, corrugations removed and depressions and pot holes made good with suitable materials, before spreading the aggregate for GSB.

Where the existing surface over which the sub base of GSB is to be laid is black topped, to ensure effective internal drainage, furrows 50 mm x 50 mm (depth of furrows increased to reach bottom of bituminous layer where necessary) at one metre intervals shall be cut in the existing bituminous surface at 45 degrees to the central line of the carriageway at one metre intervals in the existing road before the GSB is laid.

2.3.2. Spreading and compacting:

The sub-base material of grading specified in the Contract and water shall be mixed mechanically by a suitable mixer equipped with provision for controlled addition of water and mechanical mixing. So as to ensure homogenous and uniform mix. The required water content shall be determined in accordance with IS:2720 (Part 8). The mix shall be spread on the prepared sub-grade with the help of a motor grader of adequate capacity, its blade having hydraulic controls suitable for initial adjustment and for maintaining the required slope and grade during the operation, or other means as approved by the Engineer-in-charge.

Moisture content of the mix shall be checked in accordance with IS:2720 (Part 2) and suitably adjusted so that, at the time of compaction, it is from 1 to 2 per cent below the optimum moisture content (OMC).

Immediately after spreading the mix, rolling shall be done by an approved roller. If the thickness of the compacted layer does not exceed 100 mm, a smooth wheeled roller of 80 to 100 kN weight may be used. For a compacted single layer upto 200 mm the compaction shall be done with the help of a vibratory roller of minimum 80 to 100 kN static weight capable of achieving the required compaction. Rolling shall commence at the lower edge and proceed towards the upper edge longitudinally for portions having unidirectional crossfall or on super elevation. For carriageway having crossfall on both sides, rolling shall commence at the edges and progress towards the crown.

Each pass of the roller shall uniformly overlap not less than one third of the track made in the preceding pass. During rolling, the grade and crossfall (camber) shall be checked and any high spots or depressions, which become apparent, corrected by removing or adding fresh material. The speed of the roller shall not exceed 5 km per hour.

Rolling shall be continued till the density achieved is at least 98 percent of the maximum dry density for the material determined as per IS : 2720 (Part 8). The surface of any layer of material on completion of compaction shall be well closed, free from movement under compaction equipment and from compaction planes, ridges, cracks or loose material. All loose, segregated or otherwise defective areas shall be made good to the full thickness of layer and re-compacted.

2.4. Measurements

Granular sub-base shall be measured as finished work in position in cubic metres. The length and breadth shall be measured to the nearest centimetre. The depth of consolidated layer shall be computed to nearest half centimetre by taking average of depths at the centre and at 30 cm from the left and right edges at a cross section taken at 100 metre interval or less as decided by the Engineer-in-Charge by making small pits. The consolidated cubical contents shall be calculated in cubic metres correct to two places of decimal. The protection of edges of granular sub-base extended over the

full formation as shown in the drawing shall be considered incidental to the work of providing granular sub-base and as such no extra payment shall be made for the same.

2.5. Rate

The Contract unit rate for granular sub-base shall be payment in full for carrying out the required operations including all labour, tools, equipments, machinery and incidentals to complete the work to the specifications as 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. ROAD MARKINGS STRIPS

The colour width and layout of road markings shall be in accordance with the Code of Practice for Road Markings with paints, IRC : 35, and as specified in the drawings or as directed by the Engineer in-Charge.

4.1. Materials

Road markings shall be of ordinary road marking paint (retro-reflective), hot applied thermoplastic compound as specified in the item.

4.2. Hot Applied Thermoplastic Road Marking

General

- (i) The thermoplastic material shall be homogenously composed of aggregate, pigment, resins and glass reflectorizing beads.
- (ii) The thermoplastic compound shall be screeded/extruded on to the pavement surface in a molten state by suitable machine capable of controlled preparation and laying with surface application of glass beads at a specific rate. Upon cooling to ambient pavement temperature, it shall produce an adherent pavement marking of specified thickness and width and capable of resisting deformation by traffic.
- (iii) The thermoplastic material shall conform to ASTM D36/BS-3262-(Part I).
- (iv) The material shall meet the requirements of these specifications for a period of one year. The thermoplastic material must also melt uniformly with no evidence of skins or unmelted particles for the one year storage period. Any material not meeting the above requirements shall be replaced by the manufacturer/supplier/Contractor.
- (v) Marking : Each container of the thermoplastic material shall be clearly and indelibly marked with the following information:
 - a. The name, trade mark or other means of identification of manufacturer.
 - b. Batch number
 - c. Date of manufacture
 - d. Colour (White or yellow)
 - e. Maximum application temperature and maximum safe heating temperature.
- (vi) Sampling and Testing : The thermoplastic material shall be sampled and tested in accordance with the appropriate ASTM/BS method. The Contractor shall

furnish to the Engineer-in-Charge a copy of certified test reports from the manufacturers of the thermoplastic material showing results of all tests specified herein and shall certify that the material meets all requirements of this Specification.

4.3. Preparation

The material shall be melted in accordance with the manufacturer's instructions in a heater fitted with a mechanical stirrer to give a smooth consistency to the thermoplastic material to avoid local overheating. The temperature of the mass shall be within the range specified by the manufacturer, and shall on no account be allowed to exceed the maximum temperature stated by the manufacturer. The molten material should be used as expeditiously as possible and for thermoplastic material which has natural binders or is otherwise sensitive to prolonged heating, the material shall not be maintained in a molten condition for more than 4 hours.

After transfer to the laying equipment, the material shall be maintained within the temperature range specified by the manufacturer for achieving the desired consistency for laying.

4.4. Properties of Finished Road Marking

- a) The stripe shall not be slippery when wet.
- b) The marking shall not lift from the pavement in freezing weather.
- c) After application and proper drying, the stripe shall show no appreciable deformation or discolouration under traffic and under road temperatures upto 60°C.
- d) The marking shall not deteriorate by contact with sodium chloride, calcium chloride or oil drippings from traffic. The stripe or marking shall maintain its original dimensions and position. Cold ductility of the material shall be such as to permit normal movement with the road surface without chopping or cracking.
- e) The colour of yellow marking shall conform to IS Colour No. 356 as given in IS 164.

4.5. Application

Marking shall be done by fully /semi automatic paint applicator machine fitted with profile shoe, glass beads dispenser, propane tank heater and profile shoe heater, driven by experienced operator as specified in item. For locations where painting cannot be done by machine, approved manual methods shall be used with prior approval of the

Engineer-in-charge. The Contractor shall maintain control over traffic while painting operations are in progress so as to cause minimum inconvenience to traffic compatible with protecting the workmen.

The thermoplastic material shall be applied hot either by screeding or extrusion process. After transfer to the laying apparatus, the material shall be laid at a temperature within the range specified by the manufacturer or otherwise directed by the Engineer-in-Charge for the particular method of laying being used. The paint shall be applied using a screed or extrusion machine.

The pavement temperature shall not be less than 10°C during application. All surfaces to be marked shall be thoroughly cleaned of all dust, dirt, grease, oil and all other foreign matter before application of the paint.

Thermoplastic paint shall be applied in intermittent or continuous lines of uniform thickness of at least 2.5 mm unless specified otherwise. Where arrows or letters are to be provided, thermoplastic compound may be hand-sprayed.

The minimum thickness specified is exclusive of surface applied glass beads.

The finished lines shall be free from ruggedness on sides and ends and be parallel to the general alignment of the carriageway. The upper surface of the lines shall be level, uniform and free from streaks.

4.6. Measurements for Payment

The painted markings shall be measured in sq. metres of actual area marked (excluding the gaps, if any) correct upto the two places of decimal.

The rate includes the cost of all materials, labour and equipments required in all the above operations.

5. REFLECTIVE PAVEMENT MARKERS (RPM) OR ROAD STUDS

5.1. **Scope:** The work shall cover the providing and fixing of reflective pavement marker (RPM) or road stud, a device which is bonded to or anchored within the road surface, for lane marking and delineation for night-time visibility, as specified in the Contract.

5.2. Material

5.2.1. Plastic body of RPM/road stud shall be moulded from ASA (Acrylic Styrene Acrylonitrile) or HIPS (Hi-impact Polystyrene) or Acrylonitrile Butadiene Styrene (ABS) or any other suitable material approved by the Engineer. The markers shall support a load of 13.635 kg tested in accordance with ASTM D 4280.

5.2.2. Reflective panels shall consist of number of lenses containing single or dual prismatic cubes capable of providing total internal reflection of the light entering the lens face. Lenses shall be moulded of merthyl methecrylate conforming to ASTM D 786 or equivalent.

5.3. **Design:** The slope or retro-reflecting surface shall preferably be $35 \pm 5^\circ$ to base and the area of each retroreflecting surface shall not be less than 13.0 sq.cm.

5.4. Optical Performance

5.4.1. **Unidirectional and Bi-directional Studs.** Each reflector or combination of reflectors on each face of the stud shall have a Coefficient of Luminous Intensity (C.I.L.), as specified in Table 16.48 of CPWD Specifications.

5.5. Tests

5.5.1. Co-efficient of luminance intensity can be measured by procedure described in ASTM E 809 “Practice for Measuring Photometric Characteristics” or as recommended in BS:873-Part 4: 1973.

5.6. Fixing of Reflective Markers or Road Studs or Cats Eyes.

5.6.1. **Requirements** The enveloping profile of the head of the stud shall be smooth and the studs shall not present any sharp edges to traffic. The reflecting portions of the studs shall be free from crevices or ledges where dirt might accumulate. Marker height shall not be less than 10 mm and shall not exceed 20 mm, and its width shall not exceed 130 mm. The base of the marker shall be flat within 1.3 mm. If the bottom of the marker is configured, the outermost faces of the configurations shall not deviate more than 1.3 mm from a flat surface. All road studs shall be legibly marked with the name, trade mark or other means of identification of the manufacturer.

5.6.2. **Placement** The reflective marker shall be fixed to the road surface using the adhesives and the procedure recommended by the manufacturer. No nails shall be used to affix the marker so that they do not pose safety hazard on the roads. Regardless of the type of adhesive used, the markers shall not be fixed if the pavement is not surface dry and on new asphalt concrete surfacing until the surfacing has been opened to traffic for a period of not less than 14 hours. The portions of the highway surface, to which the marker is to be bonded by the adhesive, shall be free of dirt, curing compound, grease, oils, moisture, loose or unsound layers, paint and any other material which would adversely affect the

bond of the adhesive. The adhesive shall be placed uniformly on the cleaned pavement surface or on the bottom of the of the marker in a quantity sufficient to result in complete coverage of the area of contract of the marker with no voids present and with a slight excess after the marker has been lightly pressed in place. For epoxy installations, excess adhesive around the edge of the marker, excess adhesive on the pavement and adhesive on the exposed surfaces of the markers shall be immediately removed.

5.6.3. **Warranty and Durability** The contractor shall submit a two year warranty for satisfactory field performance including stipulated retro-reflectance of the reflecting panel, to the Engineer-in-charge. In addition, a two year warranty for satisfactory infield performance of the finished road marker shall also be given by the contractor who carries out the work of fixing of reflective road markers. In case the markers are displaced, damaged, get worn out or lose their reflectivity compared to stipulated standards, the contractor would be required to replace all such markers within 15 days of the intimation from the Engineer-in-charge, at his own cost.

5.7. **Measurement** The measurement of reflective road markers or road studs shall be made in numbers supplied and fixed at site.

5.8. **Rates** The rates include the cost of all the material, labour, tools and equipments required in all the operation described above.

6. CONCERTINA COIL FENCING

6.1. **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.

6.2. **Measurements** The length of fencing shall be measured correct to a cm. for finished work.

7. WELDED STEEL WIRE FABRIC FENCING WITH RCC POSTS

7.1. **Materials** RCC posts and struts shall be as specified in 16.1.12. 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.

7.2. **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.

8. POST DELINEATORS

- 8.1. The role of delineators is to provide visual assistance to drivers about alignment of the road ahead, especially at night. Delineators are particularly effective in the case of complex locations involving changes in horizontal / vertical geometry and during severe weather conditions such as heavy rain, fog or snow. Normally reflectors are used on the delineators for better night time visibility. Road delineators may have a circular, rectangular or triangular cross-section, however the side facing the traffic should not be less than 10 cm wide. In broad sense, Delineators stand for any device or treatment whose aim is to outline the road way.
- 8.2. **Material:** The design, materials to be used and the location of the road delineators shall conform to recommended practice for road delineators, IRC:79, and to relevant drawings and as directed by the Engineer-in-charge. The delineators are to be made of Acrylonitrile Butadiene Styrene (ABS) body fitted with 2 No. 100 mm dia of highly reflective reflectors are mounted on M.S. pipe of 65 mm dia or of size specified otherwise, duly powder coated of minimum 40 microns thickness anti-rust and anti-theft, installed as per direction of Engineer-in-charge. Road delineators may have a circular, rectangular or triangular cross-section, however the side facing the traffic should not be less than 10 cm wide.
- 8.3. **Dimensions:** Height of the delineator should be not less than 800 mm above ground. Width not less than 100 mm. Not more than 300 mm below the ground while being installed.
- 8.4. **Placement and spacing:** As a general rule, delineator posts should be erected at the edge of the usable shoulders, and in the case of kerbed sections at a distance of 0.6 to 1.5 m from the kerb face. On hill roads they may be placed either on the parapet or at the edge of the shoulders. The delineator should be so positioned that the reflectorised face is perpendicular to the direction of travel.
- 8.5. **Warranty:** The contractor shall obtain a two years warranty for satisfactory performance including stipulated retro-reflectance of the retro-reflective sheeting and submit the same to the Engineer-in-charge.
- 8.6. **Measurement** The measurement shall be made in numbers of delineators fixed at site.
- 8.7. **Rate** The rate includes the cost of all the material, labour and equipment required in all the operations described above.

9. RETRO REFLECTIVE SIGN BOARD

General: The colour, configuration, size and location of all the traffic signs for highways other than Express ways shall be in accordance with the code of practice for road signs, IRC:67 or as shown on the drawings. For expressways, the size of the signage, letters and their placement shall be as specified in the contract drawings and relevant specifications or as directed by the Engineer-in-Charge.

9.1.1. Materials

9.1.1.1. Concrete: Concrete shall be of M-25 grade.

9.1.1.2. Reinforcing steel: Reinforcing steel shall confirm to the requirement of IS 1786 unless otherwise specified.

9.1.1.3. Bolts Nuts and Washers: High strength bolts shall confirm to IS 1367 whereas precision bolts, nuts etc. shall confirm to IS 1364.

9.1.1.4. Plates and Supports: Plates and support sections for the sign posts shall confirm to IS 226 and IS 2062 or any other stated IS specification.

9.1.1.5. Substrata: The substrate shall be either aluminium sheeting or aluminium composite material (ACM) confirming to following sub-sections.

9.1.1.5.1. Aluminium: Aluminium sheets used for sign boards shall be of smooth, hard and corrosion resistant aluminium alloy confirming to IS 736 material designation 24345 or 1900.

9.1.1.5.2. Aluminium composite materials:

9.1.1.5.2.1. The Aluminum Composite Material (ACM), used as the substrate for signage application shall have a thickness of at least 4.0mm (excluding coating thickness).

9.1.1.5.2.2. The ACM shall be composed of thermoplastic core of “Low Density Polyethylene” (LDPE) of 3.0mm thickness sandwiched between two thick sheets of aluminium, of 3003 grade and H18 temper and minimum thickness of 0.5mm each. The retro reflection sheeting must be applied on the top surface with aluminium surface with recommended surface preparation from sheeting manufactures.

9.1.1.5.2.3. A fluorocarbon coating may be applied over the exposed surface of aluminum to ensure corrosion resistance and weather proof and thus shall confirm to relevant ASTM.

- 9.1.1.5.2.4. The ACM shall have a high-surface energy coating on the top surface, over which the retro reflective sheeting shall be applied.
- 9.1.1.5.2.5. When measured after 24 hrs after application, the 90 peel-adhesion strength of the top surface of ACM with the retro reflective sheeting applied on it using a 2kg roller as per ASTM D3330 shall be at least 1.5 kg-f.
- 9.1.1.5.2.6. The front surface shall have no other coating other than the high-surface energy coating and shall be protected with a self-adhesive peel-off film. The retro reflective sheeting shall be applied only on the top surface with high-surface energy coating.
- 9.1.1.5.2.7. On the back surface, it shall have a polyester based service coating preferably grey in color to protect against possible corrosion and to avoid undesired glare from the rear side of the sign.
- 9.1.1.5.2.8. The mechanical properties of 4mm ACM and that of its aluminium skim shall confirm to the requirement given in Table 16.44 of CPWD specification-2019. When tested accordance with the test methods mentioned against each of them.
- 9.1.1.5.3. Performance Certificate: Requisite performance certificate from the manufacturer of the ACM stating compliance with ACM technical specification as per Table 16.44 above shall be submitted by the contractor to the Engineer-in-Charge.
- 9.1.1.6. Retro- Reflective Sheeting (Type-XI Prismatic Grade sheeting): (AS per IRC 67-2012 Clause 6.7) The retro reflective sheeting used on the signs shall consist of white or coloured sheeting having a smooth outer surface which has the property of retro reflection over its entire surface. It shall be weather resistant and exhibit colour fastness. It shall be new and unused and show no evidence of cracking, scaling, and pitting, blistering, edge lifting or curling and shall have negligible shrinkage or expansion. A certificate of having the sheeting tested for coefficient of retro reflection, daytime colour and luminance, shrinkage, flexibility, liner removal, adhesion, impact resistance, specular gloss and fungus resistance, 3 years outdoor weathering and its

having passed these tests shall be obtained from International / Government Laboratory / Institute by the manufacturer of the sheeting and in case the certificate is obtained from international agency, it should also be obtained from Indian agency within 3 years of launching of product by the manufacture in abroad. Alternatively, a certificate conforming to ASTM Specification (D 4956-09) on artificial accelerated weathering requirements from a reputed laboratory in India can be accepted provisionally. In such a situation, the Employer/ Client, if so desires, could seek for a performance guarantee which would be released after receipt of certificate meeting the requirement of three years outdoor weathering of the sheeting.

Retro-reflective sheeting is typically manufactured as a cube corner. The reflective sheeting shall be retro-reflective sheeting made of micro prismatic retro-reflective material. The retro-reflecting surface after cleaning with soap and water and in dry condition shall have minimum co-efficient of retro reflection (determined in accordance with ASTM D4956-09) confirming to IRC:67 Table 6.9.

When totally wet, the sheeting shall not show less than 90 per cent of the values of retro-reflection. At the end of 10 years the sheeting shall return at least 80 per cent of its original retro-reflectance.

9.1.1.7. Adhesives : The sheeting shall have a pressure-sensitive adhesive of the aggressivetack type requiring no heat, solvent or other preparation for adhesion to a smooth clean surface, in a manner recommended by the sheeting manufacturer and approved by Engineer-in-Charge. The adhesive shall be protected by an easily removable liner (removable by peeling without soaking in water or other solvent) and shall be suitable for the type of material of the base plate used for the sign. The Adhesive shall form a durable bond to smooth, corrosion and weather resistant surface of the base plate such that it shall not be possible to remove the sheeting from the sign base in one piece by use of sharp instrument. The sheeting shall be applied in accordance with the manufacturers specifications.

9.1.2. Installation

9.1.2.1. Surface to be reflectorised shall be effectively prepared to receive the retro- reflective sheeting. The Aluminium / ACP sheeting shall be de-greased

either by acid or hot alkaline etching and all scale/dust removed to obtain a smooth plain surface before the application of retro-reflective sheeting. Complete sheet of the material shall be used on the signs except where it is unavoidable. Sheeting with heat-activated adhesives may be spliced with an overlap not less than 5 mm or butted with a gap not exceeding 0.75 mm. The material shall cover the sign surface evenly and shall be free from twists, cracks and folds.

9.1.2.2. Sign posts, their foundations and sign mountings shall be so constructed as to hold these in a proper and permanent position against the normal storm wind load or displacement by vandalism. Normally, sign with an area upto 0.9 sq.m shall be mounted on a single post and for greater area two or more supports shall be provided. Sign supports shall be as specified in item or as per directions of Engineer-in-Charge. The work of foundation shall conform to relevant specification as specified.

9.1.2.3. Backside of aluminium sheet portion shall be painted with two coats of epoxy paint. Any part and support frame with two or more coats of synthetic enamel paint.

9.1.3. Performance Certificate Requisite performance certificate from the manufacturer of the ACM stating compliance with ACM technical specification as per Table 16.44 of CPWD specification-2019 above shall be submitted by the contractor to the Engineer-in-Charge

9.1.4. Warranty and Durability: The Contractor shall obtain from the manufacturer a ten year warranty as per IRC:67 for satisfactory performance including stipulated retro-reflectance of the retro-reflective sheeting, the screen printed areas and cut out sheeting and cut out durable transparent overlay film and submit the same to the Engineer-in-Charge.

Processed and applied in accordance with recommended procedures, the reflective material shall be weather resistant and following cleaning, shall show no appreciable discoloration, cracking, blistering or dimensional change and shall not have less than 50 percent of the specified minimum reflective intensity values when subjected to accelerated weathering of 1000 hours, using type E or EH Weather meter (AASHTO Designation M 268).

9.1.5. Measurement These shall be measured in square meters upto two place of decimal.

9.1.6. Rate The rate includes the cost of materials labour and equipment involved in all the operations described above except earthwork, Concrete, Reinforcing steel, Plates and Supports.

10. RETRO REFLECTIVE OVERHEAD SIGNAGE

10.1. **General** Overhead signs may be used in lieu of, or as an adjunct to, ground signs where the situation so warrants for proper information and guidance of the road user. The support system should be properly designed based on sound engineering principles, to safely sustain the dead load, live load and wind load on the completed sign system. For this purpose, the overhead signs shall be designed to withstand a wind loading of 150 kg/m² normal to the face of the sign and 30 kg/m² transverse to the face of the sign. In addition to the dead load of the structure, walkway loading of 250kg concentrated live load shall also be considered for the design of the overhead sign structure.

10.2. **Height** Overhead signs shall provide a vertical clearance of not less than 5.5 m over the entire width of the pavement and shoulders except where a lesser vertical clearance is used for the design of other structures. The vertical clearance to overhead sign structures or supports need not to be greater than 300 mm in excess of the minimum design clearance of other structures.

