



# TENUGHAT VIDYUT NIGAM LIMITED

2x210 MW Tenughat Thermal Power Station  
Jharkhand  
Dry Fly Ash Collection & Disposal System



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## PART – I (MATERIALS)

### 1.0 GENERAL

#### 1.1 Scope

This part deals with the requirements of materials for use in construction work with regard to quality, testing, approval and storage, before they are used on work. This part is supplementary to Part-II: Workmanship and Other requirements of the Technical Specifications for civil works.

#### 1.2 Standard

A high standard of quality is required for all materials used in construction work. They shall be the best of the kind obtainable indigenously in each case and shall be procured from manufacturers of repute in order to ensure uniformity of quality and assurance of timely supply.

#### 1.3 Approval and Tests

1.3.1 All materials to be used in construction shall be subject to approval of the Engineer. The Bidder shall supply sufficiently in advance with samples of the materials including the supporting test results from the approved laboratory and other documentary evidence from the manufacturer wherever applicable and indicating the types of materials and their respective sources. The delivery of materials at site shall commence only after the approval of the quality, grading and sources of the materials by the Engineer.

1.3.2 The quality of all materials once approved shall be maintained throughout the period of construction and periodical tests shall be carried out to ensure that it is maintained. Such routine tests shall be listed under the different materials and/or as may be ordered by the Engineer from time to time.

1.3.3 Where a particular "Brand" or "Make" of material is specified in the Schedule of Items or Technical Specifications, such "Brand" or "Make" of material alone shall be used on the work. Should it become necessary for any reason (such as non-availability/ceased to be produced), to use any material other than the specified "Brand" or "Make", the Bidder shall submit sample of the same to the Engineer for approval together with test certificates and other documents necessary for examining and giving approval thereof.



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## 1.4 Codes

- 1.4.1 The years of publication against various standards, referred in this specification, correspond to the latest standards as on date of preparation of this specification. During use of this specification in future, the latest publication as on date shall be referred to. Where standards are not yet published by the BIS or IRC, adoptable British Standards or other International Standards shall apply.
- 1.4.2 In case of any conflict in meaning between these specifications and those of BIS or IRC, or British /International Standard; the provisions of these specifications shall prevail.

## 1.5 Rejection of Materials

- 1.5.1 Any material brought to site which, in the opinion of the Engineer is damaged, contaminated, deteriorated or does not comply with the requirement of this specification shall be rejected.
- 1.5.2 If the routine tests or random site tests show that any of the materials, brought to site, do not comply in any way with the requirements of this specification or of I.S. Codes as applicable, then that material shall be rejected.
- 1.5.3 The Bidder at his own cost shall remove from site any and all such rejected material within the time specified by the Engineer.

## 2.0 MATERIALS FOR CONCRETE

### 2.1 Aggregates

- 2.1.1 Aggregates shall comply with the requirements of IS: 383 "Coarse and Fine Aggregates for Concrete". They shall be hard, strong, dense, durable, clean and free from veins and adherent coating, vegetable matter and other deleterious substances; and shall be obtained from approved sources. Aggregates shall not contain any harmful material such as pyrites, coal, shale or similar laminated material, clay, alkali, soft fragments, sea shells and organic impurities in such quantity as to affect the strength or durability of concrete. Aggregates which are chemically reactive with alkalies of cement shall not be used. Aggregates which are not sufficiently clean shall be washed in clean fresh water to the satisfaction of the Engineer.



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## 2.1.2 Testing

All aggregates shall be subject to inspection and testing. The Bidder shall submit samples for testing as may be required by the Engineer. Sampling and testing shall be carried out in accordance with IS: 2386 "Methods of Test for Aggregates for concrete".

## 2.1.3 Grading

The Bidder shall ensure that the full range of aggregate used for making concrete is graded in such a way as to ensure a dense workable mix. The delivery of aggregates will commence only when the Engineer has approved the samples and the quality and grade shall be maintained consistent and equal to the approved sample. Before construction commences, the Bidder shall carry out a series of tests on the aggregates and on the concrete made therefrom to determine the most suitable grading of the available aggregates. Once the most suitable grading has been found, the grading shall be adopted for the construction of the works and periodic tests shall be carried out to ensure that it is maintained.

### 2.1.3.1 Size and grading of fine aggregates

The grading shall conform to IS: 383 and shall be within the limits of Grading Zone-III. The maximum size of particle shall be 4.75mm and shall be graded down. Sand containing more than 10% of fine grains passing through 150 micron sieve or having the fineness modulus less than 2 shall not be used for concrete work.

### 2.1.3.2 Size and grading of coarse aggregates

The nominal maximum size of the aggregates for each mark of concrete or for each type of work shall depend upon the description of the particular item in the Specified Items and/or according to relevant clauses of IS: 456 . The aggregates shall be well graded and the grading shall conform to relevant requirements of IS: 383 depending upon the maximum nominal size as specified or as required.

### 2.1.3.3 Fine aggregate for mortar and grout

The grading of fine aggregate for mortar and grout shall be within the limits of grading zone III and IV as defined in IS: 383.



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## 2.1.4 Storage & stacking

Care shall be taken in the storage to avoid intrusion of any foreign materials into the aggregates and where two types of aggregates are stored close to each other, they shall be separated by a wall or plate. In case of stockpiling, care shall be taken to avoid forming pyramids resulting in segregation of different sized materials. The height of the stacks shall be generally limited to 150 cm.

## 2.2 Coarse Aggregates

### 2.2.1 Types

The type of coarse aggregate viz., stone chips, gravel or broken brick shall be as described in the Technical Specification. Unless otherwise specified stone chips shall be used as coarse aggregate.

### 2.2.2 Stone chips

It shall be crushed or broken from hard stone obtained from approved quarries of igneous or metamorphic origin. The stone chips shall be hard, strong, dense, durable and angular in shape. It shall be free from soft, friable, thin, flat, elongated or laminated and flaky pieces and free from dirt, clay lumps, and other deleterious materials like coal, silt, soft fragments, and other foreign materials which may affect adversely the strength & durability of concrete. The total amount of deleterious /foreign materials shall not exceed 5% by weight according to relevant clause of IS: 383. If found necessary the stone chips shall be screened and washed before use.

### 2.2.3 Gravel

It can be either river bed shingle or pit gravel. It shall be sound, hard, clean, irregular in shape and suitably graded in size with or without some broken fragments. It shall be free from flat particles, powdered clay, silt, loam and other impurities. Before using, the gravel shall be screened and washed to the satisfaction of the Engineer. However, the foreign/deleterious materials shall not exceed 5% by weight.

### 2.2.4 Broken bricks / Brick aggregates

These shall be obtained by breaking well burnt or over burnt dense brick bats. They shall be homogeneous in texture, well graded in size, roughly cubical in shape, clean and free from dirt, clay, silt or any other deleterious matter. Before use, these shall be screened.



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## 2.3 Fine Aggregates

2.3.1 Unless specified otherwise it shall either be natural river sand or pit sand.

2.3.2 Sand shall be clean, sharp, strong, angular and composed of hard siliceous material. It shall not contain harmful organic impurities in such form or quantities as to affect adversely the strength and durability of concrete. Sand for reinforced concrete shall not contain any acidic or other impurities which is likely to attack steel reinforcement. The percentage of all deleterious materials including silt, clay etc., shall not exceed 5% by weight. If directed, sand shall be screened or washed before use to the satisfaction of Engineer.

### 2.3.3 Crusher dust

Crusher stone dust ( that is retained on 300 micron sieve ) may be used as replacement for certain quantum of sand aiming to improve the fineness modulus of fine aggregate. The quantum of replacement for sand shall be arrived at by suitable trial mixes. The Engineer will decide the final usage of crusher dust depending on the circumstances.

## 2.4 Lime

Lime for mortars and concrete shall conform to IS: 712 The total of CaO and MgO content in quick lime shall not be less than 85% (MgO shall not exceed 5%). Quicklime, after slaking, shall leave a residue of not more than 5% by weight on IS sieve 85.

## 2.5 Surkhi

Surkhi used in lime concrete for flooring, terracing etc., shall conform to IS: 3182 Surkhi shall be made from well burnt bricks or brickbats. Surkhi shall pass through I.S. sieve 3.35mm with at least 50 % of it passing through I.S. sieve 1.70mm and be perfectly clean and free from foreign matter. Surkhi shall not be made from bricks which have come in contact with any mortar.

## 2.6 Cement

Portland cement -43 grade / Portland slag cement /Portland Pozzolana cement complying with the requirements of IS:8112 I.S. 455 and IS: 1489 respectively shall be used for making plain and reinforced concrete, cement grout and mortar.



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Other types of cement may be used depending upon the requirements of certain jobs with the approval of the Engineer. These shall conform to the following standards :

Rapid Hardening Portland Cement	IS: 8041
53 Grade Ordinary Portland Cement	IS: 12269
Hydrophobic Portland Cement ..	IS: 8043
High alumina cement for structural work	IS: 6452
White portland cement	IS: 8043
Sulphate Resisting Portland Cement	IS: 12330

## 2.6.1 Testing of samples

The Bidder shall supply a copy of the manufacturer's test certificate for each consignment of cement supplied by him and consignments shall be used on work in the order of delivery. The Bidder shall supply samples of cement to the Engineer as frequently as he may require for testing. The sampling of cement for testing shall be according to IS: 3535. All tests shall be in accordance with the relevant clauses of IS: 4031 (Part-I to Part-15) & IS: 4032.

## 2.6.2 Bidder's responsibility

From the time a consignment of cement is delivered at site and tested and approved by the Engineer until such time as the cement is used on the works, the Bidder shall be responsible for keeping the same in sound and acceptable condition and at his expense and risk. Any cement which deteriorates while in the Bidder's charge and is rejected as unsuitable by the Engineer, shall be removed from the site to outside the limits of work at the cost of bidder within two days of ordering such removal by the Engineer.

## 2.6.3 Stock of cement

In order to ensure due progress, the Bidder shall at all times maintain on the site at least such stock of cement as the Engineer may from time to time consider necessary. No cement shall be used upon the works until it has been accepted as satisfactory by the Engineer.



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## 2.6.4 Storage of cement

The cement shall be stored in such manner as to permit easy access for proper inspection and in a suitable weather-tight, well ventilated building to protect it from dampness caused by ingress of moisture from any source. Different types of cement shall be stored separately. Cement bags shall be stacked at least 15 to 20 cm clear of the floor leaving a space of 60 cm around the exterior walls. The cement shall not be stacked more than 10 bags high. Each consignment of cement shall be stacked separately to permit easy access for inspection. Cement shall not be stored for more than 90 days.

## 2.7 Water

River water shall be supplied by M/S NTPL for construction purpose. Water for construction purpose shall be stored in proper storage tanks to prevent any organic impurities getting mixed up with it.

## 2.8 Admixture for Concrete

### 2.8.1 Approval

Admixtures to concrete shall not be used without the written consent of the Engineer. When permitted, the Bidder shall furnish full details from the manufacturer and shall carry out such test as the Engineer may require before any admixture is used in the work.

### 2.8.2 Types

#### 2.8.2.1 Integral water proofer

Admixtures used as integral water proofer shall be free of chlorides and sulphates and shall conform to IS: 2645. The application and doses shall be as per manufacturer's specification.

## 2.9 Interval of Routine Test

2.9.1 The routine tests of materials, delivered at site, shall be at the following intervals :

Aggregates - Fortnightly or for every 200 m<sup>3</sup> for each aggregate whichever is earlier and in other respects generally as per IS : 2386 (Part 1 to 8).





