



MAZAGON DOCK SHIPBUILDERS LIMITED

(Formerly known as Mazagon Dock Ltd.)

CIN : U35100MH1934GOI002079

(A Government of India Undertaking)

Shipbuilders to the Nation

Dockyard Road, Mazagon,

Mumbai 400 010.

INDIA

**Strengthening of RCC Structures below Deck
Slab of Workshop 'C' including removal of
accumulated sludge and repair of Dry Dock
Wall at East Yard, MDL, Mumbai**

VOLUME-IV

Preferred Make

&

Technical Specification

GENERAL TECHNICAL SPECIFICATIONS**CIVIL WORK**

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1. GENERAL

1.1. Materials

All materials required to complete the works shall be procured by the contractor including steel and cement unless specified. All materials shall be of Indian origin of the best quality of their respective kinds as specified and shall conform strictly to the stipulations laid down by the latest Indian Standards. Standards issued elsewhere may be used only if approved by the Engineer-In-Charge and for those materials only for which appropriate Indian Standard does not exist.

1.2. Sampling and Testing

The Contractor shall submit adequate number of samples of materials to the Engineer-In-Charge for approval giving all relevant information like source of supply, availability, etc. The approved samples shall be deposited with the Engineer-In-Charge whenever so instructed.

The Engineer-In-Charge shall order such tests and analysis of all materials before leaving the manufacturer's premises or the source of supply and/or when brought on site as considers necessary and the Contractor shall bear the cost of all sampling and testing which is in consonance with the Indian Standards.

If tests on materials lead to rejection of the particular consignment, notwithstanding the results of the tests at the manufacturer's works or elsewhere or of test certificates or of any approval given earlier, such materials shall be removed forthwith from the site by him at his own cost and replaced by other proper consignment. All charges in connection with of the new materials shall be borne by the Contractor.

Samples required for approval and testing must be supplied well in time to allow for testing and approval, due allowance being made for the fact that if the first samples are rejected, further samples may be required. Delay to the Works arising from the late submission of samples will not be acceptable as a reason for delay in the completion of the Works.

1.3. Storage of Materials

Generally stacking and storage of construction materials at site shall be as per recommendations in IS: 4082. All materials required to be incorporated in the Works shall be stored in racks in bins, under cover etc. as appropriate and as amplified in the succeeding clauses to prevent deterioration or damage from any cause whatsoever to the satisfaction of the Engineer-In-Charge.

1.4. Records & Usage of Materials

The Contractor shall maintain detailed records of all materials received at Site or in his workshop and also about the consumption, balance in stock etc. and shall make such records available to the Engineer-In-Charge at all times as the latter may reasonably require.

Depending on the types of materials the same should be used in the order in which they arrive at site and as directed by the Engineer-In-Charge.

1.5. Contractor's Responsibility

The Contractor shall be responsible for keeping the material in sound and acceptable condition from the time of consignment of any material is received at site and till its consumptions. Any material not approved for use shall be removed from the site at Contractor's cost.

1.6. Workmanship

In all cases the work shall be carried out in accordance with the latest Indian Standard Specifications and the best Engineering practice. In the absence of such specifications, work shall be executed in accordance with any other relevant standards issued elsewhere as approved by the Engineer-In-Charge or as per the instructions and directions of the Engineer-In-Charge.

1.7. Constructional Plant (s)

The Contractor shall be responsible for the supply, use and maintenance of all Constructional Plant and Equipment so as to ensure smooth and efficient working of the job at his own cost. The Engineer-In-Charge shall have access to the Plant at all times.

1.8. Workmen and Staff

The Contractor shall ensure that they employ only capable and experienced labour force, foremen, other tradesmen and supervisory staff on the job capable of handling the types of work assigned to them in a workmanlike and efficient manner to the satisfaction of the Engineer-In-Charge. They shall also ensure that his Sub-contractors or nominated Sub-contractors also employ all workmen and supervisory staff capable of delivering work of a high standard.

For all concrete work, a fully qualified and experienced Quality Control Engineer shall be employed by the Contractor and he shall be available on Site at all times when concreting operations are in progress. Operators for mixers, mechanical vibrators and personnel in-charge of placing of concrete shall be fully trained and experienced for their type of work.

1.9. Method of Measurement

Mode of measurement shall be in accordance with the relevant parts of IS: 1200 "Method of Measurement of Building and Civil Works" only, unless otherwise specified in various item wise specifications describes herein below.

1.10. Rates and Prices

Unless otherwise mentioned, the rates and prices set against items in the bill of quantities or which can be reasonably inferred there from complete as a functioning entity shall include all costs and expenses which may be required in and for the construction of the work such as- material to be incorporated in the works (permanent/ temporary), labour required for all operations, temporary works, tools and equipments as required, all operations required for the completion and or maintenance of the relevant items as per specifications, all leads and lifts unless otherwise specifically mentioned in the items, including all general risks, liabilities and obligations set forth or implied in the documents on which the tender is based.

1.1.1. List of Bureau of Indian Standard Codes (BIS)

Following is the consolidated list of various Indian Standards relevant to the civil works appearing in this specification.

GENERAL

S. No	IS Code No	Particulars
1	IS : 4082-1977	a. Carriage of materials. Recommendation of stacking and storage of construction materials at sites. (1 st revision) (Reaffirmed-1990)
2	IS:1200 (Part 22)-1988	Method of Measurement of Building & Civil Engineering Works-Part 22-Materials
3	IS : 17293-1974	Safety code for working with construction machinery
4	IS : 7969-1975	Safety code for handling & storage of building materials
5	IS : 8989-1978	Safety code for erection of concrete framed structures
6	IS : 4014 (part 2) 1967	Code of practice for steel tubular scaffolding – Part 2 – Safety regulations for scaffolding
7	IS:13416 (Part 1) 1992	Preventive measures against hazards at work places – Part 1 – Falling material hazard prevention.
8	IS : 13416 (Part 2)1982	Preventive measures against hazards at work places recommendations – Fall prevention.
9	IS: 13416 (part 3) 1994	Preventive measures against hazards at work places – Recommendations – Part 3 – Disposal of debris (MULBA)
10	IS : 13416 (Part 5) 1994	Preventive measures against hazards at work places – Recommendations – Part 5 – Fire protection

MARBLE/GRANITE / STONE WORK

S. No	IS Code No	Particulars
1	3316 – 1974	Granite slabs

STEEL WORK

S. No	IS Code No	Particulars
1	800-1984	Code of practice for use of structural steel in general in steel construction (2 nd revision) (Amendments 2) (Reaffirmed 1991)
2	806-1968	Code of practice for use of steel tubes in general building construction (1 st Revision) (Amendment 1) (Reaffirmed 1991)

3	812-1978	Glossary of terms relating to welding and cutting of metals (Reaffirmed 1991)
4	813-1986	Scheme of symbols for welding (revised) (Reaffirmed 1991)
5	816-1969	Code of practice for use of metal arc welding general construction in mild steel (1 st revision) (Amendments 2) (Reaffirmed 1992)
6	818-1968	Code of practice for safety and healthy requirements in electric and gas welding and cutting operations (1 st revision) (Reaffirmed 1991)
7	822-1970	Code of procedure for inspection of welds (Reaffirmed 1991)
8	1200-1993 (Part VIII)	Method of measurements of building and civil engineering works steel work and iron works (4 th revision)

FINISHING

S. No	IS Code No	Particulars
1.	104-1979	Specification for ready mixed paint, brushing, zinc chrome, priming (Reaffirmed 1993) (2 nd Revision)
2.	109-1968	Ready mixed paint, brushing, priming plaster to Indian Standard colour No.361.631 white and off white (Reaffirmed 1993) (1 st Revision)
3.	419-1967	Putty for use on window frames (Reaffirmed 1992) (Revised)
4.	428-1969	Distemper, oil emulsion, colour as required (Reaffirmed 1993) (1 st Revision)
5.	1200-1976 (Part XII)	Method of measurements of building and civil engineering works: Part XII – Plastering and pointing (Reaffirmed 1992) (3 rd Revision)
6.	1200-1994(Part XIII)	Method of measurements of building and civil engineering works: Part XIII – white washing, colour washing, distemping and painting of building surfaces (5 th Revision)
7.	1200-1987 (Part XV)	Methods of measurements of building and civil engineering works: Part XV – Painting, polishing, varnishing etc. (Reaffirmed 1992) (4 th Revision)
8.	2932-1994	Enamel, synthetic, exterior (a) undercoating (b) Finishing (2 nd Revision)
9.	5410-1992	Cement paint (1 st Revision)
10.	1661	Application of plaster
11.	1542	Plaster for sand
12.	2645	Integral waterproofing compound

13.	2395 (Part I & II)	Painting workmanship
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DISMANTLING AND DEMOLITION

S. No	IS Code No	Particulars
1	1200-1974	Method of measurements of building and civil engineering works: Part XVII: Demolition and dismantling (Reaffirmed 1992) (3 rd Revision)

ALUMINIUM WORK

S. No	IS Code No	Particulars
1	1285-1975	Specification for wrought aluminium and aluminium alloy, extruded round tube and hollow sections (for general engineering purposes)
2	1868-1996	Anodic coatings on aluminium and its alloys – Specification
3	1948-1961	Specification for aluminium doors, windows and ventilators (Reaffirmed 2001)

2. EARTHWORK

2.1 Earthwork in Excavation & Backfilling

1. General

The work to be done under this section comprise performance of all work necessary for excavation with shoring, strutting, dewatering, pumping including disposing of all surplus excavated material from the site as directed by the Engineer.

Excavation shall be carried out in any type of soil, gravel, conglomerate, soft rock, boulders, old foundation, hard rock, concrete, asphalt or stone paved surfaces old masonry or concrete (plain or reinforced) encountered within width, length and depths indicated in the drawings. Where any temporary or permanent structure like sheet piling, diaphragm wall or piles have already been taken up, all excavation work shall be from the point carried out earlier and all precaution during further excavation and or any construction operation shall be exercised not to damage such existing temporary or permanent work. Where directed by the Engineer trees encountered within the work site shall be uprooted as per approved manner and serviceable wooden logs shall be stacked at site / disposed of as directed by the Engineer. Branches of trees etc. shall be disposed of or stacked at site as directed by the Engineer. No permanent work shall be commenced in the excavated area until the foundations pits have been inspected and approved by the Engineer. The Contractor may use any suitable excavated materials for incorporation in the permanent or temporary works as may be convenient subject to compliance with the specifications. Any obstacles encountered during excavation shall be reported immediately to the Engineer and shall be dealt with as directed by the Engineer.

2. Method of Excavation

Depending on the type of material, quantum of excavation and time for construction, the Contractor may carry out the work manually or by use of appropriate mechanical equipment.

3. Details of Works

Dimensions / Levels

Excavation for permanent work shall be carried out to the correct dimensions, lines and levels and profiles shown on the drawings or as directed by the Engineer-In-Charge. Rough excavation shall be carried out to a depth 150 mm. above the final 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.

4. Shoring and strutting

The Contractor shall provide and maintain all planking and strutting as may be necessary to prevent any ground movement.

5. Excavation to be kept dry

The Contractor shall keep all excavation free from water, whether from sub-soil or from rains or from any other source, by pumping or other approved means.

6. Sides and bottom of excavation

Excavation shall be left open for as short period as practicable and necessary. Immediately before foundations or other work be constructed therein, the sides of excavation shall be trimmed, if necessary and the bottom shall be cleaned, free of loose or disturbed ground, dry well rammed and approved by the Engineer-In-Charge.

7. Stacking / Removal of excavated material

Stacking, dumping, spreading at site or removal from site of excavated material shall be strictly as approved by the Engineer-In-Charge.

