SPECIFICATIONS
VOL. II

PROPERTIES & FACILITIES DEPT., OLD AIRPORT
VOLUME II

F O R E W O R D

As one who has closely watched the growth of Properties & Facilities Department since its formation in 1972, I have great pleasure in writing this foreword.

Of late, great advancements have taken place in design considerations and methods of construction with emphasis on safety, quality and economy. Wide range of new materials are now available to the engineers. It is most appropriate that Properties & Facilities Department of Air-India is bringing out books on **"Specifications"** incorporating all the modern trends.

The books cover in detail all aspects of specifications. The books give the various tests to be carried out before and during construction. Reference is given about the appropriate Indian Standards Specifications and Codes of Practice. Another important feature of the books is that the mode of measurement is given in each case so that disputes in billing are minimized.

Today the quality of the end product depends as much and perhaps more, on the Man on the Job as on the constituent material. Once the specifications are clearly defined as given in these books, ambiguity is greatly reduced regarding the quality and standards to be achieved.

The books put emphasis on ease of use and ready availability of information by placing the matter in the logical sequence. The text has been written in simple language and is supplemented by illustrations, charts and tables wherever necessary. I am sure these books on "Specifications" will be of immense value not only to the staff of Properties & Facilities Department but to builders, architects and engineers engaged in construction and maintenance activities.

Sd/-

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I. BRICK WORK

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2.	IS : 1200(Part III) – 1976	: Method of measurement of building and Civil Engineering Works – Brick work (3rd Revision)
3.	IS : 2212-1991	: Code of Practice for Brick Work. (1st Revision)
4.	IS : 3102 – 1971	: Classifications of burnt clay solid bricks
5.	IS : 3495 (Part I to IV 1992	: Methods of tests on burnt clay building Bricks (3rd Revision)
6.	IS : 6042 – 1969	: Code of practice for construction of light weight concrete block masonry.
7.	IS : 3466 – 1988	: Specification for masonry cement (2nd Revision Amendment No.1)

The above mentioned IS Specifications and Codes of Practice have been indicated for general guidance.

However, these IS Specifications and Codes will be adopted only for those particular items in the contract where either the mode of measurement or detailed technical specifications are not laid down in the Tender.

2.0 BRICKS :

Brick shall be locally available, fairly uniform in size, with plane rectangular faces, shape and colour. Brick shall be uniformly well burnt so as to give clear ringing sound when struck and shall be free from cracks or other flaws which impair their strength.

They shall show a fine grained, uniform, homogeneous and dense texture on fracture and shall be free from lumps of lime, laminations, cracks, air holes, soluble salts causing efflorescence or other defects which may impair their strength, durability, appearance or usefulness for the purpose intended. They shall have frog of 10 to 20 mm depth.

Classification of Bricks :

The common burnt clay brick shall be classified on the basis of their minimum compressive strength as given below :

Class Designation	Avg. Compressive Strength (Kg / sq.cm)	
	Not less than	Not more than
100	100	125
75	75	100
50	50	75
35	35	50

Sampling :

For carrying out compressive strength, water absorption, efflorescence and dimensional test, the sample of the brick shall be taken at random as given below :

Class Designation	Lot Size	No. of Samples
100	More than 50,000 bks	20 Nos.
75, 50, 35	More than 1,00,000 bks	20 Nos.

3.0 TESTING OF BRICKS :

a) **Dimensions** : 20 bricks shall be selected at random from stacks per lakh of bricks, cleaned of blisters, kiln, rubbish, and laid touching edge to edge for measuring length, breadth and height. Dimension shall be measured with a steel tape correct to 1mm, Dimension tolerance shall be ± 8% from the standard dimension, which will be 10 mm less than the required dimension to allow for mortar joints. Thus, a 230 mm brick may have an actual standard dimension upto 220 mm x 105 mm x 65 mm. Tolerance on the plus side is acceptable provided nothing extra shall be payable for thicker masonry.

b) **Compressive Strength** : The sample of bricks shall be taken at random according to their designation, numbers, lots and number of samples as per the table given above.

The sample brick shall be thoroughly wetted, the frog filled with CM (1:3) cured for 24 hours under wet gunny bags and 3 days under water; on removal from water, the test sample shall be wiped dry. The test sample shall be placed between plywood sheets of 3mm thick in such a way that frog project upward and brick correctly center in the machine. The length, breadth of each brick, shall be measured correct to one mm. The load shall be applied at the rate of 140 kg / sq.m. per minute. The strength shall be worked out in kg/ sq.m. as follows :

Compressive strength in kg/ cm^2 : $\frac{\text{Max. load at failure (in kg.)}}{\text{Area of bricks (in sq.m.)}}$

The average of the five test results shall be the compressive strength.

c) **Water absorption** : The sample of the bricks (5 Nos.) selected at random shall be dried in a ventilated over for 48 hrs. at 110^{o}C to 115^{o}C, then allowed to cool for at least 2 hours under fan at room temperature. Find out the weight (W1) in kg. At room temperature. After weighing, the sample bricks shall be kept under water for a period of 24 hours. The brick shall be removed from water and wiped with a damp cloth and find out the weight (W2) in kg. Calculate the absorption percentage of each sample as follows :

$$\text{Absorption percentages} = \frac{W2 - W1}{W1} \times 100$$

The average of five test of brick sample being taken as the percentage.

The water absorption shall not exceed 20 %.

Testing :

One series of all the above tests shall be carried out for every lot of 50,000 bricks at an approved Laboratory at the cost of the contractor, including cost of transporting the specimens to the Laboratory.

4.0 **BRICK MASONRY** :

One brick thickness and above :

The mortar for the brick masonry work shall be as specified in Schedule of Items. Cement, sand and water used in mortar shall conform to the quality as described in concrete.

The brick required for brick masonry in cement mortar shall be adequately soaked in stacks before use by profusely spraying with clean water at regular intervals so as to keep bricks wet so that they do not absorb too much water from the mortar.

The brick masonry work shall be laid normally in English Bond, i.e. rows of header and stretchers alternately, unless otherwise specified. No half or cut bricks to be used, except where necessary to complete the bond. Closer in such cases, shall be cut to required size and used in the ends of the wall. A layer of mortar shall be spread on full width over suitable length of the lower course. Each brick and with frog upward shall be properly bedded and set in position by gently tapping with handle of trowel. On completion of a course, all vertical joints, not more than 12mm thick shall be fully filled from the top with cement mortar, without any void in brick work. The brick work shall be raised truly plumb. All courses shall be laid truly horizontal and all vertical joints shall be truly vertical. Vertical joints in alternate courses shall be in the same vertical line. The thickness of each course shall be kept uniform. The brick work shall not be raised more than ten courses a day, unless otherwise approved by the Engineer-in-Charge. The level of window sills, soffit level of lintel and such other important levels shall be kept as shown in the drawing or otherwise specified and as directed by the EIC. The course shall be so adjusted as to get complete number of courses upto that level. At least one face of the brick masonry wall shall be in true plane (due to variation in the size of brick).

All iron fixtures, pipes, outlets of water, holdfasts of doors, windows, which require to be built into the brick wall, shall be embedded in mortar or cement concrete as specified in correct position, as work proceeds and as directed by the EIC. After the brick work is over, brick work shall be marked with date of construction, visible for inspection and curing.

Joints :

The thickness of the brick masonry of any class designation shall not exceed more than 10mm thick. All face joints shall be raked out to a minimum depth of 15mm by raking tools during the progress of work, when the mortar is still green so as to provide proper keys for the plaster or pointing. In no case mortar, which has set shall be removed from joints by hammering, chiseling, or in such a manner, so as to cause damage to the brick masonry. In case of plastering or painting is not required, the joints shall be struck flush and finished at the time of laying. The face of brick work shall be cleaned on the same day on which the brick work is laid and all mortar dropping a removed promptly.

Curing :

Brick work shall be protected from rain by suitable covering when the mortar is green. Brick masonry in cement mortar shall be kept constantly moist on all faces, for a minimum period of 7 days.

Scaffolding :

For brick masonry in buildings, single scaffolding shall be permitted. The inner end of the horizontal scaffolding pole shall rest in brick masonry by omitting one header brick in Header course. Such holes for scaffolding shall be filled and made good before plastering.

4.1 **Measurement** :

One brick thick masonry wall shall be measured in sq. meters, correct to two places of decimal. All openings in brick masonry work for doors, windows, ventilators and any other opening shall be deducted to get net quantity of actual brick work done. No deduction is to be made for opening upto 0.1 m^2. No separate payment shall be made for extra work involved in making opening, chases in wall for electrical inserts, conduits, etc.

Brick masonry exceeding 230 mm shall be measured in m^3 correct to two places of decimal. Other details of measurement remain unchanged as specified in the above para.

4.2 **Rate** :

The rate quoted for brick masonry work shall include the cost of material, wastage, labour involved in all operations described above, including transportation, overheads, profits, curing, tools, equipment, necessary scaffolding, raking out joints to receive plaster, opening, cutting out chases in brick work for fixing doors, windows, ventilators, switch boxes, conduits, etc. and making good, etc.

Rate is also inclusive of making pillars, pilasters, piers, coping, ledges, projections, if any. However, rate for works in foundations shall include all depth below plinth level, and superstructure shall include all operations for all heights above plinth level.

5.0 **HALF BRICK MASONRY** :

Half brick masonry shall be built by laying bricks with frog projecting at top in stretcher cources only. The mortar for the brick masonry shall be as specified in Schedule of Items. Cement, sand and water used in mortar shall conform to the quality as described in Concrete. Other detailed specifications for masonry work shall remain unchanged as described in para 4.0 above. It is mandatory to provide 115 mm x 115 mm horizontal R.C.C. stiffeners (Patli) at about 1\2.15 m from floor level or at door top level. The R.C.C. and reinforcement shall be paid separately as mentioned in the Schedule of Items. The deductions for stiffeners shall be made from brick masonry.

5.1 **Measurement** :

Half brick thick masonry shall be measured in sq. mtrs. Correct to two places of decimal. All openings in brick masonry work for doors, windows, ventilators and any other opening shall be deducted to get net quantity of actual brick work done. No deduction is to be made for opening upto 0.1 m^2. No separate payment shall be made for extra work involved in making opening, chases in wall for electrical inserts, conduits, etc. Deduction shall be made for stiffeners.

5.2 **Rate** :

The rate shall include the cost of materials and labour for all the operations described above.

6.0 **LIGHT WEIGHT CONCRETE BLOCK** :

Material :

The light weight block shall be of Siporex (India) manufacture or equivalent. The blocks shall have thickness of 200 mm, 150 mm, 100 mm for load bearing walls, partitions and cladding work, etc. The blocks shall have a maximum density of 640 kg / cu.m. or less.

Structural Strength requirement :

a) Compressive Strength : The light weight concrete block shall have a minimum compressive strength of 35 kg / sq.cm.

b) Bending Compression : 15 kg / sq.cm.

The mortar used for light weight concrete block shall be as specified in the Schedule of Items; Cement and water used in mortar shall conform to the quality as described in 'Concrete', whereas sand used for mortar shall be fine screened only. The cement mortar shall be admixed with Cemex (Snowcem India) powder at a rate of one packet (100 gms) per bag (50 kg) of cement.

The light weight concrete block masonry should not be used below ground or in plinth. The block masonry work shall be built in stretcher course only.

The light weight concrete block (Siporex or equivalent) wall or required thickness as described in Schedule of Items, shall be constructed with R.C.C. vertical and horizontal stiffeners, of required size at suitable intervals, as directed by the Engineer-in-Charge, or as per drawing.

R.C.C. and steel reinforcement shall be measured and paid for separately. The masonry work shall be raised truly in plumb. All courses shall be laid truly horizontal and all vertical joints shall be truly vertical. The vertical joints should be not more than 12mm thick and shall be fully filled from the top with cement mortar without any void in masonry. All face joints shall be raked out to a minimum depth of 15 mm. by raking tool, during the progress of the work, when the mortar is still green, so as to provide proper key for the plaster or pointing. All fixtures, pipes, outlets of water, holdfasts, of doors, windows, which are required to be built into the block masonry, shall be embedded in mortar or cement concrete, as specified, in correct position, as the work proceeds and as directed by the Engineer-in-Charge. After masonry work is over, the masonry shall be marked with date of construction, visible for inspection and curing.

Curing :

All joints of block masonry shall be kept constantly moist by sprinkling water on all joints for a minimum period of seven days.

Scaffolding :

Same as described in 4.0 of Brick masonry.

6.1 Measurement :

Light weight block masonry wall shall be measured in sq. metres correct to two places of decimal. All opening in masonry works for doors, windows, ventilators and any other opening such as R.C.C. stiffeners, shall be deducted to get net quantity of actual light weight concrete block masonry.

No deduction is to be made for opening upto 0.1 m^2. No separate payment shall be made for extra work involved in making openings, chases in wall for electrical inserts, conduits, etc.

6.2 Rate :

The rate quoted for block masonry shall include the cost of material, wastage, labour involved in all operations described above, including transportation, overheads, profits, cutting, tools, equipment, necessary scaffolding, raking out joints to receive plaster, opening, cutting and chases in masonry for fixing doors, windows, ventilators, switch boxes, conduit, etc. and making good.

Rate is also inclusive of making pillars, copings, ledges, projections, if any, and also to be inclusive of all operations for masonry work to be done at all levels.

II. STONE MASONRY

1.0 INDIAN STANDARDS :

1. IS : 1597 (Part I) - 1967 : Code of Practice for construction of Rubble Stone Masonry.

2. IS : 1200(Part IV) – 1976 : Method of measurement of building and Civil Engineering Works – Stone Masonry

3. IS : 1129 - 1972 : Recommendations for dressing of natural building stones.

The above mentioned IS Specifications and Codes of Practice have been indicated for general guidance.

However, these IS Specifications and Codes will be adopted only for those particular items in the contract where either the mode of measurement or detailed technical specifications are not laid down in the Tender.

2.0 UNCOURSED RUBBLE MASONRY :

Stone :

Stone shall be hard, durable, free from cracks, flaws, sand, holes, veins, patches of soft or loose material, etc. Stone shall be obtained from approved quarry.

Size of Stone :

Normally stone used should be small enough to be lifted and placed in position by hand. The length of stone shall not exceed three times the height, and the breadth on base shall not be greater than ¾ of the thickness of wall, but not less than 15 cm. The height of stone may be upto 30 cms.

Dressing :

Stone shall be hammer dressed on faces, the sides and the beds, to enable it to come into close proximity with the neighboring stone. The 'bushing' in the face shall not project more than 40 mm on exposed faces and 10 mm on a face to be plastered.

Mortar :

The mortar used for jointing shall be as specified, in the Schedule of Quantities. Cement, sand and water used in mortar shall conform to the qualities described in 'Concrete'.

Laying :

All stone shall be wetted before use. The base or bed shall be prepared before commencing masonry. The cement mortar of specified mix shall be spread over the base of minimum thickness 20mm. Every stone shall be carefully fitted to the adjacent stone so as to form neat and close joints. The 'bushing' more than 40mm for random masonry may be knocked off.

The hearting or interior filling of wall shall consist of rubble stones which may be of any shape but shall not pass through a circular ring of 150mm inner diameter. The thickness of these stones in any direction shall not be less than 100mm. This stone shall be carefully laid, hammered down with wooden mallet, into position and solidly bedded in mortar, chips and spalls of stone being used, wherever necessary to avoid thick mortar beds or joints.

The header stone shall be provided and paint marked 'H' on exposed face. The wall shall be constructed in true plumb and shall be roughly brought to the same level all along the construction of wall and where permitted, stepping shall not exceed one metre height at an angle of 450.

Bond Stones :

Bond or through stones shall be laid right through the thickness of walls. At least one bond stone or a set of bond stones shall be provided for every 0.50 m^2 of the wall surface. All bond stones in stone masonry shall be marked suitably as directed by the Engineer-in-Charge. In case the wall thickness is less than or equal to 60 cm., single through stone shall be provided. In case the wall thickness exceeds 60 cm., a set of two or more through stones overlapping each other by at least 15 cm. shall be provided in a line from face to back.

Where bond stone of suitable length is not available, cement concrete block of 1:3:6 (nominal mix) shall be used at no extra cost.

Quoins :

The quoins shall be of selected stones neatly dressed with the hammer or chisel to form the required angle, and laid header and stretcher alternately.

Joints :

Stones shall be so laid that all joints are fully packed with mortar and chips. The face joints shall not be more than 20 mm thick. Where plastering or pointing is not required, the joints shall be struck flush and finished at the time of laying only. Otherwise the joints shall be raked to minimum depth of 20 mm by raking tools, during the progress of work, when the mortar is still green.

Scaffolding :

For rubble masonry, single scaffolding shall be permitted. If required, additional one set of vertical support may be allowed. The support shall be sound and strong, tied together by horizontal pieces, over which the scaffolding plank shall be fixed. The inner end of horizontal scaffolding member may rest in holes provided in the masonry. However, no holes shall be allowed in piller under one metre in width or near skew back of arches. The holes left in masonry work for supporting scaffolding shall be filled and made good with cement concrete 1:3:6 (nominal mix).

Curing :

Masonry work shall be kept constantly moist on all faces for a minimum period of seven days.

2.1 Measurement :

The length, height and thickness shall be measured correct to cm. The thickness of wall shall be measured at joints, excluding the bushings. Only specified dimension shall be allowed and paid, anything extra shall be ignored. The quantity shall be calculated in cubic metre nearest to two places of decimal. However, no deduction shall be made nor extra payment shall be made for opening upto 0.1 sq.m. in area, water pipe holes, drain holes, or weep holes, gas pipe holes, cable entry holes.

2.2 Rate :

The rate shall include the cost of materials, wastage, labour involved in all operations described above, including transportation, overheads, profits, curing, tools and equipment, necessary scaffolding, raking out joints, pointing, etc. including dressing stone, bond stone, or cement bond stones, weep holes of required dia. as specified in items.

3.0 KERB AND CHANNEL STONES :

Kerb and Channel stones are provided on roads having raised berms for foot-path etc. These shall be selected hard stone, sound, durable, free from laminations and other structural defects. The length of each kerb and channel stone shall not be less than 49.5 cm. except that 29.5 cm long stones shall be permitted for closures and or curves. The other dimensions shall be 30 cm x 20 cm for kerb stones, and 30 cm x 10 cm for channel stones, unless specified otherwise. Kerb and channel stones shall be chisel dressed on exposed surface and edges. The dimensions of the exposed faces of kerb and channel stones shall be of size as specified with a tolerance of 10 mm in width and depth. In the case of kerb stones, a tolerance of 5 cm shall be allowed in the dimensions of unexposed back and bottom faces and in the case of channel stones, a tolerance of 10 mm shall be allowed in thickness.

Laying :

Trenches shall first be made a long the edge of the wearing course of the road to receive the kerb and the channel stones. The bed of the trenches shall be compacted to a firm and even surface and then the stones shall be set in cement mortar of specified proportion.

The kerb stones with top 20 cm wide, shall be laid with their length running parallel to the road edge, true in ine and gradient at a distance of 30 cm from the road edge to allow for the channel and shall project about 12.5 cm above the latter. The channel stones with top 30 cm wide shall be laid in position in camber with finished road surface and with sufficient slope towards the road gully chamber. The joints of kerb and channel stones shall be staggered and shall not be more than 10 mm. Wherever specified, all joints shall be filled with mortar 1:6 (1 cement : 6 coarse sand) and pointed with mortar 1:2 (1 cement : 2 fine sand) which shall be cured for 7 days.

The necessary drainage openings of specified sizes shall be made through the kerb as per drawings or as directed by the Engineer-in-Charge for connecting to storm water drains.

Finishing :

Berms and road edge shall be restored and all surplus earth, including rubbish etc., disposed off as directed by Engineer-in-Charge. Nothing extra shall be paid for this.

3.1 Measurement :

Length of the finished work shall be measured in running metre along the edge of the road, correct to a cm.

3.2 Rate :

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

4.0 STONE PITCHING :

The slope of filling shall be protected with stone pitching.

NOTE : When circumstances permit, one rainy season should be allowed to elapse after constructing the slope, to allow for consolidation before pitching is commenced.

Stone :

The stone to be good, hard, quarry or boulder stone such as will not weather on the surface. It is to be roughly hewn or squared with the hammer to ensure the stones fitting fairly one on the other, so as not to expose the earthwork below.

Laying :

The stones are to be laid with their broadest faces downwards and firmly bedded on a layer of murum, spalls (or gravel) at least 150 mm in thickness.

They are to be packed against each other with the hammer or mallet so as to fit closely for at least 75 mm in height and to lie generally perpendicular to the slope. No pinning is to be allowed between the sides of stones, and the use of chips should be confined to hollow and inequalities in the bed and for packing, after the stones are laid, on the surface, to form a uniform slope.

The surface packing should not be allowed to proceed till the previous work is inspected and approved.

Size of Stone :

The size of stone for pitching shall be not less than 200 mm x 230 mm in size on the face.

The topmost course shall consist of roughly dressed headers projecting 230 mm above the face of the pitching and shall be laid in a continuous level line.

Slope :

The face slope of the pitching when complete is to be that of the filling.

4.1 Measurement :

The length and width of the pitching shall be measured correct to a cm and the area shall be measured in sq.metres correct to two places of decimal.

4.2 Rate :

The rate shall include the cost of materials, wastage, labour involved in all operations, including transportation, overheads, profit, tools and equipment, scaffolding, curing, raking out joints, pointing, including dressing stone, bond stone (if required), cement concrete bond stones (if required), as specified in the item.

III. WOODWORK AND JOINERY

1.0 INDIAN STANDARDS :

1.	IS : 287 - 1993	: Recommendation for maximum permissible moisture contents for timber used for different purposes. (3rd Revision)
2.	IS : 1141 – 1993	: Code of practice for seasoning of timber (2nd Revision)
3.	IS : 1659 - 1990	: Blockboards (3rd Revision) (with Amendment No.1)
4.	IS : 1708 – 1986 (Part 1 to 18)	: Methods of testing of small, clear specimens of timber.
5.	IS : 2202(part I)-1991	: Plywood face panels for wooden flush door, shutters (solid core type) (5th Revision) (with Amendment No.1)
6.	IS : 2202(part II)-1983	: Particle board face panels for wooden flush door shutters (solid core types). (3rd Revision)
7.	IS : 4021 – 1983	: Timber door, window and ventilator frames (2nd Revision) (with Amendment No.1)
8.	IS : 401 – 1982	: Code of practice for preservation of timber. (3rd Revision) (with Amendment No.2)

The above mentioned IS Specifications and Codes of Practice have been indicated for general guidance.

However, these IS Specifications and Codes will be adopted only for those particular items in the contract where either the mode of measurement or detailed technical specifications are not laid down in the Tender documents.

2.0 TIMBER :

timber used under this section shall be (1) Teak wood (2) Hard wood of approved species (3) Sal wood (only where specified).

Moisture Content :

The maximum permissible limits of moisture content shall be from 10 to 16 percent for timber 50 mm and above in thickness, and 8 to 14 percent for timber less than 50 mm, for different regions as specified in IS : 287 – 1973.

As per IS: 287 – 1973, the country has been broadly divided into Four Zones, based on humidity variations, as follows :

Zone I : Average annual relative humidity less than 40 %

Zone II : Average annual relative humidity 40 to 50 %

Zone III : Average annual relative humidity 50 to 67 %

Zone IV : Average annual relative humidity more than 67 %

The maximum moisture contents of timber for various zones are as follows :

Climate Zones as per IS : 287 - 1973 :

	Zone-I	Zone-II	Zone-III	Zone-IV
	Moisture content percent of oven dry weight of timber.			
a) For joinery including frames, staircases, mouldings and other joiner's work, 50mm and above in thickness	10	12	14	16
b) Ditto, thinner than 50 mm.	08	10	12	14

A relaxation of 3 to 5% may be allowed upon local conditions, at the discretion of the Engineer-in-Charge. Where joints are strengthened by steel straps, bolts, etc., relaxation upto 7 ½% may be permitted.

Seasoning and Treatment :

All timber shall be well seasoned by a suitable process confirming to IS:1141 – 1973, before being planed to the required sizes. Sap wood, where permitted, and hard wood shall be treated with suitable preservatives as specified in IS:401 – 1982, Code of practice for preservation of timber (3rd revision). The finished components shall be given suitable treatment.

Defects Prohibited :

Timber shall be free from decay, fungal growth, boxed heart, pitch pockets or streaks on exposed edges, bore holes, splits and cracks.

Permissible Defects :

Second Class Individual sound knot and hard knot shall not be more than 40 mm dia and the knots shall not be more than 1.5% of the area of piece.

Pitch pockets or streaks are permissible except on exposed edges provided that they are clean and filled up with suitable putty or filler. When pitch pockets or streaks are located on the exposed edges of the core, they shall be cut out and filled with pieces of wood of similar species with grain running in the same direction. The piece shall be well glued.

It shall be generally free from sap wood but traces of sap wood shall be permitted.

Pint holes shall be permitted, provided they are filled.

Wormholes shall be permitted, provided they are not more than 10 mm in diameter and not more than one per member and provided such worm holes are plugged with similar timber in such a manner that the plugging merges with the surrounding area both as to colour and grain.

3.0 WORKMANSHIP FOR DOOR, WINDOW & VENTILATOR FRAMES

All members of frames of doors, windows and ventilators, etc. shall be at right angles, checked from the inside surfaces of the respective members.

All members of frames shall be straight without any warp or bow and shall have three exposed sides smooth and well planed and shall be at right angles to each other. The surface touching the walls may not be planed unless it is required in order to straighten up the member or to obtain the overall sizes within the tolerances referred to hereafter.

The frames shall be wrought, framed and fixed in position as per detailed drawings. Specified timber shall be used and it shall be sawn in the direction of the grains. Sawing shall be truly straight and square. The scantlings shall be planed smooth and accurate to the full dimensions, rebates, roundings and mouldings as per detailed drawings.

Joinery :

Frames of timber doors, windows and ventilators shall have dove-tailed joints.

The jamb post shall be through and tenoned into the mortices of the transome to the full width t\of the transome and the thickness of tenon shall be closely fitted into the mortices and pinned with corrosion resisting metal pins, not less than 8 mm diameter or with hard wood or bamboo dowels not less than 10 mm dia. For internal/unexposed joinery work, the joints shall be glued and similarly pinned. The depth of rebate in frames for housing the shutters shall be 15 mm.

Surface Treatment :

Woodwork shall not be painted, oiled or otherwise treated before it has been approved by the Engineer-in-Charge. All portions of timber abutting against masonry or concrete or embedded in ground and all joints shall be painted with approved wood primer, boiling coal tar, creosote, solignum or equivalent approved anti-termite solution as directed by the EIC.

Glueing of Joints :

The contact surfaces of tenon and mortice joints shall be treated before putting together with an adhesive of make approved by the EIC.

Dimensions of Frames – Tolerances for :

The finished dimensions of timber sections in frames for doors, windows, and ventilators shall be as specified in description of items and shall be subject to a general tolerance of (+) 3mm or (-) 2 mm.

Holdfast :

Holdfast shall be made from M.S. flat of size 225 mm x 40 mm x 3 mm unless otherwise specified. Length of 5 cm at one end shall be bent at right angles and this portion will have two holes for fixing the same to the door frame and with screws. The hold-fast at its other end, shall be forked, bent, if required and embedded in cement concrete block of specified size or 75 mm x 115 mm x 230 mm size, if not specified.

A minimum number of 3 holdfasts shall be fixed on each side of door and window frames, where height of frame is one metre and above; one at the center point and other two at 30 cms from the top and bottom of frames. In case of window and ventilator frames whose height is less than one metre, two holdfasts on each side shall be fixed at quarter points of the frame.

Sampling :

All frames selected in the sample shall be inspected for material dimensions, tolerances, workmanship and finish as per IS : 4021-1983.

Finish :

All surfaces of door, window and ventilator frames which are required to be painted ultimately shall be covered evenly by brush painting with a priming coat of a wood primer, or as specified.

Fixing in Position :

No frame shall be fixed in position unless it is inspected and approved by the EIC or his representative at site. The frame shall be secured to alls or columns, as the case may be, with metallic fastners or M.S. holdfasts.

The vertical members of door frames shall be embedded in the flooring to its full depth. The door frames, while being placed in position, shall be suitably strutted and wedged to prevent warping during construction.

In case of wooden scantling for posts, trusses, rafters, purlins, etc. the fixing shall be done by clamps, bolts and nuts, spikes, as directed by EIC. In case of the last alternative, the large nail with a cap shall be driven through about 40 mm beyond the wooden members, to be fixed together and the end of the nail turned back so as to ensure proper fastening. Wherever making up the length is necessary, it may be done by half lap joints secured together with 50 mmx 6 mm M.S. clamps of suitable length and shape fixed with bolts and nuts.

T.W. work in framing of false ceiling, roofing, wall paneling or any other location, not directly exposed shall be done as mentioned above, except that the scantlings need not be planed.

3.1 Measurements :

Wrought (planed) and framed woodwork shall be measured for finished dimensions. No allowance shall be made for wastage and for dimension supplied beyond those specified. Length of each piece shall be measured overall to the nearest centimeter, so as to include projections for tenons, scarves and mitres. Width and thickness shall be measured to the nearest millimeter. Cubical contents shall be worked out in cu.m. correct to three places of decimal.

In case of mouldings, roundings, rebates, circular and varying sections, the sectional area of the piece shall be taken as the area of the least square or rectangle from which such a section can be cut.

The rate includes the cost of materials, labour involved in all the operations for complete work as described and specified and shall be inclusive of preservatives applied, hinges, holdfasts and concrete block embedding them, in case frames of door, window, ventilator, etc.

In case of wooden scantlings in posts, trusses, rafters, purlins, etc. the rate shall be inclusive of half lap joints with 50 xx x 6mm M.S. clamps, bolts, nuts, nails, spikes, etc.

4.0 PANELLED, CLAZED OR PANELLED AND GLAZED SHUTTERS :

The work shall be carried out as per detailed drawing. The wooden members shall be planed smooth and accurate. They shall be cut be the exact shape and size without patching or plugging of any kind. Mouldings, rebates, roundings, etc. shall be done as shown in the drawing, before the pieces are assembled into the shutter.

Joinery Work :

The thickness of the stiles and rails shall be specified for the shutters. The minimum thickness of the panels shall normally be 15 mm where the clear width of panel is not more than 300 mm and 20 mm where the clear width of the panel is more than 300 mm. Solid wood panel for door and window shutters shall be made out of one or more strips of timber planks of not less than 125 mm width. Strips of not more than 200 mm width will be used to reduce chances of warping, splitting or other defects. The timber strips shall be joined together with continuous tongue and grooved joints, glued together and reinforced with metal dowels. The groovings of the solid panel shall normally run along the longer dimensions of the panel unless otherwise directed. The corners and edges of panels shall be finished as shown in the drawing and these shall be further tongued into stiles and rails. Sash bars shall have mitred joints with the stiles.

Stiles and rails of shutters shall be made out of single piece. Lock and intermediate rails exceeding 200 mm in width may be made out of one or more pieces of timber, but the width of each piece shall not be less than 75 mm. Where more than one piece of timber is used, they shall be jointed with a continuous tongue and grooved joint glued together and reinforced with metal dowels (rust proof) at regular intervals of 20 cm or pinned with not less than three 40 mm rust proof pins of the lost head type. The tenons shall pass clear through stiles at least 3/4th of the width of stile. The stiles and rails shall have a 12mm groove to receive the panel. In case of the double shutters, the rebate at the closing junction of the two shutters shall be of depth not less than 2 cm.

Tolerance :

The finished work, with a tolerance of ± 1mm n thickness and +3 mm and –2 mm in width of stiles and rails shall be acceptable. The rates for shutters are based on the dimensions of various components or parts, as furnished below, unless otherwise mentioned.

a) **Framed & Panelled Shutters** :

1. Bottom and middle or lock rail : 160 to 250 mm wide
2. Other stiles and rails : 100 to 120 mm wide
3. Mullions : 100 mm wide
4. Panels, flat on both sides : 12 mm thick
5. Panels raised on one side : 20 mm thick
6. Panels raised on both sides : 25 mm thick

b) **Fully glazed shutters for windows, ventilators, etc** :

1. Stiles and rails	: 60 to 80 mm wide
2. Mullions	: 60 mm wide
3. Glazing bars	: 30 to 40 mm wide
4. Rebates for glazing	: 10 to 15 mm x 5 to 10 mm.

c) **Partly glazed shutters** :

1. Stiles and rails, etc.

d) **Louvered Shutters** :

1. Stiles and rails etc.	: as per (a) above
2. Louvers	: 10 to 15 mm thick

Beading :

Timber, plywood, hardboard and particle board panels shall be fixed only with grooves. In the case of glass, asbestos, mesh panels, beading shall always be provided without groves, the beading being on one side, the other side being supported by rebate from stiles. For external doors/windows, shutters, beading shall be fixed from the inside.

Fittings :

The cost of providing and fixing shutters shall include the cost of hinges, screws as specified in item/ standard drawing. All other fittings shall be measured and paid as specified or described elsewhere.

4.1 Measurements :

Woodowork and joinery work shall be measured in square metres. Length and width of unfinished opening shall be measured to the nearest 0.01 m.

Areas shall be worked out to the nearest 0.01 m^2. All work shall be measured net as fixed, that is, no extra allowance in measurement shall be made for shape, joints, etc. However, where the dimension as fixed exceeds the specified dimensions only, the specified dimension(s) shall be measured if within tolerance limits permitted; and where one or more dimension(s) of the piece, as fixed, is less than the specified dimensions and is accepted by the EIC, then the actual dimensions will be measured.

