



ATTACHMENT-5 GENERAL BUILDING WORKS



1 SCOPE

This specification covers the general requirements for civil and architectural works comprising of masonry, flooring, skirting, dado, plastering for wall and ceilings, painting, doors, windows, ventilators, Builders hardware, ironmongery, Glass and glazing, Partition works, False ceiling works, toilet cubicles, sanitary fixtures and fittings, water proofing, Metal sheet cladding, grills and railing works.

The works under this specification shall consist of furnishing of all tools, plants, labor, materials, and everything necessary for execution.

2 MASONRY WORK

2.1 GENERAL

The works covered under this specification shall include:

Rubble masonry. brick masonry and concrete block masonry.

2.2 APPLICABLE CODES AND STANDARDS

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| IS:2117 | - | Guide for manufacture of hand-made common burnt-clay building bricks |
| IS:1077 | - | Specification for common burnt clay building bricks. |
| IS:1124 | - | Method of test for determination of water absorption, apparent specific gravity and porosity of natural building stones. |
| IS:1397 | | Specification for Kraft paper. |
| IS:1597 | - | Code of practice for construction of stone masonry: Part 1 Rubble stone masonry. |
| IS:2116 | - | Specification for sand for masonry mortars. |
| IS:2185 | - | Specification for concrete masonry units (Parts 1,2 & 3). |
| IS:2212 | - | Code of practice for brickwork. |



- IS:2250 - Code of practice for preparation and use of masonry mortars.
- IS:2572 - Code of practice for construction of hollow concrete block masonry.
- IS:2691 - Specification for burnt clay facing bricks.
- IS:2750 - Specification for steel scaffoldings.
- IS:3495 - Method of test for burnt clay building bricks Part 1 to 4.
- IS:3812 - PART 1 , pulverized fuel ash — specification part 1 for use as pozzolana in cement, cement mortar and concrete
- IS:3812 - Part 2 , pulverized fuel ash —part 2 for use as admixture in cement mortar and concrete
- IS:6041/ IS:6042 - Code of practice for construction of autoclaved cellular concrete block masonry.
- IS:13757 - Burnt clay fly ash building bricks Specification

2.3 UNCOURSED RANDOM RUBBLE MASONRY, IN FOUNDATION. PLINTH AND SUPERSTRUCTURE

MATERIALS

1. Stones for the works shall be of the type specified such as granite, trap, sandstone, quartzite, etc. and shall be obtained from quarries, approved by Engineer. Stone shall be hard, sound, durable, fine grained and uniform in color (for superstructure work) and free from weathering decay and defects like cavities, cracks, flaws, sand holes, injurious veins, patches of loose or soft materials and other similar defects that may adversely affect its strength and appearance. As far as possible stones shall be of uniform color, quality, and texture. Generally stone shall not contain crypst, crystalline silica or chart, mica and other deleterious materials like iron-oxide, organic impurities etc. Stones with round surface shall not be used and work shall conforming to IS1597
2. The compressive strength of common types of stones shall be a minimum of 300kg/cm² and the percentage of water absorption shall



- generally not exceed 5% as per test conducted in accordance with IS:1124.
3. Cement-sand mortar for stone masonry works shall be in the proportion of 1:6 unless otherwise specified in the respective items of work. Sand for masonry mortar shall conform to IS:2116. The sand shall be free from clay, shale, loam, alkali and organic matter and shall be of sound, hard, clean and durable particles. Sand shall be approved by ENGINEER. If so directed by the ENGINEER, sand shall be screened and washed till it satisfies the limits of deleterious materials.
 4. For preparing cement mortar, the ingredients shall first be mixed thoroughly in dry condition. Water shall then be added and mixing continued to give a uniform mix of required consistency. Mixing shall be done thoroughly in a mechanical mixer, unless hand mixing is specifically permitted by the ENGINEER. The mortar thus mixed shall be used as soon as possible, preferably within 30 minutes from the time water is added to cement. In case, the mortar has stiffened due to evaporation of water, this may be re-tempered by adding water as required to restore consistency, but this will be permitted only upto 30 minutes from the time of initial mixing of water to cement. Any mortar which is partially set shall be rejected and shall be removed forthwith from the site. Droppings of mortar shall not be re-used under any circumstances
 5. The BIDDER shall arrange for test on mortar samples if so directed by the ENGINEER.