Excavated material suitable for filling shall be dumped in an orderly manner to required levels / grades as directed. All surplus material or material not suitable for filling shall be carried away from site to approved dumping ground.

8. Backfilling

All return fill in excavated trenches, pits etc. shall consist of materials selected from excavation or elsewhere and shall be dry, friable and free from clay and plastic material, mud, vegetable, salts, sulphates and organic matter likely to decay and shall be subject to the Engineer-In-Charge's approval before use. All clods of earth shall be removed or broken. Where excavated material is mostly rock, it shall be broken to pieces not larger than 150mm size and mixed with properly graded murum or equivalent approved material. Filling shall be placed in layers not exceeding 150mm well watered & consolidated by mechanical compaction machines or manually to achieve 95% proctor density if permitted by the Engineer-In-Charge and to the satisfaction of the Engineer-In-Charge.

2.2 Earthwork in Filling

1. Material

All fill material, whether out of surplus material from excavations or brought from any other source outside shall be subject to prior approval of the Engineer-In-Charge. The source of outside material shall also be approved by the Engineer-In-Charge.

All fill material shall be free from vegetable refuse and other organic matter, marine clay, black cotton soil, injurious salt and other material considered unsuitable by the Engineer-In-Charge.

All large clods shall be broken. Where the material is mostly rock, boulders shall be broken into pieces not larger than 15 cm. size, mixed with properly graded fine material like murum etc.

2. Filling over areas (site gradation) / roads / pathways

Any filling work shall be started by the Contractor only after recording existing ground levels jointly with the Engineer-In-Charge.

Formation width and side slopes shall be as per drawings or as directed by the Engineer-In-Charge.

All banks shall be thrown up in layers of not more than 200 mm. in depth over the whole width between the surfaces of side slopes slightly concave in section, so as to retain water for subsidence. When on side long ground, the whole area of the bank of the slope shall be benched out or stepped so as to prevent material from slipping.

Each layer of filling shall be watered, rammed and thoroughly consolidated to the satisfaction of the Engineer-In-Charge and to obtain the density stipulated in the item. Compaction shall be done by mechanical compaction machines unless otherwise allowed by the Engineer-In-Charge. The normal allowance for subsidence or settlement shall be 5 cm. per 30 cm. depth of bank. This may be increased or decreased by the Engineer-In-Charge depending on the nature of the filling material used. Necessary field and laboratory tests shall be carried out by the Contractor to demonstrate that the specified density at moisture content is obtained in the fill at different stages of filling and after the fill to the entire height is completed, if so specifically called for.

The Contractor shall protect the fill from being washed away by rain or damaged in any other way. Should any slip occur, the Contractor shall remove the affected material and make good the same at his own cost.

If rock obtained from excavation (which may be used for filling and levelling to indicated grades without further breaking) is permitted for filling by the Engineer-In-Charge, filling shall be done in layers not exceeding 50cm approximately. After rock filling to the approximate level, the voids in the rocks shall be filled with finer materials such as earth, broken stone etc. and the area shall be flooded with water so that the finer materials fill up the voids. Care shall 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 consolidation carried out by a 10 -12 tonne roller. No less than twelve passes of the roller shall be accepted before subsequent similar operations are taken-up.

After the filling layers are consolidated, the surface and slopes shall be trimmed to the levels, formation width and to even and uniform gradient as per requirement.

3. Plinth filling

Plinth filling shall be carried out with approved material in layers not exceeding 15cm. watered and compacted with mechanical compaction machines such as pneumatic tampers, rammers etc. 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, unless otherwise directed, for at least 24 hours, allowed to dry and then the surface again compacted as specified above to avoid settlements at a later stage. The finalised level of the filling shall be trimmed to the level/slope as directed / specified.

Where specifically specified, compaction of the plinth fill shall be carried out by means of 8 -10 tonne approved type of roller. In this case fill layers can be upto a maximum of 300 mm. As rolling proceeds water sprinkling shall be done to assist consolidation. Water shall not be sprinkled in case of sandy fill. Rolling shall commence from the outer edge and progress towards the centre and continue until compaction to the satisfaction of the Engineer-In-Charge or provides density not less than that specified in the item but in no case less than 10 passes of the roller shall be accepted for each layer. The compacted surface shall be properly shaped, trimmed and consolidated to an even and uniform gradient. All soft spots shall be excavated and filled and consolidated.

At places back filling shall be carried out 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-sand shall be kept flooded with water for 24 hours to ensure maximum consolidation. The surface of the consolidated sand shall be dressed to required level or slope. Construction of floors or other structures on sand fill shall not be started until the Engineer-In-Charge has inspected and approved the fill.

2.3 Measurements

Excavation shall be measured as net dimensions in accordance with the instruction by Engineer-in-charge/ Drawings issued specifically for excavation work for foundation / trench excavation where PCC area shall be considered for measurements of excavation. No measurements shall be considered for extra excavation that may be required such as for working space, for keeping sides of excavation straight etc. or for extra excavation that may result due to removal by blasting, mechanical equipments etc. Founding surface, if uneven, shall be made level with 1:3:6 nominal mix concrete at the Contractors expense.

The depth shall be reckoned from average G. L. of concerned pit / area.

2.4 Rates

Rate shall include all materials, labour involved in the above operations as described above including setting out works, profiles, preparing beds for foundations, site clearance, removal of slips/falls, watching and lighting wherever necessary. The rate of excavation is inclusive of dewatering to keep the bed dry irrespective of source of water (such as subsoil water, water table, tidal, rains, seepage, pipe line etc.) shoring if, and when required.

3. DRY RUBBLE SOLING

3.1 Materials

Supply of rubble stone of the specified type and size and shall be obtained from approved sources only and transporting to the site of work including all loads, lifts, handling, transportation etc.

The rubble of the specified type of stones shall be hard, tough, sound, durable, dense, clean of close texture and free from unsound material, cracks, decay and weathering. Their water absorption shall be as low as possible but not more than 5 percent.

The shape of the stones shall be as regular as can be obtained by quarrying without attempt at shaping or dressing. They shall be sufficiently flat bedded. The stone shall be broken with the smallest dimensions equal to the specified thickness of soling. The length and breadth should not generally exceed twice its thickness. Before starting collection, the contractor shall get a sample conforming to the required quality, shape and size approved by the Engineer-In-Charge who will keep it in his office for reference.

Stacking shall be done only after the quality; shape and size of rubble are approved.

The hard murum used as binding material shall be of disintegrated trap, granite, quartzite or gneiss rock freshly quarried. It shall be sufficiently hard and free from soft murum, earth, organic matter or order deleterious or soft material. The particle size of the hard murum shall generally fulfil the size (Square mesh) percentage passing through, 80mm - 95% and 25mm - 2%. Stacking lift and lead etc. shall be as specified in the BOQ, or as directed by the Engineer-In-Charge.

3.2 Laying Soling

The item provides for the labour for laying soling of specified type of stones in the specified thickness including preparing the sub-grade to proper sections by scrapping, dressing, compaction, etc. and hand packing the rubble chips to the required line, curve and grade and section.

The rubble supplied shall be laid with the largest face downwards and in contact with each other. The stones shall break joint as far as possible. The full thickness of the soling shall generally be made with one stone only. Unless otherwise provided in the plans or directed by the Engineer-In-Charge, the width of the soling shall be 30cm more than that of the metal above.

As the laying of rubble advances the soling shall be hand packed by wedging and packing with 80mm metal collected for the purpose in the joints of the soling and driving them by hammers in place so as to fill the voids as completely as possible. This operation of hand packing shall follow the rubble laying closely. The soling shall be laid and hand packed true to grade and section and these shall be often checked by boning rods, template boards and fish lines, etc. The grades sections etc. of the soling shall correspond to those of the surfacing coming on it.

The soling thus laid shall be finished by knocking out projecting stones and filling depressions by chips to come up to the grade and camber.

4. PLAIN AND REINFORCED CEMENT CONCRETE:

4.1 GENERAL

These specifications cover the general requirements of plain and reinforced concrete for use in various components of structures.

For all items of concrete in any portion of the structure or its associated works controlled concrete shall be used unless otherwise specified. Normal /ordinary concrete mix as indicated in the item specification may be used as directed by the Engineer-in-charge.

Controlled concrete shall be based on a mix design carried out in laboratory, approved by MDL, and shall conform to IS 456-2000.

4.1.1 OTHER CODES AND SPECIFICATIONS

Other IS codes pertaining to the items of cement concrete work in structural work not indicated above shall also be deemed to come under the purview of this clause. All Indian Roads Congress Standards, specifications and codes of practice also come under this purview.

4.2 GRADE OF CONCRETE

4.2.1 CONTROLLED CONCRETE

For controlled concrete, design of the mix shall be carried out for the respective target strength and in its production all necessary precautions shall be taken to ensure that the required works cube strength is attained and maintained.

The controlled concrete grades are designated as M 20, M 25, M 30, M 35, M 40, M 45 and M 50 and as per the latest IS codes.

4.2.2 ORDINARY CONCRETE (Concrete Grades M:15 & below)

In case of ordinary / nominal grade concrete, mix is required to be arrived at by preliminary tests, proportions of cement, fine aggregates and coarse aggregates are specified by mass as given in Table – 2

In the designation of a concrete mix, letter 'M' refers to the mix and the number to the specified 28 days works cube compressive strength of that mix on 150 mm cubes, expressed in N/mm².

4.3 STRENGTH REQUIREMENT OF CONCRETE

Where Ordinary Portland Cement conforming to IS:269 or Portland Blast Furnace Cement conforming to IS:455 is used, the compressive strength requirements for various grades of concrete controlled as well as nominal shall be as given in Table 1. Where rapid hardening portland cement is used, the 28 days compressive strength requirements shall be met at 7 days.

For controlled concrete, the mix shall be so designed for the so called Target strength as to attain in preliminary tests a strength at least 33 per cent higher than that required on work tests, for concrete strength upto and including M-25 and 25% higher for higher strengths.

Table 1

Grade of Concrete	Compressive Works Test Strength in N/Sq. mm on 150 mm Cubes after Testing Conducted in accordance with IS : 456	
	Min. at 7 days	Min. at 28 days
M 10	7	10
M 15	10	15
M 20	13.5	20
M 25	17	25
M 30	20	30
M 35	23.5	35

4.4 MATERIALS :**4.4.1 CEMENT:**

Fresh quality cement shall be procured only from approved manufacturer / supplier and shall be subject to prior approval of the Engineer-in-Charge. Following types of cement shall be used :

- i) All cement used for the work shall be ordinary portland cement or such other cement as may be permitted by the Engineer-in-charge. Portland cement shall comply with the requirements of the latest issue of IS 269. High alumina cement, rapid hardening cement and portland Slag cement etc., can be used only when permitted by the Engineer-in-charge. Such cements shall be in accordance with relevant IS Codes. Portland Pozzolana cement when permitted by the Engineer-in-charge shall conform to IS 1489 Part I but it shall not be used or RCC structural member.
- ii) Cement which has remained in bulk storage at the mill for more than 6 months or which has remained in bags at the dealers storage for over 3 months, or which has been stored at project site for more than 3 months shall be re-tested before use. Cement shall also be rejected if it fails to conform to any of the requirements of these specifications.
- iii) Different types of cement shall not be mixed.

4.4.2 FINE AGGREGATES

Fine aggregates shall consist of natural sand, manufactured sand or an approved combination thereof and shall conform to IS: 383. The grading zone of sand proposed for use shall be supplied by the contractor and got approved by the Engineer-in-Charge.

The sand shall be siliceous material, sharp, hard, strong and durable and shall be free from adherent coatings, clay, dust, alkali, organic material, deleterious matter, lumps, etc.