Items shall include: (1) Supply of specified species of timer, sawn to requisite sizes without any defects, wrought, framed and fixed in position with the required standard of workmanship including supply and fixing of fixtures, straps, bolts, holdfasts, spikes, nails, screws, etc. applying glue or other jointing materials, coal-tarring or any other methods; embedded parts, glazing and supplying and fixing of all specified fittings.

2) All materials, labour, scaffolding, use of equipment, etc. for framing and fixing and completing the items as specified.

4.2 **Rate** :

Rate shall include the cost of materials and labour involved in all the operations described above for complete work.

5.0 **WOODEN FLUSH DOOR SHUTTERS** : **(SOLID CORE TYPE)**

Types :

Solid core flush door shutters may be of the decorative type or non-decorative paintable type.

`**Nature of Construction** :

CORE	**TYPE**
i) Blockboard	a) Decorative b) Non-decorative
ii) Particle board with or without blockboard	a) Decorative b) Non-decorative

The Specification in general shall conform to IS:2202 (Part-I) – 1983. Nominal thickness of shutters shall be 25, 30, 35 mm or 40 mm as specified.

Tolerances :

Tolerances on nominal width and height shall be ± 3 mm and tolerance on nominal thickness shall be ± 1.2 mm. The thickness of the door shutters shall be uniform throughout with a permissible variation of not more than 0.8 mm when measured at any two points.

For stiles, rails and lipping, only non-coniferous timber (hardwood) specified in Group 2 of Appendix 'A' of IS : 2202 (Part I) – 1983 shall be used.

The moisture content in timbers used in the manufacture of flush door shutters shall not be more than 12%, tested according to IS : 1708 – 1986.

Adhesives :

Adhesive used for bonding cross- band and plywood to core and face veneers to cross band, shall be phenol formaldehyde synthetic resin conforming to B.W.P. type specified in IS : 848 – 1974. Specification for synthetic resin adhesives for plywood (Phenolic & Aminoplastic (First Revision)).

Construction :

Blockboard core shall conform to the requirements of IS : 1659-1979. A wooden frame constructed of stiles and rails of well seasoned and treated wood shall be provided for holding the core. The width of the members shall not be less than 50 mm and not more than 100 mm. Alternatively, the core shall be of solid board with slots extending for about two third depth and at approximately 20 mm spacings. The slots shall be made alternatively on two faces of board.

Particle board core with or without Blockboard : The core shall be either particle board or a combination of blockboard and particle board. In a combined construction, the width of blockboard construction shall extend at least 150 mm from inner edge of the stile, on the rest shall be particle board. The particle board shall be either of flat pattern pressed type or extrusion type.

Particle board core : the particle board core shall be either of flat pattern pressed type or extrusion type. The frame for holding the core shall be as specified above.

Lipping : Lipping shall be provided internally as specified. Lipping when provided, may be internal and designated as edge-band or external as specified. Joints shall not be permitted in the lipping.

Edge-band i.e. internal lipping shall have a total depth of not less than 25 mm. Edge band may be provided separately, when its species is different from that of backing or as one piece with the stile, designated as frame-cum-lipping, when edge-band and backing are of the same species.

External lipping, where provided, shall be solid and shall measure at least 6 mm on the face of the door.

Rebating :

In case of double leaved shutters, the meeting of the stiles shall be rebated by one third the thickness of shutters. The rebating shall be either splayed or square type. Where lipping is provided, the depth of lipping at the meeting of stiles shall not be less than 35 mm.

Face Panel :

The face panel shall be formed by glueing, by the hot press process, on both faces of the core, either plywood or cross bands or face veneers. The thickness of the cross bands or of the plywood shall be between 1 mm and 3 mm.

The thickness of the face veneer or of the plywood shall be between 0.5 mm and 1.5 mm for commercial veneers and between 0.5 mm and 1.0 mm for decorative veneers. The combined thickness of cross bands and face veneer shall not be less than 2.5 mm. The plywood conforming to these requirements shall be glued under pressure on both of the core. When the panel consists of cross bands

and face veneers glued separately, the cross bands shall be laid with their grains at right angles to those of the core and glued to both its faces. Face veneer shall then be laid with their grains at right angles to those of the cross bands. Application of a decorative face veneer on a finished face panel, having veneer in the same direction as the proposed veneer shall be avoided.

Opening of Glazing :

Where specified or otherwise shown in the drawing, opening for glazing shall be provided. The opening shall be 25 cm in height and 20 cm. in width, unless otherwise directed. The bottom of the opening shall be at a height of 140 cm. from the bottom of he shutter. Opening for glazing shall be lipped internally with solid timber.

Opening of Louvres :

Where specified, or otherwise shown in the drawing, opening for louvre shall be provided. The height of the opening shall be 30 cm from the top of the bottom rail unless otherwise directed. The width of the opening shall be as directed, but in no case this shall extend beyond vertical stiles of the shutter.

Provision for fixing locks :

Shutters shall be shop prepared for taking mortice locks or latches as may be specified or directed. Suitable blocks of wood may be provided for fixing the hardware. The sizes of blocks shall preferably correspond to the maximum size of lock.

Workmanship & Finish :

All the four edges of the door shutter shall be square. The shutter shall be free from twist or warp in its plane.

Both faces of the door shutter shall be sanded to a smooth even texture.

Workmanship and the finish of the face panels shall be in conformity with those specified in IS : 303 – 1975 for non-decorative type and IS : 1328-1979 for decorative type.

Tests :

End immersion Test :

Door shutters shall be tested for resistance of their base to immersion in water as follows :

The door shutter shall be immersed vertically to a height of 30 cm in water at room temperature for 24 hours and then allowed to dry for 24 hours at $27^{o}C + 2^{o}C$ and relative humidity of 65 ± 5 percent. The cycle shall be repeated eight times. There shall be no delamination at the end of the test.

Sample Size & Criteria for Conformity :

No. of shutters In a lot	No. of Shutters to be tested	Permissible no. of defective Shutters	No. of shutters tested for end immersion test & glue adhesion test
11 to 25	4	0	1
26 to 50	8	0	2
51 to 100	13	1	2
101 to 150	20	1	3
151 to 300	32	2	5
301 to 500	50	3	8
501 & above	80	5	13

For a lot of 10 shutters and less, no testing is required.

Fittings :

The coat of providing and fixing shutters shall include the cost of brass oxidized hinges and necessary M.S. screws for fixing the same. All other fittings shall be measured and paid for separately, unless specified or described.

5.1 Measurements :

a) Length and width of the shutters shall be measured to the nearest centimeter in closed position, covering the rebates of the frame but excluding the gap between the shutter and the frame. Overlap of two shutters shall not be measured. All work shall be measured net as fixed.

b) Length and width of the vision panel and louvre panel shall be measured inside of lipping correct to a cm. and area in sq.m. correct to two places of decimal.

c) No deduction in the measurement of shutters will be made for the openings made in the shutter for fixing vision panel or louvre panel.

5.2 **Rate** :

Rate shall include the cost of materials and labour involved in all the operations for complete work. For vision panel and louvred panel, where provided, it shall also include the cost of lipping.

5.0 **CELLULAR & HOLLOW CORE TYPE – DECORATIVE, COMMERCIAL** :

These shall generally confirm to Indian Standard Specifications IS : 2191 (Part I) - 1973 and IS : 2191 (Part II) – 1966 and the core shall be cellular or hollow, bound by timber frame.

Core :

The core shall be one of the following types :

a) **Cellular Core** : shall be any of the following types :

Type A : Particle board conforming to IS:3087-1965, hardboard conforming to IS:1658-1966. Wooden or plywood battens, tubular strips of blocks or batten strips of not less than 25mm width, so fixed that each of the voids formed, does not exceed 25 cm^2 in area and volumetric contents of the voids do not exceed more than 50 percent of the total core volume i.e. when measured from edge to edge.

b) **Hollow Core** :

Timber frame of well seasoned and treated good quality wood shall be constructed from stiles and top, bottom and two intermediate rails, each not less than 75 mm wide. In each segment , battens not less than 25mm wide shall be fixed in such a way that the voids are equally distributed and the void area in any segment is less than 500cm^2 . Battens may be replaced by suitable rolls or strips or strips of veneers. Stiles and rails of shutters shall be made out of one piece or alternatively, two or more pieces suitably fastened together.

Face Panel :

The plywood, forming the face panel, shall not be less than 3 mm in thickness in the case of cellular core shutter and not less than 6mm in thickness in case of hollow core shutters, except for 25mm thick door in which case 4mm thickness may be permitted. Two ply face skin construction in a combination of cross-band and face veneers may also be adopted in which case, the combined thickness shall not be less than 4mm. The thickness of face veneers in the plywood shall be between 0.5mm and 1.5 mm for commercial veneers and between 0.5 mm to 1.00 mm for Decorative veneers. The plywood face skin assembly conforming to these requirements shall be glued under pressure on both faces of the core.

7.0 PANELLED PARTITION :

Frame work shall be measured and paid for separately, unless otherwise mentioned or specified.

The panelling will be wooden, glazed, asbestos sheet, hard board, particle board or as specified. These shall be fixed in the rebate of the frame work or over the frame work, as described or shown in drawings or as per the instructions of the Engineer-in-Charge.

7.1 Measurements :

The width and the height of the partition shall be measured out to out of the frame work on which panelling is done, correct to a centimeter and the area worked out correct to two places of decimal.

7.2 Rate :

Rate shall include the cost of materials and labour required for all the operations for complete work.

8.0 LOUVRED WINDOWS :

The louvres shall be of wood, glass, asbestos cement sheet or any other material as specified.

Fixing :

The louvres shall be fixed in grooves of minimum 12mm depth, made in frame (provided and paid separately). The louvre blades shall slope down towards the outside at an angle of 45^{o} unless otherwise shown on drawings. These shall overlap each other by about half their widths unless otherwise shown in drawings.

The louvres shall be fixed in grooves of minimum 12mm depth, made in frame (provided and paid separately). The louvre blades shall slope down towards the outside at an angle of 45^{o} unless otherwise shown on drawings. These shall overlap each other by about half their widths unless otherwise shown in drawings.

8.1 Measurements :

The width and height of the clear opening in the frames in which the louvres are fixed shall be measured to the nearest centimeter and the area calculated in sq.m. correct to two places of decimal.

8.2 Rate :

The rate is inclusive of the cost of materials, labour required for all operations described above for complete work, including making grooves in wooden frames for fixing louvres.

9.0 WOODEN LOUVRED SHUTTERS :

Specified timber shall be used. It shall be sawn in the direction of the grains. Sawing shall be truly straight and square. The timber shall be planed smooth and accurate to full dimensions, rebates, roundings and mouldings as shown in the drawings made before assembly.

Stiles and rails shall be as for paneled, glazed o paneled and glazed shutters. Louvres shall be as for louvred window.

Tolerance :

The tolerance in thickness shall be ± 1 mm, and width of battens +3mm, - 2 mm.

9.1 Measurements :

The length and breadth of shutters shall be measured correct to a cm and the area in sq.m., correct to two places of decimal.

9.2 Rate :

The rate shall include the cost of materials and labour involved in all operations required for complete work.

10.0 WIRE GAUZE FLYPROOF SHUTTERS :

Specified timber shall be used, and it shall be sawn in the direction of the grains. Sawing shall be truly straight and square. The timber shall be planed smooth and accurate to full dimensions, rebates, roundings and mouldings as shown in the drawings

Stiles and rails shall be as for paneled shutters, glazed shutters and shall be given rebate to receive the wire gauze, which forms the panels.

Wire gauze shall be galvanized M.S. wire and shall be of 0.56 or 0.71 mm diameter as specified. The wire gauze shall be bent at right angles in the rebates of stiles and rails, turned back and fixed tight with blue-tacks at about 75mm centers, fixed alternately in two faces of the rebates. Over this wooden beading 60mm x 20mm shall be fixed with small screws at about 75mm centers. The space between the beading and rebates, where wire gauze is bent shall be neatly finished with putty to cover the end of wire gauze.

10.1 Measurements :

The measurement shall be as for door and window shutters, length and breadth of shutters being measured correct to a cm. and area in sq.m. correct to two places of decimal.

10.2 Rate :

The rate shall include the cost of materials and labour involved in all the operations for complete work, including painting/ polishing and hardware as specified in the item.

NOTE **:** The following items are included in other sub-heads of specifications:

i) Brass chrome plated/oxidized hinges.

ii) M.S. grills for windows, fan lights, verandah and MS grill doors

iii) Expanded metal

iv) Hard drawn steel fabric.

IV. IRON, STEEL AND ALUMINIUM WORK

1.0 INDIAN STANDARDS :

1.	IS : 1038 – 1983	:	Steel Doors, windows and ventilators.
2.	IS : 1948 – 1961	:	Aluminium doors, windows and ventilators.
3.	IS : 1200 (Part VIII) - 1993	:	Method of measurement of building and Civil Engineering Works – Steel Work and Iron Work.

The above mentioned I.S. Specifications and Codes of Practice have been indicated for general guidance.

However, these I.S. Specifications and Codes will be adopted only for those particular items in the contract, where either the mode of measurement or detailed technical specifications are not laid down in the tender documents.

2.0 COLLAPSIBLE STEEL SHUTTERS/ GATES :

These shall be double or single shutters depending upon the openings. These shall be made out of vertical double channels 20 mm x 10mm x2mm or 18mm x 8mm x 3mm at maximum 125 mm apart when fully stretched as specified, braced with flat iron diagonals 20mm x 5mm or 18 mm x 5 mm as specified in the item. The top and bottom rails shall be of M.S. section 40mm x 40mm x 6mm with 38 mm dia rollers in every fourth double channels.

Where collapsible gate is to be fixed within the opening but is fixed along the outer surface of opening; the M.S. section at top shall be replaced by M.S. flat 40mm x 10mm.

The necessary fittings such as bolts, nuts, locking arrangements, stoppers, handles, etc. shall be provided. The gates shall open and close smoothly and easily.

T-iron rails shall be fixed to the lintel and floor with masonry nails embedded in cement concrete of lintel and floors at suitable spacing. The bottom runner shall be embedded with floor and proper groove formed and the floor shall be made good to match the rest of the flooring.

At the sides, the end double channels shall be fixed with T-iron rails and also by holdfasts 200mm x 40mm x 4 mm bolted at one end to the end double channels and in the masonry in cement concrete 1:2:4 (nominal mix) blocks of size 115 mm x 75 mm x 230 mm, 3 nos. each side. The side masonry shall be made good to match the rest of the masonry finish.

2.1 **Painting** :

One coat of red oxide zinc chromate primer and two coats of synthetic enamel paint of approved make, quality, colour and shade as approved by the EIC, shall be applied to all steel work as per specifications in relevant section under sub-head Structural Steel.

2.2 **Measurements** :

The height of the gate shall be the height of the double channels and breadth from out to out of the end fixed double channel in open position of the gate. The height and breadth shall be measured correct to a cm. and the area worked out in sq.m. correct to two places of decimal.

2.3 **Rate** :

The rate shall include the cost of all materials and labour involved in all operations including providing and fixing holdfasts, cement concrete 1:2:4 (nominal mix) blocks, cutting in wall and floor, providing groove in floor, making good to match wall, floor and painting etc.

3.0 **ROLLING SHUTTERS** :

Rolling shutters shall be obtained from manufacturers such as Swastik, Shubhdwar, Sentinel or other equivalent quality and approved by the EIC. Shutters upto 12 sq.m. shall be push and pull type. Shutters exceeding 12 sq.m. shall be provided with gears operated by mechanical devices with chain and/or handle or shall have electrically operated arrangement as specified. Rolling shutters of 8 sq.m. or beyond shall be provided with ball bearings. The width and thickness of M.S. lath shall be 80 mm and 1.25 mm.

The shutters shall be of length and width as specified. The spring shall be preferably of coiled type and shall be manufactured from high tensile spring steel wire or strip of adequate strength to balance the shutters in all positions. The spring pipe shaft etc. shall be supported on strong mild steel brackets.

Guide channels shall be of mild steel deep channel section and of rolled, pressed or built-up construction. The thickness of sheet shall not be less than 3.15 mm (10 gauge). The thickness of sheet shall not be less than 3.15 mm (10 gauge). The depth of side channels shall be 60 mm for clear shutter with width upto 3.0 m and 75 mm for width 3.0 m and above. The gap between two legs of guide channel shall be close enough to prevent rattling due to wind and wide enough for free movement of shutters.

Guide channels, each shall have 3 fixing cleats spaced at not more than 0.75 m. Cleats shall be fixed to walls or RCC work with bolts or screws. The guide channels shall be fixed to the jambs either (a) embedded in grooves (b) projecting or (c) overlapping, as directed by the Engineer-in-charge. Any cutting to side walls shall be made good after fixing of cleats/lugs.

The cover of shaft etc. shall be of the same gauge material as laths.

3.1 Measurements :

The clear width and clear height of the opening (on which rolling shutter is fixed) shall be measured to a mm. The clear distance between he jambs of the opening shall be the clear width, and the clear distance between finished floor or sill, to the bottom of lintel shall be the clear height. The area shall be worked out in sq.m, correct to two places of decimals.

The electrically operated arrangement carried out as per the item description shall be measured in numbers.

3.2 Rate :

The rate shall include the cost of material and labour involved in all the operations described, including the cost of top cover and spring, one coat of primer and two coats of synthetic enamel paint. It shall also include the cost of providing and fixing ball bearings and mechanical devices of gear/ chain and crank operations, electrically operated arrangements where specified in the items.

4.0 M.S.SHEET SLIDING SHUTTERS :

These shall be fabricated from M.S. sheets of 18 gauge and manufactured as per drawings, of sizes as required.

The shutters shall be single leaf or double leaf shutters as specified or as per drawings.

The shutters shall have M.S. angle frame and diagonals out of 40mm x40 mm x 6 mm angles or as specified, welded with 10 gauge gusset plates at junctions to form a rigid frame. M.S. sheet of 18 gauge or as specified shall be fixed to the frame with rivets.

Top and bottom guide rails shall be out of M.S. Angle or T-iron 40mm x40 mm x 6 mm angles or as specified and 25mm dia. pulleys or 25 mm dia. ball bearings at bottom and guide block with steel pulleys at top. Guide rails shall be continued along walls on both ends to enable the shutters to give full openings. The necessary fittings, locking arrangements, handles, stoppers, holdfasts, concrete blocks for embedding holdfasts, etc. shall be provided.

The floor shall be cut and a uniform groove of required size shall be formed and guide rails fixed with Anchor bolts, and the floor along the groove made good to match the rest of the floor. The top steel section shall be fixed with suitable supports from the walls. Channel sections shall be fixed at the end to stop the sliding shutter at the extreme end. Any damage to walls, sides, etc. shall be made good at no extra cost to match the existing finish.

All members shall be cleaned of rust, scales, grease, etc. and one coat of red oxide zinc chromate primer and two coats of synthetic enamel paint applied as per the specifications.

4.1 Measurements :

The height shall be measured out to out of guide rails correct to a cm. and width out to out of shutter and the area shall be worked out in sq.metre correct to two places of decimal.

4.2 Rate :

The rate shall include the cost of all material including cement and labour involved in all operations described, including the cost of full length of guide rails, fixtures and fittings, welding, painting, making good flooring, side walls, etc.

5.0 M.S. SHEET DOOR :

These shall be manufactured as per the drawings and specifications and fabricated out of M.S. Sheet and angle iron.

The door shall be of required sizes and double leaved as shown in drawing or as directed. The size of frame members, diagonal supports and gauges of sheet and gusset plates shall be as specified or as shown in the drawing. The frame shall be welded at junctions.

Cleats out of 40 mm x 10 mm flat shall have vertical leg of 150 mm fixed with frame and horizontal leg 50mm provided with a hole of 24 mm dia. and fixed in the projected pin clamp. Two cleats per shutter upto 2.4 m height shall be provided.

The shutter shall be fixed to masonry with four pin clamp per shutter of height exceeding 2.4 m. Pin clamps shall be out of 50 mm x 6 mm x 450 mm long. One end shall be embedded in block of 40 cm x 20 cm x 20 cm of cement concrete 1:2:4.

The shutter shall be provided with locking arrangements, two handles of shape and pattern approved by the EIC, hooks and eyes 45 cm long 10 mm dia. A cement concrete 1:2:4 block of 15 cm x 10 cm x 20 cm shall be provided in the floor where the two shutters meet to stop the shutters opening inside, all as directed by the EIC.

5.1 Painting of surface :

Painting with one coat of red oxide zinc chromate primer and two coats of synthetic enamel paint shall be carried out as per the specifications.

5.2 **Measurements** :

The height and width shall be measured correct to a cm. out to out of shutter and area shall be worked out in sq.metre correct to two places of decimal.

5.3 **Rate** :

The rate shall include the cost of all materials and labour involved in all operations including the concrete blocks for cleats in masonry and in floor blocks, hooks and eyes, making good masonry and floor, painting, etc.

6.0 **M.S. WICKET GATE IN ROLLING SHUTTERS** :

These shall be manufactured with M.S. members of sheet of sizes and as per the details shown on the drawings and fixing in position all fittings required such as hinges, locking arrangements, etc. shall be provided. Painting shall be carried out as per the rolling shutters.

6.1 **Measurements** :

The measurements shall be the clear opening of height and width in the rolling shutter for the wocket gate measured out to out of frame correct to a cm. and the area worked out in sq. metre correct to two places of decimal.

6.2 **Rate** :

The rate shall include the cost of all materials and labour involved in all operations required, including cutting, opening in rolling shutters.

7.0 **M.S. GRILL WORK IN ROLLING SHUTTERS** :

These shall be manufactured with grill made out of 8mm dia M.S. rounds bent to required shape and connected by means of flat iron 20mm x 6mm as shown on the drawings and fixed in the rolling shutter. The painting shall be carried out with one coat of Red Oxide zinc chromate primer and two coats of synthetic enamel paint of approved quality, make, colour and shade.

7.1 **Measurements** :

Measurements shall be in sq.metres correct to two places of decimal. The height and width shall be measured to the outside of grill bar correct to a cm.

7.2 **Rate** :

The rate shall include the cost of materials and labour for all the operations involved, including where required, cutting, opening in rolling shutters, painting, etc.

8.0 STEEL DOORS, WINDOWS, VENTILATORS AND COMPOSITE UNITS :

Steel doors, windows, ventilators and composite units shall be manufactured as per IS : 1038-1983 using rolled steel sections of the weights specified in IS: 7452-1982. It shall be fixed side hung, top hung, bottom hung or center hung as specified and/or shown on drawings. The steel shall be of S.T. 32- 0 grade, conforming to IS : 1977-1969.

SIZE :

The sizes, types, position of steel doors, windows and ventilators shall be as shown on drawing and/or as directed by the EIC. External doors shall have thresholds. The actual size of doors, windows, ventilators shall not vary by more than 1.5 mm from those given in the drawings.

The various sections to be used shall have the weights as specified in the relevant Indian Standard Code IS : 7452-1982. Generally the weight shall not be less than :

Glazing bars	:	a) 0.306 kg/m b) 0.334 kg/m c) 0.363 kg/m
Mullion bar	:	2.280 kg/m
Ventilator bar	:	1.800 kg/m
Outer bar for ventilators	:	2.300 kg/m
Frame bar ventilator	:	1.419 kg/m
Inside Frame	:	1.550 kg/m
Outside Frame	:	1.920 kg/m
Mullion coupling bar	:	2.300 kg/m
Transome coupling bar	:	1.800 kg/m
Fabricated weather bar	:	1.600 kg/m

Fabrication :

Fixed and opening frames shall be cut to the length and mitred. Corners of the frames shall be welded properly. Frames shall be rectangular and in one plane.

Doors :

The hinges shall be of 50mm projecting type or non-projecting type as approved by the EIC. The hinge pin shall be of electro galvanized steel. Door handles shall be of type and size as approved by the EIC.

A latch lock openable from both sides shall be provided. In case of double doors, the first closing shutter shall have a steel bolt at top and bottom of approved type.

Windows :

a) For fixed windows, the frame shall be fabricated as above.

b) Side hung and top hung windows and ventilators: slots shall be cut in the fixed frames and hinges inserted and welded. Hinges shall be projecting type 25mm to 65mm wide. Hinge pin shall be of galvanizes steel. Hinges for shutter frame shall be fixed in the same way or hinges riveted in the holes made in shutter frames. Friction hinges of approved type shall be provided if specified. For side hung window, the brass oxidized fastener shall be used and shall be mounted on steel plates. The handle plate shall be fixed by riveting or screwing before the glazing work is done and should not be easily removable after glazing. The handle shall have arrangement to keep the shutter fully closed or slightly open. The rotation of handle should not cause the unscrewing of the pin. If friction hinge is not provided, brass oxidized peg stays of approved type shall be provided with holes in three positions.

c) Centre hung windows/ ventilators: These shall have two pairs of brass cup pivots riveted to shutter frame and ventilator/ window frame for swing of about 85^{o} with necessary fixture and fittings. An oxidized steel spring catch shall be provided for operation of the ventilator shutter, with a pulley and chord.

Composite Unit :

These are combination of units of doors, windows, ventilators, coupled with coupling sections, manufactured from 16.mm thick M.S. plate, all as per drawings and as directed. Mastic shall be provided between the junction of the framed and couplings to make the composite unit waterproof.

Finishing :

All steel surfaces shall be cleaned of rust, scale, dirt, grease, oil, etc. They shall be treated with rust proofing by hot dip, zinc spray or electro galvanized process and priming coat of approved red oxide zinc chromate primer as specified or directed. After the doors, windows, ventilators, composite units, etc. are fixed in position, two coats of synthetic enamel paint of approved make, quality, colour and shade shall be applied.

Fixing :

Necessary openings in the masonry with minimum specified clearance between openings and units frame shall be provided and frames fitted afterwards. Necessary number of holes shall be made in the masonry and lugs of sizes 15mm x 3mm x 100 mm long shall be fixed in cement concrete block 1:2:4 (nominal mix) (1 cement : 2 sand : 4 metal aggregate of 20mm nominal size)75mm x 115mm x 200mm. The necessary cutting in masonry shall be made and concrete block cast. The masonry surface shall be made good to match the rest of the masonry finish. The frames shall be fixed to the lugs with 20mm long x 6.3 mm dia. G.I. counter sunk machine screw and nuts. The cozing mastic shall be cleaned and flush pointed and the filled up gap shall be rendered waterproof.

When fixing with R.C.C. work opening where lungs cannot be provided, approved metallic fasteners shall be fixed and frame fixed with 60mm galvanized screws of designation 10.

When fixing in wood work opening, approved mastic or rubber lining shall be applied be jambs, sill and channel, before fixing in position. The frame shall be fixed to the openings with 60mm galvanizes screws of designation 10. The gap between opening and frame shall be covered with timber fillet of hardwood around the frame.

When fixing in steel work opening, metallic mastic shall be applied as per clause above, before fixing the frame in position and M.S. or hardwood fillet all around the frame. The frames or composite unit is fixed to the opening with fixing clips or with nuts and bolts as shown on drawings or as directed by the EIC.

For composite units, the mullions and transoms shall be bedded in mastic which shall be applied liberally to the channels or frames before assembly and after coupling.

Precaution should be taken to ensure that the steel doors, windows, etc. are not deformed during the construction and no scaffolding shall be tied or rest on their members.

All fittings and projecting hinges shall be protected from damage during construction.

8.1 Measurements :

The length and breadth of doors, windows, ventilators and composite unit shall be measured as fixed out to out of the unit correct to a cm. The area worked out in sq.m. correct to two places of decimal.

8.2 Rate :

The rate shall include the cost of all materials and labour involved in all operations described above, including overheads and profits, cutting, glazing, painting, mastic, lugs/holdfasts, cement concrete 1:2:4 (nominal mix), in masonry

and making good, peg stays, hinges, pivots, handles, etc. complete as required, shown on drawings or as directed. The rates shall also include the metal or wood beading round the frame work.

9.0 M.S. BARS AND M.S. GRILLS IN WOODEN FRAMES :

M.S. bars and M.S. grills with round, square bars and with flat shall be cut and/or fabricated and fixed as per drawing and/or welded all as directed by EIC.

Fixing M.S. Round or Square bars to windows :

M.S. round or square bars of required sizes shall be fixed in window frames by providing through hole on one side of the frame and a hole 50mm deep in other and the bars should be exact length to reach 50mm in one and flush with outside of the frame on the other side of the frame. On steel windows, the round or square bars shall be welded on the frame with good workmanship.

M.S. grills shall be fabricated and fixed to frames by screws. The welding, cutting holes through flats, bending etc. shall be carried out to required length and design and precision and the complete work shall give neat appearance. All the excess welding sports, etc. shall be properly ground and finished smooth.

All the steel concealed or exposed shall receive one coat of red oxide zinc chromate primer. All exposed steel work shall be given further two coats of synthetic enamel paint of approved make, quality, colour and shade. The grill when directed shall be fixed in the masonry, jambs with screws fixed on wooden gutties embedded in masonry all as directed.

The grill shall be true to pattern in form and dimensions. Gills shall not be painted until they have been inspected and approved by the EIC.

9.1 Measurements :

M.S. bars and M.S. grills shall be measured in kgs.

The length of bars going into the wooden window frames shall not be measured. Measurements shall be length of bars between the window frames. For steel windows, the length of bars and flats will be measured as provided and fixed.

For grill work, the complete length of M.S. bars and flats as fixed as per drawing shall be measured separately correct to a cm.

The exact weight in kg. Correct to two places of decimals shall be calculated from standard tables. No allowance shall be made for wastage, welding, nuts, bolts, screws, holdfasts, if any. No deduction shall be made for holes in flats, etc.

9.2 **Rate** :

The rate shall include the cost of all materials and labour required for all the operations described including overheads and profits, painting, cutting into masonry and R.C.C. work and making good etc.

10. **M.S. LADDERS** :

M.S. ladders shall be fabricated out of M.S. rounds, squares, flats, etc. as described, as per the drawing or a directed. The work shall include cutting to required sizes, welding, fixing in position, bending and curving the flat iron stringer at top to form handles, embedding the bottom of ladders, providing and casting foundation block in cement concrete 1:2:4 (nominal mix) (1 cement : 2 sand: 4 stone aggregate 20mm nominal size) of 60mm x 30mm x 150 mm. All the work shall receive on coat of red oxide zinc chromate primer and two coats of synthetic enamel paint of approved make, quality and shade.

The width of the ladder shall be 450 mm in between stringers made out of 40mmx 5mm x 6mm flats as specified and 16mm dia. M.S. round at maximum 30 cm centers, notched and welded to stringer flats. The ladder shall be fixed at top with welding or with nuts and bolts as required.

10.1 **Measurements** :

The length of ladder shall be measured in Rmt. From above the foundation block to 150 mm above the top most rung.

10.2 **Rate** :

The rate shall include all the materials and labour required in all the operations described including wastage, overheads and profits, cement concrete foundation block, painting, etc.

11.0 **STAIRCASE RAILING** :

The work shall be carried out as described and as per the drawing. The M.S. plate 225 mm x 150 mm x 6mm with two anchor/ holdfast 200 mm x 40mm x 6mm shall be fixed in R.C.C. steps at the time of casting. The M.S. verticals out of 20mm square bars shall have two lugs 20mm x 20mm and minimum 25mm long welded near the bottom of verticals and to the M.S. plate fixed. At top 20 mm x 20mm horizontal lug 50mm long shall be welded to verticals and to 75mm dia 6mm thick plate. This plate shall have 4 screw holes for fixed this to the wooden railing out of 65mm x 150 mm. The height of T.W. hand rail shall be 900 mm above the finished nosing. There shall be one vertical per step fixed along the edge of the stair. The excess welding shall be properly smoothened and burrs removed. The whole railing shall be finished and fixed in true line and level. The finished work shall have one coat of zinc chromate primer and two coats of synthetic enamel paint of quality, manufacture, colour and shade as approved by the EIC.

11.1 **Measurements** :

The measurements will be in running metre correct to a cm.

11.2 **Rate** :

The rate shall include all materials and labour involved in all the operations described and specified, including fixing in R.C.C., painting, polishing, etc. complete.

12.0 **M.S. PIPE RAILING** :

The M.S. pipe railing shall be fabricated as per drawings and instructions of EIC, out of 40 mm dia. or 50 mm dia. nominal bore. Unless otherwise shown on the drawings or as directed, the top horizontal or inclined pipe shall be at a height of 0.5 metre. The top pipes will be bent at ends and form into vertical support. The vertical supports shall consist of 40mm to 50mm pipe as shown on the drawing or as directed/ specified, at not more than 1.5 metre centers. All vertical pipes shall be embedded in floor to a depth of 250 mm in foundation block of 300mm x 300mm x 300 mm in cement concrete 1:2:4 (nominal mix) (1 cement: 2 sand: 4 stone aggregate 20mm nominal size). Alternatively, if directed, the pipes shall be welded to M.S. plate 225 mm x 150mm x 6mm fixed flush in cement concrete block as above with holdfasts welded to the three sides of M.S. plate anchored in cement concrete. The floor shall be cut to required size and depth and after casting the foundation blocks, made good to match with the rest of the floor. The vertical pipes shall be full from foundation to the top horizontal, which shall be continuous without any break. The middle horizontal pipe shall be continuous between vertical supports. The joints shall be properly made and welded and the welding finished to give a smooth surface. The railing shall be fixed truly vertical and shall have a neat appearance. The railing shall receive one coat of zinc chromate primer and two coats of synthetic enamel paint.

12.1 **Measurements** :

The measurements shall be in sq.metres, correct to two places of decimal, length being measured from the center lines of end supports and height above finished floor upto the center line of the top pipe line measured vertically correct to a centimeter for horizontal pipe railing and at right angles to the top pipe, if inclined.

12.2 **Rate** :

The rate shall include the materials and labour required in all the operations described above, including cement concrete in all foundation blocks, making good floor, painting, etc.