WORKMANSHIP

1. For all works below ground level the masonry shall be random rubble un-coursed with ordinary quarry dressed stones for the hearting and selected quarry dressed stones for the facing. Stones having sharp corners or round surface shall not be used.
2. For all works above ground level and in superstructure the masonry shall be random rubble un-coursed, well bonded, faced with hammer dressed stones with squared quoins at corners. The bushings on the face shall not be more than 40 mm on an exposed face and on the face to be plastered it shall not project by more than 12 mm nor shall it have depressions more than 10 mm from the average wall surface.
3. Face stones shall extend back sufficiently and bond well with the masonry. The depth of stone from the face of the wall inwards shall not be less than $\frac{2}{3}$ the thickness of wall. The length of the stone shall not exceed three times the height and the breadth on base shall not be greater than three-fourths the thickness of wall nor less than 150 mm. The height of stone may be upto a maximum of 300 mm. Hearting stones shall not be less than 150 mm in any direction and shall be bedded in mortar. Stones shall be laid with its grains horizontal.
4. Chips and spalls shall be used wherever necessary to avoid thick mortar joints and to ensure that no hollow spaces are left in the masonry. The use of chips and spalls in the hearting shall not exceed 20 percent of the quantity of stone masonry. Spalls & chips shall not be used on the face of the wall and below hearting stones to bring them to the level of face stones.
5. The maximum thickness of joints shall not exceed 20 mm. All joints shall be completely filled with mortar. When plastering or pointing is not required to be done, the joints shall be struck flush and finished as the work proceeds. Otherwise, the joints shall be raked to a minimum depth of 20 mm by a raking tool during the progress of the work while the mortar is still green.
6. Through or bond stones shall be provided in walls up to 600 mm thick and in case of walls above 600 mm thickness, a set of two or more bond stones overlapping each other by at least 150 mm shall be provided in a line from face to back. In case of highly absorbent types of stones (porous lime stone and sand stone, etc.) the bond stone shall extend about two-thirds into the wall and a set of two or more bond stones overlapping each other by at least 150 mm shall be provided. Each bond stone or a set of bond stones shall be provided for every 0.5 sq.m of wall surface and shall be provided at 1500mm clear spacing in each course.
7. All stones shall be sufficiently wetted before laying to prevent absorption of water from the mortar. Stones shall be laid on their natural bed and shall be solidly bedded full in mortar with close joints. Chips of stone spalls be wedged into the work wherever necessary. No dry work or hollow spaces shall be allowed and every stone whether large or small shall be carefully selected to fit snugly the interstices between the large stones. Masonry shall be built breaking joints in all the three directions.



Bond stone and headers shall be properly laid into the work and shall be marked by the BIDDER with white lead paint. The bond stones shall be provided as specified in para 3.1.2.6. The masonry work in wall shall be carried up true to plumb or to specified batter. Random rubble masonry shall be brought to the level courses at plinth, window sills, lintel and roof levels. Levelling shall be done with concrete comprising of one part of mortar as used for masonry and two parts of graded stone aggregate of 20mm nominal size. The masonry in structure shall be carried uniformly. Where the masonry of one part is to be delayed, the work shall be racked back at an angle not steeper than 45° . Height of wall raised in any one day shall not exceed one metre.

8. Green work shall be protected from rain by suitable covering. Masonry work shall be kept constantly moist on all the faces for a minimum period of seven days for proper curing of the joints.
9. Double scaffolding having two sets of vertical supports shall be provided to facilitate execution of the masonry works. The scaffolding shall be designed adequately considering all the dead, live and possible impact loads to ensure safety of the workmen, in accordance with the requirements stipulated in IS:2750 and IS:3696 (Part 1). Scaffolding shall be properly maintained during the entire period of construction. Single scaffolding shall not be used on important works and will be permitted only in certain cases as decided by the ENGINEER. Where single scaffolding is adopted, only minimum number of holes, by omitting a header shall be left in the masonry for supporting horizontal scaffolding poles. All holes in the masonry shall be carefully made good before plastering/painting.

2.4 COURSED RUBBLE MASONRY (FIRST SORT) FOR SUPERSTRUCTURE

MATERIALS

1. The material specification for the work shall be as per clause 2.3.1 WORKMANSHIP
2. Face stones shall be hammer dressed on all beds, and joints so as to give them approximately rectangular block shape. These shall be squared on all joints and beds. The bed joint shall be rough chisel dressed for at least 80 mm back from the face, and side joints for at least 40 mm such that no portion of the dressed surface is more than 6 mm from a straight edge placed on it. The remaining unexposed portion of the stone shall not project beyond the surface of bed and side joint. The bushing on the face shall not project more than 40 mm as an exposed face and 10 mm on a face to be plastered. The hammer dressed stone shall also have a rough tooling for minimum width of 25 mm along the four edges of the face of the stone, when stone work is exposed.
3. All stones shall be wetted before use. The walls shall be carried up truly plumb or to specified batter. All courses shall not be less laid truly