Either natural or manufactured sand shall be prepared for use by such screening or washing, or both, as necessary, to remove all objectionable foreign matter. Natural sand shall be washed, unless specific written authority is given by the Engineer-in-charge to use sand that meets specifications and standards of cleanliness without washing. The cost of screening and washing must be borne by the contractor. The fine aggregate shall be taken from a source approved by the Engineer-in-charge.

4.4.3 COARSE AGGREGATES

Coarse aggregates shall consist of hard, strong, durable particles of crushed stone and shall be free from thin elongated soft pieces, organic or other deleterious matter. It will be from a source approved by the Engineer in charge. Coarse aggregate shall conform to IS: 383.

Coarse aggregate shall be washed if necessary to remove all vegetable and other perishable substances and objectionable amounts of other foreign matter, the cost of washing and screening being borne by the contractor.

Size of Coarse Aggregates

Following shall be the maximum nominal size of coarse aggregate for the different items of work if not specified in the item of works or their respective specifications:

Sr. No.	Item of Construction	Max. Nominal Size of Coarse Aggregate
(i)	RCC well steining concrete, RCC well curb & RCC piles in plum concrete	40 mm
(ii)	Well cap or pile cap, solid type piers, abutments and wing walls, and, footing of open foundation and general items of work in bridge and building construction.	20 mm
(iii)	RCC works in girders, deck slab, wearing coat, kerbs, light posts, ballast walls, approach slab etc. and piers, returns, wing walls and retaining walls.	20 mm
(iv)	RCC bearings, shells and other thin walled members and in zones of congestion.	20 mm
(v)	For any other item of construction not covered by items (i) to (iv)	As specified in the drawings or as desired by the Engineer-in-Charge

For heavily reinforced concrete members as in the case of ribs of main beams, the nominal maximum size of aggregate shall usually be restricted to 5 mm less than the minimum lateral clear distance between the main bars, or 5 mm less than the minimum cover to the reinforcement, whichever is smaller.

4.4.4 REINFORCING STEEL

Reinforcing steel shall be clean and free from loose mill scales, dust, loose rust and coats of paints, oil, grease or other coatings which may impair or reduce bond.

- a) Fe 240 - Mild steel shall conform to the latest edition of IS: 432 Part 1.
- b) Fe 415 & Fe-500 high strength deformed bars shall conform to IS: 1786, **TMT bars conforming to IS: 1786 shall only be used.**
- c) Structural steel sections and plates shall conform IS : 226 and IS : 2062.

Note: The reinforcement steel to be used for the construction shall be of Grade Fe – 500 only (for all RCC structures).

4.4.5 WATER

Water used mixing and curing shall be free from injurious amounts of deleterious material. pH value of water shall not be less than 6. Potable water is generally considered satisfactory for mixing and curing concrete. Water shall be got tested before use in concrete and curing. The cost for the same shall be borne by the contractor. Permissible limits for solid shall be as below:

PERMISSIBLE LIMIT FOR SOLIDS

	Tested as per	Permissible limit max.
Organic	IS : 3025 (Pt.18)	200 mg/lit.
Inorganic	IS : 3025 (Pt. 18)	3000 mg/lit.
Sulphates (as SO ₃)	IS : 3025 (Pt. 28)	400 mg./lit.
Chlorides (as Cl)	IS : 3025 (Pt. 32)	2000 mg. lit. for concrete work not containing embedded steel and 500 mg./lit. for prestressed /reinforced concrete work.
Suspended matter	IS : 3025 (Pt. 7)	2000 mg./lit.

4.4.6 ADMIXTURES

No materials other than essential ingredients i.e., cement, aggregate and water, shall ordinarily be used in the manufacture of concrete or mortar. But the Engineer-in-Charge may permit the use of approved admixtures for improving the workability of the concrete, if so specified on satisfactory evidence that its use does not in any way adversely affect the properties of concrete particularly its strength, volume changes, durability and has no deleterious effect on the reinforcement. Admixture where allowed shall conform to relevant IS: 9103.

Chloride content in admixture shall be independently tested for each batch before acceptance.

4.5 MATERIALS FOR REPAIR WORK

The use of epoxy for bonding fresh concrete used for repairs will be permitted on written approval of the Engineer-in-Charge. Epoxies shall be applied in accordance with the instructions of the Manufacture. The cost of such repair when approved by the Engineer-in-Charge shall be borne by the contractor

4.6 STORAGE OF MATERIALS

i) Cement

The contractor shall make arrangements to the satisfaction of the Engineer-in-Charge for the storage of cement to prevent deterioration due to moisture and/or intrusion of foreign matter. Bulk cement shall be stored in approved water-proof bin or silo. Bagged cement shall be stored in a suitable weather tight warehouse in a manner to provide easy access for identification and inspection of each consignment. Stored cement shall meet the test requirements as per IS-269 at any time after storage, when a retest is ordered by the Engineer-in-Charge. Each consignment shall be stacked separately with the date of receipt flagged on it, not more than 12 bags being stacked in height, the bags being arranged with headers and stretchers. Normally consignments shall be used in the order of receipt at site unless otherwise directed. In the case of large concrete pours the Engineer-in-Charge will decide on the batch of cement to be used taking into consideration the quantity of cement with particular reference to the concerned concrete pours. Any additional work in handling and storage of cement contingent upon this requirement shall be to the contractors' account and no extra claim will be entertained. Cement shall be protected from closure to moisture in transit, in storage at the works and until it enters the concrete mixers. The contractor shall keep accurate records of the deliveries of the cement and of its use in the work.

ii) Aggregates

Coarse and fine aggregates shall be stacked separately in such manner as to prevent contamination by foreign materials. All aggregates shall be stored on concrete or masonry platforms, each size shall be kept separate with wooden, steel, concrete, or masonry bulk heads, or shall be stored in separate stacks, taking care to prevent the materials at the edges of the stock piles from getting intermixed. Stacks of fine and coarse aggregates shall be kept sufficiently apart. The aggregates shall be stored in easily measurable stacks of suitable heights as may be directed by the Engineer-in-Charge.

iii) Reinforcing Steel

Reinforcing steel shall not be stored directly on the ground. These shall be stored under cover and shall be protected from rusting, oil, grease and distortions as directed by the Engineer-in-Charge.

4.7 PROPORTIONING CONCRETE

4.7.1 CONTROLLED CONCRETE

Concrete mix shall be designed for 33% higher strength than the grade of concrete specified. The proportions for ingredients chosen shall be such that concrete has adequate workability for conditions prevailing on the work in question and can be properly compacted with the means available.

Except where it can be shown to the satisfaction of the Engineer-in-Charge that a supply of properly graded aggregate of uniform quality can be maintained till the completion of work, grading of aggregate should be strictly controlled. The different sizes shall be stocked in separate stock piles. Required quantity of material shall be stock-piled several hours, preferably a day, before use. Grading of coarse and fine aggregate shall be checked as frequently as possible, frequency for a given job being determined by the Engineer-in-charge to ensure that the suppliers are maintaining the uniform grading as approved for samples used in the design mix.

The quantity of both cement and aggregate shall be determined by weight. Water shall either be measured by volume in calibrated tanks or weighed. All measuring equipment shall be maintained in a clean and serviceable condition. Their accuracy shall be periodically checked.

It is most important to keep the specified water-cement ratio constant and at its correct value. To this end, the moisture content in both fine and coarse aggregates shall be determined by the Engineer-in-charge according to the weather conditions. The amount of mixing water shall then be adjusted to compensate for variations in the moisture content. For the determination of moisture content in the aggregates, IS: 2386 (Part III) shall be referred to. Suitable adjustments shall also be made in the weights of aggregates to allow for the variation in weights of aggregates due to variation in their moisture content.

For the minimum cement and maximum water cement ratio and minimum grade of concrete refer Table : 5 of IS-456-2000.

For adjustments to Minimum Cement Contents for Aggregates other than 20 mm Nominal Maximum Size, refer Table:6 of IS-456-2000

For Limits of Chloride Content of Concrete refer Table : 7 of IS-456-2000

Condition of Exposure:

- i) **Severe - Marine Environment :** Alternate wetting and drying due to sea spray, alternate wetting and drying combined with seeping, buried in soil (having corrosive effect); members in contact with water where the velocity of flow and the bed material are likely to cause corrosion of concrete.
- ii) **Moderate - Condition other than 'severe' :**
 - a) The minimum cement content is based on 20 mm size aggregates. For larger size aggregates, it may be reduced suitably by not more than 10%. Similarly for smaller size aggregates, it may be suitably increased, but not more than 10%.
 - b) The cement content shall not exceed 540 kg/cu.m. of concrete.
- iii) **Ordinary / Nominal Concrete:**

The ordinary / nominal concrete mix shall also be specified by mass. Proportioning of sand shall be as per its dry volume and in case it is damp, allowance for 'bulking' shall be made as per IS : 2386 (Part III).

Ingredients required for nominal mix concrete containing one 50 Kg. bag of cement for different proportions of mix shall be as given in Table-2.

PROPORTION OF NOMINAL MIX CONCRETE

TABLE - 2

Grade of Concrete	Total quantity of dry aggregates by mass per 50 Kg. of cement, to be taken as the sum of the individual masses of fine & coarse aggregates, (Kg.), Max.	Proportion of fine aggregate to-coarse aggregate by mass.	Qty. of water per 50 Kg. of cement Max. (Ltrs.)
M-7.5	625	Generally 1:2 for fine aggregate to coarse aggregate by volume but subject to a upper limit of 1:1 ½ and a lower limit 1.2 ½	45
M-10	480		34
M-15	330		32

Note No. 1: The proportions of the aggregates shall be adjusted from upper limit to lower limit progressively as the grading of the fine aggregates becomes finer and the maximum size of coarse aggregate becomes larger.

Note No.2 : The amount of water should be kept minimum required for proper workability. The quantity given in Col. 4 is not to be exceeded.

Example

For an average grading of fine aggregate (that is Zone the proportions shall be 1:1 ½ , 1:2 and 1:3, for maximum size of aggregates 10 mm, 20 mm and 40 mm respectively.

Note No.3 : A mix leaner than M 10 may be used for non-structural parts if specified on the drawing or provided in the contract. In such case grading of aggregates shall be as specified in the contract or on the drawings. Other requirements for mixing, placing and curing shall be the same as specified in this section.

iv) Quantity of Water

The quantity of water shall be just sufficient to produce a dense concrete of required workability and strength for the job. An accurate and strict control shall be kept on the quantity of mixing water.

In the case of reinforced concrete work, workability shall be such that the concrete surrounds and properly grips, all reinforcements. The degree of consistency, which shall depend upon the nature of work and the methods of vibration of concrete, shall be determined by regular slump tests. The slump

shall be adopted for different types of works shall be as per IS 456, cl. No. 7, pg no. 17.

4.8 MIXING AND PLACING OF CONCRETE

INGREDIENTS AND MEASUREMENTS OF MATERIALS

The concrete shall be comprised of water, Portland cement, sand and coarse aggregate. If required by the Consultant the Contractor shall have to add approved brand of plasticizer in required quantities to facilitate easy flow of concrete. No extras shall be paid for providing and adding plasticizer.

All sand and coarse aggregate used on the works shall be carefully and accurately measured in suitable gauge boxes and in quantities to the entire satisfaction of the Consultant and the cement to be added to the aforesaid mix shall be either by one or two full scale bags, the water being added to the dry mix in a manner in which it can be properly controlled and measured. The cement shall be measured by weight or by bags. One bag of cement weighing 50 kg. shall be considered equal to 0.034 Cu.m. (1.20 cft) in volume. Volumetric measurement of cement will not generally be permitted. If loose cement is used it shall be weighed and 40.8 kg. shall be considered as 0.0283 Cu.m (1 cft). The contractor shall provide an accurate weighing apparatus on the work for this purpose. If he wants to use volumetric batching, he would have to prove the correct weights of cement bags.