13.0 **M.S. WATER STORAGE TANK** :

The M.S. water storage tanks shall be fabricated out to 3.15 mm thick M.S. Sheet to the required sizes and whenever the size exceeds 1.2 M x 1.2 M x 1.2M shall have steel angle stiffeners as shown on drawings or as directed by the EIC. The M.S. sheet cut to required sizes shall be welded around its edges, at meeting points of partitions and at stiffeners and the excess welding shall be removed and surface ground and polished smooth. The top sheet shall have slight

slope from center towards edge so as not to allow any water to stand. Necessary openings of required sizes shall be neatly made for accommodating G.I. supply and

delivery pipes, manholes, drain pipes, overflow pipes, etc. Necessary fittings such as heavy duty brass/copper ball valve with brass rod and PVC ball, mosquito proof M.S. hinged cover with locking arrangements, G.I. overflow pipe with mosquito proof coupling, drain/scour pipe and drain cork etc., shall be provided as required by the Local Municipal Authorities. The tank shall be provided as required by the Local Municipal Authorities. The tank shall be painted inside and outside with a coat of red oxide zinc chromate primer and two coats of tank bitumastic paint inside and two coats of synthetic enamel paint of approved make, quality, colour and shade outside on all sides, top and bottom. The tank shall be mounted on M.S. Channel or 'I' section supports. Foundation blocks of cement concrete 1:2:4 (nominal mix) (1 cement: 2 sand: 4 stone aggregate 20mm nominal size) of 300 mm x 300mm x 300mm size shall be provided.

Hoisting :

The hoisting of tanks into position as per the scheme approved by the EIC shall be carried out in such a way that no part of tank or of structure is damaged during the operation. The tanks shall be installed in position truly level.

13.1 Measurements :

The top 150 mm shall be considered as free board and shall not be considered for calculations of the net volumetric capacity.

13.2 Rate :

The rate shall include the cost of all materials and labour required in all operations described above and in the description of item, including hoisting, manhole covers with hinge and locking arrangement, painting, ball valve, etc. The overflow pipe, mosquito-proof coupling, scour pipe and valve shall be included in rate.

14.0 M.S. PLAIN/CHEQUERED PLATE DRAIN COVER :

The M.S. plain/ chequered plate cover shall be fabricated as per drawing and instructions of EIC, out of 6 mm thick plate, any shape and size hinged to 25mm x 25mm M.S. angle or tee, with 3mm thick x 25 mm x 100mm long M.S. hold fast welded to M.S. angle/tee frames spaced at 300mm center to center for fixing in the bed concrete, with 6mm dia M.S. handle of required size as per drawing. The steel work for cover, frame, handle, etc. shall receive one coat of approved steel primer and two costs of approved paint and shade.

14.1 Measurements :

The measurements of cover shall be in square metres correct to two places of decimal, length being measured from the center lines and width from the back to back of angle frame, correct to a cm.

14.2 Rate :

The rate shall include the materials and labour required in all operations described above, excluding cement concrete, which is paid separately.

15.0 ALUMINIUM DOORS, WINDOWS, VENTILATORS, CURTAIN WALLS

The contractor shall be given drawings showing the size of various doors, windows, ventilators, composite units, curtain walls, etc. and weights and sizes of various members of doors, windows, etc.

The contractor shall along with the quotation submit three sets of shop drawings covering items of work of this specifications. The drawing shall show details of the extruded section, all dimensioned details of construction and installation, weathering strip arrangements, holdfasts and fixing arrangements, joint details, position of all fittings and fixtures, mullions, transome details, glazing arrangements, locking arrangements, the weight of various sections per running metre etc. The various units shall be properly marked and then correct position shall be indicated.

Single Glazed Window : (Weights indicated shall be aluminium)

a) Openable

1) Outer Frame	:	Weight 0.70 kg/Rmt
2) Shutter Frame	:	" 0.97 kg/Rmt
3) Intermediate mullion/T	:	" 0.97 kg/Rmt
4) Beading	:	" 0.31 kg/Rmt

Fixing louvers window/ventilators :

Outer frame	:	Weight 0.46 kg/Rmt

Double Glazed Window **:** (weight indicated shall be minimum)

Outer Frame	:	Weight 0.72 kg/Rmt
Shutter Frame	:	" 0.97 kg/Rmt
Intermediate mullion	:	" 0.98 kg/Rmt
Beading	:	" 0.31 kg/Rmt

Aluminium Door : (Weights indicated shall be minimum)

Outer door Frame	:	Weight 2.508 kg/Rmt
Shutter Frame	:	" 0.92 kg/Rmt
Bottom Stile	:	" 2.508 kg/Rmt

Window shall be made out of extruded aluminium tubular hollow sections. Openable windows shall be double weather stripped, one in the outer frame and the other strip in the shutter frame. The weather strip shall be extruded neoprene and of a size to make window weather tight. The hinges of openable window shall be of stainless steel friction hinges sufficiently strong. The pins of hinges shall be of non-corrosive material preferably nylon. In case the windows are top or side hung, they shall be provided with brass pivots, sliding on stainless steel guides fixed to frame, thus allowing cleaning, fixing and replacing of glasses from

inside and outside. The windows shall be provided with handles for single/double point locking as required. The handles shall be made out of high quality chrome plated brass. Aluminium sections shall be anodized in natural matt/ stain finish and

the anodic film shall be minimum 15 micron. All joints shall be mitred. Window shutters shall be provided with special locking arrangements. 5.2mm to 5.5 mm thick glasses shall be fixed in shutters by means of a rubber gasket. Each shutter shall be provided with HDP anti-ratting pieces at top and bottom to control vibrations due to wind.

15.1 SLIDING WINDOWS :

The two track outer frame top sill and bottom sill shall be minimum weight of 0.580 kg/m.

Outer frame verticals shall be of minimum weight of 0.526 kg/m.

Shutter frame vertical shall be of minimum weight of 0.431 kg/m.

Shutter frame interlocking sections shall be minimum weight of 0.414 kg/m.

All aluminium work shall be anodized.

The aluminium work carried out shall have perfect waterproofing arrangement between various aluminium members.

Each sliding shutter shall be provided with two ball hearings rollers, two anti-rattling pieces/ guides, one each at top and bottom, weather strip all around.

No work shall be undertaken till the shop drawings are approved by the Engineer-in-Charge.

15.2 Measurements :

The measurements shall be in sq.mtr. The length and breadth being measured correct to a cm., out to out of the frame work.

15.3 Rate :

The rate shall include the cost of materials and labour required for all the operations required to complete the work, including overheads, profits, cutting, jointing, waterproofing gaps with approved rubber lining or mastic or neoprene, all fittings, friction hinges wherever directed, anodizing, glazing, preparing, submitting and getting approval to the detailed working drawings.

16.0 ALUMINIUM PARTITIONS AND DOORS :

The work shall be done strictly according to relevant latest IS Codes.

The aluminium sections shall be of Indian Aluminium Ltd., known also as Indal or equivalent.

All sections shall be manufactured out of wrought alloy designation "Indal 50S" conforming to H 9 of IS:733 to 740.

The contractors shall fabricated / assemble one completed sample of each type such as frame work/ door and obtain the approval of the EIC before execution of further work.

The sheet glass / glass panes shall be of thickness as specified in the item and shall be of a reputed make like H.P.G. or equivalent as approved by the EIC.

The rate quoted by the contractor shall include all material, labour, required to execute the work as per drawings, specifications, etc. The rate shall also include the cost of providing and fixing fittings, stoppers, stays, etc.

16.1 Mode of Measurements :

Aluminium partitions shall be measured in square metres. The product of length and height measured nearest to a cm. The finished length and height shall be measured.

NOTE: Any extension piece required for fixing shall not be measured separately.

Aluminium doors shall be measured in sq.metres, the product of width height measured nearest to a cm. The width shall be measured between the outer edges of shutter's stiles and height.

17.0 ALUMINIUM SHEET DADO :

The aluminium sheets for dado/skirting shall be of 16 gauge thickness, of Indian Aluminium, or Bharat Aluminium make.

The sheets shall be cut to the required height and length and fixed on the fairly smooth surface of wall, with approved make aluminium screws at 300 mm center to center spacing in both directions. The joints in this sheet shall be covered with 25mm x 3mm thick aluminium flat fixed with screws spaced at 300mm center to center. The corners shall be covered with aluminium angle 50mm x 50mm x (16G) fixed with approved aluminium screws.

17.1 Measurements :

The measurements of aluminium dado shall be in square metres correct to two places of decimal. Length and height shall be measured upto 1 cm. correctness.

17.2 Rate :

The rate shall include labour charges for fixing aluminium sheets with aluminium flat and angle with contractor's screws, as per the drawing or as directed by the EIC. (Aluminium sheets in 8' x 4' size, 25 x 25 x 3 cmm Aluminium angles, 25 x 3 mm aluminium flats shall be supplied by Air-India)

18.0 ALUMINIUM KICK PLATE :

The aluminium kick plate shall be of 22 G thick. The plate shall be fixed to door shutter or frame in 'U' form or as required, keeping inner side 230 mm and outside 300mm deep or in the shapes as required as per site condition, or as per the instructions of the Engineer-in-Charge. The plate shall be fixed with galvanized done screws. The edges of the plate shall be fixed or the corner rounded.

18.1 Measurements :

The measurements shall be in square metres of the actual area provided at site.

18.2 Rate :

The rate shall include labour charges for fixing aluminium sheets with aluminium flat and angle with contractor's screws as per drawing or as directed by the EIC.

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V. PLASTERING AND POINTING

1.O INDIAN STANDARDS :

1. IS : 712 – 1984 : Specification for Building limes.

2. IS : 1200(Part 12) – 1976 : Method of measurement of Plastering and Pointing.

The above mentioned IS Specifications and Codes of Practice have been indicated for general guidance.

However, these IS Specifications and Codes will be adopted only for those particular items in the contract where either the mode of measurement or detailed technical specifications are not laid down in the tender.

2.0 MATERIALS :

Cement, sand and water used shall conform to the quality as described in "Concrete" and also comply with IS:456-1978, for plastering work.

3.0 SCAFFOLDING :

Scaffolding shall be either double or single as required. The scaffolding shall be erected with steel sections or pipes, bullies or bamboos, of adequate strength for safe operations.

The Contractor shall take all measured to ensure the safety of the structure and his workers. The scaffolding shall be got approved by the EIC. The contractor shall be responsible for any damages caused to the structures and injury to the persons due to faulty erection and scaffolding, defective ladders, and materials, etc. The scaffolding shall be so erected that every part of the work is easily approachable.

After the work is completed and the scaffolding is being removing, leaving behind 'Log holes': these 'Log Holes' shall be simultaneously filled up, made good and finished to match the surrounding surface. Contractor shall ensure that no long holes are left unattended before removing the next stage of scaffolding.

4.0 TOOLS & ACCESSORIES :

All tools and accessories are to be arranged by the contractor and shall conform to the relevant IS Code of Practice. All tools required for the operation shall be examined to ensure that they are thoroughly cleaned and in true shape before plastering is begun.

5.0 PREPARATION OF SURFACE :

All joints in the masonry work, which are to be plastered, shall be raked out to a depth equal to not less than the width of the joints or as directed by the EIC. Care shall be taken to avoid chipping of masonry, while raking out the joints. In case

of new work, the raking out shall be done when mortar in joints is still green. The concrete surface shall be suitably roughened to provide necessary bond for plaster. All dirt, oil, grease, paint, etc. shall be cleaned and scrubbed with fresh water prior to plastering. Before commencement of plastering, the surface preparation shall be got approved in writing from the EIC.

In case the thickness of plaster required is more than that specified in the respective item, the same shall be carried out in two layers. G.I. hexagonal wire netting 24 SWG X ¾" (19 mm) shall be fixed over first layer by using 'U' nails or any other suitable arrangement approved by the IEC, and finished in line and level in the final layer. No additional payment shall be made for extra thickness of plaster. However, the cost of providing G.I. netting and fixing shall be paid separately.

Gauges :

Patches of plaster size 150mm x 150 mm shall be made at site about 2.0 m apart as gauge to ensure even plaster in one plane.

6.0 FINISHING :

In any continuous face of a wall, finishing treatment of any type should be carried out continuously and day-to-day breaker made to coincide with architectural breaks in order to avoid unsightly junctions. The entire work, including moulding, grooves, band , etc. shall be carried out in true line and level.

7.0 WATERING & CURING

All plaster work shall be kept damp continuously for a period of 7 days. To prevent excessive evaporation due to weather condition, gunny bags may be hung/kept over the plaster and kept moist for a period of 7 days. In case the contractor fails to carry out the curing work as specified, at any time, on any day, the EIC shall, without serving any separate notice, engage at the risk and cost of the contractor, requisite labour, materials and equipment. The cost incurred towards curing operations made shall be recovered from the Contractor.

8.0 NEERU FINISH :

Material :

The lime used for Neeru plaster shall conform to 'C' Class lime (i.e. pure fat lime) as per IS : 712 – 1984.

Preparation of Neeru :

Lime shall be slaked and mixed with sufficient water to form a thick paste. It shall be reduced to a fine paste by grinding the unslaked particles and foreign matter shall be removed by passing through a fine sieve. The paste thus

obtained shall be allowed to mellow under water for at least 7 days in a large slaking tank. The surplus water on the top shall be allowed to run off. The slaked lime paste thus formed shall be used for preparing Neeru.

Mortar :

The mix of the mortar shall be as specified in the Schedule of Items. Cement and water used in mortar shall conform to the qualities as specified for them in sub-head 'Concrete'.

Application of Plaster :

Ceiling plaster shall be completed before commencement of wall plaster.

Plastering shall be started from top and worked down towards the floor. All 'Log Holes' shall be properly filled in advance of the plastering as the scaffolding is being taken down. To ensure even thickness and true surfaces, gauged area shall be prepared as described at 5.0. The mortar of specified mix shall then be applied/laid on the wall between the gauges with trowel. The mortar shall be applied in a uniform surface, slightly more than the specified thickness. This shall be beaten with straight edged wooden rule about one metre long to ensure through filling of joints and then brought to true surface by reaching across the gauges. Finally, the surface shall be finished to plane or curved surface as shown on the drawing or as directed by the EIC with trowel or wooden float to achieve a smooth or sandy granular texture.

Neeru shall be applied on prepared and partially set plaster, with steel trowel to a thickness slightly exceeding 1.5mm and rubbed down to 1.5mm thickness and polished to a required degree of smoothness or as directed by the EIC, from top to bottom.

After completion of 24 hours of neeru plaster, the plaster surface shall be kept constantly moist by sprinkling water for a minimum period of 7 days.

8.1 Measurement :

The length shall be measured between the finished wall surface or partition, and the height from top of finished floor or skirting top to the ceiling. The jambs, sill soffits of door, window, ventilator openings, chajja, etc. shall be measured between finished surface and paid.

The length and breadth or height shall be measured correct to a cm. and its area shall be calculated in sq. metres correct to two places of decimals. No extra payment shall be made for bands of any width, grooves, cornices, beadings, architraves, moulded arch wholly in plaster, etc. also for extra thickness due to variation in brick sizes or line and levels or to match with existing surface.

8.2 Rate :

The rate quoted for the neeru finish shall include cost of materials, wastage, labour involved in all operations described above, including transportation, overheads and profits, tools, equipment, scaffolding, curing, etc.

9.0 SAND FACED PLASTER (TWO COATS) :

Preparation of surface :

The surface shall be prepared as described in 5.0.

MATERIALS :

Mortar :

The Cement Mortar mix used in sand faced plaster shall be as specified in Schedule of Items. Cement, sand and water used in mortar shall conform to the qualities as described in the specification for sub-head 'Concrete'.

Gauges :

To ensure even plaster, patch plaster as described in 5.0 shall be made at site.

Scaffolding :

Specification for scaffolding shall be as described under 3.0.

Application :

The plaster shall be applied in two coats. The base coat or under coat shall be 12mm thick and finished sand faced coat shall be 6mm thick.

a) Base Coat : The cement mortar mix used in base coat shall be as specified in Schedule of Items. The approved water proofing compound such as Acroproof, Impermo, or any other standard waterproofing compound approved by EIC shall be mixed in mortar at the rate of 1 kg. Per 50 kg. Of cement. The mixing shall be done as per manufacturer's specification or as directed by EIC.

The plaster 12mm thick shall be laid over the surface and brought to a true line and level with wooden straight edge.

The key shall be formed on plastered surface with the help of scratching tool when plaster is green. The key shall be 3mm deep and about 12mm apart.

b) Sand faced Coat : The mortar used for finished sand faced cost, 6mm thick, shall be as specified in Schedule of Items.

The finished coat shall be applied after the base coat has sufficiently set but not earlier than 48 hours of application of the base coat. After the application of the finishing coat, the surface shall be finished with a wooden straight edge, or float in true line and level. Finally, the surface shall be finished with sponge-pad by gently tapping the plaster surface to retain a coarse surface texture. When final coat sufficiently hardens, the surface shall be kept moist continuously for a period of seven days.

9.1 **Measurement** :

This shall be as specified in 8.1.

9.2 **Rate** :

This shall be as specified in 8.2.

9.0 **SMOOTH CEMENT PLASTER** :

The cement plaster shall be 12mm, 15mm or 20mm thick as specified in Schedule of Items, finished with a coat of neat cement.

The other specifications, such as mortar, application of plaster, in single coat, scaffolding, are same as described in the respective heads above, except that of additional floating coat of neat cement, which shall be carried out as follows :

The plaster thickness, as specified in Schedule of Items shall be brought to a true surface with wooden straight edge. The whole surface area shall be covered with neat cement coating. The quantity of cement applied for floating coat shall be 1 kg. Per sq. metre. The plaster surface shall be finished smooth with a steel trowel.

The other details such as Measurement, Rate, etc. are same as described at 8.1 and 8.2 respectively.

11.0 **ROUGH CAST PLASTER** :

Rough cast plaster comprises of mixture of sand and gravel in specified proportion, dashed over a freshly plastered surface.

Preparation of Surface **:**

The preparation of ‘surface shall be as described in 5.0.

Scaffolding :

The scaffolding shall be as described in 3.0

Mortar :

The mortar used in rough cast plaster for both coats shall be as specified in Schedule of Items. The cement, sand and water used in mortar, should conform to the quality as described in Plain Cement Concrete. Where coarse sand is to be used, the fineness modulus of the sand shall be not less than 2.5 mm.

Application :

The rough cast plaster shall be applied in two coats. The base coat shall be 15mm thick and finished rough cast shall be 10mm thick.

a) Base Coat : The plaster of specified mix and thickness shall be applied as described in sand faced plaster except that the surface shall not be beaten with wooden straight edge.

b) Finished Coat : The finished coat shall be applied over the base coat after a day or two. The mortar used in top coat shall be or richer mix of 1:3 or as specified with aggregate of varying size from 3mm to 12.5 mm . The proportion of cement, sand and aggregate shall be in proportion of 1:1 ½:3. The mortar thus prepared shall be flung over the base coat with large trowel to form an even coat of required thickness. The finish coat shall be applied within a day or two only.

11.1 Measurement and Rate :

This shall be as specified in 8.1 and 8.2 respectively, except that nothing extra shall be paid for extra thickness, due to variation in size of aggregate or gravel also rate shall be inclusive of grading of aggregate/ sand as specified.

12.0 PEBBLE DASH FINISH :

The specification shall be the same as for rough cast plaster, except that the washed pebble or crushed stone graded from 12.5 mm to 6.3mm or as specified shall be dashed over plaster base and the vacant space, if any, shall be filled in by pressing pebbles or crushed stone as specified, by hand so that the finished surface represents a homogeneous surface.

Scaffolding, preparation of surface, mortar, measurement and rate shall be as per rough cast plaster.

13.0 POINTING :

Preparation of surface and Scaffolding **:**

Shall be as in 5.0 and 3.0 respectively.

Mortar :

The mortar shall be used as specified in Schedule of Items. Cement, sand and water used shall conform to the quality as specified in Plain Cement Concrete.

Application :

a) Flush Pointing : The mortar shall be pressed into the joints and shall be finished flush with the surface. The edges shall be neatly trimmed with trowel and straight edge.

b) Raised and cut Pointing : The raised and cut pointing shall project from the wall surface with its edges cut parallel so as to have uniformly raised band about 6mm raised and width 10mm or more as directed.

The superfluous mortar shall then be cut off from the edges of the lines and the surface of the masonry shall be cleaned off all mortar.

The finish shall be such that the pointing is of exact size and shape stipulated or directed and the edges are straight, neat and clean.

Curing :

The pointing shall be kept wet for a period of seven days. During this period it shall be suitably protected from all damage.

13.1 Measurement :

Length and breadth shall be measured correct to a cm. and its area shall be calculated in sq.mt. upto two places of decimal.

13.2 Rate :

This shall be as specified in 8.2

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VI. FLOORING

1.0 **INDIAN STANDARDS** :

1.	IS : 777 - 1988	:	Specification for glazed earthenware tiles. 2nd Rev.
2.	IS : 4457 – 1982	:	Specification for ceramic unglazed vitreous acid resistant tiles.
3.	IS : 2571 – 1970	:	Code of practice for laying in situ cement concrete flooring.
4.	IS : 1443 – 1972	:	Code of practice for laying and finishing of cement concrete flooring tiles.
5.	IS : 5491 – 1969	:	Code of practice for laying in situ granolithic concrete floor topping.
6.	IS : 4971 – 1968	:	Recommendations for selection of Industrial floor finishes.
7.	IS : 1237 – 1980	:	Specifications for cement concrete flooring tiles.
8.	IS : 3461 – 1980	:	Specifications for PVC asbestos floor tiles.
9.	IS : 657 – 1982	:	Materials for use in the manufacture of Magnesium Oxychloride flooring compositions.
10.	IS : 658 – 1982	:	Code of Practice for Magnesium Oxychoride composition floors.

The above mentioned I.S. Specifications and Codes of Practice have been indicated for general guidance.

However, these IS Specifications and Codes will be adopted only for those particular items in the contract where either the mode of measurement or detailed technical specifications are not laid down in the tender documents.

2.0 GENERAL :

Before any flooring operation is taken up, the following shall be done. The cost of these measures whichever applicable shall be deemed to have been included in the rate tendered.

The base shall be properly cleaned. If it is of cement concrete, a layer of cement slurry at the rate of 2kg. Cement per sq.mt. shall be brushed on for proper bond.

Ceiling and wall plaster to the top of skirting shall be done first. All base items of work like floor conduits, traps and other fittings shall be laid and jointed, and all openings of traps, etc. properly plugged.

The jointing shall be properly planned, providing a border, taking care of door openings, steps, sizes of floor units. If laid in situ, the border shall be mitred at corners.

All flooring shrinks and therefore, special care is required to avoid cracks. In in-situ floors, joints shall meet joints and not in the middle of a panel. Tiles and slabs may also be laid similarly or they may be laid to break joint as decided by the EIC.

Except in the case of borders, the length of floor units shall not exceed 1.5 times the breadth. The maximum size of a panel shall be restricted to an area of 20-2.0 sq.mtrs. The likely panel adopted for cement flooring shall be 3.5 M x 6.0 M or 3.0 M x 6.5 M or as directed by the EIC.

The panels shall be of uniform size and no dimension of a panel shall exceed 2 mt. And the area of panel shall not be more than 2.0 sqmtr.

The levels shall be decided taking care of drainage of adjoining corridors, adjacent verandahs, toilets, area open to sky etc. which shall be lower by 10mm than the main floor level and shall be suitably sloped at 1 in 60 to 1 in 100, as directed by EIC.

In the case of factory floors, unit/panel sizes may be decided to suit foundations of machines, walkways between rows of machines, widths required for material handling, trolley operations, etc.

The method for finishing edges specially at entrances shall be pre-decided and approved by the EIC. Generally the flooring shall extend up to the wall and not plaster or skirting. The EIC shall decide whether the junction of flooring and skirting (or dado) shall be a clear right angled joint or shall be rounded off.

Adequate quantity of cement from one batch shall be set aside for flooring in one inspectable area so that uniformity of colour is maintained.

2.1 **Measurement for all types of flooring** :

Length and breadth shall be measured between the faces of skirting/ dado/ or finished surface of plaster as the case may be. The length and breadth shall be measured correct to a cm., and the area calculated in sq.metres correct to two places of decimals. Openings up to 0.1 sq.mt. shall not be deducted. Nothing extra shall be paid for finishing around openings, depressions, fittings, traps, along edges, etc. the rate includes finishing, protecting the finished surface, making good

any damage to any other item of work during laying of the flooring. Costs shall include cost of glass or aluminium strips as may be directed by the EIC.

3.0 Concrete flooring :

3.1 Concrete shall generally conform to the specifications for item of "Plain Concrete". The maximum size of aggregate shall not exceed 1/3 the thickness of

the flooring. If the floor is to be laid continuously, glass strips 4 mm thick shall be laid to the full depth of the flooring including the topping; Care being taken to see that the top of the strip is seen flush with the top of the floor when finished. Alternatively, the floor may be laid in alternate panels laid after one or two days. The first panel will be laid with wooden or steel forms; the second will be laid against the first. On removing the form, if the edges are found broken or honeycombed, they shall be made good with mortar of the same mix as the parent concrete and suitably finished to match and allowed to set for a day before the next panel is laid. The laying of the second panel should not be delayed.

The top of the floor shall be finished as follows :

The concrete should be well tamped to get a uniform texture. It shall then be beaten with trowels to get the mortar cream to the surface. A thin layer of cement slurry 2 kg. Cement per sq.mt.of a thick consistency and not mere dry cement powder shall be spread and after initial set shall be trowelled smooth with broad steel flats, care being taken to get a uniform colour.

Raised platforms shall be provided for the workmen.

4.0 Stone Flooring :

4.1 Materials :

Stone slabs or stone square tiles shall be of naturally occurring stone of type specified. They shall be hard, durable and tough, completely free from cracks or weathered stone.

For rough dressed stones, the top be chisel dressed. All sharp arises are chipped off to a slope. Edges shall be chisel dressed to15mm from the top and then splayed inwards.

For polished and machine cut slab, the edges shall be hand cut to give sharp true edges, and the exposed surfaces machine polished to give smooth uniform surface. Stones for stairs, window sills, toppings of counters, parapets, etc. shall be similarly treated.

4.2 Laying :

The stone slabs shall be thoroughly cleaned. The bedding course in flooring shall be cement mortar as specified in Schedule of Items.

The base shall be well prepared and tamped. Then slurry at 4 kg. Cement per sq.mt., shall be spread and the slabs laid thereon and tamped firmly with a wooden mallet. Edges shall be buttered with thick slurry and the buttered edge of the next slab brought against it. Any smearing of slurry on the surface shall

be immediately cleaned off. The slurry shall be of a colour to match the colour of the stone after it has set and dried. However, in the case of rough dressed stone mortar of cement and stone dust 1:3 mix coloured to match the stone shall be used to fill the in splayed joints and the vertical joints.

Care shall be taken to see that joints are in straight lines by adjusting and choosing correct tiles for the location. Except in the case or rough dressed

stones which are to be pressed into the mortar at some points where there are quarry protrusions, the base shall be prepared 24 hours in advance. The set reduces final shrinkage and hence cracking. Stone slabs should also not be saturated with water. It would be desirable to wash them free of quarry dust on the previous day so that they are not extensively wet.

Curing shall not be done by flooding large areas like halls, as the drying thereafter may result in shrinkage cracks.

Curing shall be done for minimum 7 days before initial rubbing is permitted. In case of fine polishing, the joints must be well cleaned and filled with cement grout of the same mix as the jointing (which shall be kept for this purpose), then carefully wiped clean and allowed to set and cure for 7 days, after which polishing will be done with machines. The process shall be repeated for a final polish which would be able to show a reflecting surface. If required by IEC, the surface should be protected by waxing and spreading dry sawdust.

5.0 Plain/Terrazo Tile Flooring :

The specifications given already under “Genera” of the trade shall be carefully followed and the base prepared as specified in the item.

5.1 Materials :

The tiles shall conform to IS : 1237 – 1980, Specifications for Cement Concrete flooring tiles. The criteria are :

Tolerances on length and breadth shall be +1mm, and on thickness +5mm.

Minimum thickness of wearing layer shall be 5 mm for chips upto 12mm and 6mm for chips upto 20mm. for plain cement or plain coloured tiles the thickness shall be 5mm, and for heavy duty tiles 6mm.

Resistance to wear shall be maximum 3.5mm average, and for individual tiles, 4.0mm. For heavy duty tiles 2mm average with 2.5mm for individual tiles, using aluminium oxide powder hardness 9 on MOH’s scale. Maximum water absorption shall be 10% wet transverse strength after soaking for 24 hours shall not be less than 3 N per mm^2 (30 kgf per cm^2).

5.2 Laying :

Laying shall be done one day after the laying of the base, by spreading the slurry a 4 kg. Per sq.mt. with necessary colour to match the tiles which shall be adequately buttered on the sides with similarly slurry. The tiles shall be tapped home with a wooden mallet using thinnest joints. Care shall be taken to see that

joints are kept straight with maximum thickness of joints being 2.0 mm. Tiles are then washed to remove cement and on the third day joints are grouted with cement mixed with matching pigment, and cured for 7 days. The tiles at random be checked for hollow sound by tapping. Initial grinding with no: 48 to no:60 grit block with a machine shall be done after 14 days. Final grinding shall be done with 220 to 350 grit blocks and then washed. The surface is taken treated with oxalic acid powder. If necessary the second grinding can be done one day earlier with no:120 grit blocks.

After cleaning the surface thoroughly, polishing is done with oxalic acid powder sprinkled with water on the surface and rubbed with a wooden/jute pad. The next day the floor shall be mopped clean with a damp cloth and dried. Thereafter, if required by the EIC, it shall be waxed and treated with dry sawdust which is brushed off at the end just before handing over.

The rate shall include all the above operations/ repairing any damage, maintaining clean from sports of plant, etc.

6.0 In-situ Terrazo Flooring :

The base shall be prepared similarly to the base for tiled flooring. On the next day, the topping shall be laid after smearing the base with cement slurry at 2 kg. Per sq.mt. Except for the border, the length to breadth for the panels shall not exceed 1.5, nor shall any length exceed 2 m in exposed areas. Areas subject to sun or rain shall be limited to a length of 1.25 m.

Glass 4mm to 6mm thick or 2mm aluminium strips shall be fixed with their top at proper level, giving slopes for effective separation of panels. The thickness of the topping shall be laid extra to allow for wear in grinding and polishing to give the specified finished thickness. The mix for the topping shall be prepared as follows :

Cement and colour where required shall be mixed in sufficient quantity to avoid variations in one floor. To the mix shall be added marble dust in proportion of 3 Cement : 1 Marble Dust. Finally, to the mix, marble chips, premixed to give the necessary colour and gradation shall be added in proportion of 4 cement marble dust mix : 7 chippings mix, and mixed dry thoroughly. The quantities for the whole room shall be prepared at one time and kept in plastic bags. Adequate quantity of cement from one consignment shall be reserved for flooring wok to avoid colour variation. The minimum water shall be used to give a dense mix after it is well tamped for mortar to cream to the surface, which shall then be leveled with large wooden floats. Care shall be taken to tamp edges and corners thoroughly.

The forms shall be strong enough to withstand this operation.

Initial, second and final grinding, grouting and polishing shall be done in the same manner as for terrazzo tiles. Curing by ponding water shall be permitted. Manual grinding and polishing shall be done near walls, steps in staircase and at corners, in lavatories, etc., where machine polishing is difficult. Special care is necessary to avoid initial drying of verandah, floors and open areas, specially where they are subject to sun and for drying wind.

7.0 Stairs :

Risers and treads of stairs shall be done in a similar manner to floors, according to the items given in the Schedule of Items, and the corresponding specifications for flooring. Care should be taken to protect the nosing from damage while rest of the construction proceeds. In addition to checking of levels, it is necessary during laying to see that all nosings are in a straight line. Holes for verticals of the stair railing shall be made and kept as directed.

8.0 Specification for Dado, Skirting of pre-cast Terrazo Tiles :

The specification for tiles shall be the same as for Terrazo flooring tiles except that the thickness may be 15mm minimum, thickness of wearing layer shall be 5mm, and the criteria for resistance to wear shall not apply.

The precautions listed under flooring "General" shall be followed wherever possible. Laying shall be done in a manner similar to flooring tiles except that the minimum thickness of the base coat shall be 8 mm of cement mortar 1:4 mix, and the slurry shall be sufficiently stiff not to flow off from a vertical surface. The edges of tiles shall also be buttered with slurry before laying. Rubbing and polishing by hand shall be permitted. Laying of skirting and dado tiles shall be done after laying of flooring tiles but before initial grinding is done, care being taken to see that the joint with the floor is well filled with cement slurry and is not more than 2mm thick.

Nothing extra shall be payable for cutting tiles and rubbing the edges to get a straight edge where required. Joints of tiles need not be staggered vertically. All edges, corners shall be finished neatly correct to line, level and plumb.

9.0 Specification for in-situ terrazzo dado and skirting :

The work shall be done in the same manner as in-situ terrazzo flooring and the precautions listed under flooring "General" shall also be followed wherever possible. Projecting edges shall be protected till the topping gains necessary strength.

10.0 White glazed/colour glazed tiling for flooring, dado or skirting :

White glazed tiles shall be 150mm or 100mm square and 5 or 6 mm thick as specified. For coloured glazed tiles, only the glazed tiles, need be coloured as specified. Tiles shall conform to IS:777-1970, free from cracks or crazing.

For flooring, skirting and dado, the base mortar shall be of mix 1 cement : 3 sand.

The work of preparing and laying the tiles shall be as for terrazzo tiles except that the slurry shall be prepared with white cement, and there shall be no grinding. Accordingly it will be necessary to frequently check the planeness of the surface with a 2m straight edge. Cut edges of tiles shall be filed smooth. Joints shall be cleaned off to half the thickness of the tile and then flush pointed with white cement to give a neat finish (coloured where necessary to match the file). Nothing extra shall be paid for cutting tiles, wastage etc.

