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GOVERNMENT OF INDIA  
DEPARTMENT OF ATOMIC ENERGY  
BHABHA ATOMIC RESEARCH CENTRE  
ARCHITECTURE & CIVIL ENGINEERING DIVISION

## TECHNICAL SPECIFICATIONS

For

## CIVIL AND PUBLIC HEALTH WORKS

(August – 2007)

Technical Specifications for Civil and Public Health Works

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SECTION - V

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

## "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, A&CED, 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 (PartI/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 no be more than 50 mm or  $D/6$  which ever 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 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  
(EARTH WORK)**

- 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, 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 : 15 to 30 metres.  
Fuse from the charge
- Time of the blast after firing : 120 to 150 seconds.  
the fuse
- 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 m<sup>2</sup> to 1.00 m<sup>2</sup>.
- 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 of 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 In case of excavation exceeding 1.0 meter depth then 3V : 1H in side slopes or as specified in the drawing shall be paid to the contractor. 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.	Chlorpyriphos emulsifiable concentrates (IS: 8944)	1.0 %

#### 8.0 MODE AND RATE OF APPLICATION:

- 8.1 The chemical emulsion as stated above will be applied uniformly by spraying at the prescribed rates as detailed below in all the states of the treatment:

- 8.1.1 Treatment in Foundation Trenches:
- 8.1.1.1 In case of normal wall load bearing structure, column pits, wall trenches and basement, the treatment shall be @ 5 (five) litres per square metre of surface area of the bottom and sides to a height of at least 300 mm. After the foundation works, the sides shall be treated @ 15 (fifteen) litres per square metre at vertical surface of sub-structure on each side.
- 8.1.1.2 After the earth filling is done, treatment shall be done by rodding the earth at 150 mm center to center close to wall surface and spraying the chemical with the above dose i.e., 15 (fifteen) litres per square metre. In case of framed structure, the treatment shall start at a depth of 500 mm below ground level. From this depth the backfill around the columns, beams and R.C.C basement walls shall be treated @ 15 (fifteen) litres per square metre of the vertical surface and @ 5 (five) litres per square metre for the horizontal surface at the bottom in the trenches/pits.
- 8.1.2 Treatment on Top Surfaces of Plinth Filling:
- 8.1.2.1 The top surface of the filled earth within plinth walls shall be treated with chemical emulsion at the rate of 5 (five) litres/square metre of the surface area before sub-base to floor is laid. If filled earth has been well rammed and the surface does not allow the emulsion to seep through; holes up to 50 mm to 75 mm deep 150mm centre to centre both ways shall be made with crowbars on the surface to facilitate saturation of the soil with the emulsion.
- 8.1.3 Treatment at Junction of Walls and Floors:
- 8.1.3.1 Special care shall be taken to establish continuity of the vertical chemical barrier on the inner wall surfaces from the finished ground level (or from level where the treatment had stopped) up to the level of the filled earth surface. To achieve this a small channel 30 x 30 mm shall be made at all the junctions of wall / column with floor (before laying sub-grade) and rod holes made in the channel up to the finished ground level at 150 mm apart and the iron rod moved backward to forward to break the earth and chemical emulsion poured along the channel @ 15 (fifteen) litres (or as recommended quantity) per square metre of the vertical wall / column surfaces so as to soak the soil right up to the bottom. The soil shall be tamped back into place after this operation.
- 8.1.4 Treatment for Expansion Joints:
- 8.1.4.1 The soil beneath the expansion joints shall receive special attention when the treatment under 8.1.1 above is in progress. This treatment shall be supplemented by treating through the expansion joint after sub-grade has been laid at the rate of 2 (two) litres per metre length of expansion joint.
- 9.0 PRECAUTIONS DURING TREATMENT:
- 9.1 Utmost care shall be taken to see that the chemical barrier is complete and continuous. Each part of the area shall receive the prescribed dosage of chemical emulsion.
- 9.2 The treatment should not be carried out when it is raining or when the soil is wet with rain or sub-soil water.

- 9.3 Once formed, the treated soil barrier shall not be disturbed. If by chance, treated soil barriers are disturbed, immediate steps shall be taken to restore the continuity and completeness of the barrier system.
- 10.0 **PRECAUTIONS FOR HEALTH HAZARDS AND SAFETY MEASURES:**
- 10.1 All the chemicals mentioned above are poisonous and hazardous to health. These chemicals can have an adverse effect upon health when absorbed through the skin, inhaled as vapors or spray mist or swallowed. Persons handling or using these chemicals should be warned of these dangers and advised that absorption through the skin is the most likely source of accidental poisoning. They should be cautioned to observe carefully the safety precautions given below particularly when handling these chemicals in the form of concentrates.
- 10.2 These chemicals are usually brought to the site in the form of emulsifiable concentrates. The containers should be clearly labeled and should be stored carefully so that children and pets cannot get at them. They should be kept securely closed.
- 10.3 Particular care should be taken to prevent skin contact with concentrates. Prolonged exposure to dilute emulsions should also be avoided. Workers should wear clean clothing and should wash thoroughly with soap and water especially before eating and smoking. In the event of severe contamination, clothing should be removed at once and the skin washed with soap and water. If chemicals splash into the eyes, they shall be flushed with plenty of soap and water and immediate medical attention should be sought.
- 10.4 The concentrates are oil solutions and present a fire hazard owing to the use of petroleum solvents. Flames should not be allowed during mixing.
- 10.5 Care should be taken in the application of soil toxicants to see that they are not allowed to contaminate wells or springs, which serve as sources of drinking water.
- 11.0 **GUARANTEE:**
- 11.1 The contractor has to furnish the guarantee for 10 (ten) years from the date of completion of work stating that in case of re-appearance of termites within the building area due to defective materials or workmanship or due to any other reasons, the contractor will carry out the necessary post constructional treatment to keep the entire area free from termite once again, without any extra cost to the department during the guarantee period.
- 12.0 **MODE OF MEASUREMENT:**
- 12.1 The payment will be made on the basis of plinth area measurements at ground floor only for all the stages of treatment in square metre rounded off to two places of decimals.
- 12.2 Rate includes the cost of materials, labour and all tools, consumables, spares for complete operation.