- horizontal and all vertical joints shall be truly vertical. The height of each course shall not be less than 150mm or more than 300mm
4. Face stones shall be laid alternate headers and stretchers. No pinning shall be allowed on the face. No face stone shall be less in breadth than its height and at least one third of the stones shall tail into the work for length not less than twice their height.
 5. The hearting or the interior filling of the wall shall consist of stones carefully laid on their proper beds in mortar; chips and spalls of stone being used where necessary to avoid thick beds of joints of mortar and at the same time ensuring that no hollow spaces are left anywhere in the masonry. The chips shall not be used below the hearting stone to bring these up to the level of face stones. The use of chips shall be restricted to the filling of interstices between the adjacent stones in hearting and these shall not exceed 10% of the quantity of stone masonry.
 6. The masonry in a structure shall be carried up uniformly but where breaks are unavoidable, the joints shall be raked back at angle not steeper than 45°. Toothing shall not be allowed.
 7. Bond Stones shall be as specified in 3.1.2.6 except that a bond stone or a set of bond stones shall be inserted 1.5 to 1.8 meters apart, in every course.
 8. The quoins shall be of the same height as the course in which these occur. These shall be at least 450 mm long and shall be laid stretchers and headers alternatively. These shall be laid square on the beds, which shall be rough-chisel dressed to depth of at least 100 mm. In case of exposed work, these stones shall have a minimum of 25 mm wide chisel drafts at four edges, all the edges being in the same plane.
 9. All bed joints shall be horizontal and all side joints vertical. All joints shall be fully packed with mortar, ace joints shall not be more than one cm thick. When plastering or pointing is not required to be done, the joints shall be struck flush and finished at the time of laying. Otherwise, joints shall be raked to a minimum depth of 20 mm by raking tool during the progress of work, when the mortar is still green.
 10. Type of scaffolding to be used shall be as per Clause 2.3.2.9
 11. Requirements of execution of the work and curing shall be as stipulated in clause 2.3.2.7 and clause 2.3.2.8.
 12. Installation of miscellaneous inserts in the masonry shall be as specified in clause 2.3.2.10

2.5 BRICK MASONRY WORK

1. Bricks used in the works shall conform to the requirements laid down in IS:1077 /IS:13757. The class of the bricks shall be as specifically indicated in the respective items of work.
2. Standard modular size of common bricks shall be 190mm x 90mm x 90mm as per IS:1077/ IS13757. The nominal thickness of one brick and half brick walls using modular bricks shall be considered as 200 mm and 100 mm respectively. In the event of use of non-modular bricks, standard size shall be 230mm x 110mm x 70mm. The nominal thickness of one brick



and half brick walls using non-modular bricks shall be considered as 230 mm and 115 mm respectively. The dimensional tolerances of modular and non-modular sized bricks over the standard sizes shall be as per IS 1077. / IS13757.

3. Normal Clay Bricks shall be sound, hard, and homogenous in texture, well burnt in kiln without being vitrified, hand/machine moulded, deep red, cherry or copper coloured, of regular shape and size & shall have sharp and square edges with smooth rectangular faces. The bricks shall be free from pores, cracks, flaws and nodules of free lime. Hand moulded bricks shall be moulded with a frog and those made by extrusion process may not be provided with a frog. Bricks shall give a clear ringing sound when struck and shall have a minimum crushing strength of 5N/sq.mm unless otherwise specified in the item.
4. Clay red bricks shall be hand/machine moulded and shall be made from the admixture of suitable soils and fly ash in optimum proportioned as per IS2117. Fly ash used for manufacture of bricks shall conforming to grade 1 or grade 2 as per IS3812. The bricks shall be free from pores, cracks, flaws and nodules of free lime. Hand moulded bricks shall be moulded with a frog and those made by extrusion process may not be provided with a frog. Bricks shall give a clear ringing sound when struck and shall have a minimum crushing strength of 5N/sq.mm unless otherwise specified in the item.
5. The average water absorption shall not be more than 20 percentages by weight up to class 12.5 and 15 percentages by weight for higher classes. Bricks which do not conform to this requirement shall be rejected. Over or under burnt bricks are not acceptable for use in the works.
6. Sample bricks shall be submitted to the ENGINEER for approval and bricks supplied shall conform to approved samples. If demanded by ENGINEER, brick samples shall be got tested as per IS: 3495 by BIDDER at no extra cost to OWNER. Bricks rejected by ENGINEER shall be removed from the site of works within 24 hours.
7. Mortar for brick masonry shall consist of cement and sand and shall be prepared as per IS:2250. Mix shall be in the proportion of 1:5 for all brickworks, unless otherwise specified in the respective items of work. Sand for masonry mortar shall conform to IS:2116. The sand shall be free from clay, shale, loam, alkali and organic matter and shall be of sound, hard, clean and durable particles. Sand shall be approved by ENGINEER. If so, directed by the ENGINEER, sand shall be screened and washed till it satisfies the limits of deleterious materials.
8. For preparing cement mortar, the ingredients shall first be mixed thoroughly in dry condition. Water shall then be added and mixing continued to give a uniform mix of required consistency. Mixing shall be done thoroughly in a mechanical mixer unless hand mixing is specifically permitted by the ENGINEER. The mortar thus mixed shall be used as soon as possible, preferably within 30 minutes from the time water is added to cement. In case, the mortar has stiffened due to evaporation of water, this may be re-tempered by adding water as required to restore consistency, but this will be permitted only up to 30 minutes from the time



of initial mixing of water to cement. Any mortar which is partially set shall be rejected and shall be removed forthwith from the site. Droppings of mortar shall not be re-used under any circumstances.