NOTE : For all tiling work and in-situ terrazzo,measurements shall be as per flooring item.

11.0 P.V.C. Tile for flooring, dado or skirting :

11.1 PVC Tiles of white or coloured shaded design shall be 300 mm, 250mm, 150mm or 100mm square or any other size as specified, and 2 mm to 2.5mm average thickness as specified. The PVC tiles shall conform to IS:3461-1980.

11.2 For flooring, skirting and dado, the surface shall be smooth, either in concrete floor, or cement/stone/marble tiled floor. The surface shall be cleaned off any projections, oil stains, crevices filled up and surface made smooth, to receive the adhesive as per the manufacturer's instructions. It will be necessary to check the level of the surface during tile operation. Tile joins shall match and shall not leave any gap. Nothing extra shall be paid for cutting tiles, wastage etc. in case tiles of irregular size are cut from the running coil, to the sizes required.

11.3 The tile shall be measured in sq.mtrs. The rate shall be sq.mtrs. correct to two places of decimal, length and breadth shall be measured correct to 1cm. between the exposed surfaces no deductions shall be made nor extra paid for any opening of area up to 0.1 sq.m. The rate shall include all the cost of labour and materials involved for carrying out the work as per manufacturer's specifications and approved sample.

12.0 Marblex Tiles for flooring :

12.1 Marblex tiles of white or coloured shade and design shall be of 250mm square size and 2.0 mm to 3.0 mm thickness as specified. The marblex tiles shall conform to IS:3461. The tiles shall have water and oil absorption less than 1% of 24 hour immersion in water or oil.

12.2 For flooring, skirting and dado, the surface shall be smooth, either in concrete floor, or cement/stone/marble tiled floor. The surface shall be cleaned off any projections, oil stains, crevices filled up and surface made smooth, to receive the adhesive as per the manufacturer's instructions. It will be necessary to check the level of the surface during tile operation. Tile joints shall match and shall not leave any gap. Nothing extra shall be paid for cutting tiles, wastage etc. in case tiles of irregular size are cut from the running coil, to the sizes required.

12.3 The tile shall be measured in sq.mtrs. The rate shall be sq.mtrs. correct to two places of decimal, length and breadth shall be measured correct to 1 cm, between the exposed surfaces no deductions shall be made nor extra paid for any opening of area up to 0.1 sq.m. The rate shall include all the cost of labour and materials involved for carrying out the work as per manufacturer's specifications and approved sample.

13.0 Ceramic 'Kent'/'Vitrum' tiles flooring, dado and skirting :

13.1 Materials : The ceramic 'Kent'/'Vitrum' tiles shall be as per the manufacturer's specifications. They shall be flat and true to their shape and size. They shall be free from cracks, crazing spots, chipped edges and corners. They shall be of one consignment. The tiles shall be unglazed in white or colour shade with any decorative pattern, as specified.

The tiles shall be of nominal sizes such as 32 mm x 19 mm, 25mm x 25 mm, 40mm x 19 mm, 40mm x 40mm, or of standard sizes as specified.

The cement mortar shall be of mix as mentioned in the description of the item and specifications as given in the section 'Brickwork'.

13.2 Laying :

Subgrade concrete to brick work surfaces on which tiles are to be laid shall be cleaned, wetted and mopped. 12mm thick cement plaster plaster 1:3 shall be applied and allowed to harden. The plaster shall be roughened by wire brushes or by scratching diagonal lines 1.5mm deep at 7.5 cm center bothways. The back of tiles shall be buttered with a coat of grey cement slurry plaster and set in the bedding mortar. The tiles shall be tapped and corrected to proper place and lines. The tiles shall be butt jointed in the required pattern and joints truly vertical. After the tiles have been laid, surplus cement grout shall be cleared off.

After a period of curing of 7 days minimum, the surface shall be washed thoroughly, tiles shall be cleaned, the paper cover of the tile to be removed, the surface shall not sound hollow when tapped. The surface during laying shall be checked with a straight edge 2 m long.

13.3 Mode of Measurement : Flooring/dado/skirting shall be measured in sq.m. correct to two places of decimal, length and breadth shall be measured correct to 1 cm between the exposed surfaces. No deductions shall be made nor extra paid for any opening of area up to 0.1 sq.m. The rate shall include all the cost of labour and materials involved for carrying out the work as per manufacturer's specifications and approved sample and design.

14.0 Ceramic unglazed vitreous acid resistant tiles flooring, dado and skirting :

14.1 Materials : The ceramic unglazed vitreous acid resistant tiles shall conform to IS : 4457 – 1982. They shall be flat and true to shape and free from cracks, crazing spots, chipped edges and corners.

The tiles shall be of nominal sizes such as 300 mm x 300 mm, 200mm x 200mm, 200mm x 100mm, 100mm x 100mm size and of colour and shade as specified. They shall be of one consignment.

The acid resistant tiles shall be as per the manufacturer's specifications.

14.2 Laying :

Sub grade concrete or brickwork surfaces on which tiles are to be laid shall be cleaned, wetted and mopped. 12mm thick plaster in cm 1:3 shall be applied and allowed to harden. The plaster shall be roughened with wire brushes or by scratching diagonal lines 1.5mm deep at 75mm center bothways. The back of tiles shall be buttered with a coat of grey cement slurry paste and edges with white cement slurry and set in the bedding mortar. The tiles shall be tapped and corrected

to proper place and lines. The tiles shall be butt jointed in the required pattern and joints shall be as fine as possible. The top of facing shall be truly horizontal and joints truly vertical.

After a period of curing of 7 day's minimum, the tiles shall be cleaned and shall not sound hollow when tapped. The surface during laying shall be checked with a straight edge 2m long.

Tiles shall enter not less than 10mm under side skirting. After the tiles have been laid surplus cement grout shall be cleaned off.

14.3 Fixing of tiles for facing :

The facing work shall be done only after fixing the tiles/slabs on the floor. The approved tiles before laying, shall be soaked in water for at least two hours. Tiles shall be fixed when the cushioning mortar is still plastic and before it gets very stiff. The back of the tiles shall be covered with thin layer of cement mortar 1:2 using fine sand (table III Zone IV I.S. 383-1963) and the edge of the tile smeared with neat white cement slurry. The tile shall then be pressed in the mortar and gently tapped against the wall with a wooden mallet. The fixing shall be done from bottom of wall towards top without any hollows in the bed of joints. Each tile shall be as close as possible to one adjoining. The tiles shall be joined with white cement slurry. Any difference in the thickness of the tiles shall be arranged out in cushioning mortar so that all ties faces are in one vertical plane. The joints between the tiles shall not exceed 1.00 mm in width and they shall be uniform. While fixing tiles in facing work, care shall be taken to break the joints vertically. The top of the facing shall be touched up neatly with the rest of the plaster above. After fixing the tiles in facing etc. they shall be kept continuously wet for seven days.

If doors, windows or other openings are located within the facing area, the corners, sills, jambs, etc. shall be provided with true right angles without any specials. The contractor will not be entitled to any extra claims on this ccount for cutting of tiles if required.

14.4 Cleaning :

After the tiles have been laid in a area or the day's fixing work is completed, the surplus cement grout that may have come out of the joints shall be cleaned off before it sets. After the complete curing, the facing work shall be washed thoroughly clean.

14.5 Pointing & Finishing :

The joints shall be cleaned off with wire brush and all dust and loose mortar removed. Joints shall then be flush pointed with white or colour cement and the floor kept wet for seven days and then cleaned.

14.6 Mode of Measurement :

Flooring/ facing work shall be measured in sq.m. correct to two places of decimal. Length and breadth shall be measured correct to 1 cm between the exposed surfaces of facing. No deductions shall be made nor extra paid for any opening of area up to 0.1 sq.m. The rate shall include all the cost of labour and

materials involved and carrying out the work as per manufacturer's specifications and approved sample.

15.0 Magnesium Oxychloride flooring :

15.1 General :

The magnesium oxychloride flooring shall conform to IS:657-1982 and IS:658-1982. The base shall be properly cleaned of any projections, oil stains

cracks, crevices. Any crevices, depressions, etc. shall be filled up with cement slurry at the rate of 2 kg. Cement/sq.mtr. to make the surface reasonably level. The above surface shall be decided taking care of drainage. The base floor shall have a slope of 1 in 62, 1 in 100.

15.2 Laying :

The base surface shall be hacked to make the surface little rough to give a proper bond to the oxychloride flooring. The necessary teak wood battens of 12mm x 50mm size at 300mm center on gutties/rawl plugs shall be laid or as directed by the EIC or providing aluminium ees of 50mm (depth), for forming panel, all as directed. Magnesium oxychloride flooring of approved colour/shade shall be laid in the prepared panels and finished smooth all as per manufacturer's specifications.

15.3 Measurement :

The magnesium xoychloride flooring shall be measured in sq.m. correct to two places of decimals. Length and breadth shall be measured correct to a cm. between the exposed surfaces of facing. No deduction shall be made, nor extra paid for any opening of area upto 0.1 sq.mtr.

15.4 Rate :

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

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VII. BUILDER'S HARDWARE

1.0 **INDIAN STANDARDS** :

1.	IS : 1341-1992	:	Steel butt hinges, 6th Revision
2.	IS : 205-1992	:	Non-ferrous metal butt hinges. IV th Revision
3.	IS : 362-1991	:	Parliament hinges. 5th Revision
4.	IS : 3818-1992	:	Continuous (Piano) hinges. 3rd Revision
5.	IS : 281 – 1991	:	Mild steel sliding door bolts (for use with padlocks). 3rd Revision with amendments.
6.	IS : 2681-1979	:	Non-ferrous metal sliding door bolts (for use with padlocks) 2nd Revision
7.	IS : 208-1987	:	Door handles. IV th Revisions
8.	IS : 729-1979	:	Drawer locks, cupboard locks and box locks.
9.	IS : 207-1964	:	Hooks and eyes.
10.	IS : 3564-1986	:	hydraulically regulated door closers. 2nd Revision (with amendment No.1)

The above mentioned I.S. Specifications and Codes of Practice have been indicated for general guidance.

However, these IS Specifications and Codes will be adopted only for those particular items in the contract where either the mode of measurement or detailed technical specifications are not laid down in the tender documents.

2.0 FITTINGS :

Fittings shall have good finish and shall be smooth and free from sharp edges and corners, flaws and other defects. Screw holes shall be clean and counter sunk to suit the heads of the screws to the full depth.

Screws used for M.S. and brass fittings shall be of same metal and finish as the fittings. Screws used for aluminium fittings shall be chromium plated brass screws.

Fittings shall be fixed in position, truly vertical or horizontal as required. The screws shall be driven home with screw driver and not hammered in. Recesses shall be cut in woodwork to be exact size and depth for counter-sinking of hinges. The screws used shall be of sizes as indicated hereafter.

Butt Hinges :

Mild Steel Butt Hinges : (Medium)

Medium type M.S. butt hinges shall be manufactured from M.S. sheet and shall generally conform to IS : 1341-1981. The hinge pin shall be of M.S. wire, fitting firmly inside knuckles and with riveted head, allowing easy movement of hinge, but without causing play or shake.

The various sizes and tolerances shall be as follows :

All dimensions in mm

Size Of Hinge	Length	Breadth	Thickness of flap	Dia. of Hinge pin	No. of Knuckles	Screw design-ation	Length of screw	No. of screw holes
50	50 ±0.5	37 ±1	1.50 ±0.06	3.15 ±0.08	3	6	20	4
75	75 ±0.5	47 ±1	1.70 ±0.06	4.00 ±0.08	5	8	30	6
100	100 ±0.5	58 ±1	1.90 ±0.06	5.60 ±0.08	5	9	40	8
125	125 ±0.5	65 ±1	2.12 ±0.06	5.60 ±0.08	5	10	50	8

Cast Brass butt hinges/ light / ordinary or Heavy.

Hinge pin shall be made of brass, or phosphor bronze, or of stainless steel. Hinges shall be properly finished and firmly riveted. The hinges shall generally conform to IS: 205-1978. The movement of hinge pin shall be free, easy and small not leave any play or shake.

The various sizes and tolerances shall be as follows :

All dimensions are in mm

A. CAST BRASS HEAVY HINGES

Suitabl For shut thick-Ness	Size Of Hing	Lengt	Breadt	Thicknes Of flap	Pin Dia.	Butt Dia.	Screv desig nation	No. c Screv Hole	Length Of Screw
1	2	3	4	5	6	7	8	9	10
35	75	75±1	65±1	4.0±0.3	4.0±0.1	9.5±0.31	8	6	30

45	100	100±1	85±1	5.5±0.3	5.5±0.1	12.5±0.31	9	8	40
45	125	125±1	85±1	5.5±0.3	5.5±0.1	12.5±0.31	10	10	50

B. CAST BRASS LIGHT/ORDINARY HINGES

Suitabl For shut thick-Ness	Size Of Hing	Lengt	Breadt	Thicknes Of flap	Pin Dia.	Butt Dia.	Screv desig nation	No. c Screv Hole	Length Of Screw
1	2	3	4	5	6	7	8	9	10
25	50	50±1	40±1	2.5±0.3	2.5±0.1	6.5±0.3	6	4	20
25	75	75±1	40±1	2.5±0.3	2.5±0.1	6.5±0.3	6	6	30
35	100	100±1	70±1	4.0±0.3	4.0±0.1	9.5±0.3	10	8	40
35	125	125±1	70±1	4.0±0.3	4.0±0.1	9.5±0.3	10	10	50

The number of knuckles in each hinge shall not less than 5, except for hinges less than 40 mm when it shall be 3.

Railway type hinges shall have butt diameter as above, but gradually meeting the profile of the flat plate to form heavy section at the junction of place and butt diameter.

Extruded Aluminium Alloy Butt Hinges :

These shall be manufactured from extruded section, and shall generally conform I.S. : 205-1978. Hinge pin shall be made out of galvanized mild steel or aluminium alloy. The hinge and aluminium alloy hinge pins shall be anodized.

The number of knuckles in hinges shall not be less than 5, except for hinges less than 40mm when it shall be 3. The movement of hinges shall be free, easy and shall not have any play or shake.

Sampling & Criteria for conformity :

Butt hinges for testing shall be taken at random from at least 10 percent of the package subject to a minimum of three; equal number of hinges being selected from the lot, shall be checked for dimensional and tolerance requirements. Defects in manufacture and finish shall also be checked. A lot shall be considered conforming to the requirements of this specification, if the number of defective hinges, among those tested, does not exceed the corresponding number shown below.

The number of butt hinges to be selected from a lot shall depend on the size of the lot and shall be in accordance with the following:

LOT SIZ	SAMPLE SIZE	PERMISSIBLE NO. OF DEFECTIVE HINGES
Upto 200	15	0
201 to 300	20	1
301 to 500	30	2
501 to 800	40	2
801 and above	55	3

NOTE : Any hinge which fails to satisfy the requirements of any one or more the characteristics shall be considered as defective hinge.

Parliamentary Hinges :

These shall be of mild steel, cast brass or as specified and shall generally conform to IS : 362-1982. The size of these hinges shall be the width between open flanges. M.S. hinges shall be copper oxidized or as specified. The brass parliamentary hinges shall be finished bright, chromium plated or copper oxidized, as specified.

The hinge pin shall be made of mild steel in the case of M.S. hinges, brass or phosphor bronze or stainless steel in the case of brass hinges. The hinge pin shall be firmly riveted. The movement of the hinges shall be free, easy and shall not have any play or shake.

Sampling & Criteria for conformity :

This shall be as specified above.

Piano Hinges :

Piano hinges shall be made from mild steel or aluminium alloy sheet, and shall generally conform to IS:3818-1971.

Piano hinges shall be fixed in the entire length of the cupboard shutter. The width of the two flaps, when open, shall be taken as its size.

Types :

M.S. Piano hinges shall be made from 0.80 to 1.00 mm thick M.S. sheet and shall be finished bright polished or copper oxidized as specified. Hinge pin shall be of galvanized mild steel. It shall fit firmly in the knuckles and shall have no play or shake. The movement of the hinge shall be free and easy with knuckles straight at right at angles to the flap.

Aluminium piano hinges shall be made from aluminium alloy sheet and shall be anodized. Hinge pin shall be made from aluminium alloy anodized.

The length of the knuckles shall be 25 ± 1 mm each, and screws holes spanning 75 ± 2 mm. The nominal sizes shall be 40 and 30mm with tolerance of ± 1 mm. The hinge pin shall be 2 mm diameter.

Sampling & Criteria for conformity :

This shall be same as specified above.

The measurement shall be in running metres correct to a cm.

Sliding door bolts (without hasp and staple) and Aldrops :

Materials :

Aldrops and sliding door bolts shall be of mild steel, cast brass, aluminium alloy.

Types :

M.S. sliding bolts aldrops shall be of M.S. sheet and M.S. rods, generally conforming to IS: 281-1973. The finish shall be as specified. The length shall be as specified.

Diameter of the bolt shall be 16 ± 0.5 mm and clips shall of 20 ± 1mm wide and shall be (a) from M.S. Sheets 3.15 mm without back plate and (b) from M.S. sheet 2.50 mm with back plate out of 2.0 mm. The hasp for aldrops shall project 100 ± 2 mm beyond M.S. bolt dia. and shall be 40 ± 1 mm wide. The handle knob for sliding bolts shall project 30mm ± 2 mm beyond bolt dia/section.

Cast brass sliding door bolt shall be made from rolled brass conforming generally to IS:2681-1979. The hasp and bolt/knob and bolt shall be cast brass and shall be cast in one piece. The diameter of the bolt shall be 16 ± 0.5 mm. The hasp shall project 100 ± 2 mm beyond bolt dia 45 ± 1 mm wide. Handle knobs for sliding bolts shall project 30mm ± 2 mm beyond bolt dia. section. The finish shall be as specified. The fixing and staple bolts shall be cast with 6mm studs. Bolts shall be finished to shape and shall have threaded ends and provided with nuts of square or hexagon type. All components shall be finished smooth before assembly.

Aluminum sliding door bolts and aldrops shall be made of aluminium alloy and shall generally conform to IS:2681-1979. These shall be anodized. The general dimensions shall be as for M.S. or cast brass sliding bolts.

Sampling & Criteria for conformity :

This shall be same as specified above.

Door Latches :

Door latches shall be of cast brass, mild steel or as specified. The finish shall be as specified. Size of the latch shall be the length of the sliding bolt which shall be of section 16 x 5mm or 20 x 6 mm or as specified. The knob shall project the body of the sliding bolt by 30 ± 3 mm.

Tower Bolts barrel type :

Tower bolts shall be finished to the correct shape and shall have smooth action. All tower bolts made with sheet 1.2mm thickness and above shall have counter sunk screw holes to suit the head of the screw.

Types :

A. (i) Brass tower bolts with cast barrel and rolled or cast brass bolt.

(ii) Brass tower bolts with barrel of extruded sections of brass and rolled or drawn brass bolt. The knobs of brass tower bolts shall be cast and bolt fixed with knobs, steel spring and ball shall be provided between the bolt and the barrel.

B.(i) Mild steel barrel tower bolts with mild steel barrel and mild steel bolt.

(ii) Mild steel barrel tower bolts with M.S. barrel and cast iron bolts. The plates and straps after assembly shall be firmly riveted and spot welded. The rivet head shall be properly formed and the rivet back shall be flush with the plate. These shall be made in one piece. Aluminium barrel tower bolts with barrel and bolt of extrusions of aluminium alloy. The knob shall be properly screwed to the bolt and riveted at the back.

Dimensions :

The length of the bolts shall be 100, 150, 200, 250, 300 and 600 mm as specified with a tolerance of ± 1 mm. The length of the barrel shall be 20mm longer than the length of the bolt. Diameter of the bolts shall be 10mm or 12mm ± 0.5 mm and the corresponding width of the barrel shall be 32 ± 1 mm or 38 ± 1 mm respectively. The sockets shall be 25 ± 1 mm in length.

The thickness of metal barrel (a) for aluminium tower bolts shall be 1.60 ± 0.33 mm for bolt dia. of 10mm and 2.40 ± 0.36 mm for bolt dia. of 12mm (b) for M.S. tower bolts shall be 1.0 to 1.25 ± 0.36 mm (c) for brass tower bolts shall be 2.0 ± 0.2 mm for sizes 150, 200 and 250 sizes of tower bolts and 1.5 ± 0.2mm for 100 mm size of tower bolt.

The internal diameter of the bore of the barrel shall be 1 to 1.5 mm more than the diameter of the bolt.

Screw designation no: for 100, 150, 200 and 250 shall be 6, 8, 8 and 10 respectively.

Sampling & Criteria for conformity :

This shall be same as specified above.

Flush Bolts :

Material :

Material shall be cast brass, cast aluminium alloy or extruded aluminium alloy. Only one material shall be used in the manufacture of all the components of flush bolts, except spring which shall be of phosphor bronze or steel strip. When the bolt is pulled down, the top of the bolt shall be flush with the top of the lip. When the bolt is pushed up, it shall be retained in that position by the spring.

Dimensions and Types :

The bolts shall be either (a) round, when it is 8 ± 1 mm in diameter for the sizes 100, 150, 200 mm or (b) square, when it is 8 ± 1 mm dia. for sizes 100, 150, 200 mm or (c) rectangular, when it is 8 ± 1 mm by 10 ± 1 mm for sizes 250 and 300 mm.

The size shall be the length of the 20 x 4 mm bolt plate. The lip plate for the round, square and rectangular bolt shall be 20 x 4 mm in section and of length 20mm for 100 and 30 mm for 150 and 200 mm size of flush bolt. The thickness of the socket plate also shall be 4mm. the length of the lip plate for square/rectangular bolts shall be 30mm for sizes 150, 250 and 300 mm and for 100 mm size bolt it shall be 20mm.

Door and window handles :

Size

The size of the handle shall be the size of the inside grip of the handle. The overall length of the handle will be more than the size of the handle depending upon the design and pattern of the handle. Door handles shall be o size 100 mm and window handles 75 mm unless otherwise specified. These shall be fixed with 35mm long screws of designation no.6.

Types & Material :

Cast brass handles shall be of size, pattern, shape and make approved by the EIC and shall generally conform to IS:208-1079.

Mild steel handles shall be of mild steel sheet pressed into oval section and shall generally conform to IS:208-1979 and of size, shape, pattern and make approved by the EIC. Iron handles shall be finished as specified.

Cast aluminium handles shall be of size, pattern, shape and make approved by the EIC. Aluminium handles shall be anodized to the colour and shade approved by the EIC.

Sampling & Criteria for conformity :

This shall be same as specified above.

Mortice lock & latch :

The mortice lock and latch shall be the standard Godrej make or equivalent approved make and of the same size. The size of the lock shall be the length of the body towards the face, the tolerance being ± 3 mm. The size shall be 75 mm or 100mm as specified in Schedule of Items, or as directed by the EIC.

Keys :

The mortice lock shall be manufactured so as to have non-interchangeable keys and shall have 4 levers. Five locks from each batch of 60 locks shall be so selected that the cuts in keys differ only slightly from each other. If the keys of any of the locks opens any other lock amongst the selected locks, the whole lot shall be rejected. Each lock shall be provided with two keys.

Latch :

Mortice latch shall have a head bolt and a pair of lever handles and chrome plated steel casing. The brass bolt shall be right or left handed as required. The bolt shall be reversible. The section of the bolt shall not be less than 12 x 16mm. Each latch bolt shall have one spring of phosphor bronze or steel wire. The latch lever shall withstand the lever spring described above. The latch shall be of the best quality and make approved by the EIC.

Night Latch :

Night latch shall be of brass or mild steel and with finish as specified. It shall have minimum 6 levers. It shall be of best quality and make approved by the EIC.

Cupboard Lock :

The size of lock shall be 40, 50, 65 and 75 mm. This shall be of brass and shall be of best quality and make. Finish shall be as specified. The locks shall generally conform to IS:729-1979. The size of the locks shall be the length of the face across the body in mm.

Hooks & Eyes :

Material :

These shall be of hard drawn brass or mild steel with finish as specified, correct shape and dimension to keep windows in position required and shall generally conform to IS:207-1964. The size of hooks and eyes shall be the overall out to out length of the hook.

The sizes of hooks and eyes shall be 100, 150, 200 and 250 with tolerance of ± 2mm and size 300 ± 3 mm and the diameter shall be 5.23, 5.59, 6.30 and 7.01 mm respectively.

Casement Peg Stays :

Material :

These shall be made of mild steel, cast brass or aluminium extruded section and finishes as specified or directed by the EIC.

Aluminium and M.S. stays shall be made from channel section. The weights of each stay shall not weigh less than ;

SIZE	WEIGHT
200 mm	0.24 kg.
250 mm	0.29 kg.
300 mm	0.33 kg.

The shape and pattern and make of stays shall be as approved by the EIC. The size of the stay is the length from outside at one end to the center of the pin at the pivoted end.

Towel/ Curtain Rail :

a) Chrome plated brass pipe with two C.P. brass brackets.

Or

b) Anodised aluminium pipe, plain or with fluted surface with two anodized aluminium brackets.

Size of the towel rail shall be 75 cm x 20 mm dia. or 60 cm x 20mm dia. 11.25 mm thick. The fixing screws shall be of C.P. brass.

The curtain rod shall be of required length. The measurement of tower/curtain rail shall be in running metre correct to a cm.

Floor springs :

Floor springs shall be of make specified in the item, such as ‘Everite’ or ‘Garnish’ or ‘Hardwyn’ or equivalent and the rate of each make shall be quoted.

The fixing arrangement shall be as per manufacturer’s specifications and instructions.

Floor spring selected should be of the type suitable for the size and weight of the shutter for which it is to be fixed.

Measurement shall be in numbers.

The rate shall be for the materials and labour required for all the operations involved including cutting in floor finish and/or floor, making good to match, pivot arrangement and testing of the performance of the spring if directed.

Hydraulic door closer :

These shall be made of cast iron/aluminium alloy/zinc alloy and of shape and pattern approved by the EIC. These shall generally conform to I.S. Specifications for door closers (Hydraulically regulated) IS : 3564-1975.

The nominal size of door closer in relation to the weight and the width of the door size to which it is intended to be fitted shall be as given below :

Designation of Closer	Weight of the door in kg.	Size of the Door in mm	Remarks
1.	Up to 35	700	For light doors such as double leaved and toilet doors.
2.	36 to 60	850	Interior doors of bedrooms, kitchen and stores.
3.	61 to 80	1000	Main doors in a building such as entrance door.

Performance Requirements :

After being fitted in its position when the door is opened through 90^{o} the same should swing back to an angle of $20^{o} \pm 5^{o}$ with nominal speed, but thereafter, the speed should get automatically retarded and in case of doors with latches, it should be so regulated, that in its final position, the door smoothly negotiates with the latch.

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VIII. R O O F I N G

1.0 INDIAN STANDARDS :

1.	IS : 277-1992	:	Specifications for galvanized steel sheets. (Plain and corrugated).
2.	IS : 6745-1972	:	Methods of tests for galvanized steel sheet product.
3.	IS : 459-1992	:	Specifications for uncorrugated, corrugated and semi-corrugated asbestos cement sheets.
4.	IS : 5913-1989	:	Methods of tests for Asbestos cement products. (Ist Revision)

The above mentioned I.S. Codes of Practice have been given for general guidance.

However, these codes will be adopted only for those particular items in the contract where either mode of measurements or detailed technical specifications are not laid down in the tender documents.

2.0 GENERAL :

(a) Particular care shall be taken in providing workmanship in construction of roofs especially at vulnerable points mentioned below to ensure that the finished roof is watertight without any leakage under all weather conditions.

i) Joints between roofs and parapets, chimney stacks etc. with cement mortar and bituministic or bituminous compound.

ii) Rain water outlets

iii) Punching of holes to be avoided. Holes shall be drilled.

iv) Avoiding cracks in Asbestos cement sheets, accessories, etc. during handling and fixing. Any cracked A.C. sheet or accessories to be rejected.

v) Sealing of joints of gutters, hips and ridge coverings.

(b) Roofs shall be finished neatly without riser or hollows. Sloping roofs shall be secured with suitable wind ties where indicated and such sheets shall be bolted to roof members in the same way as the sheets. To allow for expansion and contraction, holes in wind ties shall be allotted.

3.0 Plain and Corrugated Steel Sheeting :

Galvanised steel sheets plain or corrugated shall be thickness specified in the description of the item and conform to the relevant IS Specifications.

Zinc Coating :

The galvanized steel sheets shall be of class specified.

Corrugated galvanized steel (C.G.S.) sheets shall be free from twist or buckle and shall have uniform corrugations, true in depth and pitch and parallel to the sides of the sheets. The galvanized coating shall be clean, even and free from ungalvanised spots and other defects.

The tolerance on the weight of an individual sheet shall be ± 5 %.

The contractor shall submit a copy of the manufacturer's test certificate bearing ISI mark showing the class of galvanizing of the sheets supplied, before these sheets are incorporated in the works. The galvanized steel sheets shall be uninjured in carriage either by rubbing of zinc coating or otherwise.

The weights of galvanized steel sheets shall be as follows :

Weights in kg / m^2

Sr.No.	Class	24 G 0.63mm	22G 0.80mm	20G 1.00mm	18G 1.25mm
1.	1	5.70	7.03	8.60	10.56
2,	2	5.55	6.88	8.45	10.41
3.	3	5.40	6.73	8.30	10.26

The depth of corrugations shall be 118mm (nominal) and shall have a pitch of 75 mm (nominal).

Purling spacing shall not exceed the following :

Gauge	Thickness	Maximum Spacing
24	0.63 mm	1.60 mtr.
22	0.80 mm	1.80 mtr.
20	1.00 mm	2.00 mtr.
18	1.25 mm	2.40 mtr.

Laying and fixing :

Sheets shall be laid with a minimum end lap of 150 mm and side laps of one and a half corrugations. The minimum end lap of 150mm shall apply to slope of 1 vertical to 2 horizontal and steeper slopes. For flatter slopes, minimum permissible end lap shall be 200 mm. The sheets shall be cut to suit the dimensions or shape of the roof, either along their length or their width or in a slant across their lines of intersections at hips and valleys.

The sheets shall be cut carefully with a straight edge and not with chisel.

Lapping in corrugated galvanized steel sheet shall be painted with a coat of approved steel primer and two coats of approved synthetic enamel paint for steel work before fixing the place.

The laying operation shall include all scaffolding work involved. Sheets shall be fixed to the purlin of each roof member such as hip or valley rafters, etc. with 8mm dia ‘J’ or ‘L’ hook bolts and nuts with bitumen and G.I. Limpet washers. The bolts shall be sufficiently long so that after fixing they project above the top nuts by not less than 10mm.

There shall be a minimum of three hook bolts placed at the ridges or corrugations in each sheet on every purlin and their spacing shall not exceed 300mm. Coach screws shall not be used for fixing sheets to purlins.

Holes for all bolts shall be drilled, and not punched in the crown of the corrugations from the underside, while the sheets are on the ground. Sheets with wrongly drilled holes shall be rejected. The holes in the washers shall be of the exact diameter of the hook bolts or seam bolts. The nuts shall be tightened from above to give a leak proof roof.

The bitumastic jointing compound shall be of approved manufacturers.

Wind ties shall be 40mm x 6mm M.S. flat section and shall be fixed at the eaves ends of the sheets, with the same hook bolts, which secure the sheets to the purlins.

The roof when completed shall be true to lines and slopes and shall be leakproof.

Measurements :

The length and breadth shall be measured correct to a cm. and area shall be worked out in sq.m. correct to two places of decimal.

The superficial area of roof covering/ side cladding and louvres shall be measured as fixed from ends of roof sheeting without allowance for laps and corrugations. Portions of roof covering, overlapping ridge or hip shall not be included in the measurements, but the overlapping in barge boards, eaves shall be measured separately. No deductions in measurements shall be made for openings upto 0.40 s.m. in area. For openings more than 0.40 sq.m. in area, deduction in measurements shall be made for full openings.

In either case nothing shall be paid for making openings.

Rates :

The rates shall include cost of all materials, labour, scaffolding etc. involved in carrying out the work, coat of primer, and two coats of approved paint in the overlapping, wind ties, nut bolts, hooks.

Ridges and Hips :

Ridges and hips shall be fixed with min. laps 200 mm both sides over sheet roofing. End laps also shall be min. 200 mm irrespective of any slope.

Ridges and hips shall be fixed to purlin hip and valley rafters, with the same 8mm dia. G.I. hook bolts, nuts and G.I. and bitumen washers which fix the roofing sheets to those members. End laps of ridges and hips shall have min. one hook bolt, on either side. End laps or ridges and hips should be jointed together by G.I. seam bolts and any extra bolts 25mm x 6mm with G.I. bitumen washer.

Measurements :

The finished work shall be measured I length along the center line of hips or ridges correct to a cm. Laps shall not be measured separately.

Rate :

Rate shall be include cost of all labour, materials, seam bolts and any extra G.I. hook bolts, nuts and washers required for complete work as described and specified.

Valleys and Flashings :

Valleys and flashings of size and thickness as described, shall be bent to shape, fixed and shall lap with sheet min. of 250 mm or 150 mm respectively on either side and have end laps of min. 250 mm.

Plain galvanized steel sheet flashing shall be fixed to roof members with same 8 mm dia G.I. hook, bolts and nuts and bituminous washers fixed to the roofing sheets. End laps of valleys and flashing shall have minimum one fixing bolt.

Measurements :

Length shall be measured correct to a cm. Laps will not be measured.

Rate :

Shall include complete work as described and specified.

Plain Galvanised Steel Sheet Gutters :

Gutters shall be of shape and section and of galvanized steel sheet of thickness as specified.