The maximum quantity of mixing water per 50 kg. bag of cement shall be 25 litres which shall include free water carried by the Aggregate, corrections being made to this quantity of water according to the wetness of aggregate, as instructed by the Consultant. The consistency of the concrete shall be tested by the standard slump for concrete and shall be as per IS or as directed by consultant. Contractor shall have to use approved plasticizer in required quantity at his own cost to achieve necessary workability. Water Cement Ratio should be as per the design mix and it should be strictly adhered to.

The proportioning of concrete as per design mix shall be used for mixes of grade M-20 and above. For this the Contractor shall supply the different ingredients such as cement, sand, aggregate, admixtures etc. and the required slump approved by Engineer In charge. If any of the ingredients are altered in respect of the source of production, quality or any other parameter the same will be got approved by the Engineer In charge and fresh design mix shall be done for the proportioning of the different ingredients to the satisfaction of the Engineer In charge and no parameters of the design mix for the concrete ingredients shall be altered from that submitted for the design of the concrete mix.

The concrete shall be mixed in an efficient power driven batch mixer. The capacity of the drum shall as far as possible be such that only whole bags of cement are used in each batch. Mixing shall continue for atleast 1.5 minutes after all the materials including water, are placed in the drum and before any part of the batch is discharged. The drum shall be revolved not less than 14 and not more than 18 revolutions per minute. The drum shall be

completely emptied before receiving materials for each batch shall not exceed the mixer manufacture's rated capacity of the drum. The drum shall be thoroughly washed out when mixing operation cease for any period longer than one hour. Hand mixing of concrete, if permitted by the consultant shall be carried out in the following manner.

Ready mix concrete of specified grade and consistency namely water cement ratio, slump, cement content etc. shall be used to the extent possible particularly where the quantity of concrete required at one time is sufficiently large. The source of supplier and specifications of the concrete including the admixtures, retarders, setting time, transit time, method of placement of concrete on the job such as pumping etc., quality assurance from the supplier etc. should be got approved from the Engineer Incharge before ordering of the ready mix concrete for the job. The test cube strength specified in the drawings shall be closely monitored for ensuring the required strength of the concrete.

Mortar or concrete which has partially set before having been placed in-situ shall not be taken into use again either by itself or after mixing with additional materials or water.

All concrete shall be deposited in the forms within 15 minutes after leaving the mixer and shall be worked round the various reinforcement carefully by means of tamping and rodding as well as suitable vibrations.

As far as possible no joints shall be provided in any RCC work. However, if need arises the same shall be provided as per the instructions of Consultant, in which case the face of the construction joints shall be made rough by hacking and thoroughly cleaned and which before proceeding with further concrete work it shall be wetted and covered over with thick cement paste or "Hack-Aid-Plast" as directed by the Consultant.

Concrete after it has been placed in the forms should be allowed to set and should not be disturbed. The concrete shall be thoroughly cured by ponding or inundation or by means of hessian cloth covered, maintain in a wet condition. Where 53 grade cement is used curing of exposed surface of concrete shall commence within 4 hrs. of its placing. In no case shall the centering to any concrete work be removed without obtaining the permission of the Consultant. Great care shall be exercised while removing the centering to avoid jarring the structure or throwing away the forms on the floor.

The stripping time of form work shall be generally followed as per relevant I.S. Specification. However, the discretion of the Consultant shall be final. The form work of all RCC and PCC work shall be as to bring out the exposed surfaces to a smooth and clean finish. Immediately after the removal of the form work the exposed surface of all such RCC work shall be thoroughly roughened by making deep and closely spaced indentations with a pointed steel tool (Basuli) to the entire satisfaction of the Consultant. The exposed surface of RCC and concrete work wherever directed shall be finished with cement and sand plaster - smooth sand faced or rough cast as directed.

5. CENTERING AND SHUTTERING WORK

5.1 General:

All timbering for moulds and false work to be used in connection with reinforced

work shall be strongly and firmly erected. The moulds must be planed smooth and free from knots, holes, open joints and other imperfections. They shall be coated with mineral oil or other suitable materials to prevent the concrete adhering to the surface of the timber. The slabs centering shall be covered with double wazed water proofing paper or as directed if found necessary by the Engineer. Nothing extra will be paid for this.

The false work should be properly structured and braced in at least two directions and strong enough so as to be perfectly rigid and unyielding during the operation of filling and ramming the concrete. The timbers should be of sufficient thickness and scantlings of such a good quality as not to warp, deform or deflect the concrete.

The whole arrangement regarding the dimensions and construction of the false work shall be to the entire approval of the Engineer and shall be of proper size so as to bring out the completed work of the required dimensions.

Before filling the forms care shall be taken to see that the reinforcements are in their proper and ultimate positions and thoroughly secured from being disturbed during the filling and ramming of the concrete and that the moulds are absolutely free from dried up cement or concrete, any dust, pieces of wood, rags and projecting nails.

The arrangement of the forms and centering shall be such that the slab centering and sides of beams and column forms may be removed first allowing the bottoms of beams and girders to be supported for longer time.

5.2 REMOVAL OF CENTERING

In no case shall the centering of any concrete work be removed without obtaining the special permission of the engineer or his Assistant.

Proper care shall be exercised while removing the centering to avoid jarring the structure or throwing heavy form from the floor.

Generally nothing less than the following times should elapse between the filling in of the concrete and removal of the forms: -

Type of formwork	Minimum period before striking formwork
Vertical formwork to columns, beams and slabs	16-24 hrs.
Soffit formwork to slabs (Props to be re-fixed immediately after removal of formwork.)	3 days
Soffit formwork to beams (Props to be re-fixed immediately after removal of formwork.)	7 days
Props to slabs Spanning up to 4.5 m	7 days

Type of formwork	Minimum period before striking formwork
Spanning over 4.5 m	14 days
Props to beams and arches	
Spanning up to 6.0 m	14 days
Spanning over 6.0 m	21 days

After removal of the centering any roughness or irregularity on the exposed surface of the work shall be made good by thin grouting of cement or a cement wash and the whole surface shall be so finished as to present an even and uniform appearance. No plastering will be permitted on the surface.

6. BRICKS & BRICK WORK IN GENERAL

6.1 GENERAL:

- (a) Bricks shall conform to the latest Indian standard specifications (I.S.S.). All bricks shall be of first class of standard specifications made of good brick earth, whole sound, well burnt, free from cracks to ring when struck and not to crack or break when soaked in water regular in shape and uniform in size. They should be of the best of description obtainable in the market and of the best quality and colour, and in every respect to be approved by the Engineer-in-charge. No bricks to absorb water more than one fifth of their own weight when dry for use in load bearing wall. For bricks used in panel walls, the water absorption shall not exceed $\frac{1}{4}$ of their dry weight. Bricks to be thoroughly cleaned, well wetted or soaked in fresh water before being used on the work and no broken bricks to be used except as closures. Crushing strength of the dry bricks shall be not less than 35 kg./cm.²
- (b) The mortar should be as described under the head of good quality carefully mixed and used stiff. For joints of face work only Cement and screened sand should be used in specified proportion.
- (c) A good bond should be preserved throughout the work both laterally and transversely. All bed joints should be perpendicular to the pressure upon them, i.e. horizontal in vertical walls, radial in arches and at right angles to the slope in battering walls.
- (d) In walling the courses shall be kept perfectly horizontal and rise in plumb. The vertical joints shall break joints with the courses immediately below and above, but they shall be directly over one another in alternate courses to prevent the necessity of bats. The joints shall not exceed 10 mm. thick shall be fully of mortar close, well flushed up and neatly struck or pointed as may be required.
- (e) English bond to be used throughout in walling. In arching such bond shall be used as directed by Engineer.
- (f) Facing of brick work to be specially selected brick of the same colour throughout. All external brick walls of thickness 25 mm. and above shall be

constructed in plumb from the outside face with the help of scaffolding erected on the external side.

- (g) In other respects, the work should comply with the general specification for brick work as per relevant IS code.

7. PLASTER WORK:

7.1 SAND FACE PLASTERING:

7.1.1 All external surfaces where ever the plaster is loose and detached from the surface of wall / structural members, all vegetation growths, tree roots, etc. should be removed. Plastering also includes finishes to the surface to bring in line and level. All drip moulds, cornices, jambs, insets, projections as required shall be provided and duly plastered to required finish. No extra payment shall be made for such finishes.

7.1.2 The exposed surface shall be properly raked prior to any treatment. Wherever the pointing of the wall panels is ineffective, loose fresh pointing shall be done. This shall not be paid separately. The surface cleaned with water twice, all wall joints refilled and these joints are sprayed with a thin layer of cement slurry. Then the entire surface to be plastered shall be coated with a bond coat with cement slurry just prior to application of cement plaster. Under no condition shall the first coat of the plaster be applied on dry bond coat.

7.1.3 Thereafter a 25mm thick sand face plaster 1:3 in two coats shall be applied, mixed with water proofing compound 1 Kg for 50 Kg cement or as specified by manufacturer. The second coat of the plaster shall be applied after four days. First coat shall be of minimum 15mm thick and maximum 18mm thick. The second coat shall be minimum 5mm thick and maximum 8mm thick. Under no circumstances shall the plaster be less then 25mm thick. The surface is to be treated with polymer based bonding agent where joint exists with old plaster, RC section and the brickwork. The joint shall be treated with 2 coats of bonding agent applied by brush.

7.1.4 CURING

All polymer treated surfaces can either be immediately covered with plain cement mortar and then cured after 12 hours or the surfaces can be left to naturally cure without sprinkling water for two days and then covered with plaster.

All plastered surfaces shall be water cured for seven to ten days. The First coat shall be cured for minimum 5 days. When the atmospheric temperature of the site exceeds 38degree Celsius then curing shall be resorted to as many times as required to keep the surface moist or to ensure the mortar temperature does not rise. curing shall be done with the clean water avoid of any acidic impurities.

7.2 CEMENT PLASTER WITH POP FINISH

7.2.1 Relevant clauses of 8.1.1, 8.1.2 & 8.1.4 shall apply wherever essential. The thickness of the plaster should be as specified in the item descriptions (12 to 15mm for ceiling and wall). The cement mortar used shall be in proportion

1:4 mixed with approved shrinkage resistant chemical/ fibres. One part of Portland cement shall be dry mixed with four parts of sand, sufficient water shall then be added to make a homogeneous mixture. Mortar usable within 1/2 hour only should be prepared at a time. Joints in brick and stone masonry shall be raked out to receive the plaster and concrete surfaces shall be hacked and washed well before plastering. The brickwork shall be kept wet for at least six hours before plastering. A first coat of plaster of requisite thickness shall be applied and shall be finished with a coat of pop of average 2mm thick. This is used only as a finishing coat. Line and level of the surface shall be done in plaster. All such proposed application of POP should be approved by MDL and measured before applying any POP.

7.3 CEMENT PLASTER SINGLE COAT

The cement mortar used shall be in proportion 1:3 mixed with waterproofing compound unless otherwise specified. One part of Portland cement shall be dry mixed with three parts of sand, sufficient water shall then be added to make a homogeneous mixture. Mortar usable within 1/2 hour only should be prepared at a time. Joints in brick masonry shall be raked out to receive the plaster and concrete surfaces shall be hacked and washed well before plastering. The brickwork shall be kept wet for at least six hours before plastering. A coat of plaster of required thickness shall be applied and same shall be finished. The plaster shall be kept wet for seven days.