9. The BIDDER shall arrange for test on mortar samples if so directed by the ENGINEER.

WORKMANSHIP

1. Workmanship of brick work shall conform to IS: 2212. All bricks shall be thoroughly soaked in clean water for at least one hour immediately before being laid. The cement mortar for brick masonry work shall be as specified in the respective item of work. Brick work 200mm/230mm thick and over shall be laid in English Bond unless otherwise specified. 100mm/115mm thick brickwork shall be laid with stretchers. For laying bricks, a layer of mortar shall be spread over the full width of suitable length of the lower course. Each brick shall be slightly pressed into the mortar and shoved into final position so as to embed the brick fully in mortar. Only full-size bricks shall be used for the works and cut bricks utilized only to make up required wall length or for bonding. Bricks shall be laid with frogs uppermost.
2. All brickwork shall be plumb, square and true to dimensions shown. Vertical joints in alternate courses shall come directly one over the other and be in line. Horizontal courses shall be levelled. The thickness of brick courses shall be kept uniform. In case of one brick thick or half brick thick wall, at least one face should be kept smooth and plane, even if the other is slightly rough due to variation in size of bricks. For walls of thickness greater than one brick both faces shall be kept smooth and plane. All interconnected brickwork shall be carried out at nearly one level so that there is uniform distribution of pressure on the supporting structure and no portion of the work shall be left more than one course lower than the adjacent work. Where this is not possible, the work shall be raked back according to bond (and not saw toothed) at an angle not exceeding 45°. But in no case the level difference between adjoining walls shall exceed one metre. Brickwork shall not be raised more than one metre per day.
3. Bricks shall be so laid that all joints are well filled with mortar. The thickness of joints shall not be less than 6 mm and not more than 10 mm. The face joints shall be raked to a minimum depth of 10mm/15mm by raking tools during the progress of work when the mortar is still green, so as to provide a proper key for the plastering/pointing respectively to be done later. When plastering or pointing is not required to be done, the joints shall be uniform in thickness and be struck flush and finished at the time of laying. The face of brickwork shall be cleaned daily and all mortar



- droppings removed. The surface of each course shall be thoroughly cleaned of all dirt before another course is laid on top.
4. During inclement weather conditions, newly built brick masonry works shall be protected by tarpaulin or other suitable covering to prevent mortar being washed away by rain.
 5. Brickwork shall be kept constantly moist on all the faces for at least seven days. The arrangement for curing shall be got approved from the ENGINEER.
 6. Double scaffolding having two sets of vertical supports shall be provided to facilitate execution of the masonry works. The scaffolding shall be designed adequately considering all the dead, live and possible impact loads to ensure safety of the workmen, in accordance with the requirements stipulated in IS:2750 and IS:3696 (Part 1). Scaffolding shall be properly maintained during the entire period of construction. Single scaffolding shall not be used on important works and will be permitted only in certain cases as decided by the ENGINEER. Where single scaffolding is adopted, only minimum number of holes, by omitting a header shall be left in the masonry for supporting horizontal scaffolding poles. All holes in the masonry shall be carefully made good before plastering/painting.
 7. In the event of usage of traditional bricks of size 230 mmx115mmx75mm for load bearing walls, the courses at the top of the plinth and sills as well as at the top of the wall just below the roof/floor or slabs and at the top of the parapet shall be laid with bricks on edge.
 8. All brickwork shall be built tightly against columns, floor slabs or other structural members.
 9. To overcome the possibility of development of cracks in the brick masonry following measures shall be adopted.
 - a) For resting RCC slabs, the bearing surface of masonry wall shall be finished on top with 12 mm thick cement mortar 1:3 and provided with 2 layers of Kraft paper Grade 1 as per IS:1397 or 2 layers of 50 micron thick polyethylene sheets.
 - b) RCC/steel beams resting on masonry wall shall be provided with plain or reinforced concrete bed blocks of dimensions as indicated in the drawings duly finished on top with 2 layers of Kraft paper Grade 1 as per IS:1397 or 2 layers of 50-micron thick polyethylene sheets.
 - c) Steel wire fabric shall be provided at the junction of brick masonry and concrete as specified elsewhere before taking up plastering work. The above items shall be measured and paid for separately under the respective items of work.