10.3. Lateral Clearance

10.3.1. The minimum clearance outside the usable roadway shoulder for expressway sign mounted at the road side or for overhead sign supports either to the right or left side of the roadways shall be 1.80 m. This minimum clearance of 1.80 m shall also apply outside of an unmountable kerb. Where practicable, a sign should not be less than 3 m from the edge of the nearest traffic lane.

10.3.2. Where a median is 3.6 m or less in width, consideration should be given to spanning over both roadways without a central support. Where overhead sign supports cannot be placed at a safe distance away from the line of traffic or in an otherwise protected site, they should either be so designed as to minimize the impact forces or protect motorists adequately by a physical barrier or guard rail of suitable design.

10.3.3. Number of Signs at an Overhead Installation In no case should there be more than three signs displayed at any one location, including regulatory or warning signs, either on the overhead structure or on its support.

10.4. Materials for Overhead Sign and Support Structures

10.4.1. Aluminium alloy or galvanized steel to be used as truss design supports shall conform to relevant IS. These shall be of sections and type as per structural design requirements as shown on the plans.

10.4.2. Plates and support sections for sign posts shall conform to IS 226 and IS 2062.

10.4.3. The overhead signs shall be reflectorised with high intensity retro-reflective sheeting of encapsulated lens type.

10.5. Size, Locations, etc. of Signs

10.5.1. The size of the signs, letter and their placement shall be as specified in the Contract drawings and specifications as per direction of Engineer-in-Charge.

10.6. Installation

10.6.1. The supporting structure and signs shall be fabricated and erected as per details given in the plans.

10.6.2. Sign posts, their foundations and sign mountings shall be so constructed as to hold sign in a proper and permanent position to adequately resist swaying in the wind or displacement by vandalism.

10.6.3. The work of construction of foundation for sign supports including excavation and backfill, forms, steel reinforcement, concrete and its placement shall conform to the relevant specifications given in this specification.

10.6.4. The structures shall be erected with the specified camber and in such a manner as to prevent excessive stresses, injury and defacement.

10.6.5. Brackets shall be provided for mounting signs of the type to be supported by the structure. For better visibility, they shall be adjustable to permit mounting the sign faces at any angle between a truly vertical position and three degree from vertical. This angle shall be obtained by rotating the front lower edge of the sign forward. All brackets shall be of a length equal to the heights of the signs being supported.

10.6.6. Before erecting support structures, the bottom of each base plate shall be protected with an approved material which will adequately prevent any harmful reaction between the plate and the concrete.

10.6.7. The end supports shall be plumbed by the use of levelling nuts and the space between the foundation and base plate shall be completely filled with an anti-shrink grout.

10.6.8. Anchor bolts for sign supports shall be set to proper locations and elevation with templates and carefully checked after construction of the sign foundation and before the concrete has set.

10.6.9. All nuts on aluminium trusses, except those used on the flanges, shall be tightened only until they are snug. This includes the nuts on the anchor bolts. A thread lubricant shall be used with each aluminium nut.

10.6.10. All nuts on galvanized steel trusses, with the exception of high strength bolt connections, shall be tightened only to a snug condition.

10.6.11. Field welding shall not be permitted.

10.6.12. After installation of signs is completed; the sign shall be inspected by the Engineer. If specular reflection is apparent on any sign, its positioning shall be adjusted by the Contractor to eliminate or minimize this condition.

10.7. **Measurement** These shall be measured in sq.meter up to two place of decimal.

10.8. **Rate** The rate includes the cost of materials, labour and equipment involved in all the operations described above.

11. CEMENT CONCRETE PAVEMENT UNDER CONTROLLED CONDITIONS

11.1. Shall be executed as per CPWD Specifications-2019- Clause(s) 16.37 and 16.39.

12. GALVALUME SHEET ROOFING

12.1. 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.

12.2. 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.

12.3. 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.

12.4. Laying and Fixing

12.4.1. 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.

12.4.2. 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.

12.4.3. 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.

12.4.4. 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.

12.4.5. The laying operation shall include all scaffolding work involved.

12.4.6. 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.

12.4.7. 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

12.4.8. 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.

12.5. 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.

12.6. Finish

The roof when completed shall be true to lines, and slopes and shall be leak proof.

12.7. Measurements

12.7.1. The length and breadth shall be measured correct to a cm. Area shall be worked out in sqm correct to two places of decimal.

12.7.2. 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.

12.7.3. 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.

12.8. 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.

13. Galvalume roofing accessories

13.1. 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.

13.2. 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.

13.3. 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.

DIMENSIONAL TOLERANCE

1.00.00 GENERAL

1.01.00 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 ashlar 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, $- 1.5$ mm
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

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	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

	Footings	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

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		Length of elements	:	± 20 mm
		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
	Buildings	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
	Reinforced concrete walls	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

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		Size of cross section	:	± 8 mm
	Placement of reinforcement	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
	Anchor bolts	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



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	Plastered surfaces	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

LIST OF SUGGESTED MAKES/ BRANDS/ MANUFACTURERS

- 1.00.0 The makes and brands suggested for 'Part - I - Civil Works' are specified in Tender document (Corrigendum-6), Annexure 'B' available at in www.barc.gov.in → Tenders and NITs, → Other Information. 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.

QUALITY ASSURANCE PLAN FOR CIVIL WORKS

Sr. No	Component / Operation	Characteristics	Class Of Check	Type of Check	Quantum of check	Reference Document	Acceptance Norms	Format of Records				Remarks
								Document	SR	M	C	
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	

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								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

QUALITY ASSURANCE PLAN FOR CIVIL 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
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

QUALITY ASSURANCE PLAN FOR CIVIL 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
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

QUALITY ASSURANCE PLAN FOR CIVIL WORKS

Sr. No	Component / Operation	Characteristics	Class Of Check	Type of Check	Quantum of check	Reference Document	Acceptance Norms	Format of Records				Remarks
								Document	SR	M	C	
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	

QUALITY ASSURANCE PLAN FOR CIVIL 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
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	M	C	
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			
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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								Document	SR	M	C	
1	2	3	4	5	6	7	8	9	10			12
iv	Bituminous 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 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 per before start of work/Source approval.	As Per Spec.	Tech.Spec.	TPC.		W	R	
	b	SPECIFIC GRAVITY	Major	TPL	1 Test per before start of work/Source approval.	As Per Spec.	Tech.Spec.	TPC.		W	R	
	c	PENETRATION VALUE	Major	TPL	1 Test per before start of work/Source approval.	As Per IS : 1203-1978	Tech.Spec.	TPC.		W	R	
	d	SOFTENING POINT	Major	TPL	1 Test per before start of work/Source approval.	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	M	C	
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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Sr. No	Component / Operation	Characteristics	Class Of Check	Type of Check	Quantum of check	Reference Document	Acceptance Norms	Format of Records				Remarks
								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	

QUALITY ASSURANCE PLAN FOR CIVIL WORKS

Sr. No	Component / Operation	Characteristics	Class Of Check	Type of Check	Quantum of check	Reference Document	Acceptance Norms	Format of Records				Remarks		
								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				

QUALITY ASSURANCE PLAN FOR CIVIL 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
		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.

Tentative Quality Assurance Plan for Road works

Sl. No.	Item Description	Field/ Laboratory	Test procedure	Value	As per Standards MoRTH/IRC
I	Bituminous Macadam Road				
A)	Sub base:				
(a)	Excavation	----	----	----	----
(b)	Formation/ Ploughing and Consolidation with Rolling with 8 to 10 tonne roller	Field	IS:2720 (part 8)	Not less than 97% of laboratory dry density IS:2720 (part 8 & 28) (MoRTH- Ref Page 66)	10 Nos of field tests for 3000 Sqm area. (MoRTH- Ref Page 428)
B)	WMM:				
(a)	Test for materials				
	<u>Aggregates</u>				
	(i) Los Angeles Abrasion value	Laboratory	IS 2386 (Part 4)	40% (Max.) (MoRTH- Ref Page 132)	One test per 1000 cu.m of aggregate
	(ii) Aggregate Impact Value	Laboratory	IS 2386 (Part 4)	30% (Max.)	One test per 1000 cu.m of aggregate
	(iii) Grading of aggregate	Field	IS 2386 (Part 1)	As per Table 16.47/ Table 400-13 of MoRTH (MoRTH- Ref Page 132)	One test per 200 cu.m of aggregate
	(iv) Combined Flakiness and Elongation Indices	Laboratory	IS 2386 (Part 1)	35% (Max.) (MoRTH- Ref Page 132)	One test per 500 cu.m of aggregate
	(v) Atterberg limits of portion of aggregate passing 425 micron sieve	Laboratory	IS:2720 (Part 5)	Material finer than 425 micron shall have Plasticity Index (PI) not exceeding 6. (MoRTH- Ref Page 133)	One test per 200 cu.m of aggregate
	(vi) Water absorption of aggregate	Laboratory	IS 2386 (Part 3)	Not more than 2%	
(b)	<u>Laying</u>				
	(i) Rolling			100 mm layers with smooth wheel roller of 80 to 100 kN weight. 200 mm layers vibratory roller of 80 to 100 kN weight. (MoRTH- Ref Page 134)	—
	(ii) Density of compacted layer			1) At least 98 per cent of the maximum dry density for the material. (MoRTH- Ref Page 135)	One set of three tests per 1000 sq.m
C)	Bituminous Macadam Layer				
(a)	<u>Test for materials</u>				
	(i) Quality of binder	Laboratory	IS 73	Should meet the requirements as per Table 1 of IS:73.	Number of samples per lot and tests as per IS:73, IS:217 and IS:8887 as applicable
	(ii) Aggregate Impact Value	Laboratory	IS 2386 (Part 4)	30% (Max.) (MoRTH- Ref Page 171)	One test for 50-100 Cum of aggregate
	(iii) Combined Flakiness Index and Elongation Indices	Laboratory	IS 2386 (Part 1)	35% (Max.) (MoRTH- Ref Page 171)	One test per 350 cu.m for each source
	(iv) Stripping value of aggregates	Laboratory	IS 6241	Min. Retained Coating 95% (MoRTH- Ref Page 171)	One test of each source and whenever there is change in the quality of aggregate
	(v) Water absorption of aggregates	Field or Laboratory	IS 2386 (Part 3)	Max. 2% as per IS:2386 Part III (MoRTH- Ref Page 171)	One test of each source and whenever there is change in the quality of aggregate
	(vi) Grading of aggregates	Field	IS 2386 (Part 1)	As per Table 16.41/ Table 500-7 of MoRTH (MoRTH- Ref Page 172)	Two tests per day
	(vii) Soundness test (Magnesium and Sodium Sulphate)	Laboratory	IS 2386 (Part 5)	5 cycles- Magnesium: Max. 18% ; Sodium Sulphate: Max. 12% as per IS:2386 Part V. (MoRTH- Ref Page 171)	One test for each source and whenever there is change in the quality of aggregate
	(viii) Tack Coat (Quality of Binder)	Laboratory	IS 73	Should meet the requirements as per of IS:73.	Number of samples per lot and tests as per IS:73, IS:217 and IS:8887 as applicable
	(ix) Plastic content	Field	—	6 to 8% of the weight of bitumen	—
	(x) Water sensitivity of mix	Laboratory	—	—	One test of each source and whenever there is change in the quality of aggregate

Sl. No.	Item Description	Field/ Laboratory	Test procedure	Value	As per Standards MoRTH/IRC
	(xi) Mix grading	Laboratory	IS: 2386 (Part I)—1963	—	Two tests per day on both the constituents and mixed aggregate from the dryer
(b)	Laying				
	(i) Application of tack coat (Using Bitumen Emulsion IS:8887)	Field	—	0.20-0.30 Kg per sq.m (MoRTH- Ref Page 169)	—
	(ii) Binder content	Field		Min. 3.3 % (40 mm Agg.); 3.4 % (19 mm Agg.); (MoRTH- Ref Page 172) Or as Specified in the Item.	Two tests per day per plant
	(iii) Quantity of materials as per design mix	At the hot mix plant	—	As per design mix report	Every day
	(iv) Control of temperature of the mix at the time of laying and rolling	Field	—	Laying Temperature: 140 Min. Rolling Temperature: 90 Min. (MoRTH- Ref Page 151) 8 – 10 tonnes dead weight or vibratory roller (MoRTH- Ref Page 154)	At regular intervals
	(v) Density of Comp layer	Laboratory	IS 2386 (Part 3)	Minimum field density equal to or more than 92 percent of the average theoretical maximum specific gravity.	One test per 700 sq.m area
	(vi) Rate of spread of Mixed materials	Field	—	—	At regular intervals
	(vii) Control of grade, camber, thickness and surface finish	Field	—	—	Regularly
D)	Seal Coat / Surface Dressing Layer				
(a)	Test for materials				
	(i) Quality of binder	Laboratory	IS 73	Should meet the requirements as per Table 1 of IS:73.	Number of samples per lot and tests as per IS:73, IS:217 and IS:8887 as applicable
	(ii) Los Angeles Abrasion Value	Laboratory	IS 2386 (Part 4)	Max 30%	One test per 200 cu.m of each source and whenever there is change in the quality of aggregate
	(iii) Combined Flakiness Index and Elongation Indices	Laboratory	IS 2386 (Part 1)	Max 30%	One test per 100 cu.m of aggregate for each source and whenever there is change in the quality of aggregate
	(iv) Stripping value of aggregates (Immersion Tray Test)	Laboratory	IS:6241	Min retained coating 95%	One test of each source and whenever there is change in the quality of aggregate
	(v) Water absorption of aggregates	Laboratory	IS 2386 (Part 3)	Max 2%	One test of each source and whenever there is change in the quality of aggregate
	(vi) Grading of aggregates	Field	IS 2386 (Part 1)	Max 5% passing IS sieve 75 micron	Two tests per day
	(vii) Soundness test (Magnesium and Sodium Sulphate)	Laboratory	IS 2386 (Part 5)	Sodium sulphate: Max 12%; Magnesium sulphate: Max 18%	One test for each source and whenever there is change in the quality of aggregate
	(viii) Water sensitivity retained tensile strength	Laboratory	AASHTOT 283	Min 80%	One test for each source and whenever there is change in the quality of aggregate
	(ix) Polished stone value	Laboratory	B.S. 812 (part 114)	Min 55%	One test for each source and whenever there is change in the quality of aggregate
(b)	Laying				
	(i) Temperature of binder in boiler, aggregate in dryer and mix at the time of laying and compaction	Field	—	—	At regular intervals
	(ii) Rate of spread of materials	Field	—	—	Three tests per day

Sl. No.	Item Description	Field/ Laboratory	Test procedure	Value	As per Standards MoRTH/IRC
	(iii) Percentage of fractured faces (When gravel is used)	Field	—	—	One test per 100 cu.m of aggregate
II Bituminous Concrete					
(A)	Test for materials				
	(i) Quality of binder	Laboratory	IS 73	Should meet the requirements as per Table 1 of IS:73.	Number of samples per lot and tests as per IS:73, IS:217 and IS:8887 as applicable
	(ii) Aggregate Impact Value	Laboratory	IS 2386 (Part 4)	24% (Max.) (MoRTH- Ref Page 171)	One test for 50-100 Cum of aggregate
	(iii) Combined Flakiness Index and Elongation Indices	Laboratory	IS 2386 (Part 1)	Max 35% (MoRTH- Ref Page 171)	One test per 350 cu.m for each source
	(iv) Stripping value of aggregates	Laboratory	IS 6241	Minimum retained coating 95% (MoRTH- Ref Page 171)	One test of each source and whenever there is change in the quality of aggregate
	(v) Water absorption of aggregates	Field or Laboratory	IS 2386 (Part 3)	Max 2% (MoRTH- Ref Page 171)	One test of each source and whenever there is change in the quality of aggregate
	(vi) Deleterious material	Field	IS 2386 (Part 2)	Max 5% passing 0.075mm sieve. The aggregates shall be clean, hard, durable, dry and free from dust and soft or friable matter, organic or other deleterious matter. (MoRTH- Ref Page 171) The plasticity index of the fraction passing the 0.425 mm IS Sieve shall not exceed 4, when tested in accordance with IS 2720 (Part 5). (MoRTH- Ref Page 171)	—
	(vii) Grading of aggregates	Field	IS 2386 (Part 1)	As per Table 16.42 (MoRTH- Ref Page 171)	Two tests per day
	(viii) Soundness test (Magnesium and Sodium Sulphate)	Laboratory	IS 2386 (Part 5)	Magnesium: Max. 18% ; Sodium Sulphate: Max. 12% as per IS:2386 Part V. (MoRTH- Ref Page 171)	One test for each source and whenever there is change in the quality of aggregate
	(ix) Filler content	Laboratory	—	As per Table 16.36 (MoRTH- Ref Page 171)	One test of each source
	(x) Tack Coat (Quality of Binder)	Laboratory	IS 73	Should meet the requirements as per of IS:73.	Number of samples per lot and tests as per IS:8887 as applicable
	(xi) Water sensitivity of mix	Laboratory	—	—	One test of each source and whenever there is change in the quality of aggregate
	(xii) Mix grading at hot mix plant	Laboratory	IS: 2386 (Part I)—1963	—	Two tests per day on both the constituents and mixed aggregate from the dryer
(B)	Laying				
	(i) Application of tack coat	Field	—	0.20-0.30 Kg per sq.m (MoRTH- Ref Page 169)	
	(ii) Binder content	Field		Min. 5.2 % (19 mm Agg.); 5.4 % (13.2 mm Agg.); (MoRTH- Ref Page 172) Or as Specified in the Item.	Two tests per day per plant
	(iii) Quantity of materials as per design mix	At the hot mix plant	—	As per design mix report	Every day
	(iv) Plastic content	Field	—	6 to 8% of the weight of bitumen	—

Sl. No.	Item Description	Field/ Laboratory	Test procedure	Value	As per Standards MoRTH/IRC
	(v) Control of temperature of the mix at the time of laying and rolling	Field		Laying Temperature: 140 Min. Rolling Temperature: 90 Min. (MoRTH- Ref Page 151) 8 – 10 tonnes dead weight or vibratory roller (MoRTH- Ref Page 154)	At regular intervals
	(vi) Density of Comp layer	Laboratory	IS 2386 (Part 3)	minimum field density equal to or more than 92 percent of the average theoretical maximum specific gravity. (MoRTH- Ref Page 171)	One test per 700 sq.m area
	(vii) Rate of spread of Mixed materials	Field	—	—	At regular intervals
	(viii) Control of grade, camber, thickness and surface finish	Field	—	—	Regularly

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. 2. Area clearance should be ensured for both persons and objects. 3. 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	1. Ensure slings free of cuts, breaks etc. (daily visual inspection) 2. Use Four legged sling for lifting 3. Properly attached to hook with proper required D shackles. 4. Ensure load must not be eccentric on shackles. 1. Proper selection of rigging materials. 2. Inspect hook for wear and tear. 3. Ensure the usage of tagline to control all loads. 1. Check the area for any electrical overhead lines and clear it before lifting. 2. Ensure proper grounding of crane and other equipments that could come into contact. 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. 1. 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
Electrical Works

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1. Scope of Work

1.1 Location of Work

The location of work is at Bhabha Atomic Research Centre (BARC), SMFC Project Site or Township and BARC Project Office/POCTA. The Location of site details are as follows.

Name of the site	Address	Connectivity/Access
BARC-SMFC Project Site	Bhabha Atomic Research Centre, Ullarthi Kaval, Challakere Taluk, Chitradurga, District, Karnataka-577 537	12km from Challakere Taluk towards Obulapura 212 km from Bangalore Access by road by private vehicle, less public Transport

- The Contractor may visit the site to check location/connectivity etc before submission of tender.

1.2 Scope of Electrical work

The Brief scope of work includes as follows

- Design of street light system as per mentioned Street lights, Supply, Installation, Testing and commission as per the requirement of site
- Design, SITC (Supply, Installation, Testing and commissioning) of Power distribution panel at the existing substation as per specifications
- Design, SITC of street light control panels with timers, excavation and installation of HDPE pipe, cables, termination associated earthing works.
- Design, SITC of street lights Double and single cross arms as per approved drawing including LED lights, Amber alerting type lights, Ballard lights as per specifications
- The system shall be handed over in complete ready to operate condition. All required accessories which are specifically not mentioned in SOQ/Specification but required for the completion of job shall be supplied and installed at no extra cost as per general engineering practice/applicable IS/IEC codes/ As per direction of Engineer In charge
- Contractor shall refer complete specifications including Civil for the understanding scope details of the works to be carried out before submission of the bid.

1.3 Important Instructions to Contractor

- a) 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.
- b) 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 any license issued by any government/ Aided officials in India, suitable for execution of the electrical works of the tender”.
- c) Contractor shall follow all security guidelines while entering the site, working and all other time. Contractor shall arrange own accommodation outside the site for laborer's, workers, employees with own expenses. The contractor shall adhere and accepted for all these by quoting the tender and may visit the site before applying for tender.
- d) 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.

- e) 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.
- f) 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.
- g) Deductions from each RA Bill, Electricity bill certified by EIC, and other deductions as applicable as per the rules issued time to time. Quoted rates shall include all above applicable including freight, other taxes, and other expenses as applicable
- h) 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.

1.4 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.
- All equipment accessories & services offered under the scope of this tender shall conform to “Technical Specifications and other documents” given in this contract.
- 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.
- Equipment and accessories, for which Indian Standards are not available, shall be designed, manufactured and tested in accordance with the latest issues of recognized Standards such as IEC, BS, VDE, DIN etc.
- 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.
- In case of conflicts if any, arising out of the discrepancies between terms/parameters appearing in different places of these specifications (Viz. Specification/ drawing/ technical data/ BOQ) the stringent of the terms shall be applicable and enforced.

- All equipment supplied and all work done including system design and detailed engineering, shall also comply with the statutory requirements of the Government of India, the Government of Karnataka and with the Indian Electricity Rules.
- Though this document mentioned specifications as per SOQ order, concerned points shall also applicable to related equipment/work in different sections/SOQ of this tender document

1.5 Make & Interchangeability

- The make/model of equipment shall be as per specifications, conditions mentioned Functional requirement, area of working, relevant IS/IEC/CEA/ Statutory regulations.
- Contractor shall consider equipment by ensuring maximum life to meet the functional requirement mentioned in the tender documents.
- EIC is the final authority to decide the equipment model based on the suitability of site. Contractor shall strictly follow EIC instructions in this regard.