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- Cement - Fortnightly or for each consignment, within 4 days of delivery and in other respects generally as per IS : 4031.
- Water - Once in two months for each source of supply and in other respects generally as per IS : 456.
- Reinforcement - For each consignment within 4 days of delivery in accordance with I.S. 1786, I.S. 1599 and I.S. 1608.

## 3.0 STEEL

### 3.1 For Reinforcement

Reinforcing bars for concrete shall be Corrosion Resistant bars ( manufactured by reputed companies of the following types as may be shown on the drawing :

- i) Plain mild steel bars conforming to Grade-I of IS : 432 "Mild Steel & Medium Tensile Steel for Concrete Reinforcement".
- ii) "Corrosion resistant steel with properties conforming to IS : 1786 for Concrete Reinforcement".
- iii) Reinforcement fabrics conforming to IS:1566 "Hard Drawn Steel Wire Fabric for Concrete Reinforcement"

All reinforcement bars shall be of uniform cross sectional area and be free from loose mill scales, dust, loose rust, coats of paint, oil or other coatings which may destroy or reduce bond. Unit weight of reinforcement bars conforming to I.S. 1786 is as given below.

Nominal Size (Dia) (mm)	Mass Per Metre Run (Kg)
6	0.222
8	0.395
10	0.617
12	0.888
16	1.580
18	2.000



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20	2.470
22	2.980
25	3.850
28	4.830
32	6.310

### 3.2 Binding wire

Binding wire for reinforcement shall be annealed steel wire 16/18/20 BWG conforming to IS : 280 "Specification for Mild Steel Wire". The number of strands shall be as per IS Specification.

### 3.3 Light structural work and inserts

Steel for light structural work and for preparation of inserts and embedments shall conform to IS: 2062 "Steel for general structural purposes - Specification."

### 3.4 Steel Tubes

Steel tubes for use in light structural work and inserts shall be of light or medium class (as may be specified in drawings or the schedule of items) and of grade YST 25 conforming to IS : 1161 "Specification for Steel Tubes for Structural Purposes".

### 3.5 Foundation Bolts

3.5.1 Bolts to be embedded in concrete shall, unless otherwise detailed in drawings, conform to IS : 5624 "Specification for Foundation Bolts". Material for bolts, shall, unless otherwise mentioned in drawings or the schedule of items, be of steel conforming to IS : 2062.

3.5.2 Nuts and locknuts shall conform to IS : 1363 (Part 1 to 3) "Specification for Black Hexagon Bolts, Nuts and Lock Nuts (Diameter 6-39 mm) and Black Hexagon Screws "Specification for Hexagon Bolts and Nuts (M-42 to M-150)".

3.5.3 Plain washers shall conform to IS : 2016 "Specification for Plain Washers and spring washers shall conform to IS : 3063 "Spring Washers for Bolts, Nuts & Screws".



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## 3.6 Steel Tubes for Non-structural use

3.6.1 Steel tubes for non-structural use shall conform to IS : 1239 (Part-I) "Specification for Mild Steel Tubes, Tubular and Other Wrought Steel fittings, Part-I : Mild Steel Tubes".

3.6.2 Fittings for steel tubes used for non-structural purposes shall conform to IS : 1239 (Part-II) "Specification for Mild Steel Tubular and Other Wrought Steel Pipe Fittings".

## 3.7 Threaded Fasteners

Bolts and nuts for fastening shall conform to IS:1367 (Part 1) "Technical Supply Conditions for Threaded Fasteners".

## 3.8 Testing

Test certificates from manufacturer shall be submitted for each consignment. Any additional test which the Engineer may require shall be done according to IS : 1786, 1566, 280, 2062, 1161, 2614, 3063, 1239 (Part 1 and 2) and 1367.

## 3.9 Cast Steel

### 3.9.1 Quality

Cast steel shall conform to IS : 1030 "Carbon Steel Casting for General Engineering Purpose". Unless otherwise specified, it shall conform to Grade2.

## 3.10 Conduits

### 3.10.1 Steel for electrical wiring

Rigid steel conduits for electrical use shall conform to IS : 9537 (Part 2) for rigid pipes and to IS : 3480 for flexible conduits. Fittings for conduits shall conform to IS : 2667.

All conduit pipes shall be finished with galvanised or stove-enamelled surface. All accessories shall be of threaded type and pipes shall be jointed by means of screwed couplers only. Bend in conduits shall be made to the dimension shown in drawing, but a minimum of 12 times the diameter. Where shown in drawing they shall be treated with anticorrosive preservative as specified.



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## 3.10.2 Non-metallic conduit for electrical wiring

Non-metallic conduits for electrical use shall conform to IS : 9537 (Part 3) for rigid pipes and to IS : 6946 for flexible pipes. Fittings shall conform to IS : 3419.

Bends shall be achieved by bending the pipes by inserting suitable solid or inspection type normal bends, elbows or similar fittings.

## 4.0 ASBESTOS CEMENT PRODUCTS

### 4.1 General

Asbestos cement products shall be free from visible defects, uniform in colour, of required density, length, thickness and diameter within the allowable tolerance. They shall be obtained from an approved source of manufacture and stored safely. Methods of test shall be according to IS:5913 "Method of Test for Asbestos Cement Products."

### 4.2 Building Boards

These shall be of Class A, B and C with board thickness being 6.5mm , 5mm and 4mm respectively. The length shall be 2400, 1800 and 1200mm and width in all cases 1200 mm. Building boards shall conform to IS : 2098 "Asbestos Cement Building Boards". They shall, when tested in two perpendicular directions, take a load of not less than 15 kgf for Class-A and 10 Kgf for Class-B and Class-C boards. The boards shall show water absorption of not more than 40% of their dry weight.

### 4.3 Flat Sheets

Flat sheets shall conform to IS : 2096 "Asbestos Cement Flat Sheets". They shall have a bending stress of not less than 225 kgf/cm<sup>2</sup> & a density of 1.6 kg/dm<sup>3</sup> for compressed sheets & a bending stress of not less than 160 kgf/cm<sup>2</sup> and a density of 1.2 Kg/ dm<sup>3</sup> for uncompressed sheets. Nominal thickness shall be 5,6,8,10 and 15 mm , length 2400, 1800 and 1200mm and width 1200mm. Water absorption shall not exceed 28% of dry wt.

### 4.4 Pipes and fittings



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Pressure pipes shall conform to IS : 1592 "Asbestos Cement Pressure Pipes" and to IS : 9627 "Asbestos Cement Pressure Pipes (Light Duty)". Pipes for sewerage and drainage shall conform to IS : 6908 "Asbestos Cement Pipes and Fittings for Sewerage and Drainage ". Building pipes gutters and fittings shall conform to IS : 1626 - (Part 1 to 3) "Asbestos Cement Building pipes and pipe fittings".

Pressure pipes shall satisfy Hydraulic test and transverse crushing test as per IS : 5913.

## 4.5 Corrugated and Semi-Corrugated Sheets

These shall conform to IS : 459 "Unreinforced Corrugated and Semi-Corrugated Asbestos Cement Sheets". Unless otherwise stated the sheets shall be corrugated and not less than 6mm thick. The sheets shall have a load bearing capacity of not less than 5 N/mm width of specimen and shall not absorb more water than 28% of its dry weight. Overall width of corrugated sheets is 1050mm and of semi-corrugated sheet is 1100mm.

## 4.6 Asbestos Cement Roof fittings

These shall conform to IS : 1626 (Part 3). Shapes and dimensions shall be as given in the above mentioned code. All finished products shall be free from visual defects that impair appearance or serviceability. Surface of fittings shall be of uniform texture and shall have neatly trimmed edges. Mean water absorption shall not be more than 28% of dry mass of the material.

## 5.0 BRICK AND STONES

### 5.1 Bricks

Bricks for masonry in foundations, walls and other locations shall be common burnt clay building bricks having minimum crushing strength of 5 N/sq.mm., or such other strength as may be described in the Schedule of Items, when tested in accordance with IS : 1077 "Common Burnt Clay Building Bricks". They shall be sound, hard and thoroughly well burnt, with uniform size having rectangular faces with parallel sides and sharp straight right angled edges and be of uniform colour with fine compact uniform texture. Bricks shall be of uniform deep red cherry or copper colour. They shall be free from flaws, cracks and nodules of free lime. Water absorption after 24 hours immersion in cold water shall be not more than 20% by weight. They shall not absorb more than 10% by weight of water after immersion for six hours. They shall emit a clear



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metallic ringing sound when struck by a mallet and shall not break when dropped on their face, from a height of 60 cm. Fractured surface shall show homogeneous, fine grained uniform texture, free from cracks, air holes, laminations, grits, lumps of lime, efflorescence or any other defect which may impair their strength, durability, appearance and usefulness for the purpose intended. Underburnt or vitrified bricks shall not be used. Samples of bricks brought to the site shall be tested periodically for compression and other tests according to IS : 3495 (Parts-1 to 4) "Method of Test for Burnt Clay Building Bricks". Where the size of bricks is not specifically mentioned, it shall be taken to mean conventional sizes as is commonly available in the area. In case modular bricks are to be used, it shall be accordingly specified in Schedule of Items. The bricks shall be classified on the basis of average compressive strength as given in table 1 of IS : 1077.

## 5.2 Handling

Bricks shall be unloaded by hand and carefully stacked and all broken bricks shall be removed from the site.

## 5.3 Samples and Inspection

Representative samples shall be submitted by the bidder and approved samples retained by the Engineer for comparison and future reference. Bricks shall be obtained from approved manufacturer. All bricks shall be subject to inspection on the site and shall be to the approval of the Engineer who may reject such consignment as are considered by him to be inferior to the quality specified. The Bidder shall provide all labour and plant required for the inspection and conduct such test as shall be required by the Engineer without additional charges.

## 5.4 Brick Bats

Brick bats shall be obtained from well burnt bricks of approved quality.

## 5.5 Laterite Stone Blocks

These shall conform to IS : 3620 "Laterite Stone Blocks for Masonry". The laterite stone blocks shall have a minimum compressive strength of 30 kg/cm<sup>2</sup> and to be tested as per IS : 1121. The blocks shall be minimum 15 cm thick but not exceeding 30 cm. They shall be dressed to the desired sizes and shapes with an axe. Laterite stones shall be well seasoned by exposure to air before dressing and using on work.



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## 5.6 Stone (granite, trap, sandstone, quartzite etc.)

5.6.1 Stone used shall be strong, durable, dense, compact, close grained, homogeneous, fire resistant and shall be obtained from sources approved by Engineer. Stones shall additionally be hard, sound, free from cracks, decay and other flaws or weathering and shall be easily workable. Stones with round surfaces shall not be made use of.

5.6.2 Stones shall have a crushing strength of not less than 200 kg/cm<sup>2</sup>. Stones with lesser crushing strength may be used in works with prior approval of the Engineer. Stones shall be non-porous and when tested in accordance with IS : 1124 "Method of Test for Determination of Water Absorption Etc.," shall show water absorption of less than 5% of its dry weight when soaked in water for 24 hours. Tests for durability and weathering shall be done in accordance with IS : 1126 and IS : 1125 respectively. The working of stones to required sizes and their dressing shall be as per IS : 1127 "Recommendations for dimensions and workmanship of natural building stones for masonry work" and IS : 1129 "Dressing of Natural Building Stones". Stones especially limestone and sand stones shall be well seasoned by exposure to air before use in construction works.