Longitudinal edges of Eaves gutter shall be turned back to the extent of 12mm and rounded. The ends of gutters at junctions of pieces shall be hooked into each other and beaten flush.

Gutters shall have a min. slope of 1 in 120. They shall be supported and fixed to M.S. flat brackets bent to required shape and fixed to required slope. Spacing of brackets shall be 1.20 mtrs.

Drop end of galvanized steel sheets of same thickness as gutters shall be riveted to the gutters. All gutters should be leak proof and fixed to line and slope.

Measurements :

Measurements of gutter shall be in length of finished work along the center line and correct to a cm. Hooked laps shall not be measured.

Rate :

Shall include the cost of all labour, materials, including all specials such as angles, junctions, drop ends or funnel shaped connecting pieces, stop ends, M.S. flat brackets, and bolts and nuts required for fixing to the roof members.

4.0 Asbestos Cement Corrugated Sheet Roofing :

Asbestos Cement Corrugated Sheets :

The sheets shall conform to IS : 459-1970. The sheets shall be free from cracks, chipped edges or corners and other damages.

Laying :

The sheets shall be laid on the purlins and other roof members as indicated on the working drawing or as per instructions.

The maximum spacing of purlins under sheets shall not exceed 1.40 mtrs. In any case. Ridge purlins shall be fixed at 75mm to 115mm from the apex of the roof. The top bearing surfaces of all purlins and of other roof members shall be in one plane. The finished roof shall present a uniform slope and the line of corrugations shall be straight and true. The sheets shall be laid with smooth side upwards.

The sheets shall be laid with a side lap of half of corrugation and an end lap of 150 mm minimum. In case of roofs with a pitch flatter than 1 vertical to 2 ½ horizontal (slope approx. 22^{o}) or in the case of very exposed situation, the minimum permissible end lap shall be 200 mm.

The free overhang of the sheets at the eaves shall not exceed 300mm.

Sheets shall normally be laid from left to right starting at the eaves. The first sheet shall be laid uncut, but the remaining sheets in the bottom row shall have the top left hand corners cut or mitred. The sheets in the second and other intermediate rows, except the first and the last sheets, shall have bot the top left hand corner andbottom right hand corner mitred, while the last sheets in these rows shall have only the top left hand corner mitred. The top row sheets shall have the bottom right hand corner mitred with the exception of the last sheet which shall be laid uncut.

If the sheets are laid from right to left, the whole procedure shall be reversed.

The ‘mitre’ described above is necessary to provide a snug-fit where four sheets meet at a lap. The cutting should be done with an ordinary wood saw, and not broken with sharp instruments. The length and breadth of mitre shall be equal to length of end lap and breadth of side lap respectively.

Fixing :

The sheets shall be fixed to the purlins or other roof members with 8mm dia. G.I. “J” or “L” hook bolts and nuts. “J” or “L” hooks shall have a minimum of 25mm bend on the other side of purlin. Each bolt shall have bitumen washer of approved make 35mm dia. and 1.5 mm thick and a G.I. flat washer 25mm dia. and 1.6 mm thick placed between the sheet and the nut.

Nuts shall be screwed lightly at first. The nuts shall be further tightened when about a dozen sheets are fixed, to make leak proof joint. The bolts should be sufficiently tightened so that the G.I. washer presses to bitumen washer over the bolt hole, to seal it over the corrugations, and so that the natural movement of the substructure of the roof may not damage the sheeting.

On intermediate purlins, where sheets do not have end laps, the bolt should not be overtightened so as to make the sheet rest on the purlins.

In case where the end lap is more than 150mm, the position of the fixing bolt should be more towards the apex.

Holes for bolts shall be drilled and punched in the crown of the corrugations and never in the flats or valleys. Holes should be drilled in correct positions to suit the purlins while the sheets are on the roof in correct position. The diameter of the holes shall be 10mm for 8mm dia. bolts. No hole shall be nearer than 40mm to any edge of a sheet.

Roof ladders and planks shall be used when laying and fixing sheets.

Wind Tie :

Wind Tie shall be of 40mm x 6mm M.S. flats section and shall be fixed at the eaves ends of the sheets. Fixing shall be with the same hooks which secure the sheets to the purlins.

Completed roof shall be neat and uniform in appearance and shall be leak proof.

Measurements :

Length and breadth shall be measured correct to a cm. and area calculated in sq.mtr. correct to two places of decimal. The superficial area of roof covering, side cladding and louvers shall be measured not as fixed, from ends of roof cladding without allowance for laps and corrugations. Portions of roof covering overlapping the ridges or hips shall not be included in the measurements, but the loverlapping in barge boards, eaves, etc. will be measured separately.

No. deductions in measurements shall be done for openings upto 0.40 sq.mtr. in area. For openings above 0.40 sq.m. in area deduction in measurements for the full openings shall be made. In either case, nothing shall be paid for making such openings.

Note : The rate shall include he cost of all materials, labour, scaffolding etc. involved in carrying out the complete work as described and specified.

5.0 Asbestos Cement Semi-Corrugated Sheet Roofing :

These shall conform to IS : 459-1970.

Laying :

Laying shall be same as for Asbestos Cement corrugated sheet roofing with the following exceptions.

a) The sheets shall be laid with the end stamped ‘top’ on the smooth side, pointing towards the ridge.

b) The sheets shall always be laid from right to left starting at the eaves with procedure for edge cutting for mitring for corrugation of each sheet being revered.

c) The side laps shall be of one corrugation, the left hand small corrugation of each sheet being covered by right hand corrugation.

d) Expansion joints shall be provided at every 30 to 35 metres in length of semi-corrugated roof when it is more than 60 metres in length. The end lap of expansion joints shall be minimum 150 mm. If expansion joints lap between purlins, these should be stitched with seam bolts.

Fixing :

The specification for fixing shall be the same as for asbestos cement corrugated sheet roofing with the following exceptions :

a) Along each line of purlin, a hook bolt shall be provided in every side lap corrugation and at the two verges.

b) An additional hook bolt shall be provided through one of the two intermediate corrugations on each sheet along each line of plulin.

c) At the intermediate purlins, 'J' or 'L' hook bolts, nuts, G.I. and asbestos washers are required through each side lap and verges only.

Wind Ties and Finish :

Specifications same as for Asbestos cement corrugated sheet roofing.

Measurements :

Mode of measurements shall be same as for Asbestos cement corrugated sheet roofing. In addition, the end laps of sheets under Asbestos Cement expansion joints shall also be included in measurements. The gap between the sheet about 20mm under expansion joint shall not be measured.

Rate :

Same as for Asbestos Cement Corrugated sheet roofing. Cost of expansion joint sheeting is not included which shall be measured and paid for separately.

The pitch of corrugations relates to measurement over six pitches for corrugated sheets and three pitches for semi-corrugated sheets.

Sampling and Number of Sheet Tests :

The number of sheets selected at random from the lot of any consignment of sheets of same type and of the same thickness and manufactured under similar conditions of production, shall be as follows :

Lot Size	Sample Size
Upto 200	1
200 to 500	3
500 to 1000	5
1000 to 1500	7

1501 and above	10

Each sheet shall be stamped or marked for the following information.

a) Manufacturer’s name or Trade Mark.

b) Year and Date of Manufacture.

c) I.S.I. Certificate.

TABLE DIMENSIONS & TOLERANCES OF CORRUGATED & SEMI-CORRUGATED SHEETS

Sr No	Type of Sheet	Depth of Corrugation		Pitch of Corrugation		Overall width		Effective width		Nominal thickne		Length of sheets*	
		D.Tolerance		P.Tolerance		B.Tolerance							
1	2	3	4	5	6	7	8	9	10	11	12	13	14
i)	Corrugated Sheets	48	+3 -5	146	+6 -2	1050	+10 -5	1010	+10 -5	6	+ Free -0.5	1750 2000 2500 or 3000	+5 -10
ii)	Semi-corrugated sheets	45	+3 -5	338	+6 -2	1100	+10 -5	1014	+10 -5	6	+ Free -0.5	1750 2000 2500 or 3000	+5 -10

- Intermediate metric sizes may also be manufactured by mutual agreement between The manufacturer and consumer. Tolerance given in this table for pitch of Corrugation relates no measurement of over six pitches for corrugated sheets and Three pitches for semi-corrugated sheets.

Ridges and Hips of Asbestos Cement :

Ridges and Hips shall be of the same make as corrugated or semi-corrugated sheets used for roof. The sections shall be free from cracks, chipped edges or corners or any other damage.

Laying :

Ridge sections shall be laid as per manufacturer's instructions.

The end portions of the wings of the adjustable ridges projecting beyond the verges of the roof shall be cut and trimmed off neatly.

A.C. Cement expansion joint ridge prices shall be provided every 35 metres ridge for semi-corrugated serrated adjustable type rides.

In laying hip pieces, serrations to suit the corrugations in sheets below should be cut in hip pieces for them to fit snug over the roofing sheets.

Fixing :

Wings of rides shall be fixed to the roof sheets with same 8 mm dia. G.I. 'J' or 'L' hook bolts and nuts and bitumen and G.I. washers which fix the roof sheets to the purlins. In north light adjustable ridges the curves of the two wings shall be joined at their crown with 8mm dia G.I. seam bolt and nuts, 2 number per pair of wings, and with bitumen and G.I. washers.

In the case of plain wing angular ridges or plain wing adjustable ridges, the gaps in the roofing corrugations and wings shall be filled with cement concrete 1:2:4 for the full length of overlap and finished perpendicular to sheeting.

Wings of hips shall be fixed to the roof members below with the same 8mm dia. G.I. 'J' or 'L' hook bolts and nuts which fix the sheet to those members. They shall further be secured to the sheets eblow with 8mm dia. G.I. seam bolts, nuts and washers also that together with hook bolts there shall be a bolt on each wing at least every fifth corrugation of the sheet below for corrugated sheet roofing and at least every second corrugation in the case of semi-corrugated sheets. Each seam bolt shall have one bitumen and a pair of G.I. washers.

Measurements :

Measurements shall be for complete work as finished along the center line of the ridge and hips. In length, correct to a cm. measured end-to-end laps shall not be measured.

Rate :

The rate shall include complete work as described and specified. Cement concrete 1:2:4 (nominal mix) filling in case of plain wing angular ridges or plain wing adjustable ridges shall be included in the rate of the item for ridges.

6.0 **A.C. Roof Accessories** : (including roof extensions)

These shall be of the type suitable for use with corrugated and semi-corrugated sheet roofing and shall be of the same manufacture as the A.C. corrugated or semi-corrugated sheets forming the roofing.

Laying and Fixing :

These shall be fitted as per manufacturer's instructions. 'S' type louvers shall be fixed to vertical supports spaced at 1.45 metres for 3 m pieces and 1.65 metres for 1.75 metres pieces. The laps of adjacement pieces shall be 100mm.

Measurement :

The accessories shall be measured in length correct to a cm. in numbers or in pairs as mentioned in the Schedule of Items. Laps shall not be measured.

Rate :

The rate shall include complete work as described and specified. The rate for roof lights shall include glazing with wired glass. The rate for 'S' type louvers shall exclude the supporting members.

7.0 A.C. Eaves and Valley Gutter :

Gutters and Accessories shall be of the type described and of standard size stipulated in the item. They shall be of manufacture approved by the EIC and shall be free from cracks, chipped edges or corners or other damages.

Laying and Fixing :

Gutters shall be laid with minimum slope of 1 in 120 true to line and slope and with requisite accessories as per drawing and/or as directed by the EIC.

The M.S. Flat bracket to be fixed to the side of rafters shall be 40mm x 4mm sections bent to shape and fixed to the sides of rafters with 3 nos. 10mm diameter bolts, nuts and washers.

The brackets shall overlap the rafter not less than 300mm and connecting bolts shall be at 100mm centers.

The M.S. brackets to be fixed to the purlins shall be 50mm x 4mm M.S. flat section bent to required shape and fixed to the purlin face with a 10 mm dia. bolt, nut and washer. The overhand of 50mm x 4mm bracket shall be stiffened by another 50mm x 4mm flat. The overhang of the bracket from the face of the purlin shall not exceed 250 mm.

Brackets spacing shall be max. 900 mm and shall be fixed in line of the slope of the gutters. Socketted gutters shall be supported with a bracket close to the socket and one in the center of the gutter.

Plain ended gutters shall be supported with a bracket on either side of union clip. For large section gutters, one extra supporting bracket shall be fixed in the center of the gutter.

Gutters shall be fixed to brackets with 2 nos. 8 mm dia. seam bolts, nuts and pairs of bitumen and G.I. washers.

The gap between socket and spigot shall be packed with bitumastic jointing compound of Everest or equivalent approved make, flanked with 6mm diameter asbestos rope smeared with bitumastic jointing compound on both sides and the socket and spigot tightened with 8mm diameter seam bolts, nuts, and pairs of bitumen and G.I. washers.

When both the ends of gutters to be joined are spigot ends, or ends of "Plain ended eaves or boundary wall" or "Plain ended valley" type gutters, they shall be laid as butt joints with a gap of 1.5mm and the space between the union clip and the gutter is filled up as for socket and spigot gutter with bitumastic compound filled by 6mm asbestos ropes smeared with the compound.

Measurement :

The measurement shall be for finished work in length correct a cm. along the center line of the gutters, excluding all the accessories. Laps between adjacent places of gutters or between gutter and accessories shall not be measured.

The accessories mentioned above such as drop ends, stop ends, nozzles and angles shall be measured and paid for in numbers. The cost of union clips shall be included in the rate for gutters.

Rate :

The rate for gutters shall be for complete work as described and specified.

7.0 ROOFING :

Fibreglass Reinforced Polyester Translucent roofing (FRP) :

F.R.P. Sheets are available in the following thickness :

		Tolerance
Standard Thickness	:	1.2mm / ± 0.1mm
Medium	:	1.4mm / ± 0.1mm
Heavy	:	1.6mm / ± 0.1mm

They are available in the following shades of colour and their (a) Diffuse luminous (or light) transmission factor and (b) Diffuse ultra violet transmission factor are as follows :

Type	Diffuse Luminous	Diffuse U.V.T.F.
Clear Translucent	81.9%	14.4%
Milky White	35.9%	1.9%
Blue Tinted	53.9%	19.2%
Natural	56.0%	20.0%

The make shall be Amarjyot F.R.P. translucent sheets or equivalent approved. The sheets are available in the standard size in which A.C. Corrugated or semi-corrugated sheets and G.S. Sheets are available.

The length and breadth shall be measured correct to a cm. and area shall be worked out in sq.m. correct to two places of decimal, without allowance for laps and corrugations. Portions of roof overlapping ridges, hips, shall not be included in the measurements but overlapping in barge boards, eaves, shall be measured.

No deductions in measurements shall be made for openings upto 0.40 sq.m. in area, for openings more than 0..40 sq.m. in area, deduction in measurements shall be made for full openings. In either case, nothing shall be paid for making such openings.

Rate :

The rate shall include cost of all material, labour, scaffolding etc. involved in carrying out the work, cost of 'L' or "J' G.I. bolts overlapping etc.

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IX. CEILING AND LINING

1.0 INDIAN STANDARDS :

1.	IS : 303-1989	:	Plywood for general purpose
2.	IS : 1328-1982	:	Veneered decorative plywood (III revision)
3.	IS : 1658-1977	:	Fibre hard boards
4.	IS : 2095-1982	:	Gypsum Plaster boards
5.	IS : 2098-1964	:	Asbestos Cement building boards.
6.	IS : 3097-1980	:	Veneered particle boards
7	IS : 3129-1985	:	Low density particle boards.
8.	IS : 3308-1981	:	Wood wool building slabs (Amendment No.1)
9.	IS : 3348-1965	:	Fibre insulation boards

The above mentioned I.S. Codes of Practice have been indicated for general guidance.

However, these IS Specifications and Codes will be adopted only for those particular items in the contract where the mode of measurements or detailed technical specifications are not laid down in the Tender.

2.0 DEFINATIONS :

1. Block Board :

A board having a core made up of strips of wood, each not exceeding 25mm in width, laid separately or glued or otherwise jointed to form a slab which is glued between to or more outer veneers with the directions of the grain of the core blocks running at right angles to that of the adjacent outer veneers.

2. Cross Band :

A general term indicating a transverse layer of veneer or veneers in composite wood products.

3. Decorative Veneers :

Veneers having attractive appearance due to figure, colour, grain, luster, etc.

4. Particle :

Distinct particle or fraction of wood or other lignocellulose material produced mechanically for use as the aggregate for a particle board. This may be in the form of flake, granule, shaving, splinter and sliver.

5. Particle Board :

A board manufactured from particles of wood or other lignocellulose material, for example, flakes, granules, shavings, slivers, splinters, agglomerated, formed and pressed together by use of an organic binder, together with one or more of the agents such as heat, pressure, moisture and a catalyst.

6. Plywood :

A board formed of three or more layers of veneer cemented or glued together usually with the grain of adjacent veneers running at right angles to each other.

7. Seasoning :

A process involving the reduction of moisture content in timber under more or less controlled conditions towards or to an amount suitable for the purpose for which it is to be used.

3.0 SPECIFICATIONS :

1. Block board :

These boards are used for panelling on wall surface or door shutters, shall be grade I exterior grade, which is of the following types :

ii) Type I block boards, decorative type (x DEC). These are block boards with ornamental veneers on one side or on both sides.

ii) Type II block boards, commercial type (x COM). These are block boards with faces of commercial timber.

The block boards grade I shall have been bonded with B.W.R. (Boiling Waterproofing) type synthetic resin adhesive.

2. Particle Board :

The particle board used for the panelling in door shutters, wall cladding, etc. shall be FPS (Flat Pressed Single layer board) or FPTH (Flat Pressed Three layer board) type. It shall have been bonded with B.W.R. (boiling Waterproofing) type synthetic resin adhesive. The shrinkage in thickness and length of particle shall not exceed 5 percent.

Types of particle boards :

a) Flat pressed particle board :

This is manufactured my mixing wood particles of pre determined sizes and shapes with synthetic resins of Phenol formaldehyde or urea formaldehyde types and curing and pressing in a parallel platen hot press of the usual multiplaten types but may be pressed in a continuous band type of press. The applied pressure is perpendicular to the plane of the board which orientates the particles mainly with the larger dimension parallel with the plane of the board.

b) Single layer particle board :

A board made of one uniform layer or particles and resin mix and predominantly of uniform texture and strength in the whole depth of the board.

c) Three layer particle board :

A particle board made of three layers of particles and resin mix, usually with finer and thinner particles for the top and bottom layers and coarser and bigger particles for the core layer. Resin content in a three layer board is usually higher in the face layer than in the core layer leading to a sandwich construction with stronger and denser skin.

3. Plywood :

Plywood for general purpose shall be of three grades, namely ,BWR, WWF and CWR, depending upon the adhesives used for bonding the veneers. The plywood used for panelling for door shutters, wall cladding, etc. shall be BWR grade and shall not be less than 10mm thickness for two or more panel shutters and 12mm thickness for single panel shutters. The thickness in case of wall cladding/false ceiling etc., all not be less than 6mm. The thickness of all veneers shall be uniform, within a tolerance of ± 5%.

Requirements of thickness of face and core veneers shall be as follows:

i) In 3-ply boards, upto 5mm thick, combined thickness of the face veneers shall not exceed twice the thickness of center ply.

ii) In multiple boards, the thickness of any veneer shall not be more than thrice the thickness of any other veneer.

iii) The sum of the thickness of the veneers in one direction shall approximate to the sum of the thickness of veneers at right angles to them and shall not be greater than 1.5 time the sum, except for 3 ply as specified above.

The thickness of plywood boards shall be specified as under :

BOARD	THICKNESS
3 ply	3mm, 4mm, 5mm
5 ply	6mm, 8mm, 9mm
7 ply	9mm, 16mm, 19mm
9 ply	13mm, 16mm, 19mm

11 ply 19mm, 22mm, 25mm

4. Hard board :

Hard boards are generally classified into the following three types according to their method of manufacture, density and other related mechanical and physical properties :

a) Medium hard board :

A homogeneous fibre building board having a density exceeding 480 kg/M^3 but not exceeding 800 kg/M^3.

b) Normal hard board :

Same as above, but having density exceeding 800 kg/M^3, but not exceeding 1200 kg/M^3.

c) Tempered hard board :

Hard board which has been further treated in the course of manufacture to increase its density, strength and water resistance.

The hard board used for panelling of door shutters, wall cladding, false ceiling, etc. shall be of tempered quality. The thickness of hard board panelling shall not be less than 12mm dia in case of single panel shutter and 10mm in the case of two or more panel shutters. The hard boards shall be regular and unless otherwise specified, shall have square edges. The length of the two diagonals of the board shall not differ by more than ± 3mm per metre length of the diagonal. The tolerance in length, width shall be ± 3mm and on thickness ± 0.3mm.

The boards shall be of uniform thickness subject to tolerance as above. They shall be free from warp. The surface shall be flat, free from cracks and lumps and of normal colour. At least one face shall be smooth.

5. Asbestos Cement :

The material shall have the composition of an inert aggregate consisting of clean asbestos fibre cemented together by ordinary Portland cement, rapid hardening and low heat Portland cement or blast furnace slag cement. No organic or inorganic material shall be added to he composition. Pigments which are embodied in the asbestos cement for colouring purpose shall be of permanent colour and shall conform to the requirements.

The thickness of asbestos cement board used for panelling shall not generally be less than 6 mm. tolerance in thickness shall be ± 0.5mm.

6. Sheet Glass :

The glass shall be reasonably free from blisters, stains, scratches and bubbles, so as not to disturb the visibility through the glass. Blisters exceeding 4mm shall not be present. Blisters less than 4mm, if present shall be less than 3- per sq.mtr. and shall be fairly and uniformly distributed. Bubbles less than 2mm need not be considered. The glass shall be of good and durable quality conforming to IS: 1761-1960 but weighing not less than 7.5 kg/m^2. The tolerance in length and width

of sheet glass shall be ± 1.5mm for glass of thickness 2.5mm and below; and ± 2mm for glass of thickness above 3mm.

7. Plaster of Paris :

Plaster of Paris shall be of the calcium sulphate. Its fineness shall be such that when sieved through a sieve of I.S. Sieve designation 3.35mm for 5 minutes after drying the residue left on it, shall not be more than 1% by weight. Initial setting time shall not be less than 13 minutes.

Preparation of Tiles :

The tiles of plaster of Paris reinforced with hessian cloth shall be prepared in suitable sizes as per drawing or as ordered by the EIC. The maximum size of tiles shall be limited to 75 cms. In each direction. Wooden forms of height equal to the thickness of the tiles shall be placed on a truly level and smooth surface such as glass sheet.

The section of form sides shall be such that the edges of the tiles shall be provided with a neatly formed chamfer alround of 5mm width and 8mm depth, unless the tiles are to be provided with cover fillets over joints, in which case the edges of the tiles shall be truly square. The glass sheet or the surface on which the form is kept and the form sides, shall be given a thin coat of non-staining oil to facilitate the easy removal of the tile. Plaster of Paris shall be evenly spread into the form upto about half the depth and hessian cloth weighing not less than 230 gms per square metre, shall be pressed over the Plaster of Paris layer. The ends of the hessian cloth shall be turned over at all edges to form a double layer to a width of 5 cms. The hessian cloth shall be of an open webbed texture so as to allow the plaster below and above to intermix with each other and form an integral whole. The form shall then be filled with Plaster of Paris, which shall be uniformly pressed and then wire cut to an even and smooth surface. The tile so moulded shall be allowed to set initially for an hour or so and then removed from the form and allowed to dry and harden for about a week. A good tile, after drying and hardening, shall give a ringing sound when struck. The tiles shall be true and exact to shape and size and with clean and regular chamfers. The exposed face shall be truly plane and smooth.

4.0 PANELLED PARTITIONS :

The frames shall be wrought, framed and fixed in position as per detailed drawings and as directed by the EIC. Specified timber shall be used and it shall be sawn in the directions of the grains. Sawing shall be truly straight and square. Timber shall be planed smooth and accurate to the full dimensions, rebates, roundings and mouldings, as shown in the drawings made, before assembly. The details specified for door/window frames shall apply as far as applicable. The wooden framework shall be paid for separately unless otherwise specified.

Panelling :

The space between the frame work shall be filled in with wooden panelled or glazed partitions, asbestos sheet, hard board, particle board or as specified, fixed in the rebate of the frame with screws. The above covering materials shall also be fixed with wire nails over the frame work, leaving grooves as per the pattern shown in the drawing and wooden beading. The hollow space between facing/finishing on either side of frame work shall be filled in with wood wool, glass, thermocole, or other light materials shall be paid for separately.

Measurement :

The width and height of partitions shall be measured correct to a cm. The area within the rebates of the frame shall be calculated in square metre nearest to two places of decimal.

Rate :

It includes the cost of materials and labour required for all the operations described above. The wooden frame work shall be paid for separately.

5.0 WALL LINING :

The timber shall be planed smooth and accurate to the full dimentions, rebates, roundings, mouldings, as shown in drawings, before assembly. Grounds shall be provided where so specified. These shall consist of second class T.W. plugs of trapezoidal shape and of workable size, with depth of 5 cm, embedded in wall, and second class T.W. battens 50 x 25 mm or as specified, fixed over the plugs, with 50mm long wood screws. The plugs shall be spaced at 45 to 60 cms. Priming coat of approved wood primer or a coating of anti-termite solution on all unexposed surfaces of wooden frame work..

a) Teak wood panelling :

The thickness of the panel shall be 16mm upto width of 40 cms and 19 mm for a greater width. Solid wood panels shall be made out of one or more pieces of timer of not less than 12.5 cms in width. In order to avoid warping, splitting and cracking, normally pieces not exceeding 20 cms in width shall be used. The grains of the solid panel shall run along the longer dimensions of the panel. The finished work, with a tolerance of ± 1 mm in thickness may be accepted. When made from more than one piece, the pieces shall be joined with a continuous tongue and groove joint glued together.

b) Blockboard panelling :

This panelling shall be decorative or non-decorative (paintable) type as per design and thickness specified in drawing or as per EIC, fixed over the wooden frame work fixed on wall. The unexposed surface of panelling materials and wooden framing fixed to walls shall be treated with anti-termite coating or a coat of suitable wood primer, before fixing in position. If the hollow spaces are filled with any insulation materials, the same shall be measured and paid separately.

Any other materials like plywood, particle board, asbestos sheeting, etc. may also be fixed over framework on walls, as shown in drawings, including necessary grooves, etc.

Measurements :

Length and breadth shall be measured correct to cm. Wall panelling such as T.W. panelling, block board, plain lining, plain skirting each shall be measured separately in square metre nearest to two places of decimal. The moulded work shall be measured in running length. Measurements for ground shall be taken on the basis of cubical contents of battens and paid for separately. Where only plugs are required to be fixed, the cost for the same shall be deemed to be included in the rate of ornamental work.

Rate :

The rate shall include the cost of materials and labour required for all the operations described above.

6.0 WOODEN CEILING :

Boards :

Boards shall be of the class of timer and of finished thickness as specified in the description of item and shall be in accordance with the general specifications for wood work. Only selected boards of uniform width shall be used. Unless otherwise specified in the description of the item or shown in the drawings, the width of boards, selected for use shall not be less than 100mm nor more than 150 mm.

The specific width of boards once selected within these two limits, shall be maintained through out and shall not be varied except in the first and last lines of boards adjacent to the two walls, where remaining odd width shall be adjusted equally on both sides. The maximum length of board in the finished work shall be 180 cms. The minimum length of board finished work shall be such that it will span at least two spacings of the supporting frame work, except where shorter lengths are unavoidable, depending on the arrangements of the lines of heading joints which shall be carried out to the pattern ordered by the EIC.

The boards shall be planed true on the exposed side.

Unless stipulated otherwise in the description of the item, the longitudinal joints of the boards shall be tongued and grooved, while the heading joints shall be of the square butt type and shall occur under the center lines of the support joint. Heading joints in the adjacent boards shall not be placed over the same joints, those in alternate boards being arranged in the same line, except where the joints are to be concealed by beadings.

Frame :

Timber frame of the class of wood and section specified in the description of the item for frame or as ordered by the EIC shall be provided. The width of the frame scantling shall not be less than 50mm. the arrangements and spacing of the frame scantling shall be as per design furnished. The frame shall be given two coats of approved preservative paint before the boarding is screwed on. The frame and painting of the roof shall be paid for separately, unless specifically included in the description of the item. M.S. angles or other sections shall be used for suspending the frame and paid for separately.

The bottom surface of the frame shall be checked and corrected to true planes and slopes.

Mild Steel Screws :

Screws shall be got approved from the EIC before fixing. They shall be of the slotted counter sunk head type, of length not less than the thickness of the board plus 20mm. The designation number shall not be less than 9 for screws of length 40 to 50mm and shall not be less than 9 for screws of length 40 to 50 mm and shall not be less than 6 for screws of a length 25 to 35 mm.

Fixing :

The outer lines of boards shall be accurately fixed, parallel and close to the wall. Each subsequent plank shall be carefully jointed up. The boards shall be fixed to the frame scantling above with two screws at each end joist of frame and one at every intermediate joist. The screws shall be counter sunk and the screw boles filled with putty or sloping out was. The unexposed faces of planks shall be painted with wood preservative before fixing, but this treatment will be paid for separately.

Finishing :

The exposed side of the boards shall be truly level and plane. The joints shall be truly parallel and/or perpendicular to the walls.

Beadings shall then be fixed to the ceilings, to the size and pattern required. These shall be measured and paid for separately unless specifically included in the description of the ceiling item.

Measurements :

Length and breadth shall be measured correct to a cm. Areas shall be worked out to the nearest 0.01 sq.m. The ceiling shall be measured in sq.m. of superficial area of the finished work.

No deductions in measurements shall be made for openings of areas upto 0.40 sq.m. No extra shall be payable either for any extra materials or labour involved in forming such openings. For openings exceeding 0.40 sq.m. in area, deductions in measurements for the full opening will be made and in such cases any labour involved in making these openings shall be paid for separately, in running metres.

Boardings fixed to curved surfaces in narrow widths shall be measured and paid for separately, and shall include shooting the joints to proper splay.

Circular cutting and waste shall be measured and paid for separately in running metres.

Rate :

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

7.0 CEILING WITH INSULATING BUILDING BOARDS :]

Insulating Building Boards :

The insulating building boards shall be of approved quality as per IS Code 3348-1965 and unless otherwise specified, shall have square edges. The dimension shall be subjected to the tolerances given in the table below :

DIMENSIONS & TOLERANCES

Type of Board	Nominal	Tolerance	Length	Width	Tolerance

	Thickness mm	on thickness mm			length & Width cm
i) Fibre insulation board, ordinary or flame retardant type	9 12 18 25	± 0.75 ± 0.75 ± 1.00 ± 1.25	365,399 270,249 210,180 150,120 100, 90 60, 45 and 30	180, 150 120, 100 90, 60 45 and 30	120 cm and below ± 3mm Above 120 cm ± 6mm

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Frame :

Timber frame of the class of wood and section specified in the description of the relevant item for the frame or as ordered by the EIC shall be provided. The width of the scantlings provided shall be sufficient to provide a minimum nailing surface of 50mm. The longitudinal and header scantlings shall be so arranged that : (a) the boards can be fixed to form the panel arrangements required as per drawings or as ordered by the EIC, (b) the longitudinal scantling to which the boards are mainly fixed or spaced at 30 to 45 cm centers, the actual spacing selected depending on the width of the cut board in the panel arrangement, (c) all edges of the cut board units are supported either on the longitudinal scantlings or on the header scantlings.

The frame shall be given two coats of approved preservative paint before the board is nailed on. M.S. angles or other sections shall be used for suspending the frame and paid for separately.

Where the joints in the board are to be covered with beadings the framing centers should be plus 3 to 6 mm as specified by the manufacturer for each board width to allow for space between boards.

The framing and painting thereof shall be paid for separately, unless specifically included in the description of the ceiling item.

The bottom surface of the frame shall be checked and corrected to true planes and slopes.

Nails :

The sheets shall be fixed to the frame scantling with G.I. lost head nails 2.24 mm dia. when the joints are to be left exposed. Where the joints will be covered with beadings, the sheets are to be fixed to the frame scantlings with G.I. felt headed (clout) nails 2.5mm. The length of the nails shall generally be equal to the thickness of the sheet plus 25mm, so that their grip on the framing members will not be less than 25mm.

Fixing :

The boards shall be applied with lengths parallel to all joints centered over the framing members. Where joints are to be covered, the boards may be spaced 3 to 6 mm apart as described in the respective manufacturer's specifications. Where joints are to be left exposed, the sheets shall be butt laid, with their edges abutting in moderate contact, but without having to force them into place. The

boards shall be supported and held tight to the grounds with timber pieces, the latter being moved outwards as the nailing proceeds. The boards are first nailed to the intermediate framing member proceeding from the center of the board outwards, the edges being nailed last.

Where the joints are to be left exposed, the outer rows of nails are placed at 10 cm center and about 12mmfrom the edge of the sheet. In the rows in the middle of the sheets, the nails are placed 20 cm apart, nails in the outer rows on either side of joints shall be paired and not staggered. The nails should be counter sunk in the underside of the board, with a suitable punch. Care shall be taken in driving the nails that the sheets are not marked by hammer blows.

Where the joints are to be covered with beadings, felt headed (clout) nails shall be used instead of lost head nails. The spacing of the nails in the interior rows in boards shall be the same as in the proceeding para. In the outer rows at edges to be covered by beadings, the nails will be spaced at 20 cm centre in each row but with the nails staggered. The beadings will then be fixed over the sheets with screws at 20 cm center in each row with the screws in the two rows staggered and passing through beading, sheet and framing, so that ultimately the spacing of the fixing (nails and screws taken together) in each row will be at 10 cm center so far as the sheets and frames are concerned.