8. FINISHING WORKS

8.1 Cement Plastering

Cement plaster shall be of 6, 12, or 20 mm thick as specified in the respective item.

Materials

Cement mortar shall be as described under- Mortar specifications. However, cement used in the plaster shall be Portland Pozzolana Cement (PPC) Fly ash based conforming to IS: 1489 (Part-I.) unless otherwise specified. Only river washed sand shall be used. Pan type mixer for mortar should preferably be used.

Application

Unless otherwise specified all plaster work shall be carried out in accordance with IS 1661.

The thickness and proportion of cement mortar shall be as specified or directed.

Unless permitted otherwise by the Engineer-In-Charge, only double scaffolding of adequate strength shall be provided by the Contractor. No holes shall be made in the masonry for supporting the scaffolding. Scaffolding members shall not be tied to windows, doors, other members provided in the walls.

No plastering work shall commence until the surface preparatory work is approved by the Engineer-In-Charge.

The sand shall be as approved by Engineer-In-Charge and in accordance with IS 1542 specification for plaster.

Preparation of Surface

Joints of all masonry work shall be carefully raked out for a depth of about 12 mm. without causing any damage to the masonry. Surfaces of concrete work shall be

thoroughly roughened with chisel by pricks prior to application of plaster. For materials, which are not able to receive plaster directly, the necessary procedures shall be carried out as per the directions of the Engineer-In-Charge

All surfaces shall be thoroughly cleaned of all dirt, soot, oil, grease and any other material preventing proper bonding etc. and any efflorescence shall be removed by brushing and scraping. The surface shall then be soaked with water for at-least 6 hours prior to application of plaster to ensure proper adhesion between the surface and plaster. If any surfaces become dry in spots, such area shall be moistened again to restore uniform suction.

Procedures / Precautions Applicable to Workmanship

Plaster work shall proceed from top to bottom in one operation on an entirely unobstructed surface or on areas upto break against openings.

Long straight edge shall be used to ensure perfectly even surface. All corners, angles and junctions shall be truly vertical and horizontal as the case may be and shall be carefully and neatly finished. All soffits, exposed angles with door and window frames shall be carefully finished. Internal angles shall be rounded if so directed and arises shall be rounded, splayed or beaded as directed. The mortar shall adhere to the surface intimately when set and there should be no hollow sound when struck.

All plaster work shall be kept cured for a minimum period of 10 days after the application of finishing coat to prevent excessive evaporation. Matting of gunny bags should be hung over the outside of the plaster in a hot dry weather.

1st Coat

The thickness shall be about 12 mm. thick in case of brick walls, RC walls and columns and 6 mm. thick for ceiling, soffit of beams etc. Before this coat hardens, the surface shall be cross scratched to provide a mechanical key for the 1st coat. The cross-scratch shall be horizontal as far as possible to aid curing which will be done for at least 2 days immediately following the application.

Finish Coat

At least a period of 3 days should elapse between the application of the first coat and the finish coat. Finish coat shall be applied as specified in the item description unless other wise, stated neeru finish shall apply as described under the neeru finish specifications given below.

Curing

Curing shall be started as soon as the plaster has hardened sufficiently not to be damaged when watered.

The plaster shall be kept wet for a period of at least 7 days. During this period, it shall be suitably protected from all damages at the contractor's expenses by such means as the Engineer-In-Charge may approve. The Dates on which the plastering is done shall be legibly marked on the various sections so that for the specified period r can be watched.

Measurement

For plastering, the measurement shall be on area superficial for the unfinished surfaces as actually covered. Length and breadth shall be measured correct to a cm and its area shall be calculated in Sq.m. correct to two places of decimal. Dimensions before plastering shall be taken.

The areas shall include (all the actual pointed / plastered areas for jambs, sills, soffits of openings etc.

No deductions shall be made for ends of joints, beams etc.

No extra shall be allowed for beaded, chamfered or rounded arrises or curved angles.

Rate

The rate shall include the cost of all labour and materials involved in all the operations described above excluding chicken mesh, which shall be measured separately.

8.2 Plaster of Paris Finishing (POP) :

Material

The Plaster of Paris shall be of calcium-sulphate semi-hydrate variety. Its fineness shall be such that when sieved through a sieve of IS sieve designation 3.35 mm for 5 minutes after drying the residue left on it shall not be more than by 1% by weight. It shall not be too quick setting. Initial setting time shall not be less than 13 minutes. The average compressive strength of material determined by testing 5 cm cubes after removal from moulds, after 24 hours and drying in an oven at 40° C till weight of the cubes is constant & shall not be less than 84 kg per square metre.

Application

The 'POP' as prepared above shall be applied to the prepared surface with a steel trowel to a thickness not exceeding 6mm and rubbed and polished to a perfectly smooth and even finish working from top to bottom. While towelling is going on soap stone powder contained in thin muslin bags shall be dusted over the surface and worked in.

The surface of the under coat on which the punning is to be done shall be left rough. The punning shall be applied, when the under coat is still green. The mortar for punning shall be applied in a uniform layer slightly more than 6mm thick between gauged pads, with which to ensure an even and uniformly thick surface by frequent checking with a wooden straight edge. It shall be finished to an even and smooth surface with trowels.

All corners, arrises, angles and junctions shall be truly vertical and horizontal as the case may be and shall be carefully and neatly finished. Rounding or chamfering corners, arrises, junctions etc. where required, shall be punned without any extra payment. Such rounding, chamfering or grooving shall be carried out with proper templates or battens to the size required. No portion of the surface shall be left out initially to be patched up later on.

Thickness

The thickness of the finished punning shall not be less than 6mm thick, unless specified.

Scaffolding, Finishing, Precaution and Curing

Specifications for these shall be as described under- Plaster specifications.

8.3 Waterproof Cement Plaster :

Materials

Cement mortar shall be as described under – Sand faced plaster specifications.

Application

Application shall be as described under- Sand faced plaster specifications.

Finish coat

When the plaster has been brought to a true surface with wooden straight edge it shall be uniformly treated over its entire area with paste of neat cement and rubbed smooth, so that the whole for surface is covered with neat cement coating. The quantity of cement applied for floating coat shall be 1 kg per sq. m. Smooth finishing shall be completed with trowel immediately and in no, case later than half an hour of adding water to plaster mix.

The first coat shall be evenly dampened and 5 mm thick finish coat shall be well smooth after floating it with a coat of Portland Cement. The use of dry cement shall not be permitted.

Integral waterproofing compound conforming to IS: 2645 and of approved brand and manufactured, enlisted by the Engineer-In-Charge from time to time shall be used. Applications shall be as described under sand faced plaster specifications.

8.4 White / Colour Washing:

Materials

The materials for preparing lime wash shall be freshly burnt fat lime of good quality free from unburnt stone or other foreign matter. Lime shall be of “C” type as mentioned in IS 712.

Lime shall be slaked on the spot, mixed and stirred thoroughly with sufficient quantity of water (about 4.5 litres per Kg. of lime) to make a thin cream. This shall be allowed to stand for a period of 24 hours and then strained through a clean coarse cloth. Clean gum dissolved in hot water shall then be added in the proportion of 4 gm. of gum Arabic to one litre of lime cream to prevent lime wash coming off easily when rubbed.

Indigo (Neel) up to 3 gm per Kg of lime dissolved in water shall be added and stirred well. Water at 5 litres per Kg. of lime is then added to produce a milky solution.

Alternatively ready made whiting (ground white chalk) complying to IS 63 can be used. In this case whiting shall be dissolved in sufficient quantity of warm water to form thin slurry, which shall then be screened through a clean coarse cloth. 2 gm. of gum and 0.4 gm. of copper sulphate dissolved separately in hot water shall be added for every litre of the slurry, which shall then be diluted with water to the consistency of milk for use. Rice size may be allowed instead of gum.

Colour wash shall be lime wash as above to which a solution of water and lime fast pigment, boiled if directed, shall be gradually added and stirred until the required tinge is available.

Preparation of surface

The surface shall be prepared by removing all mortar dropping and foreign matter and thoroughly cleaned with wire or fibre brush or other means to be approved by

the Engineer-In-Charge. All loose pieces and scales shall be stuffed with mortar and cured.

Application

Lime wash shall be applied with a brush. Each coat must be allowed to dry and shall be subject to an inspection before the next coat is applied. When dry, the surface shall not show any signs of cracking and shall present a smooth and uniform finish easily when rubbed with a finger. Patchy or streaky work will be rejected. No colour wash shall be done with a sample of the colour wash to the required tint or shade unless it is approved by the Engineer-In-Charge.

Precautions

Doors, Windows, floors etc., shall be protected from being splashed upon. Any splashing and droppings shall be removed and surfaces cleaned.

Scaffolding

Single or double scaffolding shall be provided by the Contractor as and when required.

Measurements

Cornices and other such wall or ceiling features, shall be measured along the girth and included in the measurements.

The number of coats shall be 3 coats unless otherwise specified. The item to include removing nails making good holes, cracks, patches etc. not exceeding 50sq.m. each with material similar in composition to the surface to be prepared.

8.5 Painting

All the water base and oil base paints such as distemper, cement paint, enamel paint, flat oil paint etc. shall be of approved manufacturers and shall conform to the respective IS Codes and Standards.

Colour and Shade shall be as approved by the Engineer-In-Charge.

Supply

All paint materials shall be supplied to the Site in the manufacturer's sealed and branded containers. Any containers reaching site with broken seals are liable for instant rejection by the Engineer-In-Charge.

Storage

All paint materials shall be stored in cool dry conditions clear of other stores to the satisfaction of the Engineer-In-Charge.

Usage

The mixing of materials of different brands before or during application shall not be permitted.

Brushes, pails, kettles and other implements and tools used in painting or preparation of the work shall be clean and free from foreign matter.

The instructions of the manufacturer shall be followed regarding preparation of surface and application of priming and finishing coats. In any event the following engineering practices shall always be followed while carrying out work as specified in IS 2395 Part-I & Part-II.

- a. No exterior or exposed painting shall be carried out under adverse weather conditions such as rains, extreme humidity, dust storms etc.,
- b. The work shall preferably be carried out in shade to avoid blistering or wrinkling due to direct sunlight.
- c. All surfaces to be painted shall be free of loose matter, efflorescence, dust etc. before application of each coat.
- d. No paint shall be applied to works, which are internally or superficially damp.

Preparation of Surfaces

General

All surfaces requiring paint shall be thoroughly cleaned of all dirt, dust, grease or oil before spotting or priming. Oil or grease film shall be washed off with an acid that is non-injurious to the surface or shop primers and rinsed off completely with plain or soapy water. Surfaces shall be dry unless dampening is required for a particular finished material.

Before starting the work, the Contractor shall obtain the approval of the Engineer-In-Charge regarding the soundness and readiness of the surface to be painted on.

Masonry, Concrete and Plastered Surfaces

Surface shall be free from all efflorescence, mildew, loose paint or other foreign and loose materials. Surface with mildew or efflorescence shall be treated as follows:

- a) All mildewed surfaces shall be treated with an approved fungicide such as ammonical wash consisting of 7 gm. of copper carbonate dissolved in 80 ml. liquor ammonia and silica fluoride solution and allowed to dry thoroughly before paint is applied.
- b) All efflorescence shall be removed by scrubbing and affected surfaces shall be treated with a solution of muriatic acid in water (1:6 to 1:8) and washed fully with clean water and allowed to dry thoroughly.

Masonry cracks shall be cleaned out and patch filled with mortar similar to the original surfaces uniformly textured. Where this type of re-surfacing may lead to the finishing paint being different in shade from the original surface, the surfaced area shall be treated with minimum one coat of cement primer, which shall be continued to the surrounding area from a distance of 100mm.