1.6 Safety

- All the workers/employees/staff shall wear safety shoes, jackets, helmets, belts, All PPE Kits etc without which it is not allowed to work. No time extension is considered in this regard.
- The safety posters/regulation for prevention of accidents shall be displayed by the Contractor 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 Contractor 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 Contractor 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

1.7 Installation of Equipment 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.

1.8 Drawing & Documentation

- The scope of Tenderer includes supply of all drawings, data sheets/documents, type test reports, operation and maintenance manuals, catalogues, as built drawings of the plant, equipment supplied and work done, for comments/ approval / information/ reference of BARC / Consultant at no extra cost.
- All drawings, specifications, furnished by BARC shall be treated as strictly confidential property of BARC. All drawings, documents and information's furnished by the Tenderer shall become property of BARC.
- Marking of equipment, Equipment Tags, Installation numbers shall be provided as approved by EIC
- Drawings, specifications, and schedule of quantities shall be treated as supplementary to each other and should anything appear in one that is not described in the other, no advantage shall be taken by the Tenderer for any such omission. For such discrepancy / inconsistency, the Tenderer shall seek the instructions from the Consultant before proceeding with the work and the clarifications/ decisions given by the Consultant shall be treated as final and binding on the Tenderer.
- The Tenderer shall furnish drawings as indicated in technical specification for each item for approval of BARC according to agreed time schedule.
- Tenderer shall furnish, if requested, additional drawings, calculations, and information to BARC to enable him to examine / study the drawings for approval.
- If incomplete drawings/ documents not meeting the requirement are sent back to the Tenderer, the responsibility for any delay in approval for the same shall be borne by Tenderer.
- Where drawings are returned to the Tenderer with marking "Commented", the Tenderer shall resubmit the revised drawings for approval.
- Where the drawings are returned to the Tenderer with marking "Approved as Noted", Tenderer shall make the necessary modifications/ changes and resubmit revised drawings for final approval.
- If any subsequent alterations are found necessary and approved by BARC, all drawings and data are affected by such alterations shall be duly revised and re-submitted for the approval of the Consultant as said above.

- BARC will scrutinize drawings/ data furnished by Tenderer and comments, if any, will be communicated to the Tenderer within 2 weeks from the date of receipt.
- In order to expedite the approval of drawings related to procurement / manufacture, Tenderer shall present the drawings to the EIC and incorporate the necessary changes after discussions and obtain the approval.
- Tenderer shall be responsible for correctly incorporating all the points conveyed to him and resubmit the drawings to BARC for final approval.
- If the Tenderer is unable to incorporate some of the comments, such non-compliance shall be clearly stated in a forwarding letter with reasons without delay. However, it shall be EIC discretion to accept or reject the non-compliance.
- Work shall be carried out exactly as indicated on the approved drawings and data and no alterations shall be made without the written approval of BARC.
- Approval of drawings by BARC shall not relieve the supplier of his contractual obligations and responsibility for engineering, design, workmanship, materials and performance of the equipment.

1.9 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 Illumination in approved software
- Design drawings of Street light poles including fabrication details in CAD format also.
- Load distribution scheme of the system
- Warranty certificates from OEM for lights, batteries etc along the service personnel details
- As built drawings in CAD, A0 format

Note: Above List is indicative EIC may add documents any in above list as per requirement of site.

1.10 Defect Liability Period/Warranty Period of Equipment and Workmanship

Defect liability period for the complete system including all equipment and workmanship will be one year from the date of handing over of each system complete in all respect. The tenderer shall carryout replace/repair the problems arrived within defect liability period within 15 days (or as instructed by EIC) of the initial intimation without any additional cost through OEM/ authorized personnel. If the tenderer fails to do the repair/replacement within specified time, BARC will execute the same work through tender/Nomination basis without any intimation to the tenderer and the same amount will be deducted from the Performance Guarantee which is available with BARC.

2. Power Distribution Panel at LTSS

2.1 General Details

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	
Breakers & Bus bar Type and Rating	--Incomer-1 & 2 - 2 No's of 4-Pole, 800A, 50kA, Electrically Interlocked ACBs with LSIG Protection -- Bus Coupler - 1 No's of 800A, 50kA ACB's Electrically Interlocked with ACBs with LSIG protection --Outgoings- 6 No's of 400Amps MCCB's, 6 No's of 200A MCCB's, 8 No's of 100 Amps MCCB's All MCCB's 36kA -- All MCCB's Shall be Icu=100%of Ics Refer Technical Specifications for Complete Details
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 Outgoings – Digital Ammeters shall be provided

2.2 Technical Parameters

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 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 (Copper)	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. Rectangular cross section suitable to take full load current and fault level indicated, color coding RYBN
Bus bar support	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
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 15 th 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 15 th 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)
Bus supports	Non hygroscopic material having high impact & dielectric strength& Halogen/ CFC Free (SMC/DMC)
<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 with minimum thickness 25 X 3 tinned copper
Gaskets	Neoprene for Suitable IP
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	10 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

2.3 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	2500 Volts

voltage	
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. (I _{cw})	As per SOQ I _{Cu} =100% of I _{Cs}
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

2.4 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

2.5 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 & fuse terminals with indication for individual control circuits 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 Aluminum/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.

- 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 maximum 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. 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 fully draw out cubicles, unless otherwise stated. These cubicles shall be such that drawout 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 Relays:**

- **The panel shall be with numerical protection relays with digital display for Transformer incomers and DG incomers with OC, REF, Uv, OV, Lockout, Earth Fault, Negative sequence overvoltage and other applicable standard protections etc with all required relay setup and control units with annunciators, master trip relay, Shunt coil etc as approved as per requirement.**

- All protection relays shall be draw out flush mounted in dust proof cases control circuits shall be automatically broken and current transformer secondary circuits shorted when a protection relay is withdrawn from its case. A marking strip shall be provided in front of each terminal block and a diagram plate at the back of each case to identify connections.
- All spare contacts shall also be wired upon the externals. Relay coils shall carry their normal currents indefinitely and such currents than can occur under fault conditions. Relay mechanism shall not be affected by normal vibrations or external magnetic fields.
- All indicating and protection relays shall have mechanically operated hand reset flag indicators. Indicators shall be capable of being reset without opening the relay case. It shall not be possible to operate any relay by hand or to alter its setting, without opening the case.
- Means shall be provided for testing relays from the front of the panel, preferably by test plugs for insertion between the finger contacts of draw out relays.

❖ **Design guidelines for CT's:**

- Protection and measuring current transformer shall be of cast resin, bar type primary, with 5A or 1A secondary as per requirement. The minimum burden shall be 15 VA. Measuring current transformers shall conform to accuracy class 1 and burden of CTs shall be as required by the associated measuring instruments and connecting leads. The CTs shall have saturation factor of 5.
- Protection current transformers shall have their accuracy as minimum 5P class and burden as required by the protection circuit in which they are used and shall have minimum saturation factor not less than 10.
- The current transformer ratios specified are provisional and are subject to alteration and confirmation later at the time of approval of manufacturer's drawings.
- Current transformers shall have a short time withstand rating equal to the short time withstand rating of the associated switchgear for one second for breaker feeders; for fuse backed feeders, the CTs shall have a withstand capacity not less than that of the let through on isolating link.

❖ **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 Illumination, Sockets**

- Suitable number of lights for illumination, Sockets shall be provided as per instructions of EIC.

2.6 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. Street Light Poles Double and Single Cross Arm

3.1 General

The scope of the work shall include Design of Street light system, Supply Installation Testing, and commissioning of Street light system as per SOQ mentioned details and technical specifications. The illumination shall be designed in the approved software like Dialux or similar approved by EIC. The distance between the poles, Lux levels is as per simulation and approved by EIC as per relevant standards. Scope shall also include RCC foundations, Cable entries external, GI Pipes of Cable entries and exit, Junction boxes, earthing terminals, fixing arrangements and all other required accessories as per standard engineering practice and relevant standard codes.

3.2 Details of Technical Parameters

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
Weather Poof Mcb Distribution Box	Supply, installation, Testing & commissioning (SITC) of Outdoor Pole/Wall Mounting Type Weather Proof IP 56 or higher GI coated MS Street 14 SWG minimum Light Junction Boxes with 4 Nos of M10 bolted type Elmax connector mounted on din rail and 10 Amps double pole 10KA Rated MCB. The size shall be: 160 mm (H) x 120 mm (W) x 100 mm (D). Actual Size as suitable as per approved drawing. Quoted Price Shall include 10A DP MCB and All other accessories. JB shall have suitable dual side earthing connections as approved. It shall have high quality sealant for cable entries suitable for weather proof conditions

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 form 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 nos 10mm pinch bolts 120 degrees apart. A stiffener plate of 200x250x6mm shall be fixed to reinforce the bracket joint
Testing	Longitudinal seam weld joint of 10% number of poles along with weld joint of base plate to be tested by liquid penetration test (LPT). Pole shaft & fastener materials to be tested as per relevant IS standards for physical & chemical properties on the samples drawn by department representatives. For IS 2062 & IS 1239 material, the sample to be collected and testing shall be done in approved laboratory in absence of original correlating material certificate.
Drawings	Fabrication drawing of sample pole with bracket shall be got approved before enmass fabrication of pole & bracket
Tolerances	As per BS 5649-2, EN 40 -2
Painting	Painting shall be non-peel paint with blue color on the external of the pole as per relevant standards as approved by EIC. It shall be smooth finish to give aesthetic look and protection from rusting, corrosion etc
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. Details of Drawings provided are for double cross arm and same shall be applicable for single cross arm except the number of arms.

4. Illumination System

4.1 General

The scope of the work shall include Design of illumination system in Dialux or approved similar software, Supply Installation, testing and commissioning of fixture for the street light system with all required accessories approved software like Dialux or similar approved by EIC. The distance between the poles, Lux levels is as per simulation and approved by EIC as per relevant standards. Scope shall also include RCC foundations, Cable entries external, GI Pipes of Cable

4.2 Details of Technical Parameters

Luminaries configuration/technical requirement	Side entry type, shall consist of separate optical and control gear compartment fixing arrangement—maintenance friendly and a separate compartment in main housing for external SPD or external fixing arrangement (bolted only) for external SPD below the light on the non-light emitting surface of the housing. Driver should be easily replaceable in the field condition.
Finish	Aesthetically designed housing with corrosion resistant polyester powder-coating.
Cover/glass	The luminaire shall be equipped with distortion free, clear, heat resistant, toughened glass. LED cover-UV stabilized polycarbonate/integrated optics cover/Toughened glass (The integrated optics over should be noncorrosive, nonyellowing and should not depreciate light due to aging). UV stabilized glass /Poly-carbonate cover in the front fixed to the die cast Aluminum frame which shall be fixed to the housing by means of corrosion resistant or Brass screws for areas not inside IP-66 rated chamber. Zinc plated steel or equivalent screws can be applied inside sealed chambers
System Efficacy (lumen/watt)	120 Lumens/Watt Efficacy
IP and IK	IP 66 and IK 07
Housing/Body of fitting	High pressure die cast aluminum LM6/ADC12 housing with corrosion resistant polyester powder coating with separate optic compartment manufacturer emblem/logo embossed into the housing. Luminaire Body Temp should not exceed 30 deg.C from ambient (45 degree C)
Lens/Lens module for LEDs	LED Lights shall be provided with Lenses/Lens modules. Lens should be of material resistant to de-gradation during

	service due to atmospheric components to avoid adverse impact on light output. Lens shall be bolted (and not pasted - However, bolted AND pasted is acceptable) on to the MCPCB above the chips and the lens should be minimum IK07 impact resistant if it is also used as a lens cover.
LED	High/ bright power LEDs shall be used in the luminaries.
Glare control	Luminaire should be full cut-off as per IS:1944. The dome and engineering of Luminaire should be in such a way that light should light up road but should not distract & should not visible to driver while travelling on road
Protection	The luminaire housing shall be made up of corrosion free High Pressure Aluminum die cast thus conforming the luminaire to minimum IP- 66 for all wattages and safety as per IEC 60598/IS 10322 (Only single housing Luminaire allowed)
Impact resistance	The luminaire shall be built in such a way that it can withstand wind speed of 150 kmph, (Impact resistance $\geq$ IK08)
Operating voltage	140 V to 270 V universal electronic driver with internal surge protection of 5 KV (Applicability IS 15885, Driver Safety 16104-1/2)
Heat dissipation / heatsink	Well-designed thermal management system with defined heat sink
Power factor	> 0.95
Lumen depreciation	for rated life $<10\%$
Power efficiency /LED driver efficiency	The efficiency shall be always more than 85% in all cases during project period.
Lumen maintenance	Life span of LEDs used in the Luminaire shall be more than 50,000 hours at 70% light output
CRI	Color rendering index (CRI) of the LEDs used in the luminaire shall be greater than 70
CCT	Color temperature of the luminaire shall 5700 K+/-350K

Driver specification	140-270 volt universal potted electronic/analog dimmable drivers with internal surge protection more than 5 KV SPD inside the luminaire
Surge Protection	External Surge protection (SPD) with Thermal Protection (TMOVs) of minimum 10 kV/ 10 kA with capability to withstand a minimum of 15 pulses of 10 kV/ 10 kA to be separately installed (fixed with screws) with each fixture below the Light with IP 66 protection for incoming and outgoing wires on SPD and Light. Alternatively, the external SPD may be provided inside the driver compartment or special enclosed compartment adjoining the driver compartment or adjoining it with proper fixing (bolting / DIN rail arrangement) for SPD inside. Internal SPD as per SOQ
THD	<10%
Lumen output variation	The luminaire light shall be constant. The voltage variation/fluctuations in the specified voltage range shall not impinge upon the lumen it produces. Maximum +/- 2% is allowed throughout in the input operating voltage range.
Electrical safety as per IEC.	As per IEC safety standards IEC61000,61547, 61347
Serial number	LED street light fitting should be supplied with serial number which should be printed on label the same should be fixed to the fitting. The label should mention: Name of Manufacturer, model name and number system lumen, nominal CCT, wattage of fittings, date of manufacture, and other labeling details.
Guarantee/Warranty	Street light should be having 5 years Onsite warranty. The Firm will arrange the 5 years warranty certificate from the manufacturer. The OEM shall have service availability at the work location
Spares	10 No's of Spare Led Drivers, SPDs shall be provided. Cost of the same shall be considered in the quoted rate.

5. All In One Solar Street Light System

5.1 General

The scope of the work shall include Design of All in one Solar Street light system, Supply Installation Testing, and commissioning of Street light system as per SOQ mentioned details and technical specifications. The illumination shall be designed in the approved software like Dialux or similar approved by EIC. The distance between the poles, Lux levels is as per simulation and approved by EIC as per relevant standards. Scope shall also include RCC foundations, Cable entries external, GI Pipes of Cable entries and exit, Junction boxes, earthing terminals, fixing arrangements and all other required accessories as per standard engineering practice and relevant standard codes.

5.2 Details of Technical Parameters

Parameter	Specifications
Pole details	4m high octagonal/Swagged pole for mounting all in one solar PV LED luminaire on RCC foundation Cost of Pole shall be included. Drawings, details shall be approved by EIC
Min. System lumen output	3000
Min. efficacy	100 lumen/watt
Wattage	Suitable As per Above Lumens
CCT	4000 to 5700 degree K
CRI	≥70
Solar PV module type & capacity	Suitable as per Autonomy time, battery capacity. Design shall be submitted and approved by EIC
Battery	Lithium ion
Autonomy	18 hours
Battery capacity	To be furnished by Tenderer
Dimming Profile	To be furnished by Tenderer
LED burning hours	>50,000 hrs
Solar Charge Controller	MPPT

Solar Charge Controller capacity	Suitable for TS, Design shall be submitted and as approved by EIC
Charger efficiency	Suitable for TS, Design shall be submitted and as approved by EIC
Housing material	Suitable for TS, Design shall be submitted and as approved by EIC
Diffuser material	UV resistant PC/ toughened glass
IP	65
In-built electrical Protection	Suitable for TS, Design shall be submitted and as approved by EIC
Testing at NABL accredited lab	To be offered as per technical Specifications
On site replacement Warranty	3 years from the date of supply. Onsite warranty
Other details	Contractor shall submit the details of system along with design drawings, battery size calculations, Solar module, charge controller, dimming and PIR details for approval of EIC. Necessary corrections changes shall be carried out

6. Post Top LED Indirect Lighting

6.1 General

The scope of the work shall include Design, Supply, Installation, Testing, and commissioning of Post top LED Indirect lighting type luminaries as per SOQ mentioned details and technical specifications. The illumination shall be designed in the approved software like Dialux or similar approved by EIC. The distance between the poles, Lux levels is as per simulation and approved by EIC as per relevant standards. Scope shall also include RCC foundations, Cable entries external, GI Pipes of Cable entries and exit, Junction boxes, earthing terminals, fixing arrangements and all other required accessories as per standard engineering practice and relevant standard codes.

6.2 Details of Technical Parameters

Parameter	Specifications
Pole details	4m high octagonal/Swagged pole for mounting all in one solar PV LED luminaire on RCC foundation Cost of Pole shall be included. Drawings, details shall be approved by EIC
Min. System lumen output	3500 Lumens
Min. efficacy	100 lumen/watt
Wattage	To be furnished by Tenderer
CCT	4000 to 5700 degree K as approved
CRI	≥70
Lumen Maintenance	L70 @ 50,000 hrs
Range of operating Voltage	140-270V AC
Total Harmonic Distortion	As per Relevant IS and as approved by EIC
Power factor	≥0.90
Input Surge Protection	≥4 KV
Housing material	As per Relevant IS and as approved by EIC
Diffuser material	As per Relevant IS and as approved by EIC

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IP	65
IK	07
Testing at NABL accredited lab	To be offered as per technical Specifications
Other details	Contractor shall submit the details of system along with design drawings for approval of EIC and necessary corrections shall be carried out before procurement

7. Amber Alerting type Blinker LED

7.1 General

Supply, Installation and commissioning of 300mm Solar based Blinker LED of Amber/Red color for alerting the passengers as per Technical Specifications and approved drawing with suitable battery rating as per NHAI Standards with having 24 Hours of backup with battery, light sensor, Solar Panel, Arrow LEDs, 12ft painted pole with all required accessories including civil foundation

7.2 Details of Technical Parameters

Parameter	Specifications
Display color	Amber/Red As approved
Operation	24 Hours (Day and Night) with 12 Hours Operation Setting and Dusk to Dawn operation with light sensor
System voltage	12 V DC
Aspect Diameter	300mm (12 Inch)
Power Consumption	8 Watts
Type of PCB	Epoxy glass FR4 PCB
No of LED	180 Nos 5 mm Ultra Bright LEDs
Lens	UV stabilized, Molded, water clear polycarbonate
LED Viewing angle	24 degrees (as per NHAI Standarad)
Lamp intensity (Centre Lux)	Greater than 330 cd (as per NHAI Standarad)
IP protection	IP 65
Number of Flashes per Minute	40 FPS
Visibility	Up to 500 meters
Solar PV Module	12V, 30 Watt minimum
Battery Inbuilt	12.8v, 6 AH Lifepo4 inbuilt

Pole type	MS Power Coated Yellow
Charge controller methodology	Three stage battery charge monitoring algorithms
LED driver efficiency	Greater than 90 percent
LED driver methodology	Dual PWM dc-dc buck converter
Protection	Short circuit protection Battery over charge protection Battery Deep discharge protection PV reverse voltage polarity protection Battery reverse voltage polarity protection Software watch- dog for LED over current
Pole:	12 feet ms powder coated, 3 inch diameter, 1.6 mm thickness, yellow powder coated with solar panel mounting bracket and accessories.
Warranty	2 Years from the date of supply
Spares	Numbers of battery of same capacity -1 No's Solar charge controller – 1 No's Photo Light sensors – 1 No's Led lights as required Above numbers shall be provided at no extra cost.

8. Solar LED Chevron

8.1 General

Supply, Installation, and commissioning of Solar LED chevron of Amber/Red color for alerting the passengers as per Technical Specifications and approved drawing with suitable battery rating as per NHAI Standards with Solar Panel, Arrow LEDs, 12ft painted pole with all required accessories including civil foundation

8.2 Details of Technical Parameters

Parameter	Specifications
No of Arrows:	Single Arrow
Solar Panel and battery	Polycrystalline 20 w , 12.8 Volts, 6AH Lifepo4 PWM inbuilt charge controller
IP	IP54
Visibility	Greater than 500 meters with wave length 590 nm
LED	2 watts or above with 82 High bright 5mm LEDS
Bracket/Frame for mounting solar panel (Ms powder coated)	included
Pole: (Ms powder coated yellow)	12 feet
Autonomy (Back up)	24 Hours
With Photo Sensor	Yes, light sensor and ON/OFF mechanism
Spares	Numbers of battery of same capacity - 1 No's Solar charge controller – 1 No's Photo Light sensors – 1 No's Led lights as required Above numbers shall be provided at no extra cost.

9. 1.1kV FRLS LT Power Cables

9.1 Scope:

- This part of the specification describes the details of all LT power cable required to be supplied, laid, terminated, tested & commissioned along with fire proof sealing system for all the cables as described in this specification.
- Termination Includes supply, installation & commissioning of double compression cable glands, cable termination kits,
- Cost of cable lugs, cable clamps, cable ties, cable identifier tags etc., for all cables shall be considered in the cable length.
- LT Power and control cable shall be supplied in suitable drum lengths considering ordered quantities, to avoid straight through joints. Maximum tolerance of $\pm 10\%$ shall also be considered on specification drum lengths.
- Cable shall be supplied in drum length as follows:

Power cables	500m
Control cables	1000m

- Any variation in length prior approval shall be obtained from Engineer In-charge
- Power cables installation & commissioning shall be done according to the IS 1255.

9.2 Technical Requirements for Cable:

- Cables supplied shall meet following minimum ambient conditions. (Cables laid directly in ground in single way ducts or pipes or Cable trays and any other modes or buried in underground).

Thermal resistivity of soil	150 degrees C cm/W
Soil temperature	40 degrees .C
Depth of laying (to the highest point of cable or grade cables and top surfaces of ducts)	75-100 cm for 1.1kV and 90-120 cm for HT cables
Horizontal formation axial spacing	15 cm in case of cables laid directly in ground in a group and approximately touching- in case of single way ducts or pipes.

9.3 LT Power Cables

- This section covers the general requirements of LT Power cables and Control Cables. The cables shall be furnished in accordance with this specification. Other cables including special cables, if any, which are necessary as per proven engineering practice for satisfactory & trouble-free operation of the entire cable system of the main plant shall also be within the scope.