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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 conforming 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 conform 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  $\pm$  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<sub>2</sub>SO<sub>4</sub>. 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 <sub>3</sub> )	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 <sup>2</sup>
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
High Strength Concrete	M - 55	55
	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/mm<sup>2</sup>.
  - 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 <sup>2</sup>
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/mm<sup>2</sup>.

## 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 :

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

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 :

<b>Placing Conditions</b>	<b>Degree of workability</b>	<b>Value of Workability</b>
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 <sup>2</sup>	1.20 N/mm <sup>2</sup>	1.70 N/mm <sup>2</sup>
2.	M-15	10.00 N/m <sup>2</sup>	1.50 N/mm <sup>2</sup>	2.10 N/mm <sup>2</sup>
3.	M-20	13.50 N/m <sup>2</sup>	1.70 N/mm <sup>2</sup>	2.40 N/mm <sup>2</sup>
4.	M-25	17.00 N/m <sup>2</sup>	1.90 N/mm <sup>2</sup>	2.70 N/mm <sup>2</sup>
5.	M-30	20.00 N/m <sup>2</sup>	2.10 N/mm <sup>2</sup>	3.00 N/mm <sup>2</sup>
6.	M-35	23.50 N/m <sup>2</sup>	2.30 N/mm <sup>2</sup>	3.20 N/mm <sup>2</sup>
7.	M-40	27.00 N/m <sup>2</sup>	2.50 N/mm <sup>2</sup>	3.40 N/mm <sup>2</sup>

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 <sup>3</sup>	One
2.	6.00 to 15.00 m <sup>3</sup>	Two
3.	16.00 to 30.00 m <sup>3</sup>	Three
4.	31.00 to 50.00 m <sup>3</sup>	Four
5.	51.00 m <sup>3</sup> and above	Four Plus one additional sample for each additional 50 m <sup>3</sup> 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 <sup>2</sup>	Individual Test Results in N/mm <sup>2</sup>
(1)	(2)	(3)
M 15	$\geq f_{ck} + 0.825 \times$ established standard deviation (rounded off to nearest 0.5 N/mm <sup>2</sup> ) or, <ul style="list-style-type: none"> <li><math>f_{ck} + 3 \text{ N/mm}^2</math>, whichever is greater</li> </ul>	$\geq f_{ck} - 3 \text{ N/mm}^2$
M 20 or above	<ul style="list-style-type: none"> <li><math>\geq f_{ck} + 0.825 \times</math> established standard deviation (rounded off to nearest 0.5 N/mm<sup>2</sup>) or,</li> <li><math>f_{ck} + 4 \text{ N/mm}^2</math>, whichever is greater</li> </ul>	$\geq f_{ck} - 4 \text{ N/mm}^2$

- 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 chasis 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  $\pm 10$  mm for a specified slump of 75 mm or less and  $\pm 25$  mm when the specified slump is greater than 75 mm. The compacting factor average of two tests shall be within  $\pm 0.03$  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 consist 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
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#### 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 m<sup>2</sup> 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.

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| 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 based 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/mm<sup>2</sup> 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 meter 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 spashes on kota stones.
- 7.0 KOTA STONE TREADS / RISERS:
- 7.1 The specifications mentioned for Kota stone flooring shall be generally applicable for this item.
- 8.0 MODE OF MEASUREMENT :
- 8.1 Unit of measurement shall be square metre.
- 8.2 Measurement for flooring shall be for the actual area covered from face of skirting.
- 8.3 Deduction will be made for columns, projections, equipment foundations, trenches, openings etc.
- 8.4 Measurement shall be for the actual area of skirting, dado, sills, coping etc. and deduction shall be made for the areas not covered by these.

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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/m<sup>2</sup> sprinkled with water and rubbed hard with a pad of woolen rags by means of polishing machine. The finished floor shall give a uniform shade of tiles and any defective tiles or scratches in tiles etc. are observed the same shall be made good at contractor's own cost.
- 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 form 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.

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**"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 <sup>2</sup>
8	Abrasion resistance	< 204 mm <sup>2</sup>
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-In-charge. 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 (+) 3 mm and on thickness it shall be (+) 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, transoms and handles etc. shall be of aluminium anodized sections as shown in the detailed drawings.
- 3.4 All sections and hardware shall have minimum anodic film (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 snap-in beveled white anodized matt aluminium metal glazing stops inside and outside.
- 3.8 All aluminium surfaces in contact with masonry or concrete shall be given a heavy coat of bitumastic paint.
- 3.9 After fabrication aluminium metal shall be protected from construction hazards that may damage their appearance or finish therefore all exposed surfaces of all aluminium members shall be protected by masking tape during the shipment and erection.
- 4.0 FABRICATION :
- 4.1 The frames shall be square and flat and the corners of the frame shall be fabricated to a true right angle. All the fixed, sliding, opening frames shall be fabricated with sections which have been cut to length 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 than 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.