The plastered surface shall be carefully rubbed smooth and thoroughly cleaned with clean fresh water.

Metal

All metal surfaces shall be absolutely clean, dry and free from wax, grease or dried soap films. Grease shall be removed by proprietary brands of approved solvent cleaner or other solutions or detergents. In addition all steel and iron surfaces shall be free from dust, rust and scales. This shall be done by wire brushing and scraping. All galvanised surface shall be pre-treated with a compatible primer according to the manufacturer's direction. Any abrasion in ship coats shall be touched with the same quality of paint as the original coat. The cleaning and operation of priming paint at site shall be carried out after the erection of steelwork.

As required single or double scaffolding or ladder shall be used without damaging or scratching the surfaces to be painted.

Cleaning up

Cleaning of paint droppings and spilling, splashed or splattered, films and smudges from finished surfaces and areas not to be painted shall be carried out concurrently with the work to the satisfaction of the Engineer-In-Charge. At completion, all equipments, excess materials and containers shall be removed and the premises shall be cleaned of all painting waste and debris.

Measurements

Length and breadth shall be measured correct to a cm and area shall be calculated in sq.m. correct to two places of decimals.

Corrugated surfaces shall be measured flat as fixed and the area so measured shall be increased by the percentage as described in above para to allow for girthed area.

Cornices and other such wall or ceiling features, shall be measured along the girth and included in the measurements.

The number of coats shall be 3 coats unless otherwise specified. The item to include removing nails making good holes, cracks, patches etc. not exceeding 50 sq.m each material similar in composition to the surface to be prepared.

- a) Timber doors, windows etc. shall be measured flat (not girthed) overall including frames and all edges, cleats etc. shall be deemed to be included in the item.
- b) Steel doors, windows, etc. shall be measured flat (not girthed) including frames, edges, etc.
- c) All pipes shall be measured in running meters and shall allow for all specials, brackets, clamps, etc. which shall not be measured separately.

8.6 Oil bound Distemper

In regards to materials, surface preparation, application, equipment & protection, cleaning etc. shall be as described above.

Application

Priming coat

The priming coat shall be with distemper conforming to IS: 428 in one coat. After the surface defects are treated with gypsum which is allowed to set hard and wiped clean, the priming coat is applied with distemper primer (when wall surface has not dried completely).

Newly plastered if required to be distempered before a period of six months shall be given a coat of alkali resistant priming paint conforming to IS: 109 and allowed to dry for at least 48 hours before distempering is commenced.

Distemper coat

After the primer coat has dried at least for 48 hours, the surface shall be lightly sand papered to make it smooth. Distemper is then applied in dry weather with a broad stiff brush in long paralleled strokes, each coat being allowed to dry before the next coat is applied. The subsequent coats shall be applied in the same way. Two coats of distemper shall be applied over primer coat to obtain an even shade. A time interval of at least 24 hours shall be allowed between successive coats to

permit proper drying of preceding coat. For old work the distemper shall be applied over the prepared surface in the same manner as in new work. 15 cm double bristled distemper brushes shall be used. After each days work, brushes thoroughly washed in hot water with soap solution and hung down to dry. Old brushes which are dirty and caked with distemper shall not be used on the work.

8.7 Plastic Emulsion Paint :

Materials, surface preparation, Application, Equipment and protection, cleaning etc. shall be as described under- Painting specifications. The plastic emulsion paints is not suitable for application on external, wood, and iron surface, which are liable to heavy condensation. These paints are to be used on internal surfaces except wooden and steel. Plastic emulsion paints as per IS: 5411 of approved brand and manufacture and of the required shade shall be used.

Application

The paint is mixed thoroughly adding about 50% water and then strained through a cloth. The paint is then applied on wall and allowed to dry thoroughly. A putty is prepared by mixing whiting and paint and is filled wherever necessary in holes depressions etc.

For the second coat only about 15 to 20% water is added.

(The correct quantity of water to be added shall be as per manufacturer's instructions)

The number of coat shall be two unless otherwise specified in the item. The paint will be applied in the usual manner with brush, spray, or roller. The paint dries by evaporation of the water content and as soon as the water has evaporated the film gets hard and the next coat can be applied. The time of drying varies from one hour on absorbent surfaces to 2 to 3 hours on non- absorbent surfaces.

The surface on finishing shall present a flat velvety smooth finish. If necessary more coats will be applied till the surface presents a uniform appearance. Painting on old surface shall be as described for new work except that the surface before application of paint shall be flattened well to get the proper flat velvety finish after painting.

Oil Paint :

Materials, surface preparation, application, equipment & protection, cleaning etc. shall be as described under-Painting specifications.

Application

Unless otherwise specified, paint shall be applied with brushes. The contents of the drum and tins shall be well stirred before using and occasionally during the use to prevent sedimentation at the bottom.

Priming coat

The priming coat shall be made up of materials depending on the surfaces to be plastered and specified or recommended by the manufacturer.

The primer shall be ready mixed primer of approved brand and manufacture and shall be compatible with finished painting scheme.

Where primer for wood work is specified it shall be prepared as per manufacturers specifications. The wood work to be painted shall be dry and free from moisture.

The surface shall be thoroughly cleaned. All unevenness surface shall be rubbed down smooth with sand paper and shall be well dusted. Appropriate filler material conforming to IS: 345 with same shade as paint shall be applied .

Finishing coat

Unless otherwise specified, the finishing shall be done in at least two coats of paint. The last coat shall give a flat, semi glossy or glossy finish as directed by the Engineer-In-Charge.

Synthetic Enamel Paint :

In regards to materials, surface preparation, application, equipment & protection, cleaning etc. shall be as described above. Synthetic enamel paint conforming to IS:2932 shall be of approved brand and manufacture and of required shade.

Application

Priming coat

Primary coat shall be of ordinary paint of shade to match with the top coat as recommended by the same manufacture. As top coat shall be used. Under coat shall be allowed to dry overnight. It shall be rubbed next day with the finest grade of wet abrasive paper to ensure smooth and even surface, free from brush marks and all loose particles brushed off.

Finishing coat

It shall be applied on properly primed surface. Subsequent coat shall not be applied till the previous coat is dry. The previous coat shall be lightly sand prepared for better adhesion of subsequent coats.

Top coats of synthetic enamel paint of desired shade shall be applied after the under coat is thoroughly dry. Additional finishing coats shall be applied if found necessary to ensure properly uniform glossy surface.

Unless otherwise specified, the finishing shall be done in at least two coats of paint. The last coat shall give a flat, semi glossy or glossy finish as directed by the Engineer-In-Charge. If, however, the surface is not satisfactory additional coats as required shall be applied to get correct finish.

Waterproof Cement Paint :

In regards to materials, surface preparation, application, equipment & protection, cleaning etc. shall be as described above. The cement paint shall be conforming to IS : 5410 of approved brand and manufacture and of required shade.

Application

Priming coat

Cement primer coat is used as a base coat on wall finish. The cement primer is composed of a medium and pigments which are resistant to alkalies present in the cement in wall finish and provides a barrier for the protection of subsequent coats. Primer coat material shall be as per recommendation of finish coat material. Primer coat shall be preferably applied by brushing and not by spraying on the clean dry and smooth surface. The surface shall be finished as uniformly as possible leaving no brush marks. It shall be allowed to dry for at least 48 hours, before subsequent coat.

Finishing coat

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. Cement paint shall be mixed with water in two stages and strictly as per manufacturer's instructions.

The surfaces shall be given one coat of paint. Care shall be taken so that the paint does not dry out too rapidly. After 4 to 6 hours, the water shall be sprinkled over the surface to assist curing and prevent cracking. After the first coat has dried (24 to 48 hours), the second coat shall be applied in a similar manner. The finished surface shall be kept moist by occasional sprinkling with water for seven days after painting.

Water proof cement paint shall not be applied on surfaces already treated with white wash, colour wash, distemper dry or oil bound, varnishes, paints etc.

Rate

The rate shall include the cost of all labour and materials involved in all the operations described above including scaffolding, unless specified. Quoted rate shall be inclusive of Cement primer coat unless separate item is specifically provided for.

Material- Acid proof paint of approved brand and manufacturer and of required shade shall be used.

Standards- In regards to materials, surface preparation, application, equipment and protection, cleaning etc. shall be as described above.

9. STEEL WORKS

9.1 Structural Work in built-up section (Welded/ bolted)

Although Broad Specifications for Structural Steel Works are as indicated below, the entire work shall be executed strictly in keeping with the working methodology, sequence of operations, safety and security etc. as approved by the Engineer-In-Charge, in best workmanship in conformity with relevant IS codes and the specifications of this tender document.

The Tenderer shall submit his own fabrication / erection methodology comprising sequence of operations to suit the works requirement such as –

- a) Material movement / storage of material
- b) Fabrication scheme considering space constraints
- c) Scheme for erection to be done at about 30 mtr. height for trusses
- d) Retractable Roof work
- e) Sliding Motorized Doors work
- f) Structural steel work of Blasting Chamber.
- g) Necessary Safety precautions as per prevailing rules.
- h) Security formalities to be maintained being a MDL area.

General

In addition to the requirements contained in this Specification, all materials shall conform to the latest edition of the relevant Indian Standard or its equivalent standard approved by the Engineer-In-Charge and shall, if required, be tested as prescribed therein.

In the event of conflict between this Specification and recognised standards, then the requirement of this Specification shall govern.

The work shall be carried out by competent personnel skilled in their various trades. All work shall be of the highest quality and the work shall be the subject of inspection and approval of the Engineer-In-Charge and the Employer.

All material shall be obtained from an approved supplier and manufacturer's appropriate test certificates shall be available upon request by the Engineer-In-Charge or the Employer.

All Steelwork shall be straightened or curved as necessary by pressure and not by hammering.

When bolt heads or nuts bear upon bevelled surfaces they shall be provided with square tapered washers to afford seating for the nut square with the axis of the bolt.

All nuts and bolts specified on the Drawings shall be to the required size with correct threaded length, and be supplied with matching nuts and washers also of the same material, except where electrolytic action is to be avoided.

Where small parts such as bolts and nuts etc. are to be sherardised, they shall be treated to receive a coating of finished thickness not less than 30 microns.

Where bolts, nuts and washers etc. are to be hot dip galvanised, they shall be treated to receive a finished thickness of zinc coating of not less than 80 microns thickness.

The Contractor shall give due notice to the Engineer-In-Charge in advance of the materials or workmanship getting ready for inspection.

The Engineer-In-Charge shall have free access at all reasonable times to those parts of the contractor's work which are concerned with the fabrication of the steel work and those portions of the site where assembly or erection is being carried out. The contractor shall give all reasonable assistance required in connection with the inspection and testing of the work.

No part of the work shall be treated as approved unless so informed by the Engineer-In-Charge in writing. However, approval of any material fabricated at shop / field shall not invalidate final rejection at site by the Engineer-In-Charge if it fails to be in proper condition or has fabrication inaccuracies, which prevents proper assembly. Similarly any approval of the fabrication and / or erection by the Engineer-In-Charge shall not relieve the Contractor of his responsibility for furnishing material and / or workmanship conforming to the requirements of the specifications.

All sections shall be free from surface defects such as pitting, cracks, laminations, twists, bends etc. The use of defective sections shall not be permitted and all such rejected material shall be immediately removed away from the store / site at contractor's cost.

All sections shall be marked for identifications and each lot shall be accompanied by manufacturers quality certificate, chemical analysis and mechanical characteristics as specified in relevant IS Codes.

Each lot of electrodes, bolts, nuts etc. shall be accompanied by manufacturer's quality test certificate conforming to relevant IS codes.