Finishing :

The exposed side of the board shall be truly level and plane without any local bulges or sags. The joints shall be truly parallel and/or perpendicular to the walls. The width of the joints shall be uniform. Care shall be taken to see that the uniformity of colour of the sheets is not spoilt during the fixing operations.

Where the joints are required to be covered beadings of size, pattern and materials as ordered shall then be fixed with screws. These shall however be measured and paid for separately, unless specifically included in the description of the ceiling item.

Where the joints are required to be covered beadings of size, pattern and material as ordered shall then be fixed with screw. These shall however be measured and paid for separately , unless specifically included in the description of the ceiling item.

The ceiling shall be treated with distemper or painting if so required but such surface treatment will be paid for separately, unless specifically included in the description of the ceiling item.

Measurement & Rate :

These shall be the same as described in 6.0

8.0 PLASTER OF PARIS (GYPSUM ANHYDROUS) CEILING OVER WOODEN STRIPS :

Frame :

The frame work shall be of the specified wood wrought and framed. In case of sloping roofs, wooden battens of suitable section (depending upon the span and load to be carried) shall be firmly fixed as main supports, to the underside of the tie beams of the trusses at required centers by means of bolts and nuts of proper

size. In case of flat roofs, the battens shall be securely fixed to the walls and pillars by holding down bolts and shall be fastened to the slabs above with iron straps or M.S. bars of suitable sections and encroached therein. Cross battens of 50mm x 40 mm sections at 40 cms centers or so shall then be fixed at right angles to the main battens. The frame work shall be treated with approved wooden preservative before it is covered with ceiling.

The underside of the frame work shall be true to planes and slopes.

The framework for ceiling shall be paid for separately unless specifically included in the description of the ceiling item.

Wooden strips :

Wooden strips 25mm x 6mm of first class kailwood, (unless otherwise stipulated specifically in the description of the item) shall be fixed to the cross batten, in parallel rows with gaps of 10mm in between adjacent rows, by means of felt headed (clout) nails. The strips shall be fixed butt jointed and not over lapped. The joints shall be staggered. The minimum length of strips to be used shall be 1.5 m depending upon the length of strips required.

Rabbit Wire Mesh :

Rabbit wire mesh shall then be fixed to the underside of wooden strips and their junctions with the battens with nails at pitch of 15 to 20 cm as ordered by the EIC. The rabbit wire mesh shall be straight, tight and perfectly true to planes and slopes and without any sagging and shall be slightly below the underside of the laths to allow the plaster to encase the metal round.

Plaster of Paris :

The Plaster of Paris shall be of the calcium sulphate Hemihydrate variety.

Its fineness shall be such that when sieved through a sieve of I.S. Sieve designation 3.35 mm for 5 minutes after drying the residue left on it shall not be more than 1% by weight. It shall not be too quick setting. Initial setting time shall not be less than 13 minutes. The average compressive strength of material determined by testing 5 cm cubes after removal from moulds, after 24 hours and drying in an oven at 40^{o}C, till weight of the cube is constant, shall not be less than 84 kg. Per square metre.

Applications :

The material will be mixed with water to a workable consistency. Plaster of Paris shall be applied to the underside of the laths over the rabbit wire mesh, in suitable sized panels and finished to a smooth surface by steel trowels. The plaster shall be applied in such a manner that it fully fills the gaps between the laths and the thickness over the laths is as specified in the description of the items. The joints shall be finished flush to make the ceiling in one piece. The finished surface shall be smooth and true to plane, slopes or curves as required.

Measurements :

Length and Breadth of superficial area of the finished work shall be measured correct to a cm. Area shall be calculated in square metre correct to two

places of decimal. No deduction shall be made for openings of areas upto 40 dm^2, nor shall extra payment be made either for any extra materials or labour involved in forming such openings.

For openings exceeding 40 dm^2 in area deduction in measurements shall be made, but extra will be payable for any extra material or labour involved in making such openings.

Curved surfaces shall be measured and paid for separately from flat surfaces. The work shall be deemed to comprise of flat surfaces only unless specifically stated otherwise in the description of the item.

Any sunk or raised mouldings in the plaster shall be measured and paid for separately, deduction being made from plastering on ceiling only if the width exceeds 15 cm. Ceiling at a height greater than 5 metres shall be so described and measured separately stating the height.

Rate :

The rate shall include the cost of all materials and labour involved in all the operations described above including all scaffolding, staging, etc. The frame work supporting the ceiling will be paid for separately unless otherwise stipulated in the description of the item.

The rate does not include for any raised or sunk mouldings or for any patterned finishing of the surface, which will be measured and paid for extra over the plaster work.

9.0 PLASTER OF PARIS (GYPSUM ANHYDROUS) TILES CEILING :

Frame :

Timber frame of the class of wood and section as specified in the description of relevant item for the frame or as ordered by the EIC shall be provided. The width of the scantlings provided shall be sufficient to provide a minimum nailing surface of 6 cm. The longitudinal and header scantlings shall be so arranged that the tiles can be fixed to form the panel arrangement required as per drawings, or as ordered by the EIC and there is supporting scantling under each and every edge of the tiles.

The framing shall be paid for separately unless specifically included in the description of the item.

Plaster of Paris :

Shall be as specified in 8.0.

Preparation of tiles :

Shall be as specified in 3.0 para 7.

Fixing :

The tiles so prepared shall be fixed to the cross battens of the ceiling frame with 40mm brass screws at spacings not exceeding 20 cm centre to centre on all edges. The tiles shall be laid with their edges in just close position to the

adjoining tiles without any gap in between. The line of screws shall be not less than 15mm away from the edge of the tiles. The screws shall be slightly counter sunk into the tiles. Holes for screws shall be drilled. The counter sunk heads of screws shall be covered up with plaster of paris and smooth finished.

Where a surface unbroken by visible joints is required, then the joints shall be filled with plaster of paris and trowelled smooth so that that whole surface appears as one without any joints. Nothing extra shall be paid for this closing of joints.

Measurements :

These shall be the same as in para 8.0. All special sizes and shapes of tiles necessitated by the openings referred to in the above para shall have to be made without any extra cost. The work at a height greater than 5 metres shall be paid for separately.

Rate :

The rate shall include the cost of all materials, labour, form work, scaffolding, etc. involved in all the operations described above. The rate does not include for covering the joints with beading, unless specifically stipulated in the item. The rate applies for plain faced tiles only and does not include tiles with sunk or moulded face.

10.0 WOODEN COVER FILLETS BEADING FOR CEILING :

Beading :

The bedding shall be of the specified wood and/or size as given in the description of the item. Unless otherwise described, the beading shall be of the plain variety with square edges.

The arrangement of the beading shall be as per drawings or as ordered by the EIC and shall be fixed normally over the joints to be covered.

Fixing :

The beading shall be planted, smooth overall exposed faces and true on the rear face fixed centrally over the butt joints between the two boards with iron wood screws in two rows on either side of the joint. The spacing of screws in each row shall be 20 cm centers. The screws thus shall pass through the beading ceiling board and then into the ceiling rafters with a minimum grip of 25mm in the latter and where the beading is to be fixed to the board above for ornamental purpose, there being no framework scantling above, then the beading shall be fixed with screws which will be driven through the full depth of the board and their spacing shall be same as before. The screws to be fixed shall be got approved by the EIC before fixing. These shall be slotted counter sunk head type and their designation number shall not be less than 8. The screws shall be oiled before insertion and shall be screwed in by means of a screw driver and in no case the use of a hammer for fixing the screws is permissible. The screws shall be driven slightly countersunk below the surface of the beading.

Finishing :

The beading shall be finished smooth and fixed in such a workmanlike manner that there is absolutely no gap left between the beading and the ceiling board nor in the joint faces. The beading line shall be absolutely straight and parallel and the plane of the underside of the beading shall be uniform.

The junction of the beading shall be fully mitred or of partly mitred kind as shown in the drawings or as ordered by the EIC. Where joints are to be fully mitred, both the longitudinal as well as the cross beadings shall be to the exact length as required by the panel arrangement. Where the joints are to be partly mitred variety and the length of the beading in one direction can run continuously over more than one panel then the minimum length of these beadings shall be 1.8 metres and the joints shall come at a corner of a panel and not in the middle of the panel side.

Measurements :

Beading shall be measured in length in running metres correct to a cm.

Rate :

The rate shall include the cost of all materials, labour and scaffolding involved in all the operations, and shall apply to square edged beading unless otherwise stipulated in the description of the item. Chamfering edges, if payable, will be separately measured and paid as extra per running metre of beading.

11.0 P.V.C. WALL PAPER :

The item shall include the removing of existing neeru plaster and paint If any, preparing the surface to receive wall paper, labour, cost of glue, etc. complete.

The item shall be measured in square metres. The length and width shall be the finished surfaces only. Nothing extra shall be paid for laps and wastage.

12.0 G.I. PRESSED METAL SECTION FRAMEWORK FOR SUSPENED CEILING :

The main load bearing member shall be C shape rectangular tube/channel with two horizontal 28mm and one vertical 50mm sided and each ends of the C turned down 9 mm, fabricated of 22 gauge (0.80 mm) G.I. Sheet. The cross runner shall be furring channel with 50mm horizontal side, two vertical 10mm and two ends turned flat 15mm outwards, fabricated out of 24 gauge (0.63 mm) G.I. sheet. Wall angle shall be 25mm x 25mm, 24 gauge (0.63mm).

The hangers or suspenders shall comprise 6mm dia, M.S. bars, painted with a coat of steel primer of approve make. These will be fixed to ‘L’ cleats of M.S. 25mm x 25mm x 5mm and 75mm long fixed to the soffit of the roof slab with metallic expansion fasteners. The hanger rods of required length shall have threaded end with 2 M.S. check nuts at the lower end fixed into holding clamp of size 75mm x 28mm and allowing level adjustment. The clamp will hold main runners which shall be running at not more that 1 metre centres in one directions. The cross runner with open side of the channel at top shall be placed below the main runner at right angles at distance as directed by the EIC but not exceeding 450 mm centers in one direction. These will be anchored and and screwed properly with main runners at every crossing with a 12 SWG, G.I. wire clip fixed diagonally around the main runner. The cross runners shall be fixed at centers not exceeding 300 mm for heavy

boards like teak particle boards, etc. The wall angles shall be properly secured to walls with rawl plugs and screws and the ends of main and cross runners shall be supported on wall angle.

NOTE : Ready made sections are manufactured under the trade name of GALVOLOK, Eastern Interiors Private Ltd.

13.0 ALUMINIUM TEE SECTION FRAME WORK FOR SUSPNEDED CELING :

The runners shall be as follows : Main and cross runners, both of Tee 38 mm x 38 mm x 1.5 mm punched at 605/610 nn centers and fixed at 605/601 mm centres.

The sections will be aluminium extruded sections of satin anodized finish.

The hangers or suspenders shall be out of 6mm dia. M.S. bar painted with a coat of steel primer of approve make as specified. The hangers shall form a hook at top and fixed to the ceiling cleat. The ceiling cleat shall be M.S. 25 MM X 25mm x 5 mm angles, 75 mm long, fixed to ceiling with metallic expansion fasteners. The hangers shall be fixed at 605/601 mm centres. The hanger rods of required length shall have threaded end with 2 M.S. check nuts at the lower end fixed into the holding clamp of size 38 mm x 65 mm allowing level adjustment. The clamp will hold the main runners. The cross runners and main runners shall be fixed both flush at bottom of Tee and at 605/610 mm centres. The wall aluminium angle 25mm x 25mm shall be secured firmly to the walls with rawl plugs and screws and ends of main and cross runners shall be supported on wall angle.

NOTE : Ready made sections are manufactured under the trade name of BESTLOK, Eastern Interiors Private Ltd.

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X. WATER SUPPLY, SANITARY INSTALLATION & DRAINAGE

1.0 INDIAN STANDARDS :

1.	IS : 4111 (Part I)- 1986	:	Code of Practice for ancillary structures in sewerage system. Part I – Manholes - Ist Revision
2.	IS :4111(Part II)-1985	:	-do- Part II – Flushing Tanks. 1st Revision
3.	IS :4111(Part III)-1985	:	-do- Part II – Flushing Tanks. 1st Revision

4.	IS : 1742 - 1983	:	Code of Practice for Building Drainage.
5.	IS : 1172 – 198	:	Basic requirements for water supply, drainage and sanitation.
6.	IS : 12339 (Part I)-1990	:	Specification for Mild steel tubes, tubulars and other wrought steel fittings. Part I – Mild steel tubes.
7	IS : 3114-1985	:	Code of Practice for laying of cast iron pipes.
8.	IS : 4127-1983	:	Code of Practice for laying of stoneware pipes.
9.	IS : 2470(Part I)-1985	:	Code of Practice for septic tank installation Part I – Design criteria and construction.
10.	IS : 9758 – 1981	:	Flush valves and fittings for water closets and urinals.
11.	IS : 2326-1987	:	Automatic flushing cisterns for urinals
12.	IS : 774-1984	:	Flushing cisterns for water closets and urinals (other than plastic cisterns).
13.	IS : 1726(Part I) – 1991	:	Cast Iron manhole covers and frames Part I – General requirements.
14.	IS : 1795 – 1982	:	Pillar taps for water supply purpose
15.	IS : 5455-1969	:	Steps for manholes, cast iron
16.	IS : 782-1978	:	Caulking lead
17.	IS : 781 – 1984	:	Cast copper alloy screw down bib taps and stop valves for water services.
18.	IS : 775-1970	:	Cast iron brackets and supports for wash basins and sinks.
19.	IS : 1703-2000	:	Waterfitting – Copper alloy flot valves (Horizontal plunger type)- specification
20.	IS : 4885-2000	:	Unplasticized PVC pipes for potable water supplies) Specification (III rd Revision)-Gr.9

The above mentioned I.S. Specifications and Codes of Practice have been indicated for general guidance.

However, these IS Specifications and Codes will be adopted only for those particular items in the contract where the mode of measurements or detailed technical specifications are not laid down in the Tender.

2.0 <u>GENERAL</u> :

Works to comply with local byelaws / regulations **:**

All sanitary installations, water supply and drainage work shall conform to the local / Municipal Byelaws and/or rules and regulations of local bodies.

The Contractor shall be responsible for the adequacy and efficient performance of the entire plumbing system and if, in his opinion, finds any serious objection to the system shown on the drawings, he shall set forth his objections and his suggestions to ensure adequacy and efficient performance of the said system and notify the EIC before proceeding with the work.

The Contractor shall arrange with the local / Municipal Authorities for obtaining temporary and permanent water and drainage connections and pay the statutory charges and deposits for permanent connections to the local / Municipal Authorities and the same shall be reimbursed to him on production of valid receipts of payments.

Setting Out :

The Contractor shall set out drainage, soil, waste and water pipe lines and other fittings and fixtures in accordance with the drawings and instructions of the EIC. The Contractor shall be responsible for the correctness of the above and any inaccuracies are to be rectified at his own expenses. He will be responsible for taking levels at site before setting out and putting them on record without extra charge.

Work Programme :

The Contractor shall complete the work so as to ensure that no damage or breakage is caused to the work once it is completed. The sanitary, water supply and drainage work shall be so programmed as not to hold up the work of other agencies.

The work shall be carried out through a licensed plumber.

The Contractor shall obtain all necessary permission forms from the various authorities having jurisdiction and shall apply and file all drawings required for obtaining permission and for satisfactory completion of work. He shall arrange at his costs the tests, and obtain the drainage completion certificate from the Municipal authorities.

The Contractor, at his own cost, shall get the work inspected and approved by the various local authorities concerned.

The rates quoted shall be for complete items as fixed in position and shall cover cost of materials, labour, tools, implements, scaffolding, supervision, checking adequacy and efficient performance of the system, testing, applying and obtaining approvals from local authorities concerned, cutting holes, chases and making good, testing of the completed system, etc. and also for providing, fixing arrangements, such as clamps, brackets, wooden blocks etc. wherever required and/or stipulated.

The rate shall also include restoration to original condition of all damages to walls, floors, works of other agencies, etc. caused during the process of fixing of sanitary installations, water supply and drainage, to the entire satisfaction of

the EIC. All debris due to plumber's excavation, etc. shall be removed away from site, as directed by the EIC, at contractor's cost. The plumbing work or the other building work affected by the plumber's work shall be attended to by the contractor and the place thoroughly cleaned to the satisfaction of the EIC.

In the interior of the building, all pipes, whether cast iron, galvanized iron, or lead, shall be embedded in an approved manner in chases made in walls or floors, if so required by the EIC. The contractor shall make necessary holes, chases, etc. in the walls etc. and make good to the original condition, at his cost.

All water supply and sanitary fixtures, pipes and pipe fittings, traps, etc. which are to be embedded into concrete or masonry work or other building work shall be placed in position and embedded/ concealed at the time of casting concrete or erecting brickwork. In case where chasing or cutting of concrete, masonry or other structural or construction work is unavoidable, the location of such fittings, pipe lines and traps, etc. shall be marked suitably and the cutting, chasing or disturbing of the construction work, shall proceed only after approval of the EIC. All cutting, chasing and fixing work shall be completed before commencement of any plastering, tiling or finishing work.

Unless otherwise specified, galvanized iron pipes and pipe fittings shall be of 'C' class conforming of IS:1239 and shall be got tested by the contractor, if so required by the local regulatory body and the EIC, at the contractor's cost.

The work in every respect, during its progress and till final acceptance by the EIC, including raw materials delivered at site to be incorporated for use in construction, shall be under the charge and in the care of and under the responsibility of the contractor at his risk. Any loss or damage to such materials or work, for any reason, shall be immediately replaced by the contractor at his expense.

Vouchers :

The Contractor shall furnish vouchers, upon request from the EIC, for the purchase of materials to indicate the source of supply, rates of purchase, the quality and make.

3.0 MATERIALS :

Materials shall be of approved quality and shall conform to the respective Indian Standard Specifications (latest revision).

Samples of materials shall be got approved before placing orders and approved samples shall be exhibited at site. If directed, materials shall be tested in an approved testing laboratory and the contractor shall produce the test certificate in original to the EIC and the entire charges for original as well as for repeat tests shall be borne by the contractor. If required by the EIC, the contractor shall arrange to test portion of the work at his own cost, in order to prove their soundness and efficiency. If, after any such test the works, or portion of works, is found, in the opinion of the EIC, to be defective or unsound, the contractor shall pull down and redo the same at his own cost. Defective materials shall be removed from the site.

It shall be obligatory for the contractor to furnish a certificate, if demanded by the EIC, from the manufacturer or the supplier of materials, that the work has been carried out by using their materials and installed/fixed as per their recommendations.

4.0 DRAINAGE (INTERNAL & EXTERNAL) :

Stoneware pipes and fittings :

Stoneware pipes and fittings shall be of approved quality and make and shall comply with IS : 651 in every respect. All stoneware pipes, bends, gully traps and sewer traps shall be of the best salt glazed variety, glazed inside as well as outside, hard, smooth, even textured, free from fire cracks or hair cracks, blow holes, blisters and crazing. The pipes shall be truly circular in cross section, perfectly straight and of standard nominal diameter.

The thickness of the pipes shall be as follows :

Internal dia. in mm	Thickness of barrel & socket
100	12 mm
150	16 mm
200	17 mm
250	19 mm

The length of the pipe shall be 60, 75, 90 cm exclusive of the internal depth of the socket.

Trenches for S.W. pipe Drains :

Protection of existing services :

All pipes, water mains, cables, etc. met with in the course of excavation shall be carefully protected and supported.

Excavation :

Trenches for the pipes shall be excavated to the lines and levels as directed. The bed of the trench shall be truly and evenly dressed throughout from one change of grade to the next.

The gradient is to be set out by means of holding rods. If the required depth is exceeded to any point, the trench shall be refilled with cement concrete of the specifications of the bed concrete, at the contractor's own expense.

The bed of the trench, if in soft or made up earth shall be well watered and rammed and depressions thus formed shall be made up with sand or other suitable material and consolidated all as directed by the EIC without any extra cost.

If rock is met with, it shall be removed to 150 mm below the level of pipe and the trench filled with 150 mm bed concrete in 1:3:6 (nominal mix).

The trench shall be kept free from water. Shoring and timbering shall be provided wherever required or directed by the EIC.

Laying & jointing of S.W. Pipes :

The pipes shall be carefully laid to the levels and gradients shown on the plans and sections with socket facing up the gradient.

All pipes shall be laid on a bed 150mm thick in cement concrete 1:3:6 (nominal mix 1 cement : 3 sand : 6 part \s of stone aggregate 40mm nominal size), well consolidated and cured. The concrete shall be laid to the full width of the trench and upto the level of the centre of the pipe line at edges of the trench and sloping upto the haunches of the pipes.

Jointing :

Spun yarn soaked in neat cement wash shall be wrapped round the spigot and inserted into the socket by means of a caulking tool. More yarn soaked in neat cement shall be added and well rammed home so as to fill not more than one fourth of the total depth of the socket.

Very stiff mixture of cement mortar 1:1 (1 cement : 1 fine sand) slightly moist, but on no account soft and sloppy , shall be carefully inserted into the joint. The mortar shall then be caulked into the joint and more cement mortar (1:1) added until the joint is filled completely with tightly caulked mortar. The joint shall then be finished off neatly outside the socket at an angle of 45^{o} .

Curing :

The joint shall be moist cured at least for 7 days.

Testing :

All joints shall be tested to a head of 600 mm of water above the top of the highest pipe between two manholes. Any joint found sweating or leaking shall be rectified or embedded into 15 cm layer of cement concrete (1:2:4) (nominal mix) 300 mm in length and section rested, at contractor’s cost.

Refilling :

Refilling in trenches for pipes shall be commenced after the joints and concrete have been tested and passed by the EIC and haunching is completed.

The refilling on the top of the pipe shall be done with great care and in such a manner as to obtain maximum compactness possible. For this, the earth shall be laid in layers of 150 mm watered and each layer rammed.

All surplus earth shall be disposed of as directed by the EIC.

Measurement :

The length of the pipes shall be measured in running metre correct to a centimeter as laid and fixed, along the centre line of the drainage line from inside of one manhole to the inside of the other manhole.

Excavation and refilling item shall be measured and paid for separately.

Rate :

The rate shall include the cost of all materials and labour involved in all the operations described in the item and specified above, including cement concrete 1:3:6 (nominal mix) bedding, testing, etc. but excluding excavation and refilling.

5.0 STONEWARE GULLY TRAP & CHAMBER :

Stoneware gully traps of 150mm x 100 mm size and of approved quality and make shall be fixed on 150 mm thick and 760 mm x 760 mm cement concrete (1:3:6) bedding. The gully trap outlet to the branch, drain shall be joined similar to joining of S.W. pipes. After fixing the fully trap a brick masonry chamber 300mm x 300 mm inside shall be constructed in half brick thick masonry in cement mortar 1:5 (1 cement : 5 fine sand) from top of bed concrete upto the ground level. The space between the trap and the wall shall be filled up with cement concrete 1:3:6 (nominal mix) and the upper portion of the chamber finished internally with cement mortar 1:4 (1 cement : 4 coarse sand) and finished with floating coat of neat cement. The exterior of the chamber shall be finished similarly.

The chamber shall have a C.I. cover with frame 300mm x 300mm (inside) with mechanical seating faces fixed on the top of the brick masonry with cement concrete 1:2:4 (nominal mix) and rendered smooth. The weight of cover and frame shall not be less than 4.50 kg and 2.70 kg. Respectively. The finished top cover shall be 4 cms above the adjoining surface so as to prevent the surface water from entering the gully trap.

Measurement :

The measurement shall be in numbers.

Rate :

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

6.0 REINFORCED CONCRETE NON-PRESSURE PIPES, CLASS NP2 :

The pipes shall be reinforced, of specified class NP 2, and shall conform to IS : 458-1971 and shall be of approved make and quality. These shall be manufactured by centrifugal (or spun) process. They shall be true to shape, straight, perfectly sound and free from cracks and flaws. The external and internal surfaces of the pipes shall be smooth and hard. Each pipe shall have one collar.

The NP 2 class pipes shall withstand hydrostatic pressure of 0.7 kg/cm^2 (7 metre head) and further bending stresses due to weight of water when running full across a span equal to the length of the pipe plus three times its own weight.

Trenches and refilling shall be as described under S.W. pipes above.

Bedding :

Normally concrete bedding is not necessary . Where the soil is made up or is very soft, concreting may be resorted to, as described under S.W. pipes, if directed by the EIC. The cost for this shall not be included in the rate for laying the pipe itself. Concrete shall be measured and paid for separately.

Laying and Jointing :

All pipes, section and connections shall be inspected carefully before being laid. Broken or defective pipes or connections shall not be used. The pipes shall be laid as described under stoneware pipe by laying the collar centrally over the joint. Pipes shall be laid true to line, and grade and laying shall proceed upgrade of a slope.

Measurement :

The length of pipes shall be measured in running metres nearest to a cm. as laid or fixed, from inside of one manhole to the inside of the other manhole. The length shall be taken along the centre line of the pipes over all the fittings, such as bends, junctions, etc. which shall not be measured separately.

Excavation, refilling, shoring and timbering in trenches and cement concreting wherever required shall be measured separately under relevant items of work.

Rate :

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

7.0 CAST IRON PIPES FOR DRAINAGE :

All drainage lines passing under buildings, floors, roads and in exposed horizontal positions above ground shall be cast iron pipes.

Pipes shall be centrifugally spun cast iron pipes of Class LA conforming to IS : 1536 – 1976.

The pipes shall be free from cracks and other flaws. The interior of pipes and fittings shall be smooth and clean. Pipes shall be painted inside and outside with Dr.Angues Smith's solution or other approved anti-corrosive paint.

The access door fittings shall be of proper design so as not to form any pockets in which filth may accumulate. Doors shall be provided with 3mm rubber insertion packing and when closed and bolted they shall be water tight.

The joints shall be filled with lead/lead wood as described hereinafter under C.I. soil pipes and fittings.

8.0 INSPECTION CHAMBERS – MANHOLES :

Size of Manholes :

The size specified in the schedule of quantities shall be clear internal dimensions of manholes. The work shall be done strictly as per standard drawings and the following specifications.

Excavation :

The manhole shall be excavated true to dimensions and levels shown on the plans or as directed by the Enginner-in-Charge.

Bed concrete :

Shall be in plain cement concrete 1:4:8 (normal mix) (1 cement: 4 coarse sand : 8 stone aggregate nominal size 40mm).

Brick masonry work :

Shall be with bricks of minimum compressive strength of 50 kg/cm^2 and make in cement mortar 1:5.

Plaster :

Inside and exterior of the walls shall be plastered with minimum 15mm thick cement mortar 1:4 and finished smooth with neat cement, with waterproof compound at 2% by weight of cement, in internal and external plaster.

Benching :

The channels and benching shall be done in cement concrete 1:2:4 (nominal mix) rendered smooth with neat cement. The depth of channel and benching shall be as hereunder :

All dimensions are in cms.

Size of drain	Depth at centre	Depth at side at walls
10	15	25
15	20	30
23	28	38
30	35	45
38	48	58
45	50	60

Rungs :

M.S. round bar 25 mm dia. rungs 4\300 mm wide and projecting 120mm shall be embedded in masonry at 300 mm vertical centres. Rungs shall be painted with bitumen as directed.

Manhole Covers and Frames :

Manhole cover shall be of tough homogenous cast iron of heavy, medium, light type as specified. Covers with frames for manholes in the road proper shall not be weighing less than 200 kgs. The covers with frames on footpaths, backyards shall be light weight (i) of 500 mm dia. weighing not less than 58 kgs. (ii) of 900 mm x 450 mm weighing not less than 90 kgs. (iii) of 600mm x 450 mm weighing not less than 60 kgs.

The frames of manholes shall be firmly embedded to correct levels and alignment and in plain cement concrete 1:2:4, minimum 100mm thick (after completion of the work, manhole covers shall be sealed by means of thick grease).

Measurement :

Manholes shall be enumerated under relevant items. The depth of the manhole shall be reckoned from the top level of the C.I. cover to the invert level of

the channel. The depth shall be measured correct to a cm. The extra depth shall be measured and paid as extra over the specified depth.

Rate :

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

Payments for extra depth of manholes shall be made separately under relevant items of work.

9.0 CAST IRON SOIL, WASTE, VENT PIPES & FITTINGS :

Cast iron soil, waste and vent pipes and fitting shall be conforming to IS : 3989.

Standard weights and thickness of pipes shall be as follows :

A tolerance upto 4% may be permitted against the standard weights.

Nominal Diameter(mm)	Thickness (mm)	Overall weight of 1.80 M length(kg)	Internal diameter of socket (mm)
65	3.5	11.0	88
75	3.5	12.7	99
100	4.0	19.2	126
150	5.0	35.5	179

A tolerance upto 15% in thickness and 20mm in length will be permitted. For fittings tolerance in length shall be +25mm and –10 mm. There will be no limit on the plus tolerance on thickness. A tolerance upto –10% will be allowed against standard weights.

Fixing :

The pipes and fittings shall be fixed to walls with proper clamps, vertically or in an approved alignment. The spigot end shall abut the shoulder of the socket and leave uniform annular space in between. All soil pipes shall be carried up above the roof to a height of 1 meter and shall have A.C. vent cowl. Connections between main pipe and the branch pipes shall be made by using the appropriate branch and bend, invariably with access doors for cleaning.

Lead Caulked Joints :

The annular space between the socket and spigot will be first well packed in with spun yarn soaked in bitumen and dried leaving 25 mm from the tip of the socket for lead pipes upto 100 mm dia. and 40mm depth for pipes of 150 mm dia.

Molten lead free from zinc or tin and thoroughly fluid shall be poured and each joint filled in one pouring. Before caulking, the projecting lead shall be

removed by flat chisel and then joint caulked round with proper caulking tools in such a manner as to make the joint quite sound. The joint shall be left flush, neat and even with the socket.

The minimum weight of lead in each joint shall be as follows :

Nominal Diameter	Kg. Of Lead per Joint
150 mm	2.95
100 mm	1.90
75 mm	1.28
65 mm	0.70

Testing :

The pipe work with joints shall be gas tight and water tight and shall be tested with smoke test and water test with water maintained for a period as recommended in relevant IS Specification and as per acceptance criterion laid down therein. (See Clause no. 13.0 given hereinafter).

10.0 TRAPS :

Traps shall be provided on all fixtures connected to the waste system, except for fixtures having integral traps. All traps shall have a seal of not less than 40 mm and not more than 100mm. All traps shall have the same internal diameter as the fixture's outlet.

Cast Iron Traps :

Traps installed in connection with C.I. pipes shall be of the same quality and grade as the pipe. The size of the outlet shall correspond to the socket of the pipe receiving it.

Intercepting Traps :

Glazed stoneware sewer interceptor trap shall be provided with cleaning arm metal stopper chain.

Gully traps outside the Building :

These shall be glazed stoneware gully traps 230 mm x 150 mm size to receive 150 mm pipe and 150 MM X 100 MM size to receive 100 mm pipe for waste pipes.

Gully traps inside the Building :

These shall be heavy cast iron sealed gully traps 150 mm x 100 mm size with extension piece, having single or double inlet as required and/or directed. Cast iron sealed cover shall be provided for each such trap and secured with threaded gun-metal bolts and felt gaskets.

Painting :

All exposed C.I. pipes and fittings shall be painted to match the colour of the surroundings with 2 coats of synthetic enamel paint over a coat of approved primer. If directed by the EIC, additional coats shall be given for satisfactory finish at no extra cost.

11.0 LEAD PIPES :

All lead pipes shall be hydraulically drawn and shall have equal substance throughout conforming to IS : 404 – 1962, weights and wall thickness of lead pipes shall be as follows :

Nominal Diameter Mm	Wall Thickness mm	Weight in kg/metre kg.
32	2.6	3.28
40	2.6	4.05

When not supported on bearers, all lead pipes shall be supported by strong lead tacks at least 40 mm wide, soldered on to the pipe at suitable intervals.

Wiped Solder Joints :

All joints of lead pipes shall be wiped solder joints. The pipe ends to be jointed shall be cleaned with a wire brush and freed from oxide, if any. Chalk shall then be rubbed in. after this plumber's black shall be applied. The length of lead shall be removed from this length with shave hook. Tallow shall be removed from the prepared surface. The molten solder, an alloy composed of 3 parts of tin and 7 parts of lead, shall be poured in thin stream from a ladle moved in an elliptical direction over the joint position, including a portion of the soil pipe at each and beyond the mark. When sufficient lead has been poured, the joint shall be wiped with a pad of wiping with a long continuous movement in one direction only, so as to leave a neatly formed elliptical shaped joint.

Surplus solder remaining on the joint shall removed.

Size of Pipe (mm)	Length of Joint	
	Minimum	Maximum
32	70	80
40	70	80

The joints shall be watertight, airtight, and shall be free from tears, burrs, strings, ribands or droppings.

Lead pipe connections with C.I. / S/W Pipes :

One of the brass thimble or ferrule shall be slipped into or over the lead pipe and joined to it by a wiped solder joint. The other end of the ferrule shall be inserted into the socket of the C.I. or stoneware pipe. In the case of the former, the

joint shall be made with molten lead (lead caulked) and in the case of the latter, with cement mortar as a stoneware pipe drains.

Lead pipe connections with W.C. Pan :

The lead pipe shall be slipped into a brass socket and joined to it by a wiped solder joint. The outgo of W.C. pan shall be inserted in to the socket and jointed by cement mortar as in S.W. pipe drains.

Lead connections shall be of specified size, of appropriate length made out of heavy lead with brass unions and wiped solder joint, shall be bent to correct shape without any distortions and the work shall include cutting, joining, fixing, painting, etc., complete to the satisfaction of the EIC.