9.4 Design Criteria - L.T. Power cables 1100 V grade:

- LV Power Cable shall conform to IS:7098 (part-1)-1988, 1100 V grade, single / multi-core, stranded compacted, Copper/ Aluminium conductor (grade H4 flexibility class-2), XLPE insulated, cores laid up extruded FRLS PVC type ST-2 inner sheathed, Aluminium round wire/strip armoured in case of single core cables/ galvanized steel round wire/strip armoured in case of multi core cables and with FRLS PVC outer sheath of type ST-2 (FRLS) compound
 - i. 1100 V grade, power cable conforming to following requirement and in line with IS-1554, IS-5831, IS – 7098, IS-8130 & IS-3975.
 - ii. Conductor : Stranded and compacted plain Aluminium of grade H2 for cable sizes above 10 sq mm and class 2 / stranded, high conductivity annealed plain copper, generally conforming to IS: 8130 for power cables up to 10 sq mm
 - iii. Insulation : XLPE confirming to IS 7098 part-1.
 - iv. Inner Sheath : Extruded FRLS PVC compound conforming to type ST2 of IS: 5831 for multicore cable.
 - v. Armour : Galvanised single round/ strip steel wire armour for twin and multicore cables.
Non-magnetic hard drawn Aluminium single round wire conforming to H4 grade for single core cables.
 - vi. Overall Sheath : Extruded FRLS PVC compound conforming to type ST2 of IS: 5831.
 - vii. 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 .C
 - Smoke density rating : Maximum 20%
 - Acid gas, Gas generation : Less than 20%

a) Cable Identification

Cable identification shall be provided by embossing the following on the outer sheath:

- i. Manufacturer's name or trade mark
- ii. Voltage grade
- iii. Year of manufacture
- iv. Type of insulation

- v. Type of inner and outer sheath e.g. "FRLS" etc.
- vi. ISI marks
- vii. Nominal cross sectional area of the conductor & no of cores
- viii. Sequential marking.

9.5 Specific Requirements

9.6 General Description

All Cables shall be furnished in strict compliance with design criteria of the Specification.

9.7 Drum Length and Tolerance

The cables shall be supplied in wooden drums, each containing minimum 500 meters length for power cables and 1000 meters for control cables. Allowable tolerance on individual drum length is $\pm 5\%$.

9.8 Non-Standard Length

BARC may accept non-standard lengths up to 10% of the total ordered quantity. However, the Contractor will be required to obtain BARC's approval before packing the Cables on drums. Non-standard lengths shall not be less than 100 meters in any case unless approved by EIC.

9.9 Packing

Cables shall be supplied in non-returnable drums. The drums shall be of heavy construction. All wooden parts shall be manufactured from seasoned wood. All ferrous parts used shall be treated with suitable rust preventive finish or coating to avoid rusting during transit or storage. Wooden cable drum shall be treated by immersing in copper-nitrate solution.

The ends of each length shall be sealed before shipment. Heat shrinkable cable cap shall be used for this purpose. A label shall be securely attached to each end of the reel indicating the Purchaser's order number, BARC's identification mark, length, type, voltage grade, conductor size and number of cores of the cable. A tag containing the same information shall be attached to the leadings end of the cable inside. An arrow and necessary instructions shall be marked on the drum indicating the direction in which it should be rolled. Drum numbers are to be indicated on the cable drums.

9.10 Selection Criteria

- In cable sizing the following are to be taken into consideration.
 - a) Short circuit current and duration
 - b) Continuous current.
 - c) Installation conditions.
 - d) Voltage drop 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.

- The standard cable sizes, capacities, de-rating factors, etc. as given in IS will be generally followed.
 - i. For breaker protected circuits minimum size will be determined by short circuit rating.
 - ii. For motor circuits the selection of size will be made ensuring that the cable shall withstand a short circuit fault directly following a second hot start.
- For power circuits, the conductor size will depend on full load current subject to voltage drop not exceeding 3%. For practical purposes, the minimum size chosen is as below and as per BOQ and as approved by EIC

a)	Aluminum	:	6 Sq. mm
b)	Copper	:	2.5 Sq. mm

- All drives of small rating where terminations with 10 Sq. mm. cables are not feasible, shall have copper cable.
- All control cables shall be 1.5 Sq. mm. copper cable. CT/PT cables shall be 2.5 sqmm copper cable.
- Multi-core control cables will generally have 20% of the total number of cores as spare.
- Separate cables for each type of following services / functions as applicable shall be used for each feeder. Same multi-core cable using different services shall not be acceptable.
 - i Power
 - ii Control, interlock & indication
 - iii Metering & measuring
 - iv Alarm & annunciation
 - v CT cables
 - vi VT cables

9.11 Cable Identification

Cable identification shall be provided by embossing the following on the outer sheath:

- a) Manufacturer's name or trade mark
- b) Voltage grade
- c) Year of manufacture
- d) Type of insulation
- e) Type of inner and outer sheath e.g. "FRLS" etc.
- f) ISI marks
- g) Nominal cross-sectional area of the conductor & no of cores
- h) Sequential marking
- i) BARC's identification mark

9.12 Tests

- Cables shall be subjected to routine, type, and acceptance tests in accordance IS – 1554 (part I). Test method shall conform to IS: 10810 (methods of test for



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cables)

- To prove the fire-retardant low smoke characteristics, additional tests as per IEC/BIS/ASTM standards shall be conducted on any size of each type of cables as per directions of EIC.
- Necessary warranty and test certificates shall be submitted as instructed by EIC.

10. EV Charging Station

- The scope of the work includes Supply, Installation, testing and commissioning of single phase minimum 16A, 3.7kW with 2 modes of charging, IP 55, IK10 metal socket for Electric vehicle charging with bracket, mounting box, along with suitable height pole junction box/ separate GI pedestal as per site condition & instructions of EIC.
- The scope shall also include providing autoglow signage of 150 x 150mm with EV charging symbol on the pole junction box surface/ pedestal as per instructions of EIC.
- Charging station ready to installed with its communication kit and RFID reader already embedded and mounted along with wall/surface mounting kit.
- Charging station shall have facility to recharge cars in different modes.
- The location of charging station shall be as per directions of EIC and fixing arrangement shall be on the wall/surface/pedestal mounting etc as per actual site condition.

11. List Of Suggested Makes 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.
- **Important Note** – Procurement and execution of the work shall comply with Public Procurement & Make In India Policy Guidelines, DPIIT Guidelines and other applicable government orders time to time issued time to time.
- The makes and brands suggested below are general recommendations and guidelines for bidders to match performance parameters and tender specifications. However, bidders may propose alternate or equivalent makes and brands, provided they meet 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 makes or 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 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.

Sr.No	Description	Suggested makes
.		

1.	Street Light Poles and cross arms	Bajaj / Surya Roshni/Valmont/Aster/ Trans Rail Lighting/ Shubham Poles/ Hakke Poles/ Bharath Poles
2.	Maintenance Free Earthing System Components	DEHN/OBO/ERICO/South Asian/JEF/TEREC(SGI)/ LORESS/JMV/LPS
3.	Illumination System &All in one Solar Street Light system	Crompton/Bajaj/Philips/havells/Wipro/Panasonic/Schneider/Binay/Lighting technologies/C&S/Surya/Halonix/Jaquar
4.	HT / LT Cable jointing kit	Raychem / Mahindra / 3M/ Yamuna Densons
5.	Compact Sandwich type Bus duct / Air insulated Bus Duct / Rising mains	Zucchini (Legrand) / L&T (Henikwon) / C&S / Schneider Electric / Godrej/Siemens
6.	LT Cable	Universal / Torrent / Polycab / Finolex / KEI / Havells / NICCO / Apar / LAPP/ KEC / RR Kabel /Ravin/Gloster
7.	Cable glands / Cable Socket (Lugs)	Braco / Comet / Dowells / Gripper / Prabhat / Jainson / Lotus / HMI / 3D / Hex
8.	Terminal Strip / Connector	Connectwell / Elmex / Phoenix/Wago
9.	G.I Ladder/ Perforated Cable trays	OBO/ Indiana / Asian / Profab / Sadhana (Steelite group) / Metalman / Patni / PILCO/BEC/ELCON, OM Industries / Globe Electrical
10.	Wire mesh cable tray	Legrand / OBO/ PILCO
11.	Cable Management System -Wall raceway / Floor raceway / Floor Access box & Pop up box	Legrand / MK Electric /OBO / Schneider Electric
12.	Power Distribution Panel at LTSS	OEM and authorized systems houses of L&T, Siemens, Schneider Electric, Legrand, ABB and BCH. C&S /Jakson/Arrow Engineers /Adlec/Samcon/MarineElectricals/Tricolite/Ambit/Tenoco/Ohm Energy Management System Pvt. Ltd., Sriperumpudur/Excel Power Switchgear, Chennai/Power Control Equipment Bangalore

13	Any Others which are not specifically not mentioned	As per directions of EIC based on the Technical Specifications

12. Milestones

- The milestones for electrical works are shown below. The contractor shall submit a detailed Time and Progress Chart (PERT/Bar Chart) within 7 days from the placement of Work order. The Time and Progress Chart (PERT/Bar Chart) submitted by the contractor shall be in line with the milestones specified in the Schedule-F/ Clause-5 and milestones specified below:

Sr.No.	Time Allowed in days (from date of start)	Description of Milestone
1	1/4 th (of Stipulated Completion period)	Finalization of Power Distribution panel Drawings and Its approval, Finalization of Poles vendor and submission of Technical Details, Design of Illumination System.
2	2/4 th (of Stipulated Completion period)	Fabrication and Supply of Power Distribution panel , Submission and Approval of GTP for LT cables, Supply of Lights, Details of earthing system.
3	3/4 th (of Stipulated Completion period)	Installation and Commissioning of Panel, Erection of Street Light Poles & Lights, Supply and commencement of Erection of Cables, Supply and erection of earthing system.
4	Full	SITC of Balance material Supply, Installation and Commissioning of the system.

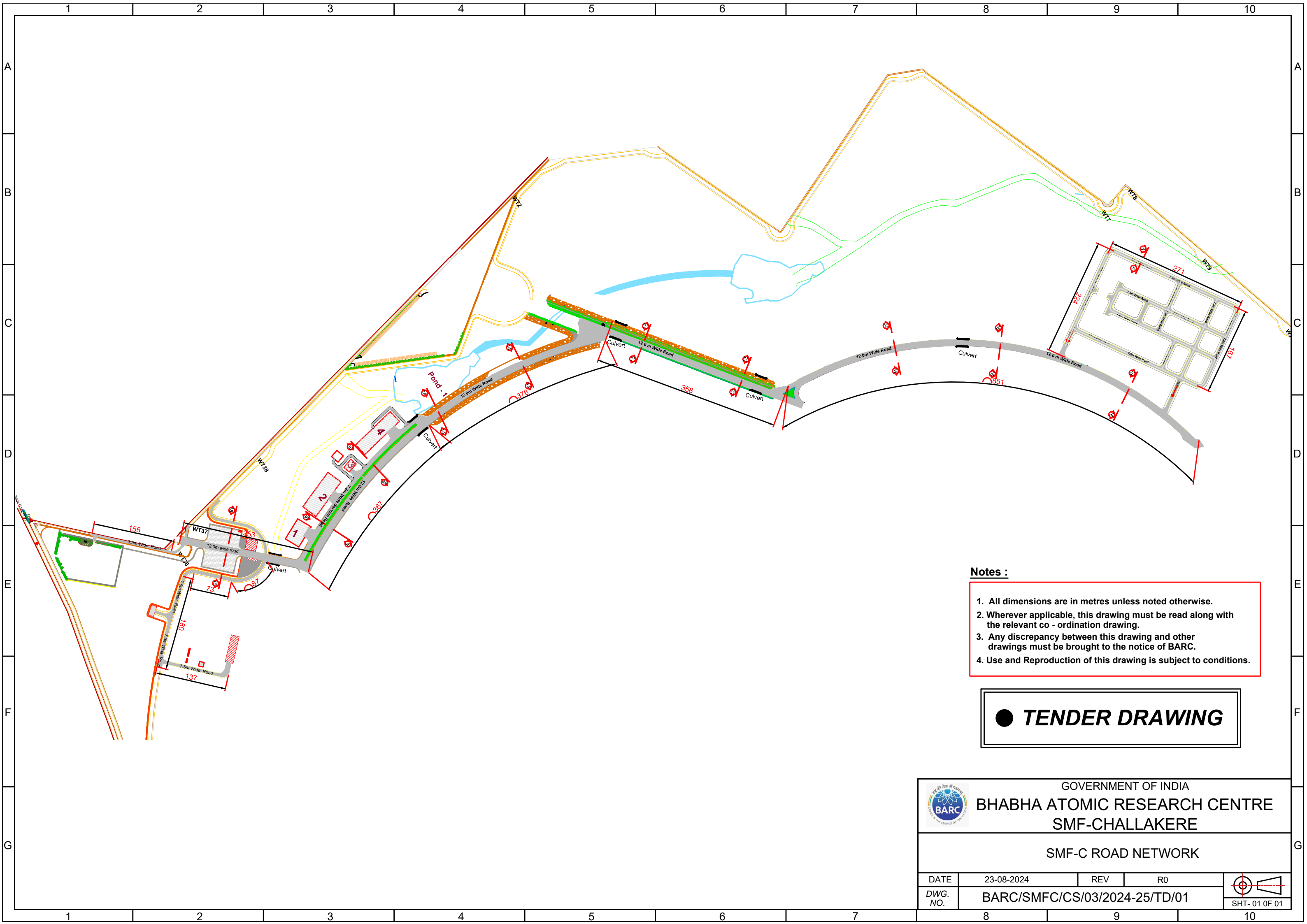
13. Annexure of tender Drawings

This Following List of Tender Drawings were uploaded along with the tender for reference of contractor

a. List and Details of Drawings

S.No	Title of Drawing	Drawing Number
1	Street Light Pole drawing	BARC SMFC 7 Meter & 9 Meter Octagonal Pole

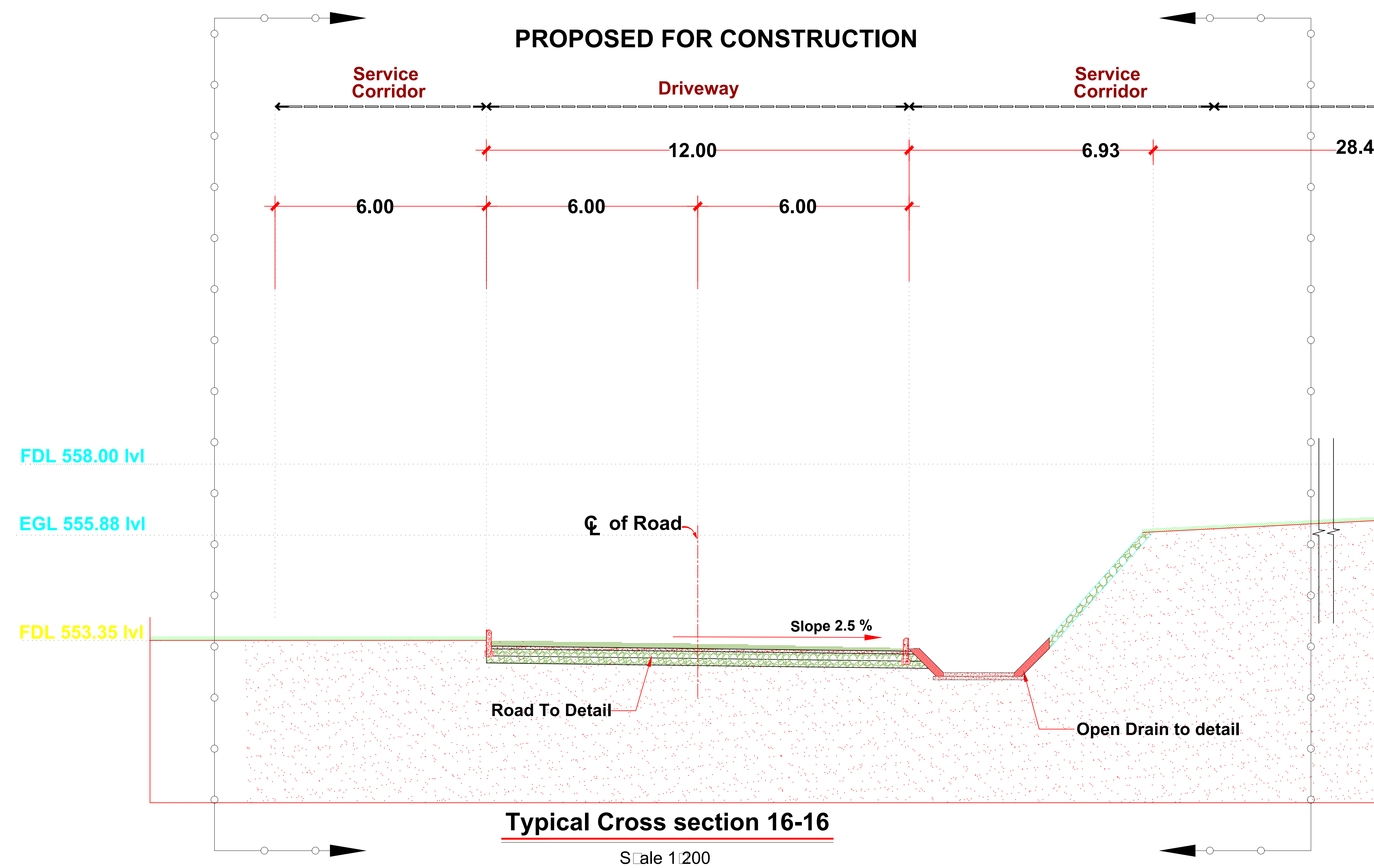
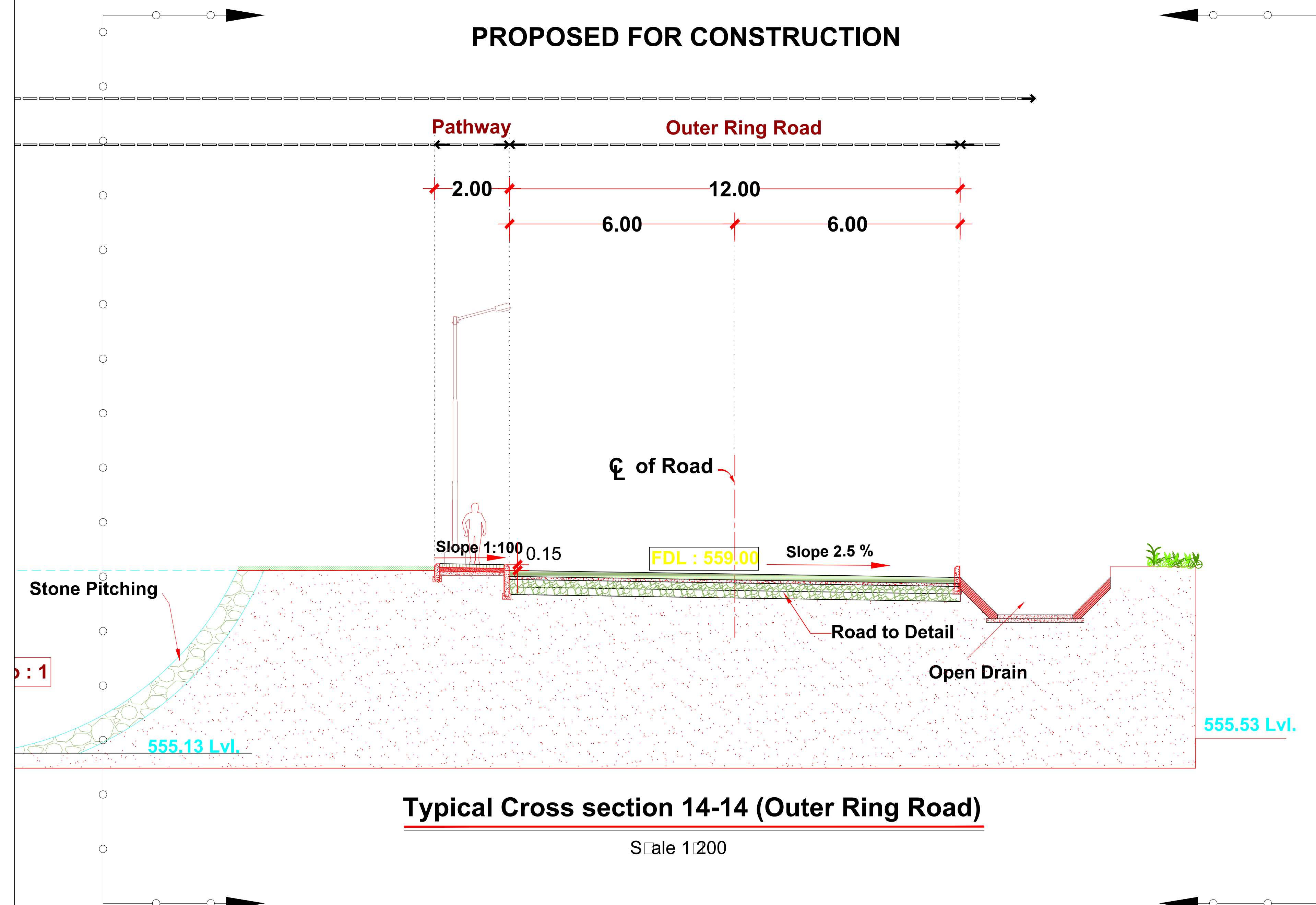
----- End of technical Specifications-----



- Notes :**
- 1. All dimensions are in metres unless noted otherwise.
 - 2. Wherever applicable, this drawing must be read along with the relevant co - ordination drawing.
 - 3. Any discrepancy between this drawing and other drawings must be brought to the notice of BARC.
 - 4. Use and Reproduction of this drawing is subject to conditions.

● **TENDER DRAWING**

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		SMF-CHALLAKERE	
SMF-C ROAD NETWORK			
DATE	23-08-2024	REV	R0
DWG. NO.	BARC/SMFC/CS/03/2024-25/TD/01		
			SHT- 01 OF 01



● **TENDER DRAWING**

Legend :

F.F.L - Finished Floor Level.
F.G.L - Formation Ground Level.
E.G.L - Existing Ground Level.
F.D.L - Formation Driveway Level.