10. Bricks for partition walls shall be stacked adjacent to the structural member to pre-deflect the structural member before the wall is taken up for execution. Further, the topmost course of half or full brick walls abutting against either a de-shuttered slab or beam shall be built only after any proposed masonry wall above the structural member is executed to cater for the deflection of the structural element.
11. Reinforced cement concrete transoms and mullions of dimensions as indicated in the construction drawings are generally required to be provided in half brick partition walls. Reinforced concrete for transoms and mullions shall be measured and paid for separately under the respective items of work.
12. Where drawings indicate that structural steel sections are to be encased in brickwork, the brick masonry shall be built closely against the steel section, ensuring a minimum of 20mm thick cement-sand 1:4 over all the steel surfaces. Steel sections partly embedded in brickwork shall be provided with bituminous protective coating to the surfaces at the point of entry into the brick masonry.
13. Facing bricks of the type specified conforming to IS:2691 shall be laid in the positions indicated on the drawings and all facing brickwork shall be well bonded to the backing bricks/RCC surfaces. The level of execution of the facing brickwork shall at any time be lower by at least 600 mm below the level of the backing brickwork.
14. Facing bricks shall be laid over 10 mm thick backing of cement mortar. The mortar mix, thickness of joint and the type of painting to be carried out shall be as specified in the item of work. The pattern of laying the bricks shall be as specifically indicated in the drawings.
15. For facing brickwork, double scaffolding shall be used.
16. Faced works shall be kept clean and free from damage, discoloration etc., at all times.
17. Cutting of chases in 230 thick wall and above for routing GI pipes, CI pipes or for any other services shall preferably be in the vertical direction. Horizontal chases shall be avoided, as far as possible. The depth of vertical chases and horizontal chases, if any, shall not exceed one third and one sixth of the thickness of masonry respectively. Vertical chases shall not be closer than 2m in any stretch. Not more than 2 horizontal chases shall be permitted in a stretch of wall and these should be located in upper or lower one-third of height of wall.
18. No lintel need be provided for circular openings upto 400mm diameter in 230mm thick wall and above. Similarly, no lintel need be provided for rectangular holes of 300mm wide and below.



2.6 CONCRETE BLOCK MASONRY

MATERIALS

1. Masonry units of hollow and solid concrete blocks shall conform to the requirements of IS: 2185 (Part 1).
2. Masonry units of hollow and solid light-weight concrete blocks shall conform to the requirements of IS: 2185 (Part 2).
3. Masonry units of autoclaved cellular concrete blocks shall conform to the requirements of IS: 2185 (Part 3).
The nominal dimensions of concrete block shall be as under.
Length 400,500 or 600 mm.
Height 100 or 200 mm.
4. Width 100 to 300 mm in 50 mm increments
5. Half blocks shall be in lengths of 200, 250 or 300 mm to correspond to the full-length blocks. Actual dimensions shall be 10 mm short of the nominal dimensions.
6. The maximum variation in the length of the units shall not be more than ± 5 mm and maximum variation in height or width of the units shall not be more than ± 3 mm.
7. Concrete blocks shall be either hollow blocks with open or closed cavities or solid blocks.
8. Concrete blocks shall be sound, free of cracks, chipping or other defects which impair the strength or performance of the construction. Surface texture shall be as specified. The faces of the units shall be flat and rectangular, opposite faces shall be parallel and all arises shall be square. The bedding surfaces shall be at right angles to the faces of the block.
9. The concrete mix for the hollow and solid concrete blocks/light weight concrete blocks shall not be richer than one part of cement to six parts of combined aggregates by volume i.e. (1:6).
10. Concrete blocks shall be of approved manufacture, which satisfy the limitations in the values of water absorption, drying shrinkage and moisture movement, as specified for the type of block as per relevant IS code. BIDDER shall furnish the test certificates and also supply the samples, for the approval of ENGINEER.

WORKMANSHIP

1. The type of the concrete block, thickness and grade based on the compressive strength for use in load bearing and/or non-load bearing walls shall be as specified in the respective items of work. The minimum nominal thickness of non-load bearing internal walls shall be 100 mm. The minimum nominal thickness of external panel walls in framed construction shall be 200 mm.
2. The workmanship shall generally conform to the requirements of IS: 2572 for concrete block masonry, IS:6042 for light weight concrete block



masonry and IS:6041 for autoclaved cellular concrete block masonry works.