Painting :

All exposed lead pipes shall be painted as in C.I. pipes and fittings.

12.0 WATER SUPPLY :

Water pressure mains shall conform to IS : 1536 – 1976 class LA or as specified in the Schedule. They shall be laid, jointed and tested along with the C.I. pipes as described in the Specifications for Cast Iron Socket and Spigot pipes.

Flanged Pressure mains :

Flanged joints shall be made by painting the face of the flange with red lead freely and bolting up evenly on all sides.

When packing is used, it shall be of rubber insertion cloth, three ply and of approved thickness. The packing should be of the full diameter of the flange with proper pipe hole and bolt hole, neat and even at both the inner and outer edges.

Where the flange is not fully placed, the packing shall be of the dimension of the facing strip only. Its proper placing shall be tested before another pipe is joined on.

Testing :

After each section of the pipe line has been completed, it shall be tested for water tightness before being covered in. this shall be done by closing each section end by means of a valve, blank flange, cap or plug and filling the pipe with water. The pressure shall be raised by means of a small hand operated pump till it registers 50% above the highest working pressure in the section. The test pressure shall be ascertained by a reliable gauge. When the pipe is laid in any appreciable gradient, the gauge should be at the lower end of the section. Any leaking joints should be made good and the above test repeated until no further leaks are noticed.

G.I. Pipes & Fittings :

The pipes shall be of class specified in the Schedule of Quantities. They shall be of galvanized mild steel, seamless or welded or screwed and socketed conforming to the requirements of IS : 1239 – 1979. They shall be of approved make and quality. All G.I. fittings shall be mild steel tubular or wrought steel fittings of approved best Indian make.

LAYING AND FIXING :

Where pipes have to be cut and/or threaded, ends shall be carefully filed out, so that no

For internal work, all pipes and fittings shall be fixed truly vertical and horizontal by means of standard pattern holder bat clamps, keeping the pipes 12mm clear of the wall everywhere, or the pipes may be concealed as directed. All pipes to be concealed/embedded in masonry or concrete shall be painted with hot asphalt and wrapped with hessian cloth and again painted with two coats of hot asphalt.

For external work, G.I. pipes and fittings shall be laid in trenches. The width of the trench shall be the minimum width required for the working. They shall be painted with hot asphalt and wrapped with hessain cloth and again painted with two coats of hot asphalt and wrapped with hessian cloth and again pained with two coats of hot asphalt.

A layer of sand of approved quality shall be filled 15mm all round the pipes in trenches.

Painting :

All exposed pipes and fittings shall be painted with two coats of synthetic enamel paint of approved make, quality, colour and shade over one coat of primer. If painting is not satisfactory in the opinion of the EIC, additional coats of paint shall be given at no extra coat.

13.0 TESTING :

13.1 The plumbing system shall be testing in the presence of the EIC or his authorized representative and the plumbing inspector of the local Municipal Corporation/local bodies. Sufficient advance notice shall be given by the contractor before carrying out the tests. The contractor shall provide all equipment, material and labour necessary for the tests. Any work not passing the test shall be repaired, rectified or replaced and the tests shall be repeated until the entire system is found satisfactory by the authorities. All tests should be carried out before concealing, insulating or back filling over any piping.

The cost of tests shall be included with the cost of respective items and rate shall be inclusive of the same.

13.2 Soil, Waste and Vent System :

This shall be tested as follows :

All sand cast iron / cast iron (spun) pipes and fittings including joints shall be tested by smoke test to the satisfaction of the Engineer-in-Charge and left in working order after completion. The smoke test shall be carried out as hereunder :

Smoke shall be pumped into the pipes at the lowest end from a smoke machine which consists of a bellow and burner. The material usually burnt is greasy cotton waste which gives out a clear pungent smoke which is easily detectable by sight as well as by smell, if there is a leak at any point in the drain.

All down spouts of rain headers and their branches within the building shall be tested by smoke test as described for soil, waste and vent system.

13.3 Hydraulic pressure test for water supply system :

The entire water supply system or sections of system shall be tested by closing all openings in piping and filling the system with water. Pressure shall be applied in the system by means of pressure Test pumps for 14 kg/cm^2. The system shall maintain this pressure for 24 hours without any drop in pressure. If pressure drops after such period of time, all joints tested shall be inspected and repairs, rectification or replacement shall be carried out as necessary and as directed to prevent leakage. The test shall be repeated till the system is found satisfactory.

13.4 G.I.Pipes & Fittings :

All G.I. pipes and fittings shall be site tested in an approved manner to ensure that pipes have proper threads and that proper materials such as white zinc and hemp have been used in jointing. All leaking joints shall be made waterproof by proper tightening or redoing at contractor's expense. All G.I. pipes of A, B and C grade shall be brought to the site by the contractor, after having them got tested by the local Municipal Authority. This is mandatory on the part of the contractor. Obtaining test certificate from the local Municipal Authority at his cost, shall be the contractor's responsibility.

The entire system shall be tested in sections, if required to expedite the work of other trades and to meet the construction schedule.

14.0 BRASS FITTINGS IN WATER SUPPLY :

All brass fittings shall be of approved quality and design and shall generally comply to the latest I.S. Specifications. They shall be fixed in the pipeline, in a workmanlike manner and care shall be taken to see that the jointed shall be tested in an approved manner to ensure that the joints are leakproof. The defective fittings and joints shall be repaired, re-done, and replaced.

15.0 ASBESTOS CEMENT RAIN WATER PIPE :

The A.C. pipes shall conform to IS : 1626-1980 or latest. They shall be of approved make and quality. They shall be straight, true, smooth and uniform in thickness. They shall be sound, homogeneous and free from cracks and other flaws.

A.C. pipes shall be fixed in full lengths as far as possible.

The pipes shall be secured to the face of wall, below every joint with standard holder bat clamps of approved manufacturer and A.C. shoe shall be fixed at the bottom.

The spigot of the upper pipe shall be properly fitted into the socket of the lower pipe such that there is uniform annular space for filling the jointing material. One third depth of this annular space between socket and spigot shall be filled in with spun yarn soaked in bitumen and properly pressed home with caulking tool. The remaining 2.3 depth of the joint shall be filled in with stiff cement mortar (1:2) and shall be pressed with caulking tool and finished smooth at the top at an angle of 45^o. This will be cured for a period of 7 days by tying a piece of gunny bag

to the pipes and keeping it wet. The finished pipe line shall be truly vertical or to lines and slopes as directed.

The pipes shall be measured net as fixed in position including fittings, bands, shoes along the centre line of pipe line in running metres correct to a cm. Nothing extra shall be paid for fittings and shoes, etc.

16.0 SANITARY INSTALLATIONS :

16.1 Indian Type W.C. Pan and Orissa pattern or integrated type :

These shall of white vitreous china conforming to IS: 2556 and of specified sizes, pattern and Hindustan Twyford or equivalent make and quality approved by the EIC. The flushing inlet shall be in front, or rear as directed by the EIC. It shall have 100mm porcelain trap 'P' or 'S' with approximately 50mm water seal and 50mm dia. vent horn. The size of the pan specified shall be the length out to out of the rim of the pan.

Fixing :

The pans shall be fixed securely with a cushioning bed in cement concrete (1:3:6) nominal mix. The bed should be uniform, even and without any hollows between the pan and the concrete. The joint between pan and trap shall be made with cement mortar 1:1 and shall be leakproof.

Each closet shall be provided with the following and the rate shll be inclusive of these.

i) High level white steel enameled flushing cistern of 10 litres capacity of Fordham or equivalent make approved by the EIC with 12mm brass ball-valve with brass connecting rod and copper float, 12mm PVC inlet connection upto stopcock, 12mm chrome plated brass stopcock, easy clean type G.I. chain and pull handle, chrome plated supporting brackets, fixing the brackets in the wall and making good the wall.

ii) 12mm dia 'C' class PVC overflow pipe with necessary specials from the cistern upto 150 mm above floor level or otherwise as directed by the EIC, with mosquito-proof chromium plated brass mesh. The PVC pipe shall be encased in the brick work in chases, made good to match the brickwork finish.

iii) 32mm lead flush pipe of appropriate length with necessary brass unions, wiped solder joints bent to proper shape and fixed in position in chases in brick work, making good to match the brickwork finish.

iv) Necessary length of 100 mm dia. C.I. pipe connecting the pan, the plug bend outside, including lead caulking.

v) Wherever anti-siphon pipe connections are required, necessary length of PVC pipe 650 mm dia. from the pan to the anti-siphon external pipe with joints etc.

vi) Cement concrete 1:3:6 (nominal mix) with 2% waterproof compound of approved make and quality of the weight of cement, cushion bed around the pan properly rammed without damaging the pan.

vii) Providing and painting water lines, fittings, etc. with one coat of primer and 2 coats of synthetic enamel paint of approved make, quality, colour, shade.

viii) All the ancillary work such as cutting in walls and floors, making good, fixing W.C. pan and all other work necessary for satisfactory working of the water closet.

16.2 Flushing Cistern :

Flushing cisterns shall be automatic or manually operated, high level or low level as specified, for water closets and urinals. A high level cistern is intended to operate with minimum height of 125 cm and a low level cistern with a height of 30 cm. between the top of the pan and the underside of the cistern.

Cisterns shall be of cast iron, vitreous china or white enameled pressed steel and plastic specified conforming to IS : 774 – 1984 and IS : 774 – 1984 and IS : 7231-1984 respectively.

The body thickness of C.I. cistern shall not at any place be less than 5mm. The body of a pressed steel cistern shall be of seamless or welded construction, of thickness not less than 1.6mm before coating, and shall be porcelain enamelled. Cistern shall be mosquito-proof.

The breadth of a low level cistern, from front to back shall be such that the cover or seat, or both, of water closet pan shall come to rest in a stable position when raised.

The cast iron or C.P. bracket for cisterns as specified shall be of size and pattern approved by the EIC and shall be embedded in cement concrete 1:2:4 (nominal mix) blocks 100mm x 75mm x 150 mm and conform to IS 775-1970.

The outlet fitting of each cistern shall be securely connected to the cistern. In the case of high level cisterns, the outlets shall be of 32mm nominal bore and for low level cisterns, the outlet shall be of 40mm nominal bore.

Ballcock shall be of screwed type 15mm in dia. brass conforming to IS:1703-1977. The float shall be made of polythene and connecting rod of aluminium.

The chain for operating cistern shall be of G.I. and strong enough to sustain a suddenly applied pull of 10 kg. Or a dead load of 50 kg. without any deformation to the shape of the link. The chain shall terminate in a suitable handle, which shall be of pottery, galvanized iron, non-ferrous metal or a moulding in any heat resisting and non-absorbent plastic as directed by the EIC. In case of low level flushing cisterns, the handle shall be of chromium plated brass.

C.I. cisterns shall be painted with 2 coats of black bitumastic paint on the inside and two coats of synthetic enamel and a primer coat of make, colour, shade, approved by the EIC.

16.3 European Type W.C. :

The closet shall be of white vitreous china of European type fixed to the floor or wall hung type as specified and shall be of best quality and of approved make.

Each closet shall be provided with the following accessories and the rate shall be all inclusive :

i) Seat: heavy plastic seat, white or black as specified, of approved quality and seat cover with rubber buffers, C.P. brass hinges fixed to the pan.

ii) Necessary length of 10mm dia. C.I. pipe connecting the pan, the plug bend outside, including lead caulking etc.

iii) Low level, white steel enamelled flushing cistern of 10 litres capacity, of Fordham or equivalent make, approved by the EIC, with all fittings and accessories, with 40mm PVC flush pipe and bend, porcelain enamelled supporting brackets for cistern and overflow arrangement with mosquito-proof mesh as directed by the EIC or where specified, flush valve; brass C.P. flush valve of 'Nelson' or equivalent approved by the EIC with 32mm outlet, C.P. pipes.

iv) 15mm plastic PVC pipe inlet connection with 15 mm C.P. brass stopcock for low level cistern.

v) All ancillary work such as cutting wall, floor, making good and all other work for satisfactory working of the W.C.

17.0 URINALS :

17.1 Bowl type urinals :

Urinals basins shall be flat back or corner wall type lipped in front. These shall be of white vitreous china conforming to IS:2556 (Part VI/Sec 1)-1979.

These shall be of approved make and shall consist of the following :

i) urinal as described and specified above of required size.

ii) 32mm chrome plated brass waste coupling.

iii) 32 mm PVC extension piece.

iv) suitable supporting arrangement.

v) flushing cistern with all attachments as described, flushing pipe, spreaders, overflow, etc.

vi) 12mm G.I. or chrome plated brass spreader pipe arrangement as specified with necessary accessories such as Tees, Unions, couplings, bends, spreaders, etc. The pipe shall be from cistern to the urinals.

vii) All ancillary work for satisfactory completion and working of urinals.

17.2 HALF STALL URINALS :

They shall be of white vitreous china conforming to IS : 2556 (Part VI/ Section 2)-1974. They shall be of one piece construction with or without an integral flushing box rim and provided with slots or alternative fixing arrangement at the flat

back end. They shall be provided with ridges where integral flushing rim is not provided in the sides of the interior of the bowl to divert the water towards the front lip of the urinal. The tolerance of ± 4% may be allowed in the dimensions specified.

18.0 WASH BASINS :

These shall be the best available type of wash basin of approved quality, type and make and shall consist of :

i) Wash basins of sizes as specified in the Schedule of Quantities and shall be in white vitreous china with or without anti-splash rim with single or double tap holes, overflow slit, etc. conforming to IS: 2556 (Part I)- 1974 and IS:2556 (Part IV)-1972 and as directed by the EIC.

ii) Supporting C.I. brackets of design approved by the EIC.

iii) 12mm chrome plated pillar taps.

iv) 32mm C.P. brass waste coupling with rubber plug and chain.

v) 32mm C.P. brass bottle trap with extension pieces and C.P. wall flange, where specified.

vi) 12mm dia. PVC pipe connection and 12mm C.P. brass stopcock.

vii) Providing and applying 2 coats of synthetic enamel paint and one coat of primer of quality, make, colour and shade approved by the EIC, to all the accessories exposed where directed by the EIC.

viii) Wash basin shall have white glazed pedestals, where so specified, in Schedule of Quantities.

ix) All the work necessary for completion of the wash basin item and for its satisfactory working.

19.0 KITCHEN SINKS :

Kitchen sink shall be of white glazed fire clay conforming to IS:771 (Part 2) – 1985 and of sizes as specified. The outlet shall be suitable for waste fittings , have flanges of 88 mm dia., and waste hole shall have a minimum diameter of 65 mm at the bottom to suit the waste fittings. Each sink shall be provided with 50mm dia. waste fitting. The sink shall have overflow of the weir type and their inverts shall be threaded to the full length to the underside of flange in each case. The waste fittings shall be brass chromium plated.

The sink shall be provided with 40mm C.P. Brass union. C.I. brackets for supporting sink shall conform to I.S.:775-1970.

The C.I. cantilever brackets shall be embedded in cement concrete 1:2:4 (nominal mix) blocks of size 100mm x 75mm x 150m.

Two coats of synthetic enamel paint and a coat of primer for brackets, etc. as directed by the EIC.

The height of the front edge of sink from the floor level shall be 80 cms.

20.0 SHOWER ROSE :

This shall be of chromium plated brass, of approx. 125 mm dia. with C.P. brass arm of required length and wall flange, etc. as per pattern approved by the EIC.

21.0 MIRRORS :

The mirrors shall be of the sizes specified in the Schedule of Quantities with rounded or beveled edges as specified. The glass used shall not be less than 5mm thick sheet glass of best Indian make.

It shall be free from distortion of image from any distance and shall have no defects, sports, holes, flaws, specks or bubbles. It 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.

It shall be mounted on 6mm thick asbestos cement sheet backing or 6mm marine ply and shall be fixed in position by means of 4 C.P. brass screws and C.P. brass washers over rubber washers and wooden plugs firmly embedded in the walls.

Where specified after the A.C. sheet backing, a cover mould of teak wood of suitable design as directed by the EIC shall be fixed all round the mirror edge and fixed to wall with suitable C.P. brass clamps.

22.0 GLASS SHELF :

The glass shelf shall be of glass of approved quality and make with thickness not less than 5.0 mm. This shall be of sizes as specified and shall have edges rounded off. This shall be fixed on C.P. brass brackets fixed with C.P. brass screws to rawl plugs firmly embedded in the walls. The shelf shall have C.P. brass guard all round the glass.

23.0 TOWERL RAILS :

The towel rails shall be of chrome plated brass tube with 2 C.P. brass brackets. The material shall be of approved quality and type. The size of the rail shall be as specified or as shown on drawing. The towel rails shall be fixed to walls with brackets fixed with rawl plugs and with C.P. brass counter sunk screws. When specified, aluminium towel rails with aluminium brackets of approved quality and design shall be used, all as directed by the EIC.

24.0 TOILET PAPER HOLDER :

The toilet paper-holder shall be of vitreous china or as specified. It shall be of design and make approved by the EIC and shall be fixed recessed in wall.

25.0 LIQUID SOAP DISPENSER :

The liquid soap dispenser shall be of glass, C.P. brass body or as specified and shall be of approved make and quality. This shall include accessories such as fixing bracket in C.P. brass, with rotary movement, C.P. brass screws, fixing to walls with rawl plugs, etc.

26.0 PILLAR TAPS :

Pillar taps shall be of C.P. brass. The nominal sizes of pillar taps shall be 15mm or 20mm as specified. The nominal size shall be designated by the nominal bore of the pipe outlet to which the tap is to be fitted. The taps shall be of quality approved by local Municipal Corporation and tested by them.

27.0 HANGERS & SUPPORTS :

Suitable hangers and support brackets shall be provided as follows :

For G.I. pipe line running along walls, shall be fixed with G.I. 'U' clamps for 15mm to 65 mm dia. pipe lines. For pipe sizes above 65mm dia. 'U' clamps shall be fabricated out of M.S. flats 3 mm x 40 mm.

For C.I. soil, waste and vent lines, 'U' clamps shall be fabricated out of M.S. flat 3 mmx 40 mm.

For main header pipes, brackets shall be fabricated out of M.S. channel or angle sections of appropriate sizes with bolting arrangement as approved by the EIC or as shown on approved working drawings.

For all suspended piping and plant room piping, hanger supports shall be fabricated out of M.S. channels or angle sections of appropriate sizes with bolting arrangement as approved by the EIC or as shown on approved working drawings.

For fixing hangers and bracket supports to walls or ceilings, dash fasteners of appropriate sizes shall be used :

The spacing of the hangers shall be as follows :

15mm to 20mm dia.	150 cm centres
25mm to 40 mm dia	210 cm centres
50mm to 80 mm dia.	300 cm centres
100mm & above	450 cm centres

All hangers and brackets shall receive one coat of primer of approved make and quality before fixing and 2 coats of synthetic enamel paint to exposed surfaces after fixing and cleaning.

28.0 MODES OF MEASUREMENT :

All drain pipes shall be measured in running metres correct to a cm. along the centre line of the drainage line laid. Deductions shall be made for inside length of the chambers and lengths of fittings, etc. Fittings shall be measured separately. The rate shall include the cost of materials and labour involved in all the operations described in the respective items and as specified.

Stoneware or cast iron gully traps, bends, junctions, sewer traps, etc. shall be measured in numbers. Rates shall include cost of materials and labour involved in all the operations described in respective items and as specified.

All cast iron socket and spigot or flanged pipes shall be measured in running metres correct to a cm. along the centre line as fixed. Deduction shall be made for length of fittings. The fittings shall be measured separately. The rate shall include the cost of materials and labour involved in all the operations as described in respective items and as specified.

C.I. fittings such as socket and spigot fittings, flanged fittings shall be measured in numbers.

C.I. pipes for soil, waste, vent and rainwater shall be measured in running metres correct to a cm., along the centre line of the pipeline as fixed. Deduction shall be made for lengths of fittings. The rates shall include cost of materials and labour involved in all the operations as described in the respective item and as specified.

C.I. fittings for the above shall be measured in numbers.

All sanitary fittings and fixtures shall be measured in numbers. The rate shall include cost of materials and labour involved in all operations described in the respective items and as specified.

All galvanized iron piping shall be measured in running metres correct to a cm. along the centre line of the pipe line including G.I. fittings. The rate shall be inclusive of cost of materials and labour involved in all the operations as described in the respective items and as specified, including all clamps, support brackets, hangers, fittings, excavation, filling, bitumen painting and wrapping with hessian cloth, wherever concealed, etc.

All valves, peat valves, sluice/gate valves, non return valves shall be measured in numbers. The length of the valve in pipe lines shall be deducted from the measurement of the respective pipe lines.

Wherever mentioned, the rates of respective items shall include providing and applying a coat of primer and two coats of synthetic enamel paint of make, quality, colour and shade approved by the EIC.

C.I. covers and frames shall be weighed correct to a kg. and the rate shall include cost of all labour and materials involved in all the operations involved in carrying out the item as specified and described, including cement concrete 1:2:4 (nominal mix) on the top of chambers and grouting the frame, etc.

29.0 S.W. INTERCEPTING TRAP & INTERCEPTING CHAMBER :

S.W. Intercepting Trap :

Intercepting trap shall conform to IS: 651-1965. These shall be sound, free from visible defects such as fire cracks or hair cracks. The glaze of the traps shall be free from crazing. They shall give a sharp clear note when stuck with light hammer. There shall be no broken blisters.

Intercepting Trap Chamber :

a) Excavation :

The excavation for the chamber shall be to the dimensions and levels shown on the plans or as directed by the EIC.

b) Bed Concrete :

The chamber shall be built on a bed of cement concrete 1:4:8 (1 cement: 4 coarse sand : 8 graded stone aggregate, 40mm nominal size). The thickness of the bed concrete shall be 200 mm for chamber upto 4.25 metres depth and 300mm for depths beyond 4.25 metres, unless otherwise specified or directed by EIC.

c) Brick work :

The brick work shall be with second class bricks in cement mortar 1:5 (1 cement : 5 coarse sand). The external joints of the brick masonry shall be finished smooth and the joints of the pipe with the masonry shall be made perfectly leakproof for chamber. The walls shall be built in one brick thick brick work for depth upto 4.25 metres. Below a depth of 4.25 metres in ordinary subsoil, this wall thickness shall be increased to one and half brick thick and at 9.75 metres, below ground, two brick thick walls shall be built.

d) Plaster :

The walls of the chamber shall be plastered inside and outside with 12mm thick cement plaster 1:3 (1 cement : 3 coarse sand) finished smooth. The external plaster shall be made smooth upto 30 cm above the highest subsoil water level, with the approval of the EIC. The plaster shall further be waterproofed with addition of approved waterproofing compound in a quantity as per manufacturer's specifications.

e) Chamber cover and frame :

The cover and frame shall conform to IS : 1726 – 1974 and shall be C.I. heavy duty / medium duty / light duty, as specified. The cover shall have a raised chequered design on the top surface to provide an adequate non slip grip. The cover shall be gas tight and water tight. The size of covers specified shall be taken as the clear internal dimensions of this frame. The appropriate minimum weight of the chamber cover and frames shall be as follows :

Description of C.I.Chamber cover	Weight of cover in kg.	Weight of frame in kg.	Total weight of cover and frame in kg.
Rechangeable frame And cover 455 mm x 610 mm	23	15	38

Cover and frame shall be coated with black bituminous composition. The coating shall be smooth. It shall not flow when exposed to a temperature of 63^{o}C and shall not be brittle so as to chip off at temperature of 0^{o}C. The frame shall be firmly embedded to correct alignment and levels in RCC/plain concrete, as the case may be, on the top of the masonry.

f) Back fill :

The excavated earth shall be back filled around manhole in level with the original ground level. The surplus earth shall be disposed off as directed by the EIC.

g) Foot Rests :

All chambers deeper than 0.8 metres shall be provided with M.S. foot rests. Foot rests shall be of 20mm M.S. square or round bars as specified. These shall be embedded 20 cm deep with 20 cm x 20 cm x 10 cm blocks of cement concrete 1:3:6 (1 cement : 3 coarse sand : 6 graded stone aggregate 20mm nominal size). The block of concrete with M.S. foot rests placed in its centre shall be cast in situ along with masonry and the surface finished with 12mm thick cement plaster 1:3 (1 cement : 3 coarse sand) finished smooth. Foot rests shall be fixed at 30 cm apart vertically and staggered laterally and shall project 10 cm beyond the surface of wall. The top foot rests shall be 45 cm below the chamber cover. Foot rests shall be painted with coal tar, he portion embedded in the masonry or cement concrete block being painted with thick cement slurry before fixing.

h) Measurements :

The chamber depth shall be reckoned from the top level of C.I. cover to the invert of the outlet of intercepting trap. The depth shall be measured correct to a cm. The extra depth shall be measured as in extra over the specified depth in the enumerated item, and in running metre under separate item following the main item. The chamber is measured as a number, including C.I. cover, and frame. The rate shall include the cost of materials and labour involved in all operations described above, but exclude the cost of (i) excavation (ii) M.S. foot rests and (iii) 12mm thick cement plaster with waterproofing material applied at the external surface of the chamber if required. These items shall be paid for separately under relevant items of work.

30.0 HUME PIPE SEPTIC TANK & FILTER :

The hume pipe septic tank (horizontal type) shall conform to IS : 2470, consisting of main treatment chamber, a filter, separated by concrete partition made in high quality concrete. The septic tank shall have inspection chambers with concrete covers, scum board, vent, inlet and outlet connections made of high quality durable concrete.

The selection of septic tank shall depend on the number of users. The various sizes of septic tank depending on the number of users shall be as per Indian Hume pipe Company's specifications, conforming to IS : 2470.

The frequency of cleaning of septic tank shall be once in twelve months.

Excavation :

The depth of excavation shall be determined after selecting the location of septic tank, based on the minimum slope of 1:40 to the connecting drain between building drainage outlet and the inlet of intercepting chamber. The depth of intercepting trap shall be 380 mm below finished ground level. The outlet of intercepting chamber should be connected to the inlet of septic tank. The excavation shall be carried out with adequate space around the true dimensions of septic tank. Preferably minimum working space of 600mm should be left around the

septic tank for easy working. The excavation shall be carried out in all sorts of soil and shall be paid separately.

Bed Concrete :

The mix for the bed concrete shall be 1:3:6 and 230 mm thick. This item shall be paid separately.

Fixing :

Lower the tank into pit already excavated. Fix the tank in position by tamping earth all round to make sure that it is perfectly in level. Back fill the space around in excavated earth and consolidate.

Mode of Measurement & Scope :

The item of Hume pipe septic tank and filter is measured in number. (Capacity of septic tank in terms of users is specified in this item). The rate shall include septic tank, filter with inlet, outlet, vent connections and manhole covers.

31.0 GREASE TRAP :

Grease trap of different sizes as specified shall be constructed near canteens to dispose off grease waste, and to such levels and dimensions as directed by the EIC. The size specified shall indicate the inside dimensions of the chamber.

Excavation :

The excavation shall be carried out in all sorts of soil true to dimensions and levels shown on the drawing or as directed by the EIC.

Bed Concrete :

The chamber shall be built on a bed of cement concrete 1:4:8 (1 cement : 4 coarse sand : 8 graded stone aggregate to 40mm nominal size). The thickness of the bed concrete shall be 15 cm, unless otherwise specified or directed by the EIC.

Brick work :

The brick work shall be with second class bricks in CM 1:5 (1 cement : 5 sand). The walls shall be built of 23 cm thick brick work for depth of upto 900 cm. The walls of this manhole shall be plastered inside and outside with 12mm thick CM 1:3 (1 cement : 3 coarse sand) finished smooth. The plaster shall further be water proofed, with addition of approved waterproofing compound in a quantity as per manufacturer's specifications.

RCC Baffle wall :

This shall be constructed as per the design and specifications. The leanest concrete mix that may be adopted to construct RCC baffle shall be 1:2:4. The steel reinforcement and plain concrete of desired strength shall be as per the specifications of the respective heads.

C.I. cover & frame :

The covers and frame shall conform to IS : 1726 – 1974 and shall be heavy duty.

Mode of Measurement :

The chamber shall be measured as one unit, inclusive of all items as mentioned. The rate shall include the cost of materials and labour involved for all the items mentioned above and the rate shall be based on chamber as a unit.

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XI. G L A Z I N G

1.0 Indian Standard :

1.	IS:2835-1987	Specification for flat transparent sheet glass.
2.	IS:419 – 1967	Specification for putty, for use on window frames.
3.	IS: 75-1973	Specification for linseed oil, raw for paints.
4.	IS:2468-1963	Specification for whiting for putty.
5.	IS:1081-1960	Code of Practice for fixing and glazing of metal (Steel and Aluminium) doors, windows and ventilators.

The above mentioned I.S. Codes of Practice have been given for general guidance.

However, these I.S. Codes will be adopted only for these particular items in the contract where either the mode of measurement or detailed technical Specifications are not laid down in the tender documents.

2.0 Materials :

The glass shall be of good quality, reasonably free from blisters, stains, scratches, bubbles, smoke, waves and air holes etc., so as not to disturb the visibility through glass.

Blisters less than 4mm if present shall be less than 30 per sq.m. and shall be fairly and uniformly distributed. Bubble below 2 mm need not be considered.

Sheet glass used for panels shall be of good and durable quality, plain and clear, conforming to IS:2835-1987 (Specification for flat transparent sheet glass), but not weighing not less than 7.5 kg/sq.m.

3.0 Classification :

Sheet glass is classified into the following 4 qualities :

a) 'AA' quality o Special Selected Quality (SSQ) - Intended for use where superior quality of safety glass, high quality mirrors, photographic plates, projection slides, etc.

b) 'A' quality or Selected Quality (SQ) - Intended for selected glazing, manufacture or mirrors, safety glass, etc.

c) 'B' quality or Ordinary Quality (OQ) – Intended for glazing and framing purposes

d) 'C' quality or Greenhouse Quality (GQ) – Intended for green house glazing, production of frosted glass, strips for flooring, etc.

4.0 Selected sheet glass shall be of type 'C' conforming to IS:2835-1987 (Specification for flat transparent sheet glass) (3rd Revision). It shall be transparent and free from cracks, and shall be as far as possible, colourless as judged by the naked eye, except when viewed edgewise. It may have light blue to green tint. It shall have no stones or knots.

Knot : A transparent area of incompletely assimilated glass having an irregular knotty or tangled finish.

Stones : Any crystalline inclusion embedded in the glass.

Dimensions : Nominal thickness, range of thickness and dimensional tolerance on cut sizes (length and width) of sheet glass shall be as prescribed in Table 1.

TABLE – 1

NOMINAL THICKNESS, RANGE OF THICKNESS OF SHEET GLASS AND DIMENSIONAL TOLERANCE ON CUT SIZES

Sr. No.	Nominal Thickness (mm)	Range of Thickness (mm)	Dimensional Tolerance on cut size (± mm)
i)	1.0	0.85 – 1.15	1.5
ii)	1.5	1.35 – 1.65	1.5
iii)	2.0	1.80 – 2.20	1.5
iv)	3.0	2.80 – 3.20	1.5
v)	3.5	3.30 – 3.70	2.0
vi)	4.0	3.80 – 4.20	2.0
vii)	5.0	4.70 – 5.30	2.0
viii)	5.5	5.20 – 5.80	2.0
ix)	6.3	5.90 – 6.70	2.0
x)	8.0	7.50 – 8.50	3.0
xi)	10.0	9.50 – 10.50	3.0
xii)	12.0	11.00 – 13.00	3.0
xiii)	15.0	13.50 – 16.50	4.0
xiv)	19.0	17.00 – 21.00	4.0
xv)	25.0	22.00 – 28.00	5.0
xvi)	32.0	28.50 – 35.50	6.0

Tests :

Thickness of sheet glass shall be measured as follows :

Divide the rectangular sheet into 4 equal segments. Measure the thickness of glass sheet using a screw calipers having an accuracy of 0.01 mm at all the points on two perpendicular bisecting lines. The individual thickness at each of the four points shall be within the range of nominal specified thickness.

Rough cast wired glass (Translucent) shall have 12/13 mm square mesh (Georgian) wire reinforcement electrically welded at each intersection, or with hexagonal 21/22 mm interwoven hexagonal mesh wire reinforcement.

4.0 Plate Glass :

Plate glass shall be translucent, transparent or wired as described. The transparent type shall have polished surface. The vision obtained being clear and totally undistorted. Plated glass are available in the following thickness with variation in thickness as shown :

Nominal thickness	Variation
6.0 mm	5.5 to 6.7 mm
10.0 mm	9.1 to 10.8 mm
12.5 mm	11.9 to 13.5 mm

5.0 Putty :

Putty generally shall be homogenous paste and shall be free from dust, grit, and other visible impurities.

Composition :

The material shall consist only of whiting (conforming to IS:2468-1963), linseed oil, raw (conforming to IS:75-1950) and suitable varnish medium in such proportions as to form a paste which shall comply with the requirements of IS:419-1967.

Consistency :

The material after thorough working in hands, shall have good plastic quality without sliminess or stickiness that would render it difficult to handle and apply.

In addition, it shall work readily and smoothly under a paletter knife without crumbing or cracking and after being moulded in place, it shall convert itself into a cohesive mass which does not yield to specified pressure applied after 72 hours.

Putty for wood/metal frames shall conform to IS:419:1967 (Specification for putty, for use in window frames).

6.0 WORKMANSHIP :

6.1 In cutting glass, proper allowance shall be made for expansion. A clearance of 2.5 mm for wood or metal surrounds, and clearance between the edge of the glass and the concrete or brick surround shall be 3mm. Each glass shall be one whole square or rectangle. Glass in pieces shall not be permitted. Broken or damaged glass shall be removed and replaced. The glass panes, after fixing shall be cleaned of any dirt, putty or other adhesive material.