Notes :

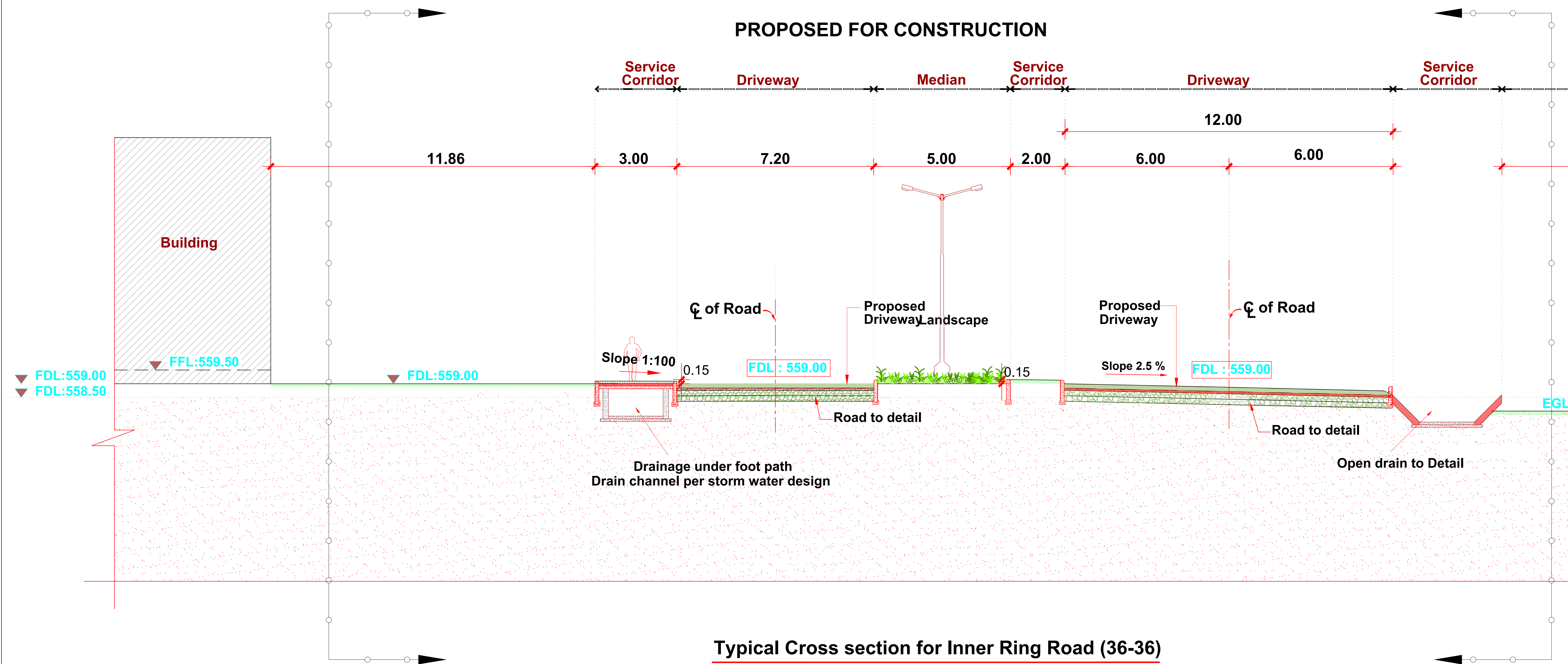
1. All dimensions are in metres unless noted otherwise.
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INTERNAL ROAD NETWORK
CROSS SECTION 14-14 □16-16

DATE	23-08-2024	REV	R0	 SHT- 01 OF 01
DWG. NO.	BARC/SMFC/CS/03/2024-25/TD/02			



Legend :

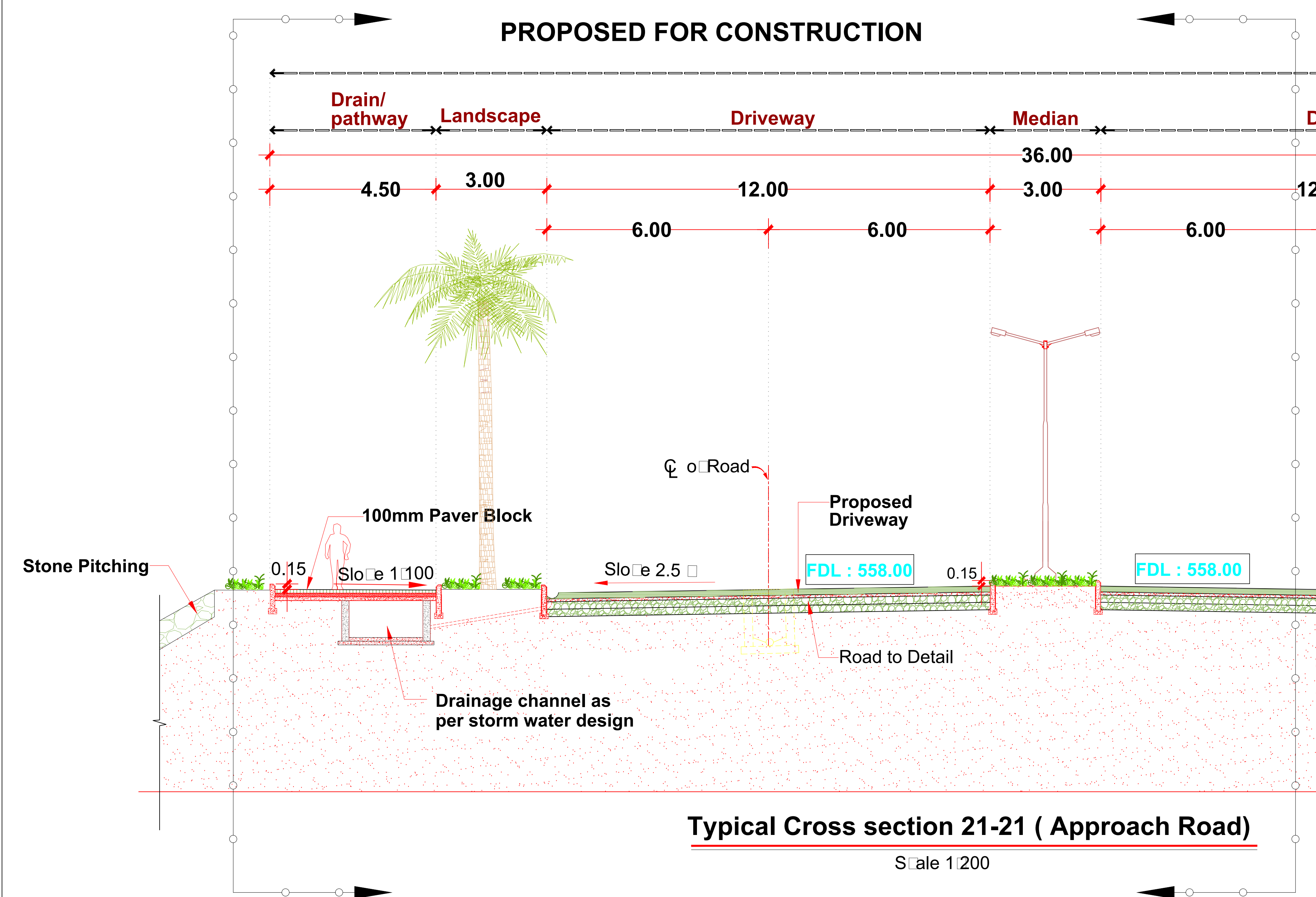
F.F.L - Finished Floor Level.

F.G.L - Formation Ground Level.

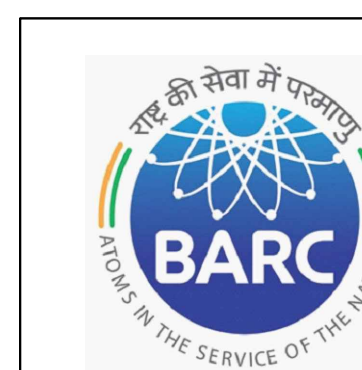
E.G.L - Existing Ground Level.

F.D.L - Formation Driveway Level.

- Notes :**
1. All dimensions are in metres unless noted otherwise.
 2. Wherever applicable, this drawing must be read along with the relevant co - ordination drawing.
 3. Any discrepancy between this drawing and other drawings must be brought to the notice of BARC.
 4. Use and Reproduction of this drawing is subject to conditions.



TENDER DRAWING

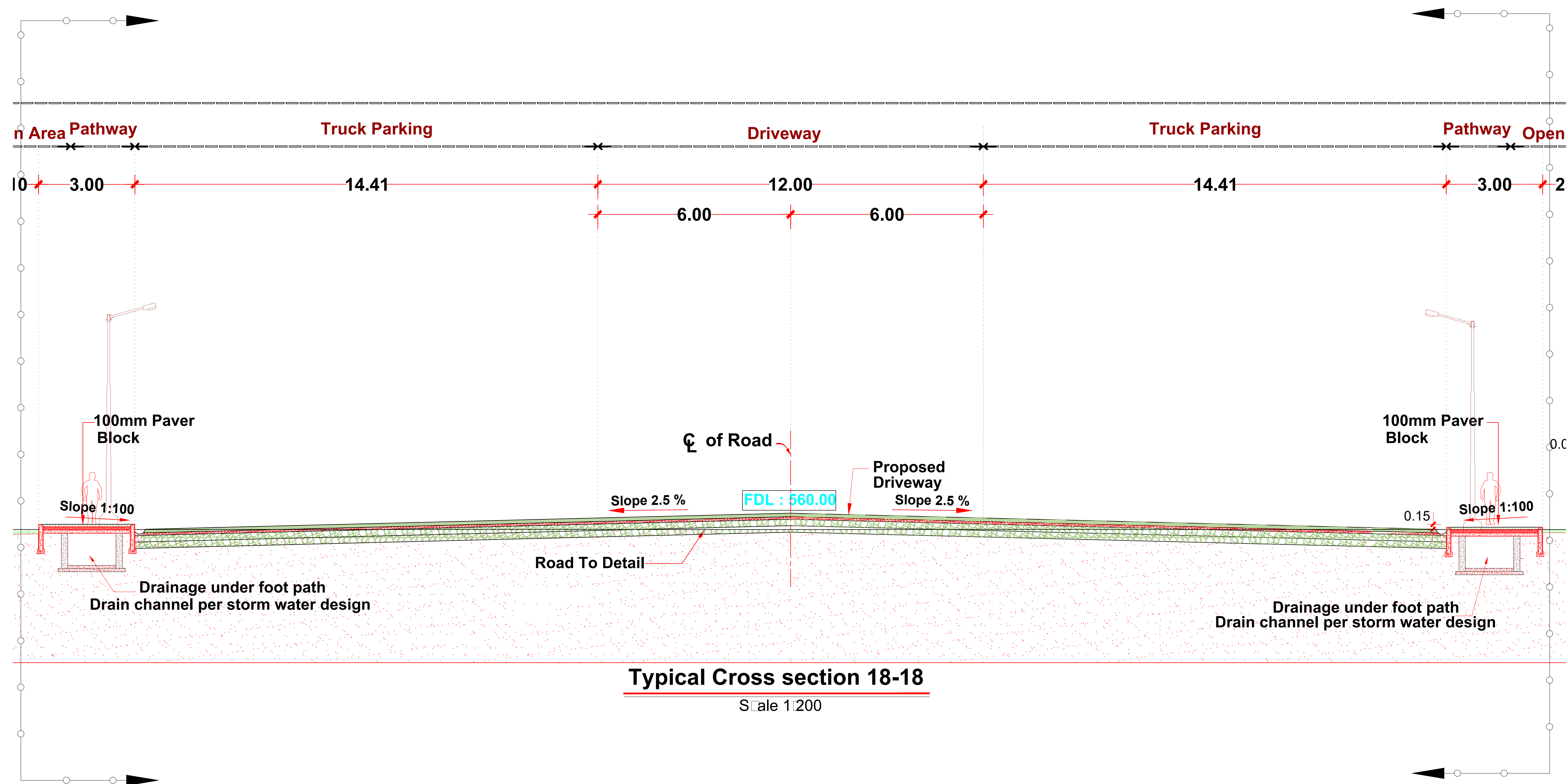


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INTERNAL ROAD NETWORK
CROSS SECTION 21-21 □36-36

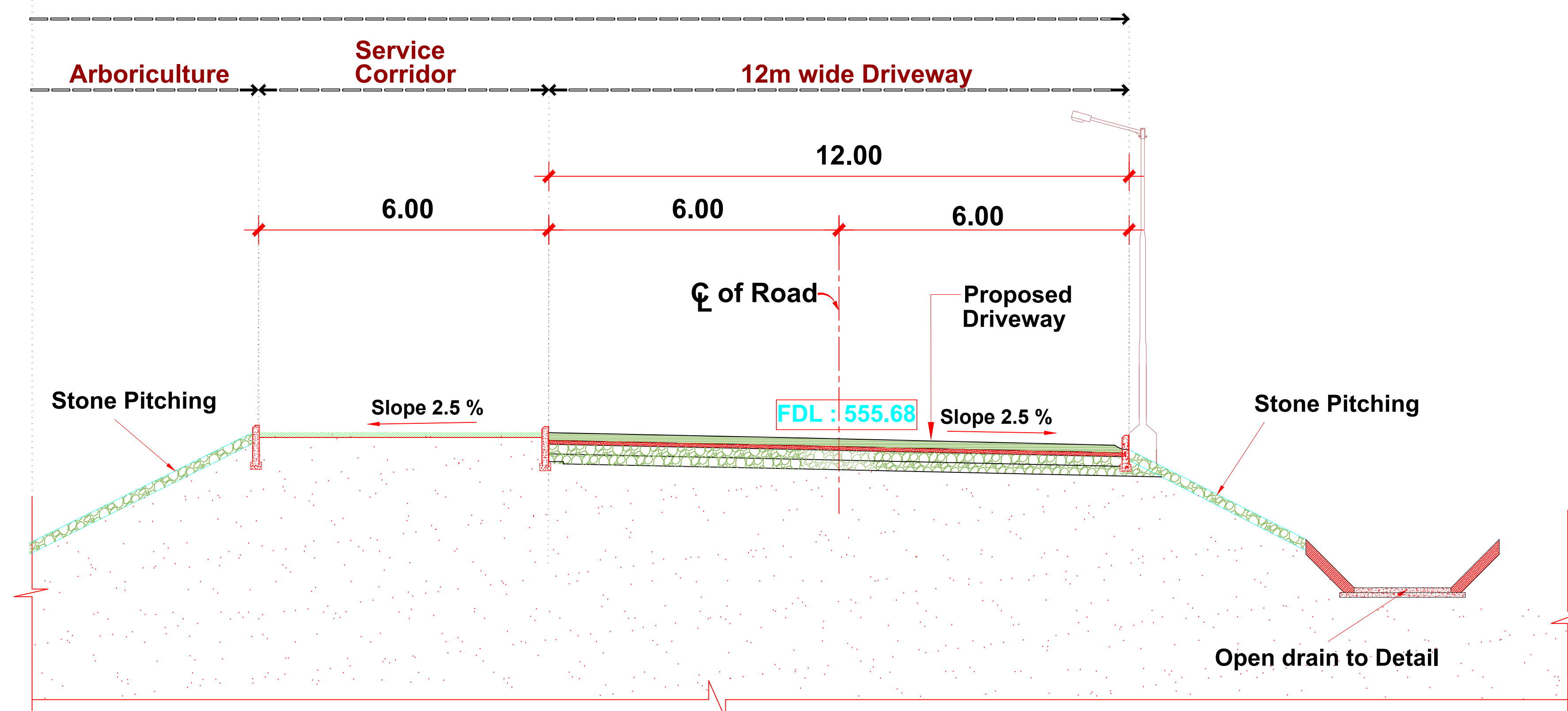
DATE	23-08-2024	REV	R0	
DWG. NO.	BARC/SMFC/CS/03/2024-25/TD/03			

SHT- 01 OF 01



Typical Cross section 18-18

Scale 1:200



Typical Cross section 34 - 34

Scale - 1:200

Legend :

F.F.L - Finished Floor Level.

F.G.L - Formation Ground Level.

E.G.L - Existing Ground Level.

F.D.L - Formation Driveway Level.

Notes :

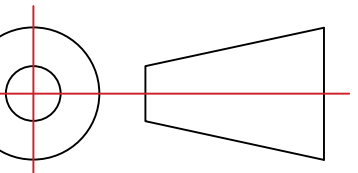
1. All dimensions are in metres unless noted otherwise.
2. Wherever applicable, this drawing must be read along with the relevant co-ordination drawing.
3. Any discrepancy between this drawing and other drawings must be brought to the notice of BARC.
4. Use and Reproduction of this drawing is subject to conditions.

TENDER DRAWING



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INTERNAL ROAD NETWORK
CROSS SECTION 18-18 □ 34-34

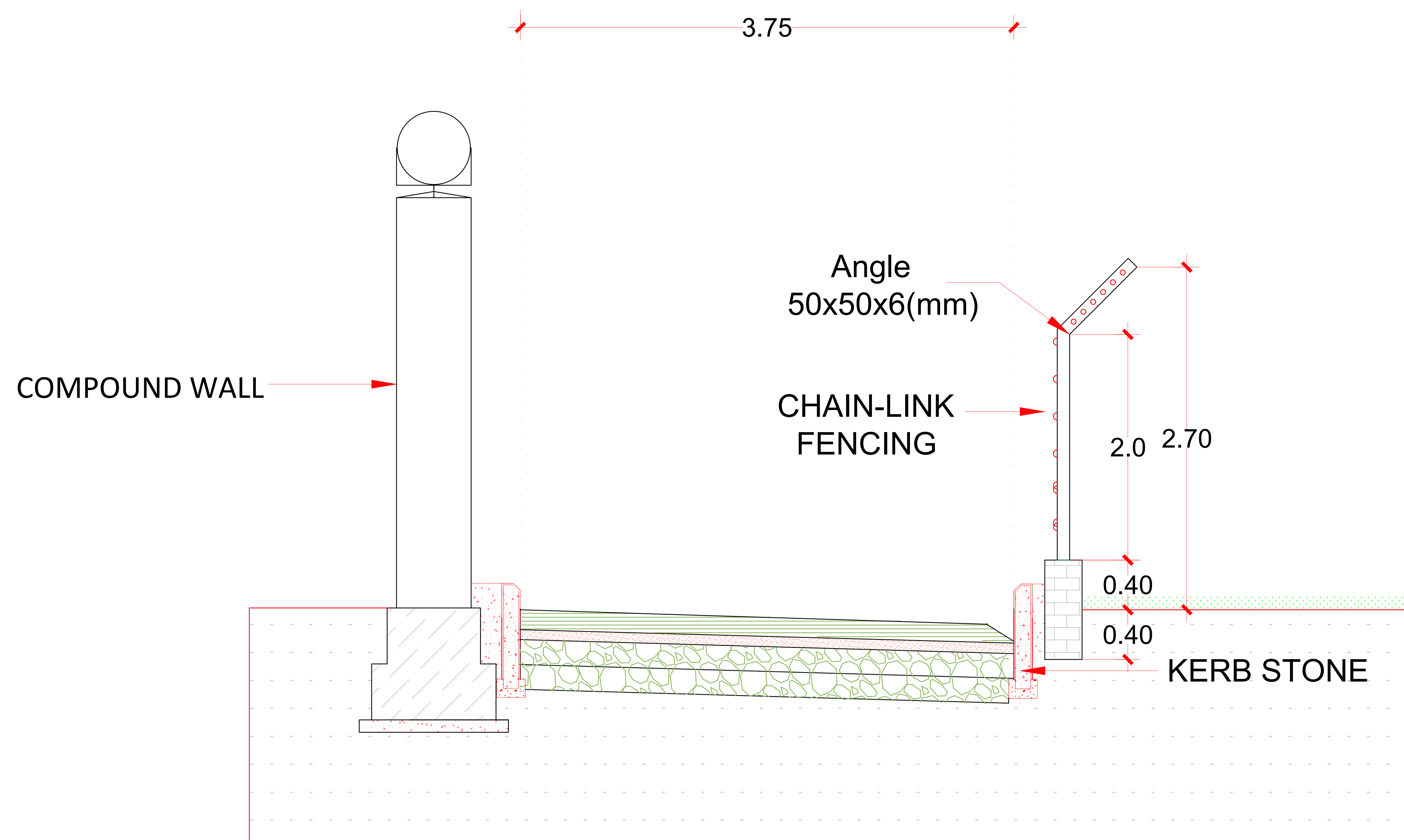
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NOTE:- APPROX 11KM LENGTH OF ROAD

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SMF-C EXTERNAL □ ATROLLING ROAD				
DATE	23-08-2024	REV	R0	
DWG. NO.	BARC/SMFC/CS/03/2024-25/TD/06			
				SHT- 01 OF 01



Typical Cross section X-X

Scale 1:50

- Notes :**
1. All dimensions are in metres unless noted otherwise.
 2. Wherever applicable, this drawing must be read along with the relevant co - ordination drawing.
 3. Any discrepancy between this drawing and other drawings must be brought to the notice of BARC.
 4. Use and Reproduction of this drawing is subject to conditions.