3. From considerations of durability, generally concrete block masonry shall be used only in superstructure works above the damp-proof course level.
4. Concrete blocks shall be embedded with a mortar which is relatively weaker than the mix of the blocks in order to avoid the formation of cracks. Cement mortar of proportion 1:6 shall be used for the works unless otherwise specified in the respective items of work. Preparation of mortar shall be as specified in clause 2.5.7 to 2.5.8.
5. The thickness of both horizontal and vertical joints shall be 10 mm. The first course shall be laid with greater care, ensuring that it is properly aligned, levelled and plumb since this will facilitate in laying succeeding courses to obtain a straight and truly vertical wall. For the horizontal (bedding) joint, mortar shall be spread over the entire top surface of the block including front and rear as well as the edges to a uniform layer of 10 mm. For vertical joints, the mortar shall be applied on the vertical edges of the front and rear sides of the blocks. The mortar may be applied either to the unit already placed on the wall or on the edges of the succeeding unit when it is standing vertically and then placing it horizontally, well pressed against the previously laid unit to produce a compacted vertical joint. To assure satisfactory bond, mortar shall not be spread too far ahead of actual laying of the block as the mortar will stiffen and lose its plasticity. Mortar while hardening shrinks slightly and thus pulls away from the edges of the block. The mortar shall be pressed against the units with a jointing tool after it has stiffened to effect intimate contact between the mortar and the unit to obtain a weather tight joint. The mortar shall be raked to a depth of 10 mm as each course is laid to ensure good bond for the plaster.
6. Only well dried blocks should be used for the construction. Blocks with moisture content more than 25% of maximum water absorption permissible shall not be used. The blocks should not be wetted before or during laying in the walls. Blocks should be laid dry except slightly moistening their surface on which mortar is to be applied to obviate absorption of water from the mortar.
7. For jambs of doors, windows and openings, solid concrete blocks shall be provided. If hollow units are used, the hollows shall be filled with concrete of mix 1:3:6. Hold fasts of doors/windows should be arranged so that they occur at block course level.
8. At intersection of walls, the courses shall be laid up at the same time with a true masonry bond between at least 50% of the concrete blocks. The sequence for construction of partition walls and treatment at the top of



load bearing walls for the RCC slab shall be as detailed under clause 3 for the brick work.

9. Curing of the mortar joints shall be carried out for atleast 7 days. The walls should only be lightly moistened and shall not be allowed to become excessively wet.
10. Double scaffolding as per clause 3.3.9.6 shall be adopted for execution of block masonry work.
11. Cutting of the units shall be restricted to a minimum. All horizontal and vertical dimensions shall be in multiples of half-length and full height of units respectively, adapting modular co-ordination for walls, opening locations for doors, windows etc.
12. Concrete blocks shall be stored at site suitably to avoid any contact with moisture from the ground and covered to protect against wetting.

3 FLOORING SKIRTING & DADO WORKS

3.1 GENERAL

The works covered under this specification shall include:

1. Flooring, Dado and Skirting
2. Tread and risers for steps

3.2 APPLICABLE CODES AND STANDARDS

Work shall be carried out as per latest edition of Indian Standards and Code of Practices. List given here shall not be considered as conclusive and is for reference and guidance only. Any discrepancies/ conflict noticed shall be brought to the notice of Architect/Engineer in charge for direction / approval. However, as a general rule more stringent specification shall take precedence.

IS: 383 Coarse and fine aggregates from natural sources for concrete

IS:456 Plain And Reinforced Concrete - Code Of Practice

IS:702 Specification for industrial bitumen.

IS: 777 Specifications for glazed earthenware tiles

IS: 1121 Method for determination of compressive, transverse and shear strengths of natural building stones

IS: 1122 Methods for determination of specific gravity and porosity of natural building stones



- IS: 1124 Method of test for determination of water absorption of natural building stones
- IS: 1126 Method of test for durability of natural building stones
- IS: 1129 Dressing of natural building stones
- IS: 1130 Marble (blocks, slabs and tiles)
- IS: 1200 PART II and skirting
- IS: 1237 Cement Concrete Flooring Tiles
- IS: 1443 Code of practice for laying and finishing of cement concrete flooring tiles
- IS: 1580 Bituminous compound for waterproofing and caulking purposes
- IS:1834 - Specification for hot applied sealing compound for joint in concrete.
- IS:1838 - Specification for preformed fillers for expansion joint in concrete pavements and structures (non-extruding and resilient type) : Part 1 Bitumen impregnated fibre.
- IS: 2046 Synthetic Resin Bonded Sheets.
- IS: 2114 Code of practice for laying in situ terrazzo floor finish
- IS: 2116 Sand for masonry mortars
- IS: 2571 Code of practice for laying in situ cement concrete flooring
- IS: 3384 Bitumen primer for use in waterproofing and damp proofing
- IS: 3462 Specification for unbacked flexible PVC flooring.
- IS: 4443 Code of practice for use of resin type chemical resistant mortars
- IS: 4457 Specification for ceramic unglazed vitreous acid resisting tiles.
- IS: 4631 Code of practice for laying of epoxy resin floor topping
- IS: 4832 Specification for chemical resistant mortars (Part II)



- IS: 5318 Code of practice for laying of flexible PVC sheet & tile flooring.
- IS: 5491 Code of practice for laying in situ granolithic concrete floor topping
- IS: 9162 Methods of test for epoxy resin, hardeners and epoxy resin composites for floor topping.
- IS: 9197 Specification for epoxy resin, hardeners and epoxy resin composites for floor topping.
- Is: 12830 Rubber based adhesives for fixing PVC tiles to cement
- IS: 269 Specification of 33 grade ordinary Portland Cement.