6.2 GLAZING TO WOOD :

(a) Glazing with putty-Rebates in wood work shall be painted with one coat of primer or moistened with raw linseed oil before glazing, if the shutters are to be painted. The glass shall be bedded on putty, applied to the rebate, and the thickness of back-putty between the glass and rebate shall not be less than 1.5mm thick after the glass is pressed into the rebate. The surplus putty squeezed out above the rebate shall be stripped off at an angle and not under-cut. The glass shall then be secured by spring clips (spaced not more than 45 cm apart, measured around the perimeter of the glass pane) as described and the front putty shall be finished to a neat chamfer stopping 1.5mm from the side line.

(b) Glazing with beads – Rebates shall be treated and glass shall be back-puttied as described above. Beads shall then be bedded with putty against the glass and secured to wooden frames with panel pins or screws as described.

7.0 GLAZING TO METAL :

Before glazing, the shutters or the framework of the opening, in which the glasses are to be fixed, shall be checked to ensure that there is no twist and the shutter closes correctly.

The frame shall be thoroughly cleaned and bedding putty shall b placed in the rebate before glazing. The glass shall then be properly cushioned into the bedding putty and front puttied. The front putty shall be finished to a neat chamfer stopping 2 to 3 mm from the side line. The back putty oozed out over the glazing rebate shall be cut off neatly and smoothened.

This back putty is necessary as a part from preventing contact of glass with the steel at any point, it will also prevent glass rattle and ingress of moisture which may corrode the steel frame.

Care shall be taken to see that the putty receives adequate coats of paint and shall be dry and hard before painting. It is advisable to carry the paint slightly beyond the edge of the putty-glass junction line to be certain of sealing the junction line.

Where panel size exceeds 60 x 30 cm, in addition to the above, the glass shall be secured by special spring glazing clips which shall be inserted in holes provided in metal doors or windows before applying the front putty.

When glazing is done with beads instead of front putty, it shall be applied to the face of the bead which is in contact with the glass. Back putty shall also be provided.

Beads shall be of durable timbers of Class I and Class II or of rustproof steel or of a aluminium. The bead shall have mitred corners.

The position and size of the bead may depend on the thickness of glass used. The bead shall be fixed with screws paced not more than 20 cm, apart and the doors or windows shall be drilled during manufacture with holes accordingly.

Where the metal is galvanized the rebate shall be cleaned with cloth soaked in linseed oil so as to leave a thin film of oil before the putty is applied.

No glazing shall be considered complete until all stains have been removed from the surface of glass. If frosted glasses are used, they are to be fixed with the frosted face away from the putty. The contractor shall provide his own scaffolding without any extra charge.

Glazing with 'Patent Glazing Mastic' - glazing with patent glazing mastic shall be done as per Manufacturer's instructions.

8.0 MEASUREMENTS :

Where glazing item is measured separately, the measurement shall be the glass size as fixed in position, length and breadth being measured correct to a cm. and area in sq.m. measured correct to two places of decimal.

Curved or irregularly shaped pieces will be measured as the least rectangle from which they can be cut.

9.0 Rate :

Rate of glazing shall include the cost of all materials and labour involved in all the operations specified.

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XII. PAINTING, POLISHING & DISTEMPERING

1.0 Indian Standard :

1.	IS: 427-1965	Distemper, dry, colour as required.
2.	IS:428 - 1969	Distemper, oil emulsion, colour as required.
3.	IS: 5410-1992	Cement paint, colour as required (5th Rev.)
4.	IS:5411(Part I)-1974	Plastic emulsion paint for interior use. (5th Rev.)
5.	IS:2339-1991	Ready mixed paint, brushing, bituminous, black, lead free, acid-alkali water and heat resisting for general purpose. (3rd Rev.)

The above mentioned Indian Standard Specifications and Codes of Practice have been indicated for general guidance.

However, these I.S. Specifications and Codes will be adopted only for these particular items in the contract, where either the mode of measurement or detailed technical Specifications are not laid down in the Tender.

2.0 SCAFFOLDING :

Scaffolding should be got approved from the EIC. Scaffolding, where required shall be erected on double supports, tied together by horizontal pieces, over which planks shall be fixed. Ballies, bamboos, planks, shall not rest on, or touch the surface being white washed or painted.

Ladders, where used, shall have old gunny bags tied to their tops and bottoms to avoid damage or scratches to walls and floors.

For white washing and/or painting of the ceiling, stage-scaffolding shall be erected.

Doors, windows, furniture, etc. shall be properly protected from white wash and paint splashes. Any such splashes and droppings shall be cleaned by the contractor, at his own cost, to the satisfaction of the EIC.

3.0 WHITE WASHING WITH LIME :

SURFACE PREPARATION :

For new work, the surface shall be brushed free from mortar dropping and other matter.

For old work, all loose scales shall be scrapped off. Holes and patches less than 50 sq.cm. in plaster shall be filled up with cement mortar of the same mix or in cement mortar 1:5 and finished to match the adjoining plastered surface at the Contractor's cost.

PREPARATION OF LIME WASH **:**

Fresh stone white lime shall be slaked, mixed and stirred with water approx. 5 litres to One kg. of lime and made into thin cream. After 24 hours, this shall be screened through coarse cloth. Gum dissolved in water shall be added at 4 gms. Per 1000 cub. Cm. of the cream. Three gms. Of Indigo per kg. of lime dissolved in water shall be well mixed and additional water at 5 litres per kg. of lime shall be added to produce a milky solution.

APPLICATION OF LIME WASH :

Each coat shall consist of strokes of brush from top to bottom, bottom to top, left to right and right to left. Next coat shall be applied when previous one is dry and approved by EIC.

After surface preparation, three coats of white wash shall be applied on new or old works.

FINISH :

The surface shall present a smooth and uniform finish through which plaster and plaster patches shall not show. The white washing of ceiling shall be done before that for walls.

MEASUREMENTS :

Length and breadth shall be measured correct to a cm., area shall be worked out in sq.m. correct to two places of decimal. Openings shall be deducted. Jambs, sills, soffits, painted shall be measured.

Corrugated surfaces shall be measured flat and the area so measured shall be increased to allow for the girthed area as follows :

Corrugated A.C. Sheets	+ 20%
Semi-corrugated A.C. Sheets	+ 10%

The items shall include removing nails, making good the holes, cracks, patches, etc. not exceeding 50 sq.cm. each, with material similar in composition to the surface to be prepared.

RATE :

The rate shall include the cost of all materials and labour involved in all the operations described including surface preparation, scaffolding, etc. wherever required, as specified above.

4.0 WHITE WASHING WITH SHITING :

PREPARATION OF WHITING :

Ground white chalk/whiting shall be dissolved in sufficient quantity of water to form thin slurry and screened through coarse cloth. Two kg. of gum and 0.4 kg. of copper sulphate dissolved separately in hot water shall be added for on cu.m. of slurry, which shall be diluted to the consistency of milk. The rest of the specifications shall be as for lime wash under 3.0 and 2.0.

6.0 COLOUR WASHING :

Mineral colours, not affected by lime, shall be added to white wash in proportion so as to obtain the desired tint, colour and shade. Indigo shall not be added. No colour wash shall be done until a sample of the colour wash of required tint or shade has been approved by the EIC.

For new work, first coat shall be with lime or with whiting as directed by the EIC on prepared surface and 2 (Two) more coats of colour wash shall be applied.

For old work, on prepared surface, a coat of colour wash shall be applied over patches and repairs and 3 (Three) coats over the entire surface.

The entire colour washed surface, old or new shall present a smooth and uniform finish. If it is blotchy or badly applied, it shall be redone by the Contractor. The finished dry surface shall not be powdery and shall not readily come off on the hand when rubbed.

Other specifications shall be as per white washing under 3.0 and 2.0 above.

6.0 DRY DISTEMPERING :

MATERIALS :

Dry distemper conforming to IS: 427-1965 of approved make and of required colour shall be used. One kg. dry distemper shall be mixed with 600 cc of warm water and allowed to stand for minimum 30 minutes, preferably overnight before use. The mixture shall be stirred well before and during use. No more quantity than can be used for a day's work shall be mixed.

SURFACE PREPARATION :

For new work, the surface shall be brushed to remove mortar droppings, etc. and sand-papered smooth. Dry distemper shall not be applied within 2 months of plastering.

For old work, all scales shall be removed by sand papering and surface cleaned of all grease, dirt, etc. pitting in plaster shall be made good with plaster of paris mixed with colour to be used and surface sand-papered and made smooth. A coat of distemper shall be applied over the patches and allowed to dry.

Priming coat shall consist of whiting for new work, over prepared surface. White lime wash shall not be used as priming coat.

APPLICATION :

For new work, a priming coat of whiting and two coats of dry distemper shall be applied.

For old work, surface shall be prepared as above, followed by one coat or two coats of dry distemper as specified in the item.

Each coat shall consist of two horizontal strokes followed immediately by two vertical. The brushes used shall be proper distemper brushes. Subsequent coat shall be applied when the previous coat is dry. Application of a coat in each room shall be completed in one operation. The brushes shall be washed in hot water after each day's work.

FINISH :

The finished surface shall be even and uniform and shall be without any brush marks.

All other specifications regarding scaffolding, protective measures, repairs to patch work, measurements, rates, etc. shall be as under 2.0 and 3.0.

7.0 OIL BOUND DISTEMPERING (O.B.D.)/ OIL EMULSION DISTEMPERING :

Oil bound distemper conforming to IS:428-1969 and of approved make and of required colour and shade shall be used. If the wall plaster is not completely dry, cement primer shall be used. Otherwise distemper primer shall be used. Oil bound (O.B.) distemper shall generally not be applied within six months of

plastering. The cement or distemper primer shall be of the same make as the distemper. The O.B. Distemper is mixed with water or other prescribed thinner as recommended by the manufacturer. No more quantity of distemper should be mixed than can be used for a day's work. Empty tins shall not be removed from the site of work till this item of work is completed and approved by the EIC. Account of paint material used shall be maintained at site.

SURFACE PREPARATION :

For new work, the surface shall be cleaned of dust, old white or colour wash by washing and scrubbing. When dried for minimum 2 days, it shall be sand prepared to a smooth and even surface. The imperfections and uneveness shall be made good by putty of plaster of paris mixed with water applied on the entire surface and filling up the undulations. When dry, the surface shall be sand prepared to a smooth finish.

For old work, all loose scales, etc. shall be removed by sand papering. The surface shall be cleaned of all grease, dirt, etc. if the old surface is painted already with dry distemper, it shall be removed completely. Pitting in plaster shall be made good with plaster of paris mixed with colour to be used. The surface shall then be sand papered to a smooth surface. A cost of O.B. Distemper shall be applied over the patches.

APPLICATION OF OBD :

For old work no primer is required. For new work primer coat shall be as specified in item and as instructed by the EIC.

For new work, a coat of primer and 2 coats of distemper shall be applied. When primer coat has dried for minimum 2 days, the surface shall be lightly sand papered. One coat of distemper mixed with water or thinner as specified by the manufacturer shall be applied in 2 horizontal strokes followed by 2 vertical strokes. The subsequent 2 coats shall be applied one after another in the same way with minimum interval of 24 hours in between.

For old work, distemper shall be applied on prepared surface in the same manner as per new work.

The specification regarding scaffolding, protective measures, repairs to patch work, measurement, rates, etc. shall be under 2.0 and 3.0 above.

8.0 CEMENT PRIMER :

The cement primer is composed of a synthetic medium and pigment, resistant to alkalis in cement or lime and provides a barrier for protection of subsequent oil bound distemper coats. Primer coat is applied by brushing. It is used for interior and exterior use, on plaster, cement, bricks, asbestos cement sheets, concrete and hard board.

In old works, new plaster patches should also be treated with cement primer before applying oil bound distemper.

SURFACE PREPARATION :

The surface shall be cleaned of dust, old white or colour wash, etc. by washing and scrubbing. When dried for minimum 48 hours, it shall be sand-

prepared to a smooth and even surface. Any unevenness shall be made good by putty of plaster of paris mixed with water on the entire surface including filling up undulation and sand papering when dry.

APPLICATION :

Cement primer shall be applied with brush on clean, dry and smooth surface, with a coat of horizontal strokes and vertical strokes. It shall be allowed to dry for 48 hours minimum.

The specifications regarding scaffolding, protecting measures, repairs to patches, measurement and rates shall be as under 2.0 and 3.0.

9.0 CEMENT BASED PAINT :

MATERIAL :

The cement paint conforming to IS:5410-1969 and of approved make and of required colour and shade shall be used. Finely ground cement paint is made from top quality white cement and lime resistant colours with accelerators and waterproofing agents. It is for exterior and interior use on cement concrete, bricks, A.C. Sheets, etc.

SURFACE PREPARATION :

For new works, the surface shall be cleaned of mortar dropping, dirt, algae, grease, moss, etc. by brushing and washing.

For old works, all loose scales, etc. shall be removed and the surface cleaned of all dust, dirt, algae, grease, old paint, moss etc. by brushing and washing. Pitting in plaster shall be made good and a coat of waterproof cement paint applied over patches after wetting them. If the old cement paint is powdery or flaky, it should be removed by scrapping or wire brushing.

MIXING :

Cement paint shall be mixed in such quantities as can be used up within a hour of its mixing, as otherwise the mixture will set and thicken, affecting flow and finish.

Two parts of cement paint shall be gradually added to one part of water, stirred well and allowed to stand for 5 minutes. Further, one part of water shall b added and mixture stirred well. The mixing shall be carried out as per manufacturers instructions.

APPLICATION :

The mix shall be applied on clean and wetted surface. The mix shall be stirred, during application, by brushes. At the end of the day's work, the surface shall be wetted. The second coat shall be applied after 24 hours when the first coat is dry and shall be wetted at the end of the day's work. Before start of application of second and subsequent coats, the surface of the previous coat shall not be wetted. The subsequent coats shall be applied similarly when the previous coat is dry. For new work, 3 coats shall be applied. For old work, one or two coats as specified.

NOTE :

Cement paint shall not be applied on works already painted with white or colour wash, dry or oil bound distemper, oil paint, or on metal surface, etc.

The specification for scaffolding, protective measures, repairs to patches, measurements, rates, etc. shall be as described under 2.0 and 3.0.

10.0 PAINTING :

Painting includes oil painting, synthetic enamel painting, plastic emulsion painting, varnishing, etc.

MATERIALS :

Paints, oil varnishes, ready mixed paints, etc. shall be of approved make and quality.

PREPARATION OF SURFACE :

The surface shall be cleaned of all dust, rust, dirt, loose scales, smoke and grease. No further work shall be started till EIC has inspected and approved the surface prepared.

APPLICATION :

The paint in its container shall be stirred while poring out and it shall be stirred while painting.

Each coat, shall consist of the process of crossing and laying off. This consists of the process of painting the area by brushing the surface hard for the first time over, then brushing alternately in opposite direction 2 or 3 times and then brushing lightly at right angles so as not to leave any brush marks.

Painting may be done by brushing or by spraying with the approval of the EIC. In the case of spraying, skilled and experienced painters shall be employed since the paint will required a suitable thinner for required consistency of paint.

Each coat, except the last coat, when dry, shall be rubbed smooth with sand paper or fine pumice stone and cleaned off before application of next coat.

Proper care shall be taken in painting corners, angles, etc. in painting doors, windows and other glazed panelled work, the putty around the glasses should be painted, leaving no stains on the glasses. Tops of shutters, sides and edges of frames shall not be missed out.

In painting steel work, bolts, nuts, rivets, overlaps shall be properly covered with painting.

Primers and other coats shall be as described and specified.

Brushes shall be cleaned after the day's use by rinsing with turpentine. Containers of paint shall be kept closed when not in use.

10.1 MEASUREMENTS :

Length and breadth shall be measured correct to a centimeter. The area shall be measured in sq.m. correct to two places of decimal.

10.2 The co-efficients given in the following statement shall be applied to the areas measured flat (not girthed) to obtain areas payable for painting, varnishing, etc.

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EQUIVALENT PLAIN AREAS ON UNEVEN SURFACES

SR. NO.	DESCRIPTION OF WORK	HOW MEASURED	MULTIPLYING COEFFICIENTS
A.	**WOODWORK – DOORS , WINDOWS, ETC.**		
1	Panelled or framed doors, windows, etc.	Measured flat, Length measured from out to out of door/ window frame and height from top of door frame to finished floor for door and top to bottom of window frame. Edges, cleats, etc. shall be deemed to be included in the item.	1.30 (for each side)
2	Flush doors	- do -	1.20 (for each

			side)
3.	Part panelled or part glazed or wire gauzed doors, windows, etc.	-do-	1.00 (for each side)
4.	Fully glazed or gauzed doors, windows, etc.	-do-	0.80 (for each side)
5.	Fully venetianed or louvred doors, windows, etc.	-do-	1.80 (for each side)
6.	Flush shutter only	Shutters shall be measured flat. The edges of shutters shall be deemed to be included in the item.	1.00 (for each side)
7.	Panelled shutters only	-do-	1.10 (for each side)
8.	Part panelled and part glazed shutters	-do-	0.80 (for each side)
9.	Fully glazed or gauzed shutters	-do-	0.60 (for each side)
10.	Fully venetianed or louvered shutters	-do-	1.60 (for each side)
11.	Door/Window frames	Actual painted area	--

SR. NO.	DESCRIPTION OF WORK	HOW MEASURED	MULTIPLYING COEFFICIENTS
B.	**STEEL WORK – DOORS , WINDOWS, ETC.**		
12.	Plain sheeted steel doors or windows, sliding doors	Measured flat, Length measured from out to out of door/ window frame and height from top of door frame to the finished floor for door; and top of window member to bottom of frame member for windows.	1.10 (for each side)
13.	Fully glazed or gauzed steel doors and windows	-do-	0.50 (for each side)

14.	Partly panelled and partly glazed or gauzed doors and windows	-do-	0.50 (for each side)
15.	Fully steel louvered doors and windows	-do-	1.50 (for each side)
16.	Corrugated sheeted steel doors or windows	-do-	1.25 (for each side)
17.	Collapsible gates	Measured flat	0.75 (for each side)
18	Rolling shutters of interlocked laths	Measured flat (size of opening) all over; jambs, guides, bottom rails, and locking arrangement etc. shall be included in the item. Top cover shall be measured separately.	1.10 (for each side)
C.	**GENERAL**		
19	Expanded metal, hard drawn steel wire fabric, grill work, balustrades, railings, M.S. bars in window frames, etc.	Measured flat overall: no deduction shall be made for open spaces, supporting members shall not be measured separately.	1.00 (for painting all over)
20	Corrugated iron sheeting in roofs, side cladding, etc.	Measured flat (not girthed)	1.14 (for each side)

SR. NO.	DESCRIPTION OF WORK	HOW MEASURED	MULTIPLYING COEFFICIENTS
21.	A.C. corrugated sheeting in roofs, side cladding, etc.	- do-	1.20 (for each side)
22.	A.C. Semi-corrugated sheeting in roofs, side cladding, etc.	-do-	1.10 (for each side)

NOTES :

i) When two faces of a door, window, etc. are treated with different specified finishes, measurable under separate items, the edges of frames and

shutters shall be treated with one or the other type of finish as directed by the EIC and the measurement of this will be deemed to be included in the measurement of the face treated with that finish.

ii) Where shutters are fixed on both faces of the frames, the measurement for door frame and shutter on one face shall be taken in the manner already described and the additional shutter on the other face shall be measured for shutter area only.

iii) Where shutters on doors are provided with clearance at top and/ or bottom, each exceeding 15 cm. height, such openings shall be deducted from flat area of each side of door and relevant coefficient shall be applied to obtain the area payable.

iv) Collapsible gates shall be measured from outside to outside of gate in its expanded position and for height from top to bottom of verticals of channels. No separate measurements shall be taken for the top and bottom guide rails, rollers, fittings, etc.

Measurements of painting as above shall be deemed to include painting all iron fittings in the same or different shade for which nothing extra shall be paid.

Width of moulded work of all other kinds as in hand rails, cornices, architraves, etc. and door and window frames without shutter shall be measured by girth.

For painting of trusses, compound girders, stanchions, lattice girders and similar work, the weight of the structure painted shall be measured as specified under relevant section of “Structural Steel” and “Iron, Steel & Aluminium Work”. The weights of bolt heads, nuts, washers, welds, etc. shall not be measured even when these are painted in a different tinit to the adjacent work. The measurement of painting shall be in metric tones of structural steel painted, correct to two places of decimal.

Painting of rain water, soil, waste, vent and water pipes, etc. shall be measured in sq.mts. being the product of length along the centre line of pipe line and the circumference of the pipe, including the fittings. No separate measurements shall be taken for painting of brackets and clamps, etc.

Measurements of wall surfaces, wood and other work not referred to above shall be recorded as per actuals.

Fans, etc. painted shall be measured in numbers.

PRECAUTIONS :

All furniture, fixtures, glazing, floors, etc. shall be properly protected by covering. Stains, splashing, if any, shall be removed and any damage caused shall be made good by the contractor at his cost.

RATE :

The rates shall include the cost of all labour and materials involved in all the operations described above. The removal of paint completely shall be paid for separately, under relevant item.

11.0 PAINTING BRICK WALLS, CONCRETE, STUCCO PLASTER, ASBESTOS CEMENT WITH PLASTIC EMULSION PAINT (P.E.P) :

Plastic emulsion paint conforming to IS : 5411-1969, of approved make and of required colour and shade shall be used.

PREPARATION OF WALL SURFACE :

The surface shall be cleaned of all dirt, dust, mortar droppings, etc. The pitting, unevenness and undulations in the plaster shall be made good by putty of Plaster of Paris. The surface shall then be sand papered smooth.

APPLICATION :

For New Work :

'Plastron' or equivalent primer as per manufacturer's instructions shall be applied.

The thinning of P.E.P. shall be with water of quantity as per manufacturer's instructions. The paint shall be applied with brush or roller. The subsequent coat shall be applied when the previous one is dry. The drying time varies between 2 to 3 hours depending on the surface. The number of coats shall be stipulated in the item.

For Old Work :

The surface which has been painted already shall be considered as old surface.

If the old paint is other than P.E.P., it shall be scrapped off and the surface prepared as in 11.0. Removal of paint completely shall be paid for separately under relevant items.

If the old paint is P.E.P., and is sound and firm, the surface shall be cleaned of all smoke, greases, etc. with lime and rinsed with water and dried and then rubbed down with pumice stone. All dust and loose paint shall be removed. The surface shall then be washed with soap and water.

If the old paint is blistered or flaked badly, it shall be completely removed. Holes, cracks, etc. shall be filled up with Plaster of Paris putty.

Further coats shall be applied as for new works. No primer coat is necessary for old work. Number of coats shall be as specified in the items.

FINISH :

The finished surface shall present a flat, velvety smooth finish and a uniform appearance.

Specifications for scaffolding, repairs to plaster, plaster patches, protective measures, rates, etc. shall be as under 2.0.

Measurements shall be as per 10.1 and 10.2 above.

12.0 PRIMING COAT ON WOOD, IRON, STEEL & PLASTERED SURFACES :

SURFACE	PRIMER USED
i) Woodwork (hard & soft wood)	Pink or grey primer conforming to IS : 3536-1966
ii) Resinous wood and Plywood	Aluminium primer
iii) Aluminium, steel and galvanized steel.	Red Oxide Zinc Chromoate primer
iv) Cement, brickwork, plaster surface, asbestos cement surface for OBD and paint.	Cement primer

The primer shall be ready mixed primer of approved quality and make.

PREPARATION OF SURFACE :

Wooden Surface :

The surface to be painted shall be thoroughly dry. The surface shall be cleaned. All unevenness shall be rubbed down with sand paper and well dusted. Any knots shall be covered with a solution of red lead group in water, mixed with strong glue sized and used hot. After priming coat, the holes on the surface shall be stopped with wood putty.

Iron & Steel Surface :

All rust and scales shall be removed by scrapping or by steel wire brushing. The surface shall be dry before primer coat is applied.

Plastered Surface :

The surface to be painted shall be thoroughly dry. Holes and undulations shall be filled up with Plaster of Paris and rubbed smooth.

APPLICATION :

The primer shall be applied with brushes. The painting shall be as under 10.0.

13.0 READY MIXED PAINTS :

Ready mixed paints of approved quality and make and of required colour and shade shall be used.

Painting on new surface :

Surface which has not been painted, or from which the paint is removed by paint removed, by burning, by caustic soda, etc. shall be considered as a new surface.

Surface preparation :

Same as under 12.0.

Application :

As described under 10.0.

Painting on old Surface :

The surface which has been painted before shall be considered as old surface.

PREPARATION OF SURFACE :

A. Woodwork :

If the old paint is sound and firm, the surface shall be cleaned of all smoke, grease, etc. by washing with lime and water and dried and then rubbed down with pumice stone. All dust and loose paint shall be removed and surface washed with soap and water. If old painted surface is blistered or flake, the old paint shall be removed completely. Holes and cracks shall be stopped with wood putty. In this case the surface shall be considered as new surface for further painting.

B. Iron & Steel work :

If the old paint is sound and firm, it shall be rubbed with wire brushes and loosened paint and dust thoroughly wiped off. The surface shall be then wiped with mineral turpentine to remove grease, etc. and then allowed to dry. If the old paint is blistered and flaked it shall be removed completely and surface prepared.

C. Plastered Surface :

Same as for woodwork in (A) above.

APPLICATION :

SAME AS 10.0 as far as applicable.

Specifications for scaffolding, repairs to plaster, protective measures, rates, etc. shall be as under 2.0.

Measurements shall be as per 10.1 & 10.2.

14.0 PAINTING WITH SYNTHETIC ENAMEL PAINT :

Synthetic Enamel Paint shall conform to IS : 1932-1964 and shall be of make, quality and colour and shade as directed and approved by the EIC.

Painting of New Surface :

Preparation of surface as per 12.0 above.

Application :

a) Undercoat : One coat of undercoat of shade suited to the shade of top coat shall be applied and allowed to dry overnight. When dry it shall be rubbed with fine grade of wet abrasive paper.

b) Top Coat : Two top coats shall be applied one after another when the previous coat is thoroughly dry.

Rest of the specifications as per 10.0 as far as applicable.

Painting on Old Surface :

Preparation of Surface :

If the existing paint is sound and firm, it shall be cleaned of grease, smoke, etc. and rubbed down with sand paper. All patches and cracks shall be treated with stopping and filler, prepared with the specified paint, and the surface rubbed again to a smooth and uniform surface.

If the old paint is blistered and flaky, it shall be removed completely.

Application :

Each coat shall be allowed to dry and rubbed down smooth with very fine wet abrasive paper to get an even glossy surface.

Other specifications for scaffolding, repairs to plaster, protective measures, rates shall be as in 2.0 and 3.0.

Measurements shall be as per 10.1 and 10.2 above.

15.0 PAINTING WITH ALUMINIUM PAINT :

The aluminium paint shall conform to IS:2339-1963 of approved make and quality. If comes in dual containers, one for paste and one for the medium. The two shall be mixed to proper consistency for use, as per manufacturer's instructions and as directed by the EIC.

PREPARATION OF SURFACE :

a) Steelwork (new surface) :

All rust and scales shall be removed by scrapping or brushing with steel wire brushes and then smoothened with sand paper and the surface shall be thoroughly cleaned.

b) Steelwork (Old surface) :

If the old paint is firm and sound, it shall be cleaned of grease, smoke, etc. and the surface subbed down with sand paper and dusted. Rusty patches shall be cleaned up and touched up with red oxide zinc chromate. If the old paint is blistered and flaky, it shall be completely removed.

APPLICATION :

One coat of red oxide zinc chromate primer shall be applied followed with 2 coats of aluminium paint. Each coat shall be allowed to dry for minimum 24

hours and lightly rubbed down with fine grade sand paper and cleaned before next coat is applied. The paint shall be stirred frequency when in use.

Specifications for scaffolding, protective measures, rates, etc. shall be as in 2.0 and 3.0.

MEASUREMENTS :

It shall be in metric tones of steel work painted as in 10.1 & 10.2.

16.0 REMOVING OLD PAINT AND SURFACE PREPARATION :

With Blow Lamp :

The blow lamp flame shall be applied to the paint to soften it without charring the paint or the surface behind. The operation shall proceed from bottom to top. The softened paint shall be removed with knife edge, following the blow lamp flame.

With patent paint remover :

The patent paint remover shall be of quality and make approved by the EIC.

It shall be used where blow lamp burning is not possible or suitable.

It shall be applied liberally by brush. When the paint wrinkles, it shall be removed with a sharp edge. If the paint is not removed properly in one application, the process is repeated.

The stripped surface shall be washed with mineral turnpentine.

With Caustic Soda Solution :

Caustic Soda Solution (1 Caustic Soda : 48 water by volume) shall be applied by brush. The paint wrinkles shall be removed with sharp edge. The process may be repeated to remove the paint thoroughly.

The stripped surface shall be washed thoroughly with clean water.

Specifications for scaffolding, protective measures, rates, etc. shall be as in 2.0 and 3.0.

MEASUREMENT :

It shall be in sq.m. as in 10.1 ad 10.2 except in the case of removal of old paint and preparation of surface for steel work when it will be in Metric Tonnes of steel work treated, measured as in 10.1 & 10.2.

17.0 VARNISHING :

The varnish shall be ordinary copal varnish or superior quality spar varnish and conform to IS:347-1952 and shall be of approved quality and make.

VARNISHING ON NEW SURFACES :

Surface Preparation :

The surface to be varnished shall be planed smooth. Cracks and holes shall be cleaned. The knots shall be cut to a slight depth. The knots, cracks, etc. shall be filled with wood putty formed of stiff paste of mixture of glue and very fine wood powder. The entire surface shall be rubbed down smooth with fine sand papers.

The surface shall then be treated with transparent wood filler with brush or rag so as to fill up the pores and indentations and to level up the surface. After 24 hours, it shall be cut and rubbed with emery paper to bare the wood surface with the filler only in pores and crevices of the wood.

APPLICATTION OF VARNISH :

The undercoat shall be with a floating varnish. This dries hard and brittle and when cut and rubbed down to produce a smooth surface, enhances the gloss of the finishing varnish. The top coat shall be with varnish of approved make.

Varnish shall be applied with special fine haired varnishing brushes. Each coat shall consist of two way horizontal short strokes finished with two way vertical strokes. Rubbing down the surface with fine sand paper shall be done after each coat except the final coat.

The finished surface shall present a uniform appearance and fine glossy surface free from streaks, blisters, etc.

VARNISHING ON OLD SURFACES :

Surface Preparation :

If the old varnished surface is firm and sound, it shall be cleaned of grease and dirt, with turpentine and rubbed smooth with wet sand paper. When dry, it shall be cleaned with soft cloth. Knots, holes and cracks shall be treated as in 17.0 above and the entire surface sand papered smooth and cleaned.

If the old surface is peeled or cracked, it shall be removed as described under specification 16.0 and the further varnishing shall be carried out as for new varnish as described under 17.0, except that the coats shall be with quality of finishing coat.

Other details for measurements, rates, etc. shall be as described under specification 2.0, 3.0, 10.1, & 10.2.

18.0 FRENCH (SPIRIT) POLISHING :

Pale orange to lemon yellow coloured 140 gms of pure shellac, free from resin and dirt, shall be dissolved in one litre of spirit and suitable pigment shall be added.

POLISHING NEW SURFACE :

Surface Preparation :

The surface shall be cleaned and unevenness sand papered smooth. Knots shall be covered with red lead and glue size laid on while hot. Holes shall be

stopped with glazier's putty. A coat of wood filler mixture of 1.5 kg of ground chalk whiting in one litre of methylated spirit shall be applied and the surface rubbed down smooth with glass paper, and wiped clean.

APPLICATION OF FRENCH POLISH :

A pad of woolen cloth covered with a fine cloth shall be moistened with the polish and rubbed hard on wood. One coat shall consist of applying the polish uniformly in a series of overlapping circles, to give an even surface. The next coat shall be applied when the previous is dry. The final coat, shall be rubbed lightly and quickly with circular motions with the pad with French piece of clean fine cloth. The finished surface shall be uniform and have high gloss.

Measurements, rates etc. shall be as detailed under specifications 10.1 & 10.2 above.

POLISHING OLD SURFACE :

Surface Preparation :

If the old polished surface is sound, it shall be cleaned of grease and dirt by rubbing with turpentine followed by sand papering.

If the old surface is not sound, the entire polish shall be removed as described under specification 16.0.

Further polishing shall be as for new work.

Measurements, rate and other details shall be as specified under 10.1 & 10.2 as far as they are applicable.

19.0 WAX POLISHING :

Wax polishing shall be with ready made wax polish of quality and make, approved by the EIC.

This is prepared from bees was, linseed oil, turpentine and varnish.

WASING NEW SURFACE :

Surface Preparation :

Same as for varnishing described under specification 18.0 except that the knots, cracks, holes are stopped with saw dust of the wood being treated, mixed with bees was.

Waxing :

The surface is fully covered with wax polish by a clean cotton cloth soft pad and rubbed for about ½ an hour. When dry, the process is repeated and rubbing is done for one hour. Finally, the process is repeated and the rubbing in all directions is carried out for 2 hours minimum till the surface is dry and glossy without any stickiness.

WAXING OLD SURFACE :

Surface preparation :

The old surface to be polished shall be cleaned of grease, etc. by washing with lime water and then with soap and dried. Thereafter, the process is the same as for waxing new surface.

All other details for measurements, rates, etc. shall be as per specifications under 10.0, 10.1 & 10.2.

20.0 ANTI-CORROSIVE BITUMASTIC PAINTING :

This shall be ready mixed paint and conform to IS:158-1968 and shall be of approved quality and make. Surface preparation shall be as described in specification 10.0 for painting on new and old surfaces and 10,1 & 10.2 for measurements, rates, etc.

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