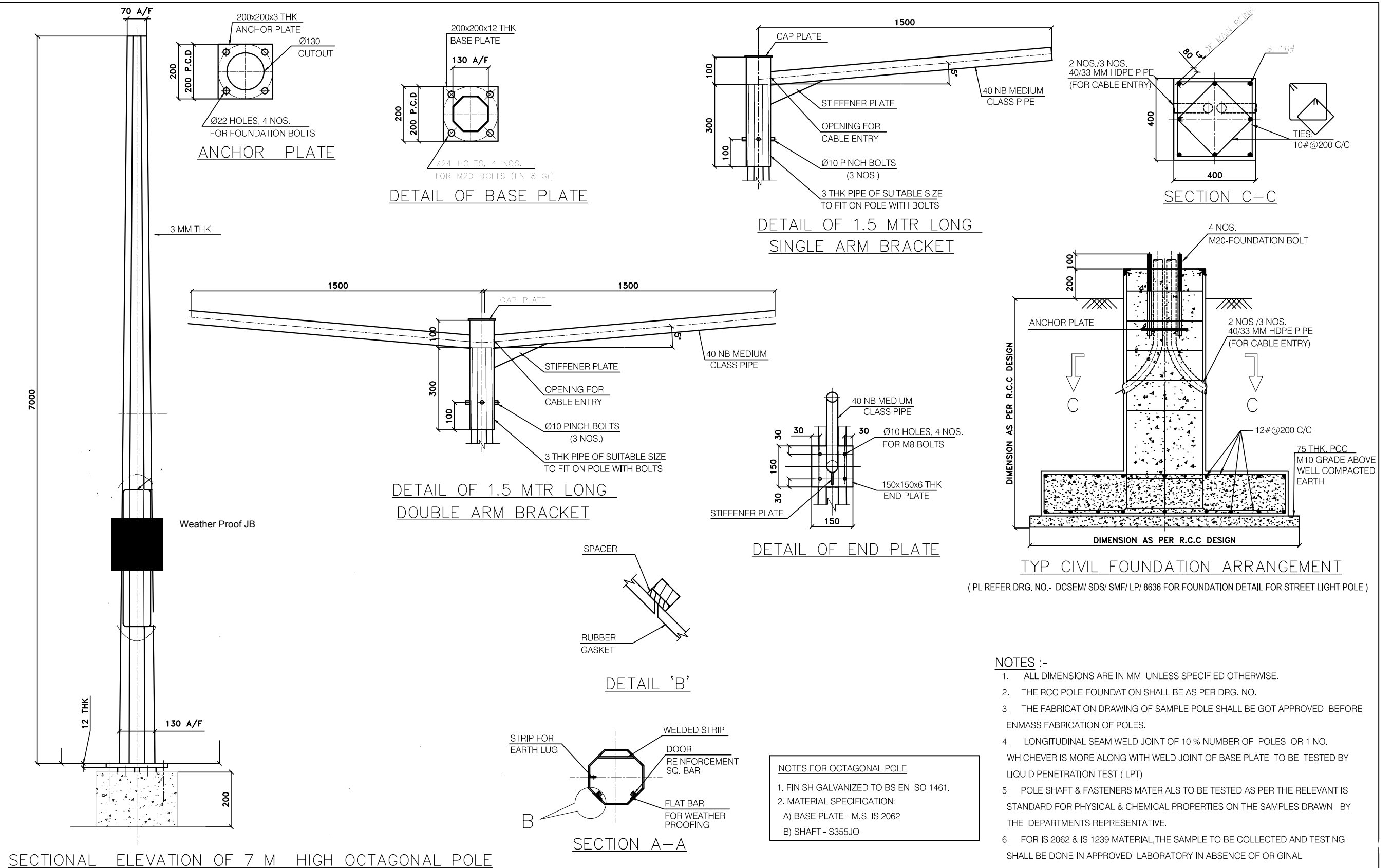
● **TENDER DRAWING**



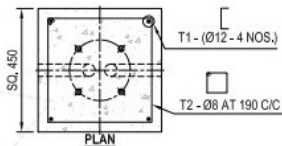
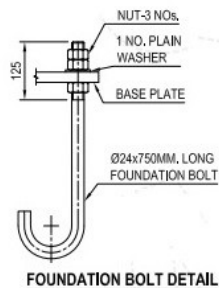
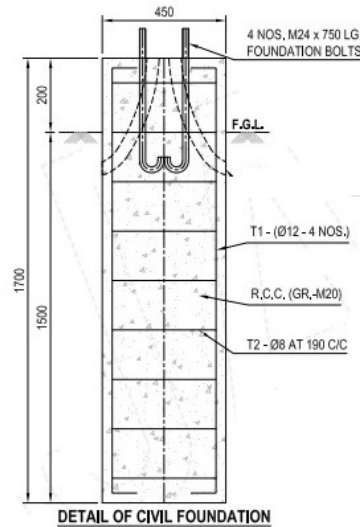
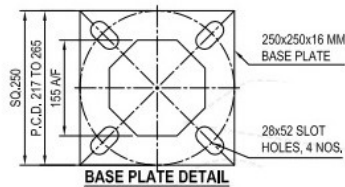
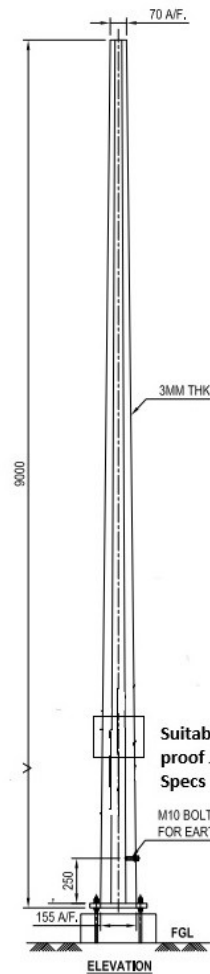
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INTERNAL ROAD NETWORK
CROSS SECTION X-X

DATE	23-08-2024	REV	R0	 SHT- 01 OF 01
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BARC SMFC 7 Meter Octogonal Pole Drawing



FOR TENDERING ONLY

Drawing No - BARC/SMFC/2024/Street Light- 9M

All Dimensions are in MM

Design Standards as per BS EN 40-3-1&3

Galvanised Finish as per BS EN ISO 1461

Base plate - MS IS 2062, Shaft S355J0

Shaft - Hot Rolled Steel Plate Conform to IS 2062 / BSEN 10025 or Equivalent

Flange/Gussets/Door Stiffener - As per IS 2062/BSEN 10025 or Equivalent Grade

Fabrication Drawing of Sample shall be got approved before enmass Fabrication

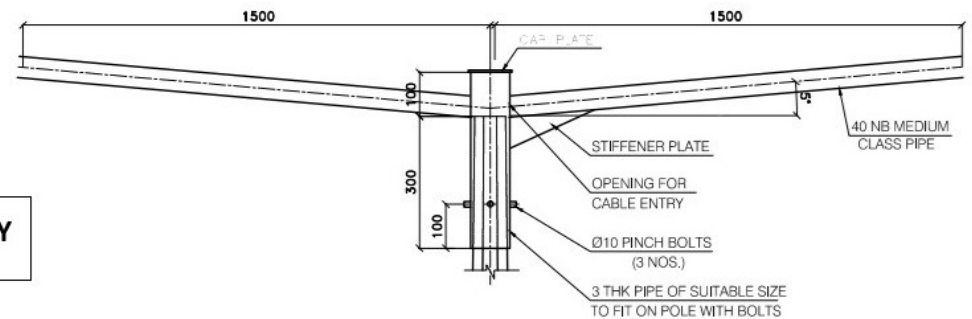
For IS 2062 & IS 1239 Material, The Sample to be collected and testing shall be done in approved laboratory in absence of original correlating material certificate

RCC - M20

Steel Reinforcement Fe 500

Concrete Vibrated Use Shuttering

Clear Cover to Reinforcement - 50mm



DETAIL OF 1.5 MTR LONG
DOUBLE ARM BRACKET

SECTION-VII (i)					
PROFORMA OF SCHEDULES					
Name of the Work:		Construction of road network including foot paths, storm water drains, culverts, embankment pitching, kerb stones, street lighting and fencing at BARC-SMF Project, Challakere, Chitradurga, Karnataka.			
Tender No:		BARC/SMFC/CS/03/2024-25/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	-	(i) 1 % of Gross Value of Work	At Water Treatment Plant located at entract gate. (Pipe/Hose for connecting the pipe from Outlet point to water tanker to be arranged by contractor)
2	Electricity for (i) Construction Activities (ii) Labour colony	As required	kWh	Rs. 10 per kWh	At one point near site of work / nearest available power source.
3	Land for (i) Temporary office and storage of Materials (ii) Labour colony	As required	-	At no cost.	Within the BARC site only, exact location shall be intimated by the EIC after placement of Contract.
Notes: (1) 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. (2) The contractor shall provide round-the-clock security, with one Security personnel assigned for each 8-hour shift. (3) 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 (Refer Section-III). (4) The contractor shall deploy a supervisor at all times in the labour colony to assist the department for security related issues. (5) Consumption of liquor and smoking are strictly prohibited in the construction site and lobour colony. The contractor shall submit an undertaking to ensure compliance with this policy.					
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	

PROFORMA OF SCHEDULES		
Name of the Work:	Construction of road network including foot paths, storm water drains, culverts, embankment pitching, kerb stones, street lighting and fencing at BARC-SMF Project, Challakere, Chitradurga, Karnataka.	
Tender No:	BARC/SMFC/CS/03/2024-25/NIT	
SCHEDULE 'D' (Not Applicable)		
Extra schedule for specific requirements / document for the work, if any.		
SCHEDULE 'E'		
Name of the Work:	Construction of road network including foot paths, storm water drains, culverts, embankment pitching, kerb stones, street lighting and fencing at BARC-SMF Project, Challakere, Chitradurga, Karnataka.	
Location:	: Special Materials Facility, BARC, DoddUllartha Kaval, Challakere, Karnataka-577537	
Scope of work	: For detailed scope of work refer Technical Specification.	
(i) Estimated cost of work	:	₹ 31,80,00,000.00 (+) GST as applicable.
(ii) Earnest money	:	₹ 47,52,000.00
(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:	Construction of road network including foot paths, storm water drains, culverts, embankment pitching, kerb stones, street lighting and fencing at BARC-SMF Project, Challakere, Chitradurga, Karnataka.
Tender No:	BARC/SMFC/CS/03/2024-25/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	: 14 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

PROFORMA OF SCHEDULES			
Name of the Work:		Construction of road network including foot paths, storm water drains, culverts, embankment pitching, kerb stones, street lighting and fencing at BARC-SMF Project, Challakere, Chitradurga, Karnataka.	
Tender No:		BARC/SMFC/CS/03/2024-25/NIT	
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)	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.
2	3/8 th (of whole work) as assessed from the running payments	2/4 th (of Stipulated Completion period)	
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		: 365 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		: 3% of Tendered value (However bill of lesser may also be accepted as per discretion of Engineer-in-Charge)	
Clause 10A (Applicable)			
List of testing equipment to be provided by the contractor at site lab.			
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	

PROFORMA OF SCHEDULES		
Name of the Work:		Construction of road network including foot paths, storm water drains, culverts, embankment pitching, kerb stones, street lighting and fencing at BARC-SMF Project, Challakere, Chitradurga, Karnataka.
Tender No:		BARC/SMFC/CS/03/2024-25/NIT
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.
13. Foot Rule.- 2 Nos.		14. Long Nylon thread – As required
15. Rebound hammer for testing concrete - 1 set		16.Dynamic penetrometer - 1 set
17.Magnifying Glass- As required		18. Screw driver 30CM Long- As required
19. Ball Pin hammer 100grm-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. Proctor Density Test equipments-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. Earth Resistance Test (For Electrical Works)- 1 set
29. 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 (Applicable)		
Component of labour expressed as percent of value of work		: 25%
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. 5,723 per MT
Steel reinforcement bars	MS Wire Rods	Rs. 61,050 per MT
Bitumen	Bitumen	Rs. 37,218 per MT

PROFORMA OF SCHEDULES	
Name of the Work:	Construction of road network including foot paths, storm water drains, culverts, embankment pitching, kerb stones, street lighting and fencing at BARC-SMF Project, Challakere, Chitradurga, Karnataka.
Tender No:	BARC/SMFC/CS/03/2024-25/NIT
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 (Not Applicable)	
Clause 10CC to be applicable in contracts with stipulated period of completion exceeding the period shown in next column	: 365 Calendar days
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.: 1 to 6, 35, 72 & 73	100%
(ii) Part - I - Civil Works- rest of the SOQ Items (iii) Part - II - Electrical 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. Excavator-1 Nos.
3. Earth Rammer Machine- 1 Nos.	4. Vibratory roller 8 to 10 tonne - 1 Nos
5. Tipper/Dumper- 2 Nos.	6. Emulsion Pressure Distributor - 1 Nos
7. Paver Machine/ finisher- 1 Nos	8. Centering & Shuttering Material – Minimum 800 Sqm.
9. Needle vibrators- 3 Nos.	10. Bar bending/Cutting Machine-1 nos
11. Air Compressor- 1 Nos.	12. Misc. machineries, tools & plants - as required.

PROFORMA OF SCHEDULES

Name of the Work:	Construction of road network including foot paths, storm water drains, culverts, embankment pitching, kerb stones, street lighting and fencing at BARC-SMF Project, Challakere, Chitradurga, Karnataka.
Tender No:	BARC/SMFC/CS/03/2024-25/NIT

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	Graduate Engineer or Diploma Engineer	Civil Engineering	Project / site engineer	5 or 10 Years Respectively.	1	Rs. 25,000/- per month
3	Graduate Engineer or Diploma Engineer	Civil Engineering	Project Planning /quality/ billing Engineer	2 or 5 Years Respectively.	1	Rs. 15,000/- per month
4	Graduate Engineer or Diploma Engineer	Electrical Engineer	Project Planning /quality/ billing Engineer	2 or 5 Years Respectively.	1	Rs. 15,000/- per month
5	Diploma Engineer	Quality Control	Quality Assurance Engineer	2 Years	1	Rs. 15,000/- per month

PROFORMA OF SCHEDULES						
Name of the Work:		Construction of road network including foot paths, storm water drains, culverts, embankment pitching, kerb stones, street lighting and fencing at BARC-SMF Project, Challakere, Chitradurga, Karnataka.				
Tender No:		BARC/SMFC/CS/03/2024-25/NIT				
6	Diploma Engineer	Safety	Safety supervisor	2 Years	1	Rs. 15,000/- per month
7	ITI	Surveyor	Surveyor	2 Years	1	Rs. 12,000/- per month
8	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				: 3% plus / minus		
For works with estimated cost put to tender more than Rs.5				: 2% plus / minus		
(b) Bitumen all works				: 2.5% plus only & nil on minus side		
(c) Steel Reinforcement and structural steel Sections for each				: 2% plus / minus		
(d) All other materials				: Nil		

PROFORMA OF SCHEDULES			
Name of the Work:		Construction of road network including foot paths, storm water drains, culverts, embankment pitching, kerb stones, street lighting and fencing at BARC-SMF Project, Challakere, Chitradurga, Karnataka.	
Tender No:		BARC/SMFC/CS/03/2024-25/NIT	
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. 11,446.00 per MT
2	Steel reinforcement bars	Nil	Rs.1,22,100.00 per MT
3	Bitumen	Nil	Rs.74,436.00 per MT

PROFORMA OF SCHEDULES

Name of the Work:	Construction of road network including foot paths, storm water drains, culverts, embankment pitching, kerb stones, street lighting and fencing at BARC-SMF Project, Challakere, Chitradurga, Karnataka.
Tender No:	BARC/SMFC/CS/03/2024-25/NIT
Special Instructions to Tenderers	
<u>Clause-53</u> Special Payment terms applicable for this tender	: a) For Part - I - Civil Works, the mode of measurement & payment terms shall be as per SOQ/ Conditions of Contract/ Specifications. b) For Part - II - Electrical works, the payment terms shall be as follows: i) Payment terms for Supply: - aa) 80 % of the supply price as per SOQ will be paid on pro-rata basis on receipt of materials at site in good conditions 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 ab) 10% of the supply price will be released after successful installation and test commissioning of the individual equipment. ac) Balance 10% of the supply price will be released on final acceptance of the entire Electrical work under the scope of the Contract, by BARC and submission of all completed documentation including 'As built drawings'. ii) Payment terms for Installation (including Testing and commissioning) portion: - aa) 80 % of the Installation price of the equipment will be paid as per the agreed unit rates and quantity after successful installation and test commissioning of the individual equipment. ab) 10% of the Installation price will be released after successful installation and test commissioning of the individual equipment. ac) Balance 10 % Installation price will be released on final acceptance of the entire Electrical work under the scope of the Contract, by BARC and submission of all completed documentation including 'As built drawings'.
<u>Clause-54.a</u> Applicability of Contractor's All Risk Policy Clause	: Yes
<u>Clause-57</u> Whether Sub-Contracting is allowed for this	: Yes
In case Sub-Contracting is allowed, details of portions (s) of the Contract that can be sub-contracted	: Part - II - Electrical works

Techno-commercial Bid Data Sheet

Name of the Work:

Construction of road network including foot paths, storm water drains, culverts, embankment pitching, kerb stones, street lighting and fencing at BARC-SMF Project, Challakere, Chitradurga, Karnataka.

Tender No:

BARC/SMFC/CS/03/2024-25/NIT

Instruction for Filling Techno-commercial Bid Data Sheet: 1) Details submitted by the Bidder in Pre-Qualification forms are to be filled by the bidder in the permitted cells (Yellow colour filled) and the Excel file is to be uploaded in CPP Portal.

Details of the Bidder		
1)	Name of the bidder(s):	
2)	Legal status of the bidder (An individual / proprietary firm / A firm in partnership / A limited company / Corporation/ Other) :	
3)	Year of establishment:	
4)	Registered Address of the bidder(s):	
5)	Postal Address of the bidder(s) along with Ph. No. & E-mail for correspondence:	
6)	Name, designation and contact details of the Authorised person of the bidder(s) for correspondence:	

FORM - A FINANCIAL INFORMATION					
I. Financial Analysis					
Particulars	Financial Year				
	FY:	FY:	FY:	FY:	FY:
i) Gross Annual turnover on Construction works (In Rupees Lakhs)					
ii) Profit / Loss (In Rupees Lakhs)					
Certified by					
Name and address of Chartered Accountant					
Unique Document Identification Number (UDIN)					

Name of the Work:

Construction of road network including foot paths, storm water drains, culverts, embankment pitching, kerb stones, street lighting and fencing at BARC-SMF Project, Challakere, Chitradurga, Karnataka.

Tender No:

BARC/SMFC/CS/03/2024-25/NIT

Name of the Work: Construction of road network including foot paths, storm water drains, culverts, embankment pitching, kerb stones, street lighting and fencing at BARC-SMF Project, Challakere, Chitradurga, Karnataka.

Tender No: BARC/SMFC/CS/03/2024-25/NIT

FORM - B	
FORM OF BANKERS CERTIFICATE FROM A SCHEDULED BANK	
Name of the bank issuing the Solvency Certificate:	
Amount mentioned in the Certificate:	
Date of certification:	

Name of the Work:

Construction of road network including foot paths, storm water drains, culverts, embankment pitching, kerb stones, street lighting and fencing at BARC-SMF Project, Challakere, Chitradurga, Karnataka.

Tender No:

BARC/SMFC/CS/03/2024-25/NIT

FORM - C

DETAILS OF ALL WORKS SATISFYING THE SIMILAR WORKS CRITERIA COMPLETED DURING THE LAST SEVEN YEARS ENDING PREVIOUS DAY OF LAST DAY OF ONLINE SUBMISSION OF THE TENDER.

S.No.	Name of work /project and location	Owner or sponsoring organization	Final completion cost of the work	Stipulated date of commencement as per the contract	Actual date of commencement	Stipulated date of completion as per contract	Actual date of completion	Justified period of Extension of Time (If applicable)	Litigation /arbitration cases pending /in progress with details*	Name & Address /Phone No. of officer to whom reference may be made.	Remarks
[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]

Name of the Work:Construction of road network including foot paths, storm water drains, culverts, embankment pitching, kerb stones, street lighting and fencing at BARC-SMF Project, Challakere, Chitradurga, Karnataka.

Tender No:BARC/SMFC/CS/03/2024-25/NIT

FORM – D

DETAILS OF WORKS UNDER EXECUTION OR AWARDED

(No works shall be left out)

S .No.	Name of work /project and location	Owner or sponsoring organization	Cost of work in Lakhs as per contract	Stipulated date of commencement as per the contract	Actual date of commencement	Stipulated date of completion as per contract	Up to date % progress of work	Slow progress if any and reasons thereof	Justified period of Extension of Time (If applicable)	Name & Address / Phone no. of officer to whom reference may be made	Remarks
[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]

Name of the Work:

Construction of road network including foot paths, storm water drains, culverts, embankment pitching, kerb stones, street lighting and fencing at BARC-SMF Project, Challakere, Chitradurga, Karnataka.

Tender No:

BARC/SMFC/CS/03/2024-25/NIT

FORM - G

DETAILS OF TECHNICAL & ADMINISTRATIVE PERSONNEL TO BE DEPLOYED FOR THE WORK

[illegible]

Name of the Work:

Construction of road network including foot paths, storm water drains, culverts, embankment pitching, kerb stones, street lighting and fencing at BARC-SMF Project, Challakere, Chitradurga, Karnataka.

Tender No:

BARC/SMFC/CS/03/2024-25/NIT

FORM - H										
DETAILS OF EQUIPMENT LIKELY TO BE USED IN CARRYING OUT THE PROPOSED WORK										
S.No.	Name of Equipment	No's	Capacity or Type	Age	Condition	Ownership status			Current Location	Remarks
						Presently owned (Invoice No. / Registration No. is to be mentioned)	Leased (Agreement no & Date is to be mentioned)	To be purchased		
[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]

Name of the Work: Construction of road network including foot paths, storm water drains, culverts, embankment pitching, kerb stones, street lighting and fencing at BARC-SMF Project, Challakere, Chitradurga, Karnataka.

Tender No: BARC/SMFC/CS/03/2024-25/NIT

Name of the Work:Construction of road network including foot paths, storm water drains, culverts, embankment pitching, kerb stones, street lighting and fencing at BARC-SMF Project, Challakere, Chitradurga, Karnataka.

Tender No:BARC/SMFC/CS/03/2024-25/NIT

FORM – I								
CALCULATION OF BIDDING CAPACITY								
I. MAXIMUM VALUE OF WORKS EXECUTED IN ANY ONE YEAR DURING THE LAST FIVE YEARS 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							

Name of the Work:

Construction of road network including foot paths, storm water drains, culverts, embankment pitching, kerb stones, street lighting and fencing at BARC-SMF Project, Challakere, Chitradurga, Karnataka.

Tender No:

BARC/SMFC/CS/03/2024-25/NIT

4)	FROM FY TO FY							
5)	FROM FY TO FY							

Name of the Work:

Construction of road network including foot paths, storm water drains, culverts, embankment pitching, kerb stones, street lighting and fencing at BARC-SMF Project, Challakere, Chitradurga, Karnataka.

Tender No:

BARC/SMFC/CS/03/2024-25/NIT

Maximum turn over in Construction Works executed in any one year during the last five years (ending on the previous day of last date of online submission of the tender) taking into account the completed as well as works in progress. The value of executed works shall be brought to current costing level by enhancing the actual value of works at a simple rate of 7% per annum calculated to last date of online submission of the tender (A):										

II. VALUE OF EXISTING COMMITMENTS AND ON-GOING WORKS TO BE COMPLETED DURING THE PERIOD OF COMPLETION OF WORK FOR WHICH TENDER HAS 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:	

Name of the Work:	Construction of road network including foot paths, storm water drains, culverts, embankment pitching, kerb stones, street lighting and fencing at BARC-SMF Project, Challakere, Chitradurga, Karnataka.
Tender No:	BARC/SMFC/CS/03/2024-25/NIT
Unique Document Identification Number (UDIN):	
Date of certification:	

Part-B

(Financial Bid/ Schedule of Quantity/ Price Schedule/ Schedule 'B'/ BOQ)

Name of Work : Construction of road network including foot paths, storm water drains, culverts, embankment pitching, kerb stones, street lighting and fencing at BARC-SMF Project, Challakere, Chitradurga, Karnataka.