### 5.6.3 Size

Normally stones shall be of size that could be lifted and placed by hand, between 20 to 30 kg per piece. The length of stones shall not exceed 3 times the height and the breadth on base shall not be greater than 3/4 of the thickness of wall or less than 15cm. The height of stone may be upto 30cm.

### 5.6.4 Dressing

#### 5.6.4.1 Random rubble

Stones shall be hammer dressed on the face, the sides, and the beds to enable it to come into close proximity with the neighbouring stone. The bushings in the face shall not project more than 4cm on all exposed faces and 2cm on a face to be plastered, nor shall it have depressions more than 1cm from the average wall surface.

#### 5.6.4.2 Coursed rubble - First sort



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Face stones shall be hammer dressed on all beds, and joints, so as to give them approximately rectangular block shape. These shall be squared on all joints and beds. The bed joint shall be rough chisel dressed for atleast 5cm back from the face, and side joints for atleast 4cm such that no portion of the dressed surface is more than 6mm from a straight edge placed on it. The bushing on the face shall not project more than 4cm as an exposed face and one cm on a face to be plastered. The hammer dressed stone shall also have a rough tooling for a minimum width of 2.5cm along the four edges of the face of the stone, when stone work is exposed.

### 5.6.4.3 Coursed rubble - Second sort

Dressing shall be as specified in 5.6.4.2 except that no portion of dressed surface shall exceed 10mm from a straight edge placed on it as against 6mm for first sort.

### 5.6.4.4 Stone for veneering

Stone lining upto 8cm shall be treated as veneering work. The stone shall be cut into slabs or required thickness along the planes parallel to the natural bed. Every stone shall be cut to the required size and shape so as to be free from any waviness and to give truly vertical and horizontal joints. Adjoining faces shall be fine chisel dressed to a depth of a 6mm, so that when checked with a 60cm straight edge, no point varies from it by more than 1mm. All edges shall be chisel dressed to be true, square and free from chippings. Top and bottom faces shall be dressed to within 3mm tolerance and vertical faces to within 6mm tolerance, when checked with a 60mm straight edge. Dressing at the back shall not be done.

## 5.7 Hollow and Solid Concrete Blocks

5.7.1 Cement concrete blocks used in the construction of concrete masonry load bearing as well as non-load bearing walls shall conform to the requirements of IS : 2185 (Part 1). Physical properties such as density, compressive strength, water absorption etc., shall be determined in accordance with the procedure laid down in IS : 2185 (Part 1) and shall conform to the requirement laid therein. When inspected visually all blocks shall be sound, free from cracks, broken edges, honeycombing and other defects which would interfere with the proper placing of blocks or impair strength or permanence of construction.

### 5.7.2 Dimensions and tolerance





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The blocks shall be made in sizes and shapes to suit the particular job and shall include stretcher, corner, double corner or pier, jamb, header, bullnose and floor units.

5.7.2.1 The nominal dimensions of concrete block shall be as follows :

Length	:	400, 500 or 600mm
Height	:	200 or 100mm
Width	:	50, 75, 100, 150, 200, 250 or 300mm

In addition, blocks shall be manufactured in half and other suitable lengths and shapes to suit Architectural requirements.

5.7.2.2 The maximum dimensional tolerances shall be plus or minus 5mm in length and plus or minus 3mm in height and width.

## 5.7.3 Hollow blocks (open and closed cavity)

5.7.3.1 The blocks having solid material about 50% to 75% of total volume of the block calculated from the overall dimensions shall be termed as hollow blocks. Grade-A blocks used as load bearing units shall have a minimum block density of 1500 kg/m<sup>3</sup> and shall have minimum average compressive strength of 3.5, 4.5, 5.5 or 7.0 N/mm<sup>2</sup> at 28 days as specified.

5.7.3.2 Grade-B Blocks used as load bearing units shall have block density less than 1500 kg/m<sup>3</sup>, but not less than 1000 kg/m<sup>3</sup> and shall have compressive strength of 2.0, 3.0, or 5.0 N/mm<sup>2</sup> or as specified.

5.7.3.3 Grade-C blocks used as non load bearing units shall have block density less than 1500 kg/m<sup>3</sup>, but not less than 1000 kg/m<sup>3</sup> and compressive strength of 1.5 N/mm<sup>2</sup> at 28 days.

## 5.7.4 Solid blocks

The blocks having solid material more than 75% of the total volume of the block shall be termed as solid block. Solid blocks (Grade-D) used as load bearing units shall have a block density of not less than 1800 kg/m<sup>3</sup> and compressive strength of 4.0 or 5.0 N/mm<sup>2</sup> as specified.

## 5.7.5 Mix proportion

The concrete mix used for blocks shall not be richer than one part by volume of cement to six parts by volume of combined aggregates before mixing.



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## 5.7.6 Surface texture and finish

Surface texture, that is, very fine closed texture or coarse open texture and finish, whether coloured or not shall be according to the drawing, description in the Schedule of Items or instructions of the Engineer.

## 5.7.7 Marking and certificate

The blocks shall be marked permanently indicating the Grade of the unit, identification of the manufacturer and the year of manufacture. Manufacturers test certificate shall be supplied with the delivery of each lot.

## 5.8 Cement, Lime and Water

Cement, lime and water shall conform to the specification under the Section Concrete of this part.

## 5.9 Sand for Masonry Mortar

Sand for masonry mortars shall be natural sand, crushed stone sand or crushed gravel and shall comply with IS : 2116 "Sand for Masonry Mortars". The sand shall be hard, durable, clean and free from adherent coatings and shall not contain amount of clay, silt and fine dust more than 5% by wt. Sand shall not contain any harmful impurities such as iron pyrites, alkalies, salts, coal, mica and organic matters. The particle size grading of sand for use in mortars shall be within the limits as specified in Table I of above code.

## 6.0 SAND FOR PLASTERING

Sand for use in mortars for internal wall, ceiling and external plastering and rendering shall conform to IS:1542 . It shall not contain any harmful impurities such as iron pyrites, alkalis, salts, coal, mica and organic matters. Percentage of salt and dust shall not be more than 5% by weight. Grading of sand shall be within the limits specified in clause no. 5.1 of above code. Fineness modulus of naturally occurring sand shall not be less than 1.5.



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## 7.0 MATERIALS FOR FLOORING & PAVING

### 7.1 Cement and Binders

#### 7.1.1 Cement

Cement, fine aggregates, reinforcement and water used shall comply with the requirements of concrete as per clauses 2.1, 2.3, 2.6 and 2.7 of this part.

#### 7.1.2 Water

Water for construction shall be clean, soft, free from loam, salt and organic materials. Hard water shall not be used.

### 7.2 Aggregates

#### 7.2.1 Coarse Aggregate

7.2.1.1 Coarse aggregate shall conform to the requirement as per clauses 2.1 and 2.2 of this part.

7.2.1.2 For granolithic floor the screeded bed shall comprise of aggregates size 15mm and down graded and topping shall comprise of clean fine stone chippings, size 4mm and down. For concrete floor with hardener treatment the topping shall comprise of stone chippings, size 6mm and down and for in-situ terrazzo flooring, chippings shall be within sizes 12mm to 6mm graded. The marble chips for topping of terrazzo floor shall be of 3-6mm size and shall conform to Grade-I of IS : 2114 "CP for laying in-situ terrazzo floor finish".

#### 7.2.2 Common burnt clay bricks

Common burnt clay bricks shall conform to IS : 1077 and comply with requirements under the section "Brick and Stones" of this part.

#### 7.2.3 Rubble

Rubble of approved quality shall be used and shall be clean and free from dirt. The loose and weathered sections shall be removed before use. Rubble used as hard core shall have a least lateral dimension



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(thickness) between 100mm and 225mm, depending on the thickness of hardcore.

## 7.3 Tiles

### 7.3.1 Terrazzo Tiles

Terrazzo tiles shall be machine made under a minimum pressure of 140 kg/cm<sup>2</sup>. It shall have a minimum total thickness of 20mm including a minimum of 6mm thick topping. It shall be of size, texture, colour, shade and pattern as specified in schedule of item and as approved by the Engineer.

### 7.3.2 Vitrified Ceramic Tiles

Vitrified Ceramic tiles shall be of approved manufacture and quality . They shall be true in shape, free from hair cracks, crazing spot, chipped edges and corners and surface shall be perfectly flat without warps and of uniform colour. The top surface shall be glazed either gloss or matt as specified. The tolerance on average facial dimension value shall be plus or minus 0.8 mm and on thickness plus or minus 0.5mm. The specials such as coves, internal and external angles, beads, cornices and their corner pieces shall be of specified sizes and of thickness not less than the thickness of tiles. For floor the minimum thickness 10mm and for wall glazed variety (of minimum thickness 5mm) shall be used of approved quality and size.

### 7.3.3 Coloured tiles

Only glaze shall be coloured as specified. The size and specification of tiles shall be of approved quality / size of approved make.

### 7.3.4 Marble tiles

It shall conform to IS : 1130 "Marble (Blocks, Slabs and Tiles)". Marble for paving and facing work shall be of selected quality, hard, sound, dense and homogeneous in texture (with crystalline texture) and free from cracks, decay, weathering and flaws and shall be of kind and quality, size and thickness as specified in schedule of items. The samples of tiles shall be got approved by the Engineer before use. The tiles shall be cut to the requisite dimensions.

### 7.3.5 Acid Resist Tiles



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Acid resist tile shall be ceramic unglazed and vitreous type conforming to IS 4457.

## 7.4 Pigments

Pigments incorporated in mortar or used for grouting shall be subject to approval of Engineer and as per table I of IS : 2114.

## 7.5 Red Oxide of Iron

Red oxide of iron where used for "Red Artificial Stone Flooring" shall be of quality approved by the Engineer, and shall be of uniform tint.

## 7.6 Hardening Agents

Hardening agents such as ironite used for "Cement Concrete Flooring with Hardener Treatment", shall be of quality approved by the Engineer for every work.

## 7.7 Dividing Strips

Dividing strips shall be of aluminium, glass, brass, copper, plastic or similar materials as specified in the schedule of item and of quality approved by the Engineer. Strips shall be 1.5 mm thick unless otherwise specified penetrating to the full depth of the flooring. Aluminium strips when used shall have a protective coating of bitumen.

## 7.8 Marble Chips

It shall be in sizes varying from 1mm to 25mm and in different colours as per requirement. Marble chips shall be hard, sound, dense and homogeneous in texture with crystalline and coarse grains. It shall be uniform in colour and free from cracks, stains, decay and weathering and shall be obtained from approved source.

## 7.9 Marble Powder

It shall be clean, free from dust and other foreign materials and of approved quality, obtained from approved source. It shall pass through sieve 300 conforming to IS: 460- (Part-1).

## 8.0 TIMBER



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## 8.1 General

All timber used for carpentry and joinery works shall be new. It shall be well seasoned by a suitable process conforming to IS : 1141 before being planed to the required sizes. It shall be sound, straight, free from sap, radial cracks, decay, fungal growth, boxed heart, pitch pockets, borer holes, splits, loose knots, flaws or any other defects and shall show a clean surface when cut. Timber shall conform to the requirements of IS : 1003 (Part 1&2) . The finished components shall be given suitable preservative treatment wherever necessary.