Materials at the shops shall be kept clean and protected from weather.

All members likely to collect rain water shall have drain holes.

Not more than one shop shall be provided to make the full length of a member.

All bolts, nuts, washers, rivets, electrodes, screws, etc. shall be supplied 10% in excess of the requirement in each category and size.

Materials -

Unless specified other wise various materials shall conform to the following IS Codes and Standards –

- | | | |
|----|---|------------|
| a) | Structural steel (Standard quality) | : IS:226 |
| b) | Rolled steel sections | : IS: 808 |
| c) | Steel tubes for structural purpose | : IS: 1161 |
| d) | Structural steel (for walkways, ladder, hand rails) | : IS: 1977 |
| e) | Welded Electrodes | : IS: 811 |
| f) | Threaded fasteners | : IS 1367 |

Supply

Supply of structural steel and all required material for the works shall be arranged by the Contractor.

Receipts and storing of materials

All steel shall be carefully off-loaded and stacked on timber or concrete supports suitably spaced on a firm level surface, and of sufficient height to keep steel clear of the ground and water. The steel shall be stored separately, by section size or thickness.

All sections shall be checked, sorted out and arranged by grade and quality in the store as per instructions of the Engineer-In-Charge.

All bolts including nuts and washers shall be thoroughly checked, sorted out and arranged diameter wise by grade and quality in the store.

All materials shall be kept protected from corrosion. Storing shall be generally in accordance with IS: 4082.

Welding electrodes and welding wires if used shall be stored separately in their original bundles or cartons, in a dry place adequately protected from weather and other effects as per IS :9595 and as per instructions given by Engineer-In-Charge. Electrodes shall be kept dry.

9.2 Welding

Welding shall generally be done by electric arc process and shall conform to the respective IS Codes and Standards as listed above.

Sequencing of welding

- a) The contractor shall choose the welding sequence after carefully studying each case such as to minimize distortion and shrinkage and submit the same to the Engineer-In-Charge for comments and approval.
- b) As far as practicable, all welds shall be made in sequence that will balance the applied heat of welding while the welding progresses.
- c) The direction of the general progression in welding on a member shall be from points where the parts relatively fixed in position with respect to each other towards points where they have a greater relative freedom of movement.
- d) All splices in each component part of a cover-plated beam or built up member shall be made before the component part is welded to other component parts of the member.
- e) Joints expected to have significant shrinkage shall be welded before joints expected to have lesser shrinkage.
- f) Welding shall be carried continuously to completion with correct number of runs.

Quality of Weld

The weld metal as deposited shall be free from blow holes, cracks, slag inclusions, excessive porosity, cavities and other faults. It shall be properly fused with the parent material without overlapping or serious under-cutting at the toes of the weld. The weld surfaces shall be cleaned of slag or flux and show a uniform and consistent contour and regular appearance.

Faulty Works

In the event of excessive convexity, weld size is to be reduced by removing the excess weld metal. In the event of faulty work the defective portions shall be cut out and re-welded. Where serious under-cutting occurs, additional weld metal shall be deposited to make good the reduction. In case of members getting distorted due to heat of welding, the members are to be straightened out by mechanical means or by careful applications of limited amount of heat when temperature of the areas affected more than 650 C.

Protection

Immediately after dislodging, inspection and approval, all site welds and the surrounding surfaces shall be painted to protect the metal.

Tolerances

The dimensional and weight tolerances for rolled shapes shall be in accordance with IS: 1852 and/or ASTM A6.

No rolled or fabricated member shall deviate from straightness by more than 1/1000 of the axial length or 100 mm whichever is smaller.

The length of members with both ends finished for contact shall have a tolerance of ± 1 mm.

Members without ends finished for contact bearing shall have a tolerance of ± 1.5 mm for members upto 10 meters long and a tolerance of ± 3 mm for members over 10 meters in length.

Lateral deviation between centre line of web plate and centre line of flange plate at contact surface in the case of built up sections shall not exceed 3mm.

The combined warp age and tilt of flanges in welded built up sections shall not exceed 1/200th of the flange width or 3 mm whichever is smaller.

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 1/150th of such length.

Deviations from the specified depth of welded girders measured at the centre line of the web shall not exceed ± 3 mm upto a depth of 1000 mm, ± 5 mm for depths above 1000mm, upto 2000mm and + 8mm and - 5mm for depths over 2000mm.

9.3 Painting

The whole of the steel work shall be thoroughly cleaned and all dirt, marks, grease overflows of primer paint and other foreign matter shall be removed by hand, cleaning tool (power tool cleaning) using compressed water jet etc. After this preliminary work of making good has been approved by the Engineer-In-Charge, all surfaces shall be thoroughly cleaned and when dry two finishing coats of approved paint shall be applied. Each coat shall be allowed to dry and harden thoroughly before the next coat is applied. The paint manufacturer's instructions shall be followed strictly. Also proper attention shall be paid to the following:

- i) Proper storage to avoid exposure and extremes of temperature
- ii) Surface preparation prior to painting.
- iii) Mixing and thinning.
- iv) Application of paint and the recommended limit on time intervals between consecutive coats.
- v) Primers and finish coat paints shall be from the same manufacture in order to ensure compatibility. Unless specified and approved, painting colour code shall be as directed by Engineer-In-Charge.

Painting work shall be carried out in accordance with IS: 8629 (Parts I to III)

All preparation, priming and painting, in colours selected by the Employer, shall be deemed to be included in the Contract price.

Painting shall generally be in accordance with IS : 1477

All items of equipment shall be suitably protected and packed to resist corrosion and impact damage. Machined surfaces are to be treated with a proprietary sealing agent for transportation and storage.

Paint materials shall be in accordance with the appropriate Indian Standard and shall be obtained from approved manufacturers and applied in accordance with the manufacturers' instructions or as ordered by the Engineer-In-Charge. All materials shall be delivered to the Site in sealed and labelled containers.

The paint for each coat shall be from the same manufacturer, compatible with the underlying coat and shall be a different colour for ease of identification.

Particular regard shall be paid to the maintenance of the recommended temperature and humidity during application and curing. Painted steelwork shall not be over coated or handled until the recommended curing period has elapsed. No finished paint coating will be accepted until the specified dry film thickness has been achieved to the entire surface including edges.

All steel surfaces shall be completely dry and free from oil and grease and all welds ground smooth and weld spatter removed. All fins at saw cuts, burrs and sharp edges shall be removed, and the edges shall be rounded off.

For all painted items, the Contractor shall submit for approval a 'Paint System Sheet' stating full details of each paint system proposed indicating the following information, with reference to IS : 1477. Surface preparation system reference together with manufacturer's brand name and product reference dry film thickness colour time to repaint

Items to be painted

All existing & new structural steel member including columns, trusses, purlins, floor plates, floor gratings, stair treads, hand rails, brackets, steel inserts etc. but not limited to it shall be painted except if otherwise specified.

No black bolts, nuts, washers and welds shall be painted before assembly or erection and approved by Engineer-In-Charge. They shall be thoroughly cleaned and dipped into boiling linseed oil and after erection, painted as specified herein.

Standard

The operations, workmanship, schedules and equipment for painting shall be generally comply with the requirement to IS: 1477 (Parts I & II) "Code of Practice for Finishing of Iron and Steel in Building – Painting and Allied Finishes".

All painting shall be carried out by brushing, spraying and roller application of paint shall not be allowed without the written permission of the Engineer-In-Charge.

No painting shall commence until the cleaned surfaces are approved by the Engineer-In-Charge.

No exterior or exposed painting shall be carried out under adverse weather conditions such as rain, extreme humidity, dust storms etc.

Rub down and primer application

The existing steel surfaces shall be rubbed down thoroughly with emery/abrasive paper to remove dust, rust, other foreign matters and degreased, if required, in accordance with IS: 1477, cleaned with warm fresh water and air dried. The portions, from where the shop coat has peeled off, shall be touched up and allowed to dry. Primer coat of zinc chromate primer (conforming to IS: 2074) shall be applied by brushing/spraying in a manner so as to ensure a continuous and uniform film throughout. Special care shall be taken to cover all the crevices, corners, edges etc. The each primer coat shall be air dried and shall have a minimum film thickness of 25 microns (tolerance $\pm 10\%$) after drying, unless specified.

Final paint application

After the primer is dry, the surfaces shall be dusted off and one coat of paint shall be applied by brushing/spraying so that a film free from "holidaying" is obtained. The second coat of paint shall be applied after the first coat is hard dry. The minimum thickness of each film shall be 20 microns ($\pm 10\%$ tolerance) after drying, unless specified.

Mode of Measurement

The Paint item shall be measured as per plan area indicated in the tender drawing for the structure viz. PPT Plant, Cable store A, Cable Store B and shed 7C.

Rate

As specified in BOQ item for structural steel work.

9.4 M.S. Chequered Plate

Materials

Chequered plates shall be of mild steel (Grade I unless otherwise specified) and conforming to IS: 3502.

Shop Drawings

Shop drawings shall be prepared by the Contractor on the basis of “Approved for Construction” (AFC) design / drawing issued to the Contractor.

Fabrication

Chequered plates shall be fabricated as per the “Approved for Construction” Shop drawings (prepared by the Contractor based on design drawings and duly approved by Engineer-In-Charge). These shall be perfectly flat and without any dents / deformations and shall be cut to the required size and shape. Holes / notches / openings of the required size, if any shown in the drawings shall be made. If used for staircase treads, nosing shall be made by cold bending of chequered plates. All edges shall be made smooth and even. All chequered plate units shall be given distinct erection marks in accordance with the marking drawings.

Erection / Fixing

Chequered plates shall be fixed to the bearing members by welding / bolting / screwing as shown in the drawings.

Painting

Chequered plates shall be cleaned (both side) with wire brush and shall be given unless otherwise specified in the item description two coats of yellow zinc chromate primer on the plain surface after fabrication conforming to IS:2074 and specifications as described under –Steel work specifications.

Measurement

Measurement shall be made on the basis of admissible weight in metric tons of the chequered plates accepted by the Engineer-In-Charge. The weight shall be calculated on the basis of IS Hand Book. No allowance in weight shall be made for rolling tolerances.

Rate

The rate shall include supplying, fabricating, erecting M.S. chequered plate including transporting, handling, straightening, if required, cutting to required size and shape, making holes / notches / opening of required size and nosing, smoothening the edges, fixing by welding / bolting / screwing, preparing detailed fabrication drawings, surface cleaning, removal of rust, scale, grease and applying two coat of yellow zinc chromate primer etc. all complete as specified.

M.S. Tubular Hand Railing

Material

M.S. tubes for hand railing shall be 25mm and 32 mm nominal diameter, unless specified of mild steel medium grade conforming to IS : 1239, vertical rolled steel angles etc. conforming to IS-808 .

Toe/Base plates shall be of mild steel conforming to IS: 226

Fabrication

Hand railing shall be fabricated strictly as per the “Approved for Construction” fabrication drawings prepared by the Contractor based on design drawings and standards. All tubes shall be straight and without any dents / deformations. Tubes shall be cut and ends shall be prepared to a neat and workman like finish. All elements shall be directly welded. Tubes shall be cold bent to shape and curvature in case of discontinuous ends of handrails. Lower ends of vertical posts shall be cut and splayed (for grouting in pockets provided in the concrete members). For removable type of hand railing, suitable base plates (with provision for bolting) shall be welded to the lower end of vertical posts.

Erection / Fixing

Hand railing shall be fixed to the bearing members by welding / bolting / grouting as indicated in the drawings or as directed by the Engineer-In-Charge.