NIT No. BARC/SMFC/CS/03/2024-25/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) The successful bidder must appoint an external consultant to design the pavement (according to IRC-37 standards), storm water drains and structural design of civil structures. Minimum 60 average CBR values (average of 3 specimens) shall be obtained along the alignment.
- 5) The successful bidder shall prepare Good For Construction drawings (for all the works) based on tender drawings, design approved by BARC, drawing issued by BARC and site conditions etc. The works shall be executed based on the approved good for construction drawings.
- 6) The Tentative Quality Assurance Plan is enclosed along with the specifications. The Quality Assurance Plan shall be finalized along with the successful bidder. The successful bidder shall tie up with an NABL accredited laboratory for sample collection and testing as per the Quality Assurance Plan.

7) The external patrolling road has a compound wall and chain-link fencing on adjacent sides, which restricts the movement of construction vehicles. The patrolling road must be constructed without damaging the compound wall or chain-link fencing. Bidders are requested to visit the site, inspect the area, and quote accordingly.

8) Bidders should quote their rates to include the cost of design work activities mentioned in the scope of work, collection and testing as per the Quality Assurance Plan, and the preparation of Good for Construction drawings. No additional payment will be made for these items.

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Item Rate BoQ

Tender Inviting Authority: Chief Engineer, Bhabha Atomic Research Centre, Mysuru.

Name of Work: Construction of road network including foot paths, storm water drains, culverts, embankment pitching, kerb stones, street lighting and fencing at BARC-SMF Project, Challakere, Chitradurga, Karnataka.

NIT No:- BARC/SMFC/CS/03/2024-25/NIT

Name of the Bidder/ Bidding Firm / Company :			
<u>PRICE SCHEDULE</u> (Note: (i) This BOQ template must not be modified or replaced by the bidder. It should be uploaded after filling the relevant columns. Failure to comply shall result in rejection of the bid for this tender. Bidders are only allowed to enter the Bidder Name and Values. (ii) Bidder is instructed to read the "General Instructions to Bidders" sheet and quote the rates accordingly. (iii) Rates to be quoted by the bidder(s) 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 #
Sl. No.	Item Description	TOTAL AMOUNT in Rs. P	TOTAL AMOUNT In Words
1	2	53	55
1	Part - I - Civil Works	0.00	INR Zero Only
2	Part - II - Electrical works	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: Construction of road network including foot paths, storm water drains, culverts, embankment pitching, kerb stones, street lighting and fencing at BARC-SMF Project, Challakere, Chitradurga, Karnataka.

NIT No:- BARC/SMFC/CS/03/2024-25/NIT

Name of the Bidder/ Bidding						
PRICE SCHEDULE Part - I - Civil Works (Note: (i) This BOQ template must not be modified or replaced by the bidder. It should be uploaded after filling the relevant columns. Failure to comply shall result in rejection of the bid for this tender. Bidders are only allowed to enter the Bidder Name and Values. (ii) Bidder is instructed to read the "General Instructions to Bidders" sheet and quote the rates accordingly. (iii) Rates to be quoted by the bidder(s) 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	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/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 soils in designated areas within a lead of 50 m etc., all complete as per specifications and as directed by the Engineer-in-Charge. For depth up to & including 1.50 m	12751.00	Cu.M		0.00	INR Zero Only
2	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/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 soils in designated areas within a lead of 50 m etc., all complete as per specifications and as directed by the Engineer-in-Charge. For depth beyond 1.50 m and up to & including 3.00 m.	524.00	Cu.M		0.00	INR Zero Only
3	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/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. For depth up to & including 1.50 m	524.00	Cu.M		0.00	INR Zero Only

4	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 <u>soft / decomposed rock (without blasting)</u> 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. For depth beyond 1.50 m and up to & including 3.00 m	22.00	Cu.M		0.00	INR Zero Only
5	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 <u>hard rock (without blasting)</u> 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. For depth up to & including 1.50 m	674.00	Cu.M		0.00	INR Zero Only
6	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 <u>hard rock (without blasting)</u> 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. For depth beyond 1.50 m and up to & including 3.00 m	22.00	Cu.M		0.00	INR Zero Only
7	Providing and laying in position cement concrete of 1:4:8 (1 cement, 4 crushed sand, 8 graded stone aggregate of maximum size 20 / 40 mm) including necessary form work, consolidation, finishing, curing etc. complete as per specifications and drawings complete at all levels	3140.00	Cu.M		0.00	INR Zero Only
8	Providing and laying in position cement concrete of 1:2:4 (1 cement, 2 crushed sand, 4 graded stone aggregate of nominal size 20 mm) including consolidation, finishing, curing etc. complete as per specification and drawings but excluding the cost of Formwork shuttering, centering and steel reinforcement at all Levels	979.00	Cu.M		0.00	INR Zero Only
9	Providing and fixing at all levels precast members using cement concrete of Grade M-30 in copings and / or bed blocks, plain window sills, shelves, louvers, steps, staircases, trench covers, drain covers etc. including hoisting and setting in position with C.M 1:3 (using crushed sand) cost of required centering, shuttering and finishing smooth with 6 mm thick cement plaster 1:3 (using crushed sand) on exposed surfaces complete as per specifications and as directed by the Engineer-in-charge.	15.00	Cu.M		0.00	INR Zero Only
10	Providing and laying in position Reinforced Cement Concrete (RCC) of Grade M-25 using 20mm maximum size aggregates and crushed sand of approved quality including admixtures of approved brand and quality (plasticiser or super plasticiser) if required, including design mix, weigh batching, mechanical mixing, transporting, placing, vibrating, consolidation, finishing, curing etc. complete but excluding the cost of centering, shuttering and reinforcement complete as per specifications up to Plinth Level, for culverts, road drainages etc.	2973.00	Cu.M		0.00	INR Zero Only

11	Providing and laying in position Reinforced Cement Concrete (RCC) of grade M-30 using 20mm maximum size aggregates and crushed sand of approved quality including admixtures of approved brand and quality (plasticiser or super plasticiser) if required, including design mix, weigh batching, mechanical mixing, transporting, placing, vibrating, consolidation, finishing, curing etc. complete but excluding the cost of centering, shuttering and reinforcement complete as per specifications up to Plinth Level for buildings, culverts, road drainages etc.	898.00	Cu.M		0.00	INR Zero Only
12	Extra (over and above the item no 10 & 11) rate for providing RCC of all grades in super structure of buildings up to 20.00 metre height.	100.00	Cu.M		0.00	INR Zero Only
13	Providing Reinforcement Steel for reinforced cement concrete at all levels including supplying, preparation of bar bending schedules, cutting, bending, transporting, fixing, tying in position with G.I binding wire, all labour charges, cost of cover blocks in specified grade of concrete etc. complete as per specifications and drawings. Reinforcement Steel supplied by the contractor Using Fe 500D TMT bars of specified grades of all sizes. TMT bars to be supplied by the contractor from the plants only using virgin materials	272.00	MT		0.00	INR Zero Only
14	Providing Structural steel work in M.S Plain Plates and chequered Plates for Embedded Parts, Trench Covers, Connection plates etc. including cutting, hoisting, fixing in position and applying a priming coat of approved zinc chromate steel primer etc. including cost of structural steel Plates, welding all labour charges etc. complete as per drawings and specifications. Structural steel produced by using virgin materials shall be used. All test reports to be provided along with the supply of the materials.	6.00	MT		0.00	INR Zero Only
15	Providing Structural steel work using angles, channels, joists and other sections, welded and / or bolted in built up sections for trusses, structural steel floors, gates, frame works, monorails and other structures including supplying, cutting, welding, fabricating, hoisting, fixing in position, applying a priming coat of approved steel primer etc. complete all as per specifications, drawings and as directed by the Engineer in charge. Up to and including 300 mm Joists, 350 mm channels, and below sections using materials. All test reports to be provided along with the supply of the materials	35.00	MT		0.00	INR Zero Only
16	Providing, supplying, cutting, welding, fabricating, hoisting and fixing in position structural steel members like trusses, purlins, posts etc. using MS hollow / circular / square / rectangular tubular sections including applying a coat of Zinc chromate primer of approved make all as per specifications, drawings and as directed by the Engineer in charge	6.00	MT		0.00	INR Zero Only
17	Providing and fixing at all levels MS bolts including nuts and washers of approved size, quality and make as per requirements and as per specifications, drawings complete all as directed at site by the Engineer in charge	2000.00	kg		0.00	INR Zero Only
18	Providing, centering, shuttering Form work using steel plates, timber planks for all types of structures including necessary strutting, propping, staging, supports, bracings etc. and de-shuttering the same after the specified time all as per drawings, specifications and as directed by the Engineer-in-charge at all levels For Sub Structure (i.e. up to Plinth Level) of buildings, culverts, road drainages, foundations etc.	17198.00	Sq.M		0.00	INR Zero Only
19	Providing, centering, shuttering Form work using steel plates, timber planks for all types of structures including necessary strutting, propping, staging, supports, bracings etc. and de-shuttering the same after the specified time all as per drawings, specifications and as directed by the Engineer-in-charge at all levels For super structure of buildings up to 20.00 metre height.	500.00	Sq.M		0.00	INR Zero Only

20	Providing and constructing Random Rubble masonry using approved Rubble stone in foundation and plinth in C.M 1:6 (using crushed sand) including raking out joints or simultaneous flush pointing below ground level / plinth level, curing etc. complete as per drawings and specifications.	325.00	Cu.M		0.00	INR Zero Only
21	Providing 12 mm thick plastering in cement mortar 1:4 without cement punning (using crushed sand) finished smooth, including sieving of sand to required fineness, preparation of the surface, scaffolding, curing all as per specifications, drawings and as directed at site complete.	110.00	Sq.M		0.00	INR Zero Only
22	Providing 20 mm thick plastering in C.M without cement punning 1:4 (using crushed sand) finished smooth, including sieving of sand to required fineness, preparation of the surface, scaffolding, curing all as per specifications, drawings and as directed at site complete.	110.00	Sq.M		0.00	INR Zero Only
23	Extra rate for providing cement punning for all types of mixes complete all as per specifications and as directed	5968.00	Sq.M		0.00	INR Zero Only
24	Providing 6 mm thick cement plastering with C. M 1:3 in concrete surfaces (using crushed sand) finished with a floating coat of neat cement for bearing of RCC beams and slabs, including hacking of concrete surfaces with a pointed tool, scaffolding, finishing, curing etc. complete as per specifications and as directed by the Engineering-charge	110.00	Sq.M		0.00	INR Zero Only
25	Providing and grouting the joints of rubble stone pitching with cement mortar 1:3 and pointing the surfaces as directed complete as directed by the Engineer-in-charge	21242.00	Sq.M		0.00	INR Zero Only
26	Providing and applying one coat of cement primer of approved brand on wall surface, kerb stones to receive specified paint including scaffolding complete all as per specifications and as directed by Engineer-in-charge	15864.00	Sq.M		0.00	INR Zero Only
27	Providing and Painting two coats of synthetic enamel paint on Steel Surfaces of approved brand and manufacture to give an even shade without primer coat. Including preparation of the surfaces, scaffolding complete. as per specifications and as directed by the Engineer-in-charge	2200.00	Sq.M		0.00	INR Zero Only
28	Dismantling plain cement concrete manually / by mechanical means carefully without damaging adjacent structures including disposal of debris within 200 m lead as per direction of Engineer-in-charge	33.00	Cu.M		0.00	INR Zero Only

29	Dismantling of RCC works carefully manually / by mechanical means without damaging adjacent structures excluding cutting of reinforcement including stacking of steel reinforcement bars and disposal of unserviceable materials within 200 m lead as per direction of Engineer-in-charge	11.00	Cu.M		0.00	INR Zero Only
30	Demolishing Stone rubble masonry (In cement mortar) manually / by mechanical means carefully without damaging adjacent structures including stacking of serviceable materials and disposal of unserviceable materials within 100 m lead as per direction of Engineer-in-charge	11.00	Cu.M		0.00	INR Zero Only
31	Demolishing dry stone pitching in floors, drains etc. including stacking serviceable materials and disposal of unserviceable materials within 200 m lead	50.00	Cu.M		0.00	INR Zero Only
32	Dismantling Bituminous road including stacking of serviceable materials and disposal of unserviceable materials within 200 m lead. Bituminous Road	174.00	Cu.M		0.00	INR Zero Only
33	Lead charges for 1st 1 KM or part thereof, by mechanical transport including loading unloading, stacking / levelling etc. Debris up to 1 km	11.00	Cu.M		0.00	INR Zero Only
34	Lead charges for Lead Exceeding 1 KM but not exceeding 2 KM, by mechanical transport including loading, unloading, stacking / levelling etc. Debris Beyond 1 Km but up to and including 2 km	278.00	Cu.M		0.00	INR Zero Only
35	Preparation and consolidation of sub-grade (Proof Rolling) with power roller of 8 to 10T capacity including excavating earth to an average thickness of 22.5 cm depth, dressing to camber and consolidating with road roller including making good the undulations etc. and rerolling the subgrade and disposal of surplus earth within a lead of 200 m	16819.00	Sq.M		0.00	INR Zero Only
36	Labour charges for dry stone pitching 22.5 cm thick by using good soling stones available at site, preparing the surface complete	165.00	Sq.M		0.00	INR Zero Only
37	Providing and applying tack coat using bitumen emulsion with Rapid Setting conforming to IS:8887, using emulsion pressure distributor including preparing the surface & cleaning with mechanical broom etc. complete as per specifications and as directed by EIC. On WBM / WMM @ 0.75 kg / sqm	87557.00	Sq.M		0.00	INR Zero Only

38	Providing and applying tack coat using bitumen emulsion with Rapid Setting conforming to IS:8887, using emulsion pressure distributor including preparing the surface & cleaning with mechanical broom etc. complete as per specifications and as directed by EIC. On bituminous surface @ 0.50 kg / sqm	175113.00	Sq.M		0.00	INR Zero Only
39	Providing laying bituminous macadam of thickness 50 to 75 mm as directed on prepared surface with specified graded crushed stone aggregate for profile corrective base / binder course including loading of aggregate with FE loader, hot mixing of stone aggregates and bitumen in hot mix plant, transporting the mixed material by tippers to paver and laying the mixed material with paver to the required level and grade and rolling with road rollers, as per specification to achieve the proper compaction but excluding the cost of primer / tack coat with bitumen of Grade VG 30 @ 3.5% (percentage by weight of total mix)	12359.00	MT		0.00	INR Zero Only
40	Providing and laying dense bituminous concrete of thickness 25 to 40 mm as directed on prepared surface with specified graded stone aggregate for wearing course including loading of aggregate with FE loader and hot mixing of bitumen with filler and stone aggregate in hot mix plant transporting the mixed material by tippers to paver and laying the mixed material with mechanical paver finisher fitted with electronic sensing device to the required level and grade and rolling with road rollers, as per specification, to achieve proper compaction but excluding cost of primer / tack coat with bitumen of grade VG 30 @ 5% (percentage by weight of total mix)	6019.00	MT		0.00	INR Zero Only
41	Providing and applying 2.5 mm thick road marking strips (retro-reflective) of specified shade / colour using hot thermoplastic material by fully / semi automatic thermoplastic paint applicator machine fitted with profile shoe healer, glass beads dispenser, propane tank heater etc. driven by experienced operator on road surface including cost of material, labour, T&P, cleaning the road surface of all dirt, dust, oil, grease and foreign material etc. complete as per direction of Engineer-in-charge and in accordance with specifications and as directed by the Engineer-in-charge	6767.00	Sq.M		0.00	INR Zero Only
42	Providing and laying 60 mm thick factory made cement concrete interlocking paver block of M-30 grade made with strong vibratory compaction and approved size, shape, design laid in required colour and pattern over and including 50 mm thick compacted bed of crushed sand, filling the joints with crushed sand etc. all complete as -per the direction of the Engineer-in-charge	4180.00	Sq.M		0.00	INR Zero Only
43	Providing and laying 80 mm thick factory made cement concrete interlocking paver block of M-35 grade made by block making machines with strong vibratory compaction and approved size, shape, design laid in required colour and pattern over and including 150 mm thick compacted bed of stone dust / Murrum, filling the joints with crushed sand etc. all complete as -per the direction of the Engineer-in-charge	220.00	Sq.M		0.00	INR Zero Only
44	Providing and fixing dry stone pitching 22.5 cm thick laid in required profile with hammer dressed stones having no side less than 15 cm, with minimum depth of 20 cm including preparing the bedding surface with compaction etc. all complete as directed by the Engineer-in-charge.	18035.00	Sq.M		0.00	INR Zero Only
45	Providing and laying, spreading and compacting granular sub-base (GSB) material up to 300 mm thick (150 mm thick in each layer) compacted layer of crushed sand, murrum, gravel crushed stone and combination there of as per specification including spreading on the prepared sub grade, maintaining the required slope and grade and cross fall (camber) etc. complete as directed by the Engineer-in-charge (Compacted thickness only will be measured and paid for and before laying GSB existing soil is to be compacted)	5258.00	Cu.M		0.00	INR Zero Only
46	Providing, laying, spreading and compacting hand broken/ crushed stone aggregate, Wet Mix Macadam including premixing of material with water in mixing plant for Wet Mix Macadam, carriage of mixed material by tippers to the site and laying material in uniform thickness and laying by mechanical paver including rolling with road roller 8/10 tonne capacity in stages to proper grade and camber spreading and brooming etc. complete as directed by the Engineer-in-Charge (Compacted thickness only will be measured and paid for and before laying WMM existing layer is to be compacted)	12340.00	Cu.M		0.00	INR Zero Only

47	Providing & fixing barbed wire to MS posts conforming to IS : 278 of approved make & having 2.5 mm line barbed wire & 2 mm point wire, 2 ply 4 pointed barbs at 75 mm apart including providing & fixing of barbed wire with suitable U bolts and nuts all as per drawing & specifications as directed by the Engineer In charge.(Rate shall include cost of Barbed wire, U bolts & nuts, making holes to the MS angle etc.). With G.I. barbed wire having 2.5 mm line barbed wire & 2 mm point wire (Mass of Complete Barbed wire shall be between 108-125 gm/m).	8604.00	RM		0.00	INR Zero Only
48	Providing & Fixing of wire fabric chain link fencing of 50 mm x50mmx 4 mm thick to the angle post including strengthening with 3mm dia wire at top & bottom, providing & fixing of nuts & bolts, 6 mm dia vertical bar at every angle post & washers, making holes to the angles etc. as required to complete the work as per specifications, drawing & the direction of the EIC. Cost of 6mm dia vertical bar shall be paid under respective item. Note: The existing barbed wire fencing (along with the stones) of 2.5 km length is to be removed by the successful bidder during the execution of the chain-link fencing. The removed barbed wire fencing (along with the stones) is to be transported and stored at a location specified by the EIC. Bidders are requested to quote the rate for the item, including the cost of removing the existing barbed wire fencing and stones for 2.5 km in length.	5260.00	Sq.M		0.00	INR Zero Only
49	Supplying , cutting to shape and fixing specified diameter UPVC pipes as per IS 4985 in RR Masonry/ RCC walls for weep holes complete all as per drawings and as specified at site. 90 mm dia UPVC Pipes	5.00	RM		0.00	INR Zero Only
50	Providing and constructing Course Rubble masonry (first sort) using approved hard stone in foundation, for chain-link fencing; in C.M 1:6 (using crushed sand) including raking out joints or simultaneous flush pointing below ground level / plinth level, , curing etc. complete as per drawings and specifications.	1219.00	Cu.M		0.00	INR Zero Only
51	Providing two coats of synthetic enamel paint of approved brand and manufacture on new work (including kerb stones) of required colour to give an even shade.	15864.00	Sq.M		0.00	INR Zero Only
52	Providing and laying non-pressure NP2 class (light duty) R.C.C. pipes with collars jointed with stiff mixture of cement mortar in the proportion of 1:2 (1 cement : 2 fine sand) including testing of joints etc. complete :					
52.1	150 mm dia. R.C.C. pipe	1650.00	RM		0.00	INR Zero Only
52.2	300 mm dia. R.C.C. pipe	2476.00	RM		0.00	INR Zero Only
53	Providing and laying Non Pressure NP-3 class (Medium duty) R.C.C. pipes including collars/spigot jointed with stiff mixture of cement mortar in the proportion of 1:2 (1 cement : 2 fine sand) including testing of joints etc. complete:					

53.1	450 mm dia RCC pipes	53.00	RM		0.00	INR Zero Only
53.2	600 mm dia RCC pipes	270.00	RM		0.00	INR Zero Only
53.3	1200 mm dia RCC pipes. (Laying by manual/ mechanical means)	248.00	RM		0.00	INR Zero Only
54	Providing and fixing Glow studs of size 100x20 mm made of heavy duty body shall be moulded ASA (Acrylic styrene Acrylortrite) or HIP (High impact polystyrene) or ABS having electronically welded micro- prismatic lens with abrasion resistant coating as approved by Engineer in charge. The glow stud shall support a load of 13635 kg tested in accordance with ASTM D4280. The slope of retro- reflective surface shall be 35 (+/-5) degrees to base .The reflective panels on both sides with at least 12 cm of reflective area up each side. The luminance intensity should be as per the specification and shall be tested as described in ASTM I: 809 as recommended in BS: 873 part 4 : 1973. The studs shall be fixed to the Road surface using the adhesive conforming to IS, as per procedure recommended by the manufacturer complete and as per direction of Engineer-in-charge.	3003.00	each		0.00	INR Zero Only
55	Manufacturing, supplying and fixing retro reflective sign boards made up of 2 mm thick aluminium sheet, face to be fully covered with high intensity encapsulated type heat activated retro reflective sheeting conforming to type - IV of ASTM-D 4956-01 in blue and silver white or other colour combination including subject matter, message (bilingual), symbols and borders etc. as per IRC ; 67:2001, pasted on substrate by an adhesive backing which shall be activated by applying heat and pressure conforming to class -2 of ASTM-D-4956-01 and fixing the same with suitable sized aluminium alloy rivets @ 20 cm c/c to back support frame of M.S. angle iron of size 25x25x3 mm along with theft resistant measures, mounted and fixed with 2 Nos. M.S. angles of size 35x35x5 mm to a vertical post made up to M.S. Tee section ISMT 50x50x6 mm welded with base plate of size 100x100x5 mm at the bottom end and including making holes in pipes, angles flats, providing & fixing M.S. message plate of required size, steel work to be painted with two or more coats of synthetic enamel paint of required shade and of approved brand & manufacture over priming coat of zinc chromate yellow primer (vertical MS-Tee support to be painted in black and white colours).Backside of aluminium sheet to be painted with two or more coats of epoxy paint over and including appropriate priming coat including all leads and lifts etc. complete as per drawing , specification and direction of Engineer-in-charge.					
55.1	Mandatory/ Regulatory sign boards of 900 mm diameter with support length of 3750 mm	20.00	each		0.00	INR Zero Only
55.2	Cautionary /warning sign boards of equilateral triangular shape having each side of 900 mm with support length of 3650 mm	20.00	each		0.00	INR Zero Only