## 8.2 Teak wood/Sal / Bija Sal / Deodar / Kail and other varieties of timber

### 8.2.1 Teak wood

The timber shall be of good quality and well seasoned. It shall be of fairly uniform colour and shall be free from defects such as cracks, dead knots, shakes etc. No individual hard and sound knot shall be more than 15 sq. cm. in size and aggregate area of all such knots shall not exceed 2 % of the area of the piece. Wood shall be generally free from sap wood but traces of the same shall be allowed. The timber shall be fairly grained having not less than 2 growth per cm width in cross section.

### 8.2.2 Sal / Bija Sal wood

Timber shall be of good quality and well seasoned. It shall have fairly uniform colour, reasonable straight grains and shall be free from all defects as mentioned in previous clauses. No individual hard and sound knot shall be more than 6 sq. cm. in size and aggregate area of all such knots shall not exceed 2 % of the area of the piece. There shall not be less than 5 growth rings per 2 cm of the width.

### 8.2.3 Deodar wood

The timber shall be of good quality and well seasoned. It shall have fairly uniform colour, reasonable straight grains and shall be free from all defects as mentioned in previous clauses. No individual hard and sound knot shall be more than 15 sq.cm. in size and aggregate area of all such knots shall not exceed 2 % of the area of the piece. There shall be at least 3 growth rings per cm width in cross section.

### 8.2.4 Kail wood



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The timber shall be generally as specified in clause 8.2.3 for Deodar wood. However, there shall not be less than 2 growth rings per cm width in cross section.

## 8.2.5 Other varieties of timber

The timber as named in the item of work shall be used. It shall be well seasoned and generally free from defects such as dead knots, cracks, shakes, sap wood etc. However, traces of sap wood shall be allowed and sound and hard knots up to 2 % of the area of the piece shall be allowed.

## 8.3 Storage and Inspection

Timber shall be carefully stored and subject to inspection on site, piece by piece. The Engineer may reject such pieces as are considered by him not of the quality or meeting the requirements specified herein.

## 8.4 Moisture Content

Timber shall be accepted as well seasoned if its moisture content does not exceed the permissible limit as per IS : 287.

## 8.5 Tolerances for Timber

For timber allowance as specified in the IS : 1003 (Part 1&2) shall be applicable.

## 8.6 Flush Door Shutters, Shelves

Flush door shutters, shall be wooden, solid core or cellular and hollow core type, as may be shown in drawing or described in the Schedule of Items or directed by Engineer. They shall be obtained from an approved source of manufacture, covered on face with commercial ply, wood veneer or other finish as may be necessary. Solid core shutters shall conform to IS : 2202 (Part 1&2) and cellular or hollow core shutters to IS : 2191 (Part 1&2) . The resin used shall be phenol formaldehyde. A full size sample door shall be offered for inspection and approval.

## 8.7 Wood Particles Boards

Particle boards for general purposes shall be of medium density conforming to IS:3087. These are of four types, Flat pressed single layer



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board (FPSI), Flat pressed three layer board (FPTH), Extrusion pressed solid board (XPSO) and Extrusion pressed tubular core (XPTU). Adhesive shall be BWR, WWR or un-extended CWR type. High density wood particle board shall conform to IS:3478 and are in flat sheets or moulded forms. These shall be of type 1 (BWR type of resin) or Type 2 (WWR or CWR type of resin). Both types of boards shall be of Grade A (resin content 20 to 50 percent) and Grade : (resin content 8-12 percent).

## 8.8 Veneered Particle Board

These shall conform to IS : 3097 and shall be of two grades. Exterior (grade-I with BWP or BWR type adhesive) & interior (grade-II with WWR or CWR type adhesive). Each grade of boards shall be of 4 types, solid core general purpose, solid core decorative, Tubular core general purpose and Tubular core decorative and accordingly designated.

## 8.9 Plywood for General Purpose

Plywood for general purpose shall conform to IS:303. Depending on type of adhesive used for bonding veneers, it is of 4 grades, BWP (boiling water proof), B.W.R (boiling water resistant), WWR (warm water resistant) and CWR (Cold Water resistant). Any species of timber may be used for plywood manufacture. However list of species, for the manufacture of plywood is given in Annexure 'B' of the IS : 303 for guidance.

Plywood is classified in 10 different types as per appearance of the surface. These are type AA,AB,AC,AD,BB, BC,BD,CC,CD and DD as detailed in IS : 303. It is available from 3 ply to 11 ply with thickness from 3mm to 25mm.

## 8.10 Veneered Decorative Plywood

This quality of plywood shall conform to IS : 1328. These plywood shall be of two types Type 1 and Type 2 as per details given in IS : 1328. Species of timber for decorative face commonly used are given in Table 1 of IS : 1328 but the purchaser shall specify the particular veneer to be used. Timber for cores and backs shall be either class I or II as specified in IS : 303. Adhesive used shall be BWR or WWR synthetic resin.

## 9.0 FITTINGS FOR DOORS, WINDOWS, ETC.

### 9.1 General





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Fittings shall be of iron, brass, aluminium or as specified. These shall be well made, reasonably smooth and free from sharp edges, corners, flaws and other defects. Screw holes shall be countersunk to suit the head of specified wood screws. All hinge pins shall be of steel and their riveted heads shall be well formed.

Iron fittings shall be finished bright or black enameled or copper oxidised or painted as specified. Brass fittings shall be finished bright, oxidised or chromium plated and aluminium fittings shall be finished bright or anodised as specified. Fittings shall be got approved by the Engineer before fixing. Screws used for fittings shall be of the same metal and finish as the fittings. However, anodised cadmium/chromium plated M.S. screws of approved quality shall be used for fixing aluminium fittings.

## 9.2 Hinges

### 9.2.1 Butt hinges

These shall be mild steel butt hinge (medium), brass butt hinges, extruded aluminium alloy butt hinges or as specified. Type (light/medium/heavy weight) and size shall be as specified in the drawing or schedule of items. Brass / Aluminium and M.S butt hinges shall conform to Indian Standard Specification for butt hinges IS : 205 and IS : 1341 respectively. Hinges shall be finished bright or satin polished or anodised.

## 9.3 Sliding Door Bolts

Mild steel sliding door bolts shall conform to IS : 281 and are of 2 types, plate type and clip or bolt type. Plate type bolts shall have plates and straps stove enameled black with hasp and bolt finished bright or copper oxidized or nickel / chromium plated. Clip or bolt type are copper oxidized or plated. All screw holes in the M.S bolts shall be countersunk. Diameter of bolt for plate type is 12mm and for clip type is 16mm.

Non ferrous metal sliding doors are of brass or aluminium alloy and shall conform to IS:2681. Brass sliding bolts are of 150 to 450mm size with bolt dia being 16mm for 150 to 300mm and 18mm for 375 and 450 size. Aluminium alloy sliding bolts are of size 200 to 450mm with 16mm bolt dia. Brass quality is finished satin, polished or plated and aluminium alloy bolts are anodised.

For both ferrous and non-ferrous metal bolts the size of the sliding bolt is determined by the length of the bolt.



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## 9.4 Door Rim Latch

This shall be of mild steel, brass, aluminium alloy or as specified and of sizes 75, 100, 125 and 150mm denoted by overall length of the body measured from outside face of the fore end to the rear end. These are of type 1 and type 2 and shall conform to IS : 1019.

## 9.5 Tower Bolts

Tower bolts may be of one of the following types and shall conform to IS : 204 (Part 1 and 2).

### i) Barrel tower bolts

These shall be of bright finished/stove enamelled/ black painted mild steel tower bolts, brass barrel tower bolts with cast brass barrel and rolled or drawn brass bolt/brass barrel tower bolts with barrel of extruded sections of brass and rolled or drawn brass bolt/brass barrel tower bolts with brass sheet barrel and rolled or drawn brass bolt. Aluminium barrel tower bolts with barrel and bolt of extruded section of aluminium alloy-bolts and barrel anodised.

### ii) Semi-barrel tower bolts

These shall be mild steel semi barrel tower bolts full cover/open type with mild steel sheet pressed barrel and cast iron/mild steel bolt. Bolt bright finished other parts stove enameled black.

### iii) Rivetted or spot welded tower bolts

These shall be mild steel tower bolts rivetted type with black flat and mild steel/cast iron bolt and open staple.

### iv) Skeleton tower bolts

These shall be of bright finished / stove enameled / black painted mild steel or brass bright finished skeleton tower bolts with cast brass/extruded sections plate and staples and rolled or drawn brass bolt or Aluminium skeleton tower bolts with plates staples and bolt or extruded sections of Aluminium alloy plate and staple anodised.

## 9.6 Door Handles



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Door handles shall conform to IS : 208 and shall be of 4 types. Type 1 is cast Iron / Brass / Aluminium or zinc alloy die casting and available in 75,100,125 150mm sizes. Type 2 is mild steel pressed oval in 75, 100,115 and 135mm sizes. Type 3 is mild steel present half oval in 75,90 and 100mm sizes. Type 4 is fabricated (brass / aluminium alloy) in 75,100 and 125mm sizes. The size of the handle shall be determined by inside (grip) size overall size and internal depth of the handles shall be as detailed in IS : 208.

Finish for type 1 shall be satin/nickel plating, copper oxidising and bronze finish for cast-brass and zinc die cast handles and stove enamelled black or copper oxidized for cast iron handles. Aluminium handles shall be anodized. Type 2 and 3 handles shall be stove enamelled black. For type 4 it shall be satin finish, nickel plating, copper oxidized and bronze finish for brass handles and anodizing for aluminium handles.

## 9.7 Mortice Lock and Rebated Mortice lock

Mortice lock with latch and pair of lever handles shall have body of steel, Aluminium alloy or brass and shall be right or left handed as shown in the drawing or as directed by the Engineer. It shall be of the best Indian make of approved quality and shall conform to IS: 2209 / 6607. The shape and pattern shall be approved by the Engineer. The size of the lock shall be determined by its length. The lock for single leaf door shall have plain face and that for double leaf door a rebated face. Lever handles with springs shall be mounted on plates and shall weigh not less than 0.5 kg per pair. These shall be of brass, finished, bright chromium plated or oxidised. The locks shall be of 65, 75 and 100 mm sizes.

## 9.8 Floor Door Stopper

These are for the use of the door shutters of 30, 35,40 & 45mm thickness. It is made of aluminium alloy/ brass with springs of phosphor bronze or hard drawn steel wire and tongue of aluminium/brass/nylon/ plastic. The floor door stoppers shall conform to IS : 1823 and shall be best Indian make of approved quality. Width of cover plate is 40mm but its overall length is 140mm for 30 and 35mm thick shutters & 150mm for 40 and 45mm shutters. The body shall be cast in one piece and fixed to cover plate by brass or M.S screws. On the extreme end there shall be rubber cushion to absorb shocks. The extension of the door stopper shall be in flush with floor and be finished bright/satin/chromium plated or anodised.

## 9.9 Hooks and Eyes



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These shall be of mild steel or hard drawn brass and shall generally conform to IS : 207.

## 9.10 Casement Window Handles

These shall be made of cast brass, steel protected against rusting, aluminium, pressed brass or as specified. Casement handles for single leaf window shutter shall be left or right handed and shall weigh as specified.

## 9.11 Casement Peg Stays

These shall be made of cast brass, steel protected against rusting, aluminium, cast alloy or as specified. The stay shall be made from a channel section and shall be 300mm long with steel peg and locking bracket. The peg stay shall have three holes to open the window in three different angles. The shape and pattern of stays shall be approved by the Engineer. The peg stay shall be minimum 2mm thickness in case of brass and aluminium and 1.25 mm in case of steel.