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## **"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 frog 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 removed and redone at the contractor's 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 wash 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 wash 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 suitable proportion of 2 gm of gum Arabic to a litre of lime or whiting to prevent the white wash coming off easily when rubbed. Rice size may be used instead of gum.
- 5.5 The surface shall be prepared by removing all mortar droppings 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 cured 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, sils, 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 appearance<sup>1</sup> 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 for 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 for 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 <sup>2</sup>	8.5m <sup>2</sup>	18m <sup>2</sup>
2	Plastic emulsion paint	14m <sup>2</sup>	8.5m <sup>2</sup>	18m <sup>2</sup>
3	Oil Bound distemper	10m <sup>2</sup>	6.0m <sup>2</sup>	12m <sup>2</sup>
4	Dry distemper	10m <sup>2</sup> per kg	6.5m <sup>2</sup> per kg	12m <sup>2</sup> 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 <sup>2</sup> per kg of Lime	3.5m <sup>2</sup> per kg of Lime	10m <sup>2</sup> per kg of Lime
6	Cement based paint	4.5 m <sup>2</sup> per kg	2 m <sup>2</sup> per kg	6 m <sup>2</sup> per kg
7	Aluminium paint	20 m <sup>2</sup>	12.5 m <sup>2</sup>	28 m <sup>2</sup>
8	Bitumen paint / Black Japan	14 m <sup>2</sup>	14 m <sup>2</sup>	28 m <sup>2</sup>
9	Neeru (or lime punning with slacked lime) over plaster	0.5 m <sup>2</sup> per kg of slacked lime		
10	Red oxide metal primer	16 m <sup>2</sup>		
11	Cement primer	12 m <sup>2</sup>		
12	Wood primer	13 m <sup>2</sup>		
13	Wax polishing of new wood work with ready made polish	20 m <sup>2</sup> per kg	20 m <sup>2</sup> per kg	20 m <sup>2</sup> per kg
14	French or spirit polish	10.5 m <sup>2</sup>		
15	Varnish	14 m <sup>2</sup>	8.5 m <sup>2</sup>	18 m <sup>2</sup>
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 smoothing 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, Arch. & Civil Engineering Division, 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 trowelled 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  $10^{\circ}$  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 conforming 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 silicons, 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.

\* \* \* \* \*

**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 smoothed 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 TROUGH/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 stucked 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 163<sup>0</sup> C to 177<sup>0</sup> C (325<sup>0</sup> F to 350<sup>0</sup> 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<sup>0</sup> C to 177<sup>0</sup> C (325<sup>0</sup> F to 350<sup>0</sup> 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<sup>0</sup> C to 177<sup>0</sup> C (300<sup>0</sup> F to 350<sup>0</sup> F) and fed into a twin shaft peddle type mixer at a temperature not less than 149<sup>0</sup> C (about 300<sup>0</sup> 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<sup>0</sup> C (about 280<sup>0</sup> F) and it shall not be less than 121<sup>0</sup> C (about 250<sup>0</sup> 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  $C_aO$  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<sup>0</sup> F to 370<sup>0</sup> 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 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<sup>2</sup> 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 to 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 peddle 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. Continues 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	<b>Reaffirmed 2002</b>	Specifications for Pig Lead
269- 1989	<b>Reaffirmed 2004</b>	Specifications for 33 grade Ordinary Portland Cement
407- 1981	<b>Reaffirmed 2001</b>	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	<b>Reaffirmed 2003</b>	Fire fighting hose ,rubber lined or fabric reinforced rubber lined woven –jacketed
638- 1979	<b>Reaffirmed 2003</b>	Sheet rubber jointing & rubber insertion jointing
651- 1992	<b>Reaffirmed 2003</b>	Specifications for Salt glazed stoneware pipes & fittings.
<b>771 (Pt. I &amp;VII)</b>		<b>Glazed Fire Clay Sanitary Appliances.</b>
771- 1979 (Pt. I)	<b>Reaffirmed 2003</b>	General requirements
771- 1985 (Pt. II)	<b>Reaffirmed 2003</b>	Specific requirements of kitchen & laboratory sinks
771- 1979 (Pt. III/ Sec 1)	<b>Reaffirmed 2003</b>	Specific requirements of urinals ( section 1-Slab urinals)
771- 1985 (Pt. III/ Sec2)	<b>Reaffirmed 2000</b>	Specific requirements of urinals ( section 2-Stall urinals)
771- 1979 (Pt. IV)	<b>Reaffirmed 2003</b>	Specific requirements of postmortem slabs.
771- 1979 (Pt. V)	<b>Reaffirmed 2003</b>	Specific requirements of shower trays
771- 1979 (Pt. VI)	<b>Reaffirmed 2003</b>	Specific requirements of bed pan sinks
771- 1981 (Pt. VII)	<b>Reaffirmed 2003</b>	Specific requirements of slop sinks
774- 1984	<b>Reaffirmed 2000</b>	Flushing cistern for water closet and urinals.
775- 1970	<b>Reaffirmed 2000</b>	Cast iron brackets and supports for wash basin and sink.
778- 1984	<b>Reaffirmed 2000</b>	<b>Specifications for copper alloy gate &amp; Globe check valves for water works</b>