3.3 RUBBLE SUB-BASE

MATERIALS

1. Stone used under grade slab for rubble soling on grade, foundations etc., shall be clean, hard, durable rock free from veins, flaws, weathering and other defects. Stones shall generally conform to the requirements stipulated in IS:1597 (Part-I).
2. Stones shall be as regular as can be obtained from quarries. Stones shall be of height equal to the thickness of the packing proposed with a tolerance of + 10mm. Stones shall not have a base area less than 250 sq.cm nor more than 500 sq.cm, and the smallest dimension of any stone shall not be less than half the largest dimension. The quality and size of stones shall be subject to the approval of the ENGINEER.

WORKMANSHIP

1. Stones shall be hand packed carefully and laid with their largest base downwards resting flat on the prepared sub-grade and with their height equal to the thickness of the packing. Stones shall be laid breaking joints and in close contact with each other-. All interstices between the stones shall be wedged-in by small stones of suitable size, well driven in by crow bars and hammers to ensure tight packing and complete filling-in of the interstices. The wedging shall be carried out simultaneously with the placing in position of rubble packing and shall not lag behind. After this,



any interstices between the smaller wedged stones shall be in-filled with clean hard sand by booming so as to fill the joints completely.

2. The laid rubble packing shall be sprinkled with water and compacted by using suitable rammers/rollers.

3.4 BASE CONCRETE

WORKMANSHIP

1. The thickness and grade of concrete shall be as specified in the item of work.
2. Before placing the blinding concrete, 50/75mm thick as per the item of work, the sub-base of rubble packing shall be properly wetted and rammed. Concrete for the base shall then be deposited between the forms, thoroughly tamped and the surface finished level with the top edges of the forms. Two or three hours after the concrete has been laid in position, the surface shall be roughened using steel wire brush to remove any scum or laitance and swept clean so that the coarse aggregates are exposed. The surface of the base concrete shall be left rough to provide adequate bond for the floor finish to be provided later.

3.5 TERRAZZO AND PLAIN CEMENT TILING WORKS

Terrazzo tiles and cement tiles shall generally conform in all respects to standards stipulated in IS:1237. Tiles shall be of the best quality manufactured adopting hydraulic pressure of not less than 14N/mm².

The type, quality, size, thickness colour etc, of the tiles for flooring/dado/skirting shall be as specified in the respective items of work.

The aggregates for terrazzo topping shall consist of marble chips which are hard, sound and dense. Cement to be used shall be either ordinary Portland cement or white cement with or without colouring pigment. The binder mix shall be with 3 parts of cement to 1 part of marble powder by weight. The proportion of cement shall be inclusive of any pigments. For every one part of cement-marble powder binder mix, the proportion of aggregates shall be 1.75 parts by volume, if the chips are between 1 mm to 6mm and 1.50 parts by volume if the chips are between 6mm to 25mm.

The minimum thickness of wearing layer of plain cement and plain coloured tiles for general purpose and terrazzo tiles with chips upto 6mm to 12mm general purpose is 5mm thick tiles. Terrazzo tiles with chips of size up to 20mm for heavy duty and general purpose and plain cement and plain coloured tiles for heavy duty shall be 6mm thick tiles. Pigment used in the



wearing layer shall not exceed 10 percent of the weight of cement used in the mix.

WORKMANSHIP

1. Laying and finishing of tiles shall conform to the requirements of workmanship stipulated in IS:1443.
2. Tiling work shall be commenced only after the door and window frames are fixed and plastering of the walls/ ceiling is completed. Wall plastering shall not be carried out up to about 50mm above the level of proposed skirting/dado.
3. The base concrete shall be finished to a reasonably plane surface about 40 to 45mm below the level of finished floor. Before the tiling work is taken up, the base concrete or structural slab shall be cleaned of all loose materials, mortar droppings, dirt, laitance etc. using steel wire brush and well wetted without allowing any water pools on the surface.
4. A layer of 25mm average thickness of cement mortar consisting of one part of cement to four parts of sand shall be provided as bedding for the tiles over the base concrete. The thickness of bedding mortar shall not be less than 10mm at any place. The quantity of water to be added for the mortar shall be just adequate to obtain the workability for laying. Sand for the mortar shall conform to IS:2116 and shall have minimum fineness modulus of 1.5. The surface shall be left rough to provide a good bond for the tiles. The bedding shall be allowed to harden for a day before laying of the tiles.
5. Neat cement slurry using 4.4 kg of cement per one sq.m of floor area shall be spread over the hardened mortar bedding over such an area at a time as would accommodate about 20 tiles. Tiles shall be fixed in this slurry one after the other, each tile being gently tapped with a wooden mallet till it is properly bedded and in level with the adjoining tiles. The joints shall be in straight lines and shall normally be 1.5mm wide. On completion of laying of the tiles in a room, all the Joints shall be cleaned and washed fairly deep with a stiff broom/wire brush to a minimum depth of 5mm. The day after the tiles have been laid, the joints shall be filled with cement grout of the same shade on the colour of the matrix of the tile. For this purpose, white cement or grey cement with or without pigments shall be used. The flooring should be kept moist and left undisturbed for 7 days for the bedding/joints to set properly. Heavy traffic shall not be allowed on the floor for at least 14 days after fixing of the tiles.
6. About a week after laying the tiles, each and every tile shall be lightly tapped with a small wooden mallet to find out if it gives a hollow sound; if it does, such tiles along with any other cracked or broken tiles shall be removed and replaced with new tiles to proper line and level. The same procedure shall be followed again after grinding the tiles and all damaged tiles replaced, properly jointed and finished to match. For the purpose of ensuring that such replaced tiles match with those laid earlier, it is