Painting

MS tubes shall be cleaned (both the surfaces) with wire brush and given two coats of yellow zinc chromate primer on the plain surface after fabrication conforming to IS:2074 and 2 coats of approved synthetic enamel paint as per specifications described under-Steel work specifications.

Measurement

Actual length of structural steel tubes/ angles etc. fixed in place for railing as per design shall be measured in running metres correct to a millimetre ,while M.S. Plates shall be measured in square meter nearest to two decimals and weights shall be calculated on the basis of Bureau of Indian Standard’s Structural Engineer’s Handbook No. 1 latest issue correct to the nearest kilogram.

Rate

The rate shall include preparation of fabrication drawings, supply of all materials handling, transporting, straightening if required, cutting to required size, bending, welding, bolting, grouting, surface cleaning, removal of rust, scale, grease and applying two coat of yellow zinc chromate primer after fabrication etc. all complete as specified.

10. DISMANTLING & DEMOLISHING

10.1 GENERAL:

The item wise detailed specifications are intended for the general description of quality, workmanship, etc. desired for the items covered in the Schedule of Items. The Specifications are not, however, intended to cover the minute details and the work shall be executed according to the relevant latest Indian Standard Codes. In absence of the later, the work shall be executed according to the prevailing local Public Works Department Practice or to the recommendations of American and British Standard Institution at the discretion of the Engineer-In-Charge.

10.2 Scaffolding

Single or double scaffolding shall be provided by the Contractor as and when required.

10.3 Objective

The desired technique to be adopted in carrying out the demolition and dismantling work of existing structure shall be such that the fragments falling out of such operation can be contained within the work area or taking suitable protection so as to prevent materials from going out. This would relieve the surrounding area from any uncertain or uncontrolled behaviour of dismantled materials.

The rubbish / materials after dismantling shall also be stored systematically and disposed off immediately outside the plant boundary in order to ensure no major formation of heaps inside / adjacent to the work site and not hamper in any way the normal business operation of the Employer.

The term demolition implies breaking up. This shall consist of demolishing whole or part of work including all relevant items as specified or shown on the drawings.

The term 'Dismantling' implies carefully removing without damage (up or down). This shall consist of dismantling one or more part of the structures / facilities as specified or shown on the drawings.

10.4 Precautions

All materials obtained from dismantling or demolition shall be the property of the Contractor once the materials are taken out of the boundary of MDL after completion of the necessary gate pass and other formalities. But till such time the materials shall be kept in safe custody as per the directives of the Engineer-In-Charge.

The demolition shall always be planned beforehand and shall be done in reverse order of the one in which the structure was constructed. The scheme shall be got approved from the Engineer-In-Charge before starting the work.

Necessary propping, shoring and / or underpinning shall be provided for the safety of the adjoining work or property 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, as per the opinion of the Engineer-In-Charge, temporary enclosures or partitions shall be provided at the Contractor's cost.

Necessary precautions shall be taken to keep down the dust nuisance.

Dismantling shall be done 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 removed first. The dismantled articles shall be passed by hand, where necessary, lowered to the ground (and not thrown) and then properly stacked as directed by the Engineer-In-Charge.

Where fixing is done by nails, screws, bolts, rivets, etc. dismantling shall be done by taking out the fixed items with proper tools and not by tearing or ripping of.

Any serviceable material, obtained during dismantling or demolition, shall be separated out and stacked properly as directed by the Engineer-In-Charge within

work site for verification required for gate pass and other formalities for taking outside the boundary. All unserviceable materials, rubbish, etc. shall be disposed off immediately outside the Owner's premises as directed by the Engineer-In-Charge.

10.5 General

Necessary data such as building size, wall thickness, construction materials, etc. that may be required shall have to be collected by the Tenderer from MDL site at his own expenses.

Information to be supplied by the Tenderer along with Tender

The information to be provided for by the Tenderer, unless otherwise specified, shall include the following :

To submit his method of demolition duly supported by specifications and drawings and sequence of operation along with a list of equipment, plants and machineries to be employed during such operation, to meet the above mentioned objective.

10.6 Work to be provided by the Contractor

To arrange all the formalities as per requirement of statutory rules, if his method involves use of explosives. He has to obtain permission from appropriate authority of buying, storing, handling & making use of explosives.

To notify, the Employer for arranging to shut off all gas, water, electricity, steam and other service lines running over ground or underground. Any temporary service connections required for the demolition work shall be separately taken and arranged by the Contractor.

Any preliminary work, necessary for Contractor's method of demolition.

To furnish all materials, labour, tools and plant and all consumables required for this work and its related temporary work such as cordoning the area, staging etc.

To furnish the details of safety measures for human life / property / structures, the Contractor proposes to take during the blasting operation of explosives, if he proposes to use on this demolition work. This should be strictly as per rules and regulations laid down by the concerned authority for explosives to be used in this work.

10.7 Work by Others

No work under this specification will be provided for by any agency other than the Contractor, unless specifically mentioned otherwise elsewhere in the Contract or approved by the Engineer-In-Charge / Employer.

10.8 Codes & Standards

The demolition work shall be carried out as per Indian Standard Code of Practice No. IS 4130 - 1970 (Safety Code for demolition of buildings) or any other relevant Indian Standard Specifications and Codes of Practice. If demolition by blasting is adopted IS 4081 (Safety Code for blasting and related drilling operations) shall be followed. However, if any, particular aspect of the work is not specifically covered by any Indian Standard Specifications or any other standard practices, Engineer-In-Charge's instruction shall be followed.

10.9 Execution

The materials available after dismantling and demolition will be deemed to be the property of the Contractor once the material are disposed off from the plant boundary and the amount offered by the Contractor against each of the facilities / buildings / structures are received by the Employer.

It is presumed that the Contractor will adopt the most suitable method of demolition and dismantling to protect the materials and its surroundings. While doing so the Contractor shall ensure the following, which should be considered as binding towards the method and specification adopted by the Contractor:

Total safety of the people working in the area of the Employer, other agencies employed by the Employer as well as those employed by the Contractor.

Safety and no damage to the adjoining properties, facilities or services.

Disposal immediately after dismantling to keep the area clean after the days work and not more than one truckload being accumulated.

No noise or dust nuisance around the area of working.

No obstruction to vehicular / pedestrian traffic during dismantling and disposal inside the plant boundary as well as outside municipal areas.

No hindrance in the Employer's day to day production work or other operation.

No accidents or other hazards.

10.10 Rates

The rate shall include the cost of all labour involved and tools used in demolishing and dismantling including scaffolding. The rate shall also include the charges for separating out and stacking the serviceable material properly and disposing off unserviceable material out side the premises into approved dumping grounds.

11. LIST OF PREFERRED MAKE- CIVIL WORK

Sr. No.	DESCRIPTION	APPROVED MAKES
1	Cement	ULTRATECH/ AMBUJA/ BIRLA/L& T /ACC
2	White Cement/ POP	'A. C. C.', JK White, Birla.
3	Reinforcement Steel – Corrosion Resistance Steel (Fe 500 grade)	TISCON / JINDAL / TATA / SAIL / RINL VIZAG
4	Structural Steel	TATA / SAIL / JINDAL/ VIZAG
5	Bricks	Ordinary clay bricks of any brand conforming to I.S. 1077 minimum crushing strength 35 kg / sq. cm. water absorption allowed 25% for bricks used in panel walls. 20% for bricks used in load bearing walls.
6	Ready Mix Concrete Suppliers	ULTRATECH / ACC / GODREJ

7	Vitrified Tiles	EURO / KAJARIA / NITCO / RAK
8	Ceramic tiles	EURO / KAJARIA / NITCO/RAK
9	Glazed wall mounted & floor mounted European / Indian water closet / Urinal	HINDWARE / PARRYWARE / RAK / AMERICAN STANDARD
10	Flush valve	PLUMBER / AQUAL
11	Counter sunk wash basin	EURO / HINDWARE / PARRYWARE / RAK
12	Waste coupling	PLUMBER / AQUAL
13	Bottle trap	PLUMBER / AQUAL
14	Angle cock	PLUMBER/AQUAL
15	CP brass fittings (Bibcock, Stopcock, Shower rose)	Parryware/ Jaguar/ Plumber/ Crabtree
16	Telephone shower/ hand spray	PLUMBER/ JAQUAR
17	Stainless Steel Sink	Nirali/ Franke/ Kingston/ Neelkanth
18	Aluminium sections	JINDAL/ HINDALCO/ BHORUKA & GLASS WITH
19	Glass	SAINTGOBAIN/ MODI FLOAT
20	Oil bound Distemper	ASIAN / NEROLAC / BERGER
21	External Premium Acrylic Paint	Ultima of ASIAN / NEROLAC / BERGER / Snowcryl XT of SNOWCEM India Ltd.
22	Premium Plastic Emulsion Paint	Asian/ Nerolac/ Berger
23	Synthetic Enamel Paint	Asian/ Nerolac/ Berger
24	Polymers Modified mortar	Sunanda/ BASF/ Chemistic/ Krishna Conchem/ MC Bauchemie
25	Water Proofing compound	Structural Water Proofing Company/ Fosroc/ Sika/ Dichtament DM The water proofing shall be done after prior approval of the procedure and the same shall be followed at site. The sign and stamp of the agency will be required on the Waterproofing Bank Guarantee Bond (as per Annexure 'J')
27	Grouting Material, epoxy putty	Sunanda / BASF/Dr. Fixit / Fosrok

	Micro concrete	Sunanda/ BASF/Krishna Conchem/ Dr. Fixit
	Rust remeover, passivator	Sunanda/ BASF/Krishna Conchem/ Dr. Fixit
	Corrosion inhibitor	Sunanda/ BASF/Krishna Conchem/ Dr. Fixit
	Sacrificial Anode	Sunanda or equivalent
	Spray Mortar	BASF/ Dr. Fixit / MC Bauchemie
	Fibre wrapping material	BASF/ Dr. Fixit / MC Bauchemie
	Carbon laminate	BASF/ Dr. Fixit / MC Bauchemie
28	Door Closer/ Floor Spring	Dorma, Hettich, Hafele, Ingersol, Geze
29	G.I. 'C' class pipes	TATA/ JINDAL/ ZENITH / PREMIUM
30	CI Pipes	ALC/ NECO Conforming to I.S.1230 for rain water pipes & Fittings I.S.1729 & ISP 3889 for soil & wastewater pipes
31	PVC pipes	Prince / Supreme/ Finolex
32	CPVC pipes	Astral / Crilce / Supreme
33	UPVC pipes	Prince / Supreme /Finolex
34	PVC Water Stops	Deep-Jyoti/ Kanta Rubber Pvt. Ltd./ Santosh Rubber Pvt. Ltd./ Fixo-seal stoppers & profiles/ Maruti Techno rubber pvt. Ltd.
35	PVC Nahni Trap	Prince / Supreme
	PVC Door Shutter	Sintex/ Rajashree/ Radhika/ Wintech
36	PVC Curtain	JMT Plasp Pvt. Ltd./ Kallerians/ Ganik Plastics
37	Plywood/ Particle board	Kit-ply/ Greenply/ Century/Novapan/ECO Board
38	RCC NP2 Hume pipes	Locally available (Vishwa/ Bharat/ India pipes, Arihant)
39	Rust remover	Sunanda/ BASF/ Chemistic/ Krishna Conchem/ Dr. fixit
40	Anti corrosive coating	Sunanda/ BASF/ Chemistic/ Krishna Conchem/ Dr. fixit

Note : Brand deviation if any, needs to be tested for cement, reinforcement steel and structural steel prior to using it for construction only if above app makes are not available and after Prior confirmation/approval from Engineer in charge.

Brand deviation if any, for other finishing items can be changed only if above approved makes are not available and after Prior confirmation/approval from Engineer In-charge.