## 9.12 Quadrant Stays

These shall be made of cast brass, aluminium alloy, CP iron or as specified. The shape and pattern shall be approved by the Engineer. It shall weigh as specified.

## 9.13 Fan Light Pivots

These shall be made of mild steel, cast brass or aluminium alloy or as specified and shall generally conform to IS : 1837.

The pattern and the shape of the catch shall be as approved by the Engineer and size and finish shall be as specified.

## 9.14 Fan light catch

These shall be made of mild steel, cast brass, aluminium alloy or as specified and shall generally conform to IS : 364. Steel springs of the catch shall be 0.90 mm dia, 6 coils, 12 mm internal diameter and 20 mm long. The pattern and the shape of the catch shall be as approved by the Engineer.

## 9.15 Steel Frames



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These shall conform to IS:4351. The frames shall be manufactured from commercial mild steel sheets of 1.25mm thickness and are suitable for door shutters 30 to 40mm thick. The door frames are designated as per profile A, B and C.

Profile A Size 105x60mm : rebated for one set of shutters  
Profile B Size 125x60mm : rebated for one set of shutters  
Profile C Size 165x60mm : rebated for two sets of shutters.

## Miscellaneous Items :

### 9.16 Putty

The material shall be homogeneous paste and shall be free from dust and other visible impurities. Putty shall conform to IS : 419 for wood work.

## 10.0 METAL DOORS, WINDOWS, VENTILATORS AND ROLLING SHUTTERS

### 10.1 General

Materials used in the fabrication of doors, windows, and ventilators shall be the best procurable and conforming to relevant Indian Standards.

### 10.2 Steel Doors, Windows and Ventilators

Steel sections used for fabrication of doors, windows and ventilators shall be standard rolled steel sections specified in IS : 1038, IS : 1977, IS : 1361 or IS : 7452 respectively as appropriate or as specified in drawing and Schedule of Items. Rivets shall conform to IS : 1148.

### 10.3 Aluminium Door, Windows and Ventilators

Aluminium sections for fabricating doors, windows, ventilators, partitions etc., shall be extruded sections conforming to IS : 1948 & IS : 1949 or as manufactured by Indian Aluminium Company Limited or approved equivalent The alloy used shall conform to Designation HE 9 - WP of IS : 733.

### 10.4 Steel Rolling Shutters, Rolling Grills



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These shall conform to IS : 6248.

## 10.5 M.S. Bolts etc.

M.S. bolts, nuts, screws, washers, peg stays and other mild steel fittings shall be treated for corrosion. Putty for glazing shall conform to IS : 419. Glass panes and glazing shall conform to the specification detailed under this series.

10.6 Hardware and fixtures shall be as specified in the drawings or Schedule of Items. All hardware and fixtures shall be able to withstand repeated use. Door closers shall be suitable for doors weighing 61 to 80 kg, unless otherwise stated. Each closer shall be guaranteed against manufacturing defect for one year and any defect found within this period shall be rectified or the closer replaced free of charge. Concealed door closers shall be either floor mounted or transom mounted, suitable for installation with metal doors. It shall conform to the performance requirements and endurance test stated in IS : 3564 Appendix-A.

10.7 The mastic for caulking shall be of best quality from a manufacturer approved by the Engineer. In general, the mastic for fixing of metal frames shall conform to IS : 1081 and/or as approved by the Engineer.

## 11.0 GLASS

### 11.1 General

Plain, ground, frosted or rough cast wired glass shall be used as shown on the drawing or as specified in the Schedule of Items. It shall be procured from a reputed source of manufacture and be of the best quality. All glass panes shall be free from flaws, specks, bubbles etc. Glass panes shall be of thickness 3mm or more as required. Weight of 3mm thick glass pane shall not be less than 7.5 Kg/sqm. The tolerance of glass panes, except wired glasses, in length and width shall be plus or minus 2 mm for 3 to 6.3 mm glass sheets. Tolerance in thickness of glass sheets shall be +/- 0.2mm for 3mm and 4mm thick glasses and +/- 0.3mm for 4.8, 5.5 and 6.3mm thick glasses.

### 11.2 Plain Transparent Glass

Plain transparent glass for glazing and framing shall conform to IS: 2835. It shall be free from flaws, specks, bubbles or distortions.

### 11.3 Ground and Frosted Glass



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Glare reducing or heat absorbing glass shall be "Calorex" or approved equivalent and special care shall be taken to grind smooth and round off the edges before fixing.

## 11.4 Thickness

Glass shall have the following thickness, unless otherwise stated in the Schedule of Items or drawings

Upto 60 cms x 60 cms	...	3 mm
do- of larger size	...	4 mm and 4.8mm
Wired glass	...	5.5 mm
Rough cast wired	...	6.4 +/- 0.4 mm

## 11.5 Inspection

All glasses shall be subject to inspection on the site. Glass found to suffer from defects shall be rejected. Samples submitted for inspection shall be selected so as to be representative of the consignment.

## 12.0 PAINTS

### 12.1 General

All paints, varnishes, distemper or other surface coating materials shall be of approved quality conforming to the appropriate Indian Standard, wherever such standard is available, and be obtained from a manufacturer of repute. If there is more than one quality for one particular product, only first quality shall be used unless otherwise stated in the Schedule of Items.

### 12.2 Sampling and Testing

The Engineer may, at his discretion, require samples of paint to be tested. In such cases testing will be according to IS : 101 (Part 1 to 8).

### 12.3 Storage

Paints, primers, distempers and varnishes shall be delivered in sealed containers. They shall be stored in cool dry condition to the satisfaction of the Engineer.



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## 12.4 Paints for Priming

Ready mixed paints for priming coats of steel and iron work shall either comply with IS : 2074 "Ready Mixed Paint", "Red Oxide Zinc Chrome Priming" or Red Oxide metal primer as specified. For wood work it shall be pink/white wood primer as specified by the manufacturer of the synthetic enamel paints, conforming to IS : 3536.

## 12.5 Paints for finishing

Ready mixed oil synthetic enamel paint of approved manufactures shall be used unless otherwise specified. Paint shall be of first grade quality of the above manufacturers.

If for any other reason, thinning is necessary, the brand of the thinner recommended by the manufacturer, shall only be used with the specific permission of the Engineer.

Aluminium paint for general purpose shall be in Dual Containers. It shall be of manufacturers as for synthetic enamel paints above.

## 12.6 White wash

White wash shall be prepared from freshly burnt fat, white in colour lime slaked on spot, conforming to IS : 712 mixed and stirred with sufficient water to make a thin cream. Best and approved quality gum and ultra marine blue only shall be used in lime wash.

## 12.7 Colour wash

Colour wash shall be prepared by adding mineral colours, not affected by lime, to white wash.

## 12.8 Water proofing Cement Paint

Cement paints shall comply with IS: 5410 and shall be of approved brand and manufacture from approval list of vendor. The shade shall be approved by the Engineer before its application.

## 12.9 Distemper

Dry/synthetic washable distemper of approved brand and manufacture shall be used. The shade shall be approved by the Engineer before application of the distemper. and shall comply with IS : 427 and IS : 428.





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### **12.10 Varnish**

Varnish for the finishing coat shall be copal finish or synthetic class varnish of approved brand. Varnish for the under coat shall be flattening varnish of the same make as the top coats and shall be to the satisfaction of the Engineer.

### **12.11 Polish**

French spirit polish shall be of an approved make conforming to IS: 348. In case it is to be prepared on site, the polish shall be made by dissolving 0.7 kg of best, shellac in 4.5 litres of methylated spirit without heating. To obtain required shade pigment may be added and mixed. Shellac shall conform to IS : 5467.

#### **12.11.1 Wax polish for Wood work**

The polish shall consist mainly of waxes and Organic solvents with or without water and shall be of smooth consistency, homogeneous, Semi-Solid mass and free from gritty materials. It shall not flow at ordinary temperature. It may be tinted with an oil soluble colour. The polish shall not crumble or dry too rapidly and shall produce non-tacky polished surface. The polish shall be amenable to smooth spreading on the furniture surface and the gloss shall appear on gentle rubbing with a soft polishing cloth.

The wax polish shall conform to IS : 8542.

12.11.2 Where wax polishing is to be prepared at site, it shall be prepared by heating two parts of "Bee Wax" two parts of boiled linseed oil over a slow fire. When dissolved but still warm, one part of turpentine is to be added. The boiled linseed oil, bees wax and turpentine used shall be of approved quality and complying with IS : 77, IS : 1504 and IS : 533 respectively.

### **12.12 Plastic (Acrylic) emulsion paint**

Plastic emulsion paint of approved manufacturers paints only shall be used unless otherwise specified and shall comply with IS : 5411 (Part 1) & (Part 2) as applicable. Cement primer used for priming work both for oil bound distemper and plastic emulsion paint shall be of the same manufacture as that of distemper or plastic emulsion paint used. For dry distemper priming, whitening of approved quality shall be used.



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### **12.13 Creosote oil or Coaltar Creosote**

It is primarily used for preservation of wood. It shall be a homogeneous liquid and shall liquify completely on being warmed to 38 degree C with stirring and shall remain liquid on cooling down to 32 degree C and on standing at that temperature for 2 hours.

The material shall conform to IS : 218. All persons handling the creosote oil should be fully aware of the hazards involved in handling . Skin should be protected from coming in direct contact and eyes should be protected by using safety goggles while handling the material.

### **12.14 Coaltar Black Paint**

Coaltar paint film protects surfaces by serving as a barrier against the action of moisture and other corrosive agents. Coaltar black paint is generally used as a protective and anti corrosive paint of iron and steel as well as protection of other building surfaces. For this it has to be applied under proper condition and on suitably prepared surface. Coaltar should be applied by brush only and is not recommended for locations which are not likely to be well ventilated. Coaltar paint shall conform to IS : 290 .

The material is of two types : Type A Quickly drying and Type B Slow drying. It shall be a homogenous black solution type paint consisting of a base prepared by blinding suitable grades of Coaltar pitch, washed free from ammoniacal liquor, tar acid bases etc. Consistency, permeability, thickness and surface preparation etc. shall be as per para 5 and A-2 of the above code.

### **12.15 Floor Polish - Paste**

The polish shall consist mainly of waxes and organic solvents with or without water.

The paste floor polish shall be of smooth consistency, homogenous, semi-solid-mass and free from gritty material. It shall not flow at ordinary temperature. It shall be so constituted and prepared that on application by means of a clean cloth, it shall spread easily and evenly and shall give with minimum buffing a firm and glossy surface free from greasiness or tackiness. The polish film after spreading with a cloth shall not take more than 10 minutes to dry. The polished floor shall neither be slippery nor show any resistance to easy walking.

Floor polish paste shall conform to IS : 8591.



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## 13.0 WATER PROOFING MATERIALS

### 13.1 Integral Cement Waterproofing Compounds

Integral cement waterproofing compounds, i.e. admixture for waterproofing purposes shall fully comply with the requirements of IS : 2645. Properties like permeability, setting time, compressive strength shall be in accordance with the requirements of this code when tested as per procedure laid therein. Calcium chloride content of the product used shall be made known to Engineer before use.

### 13.2 Bitumen

The bitumen bonding material for waterproofing shall conform to the requirements laid down in IS : 702 or IS : 93 or IS : 217 or IS : 454 depending upon whether industrial bitumen, paving bitumen or cutback bitumen is used. For selecting the particular type and grade of bitumen to be used the relevant item in Schedule of Items shall be referred to.