<b>Indian Standard</b>	<b>Reaffirmation</b>	<b>Subject</b>
779- 1994	<b>Reaffirmed 2004</b>	Water meters (domestic type)
781- 1984	<b>Reaffirmed 2001</b>	Specifications for cast copper alloy screw down bib taps & stop cocks for water services
782- 1978	<b>Reaffirmed 2003</b>	Specification for Caulking lead.
783- 1985	<b>Reaffirmed 01</b>	Code of practice for laying concrete pipes.
784- 2001	<b>Reaffirmed 2002</b>	Pre-stressed concrete pipes.
884- 1985	<b>Reaffirmed 2000</b>	Fire aid hose reel for fire fighting (for fixed installation)
901 – 1988	<b>Reaffirmed 2003</b>	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	<b>Reaffirmed 2003</b>	Couplings for fire hose delivery, branch pipe, nozzles specification
904 – 1983	<b>Reaffirmed 2000</b>	Specification for 2 way and 3 way suction collecting heads for Fire Fighting purposes.
905 - 1980	<b>Reaffirmed 2002</b>	Specification for delivery breechings, dividing and collecting instantaneous pattern for Fire Fighting
906 – 1988	<b>Reaffirmed 2000</b>	Specification for revolving branch pipe for Fire Fighting
907 – 1984	<b>Reaffirmed 2000</b>	Specification for suction strainer, cylindrical type for Fire Fighting purposes.
908- 1975	<b>Reaffirmed 2000</b>	Fire Hydrants, Stand post type
909- 1992	<b>Reaffirmed 2002</b>	Specifications for underground fire hydrants, sluice valve type
940 – 1989	--	Portable Fire Extinguisher, water Type (Gas Cartridge) – Specification
941- 1985	<b>Reaffirmed 2000</b>	Specification for Blower and Exhauster for Fire Fighting.
1172- 1993	<b>Reaffirmed 2002</b>	Code of basic requirements for water supply, drainage and sanitation
1200-1979 (Pt. 16)	<b>Reaffirmed 2002</b>	Method of measurements for Laying of water and sewer lines including appurtenant items.
1200-1981 (Pt. 19)	<b>Reaffirmed 2002</b>	Method of measurements for Water supply, plumbing and drains.
1239- 2004 (Pt I)		Specifications for Mild steel tubes
1239- 1992 ( Pt. II)	<b>Reaffirmed 2002</b>	Specifications for Mild steel Tubular & other wrought steel pipe fittings
1300- 1994	<b>Reaffirmed 2000</b>	Phenolic moulding material specification
1536- 2001	--	Specifications for Centrifugally cast iron (spun) pressure pipes for water, gas and sewage
1537- 1976	<b>Reaffirmed 2000</b>	Specifications for Vertically cast iron pressure pipes for water, gas and sewage

<b>Indian Standard</b>	<b>Reaffirmation</b>	<b>Subject</b>
1538 -1993	<b>Reaffirmed 1999</b>	Cast iron fittings for pressure pipes for water, gas and sewage
1700- 1973	<b>Reaffirmed 2003</b>	Drinking fountains
1701- 1960	<b>Reaffirmed 2003</b>	Combination valve , mixing valves
1703- 2000		Ball valve (horizontal plunger type) including floats for water supply.
1711- 1984	<b>Reaffirmed 2000</b>	Self closing taps.
1726- 1991	<b>Reaffirmed 2003</b>	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	<b>Reaffirmed 2002</b>	Code of practice for building drainage
1795- 1982	<b>Reaffirmed 2000</b>	Pillar taps for water supply purposes
1978- 1982	<b>Reaffirmed 2002</b>	Specification for line pipe (M S Seamless )
1979- 1985	<b>Reaffirmed 2002</b>	Specification for high test line pipe
2065- 1983	<b>Reaffirmed 2001</b>	Code of practice for water supply in buildings.
2097 – 1983	<b>Reaffirmed 2000</b>	Specification for foam making branch pipe.
2104- 1981	<b>Reaffirmed 2003</b>	Water meter boxes (domestic type)
2171 – 1999	--	<b>Specification for portable fire extinguisher, dry powder (Cartridge Type)</b>
2190- 1992	<b>Reaffirmed 2002</b>	Code of practice for selection ,installation & maintenance of portable first-aid fire extinguishers
2267- 1995	<b>Reaffirmed 2000</b>	Polystyrene moulding and extension materials – specification
2326- 1987	<b>Reaffirmed 03</b>	Automatic flushing cistern for urinals
2379- 1990	<b>Reaffirmed 2000</b>	Colour code for identification of pipe lines.
2401- 1973	<b>Reaffirmed 2003</b>	Code of practice for selection, installation & maintenance of domestic water meters
<b>2470 (Pt. I to II)</b>	--	<b>Code of practice for installation of septic tanks</b>
2470- 1985 (Pt. I)	<b>Reaffirmed 2001</b>	Design criteria & construction
2470- 1985 (Pt. II)	<b>Reaffirmed 2001</b>	Secondary Treatment & disposal of septic tank effluent
2527- 1984	<b>Reaffirmed 2000</b>	Code of practice for fixing rain water gutters and down pipes for roof drainage.
2546 – 1974	<b>Reaffirmed 2000</b>	Specification for galvanized Mild Steel Fire bucket.
2548- 1996(Pt. I)	<b>Reaffirmed 2002</b>	Plastic water closet seats and covers.

<b>Indian Standard</b>	<b>Reaffirmation</b>	<b>Subject</b>
2548- 1996(Pt. II)	<b>Reaffirmed 2002</b>	Plastic water closet seats and covers.
<b>2556 (Pt. 1 to XV)</b>	--	<b>Specification for Vitreous (Vitreous China) sanitary appliances.</b>
2556- 1994 (Pt.1)	<b>Reaffirmed 2004</b>	General requirements
2556- 1994 (Pt.2)	<b>Reaffirmed 1999</b>	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)	<b>Reaffirmed 2004</b>	Specific requirements of laboratory sinks
2556- 1995(Pt.6)	<b>Reaffirmed 2003</b>	Specific requirements of urinals & partition plate
2556- 1995 (Pt.7)	<b>Reaffirmed 2003</b>	Specific requirements of accessories for sanitary appliances
2556- 1995 (Pt.8)	<b>Reaffirmed 1998</b>	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 mase on the threads – dimension, tolerances and designation
2692- 1989	<b>Reaffirmed 2003</b>	Specification for Ferrules for water services.
2871- 1983	<b>Reaffirmed 2000</b>	Specification for Branch pipe, universal, for fire fighting purposes
2878 – 2004	--	Fire Extinguisher, Carbon Dioxide Type (Portable and Trolley Mounted) – Specification.
<b>2951 (Pt. I to II)</b>	--	<b>Recommendation for estimate of flow of liquids in closed conduits.</b>
2951- 1965 (Pt. I)	<b>Reaffirmed 2003</b>	Head loss in straight pipes due to frictional resistance
2951- 1965 (Pt. II)	<b>Reaffirmed 2003</b>	Head loss in valves & fittings.
3006- 1979	<b>Reaffirmed 2003</b>	Specification for Chemically resistant glazed S.W. pipes and Fitting
3076- 1985	<b>Reaffirmed 2003</b>	Low density polyethylene pipes for potable water supply
3114- 1994	<b>Reaffirmed 2004</b>	Code of practice for laying of Cast Iron pipes.
3311- 1979	<b>Reaffirmed 2003</b>	Waste plug & its accessories for sinks & wash basins.
3328- 1993	<b>Reaffirmed 2003</b>	Quality tolerances for water for swimming pools
3389- 1994	<b>Reaffirmed 2000</b>	Urea formaldehyde moulding materials
3486- 1966	<b>Reaffirmed 2000</b>	Specification for Cast iron spigot and socket drain pipes
3489- 1985	<b>Reaffirmed 2000</b>	Specifications for enameled steel bath tubs