56	Manufacturing, supplying and fixing retro reflective overhead signage boards made up of 2 mm thick aluminium sheet, face to be fully covered with high intensity and encapsulated lens type heat activated retro reflective sheeting conforming to type - III of ASTM-D-4956-01 as approved by Engineer-in-charge, letters, borders etc. as per IRC : 67-2001 in silver white with blue colour back ground and with high intensity grade, pasted on substrate by pressure sensitive adhesive backing which shall be activated by applying pressure conforming to class II of ASTM-D-4956-01 and fixing the same to the plate of structural frame work by means of suitable sized aluminium alloys, rivets or bolts & nuts @ 300 mm centre to centre all along the periphery as well as in two vertical rows along with theft resistant measures, including the cost of painting with two or more coats of epoxy paint in grey colour on the back side of aluminium sheet including appropriate priming coat. The rate includes the cost of rounding off the corners, lowering down the structural frame work from the gantry, fixing and erecting the same in position all complete as per drawings, specification and direction of the engineer-in charge.(Structural frame work including M.S. plate to be provided separately. Rectangular area of the sheet only shall be measured for payment). Overhead informatory road signage	28.00	sqm		0.00	INR Zero Only
57	Providing and fixing post delineators made of ABS round body fitted with 2 nos 100 mm dia high reflective reflectors and mounted on MS pipe of 65 mm dia duly powder coated anti-rust and anti theft steel to be installed as per direction of Engineer-in-charge.	400.00	each		0.00	INR Zero Only
58	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).	2044.00	Cu.M		0.00	INR Zero Only
59	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 (cost of Priming & Painting inclusive). Size shall be as per the directions of Engineer-in-charge.	6292.00	kg		0.00	INR Zero Only
60	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	1259.00	RM		0.00	INR Zero Only
61	Providing, applying one coat of primer with ready mixed red oxide primer of approved brand and manufacturer on steel works including preparation of the surfaces, scaffolding complete. as per specifications and as directed by the Engineer-in-charge	220.00	Sq.M		0.00	INR Zero Only
62	Providing and constructing brick work in Cement mortar using standard bricks of approved class/ quality, make or brand including curing, raking out joints, simultaneous pointing below plinth level if specified, complete as per drawings, specifications and as directed by the Engineer-in charge. Brick work in C.M 1:4 using crushed sand in Sub Structure (i.e. up to Plinth Level) of buildings, culverts, road drainages, foundations etc.	55.00	Cu.M		0.00	INR Zero Only
63	Providing and constructing brick work in cement mortar using Standard bricks of approved quality / class, make / brand in super structure above plinth up to Floor-II level in all shapes and sizes including curing, raking out joints complete as per specifications and as directed by the Engineer-in-charge Brickwork in super structure of buildings with standard bricks in C.M 1:4 using crushed Sand	55.00	Cu.M		0.00	INR Zero Only

64	Providing and fixing pre-coated 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	110.00	Sq.M		0.00	INR Zero Only
65	Providing and fixing pre-coated 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 such as ridges, gutters, aprons and flashings of Galvalume sheet up to 600 mm total width	55.00	RM		0.00	INR Zero Only
66	Providing, Laying, jointing, fixing and testing Heavy quality (C-Class) Galvanised Iron pipes and ISI marked fittings like, tees, elbows, bends, unions, nipples, reducers etc. as required for the external work , including trenching, refilling, testing the pipes and fittings for 10.00 Kg / Sq.Cm hydraulic pressure with a minimum period of two hours duration with clean water, including cutting , threading, jointing with hemp yarn, white lead, jointing Teflon tape, complete all as per specifications and drawings, including two coats of anti-corrosive bitumastic paint as directed by the Engineer-in-charge. 50 mm diameter nominal bore	1100.00	RM		0.00	INR Zero Only
67	Providing and constructing Inspection chambers of Internal size clear dimension of 900 x 600 mm in 230 thick brick masonry with cement mortar 1:4 over a bed of 150 mm thick 1:4:8 cement concrete foundation, plastering with cement mortar 1:4 20 mm thick on inside, out side and all exposed surfaces finished with a floating coat of neat cement, brick corbelling at top to provide opening of 900 X 450 mm, embedding the frame and cover with CC 1:2:4 concrete, and fixing cast iron steps if necessary at 300mm intervals complete . Depth of chamber not exceeding 900 mm. (excavation, soling, cast iron cover and C.I steps will be paid separately under relevant item)	4.00	each		0.00	INR Zero Only
68	Extra depth (for Inspection chambers of Internal size clear dimension of 900 x 600 mm) over initial depth of 900 mm for chambers of 900 x 600 mm internal size. Including fixing cast iron steps (C.I steps shall be paid under relevant item)	11.00	meter		0.00	INR Zero Only
69	Constructing brick masonry circular type manhole 0.91 m internal dia at bottom and 0.56 m dia at top, with 230 mm brick work in cement mortar 1:4, inside and outside & all exposed surfaces cement plaster 20 mm thick with cement mortar 1:3 finished with a floating coat of neat cement, foundation concrete of mix 1:3:6 and making necessary channel in cement concrete 1:2:4 finished with a floating coat of neat cement all complete as per standard design , fixing C.I circular manhole cover, C.I steps as per the drawing (C.I frame & cover, C.I steps and excavation work will be paid separately under relevant Item.) For an initial depth of 910 mm	6.00	each		0.00	INR Zero Only
70	Extra depth for circular type manhole 910 mm internal dia at bottom and 569 mm Internal dia at top, in brick work. Beyond 0.91 m	22.00	meter		0.00	INR Zero Only
71	Supplying and fixing Cast Iron Man hole cover or Cast Iron Steps of approved make and weight as specified in the drawings or as directed by the Engineer in charge.	1100.00	kg		0.00	INR Zero Only
72	Filling available excavated earth (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.	5940.00	Cu.M		0.00	INR Zero Only

73	Lead charges for 1st 1 KM or part thereof, by mechanical transport including loading unloading, stacking / levelling etc. For Soil	5940.00	Cu.M		0.00	INR Zero Only
74	Providing and laying design mix cement concrete of M-30 grade in roads, taxi tracks and runways using crushed Sand, graded stone aggregate of 20 mm nominal size in appropriate proportions as per specified design criteria approved by Engineer-in-charge, mechanically vibrated using needle / Surface vibrators including steel form work with sturdy M-S channel sections including curing and providing and filling construction joints and dummy joints with approved joint filler primer or equivalent including rounding of the edges and filling the grooves 10 x 25 mm deep at top for construction joints and 10 mm x 50 mm deep at top for dummy joints with joint sealing compound (conforming to grade B of IS:1834) including making necessary arrangements for expansion joints etc. all complete as directed by the Engineer-in-charge.	850.00	Cu.M		0.00	INR Zero Only
75	Providing and fixing in position pre-moulded jointer filler in expansion joints	1000.00	RM		0.00	INR Zero Only
76	Providing and laying in position bitumen hot sealing compound for expansion joints using approved make.	15.00	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: Construction of road network including foot paths, storm water drains, culverts, embankment pitching, kerb stones, street lighting and fencing at BARC-SMF Project, Challakere, Chitradurga, Karnataka.

NIT No:- BARC/SMFC/CS/03/2024-25/NIT

Name of the Bidder/ Bidding Firm / Company :						
PRICE SCHEDULE Part - II - Electrical works (Note: (i) This BOQ template must not be modified or replaced by the bidder. It should be uploaded after filling the relevant columns. Failure to comply shall result in rejection of the bid for this tender. Bidders are only allowed to enter the Bidder Name and Values. (ii) Bidder is instructed to read the "General Instructions to Bidders" sheet and quote the rates accordingly. (iii) Rates to be quoted by the bidder(s) 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	Power Distribution Panel at LTSS - Design, Fabrication, supply, installation, testing & commissioning of single front, Self Standing, Compartmentalized, Non-Draw out Distribution Panels as per IEC 61439 1 & 2 Fully type tested panel per Technical specifications and approved GA Drawing. -- Incomers with Graphical display THD measuring Meter -- Suitable size Analog Voltmeter and ammeter for incomers -- Outgoings Shall have Digital Ammeter -- All incoming and outgoing breakers shall have ON/OFF/Trip Indication Main Power Distribution Panel at LT Substation --Incomer-1 & 2 - 2 No's of 4-Pole, 800A, 50kA, Electrically Interlocked ACBs with LSIG Protection -- Bus Coupler - 1 No's of 800A , 50kA ACB's Electrically Interlocked with ACBs with LSIG Protection --Outgoings- 6 No's of 400Amps MCCB's, 6 No's of 200A MCCB's, 8 No's of 100 Amps MCCB's All MCCB's 36kA with LSIG Protection --All MCCB's Shall be Icu=100%of Ics Refer Chapter -2 of Technical Specifications for Complete Details					
1.1	Cost of Supply	1.000	No's		0.00	INR Zero Only
1.2	Cost of Installation	1.000	No's		0.00	INR Zero Only
2	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 CRCAsheet steel powder coated to RAL 7026 with one no fo 100 Amps 4 Pole 36 KA rated MCCB as incomer and Three nos 63 Amps 4 pole 36 KA rared MCCB and 63 Amps rated 4 pole power contactor controlled by Astronomical timer and LDR with complete wiring of aproximate size 600 mm(H) x 400 mm (W) x 200 mm (D).					
2.1	Cost of Supply	6.000	No's		0.00	INR Zero Only
2.2	Cost of Installation	6.000	No's		0.00	INR Zero Only
3	9 meter Street Light Pole with GI Pipes, Fixing arrangement, Bolt nuts and other required accessories Supply ,installation , Testing & commissioning (SITC) of 9 mtr high Internally and Externally GI Coated Octogonal Street Light Pole with mounting provision for external weather proof type junction box with necessary clamps , earthing arrangement, all related civil works concrete, pedestal with 2 nos of 40 mmx2000mm Class B GI pipe upto 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 excluding Light and Junction box. -- For complete details refer chapter -3 of technical Specifications and attached Tender Drawing					
3.1	Cost of Supply	100.000	No's		0.00	INR Zero Only

3.2	Cost of Installation	100.000	No's		0.00	INR Zero Only
4	7 meter Street Light Pole with GI Pipes, Fixing arrangement, Bolt nuts and other required accessories Supply ,installation , Testing & commissioning (SITC) of 7 mtr high Internally and Externally GI Coated Octagonal Street Light Pole with mounting provision for external weather proof type junction box 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 excluding Light and Junction box.. -- For complete details refer chapter -3 of technical Specifications and attached Tender Drawing					
4.1	Cost of Supply	80.000	No's		0.00	INR Zero Only
4.2	Cost of Installation	80.000	No's		0.00	INR Zero Only
5	Double Cross Arm - Supply and Installation of Medium class GI Pipe Cross arm of length 1.5 Meters each side suitable for LED light and Above street light Pole as per Technical Specifications with closing caps, fixing bolts and all other required accessories For complete details refer chapter -3 of technical Specifications and attached Tender Drawing					
5.1	Cost of Supply	100.000	No's		0.00	INR Zero Only
5.2	Cost of Installation	100.000	No's		0.00	INR Zero Only
6	Single 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 For complete details refer chapter -3 of technical Specifications and attached Tender Drawing					
6.1	Cost of Supply	80.000	No's		0.00	INR Zero Only
6.2	Cost of Installation	80.000	No's		0.00	INR Zero Only
7	Street Light Pole JB - Supply ,installation , Testing & commissioning (SITC) of Outdoor Pole/Wall Mounting Type Weather Proof IP 56 GI coated MS Street Light Junction Boxes with 4 Nos of M10 bolted type Elmax connector mounted on din rail and 10 Amps double pole 10KA Rated MCB . The size shall be : 160 mm (H) x 120 mm (W) x 100 mm (D). -- Quoted Price Shall include 10A DP MCB and All other accessories					
7.1	Cost of Supply	180.000	No's		0.00	INR Zero Only
7.2	Cost of Installation	180.000	No's		0.00	INR Zero Only
8	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 For complete details refer chapter -4 of technical Specifications and attached Tender Drawing					
8.1	Cost of Supply	280.000	No's		0.00	INR Zero Only
8.2	Cost of Installation	280.000	No's		0.00	INR Zero Only

9	All-in-one Solar street light fixture complete with 12V, LED luminaire with min. output of 3000 lumens (min. lumen efficacy of 100 lumen/W), IP 65, 4000 to 5700 degree K CCT, MPPT Solar charge controller, Solar PV Panel, inbuilt protection & suitable lithium-ion battery for min. 18 hours autonomy with dimming. Quoted Price shall Include 4 meter Pole, Bolts nuts, accessories , cross arm, all required accessories and Foundation work. For complete details refer chapter -5 of technical Specifications and attached Tender Drawing					
9.1	Cost of Supply	30.000	No's		0.00	INR Zero Only
9.2	Cost of Installation	30.000	No's		0.00	INR Zero Only
10	Post top LED indirect lighting type luminaries Including LED Light having a minimum efficacy of 100 lumen/watt and a minimum output of 3500 lumens, with 4000 to 5700 degree K CCT, having IP65 & IK07 protection, dark sky norms etc. as per specifications. Quoted Price shall Include 4 meter Pole, Bolts nuts, accessories , cross arm, all required accessories and Foundation work. For complete details refer chapter -6 of technical Specifications and attached Tender Drawing					
10.1	Cost of Supply	30.000	No's		0.00	INR Zero Only
10.2	Cost of Installation	30.000	No's		0.00	INR Zero Only
11	Amber Alerting type Solar LED Chevron Blinker -Supply, Installation and commissioning of 300mm Solar based Blinker LED of Amber/Red colour for alerting the passengers as per Technical Specifications and approved drawing with suitable battery rating as per NHA Standards with having 24 Hours of backup with battery, light sensor, Solar Panel, Arrow LEDs, 12ft painted pole with all required accessories including civil foundation For complete details refer chapter -8 of technical Specifications and attached Tender Drawing					
11.1	Cost of Supply	12.000	No's		0.00	INR Zero Only
11.2	Cost of Installation	12.000	No's		0.00	INR Zero Only
12	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 For complete details refer chapter -7 of technical Specifications and attached Tender Drawing					
12.1	Cost of Supply	15.000	No's		0.00	INR Zero Only
12.2	Cost of Installation	15.000	No's		0.00	INR Zero Only
13	Supply & Installation of 1.1 KV FRLS grade L.T AL/ Copper Power Cables as per technical specifications & approved data sheets and of following sizes including required dressing hardware's .Cables to be Installed in ground / Excavated Trench/Hume Pipe/HDPE pipe and other modes as per actual site condition. The excavation of cable trench is as per relevant BOQ item . Quoted rates shall include Lugs required for the cables termination. For complete details refer chapter -9 of technical Specifications and attached Tender Drawing 3Cx 2.5 Sq.mm, Un-Armoured 1.1 KV grade PVC FRLS, Copper - Double Sheathed					
13.1	Cost of Supply	2000.000	RMT		0.00	INR Zero Only
13.2	Cost of Installation	2000.000	RMT		0.00	INR Zero Only

14	Supply & Installation of 1.1 KV FRLS grade L.T AL/ Copper Power Cables as per technical specifications & approved data sheets and of following sizes including required dressing hardware's .Cables to be Installed in ground / Excavated Trench/Hume Pipe/HDPE pipe and other modes as per actual site condition. The excavation of cable trench is as per relevant BOQ item . Quoted rates shall include Lugs required for the cables termination. For complete details refer chapter -9 of technical Specifications and attached Tender Drawing 4C X 10 Sqmm, Armoured 1.1 kV grade XLPE FRLS, Aluminium					
14.1	Cost of Supply	3000.000	RMT		0.00	INR Zero Only
14.2	Cost of Installation	3000.000	RMT		0.00	INR Zero Only
15	Supply & Installation of 1.1 KV FRLS grade L.T AL/ Copper Power Cables as per technical specifications & approved data sheets and of following sizes including required dressing hardware's .Cables to be Installed in ground / Excavated Trench/Hume Pipe/HDPE pipe and other modes as per actual site condition. The excavation of cable trench is as per relevant BOQ item . Quoted rates shall include Lugs required for the cables termination. For complete details refer chapter -9 of technical Specifications and attached Tender Drawing 4C X 35 Sqmm, Armoured 1.1 kV grade XLPE FRLS, Aluminium					
15.1	Cost of Supply	1500.000	RMT		0.00	INR Zero Only
15.2	Cost of Installation	1500.000	RMT		0.00	INR Zero Only
16	Double compression brass glands for 4C X 10 Sqmm/4C X 35 Sqmm					
16.1	Cost of Supply	400.000	No's		0.00	INR Zero Only
16.2	Cost of Installation	400.000	No's		0.00	INR Zero Only
17	Supply and Installation of 50/42 mm Dia HDPE PLB Duct Pipe of Approved colour with required finish of inner layer suitable for easy and smooth cable drawing outer layer resistance to conventional chemical environments , flexible and durable as per IS 4984 as per directions of Engineer In charge					
17.1	Cost of Supply	4000.000	RMT		0.00	INR Zero Only
17.2	Cost of Installation	4000.000	RMT		0.00	INR Zero Only
18	Excavation of Cable Trench Excavation of trench in ground, complete with excavation in all types of soil, covering the cable in side DWC pipe, on all the sides with M-sand, dressing the cable, refilling with excavated soil and ramming& compacting . The size of the trench will be 400 X 1000mm (W X Depth) from the FGL.					
18.1	Cost of Supply	2500.000	RMT		0.00	INR Zero Only
18.2	Cost of Installation	2500.000	RMT		0.00	INR Zero Only

19	MAINTENANCE FREE EARTHING SYSTEM Supply,installation,testing & commissioning 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 11kG Ground Enhancing Material, earth rod clamp, Earth pit chamber made out of brick masonry with a 25mm dia PVC conduit for earth wire entry and covered with GI lid cover of size 450 X 450 mm. The system shall confirm with IS- 3043 and IEC-62561-7. - 150mm dia bore well digging suitable in Hard rock area. - Providing & making concrete chamber (1:2:4) of size 600 x 600 x 600 mm (inside dimension) with 10 mm thick MS hinged cover mounted (Chamber and Cover will be paid in civil item) -Treatment with 2-3 bags each 11kg as required Groundenhancement Material Non corrosive, Non Soluble, Higly electrical conductive -GEM shall be less than 20 Ohm-cm resistivity - Chemical mixed compound in order to produce low earthpit values (<5 ohm) as per IS 3043 - Finishing with civil work , painting and numbering as per Directions of EIC -- Installation of earth rods including making pit/drilling suitable size bore holes in normal soil/hard rock as per manufacturer's recommendations & design. -- 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.					
19.1	Cost of Supply	15.000	No's		0.00	INR Zero Only
19.2	Cost of Installation	15.000	No's		0.00	INR Zero Only
20	Providing & making concrete chamber (1:2:4) of Suitable size thick MS hinged cover mounted arrangement for above earth pits with approved paint along with the earth pit board mentioning the date of testing and serial number of the earth pit as approved by Engineer incharge					
20.1	Cost of Supply	15.000	No's		0.00	INR Zero Only
20.2	Cost of Installation	15.000	No's		0.00	INR Zero Only
21	Supply and installation of 8 SWG GI earth strip as per direction of Engineer incharge					
21.1	Cost of Supply	3000.000	RMT		0.00	INR Zero Only
21.2	Cost of Installation	3000.000	RMT		0.00	INR Zero Only
22	Supply , Fabrication and installation of MS items like ISMC-100/ISA - 50/ 5 mm Chequered plate, panel supports . The fabricate items shall have one coat of red oxide primer and two coats of enamel paints as approved by Engineer in charge					
22.1	Cost of Supply	500.000	Kg		0.00	INR Zero Only
22.2	Cost of Installation	500.000	Kg		0.00	INR Zero Only
23	EV Charging Points : Supply, installation, testing & commissioning of single phase minimum 16A, 3.7kW mode1/2 charging , IP 55, IK10 metal socket for Electric vehicle charging with bracket, mounting box, along with suitable height streetlight pole junction box/ separate GI pedestal as per site condition & instructions of EIC. Note: The scope includes providing autoglow signage of 150 x 150mm with EV charging symbol on the pole junction box surface/ pedestal as per instructions of EIC					
23.1	Cost of Supply	4.000	No's		0.00	INR Zero Only
23.2	Cost of Installation	4.000	No's		0.00	INR Zero Only

24	Supply and Installation of battery Operated UPS for testing of Street lights					
24.1	Cost of Supply	2.000	No's		0.00	INR Zero Only
24.2	Cost of Installation	2.000	No's		0.00	INR Zero Only
25	Supply and Installation of Battery operated cable continuity tester					
25.1	Cost of Supply	2.000	No's		0.00	INR Zero Only
25.2	Cost of Installation	2.000	No's		0.00	INR Zero Only
26	Supply and Installation of Fire retardant Paint as per relevant IS standards					
26.1	Cost of Supply	40.000	Kg		0.00	INR Zero Only
26.2	Cost of Installation	40.000	Kg		0.00	INR Zero Only
27	Supply and Installation of 3-Phase/1-single phase 20A Weather proof Socket set along with the connecting plug including JB as per direction of EIC with suitable size MCB					
27.1	Cost of Supply	10.000	No's		0.00	INR Zero Only
27.2	Cost of Installation	10.000	No's		0.00	INR Zero Only
Total in Figures					0.00	INR Zero Only