### 13.3 Bitumen Primer

Bitumen primer used for application to concrete and masonry surfaces and bitumen for the purpose of waterproofing shall conform to requirements given in IS : 3384 and pass tests in accordance with the procedure laid down in appropriate IS mentioned in Table-I of IS : 3384. Bitumen primer should be free from water and shall preferably ;be made from the same grade of bitumen as used in bonding.

### 13.4 Bitumen Felt

Bitumen felts used for water proofing purposes shall be as specified in IS: 1322. Physical properties shall conform to the requirements and tests shall be carried out as per procedure laid down in IS :1322 . Base, (whether fibre or Hessian), type and grade of felt shall be as mentioned in the relevant items under Schedule of Items. Unless otherwise stated, hessian base felt Type-3, Grade-2 shall be used.

### 13.5 Bitumen Mastic



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Bitumen mastic used for water proofing of roofs shall have the physical properties as mentioned in IS : 3037 when tested with the procedure laid down in appropriate IS mentioned in IS : 3037.

## 13.6 Bituminous Compounds

Bituminous compounds when used for waterproofing of porous masonry, concrete floors, walls and roofs shall conform to the requirements of IS : 1580. Physical properties shall be governed by the requirements of this code when tested in accordance with the procedure laid therein.

## 13.7 Surface Application Materials

Waterproofing material for application on mortar or concrete surface shall conform to IS: 9862 . The primer shall be suitable for spray or brush application. It shall have properties enabling it to penetrate through pores or cracks and fill them up, making the surface impervious.

## 13.8 Polymer based paints

The materials used shall be high polymer based chloride and sulphide free cement and waterproofing additions and epoxy based waterproofing paints as per manufacturer's specification and approved by Engineer.

## 13.9 Fibre glass R. P. Tissue

The fibre glass R.P. tissue is a thin flexible uniform mat, composed of glass fibre in an open porous structure bonded with a suitable inert material compatible with coal tar, asphaltic enamel and oil plastic based wall paint. The fibrous glass mat is reinforced with continuous filament glass yard at 3/8" (10mm) pitch in the longitudinal direction.

### PHYSICAL PROPERTIES

- |               |  |
|---------------|--|
| i) Weight     | The average weight of fibre glass R.P. tissue shall not be less than 50 gms/sq.sm. |
| ii) Thickness | The fibre glass R.P. tissue shall have a thickness not less than 0.4mm.            |



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- |      |                   |  |
|------|-------------------|--|
| iii) | Tear Strength     | The tear strength shall be not less than 900 grams in the transverse direction.  |
| iv)  | Breaking Strength | This shall have a minimum breaking strength of 13 lb/in (2.32kg/cm) in the longitudinal direction.   |
| v)   | Porosity          | This shall have a porosity when related to pressure difference across the sample of not less than 0.022" (0.56mm) and not more than 0.76" (1.92mm) of water guage at an air velocity of 200fpm.(100cm/sec.). |
| vi)  | Pliability        | There shall be no cracking of the tissue mat when bent over a 1/8" (3.2mm) radius after immersing for 10-15min. through a 90 degree arc.   |
| vii) | Temperature       | The fibre glass tissue shall be Resistance under a load of hot bitumen at 530 degree F (276 degree C) for one minute.  |

## 13.9.1 Primer

Primer shall conform to requirements laid down in IS : 3384. It is to be prepared by blending turpentine and blown grade bitumen in the ratio of 60:40 by weight.

## 13.9.2 Blown Materials

Blown grade bitumen shall be conforming to IS : 702 and residual grade bitumen conforming to IS:73 respectively. This shall be prepared by heating to correct working temperature.

## 13.9.3 Surface finish

Pea sized gravel/grit 6mm and down.

## 13.10 P.V.C. Membrane/Sheets

Polyvinyl chloride sheets for the purpose of water proofing and other underground use are specially developed sheets made from the compounded resin of grade MP/DP/CR-02 and shall be resistant to the passage of gross water and water vapour. It shall be corrosion resistant



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and resistant to a wide range of acidic and alkali reagents, saltpetre action, salt water and ultra violet rays etc. PVC sheets manufactured by approved and reputed firms shall only be used

The sheets shall consist of Knobs or Lugs jutting out of the sheets in a grid fashion so as to provide a perfect grip in the mortar and concrete. Sheet thickness, spacing of the knobs and their projection from the sheet shall be as specified in the item. The sheets shall be of maximum practicable length and width unless otherwise specified.

The adhesive used for jointing shall be of approved quality and of grade C-02.

The sample of the material shall be got approved before use.

## 13.10.1 Properties

- i) Chemical Composition : Resin Plasticiser Inhibitor Stabiliser UV Barrier.
- ii) Thickness : Not less than 0.25 mm
- iii) Rupture/Tensile Strength : Not less than 225Kg/cm<sup>2</sup>
- iv) Adhesive bond Strength : : Not less than 7.1 Kg/cm [width]
- v) Elongation at Break : 130%

## 14.0 WATER BAR

### 14.1 General

Water bar for use in construction/expansion joints in concrete and reinforced concrete structures shall be of copper sheet, galvanised steel sheet, rubber or PVC as shown in drawing or described in the Specified Item It shall be subject to approval of Engineer.

### 14.2 Jointing

The water bar shall have dimensions as shown in drawing. Where water bars are required to be lengthened or otherwise jointed the joining shall be done in such a way as to achieve a perfectly watertight joint.

## 15.0 LEAD



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## 15.1 General

Lead for joints in cast iron spigot and socket pipes shall be melted from pure soft pig lead conforming to Type-I of IS : 782. "Caulking Lead". Where lead wool is allowed for caulking, it shall be equal to or better than Type-II of IS : 782. Lead flashing shall conform to IS : 405 Part I&II.

## 16.0 BUILDING PAPER

16.1 Building paper shall be bitumen impregnated paper conforming to IS: 5134, or such other as may be approved by the Engineer.

## 17.0 FILLING MATERIAL

### 17.1 General

Filling material shall conform to what is shown in drawing, described in the Schedule of Items or otherwise directed by the Engineer. Earth or sand for filling under floors shall correspond to those described elsewhere in these specifications.

### 17.2 Mastic Bitumen

Mastic Bitumen shall conform to IS : 3037 or IS : 5871 as appropriate.

### 17.3 Flexible Boards

Flexible boards for use in expansion joints shall correspond to the description given in drawing or the Schedule of Items or the instruction of Engineer.

## 18.0 DRAINAGE & SANITATION (INTERNAL)

### 18.1 General

All materials, pipes, specials, fittings, fixtures etc., to be used in the works shall be of best quality and class specified in relevant IS Code. Where specified these shall be of specific manufacture and quality and shall be procured from manufacturer or their accredited stockists and be marked with manufacturers' names and trade mark. Bidder shall submit to the Engineer samples of all materials, pipes, specials, fittings fixtures for approval before use in the works. Such approved samples shall be retained by the Engineer till completion of works. Pipes and Specials may be any or combination of following types:-



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- i) PVC Pipes
- ii) Stone Ware Pipes
- iii) Sand Cast Iron Pipes for soil waste & Ventilation
- iv) CI Pipes for rain water
- v) R.C.C Pipes

## 18.1.1 High density PVC pipes and fittings

This shall conform to IS : 4984 and IS : 8008 (Part 1 to 7) unless otherwise specified.

## 18.2 PVC Waste Pipe

This shall conform to IS : 4985 unless otherwise specified.

## 18.3 Stoneware Pipes & Fittings

All stoneware pipes, bends, gully traps and sewer traps shall be of the best salt glazed variety inside and outside, hard burnt dark grey colour, perfectly sound, free from fire cracks and imperfection of glaze, truly circular in cross section, perfectly straight, of standard nominal length and depth of socket and barrel. These shall be of approved manufacture and shall comply with the requirement of IS: 651. These pipes shall be of grade AA unless otherwise specified.

## 18.4 Sand Cast Iron Pipes & Fittings conforming to IS : 1729

All soil waste and vent pipes and fittings used in the work shall be cast iron and shall conform to IS: 1729. The pipes shall have spigot and socket ends, with bead on spigot end and shall be with or without ears. The pipes shall be free from cracks and other flaws. The interior of the pipe and fittings shall be clean, smooth painted inside and outside with DR Angas smiths solution or other approved anti-corrosive paint.

The standard weights and thickness of pipe shall comply with the requirements of IS: 1729. The tolerance on wall thickness and weight shall be minus 15 percent and minus 10 percent respectively. Pipes weighing more than the nominal weight given below may be accepted provided they comply in every other respect.





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Nominal size	Weight per piece in Kg. excluding ears Overall length		
	1500 mm	1800 mm	2000 mm
50	9.56	11.41	12.65
75	13.83	16.52	18.37
100	18.14	21.67	24.15
150	26.70	31.92	35.66

Specials and Fittings shall include bends, offsets, branches of various types, junctions etc., as required for the work which shall be provided according to drawings and directions of the Engineer. B.M. trap shall have water seal as per I.S. provisions.

The specials and fittings shall be provided with access doors where so specified or directed by the Engineer. The access door fittings shall be of proper design so as not to form cavities in which the filth may accumulate. Doors shall be provided with 3 mm thick rubber insertion packing, and when closed and bolted they shall be water tight. The access doors shall have MS studs and bolts or screws or bolts and nuts.

## 18.5 Cast Iron Pipes pipes : Rainwater pipe

**18.5.1** Pipes shall be of approved manufacture, true, smooth and cylindrical, their inner and outer surfaces being as nearly as practicable concentric and shall conform to IS : 1230. These shall be sound and uniform casting, free from laps, pin holes or other imperfections and shall be neatly finished inside and outside. The ends of pipes shall be reasonably square to their axis.

### 18.5.2 Dimensions

CI rain water pipes shall be of the dia specified and shall be in full lengths of 1.8 metres including socket ends of the pipes, unless shorter lengths are required at junctions with fittings. The pipe lengths shall in each case be with sockets. The pipes shall be supplied without ears unless otherwise specifically mentioned.

The pipes supplied shall be factory painted with a tar based composition both inside and outside which shall be smooth and tenacious unless specified otherwise.



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Every pipe shall ring clearly when struck all over with a light hand hammer. When shorter pipes are cut from full lengths they shall be cut with a hacksaw.

Where the pipes are to be embedded in masonry they shall be of Class of pipes as are used for soil and vent pipes. For the weights of different sizes of these pipes, the specifications under SCI and vent pipes may be referred to.

**18.5.3** Fittings the pipes and fittings shall be of approved manufacture and shall conform to IS:1626. These shall be homogeneous and free from cracks and other defects. The pipes shall be straight, smooth and regular in thickness.

The diameter of the pipe shall be as specified. The fittings like heads, bends of different degrees, offsets of different projections, shoes and junctions shall be of the type, diameter and size as required for the work. The pipes shall be used in full lengths as far as possible.

## **18.6 Sanitary appliances**

Sanitary appliances like I.W.C/E.W.C pans, wash basin, urinals and sinks etc. shall be made of vitreous china or fire clay as specified. These shall be of Hindustan Sanitary ware or Parry ware make unless otherwise specified and to be approved by the Engineer. These shall conform to A class quality of IS : 2566 (Part 1 to 15) and IS : 771 (Part 1 to 15) respectively.