<b>Indian Standard</b>	<b>Reaffirmation</b>	<b>Subject</b>
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	<b>Reaffirmed 2000</b>	Code of practice for installation and maintenance of internal fire hydrants Hose Reels in premises.
3950- 1979	<b>Reaffirmed 03</b>	Specification for Surface boxes for sluice valve.
3989- 1984	<b>Reaffirmed 2000</b>	Centrifugally cast (spun) iron spigot and socket soil, waste and ventilating pipes, fittings & accessories.
4038- 1986	<b>Reaffirmed 2000</b>	Foot valves for water works purposes.
<b>4111 (Pt. I to V)</b>		<b>Code of practice for ancillary structures in sewage system.</b>
4111- 1986 (Pt. I)	<b>Reaffirmed 2001</b>	Manholes
4111- 1985 (Pt. II)	<b>Reaffirmed 2001</b>	Flushing tanks
4111- 1985 (Pt. III)	<b>Reaffirmed 2001</b>	Inverted siphon
4111- 1968 (Pt. IV)	<b>Reaffirmed 2001</b>	Pumping stations & pumping mains (rising mains)
4111- 1993 (Pt. V)	<b>Reaffirmed 2004</b>	Tidal out-falls
4120- 1967	<b>Reaffirmed 2000</b>	Tubs and baths.
4127- 1983	<b>Reaffirmed 2001</b>	Code of practice of laying of glazed stone ware pipes.
4308 – 2003	--	Dry Chemical Powder for Fighting B & C class Fires– Specification.
4350- 1967	<b>Reaffirmed 2001</b>	Specification for concrete porous pipes for under drainage.
4733- 1972	<b>Reaffirmed 1992</b>	Methods of sampling & test for sewage effluents
4736- 1986	<b>Reaffirmed 2001</b>	Specification for hot –dip zinc coating on mild stele tubes.
<b>4854 (Pt. I to III)</b>		<b>Glossary terms for valves and their parts</b>
4854- 1969 (Pt. I)	<b>Reaffirmed 1999</b>	Screw down stop, check & gate valves & their parts
4854- 1968 (Pt. II)	<b>Reaffirmed 1999</b>	Plug valves & cocks & their parts
4854- 1974 (Pt. III)	<b>Reaffirmed 1999</b>	Butterfly valves
4927- 1992	<b>Reaffirmed 2002</b>	Unlined flax canvass hose for fire fighting
4947 – 1985	<b>Reaffirmed 2000</b>	Specification for gas cartridge for use in Fire extinguishers.
4984- 1995	<b>Reaffirmed 2002</b>	Specifications for HDPE pipes for water supply

<b>Indian Standard</b>	<b>Reaffirmation</b>	<b>Subject</b>
4985- 2000	--	Specifications for unplasticised PVC pipes for potable water supplies
5290- 1993	<b>Reaffirmed 2003</b>	Specifications for Landing valves.
<b>5312 (Pt. I )</b>		<b>Swing check type reflux (non return ) valves</b>
5312- 1984 (Pt. I)	<b>Reaffirmed 2000</b>	Reflux (non return ) valves – single door pattern
5329- 1983	<b>Reaffirmed 2001</b>	Code of Practice for sanitary pipe work above ground for building
5330- 1984	<b>Reaffirmed 2000</b>	Criteria for design for anchor blocks for pen-stocks with expansions joints.
5382- 1985	<b>Reaffirmed 2003</b>	Specifications for rubber sealing rings for water, gas & sewer mains
5455- 1969	<b>Reaffirmed 2003</b>	Cast iron steps for manholes
5600- 2002	--	Specifications for Sewage and drainage pumps
5611- 1987	<b>Reaffirmed 2002</b>	Code of Practice for waste stabilization ponds (Facultative type)
5714- 1981	<b>Reaffirmed 2002</b>	Specifications for Hydrant stand-pipe for fire fighting
5822- 1994	<b>Reaffirmed 2004</b>	Code of Practice for laying of welded steel pipes for water supply
5961- 1970	<b>Reaffirmed 2003</b>	Specifications for Cast Iron grating for drainage purposes
6234-2003	-----	Portable fire Extinguisher water Type (Stored Pressure) – Specification
6279- 1971	<b>Reaffirmed 2001</b>	Equipment for grit removal
6280- 1971	<b>Reaffirmed 2001</b>	Sewage screens
6295- 1986	<b>Reaffirmed 2001</b>	Code of practice for water supply & drainage in high altitude & / or sub-zero region
6392- 1971	<b>Reaffirmed 1998</b>	Steel pipe flanges
6411- 1985	<b>Reaffirmed 2000</b>	<b>Specifications for gel coated glass fiber reinforced polyester resin bath tubs</b>
6418- 1971	<b>Reaffirmed 2000</b>	Cast Iron & malleable flanges for general engg. Purpose
6494- 1988	<b>Reaffirmed 2000</b>	Code of Practice for water proofing of under ground water tanks & swimming pools
6587- 1987	<b>Reaffirmed 2003</b>	Specifications for Spun hemp yarn
7181- 1986	<b>Reaffirmed 2000</b>	Horizontally Cast Iron Double Flanged pipe for water, gas & sewage.
7231- 1994	<b>Reaffirmed 2004</b>	Specifications for Plastic Flushing Cisterns for w.c. & urinals
7558- 1974	<b>Reaffirmed 2001</b>	Code of Practice for domestic hot water installations

<b>Indian Standard</b>	<b>Reaffirmation</b>	<b>Subject</b>
<b>7634 (Pt. I to III)</b>		<b>Code of Practice for Plastic pipe work for potable water supplies</b>
7634- 1975 (Pt. I)	<b>Reaffirmed 2002</b>	Choice of materials & general recommendations
7634- 1975 (Pt. II)	<b>Reaffirmed 2002</b>	Laying & jointing polyethylene (PE) pipes
7634- 2003 (Pt. III)	--	Laying & jointing unplasticised PVC pipes
7740- 1985	<b>Reaffirmed 2001</b>	Code of Practice for road gullies
<b>7834 (Pt. I to VIII)</b>		<b>Injection moulded PVC socket fittings with solvent cement joints for water supplies</b>
7834 – 1987(Pt.I)	<b>Reaffirmed 2003</b>	General requirements
7834- 1987 (Pt.II)	<b>Reaffirmed 2003</b>	Specific requirements for 45 <sup>0</sup> elbows
7834- 1987 (Pt. III)	<b>Reaffirmed 2003</b>	Specific requirements for 90 <sup>0</sup> elbows
7834- 1987 (Pt. IV)	<b>Reaffirmed 2003</b>	Specific requirements for 90 <sup>0</sup> tees
7834- 1987(Pt.V)	<b>Reaffirmed 2003</b>	Specific requirements for 45 <sup>0</sup> tees
7834- 1987 (Pt. VI)	<b>Reaffirmed 2003</b>	Specific requirements for sockets
7834- 1987(Pt. VII)	<b>Reaffirmed 2003</b>	Specific requirements for unions
7834- 1987 (Pt. VIII)	<b>Reaffirmed 03</b>	Specific requirements for caps
<b>8008 (Pt. I to VII)</b>		<b>Injection moulded HDPE fittings for potable water supplies</b>
8008- 2003 (Pt. I)	--	General requirements for fittings
8008- 1976 (Pt. II)	<b>Reaffirmed 1997</b>	Specific requirements for 90 <sup>0</sup> bends
8008- 2003 (Pt. III)	--	Specific requirements for 90 <sup>0</sup> 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
<b>8413 (Pt. I)</b>		<b>Requirements for biological treatment equipment</b>
8413- 1977 (Pt. I)	<b>Reaffirmed 2001</b>	Trickling Filter
8718- 1978	<b>Reaffirmed 2000</b>	Specifications for vitreous enameled steel kitchen sinks
8727- 1978	<b>Reaffirmed 2000</b>	Specifications for vitreous enameled steel wash basin

<b>Indian Standard</b>	<b>Reaffirmation</b>	<b>Subject</b>
8835- 1978	<b>Reaffirmed 1999</b>	Guideline for planning and design of surface drains.
8931- 1993	<b>Reaffirmed 2003</b>	Specifications for copper alloys Fancy single taps, combination tap assembly & stop valves for water services
9140- 1996	<b>Reaffirmed 2002</b>	Method of sampling of vitreous & fire clay sanitary appliances
9293- 1991	<b>Reaffirmed 1996</b>	Specifications for flax canvas
9338- 1984	<b>Reaffirmed 2000</b>	Specifications for Cast Iron screw down stop valves and stop & check valves for water works purposes
9668- 1990	<b>Reaffirmed 2000</b>	Code of practice for provision & maintenance of water supplies for Fire Fighting
9739- 1981	<b>Reaffirmed 2003</b>	Specifications for Pressure reducing valves for Domestic water supply system.
9758- 1981	<b>Reaffirmed 2003</b>	Flush valves and Fittings for water closets and urinals
9762- 1994	<b>Reaffirmed 2004</b>	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	<b>Reaffirmed 1997</b>	Code of practice for coating and wrapping of underground M.S. steel pipeline,
11108 - 1984	<b>Reaffirmed 2000</b>	Specification for portable fire Extinguisher Halon 1211 Type.
11606 - 1986	<b>Reaffirmed 2000</b>	Method for sampling of cast iron pipes and fittings.
12183- 1987 (Pt. I)	<b>Reaffirmed 2004</b>	<b>Code of practice for Plumbing in multi-storied buildings (for water supply)</b>
12231 - 1987	<b>Reaffirmed 2003</b>	UPVC pipes for section & delivery lines of agricultural pumps–Specification.
12235 - 1986	<b>Reaffirmed 1998</b>	Method of test for UPVC pipe for potable water supply
12288 - 1987	<b>Reaffirmed 2002</b>	Code of practice for use and laying of Ductile Iron pipes.
12469 - 1988	<b>Reaffirmed 2002</b>	Specifications for pumps
12592- 2002	--	Precast concrete frame & cover ( SFRC frame & cover )
12701-1996	<b>Reaffirmed 2002</b>	Specifications for rotational moulded polyethylene water storage tanks
12709 - 1994	<b>Reaffirmed 2004</b>	Glassfiber reinforce plastic(GRP) pipes, joints & fittings for use for potable water supply – Specification.
12820 - 1989	<b>Reaffirmed 1999</b>	Dimensional Requirements of Rubber Gaskets for Mechanical Joints & push in joints for use with Cast Iron Pipes & fittings for carrying water, Gas & sewage.