### **18.6.1 European Pattern W.C.**

Unless otherwise specified, these shall comprise of :

- a) Coloured glazed earthenware wash down closet set with 'S' or 'P' trap of standard size.
- b) 'Duco' spray painted 10 litres mosquito proof low level Ceramic or M.S flushing cistern with valveless siphon, 15 mm ball cock, C.P. brass unions & couplings for the 32 mm dia flush pipe, 20 mm dia overflow PVC pipe with mosquito proof cover etc.
- c) 'Duco' spray painted 1 1/4" (32 mm) dia G.I. telescopic flush pipe with buffer clamp, holder bat clamp and 38mm dia PVC pipe or 35/40mm O.D. high density polythene flush pipe with buffer clamp, holder bat clamp.



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- d) Approved quality W.C. seat and cover, bar hinges, screws bolt, rubber buffers conforming to IS : 2548 (Part 1&2).
- e) 15 mm PVC connection pipe with brass couplings at both ends and 15 mm brass CP cock.
- f) Hard wood wooden blocks or other suitable fixing arrangement with screws and detofix for fixing WC in floor and putty joint with flush pipe and soil pipe.

### 18.6.2 Indian Pattern W.C. (Orissa Pan)

Unless otherwise specified these shall comprise of :-

- a) Colour glazed earthenware WC pan back entry type(Large Size).(Orissa pan)
- b) Colour glazed earthenware 'P' or 'S' trap with or without vent.
- c) 10 litres low level approved make mosquito proof flushing cistern with valveless siphon, 15 mm ball cock, galvanised iron chain handle, cast iron brackets with wall plugs, brass unions and couplings for flush pipe, 20 mm dia overflow PVC pipe with mosquito proof cover etc.,
- d) 32 mm dia GI telescopic or 35/40 mm O.D high density PVC flush pipe with holder bat clamps.
- e) 15 mm PVC connection pipe with brass couplings at both ends and 15 mm brass stop cock.

### 18.7 Wash Hand basin

Unless otherwise specified these shall comprise of :-

- a) Colour glazed earthenware basin with 2 nos. Concealed Cast Iron Brackets with wall plugs.
- b) 1 no. 15 mm C.P. brass pillar tap( heavy duty ).
- c) 32 mm C.P. brass waste fitting, C.P. brass chain and rubber plug.



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- d) 32 mm PVC waste pipe with brass couplings/32 mm C.P. bottle trap.
- e) 15 mm PVC connection pipe with brass couplings and 15 mm brass stop cock.

### 18.8 Flat Back Lipped Urinal

Unless otherwise specified these shall comprise of:-

- a) Colour glazed earthenware urinal basin back type.
- b) CI/M.S mosquito proof high level automatic flushing cistern of capacity as specified in the Schedule of Quantities with all accessories, cast iron brackets with wall plugs, brass unions and coupling for flush pipe, 20 mm dia overflow pipe with mosquito proof cover.
- c) 25 mm dia CP brass flush pipe and spreaders with wall clips and brackets.
- d) 15 mm PVC connection pipe with brass couplings joint at both ends and 15 mm brass stop cock.
- e) 32 mm C.P. brass outlets complete with PVC waste.

### 18.9 Mirror Frames

Mirror frame where specified shall be of fibre glass of approved shape, size, colour and make.

- 18.9.1 Mirror shall be of superior glass with edges rounded off or leveled as specified. It shall be free from flaws, specks or bubble and its thickness shall not be less than 5.0 mm. The glass for the mirror shall be uniformly silver plated at the back and shall be free from silvering defects. Silvering shall have a protective uniform covering of red lead paint.

### 18.10 Toilet Shelf

- 18.10.1 Glass shelf unit shall consist of an assembly of glass shelf, anodised aluminium / CP brass guard rail and supporting brackets. The shelf shall be of glass of best quality with edges rounded off and shall be free from flaws, specks, bubbles and of thickness not less than 5.0 mm. The shelf shall have guard rail, resting on rubber washers on glass plate.



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- 18.10.2** Ceramics shelf shall be of shape, size and design as specified in the Schedule of Items.
- 18.11** **Towel Rail**
- Towel rail shall be of CP brass / anodised aluminium with two brackets of same material, diameter and length as specified.
- 18.12** **Soap Container**
- Soap container shall be of C.P brass, PVC with cp brass brackets of approved make and design.
- 18.13** **CP Flush Valves for EWC**
- The CP flush valve for EWC shall be of "Jaquar" brand of Jaquar & Co., 'ACCO' brand of Asia Continental Metallwaren Fabric or equivalent quality.
- 18.14** **CP Flush Valve for Urinals**
- CP flush valve for urinal shall be of "Jaquar" brand of Jaquar & Co., 'ACCO' brand of Asian Continental Metallwaren Fabric or of equivalent quality.
- 18.15** **Gully Trap**
- Each gully trap shall have one C.I. grating 150 mm x 150 mm and one water tight pre-cast R.C. cover 300 x 300 x 40 mm thick with 1:1 1/2:3 mix concrete (one cement: one and half sand : 3 stone chips 20 mm down) including neat cement finish.
- 18.16** **CI Manhole Covers & Frames**
- These shall be of light or medium duty (LD or MD) as specified in Schedule of Items and of cast iron with raised chequered design, lifting key and key hole and shall be coated with black bituminous base material,. Light duty covers and frames shall be of either rectangular type, single seal, pattern 1 and 2 having minimum weight of cover and frame 38 Kg and 25 Kg. respectively or with double seal, minimum weight of cover and frame being 52 Kg. These may be of square type also. Single seal with clear openings of 455 and 610 mm with minimum weight of cover and frame being 20 Kg and 38 Kg respectively, double seal of same openings shall have minimum Wt. of cover and frame 30 Kg and 55 Kg respectively. Medium duty covers and frames shall be



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either of circular type with 500 and 560 mm clear openings and minimum Wt. of cover and frame 116 Kg and 128 Kg respectively or of rectangular type with minimum Wt. of cover and frame 144 Kg.

The C.I. manhole covers and frames shall conform to IS : 1726.

### 18.17 Flushing Cisterns

Manually operated high level and low level flushing cisterns are of 5 litre and 10 litre capacities, both single flush and dual flush type. The cisterns shall conform to IS : 774 and be made of Cast Iron, Vitreous China or enamelled pressed steel. The cisterns shall be mosquito-proof.

The thickness of the body including cover shall be not less than 5 mm for Cast Iron and 6 mm for Vitreous China Cisterns. Flush pipe shall have internal diameter of 32 plus or minus 1 mm for high level cisterns and 38 plus or minus 1mm for low level cisterns. For high density polyethylene and unplasticised PVC pipes the outside diameter of the pipe shall be 40 mm. In case of PVC plumbing pipes the outside diameter of the pipes shall be 40mm for high level and 50mm for low level cisterns. Steel flush pipes shall be hot dip galvanized electroplated or vitreous enameled.

The flush pipe shall be securely connected to the cistern outlet and made airtight by means of a coupling nut. Float valve shall conform to IS : 1703 or IS : 12234. Polyethylene float valve shall conform to IS : 9762.

Cast Iron Cisterns shall be painted and finished in accordance with recommendation made in IS : 1477 (Part 1&2) or shall have a coating of enamel.

In general, Materials Construction and operational and performance requirements shall be as specified in para 3, 4 and 6 of IS : 774.

### 18.18 Plastic Seats & Covers for Water Closets

These shall conform to IS : 2548 (Part 1&2) and shall be either of thermo-set or of thermo-plastic quality.

Thermo-set Seats and Covers are moulded from phenolic plastics (Type A) or Urea Formaldehyde (Type B). Thermo-plastic Seats and Covers are also of Type A, moulded from Polystyrene or Type B, moulded from Polypropylene.



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Underside of the seats may be either flat or recessed and colour shall be as agreed. Table Dimensions of the seats and covers shall be as per Table-I of the Code (both Part 1&2). Hinging device may be either of the following materials :

- i) Bronze or Brass with Nickel Chromium Plating
- ii) Mild Steel with Nickel Chromium Plating
- iii) Aluminium alloy with anodic coating
- iv) Suitable plastic with reinforcement.

## 19.0 WATER SUPPLY & PLUMBING (INTERNAL)

### 19.1 General

This section deals with the specification of material for pipes, fittings, fixtures etc., to be used in water supply works.

All materials, pipes, fittings, fixtures to be used in the works shall be of the best quality and of the class specified in various clauses herein under. Where specified these shall be of specific manufacture and quality and shall be procured from the manufacturer or their accredited stockist and be marked with manufacturers name and trade marks. The Bidder shall submit to the Engineer samples of all pipes, fittings, fixtures for approval before being used in the works. Such approved samples shall be retained by the Engineer till completion of works.

Pipes and pipe fittings may be of any or combination of following types:

- i) Wrought iron galvanised pipe
- ii) PVC pipes
- iii) Cast iron pipes
- iv) Steel pipes coated with bitumen composition inside and galvanised outside.
- v) Reinforced concrete pipes
- vi) Asbestos cement pipes
- vii) Pre-stressed concrete pipes

### 19.2 Galvanised Iron Pipes and Fittings



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Generally pipes for installations in buildings shall be medium quality malleable steel galvanised pipe 'B' class for cold water supply and 'C' class for hot water supply, having threaded ends with socket at one end.

The details of standard medium quality "B" class pipes and sockets regarding nominal bore thickness and weight in kg/m are given below:-

Pipe Dia (Nominal Bore)	Dimension of Pipe		Thick -- ness	Dimension of ordinary socket		Wt. of Pipe plain end
	Max. (outside dia)	Min.		Outside dia (approx.)	Min. length	
mm	mm	mm	mm	mm	mm	Kg/m
15	21.8	21.0	2.65	26.90	34	1.21
20	27.3	26.5	2.65	33.70	36	1.57
25	34.2	33.5	3.25	42.00	43	2.42
32	42.9	42.0	3.25	51.00	48	3.11
40	48.8	47.9	3.25	57.00	48	3.59
50	60.8	59.7	3.65	70.00	56	5.07
65	76.6	75.3	3.65	88.00	65	6.49
80	89.5	88.0	4.05	101.60	71	8.43

**Note :-** Manufacturing tolerances shall be permitted on tubes and sockets in addition to above as per IS : 1239 (Part 1&2) .

The galvanised iron pipes shall be of approved make and conform to IS:1239 (Part 1&2) and of tested quality. The GI pipes shall be of threaded ends with a socket at one end only. The fittings for GI pipes shall be either galvanised wrought iron or galvanised malleable iron.

### 19.3 R.C.C, Asbestos, Prestressed Pipes and Fittings

These shall be of approved manufacture and quality and shall conform to IS : 458 , IS : 1592 , IS : 9627 & IS : 784 respectively.

### 19.4 Cast Iron Pipes and Fittings





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The cast iron pipes shall be of approved manufacture and quality and shall conform to IS: 1536 "Centrifugally Cast (Spun) iron pressure pipe and/or IS : 1537 ". Vertically Cast Iron pressure pipe for water, gas and sewage. CI fittings shall conform to IS : 1538 (Part 1 to 23) .

## 19.5 Steel Pipes

This shall conform to IS: 1239 (Part 1&2) and IS : 3589. Steel pipes shall be coated with bituminous composition inside and galvanised outside.

## 19.6 Bib Tap and Stop Tap

Bib tap and stop tap for water services shall be of brass screw down type and shall conform to IS: 781. Minimum finished weight of bib and stop taps shall be as given below:

No. of size (mm)	Bib taps (kg)	Stop tap (kg)
10	0.30	0.35
15	0.40	0.40
20	0.75	0.75
25	1.25	1.30
32	-	1.80
40	-	2.25
50	-	3.85

The taps shall be tested under internal hydraulic pressure of at least 20 kgf/cm<sup>2</sup> and maintained at the pressure for a period of at least two minutes during which period it shall neither leak nor sweat.