<b>Indian Standard</b>	<b>Reaffirmation</b>	<b>Subject</b>
13095 - 1991	<b>Reaffirmed 2003</b>	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	<b>Reaffirmed 2002</b>	Specifications for PVC soil, waste & rain water (SWR) including ventilation pipes
13593 - 1992	<b>Reaffirmed 2002</b>	UPVC pipes fittings for use with section and delivery lines for Agricultural pumps – Specification.
13916 – 1994	<b>Reaffirmed 2004</b>	Code of practice for installation of GRP piping system.
13983-1994	<b>Reaffirmed 2004</b>	Specifications for stainless steel kitchen sinks & drain boards for domestic purpose
14333-1996	<b>Reaffirmed 2001</b>	Specification for HDPE pipes for sewerage system.
14402-1996	<b>Reaffirmed 2001</b>	GRP pipes, joints & fittings – Specification.
14735-1999	<b>Reaffirmed 2004</b>	UPVC injection moulded fittings for UPVC – SWR pipes – Specifications.
14845- 2000	<b>Reaffirmed 2004</b>	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.

<b>S.N.</b>	<b>Description of items</b>	<b>Nominal size/ thickness</b>	<b>IS code</b>	<b>Minimum Unit Weight</b>
1	Brass non-fancy type Bib Tap Please see Table under relevant item for other sizes.	15mm	781- 1984	400 Grams
2	C.P. brass fancy type Bib Tap	15mm	8931- 1993	550 Grams
3a	Brass non-fancy types Stop cock – Internally threaded	15mm	781- 1984	330 Grams
3b	Brass non-fancy types Stop cock – Externally threaded	15mm	781- 1984	400 Grams
4	C.P. brass fancy types Stop cock	15mm	8931- 1993	550 Grams
5	C.P. brass concealed typed Stop cock	15mm	8931- 1993	750 Grams
6	C.P. brass fancy Pillar Tap	15mm	1795- 1982	650 Grams
7	C.P. brass waste coupling	32mm	3311- 1979	200 Grams
8	C.P. brass waste coupling	40mm	3311- 1979	250 Grams
9 a	C.I. Nahani Trap 165mm inlet dia.	75mm(outl et)	1729-2002/ 3989- 1984	6.50 Kg.
9 b	C.I. Floor Trap 100 mm inlet dia.	75mm(outl et)	1729-2002/ 3989- 1984	4.80 Kg.
9 c	C.I. Nahani Trap with 20 mm water seal	65mm(outl et)	non ISI	4.50 Kg.
10	Cast Iron surface box for sluice valve	(rectangula r shape)	3950-1979	33 kg.

The minimum unit weight of each fitting shall not be less than as given in the following table which are used in General practice.

<b>S.N.</b>	<b>Description of items</b>	<b>Nominal size/ thickness</b>	<b>Minimum Unit Weight</b>
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	<b>Physical</b> Dimensional Nominal unit wt. Tensile, Elongation  <b>Chemical</b> Mass of zinc coating Sulphur, Phosphorus	Field/lab Field/lab Lab  Lab Lab Lab	IS 4736 IS 228 IS 228	>20tubes >20tubes >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 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	<b>As per Civil specification</b>					
PreCast Concrete man hole frame & covers/ Gratings	Dimensional 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	Dimensional Load test	Lab	IS 1726	>50 frame & covers/ gratings	Sampling as per IS 1726	
Humepipe NP class	Dimensional 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 mounts, 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) ANTIQUITIES :** 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 and 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 plat 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.

**3.9.06MODE 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 :**

**3.18.01 GENERAL:**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 conform 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/cm<sup>2</sup>) 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%
<b>Random length of tube:-</b> unless otherwise specified 4.0 to 7.0 m includes one socket for screwed & socketed tubes				<b>COATING:-</b> 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, downtake 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 burrs of the cut end shall be filed smooth and any obstruction in bore shall be entirely eliminated.

**4.2.06 JOINTING** : Please refer Clause No. 4.1.05

**4.2.07 PAINTING** : All the concealed piping work shall be thoroughly painted with two coats of anti-corrosive black bitumastic paint of approved quality shade over a coat of approved primer before concealing and filling the mortar.

**4.2.08 INSULATION** : The hot water pipe line concealed on the wall, floor etc. after painting shall be insulated with 2.5 mm thick 95% asbestos magnesia compound of approved make all round the pipe and fittings.

**4.2.09 WRAPPING** : After painting the cold water pipe line, it shall be wrapped with two layers of hessian cloth of approved quality.

**4.2.10 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 gauges shall be correctly positioned and closely observed to ensure that at no time are the test pressure exceeded. The systems shall be slowly and carefully filled with water to avoid surge pressure or water hammer. Air vents shall be open at all high points so that air may be expelled from the system during filling.

When the system has been fully charged with water and air displaced from the line air vent shall be closed and the line initially inspected for seepage at joints and firmness of supports under load. 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/cm<sup>2</sup>) 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/cm<sup>2</sup>) 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/cm<sup>2</sup>) along with testing of pipe line for a minimum duration of 2 hrs.

**4.8.05 THE RATE INCLUDES FOR :**

1. Supplying Valve including fixing and testing.
2. All necessary labour, materials and use of tools.

**4.8.06 MODE OF MEASUREMENT :** The measurement shall be for each unit of valve of specified diameter fixed.

**4.8.07 MODE OF PAYMENT :** The contract rate shall be for each unit of valve of specified diameter fixed.

#### **4.9 CAST IRON WATER QUALITY PIPING WORK :**

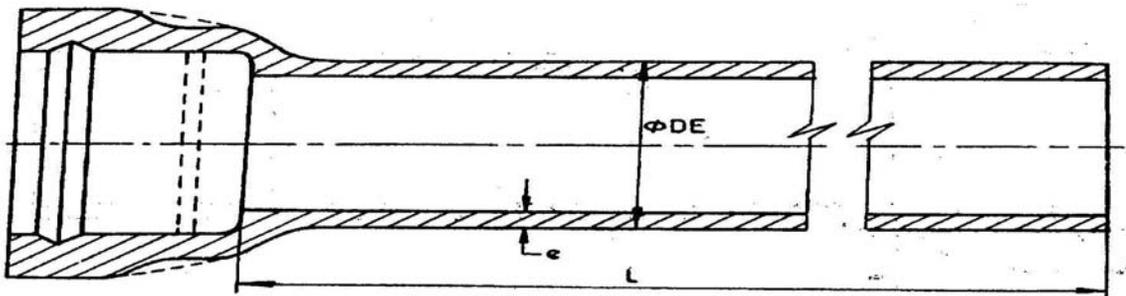
**4.9.01 GENERAL :** The item includes the provision of supplying water quality cast iron pipe of specified diameter including cutting, laying, fixing, and painting the pipe line.

**4.9.02 MATERIAL :** The pipes shall be centrifugally cast (spun) Iron Pressure pipe conforming to IS 1536 and shall be of class "LA", 'A' or "B". These shall be of socket and spigot or double flanged. All the pipes shall be cylindrical reasonably true with inner and outer surfaces and nearly concentric as practicable. The outer surface shall be smooth, sound, free from pin holes, cracks and other imperfections. The pipes shall be treated with solution of Dr. Angus Smith's solution. The coated surface shall give glossy finish. The table showing the dimensions & weight of different diameter of pipes is given below:

#### **CENTRIFUGALLY CAST (SPUN) IRON 'WATER QUALITY' PIPES**

**Tolerances :** a) Length  $\pm 25$  mm (b) weight 5% (c) Thickness  $\pm (1+0.05e)$ mm  
Value of 'e' for

- (i) LA class pipe  $e = 10/12 (7 + 0.02 \text{ DN})$
- (ii) A class pipe  $e = 11/12 (7 + .02 \text{ DN})$
- (iii) B class pipe  $e = (7 + 0.02 \text{ DN})$



**CENTRIFUGALLY CAST (SPUN) IRON 'WATER QUALITY' PIPES WEIGHT FOR SOCKET & SPIGOT PIPES (IS 1536-2001)**

Nom. Dia	Class	Barrel				Socket Mass	Total weight for one working length ' L ' in meter					
		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.
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 cm<sup>3</sup>/h determined by the formula :

$$ql = \frac{ND\sqrt{P}}{3.3}$$

Where ql = the allowable leakage in cm<sup>3</sup>/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/cm<sup>2</sup>.

**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/cm<sup>2</sup> 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 around or as specified in the schedule.
- b) Brick masonry in cement mortar 1:4 as specified.
- c) Plastering inside and outside surfaces of walls in two courses using cement mortar 1:3 of thickness as specified mixed with water proofing compound of specified Quality including inner surfaces finished smooth with neat cement punning.

**4.12.04 RCC PRECAST/CAST IRON COVERS**

**4.12.04.1 RCC PRECAST COVER ( for chambers of size upto 600 x 600 mm) :** Chamber cover shall be 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 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/cm<sup>2</sup> )and for seat 0.2 MPa (2 kg/cm<sup>2</sup>) 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.

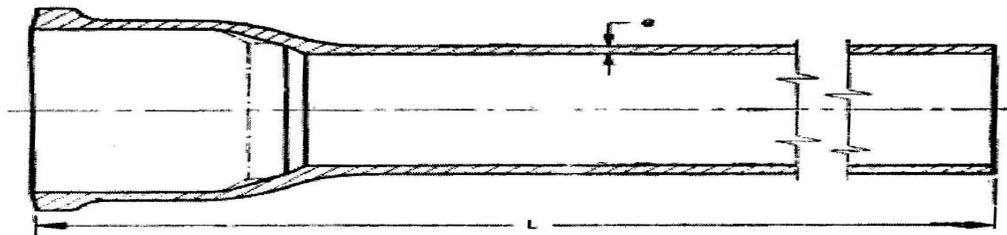
## **5.0 DRAINAGE SYSTEM**

### **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 that profile or cut surfaces shall not be changed and the fibrous material shall be removed with scraper or knife.

**5.2.08 DETACHABLE JOINT :** Detachable joints shall be made where pipes of different materials have to be jointed or as specified in the schedule. The flanges are first pushed over the pipe ends and jointing shall be made by cement solvent.

**5.2.09 PAINTING :** In case of underground piping, the pipe line shall be painted with two coats of approved oil paint of matching colour over a coat of primer.

**5.2.10 DEWATERING :** In case of underground pipes ,the contract rate shall include bailing or pumping out all the water till completion or work if accumulated during the progress of work either from seepage, springs, rain or any other cause.

**5.2.11 TESTING :** Please see clause no.5.3.10

**5.2.12 THE RATE INCLUDES FOR :**

1. Supplying of UPVC-SWR pipes and fittings of specified diameter.
2. Laying and cutting the pipe wherever necessary and wastage.
3. Fixing the pipe line with G.I. clamps not less than 2mm thick and G.I./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 burner and fuel. 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 Helen, 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) Not withstanding (a) & (b) above, the total width of trench shall not be less than 750 mm for depths exceeding 900 mm.

The width of trench in the upper reaches shall be increased as described in sub head under "Earth Work."

**5.21.05 LAYING AND FIXING :** Pipes shall be laid carefully to the correct alignment, levels and gradient and care shall be taken to prevent for entering the sand, earth or other foreign material into the pipes during laying. The pipes between manhole shall be laid truly in straight line, without vertical or horizontal undulations.

All inverts shall be laid from sight rails fixed at the true levels, with proper boning rods, The pipes shall be laid sockets facing up the gradient, alignment at the lower end and with the socket resting in the concrete bed if specified. Each pipes shall be laid singly and no pipe shall be laid until the trench has been excavated up to the required depth for a distance of 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 rammmed 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