## 19.7 Valves

Unless otherwise mentioned in the Technical Specification globe and check valve of nominal sizes 80 to 100mm and conforming to IS : 778 shall be used . Valves shall be of class 1 and class 2, suitable upto a temp. of 45 degree C and can sustain non shock working pressure upto 1.0 and 1.6 MPA respectively. They shall have screwed or flanged ends.



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All the metal parts shall be of brass/brass alloy except hand wheel of Cast Iron or other approved quality.

## 19.8 Shower Rose

The shower rose shall be of heavy quality chromium plated brass with flat bottom, of diameter 100 mm or as specified with uniform perforations.

## 19.9 Storage Tank

Storage tank shall be either pressed steel, Galvanised iron, R.C.C or PVC of specified sizes, capacities, make, manufacture as specified in Schedule of Items. It shall have facilities for connecting inlet, outlet overflow and washout pipes and a top cover. Where tanks are to be fabricated by the Bidder the fabrication/R.C.C detailed drawings shall be got approved by Engineer.

## 19.10 Miscellaneous items

### 19.10.1 Half round channel

This shall be made of vitreous china channel with or without outlet/stop end as specified in Schedule of Items and shall be of approved manufacture.

### 19.10.2 Urinal partition

This shall be made of vitreous china or R.C.C. with mosaic finish or marble as specified and shall be of approved make and quality.

## 20.0 EXTERNAL SEWERAGE & DRAINAGE

Unless otherwise specified CI pipe and specials, caulking lead, SW pipe, RCC pipe shall conform to the following.

### 20.1 C.I. Pipes

- i) C.I. pipe shall conform to IS : 1536 or/and IS : 1537 of class as specified in Schedule of Items.
- ii) C.I. pipe fittings shall conform to IS : 1538 (Part 1 to 23) as specified in Schedule of Items.



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- iii) Bolts and nuts shall be hexagonal bolts and nuts conforming to IS : 1363 (Part 1 to 3).

### 20.2 Washers

Spring washers conforming to IS : 3063 shall be used near the pumps to take care of vibration. In other places plain washers conforming to IS : 2016 shall be used.

### 20.3 Gaskets

Gaskets shall be reinforced rubber sheet or compressed fibre board conforming to IS : 638 of thickness between 1.5mm to 3mm or as specified.

### 20.4 Caulking Lead

Lead for the spigot and socket joints shall conform to IS : 782.

### 20.5 Salt Glazed Stone Ware Pipes

Salt glazed stone-ware pipes used shall conform to IS : 651 and shall be laid as per IS : 4127 . The pipes shall be of grade AA unless otherwise specified.

### 20.6 Steel Pipes

Steel pipes and fittings used for encasing shall conform to IS : 1239 (Part 1&2) medium Class upto 150 mm dia and as per IS : 3589 for pipes of dia 200 mm and above. For pipes of dia 200 mm and above fittings, if required shall be fabricated from pipes itself.

### 20.7 Cast Iron Manhole Covers & Frames

These shall be of medium or heavy duty (M.D. or H.D.) as specified in Schedule of Item and of Cast Iron with raised chequered design, lifting key and key hole and shall be coated with black bituminous base material. Medium duty covers and frames shall be either of circular type with 500 mm clear opening and minimum weight of cover and frame 116 Kg and 128 Kg respectively or of rectangular type with minimum weight of cover and frame 144 Kg.

Heavy duty covers and frames shall be either of circular type with clear openings of 500 and 560 mm and 170 and 208 Kg weight respectively or of double triangular type with clear openings of 500 and 560 mm and 229 and 255 Kg weight respectively.



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The CI manhole cover and frames shall conform to IS : 1726.

## 21.0 ROAD

### 21.1 General

Roads shall be understood to include road bed, the wearing surface, berms, foot-paths, kerbs, culverts and bridges.

### 21.2 Soling Stones

Material for soling shall be natural stone boulders or crushed blast furnace slab. Stones for soling shall be of height equal to thickness of the soling with tolerance of plus or minus 25mm and shall not have a base area of less than 250 sq.cm. nor more than 500 sq.cm. and the smallest dimension of any stone shall not be less than half the largest dimension. Stones shall be tough, angular, durable and generally free from flat, elongated, soft and disintegrated particles. They shall also be free from dirt or other objectionable matter and be obtained from quarries approved by the Engineer.

Crushed slag obtained from air-cooled blast furnaces slag shall be angular, of reasonably uniform quality and density and generally be free from any thin, elongated, and soft pieces, dirt or other objectionable matter. The density of slag should not be less than 1.12 gm/cc and glassy material shall not exceed 20%. Water absorption when determined in accordance with IS:2386 (Part-III) . "Methods of Tests for Aggregates for Concrete : Specific Gravity, Density Voids, Absorption and Bulking", shall not exceed 10%.

### 21.3 Coarse Aggregate for Water Bound Macadam

Coarse aggregate for water bound macadam shall be natural gravel, crushed stone obtained from approved quarries or crushed blast furnace slag. Crushed stone shall be hard, durable, tough and of uniform quality, generally free from flat, elongated, soft and disintegrated particles. It shall have sharp edges and also not have excess of dirt and other objectionable matter. When tested as per IS: 2386 (Part-IV) for Los Angeles Abrasion Value or Aggregate Impact Value, the limiting values shall be 50% and 40% respectively for base course and 40% and 30% respectively for surfacing course. The flakiness index shall not exceed 15% when tested in accordance with IS: 2386 (Part-I) "Methods of Test for Aggregates for Concrete : Particle size and Shape". Crushed slag



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aggregates shall meet the requirements given for soling stones from blast furnace slag.

Size and grading requirements of coarse aggregates shall be as specified in Table-2 of IRC : 19 "Standard Specification and Code of Practice for Water Bound Macadam". The grading number of the table shall correspond to the following layer thicknesses :

Grading Number	Size Range	Layer Thickness
1	90 mm to 40 mm	More than 90 mm
2.	63 mm to 40 mm	90 mm to 75 mm
3.	50 mm to 20 mm	75 mm to 50 mm

## 21.4 Screenings

Screenings used for filling voids in coarse aggregates for water bound macadam shall generally be of the same material as the coarse aggregate. Non-plastic materials such as Kankar nodules, moorum or gravel (other than river bore rounded aggregates) may be used, provided that the liquid limit and plasticity index are below 20 and 6 respectively. The fraction passing 75 microns sieve shall not exceed 10%. Size and grading of screenings shall be as specified in Table-3 of IRC-19 . Type-A screening shall be used for grade number 1 coarse aggregate. Type-B screenings shall be used for grade number 3. Either Type-A or Type-B screenings may be used for grade number 2.

## 21.5 Stone Chips for Bituminous Surfacing

Coarse aggregate shall consist of crushed stone, crushed slag or crushed gravel (Shingle) retained on 2.36 mm sieve. The aggregates shall be clean, strong, durable and fairly cubical, free from disintegrated pieces, organic and other objectionable matter. The aggregates shall preferably be hydrophobic and of low porosity. The mechanical properties and grading shall be in accordance with IRC-29 "Tentative Specifications for 4 cm Asphaltic Concrete Surface Course", having aggregate impact value 30%, Flakiness Index 25% and graded between 20mm and 2.36 mm.

## 21.6 Sand

Sand for use as fine aggregate in bituminous surfacing shall consist of crushed screenings, natural sand or a mixture of both, passing a 2.36mm sieve and retained on 75 micron sieve. It shall be clean, hard, durable,



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uncoated and dry, free from injurious, soft or flaky pieces and organic deleterious substances.

## 21.7 Binder

Binding material for water bound macadam shall consist of fine grained material such as stone dust, kankar modules or moorum. The plasticity index shall be between 4 to 9 when water bound macadam is to be used as surface course and upto 6 when used as sub/base or base course.

### 21.7.1 Paving Bitumen

It shall conform to IS : 73 and shall be of the specified type and grade. The material shall be homogeneous and shall not foam when heated to 175 degree C. Various properties like specific gravity, flash point, softening point, penetration etc. shall be as given in the above code.

### 21.7.2 Bitumen Cut Back

Bitumen cut-back shall conform to specification given in IS : 217 . It shall be of three types, Rapid Curing (RC), Medium Curing (MC) and Slow Curing (SC). These shall comply with the requirements specified in Table - 1, 2 and 3 respectively of the above code.

The above three types of cutback bitumens shall be classified into different grades on the basis of Kinematic viscosity. Rapid curing type shall be used with aggregates containing practically no fine aggregates passing through 2.36 mm sieve. Medium curing bitumen shall be used with aggregates containing less than 20 per cent of fine aggregates passing through 2.36 mm sieve. Slow curing type shall be used with aggregates containing more than 20 per cent of fine aggregate passing through 2.36 mm sieve.

Medium curing bitumen of 30 grae i.e. MC 30 shall be used as primer. Manufacturer shall indicate source and type of the bitumen.

## 21.8 Kerbs

Kerbs may be of stone or concrete as may be shown in drawing or otherwise directed by Engineer.

### 21.8.1 Stone kerbs

Stones shall conform to the dimensions and shapes given in drawing.



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Exposed faces shall be dressed to lines.

## 21.8.2 Concrete kerbs

Shape and dimension shall conform to the drawing. They shall be pre-cast and the road side top corner shall be given a chamfer.

## 21.9 Galvanized Steel Barbed Wire for Fencing

These shall be of two types A&B. In both types Barbs shall have 4 points formed by twisting two point wires, each two turns. In type A (Iowa type) twisting is done around both line wings and in type B (Glidden type) around one line wire, in both cases making altogether four complete turns. It shall conform to IS : 278 and shall have the diameter of line and point wire as described in schedule of item. Galvanized mild steel wire shall conform to IS : 280.

Line and point wire shall be circular in section, free from scales and shall be uniformly galvanized. Line wire shall be in continuous length and shall not contain any welds other than those in rod before it is drawn.

## 21.10 Galvanized Steel Chain Link Fabric

It will conform to IS : 2721. It shall be of width, mesh and wire dia as per description of Item. For chain link fabric having width upto 2.00 M, of all mesh sizes, two line wires shall be provided. Whereas for width of 2.40 M and mesh size exceeding 50mm three line wires shall be provided. These shall be provided at top and bottom of the fabric, but wherever three line wires have been specified, these shall be provided at top, bottom and middle of fabric.

The mesh wire and line wire of the fabric shall be manufactured from Galvanised steel conforming to IS : 280. It will have zinc coating of type medium as given in IS : 4826 . " Specification for Hot dipped galvanized coatings on round steel wires". Unless otherwise mentioned in the description of item fabric with both ends twisted shall be used.

The galvanised steel pipe posts shall consists of 80 mm and 50 mm nominal diameter. The pipe posts shall conform to IS : 1161 and shall be of medium grade and galvanised.

## 22.0 LIST OF MATERIALS FOR WHICH APPROVAL OF BRANDS / MANUFACTURER IS REQUIRED BY THE BIDDER:



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The list of materials for which approval of brands / vendors is required by the Bidders from NTPL are given in Vol. IIA – Chapter 15.00. The Bidder shall furnish the names of the brands / manufacturer for the materials given in the list.

## 23.0 MATERIALS NOT SPECIFIED

Any materials not fully specified in these specification and which may be offered for use in the works shall conform to the relevant standards & codes.