- necessary that the BIDDER shall procure sufficient quantity of extra tiles to meet this contingency.
7. Wherever a full tile cannot be provided, tiles shall be cut to size and fixed. Floor tiles adjoining the wall shall go about 10mm under the plaster, skirting or dado.
 8. Tile skirting and dado work shall be executed only after laying tiles on the floor. For dado and skirting work, the vertical wall surface shall be thoroughly cleaned and wetted. Thereafter it shall be evenly and uniformly covered with 12mm thick backing of 1:4 cement sand mortar. For this work the tiles as obtained from the factory shall be of the size required and practically full polished. The back of each tile to be fixed shall be covered with a thin layer of neat cement paste and the tile shall then be gently tapped against the wall with a wooden mallet. Fixing shall be done from the bottom of the wall upwards. The joints shall be in straight lines and shall normally be 1.5mm wide. Any difference in the thickness of the tiles shall be evened out in the backing mortar or cement paste so that the tile faces are in conformity & truly plumb. Tiles for use at the corners shall be suitably cut with bevelled edges to obtain a neat and true joint. After the work has set, hand polishing with carborundum stones shall be done so that the surface matches with the floor finish.
 9. Wall plastering of the strip left out above the level of skirting/dado shall be taken up after the tiles are fixed.
 10. Chequered terrazzo tiles for flooring and for stair treads shall be delivered to site after the first machine grinding.
 11. Machine grinding and polishing shall be commenced only after a gap of 14 days of laying. The sequence and three numbers of machine grinding operations, usage of the type of carborundum stones, filling up of pin holes, watering etc. shall be carried out all as specified in IS:1443.
 12. Tiles shall be laid to the levels specified. To ensure this, finished floor levels should be marked at all door locations and also on the floor at frequent intervals. Where large areas are to be tiled the level of the central portion shall be kept 10mm higher than that at the walls to overcome optical illusion of a depression in the central portion. Localized deviation of $\pm 3\text{mm}$ in any 3m length is acceptable in a nominally flat floor.
 13. All corners shall be in perfect right angle matching up with the corners of walls. If due to any misalignment during construction, the corners of wall



are not at right angle, adjustment shall be made in the title portion lying below skirting.

14. Flooring in toilets, kitchen shall be taken up only after fixing water closet, squatting pans & floor traps.

3.6 IN-SITU TERRAZZO WORK

The aggregates for terrazzo topping shall consist of marble chips which are hard, sound and dense.

Cement to be used shall be either ordinary Portland cement or white cement with or without colouring pigment.

The binder mix shall be with 3 parts of cement to 1 part of marble powder by weight. The proportion of cement shall be inclusive of any pigments. For every one part of cement-marble powder binder mix, the proportion of aggregates shall be 1.75 parts by volume, if the chips are between 1 mm to 6mm and 1.50 parts by volume if the chips are between 6mm to 25mm.

WORKMANSHIP

1. Cement shall first be mixed with the marble powder in dry state. The mix thus obtained shall be mixed with the aggregates in the specified proportions.
2. Care shall be taken not to get the materials into a heap which results in the coarsest chips falling to the edges and cement working to the centre at the bottom.
3. Materials shall be kept, as far as possible, in an even layer during mixing. After the materials have been thoroughly mixed in the dry state, water shall be added, just adequate to obtain plastic consistency for the desired workability for laying.
4. The mix shall be used in the works within 30 minutes of the addition of water to the cement.
5. The thickness, type, quality, size and colour of chips etc. for the in-situ terrazzo finish for flooring/dado skirting shall be as specified in the respective items of work. Laying and finishing of in-situ work shall conform to the requirements of workmanship stipulated in IS: 2114.
6. In-situ terrazzo finish shall be laid over hardened concrete base. The finish layer consists of an under layer and terrazzo topping. The under layer shall be of cement concrete of mix 1:2:4 using 10mm downgraded coarse aggregates. The combined thickness of under layer and topping shall not be less than 30 mm for flooring and 20mm for dado/skirting work.
7. The minimum thickness of topping shall be 6mm if chips used are between 1mm to 4mm, 9mm if chips are between 4mm to 7mm and 12mm if chips are between 7mm to 10mm. If chips larger than 10mm size



- are used, the minimum thickness shall be one and one third the maximum size of chips.
8. Both the under layer and later the topping shall be divided into panels not exceeding 2 Sq.m. for laying so as to reduce the possibility of development of cracks. The longer dimension of any panel shall not exceed 2m. Dividing strips shall be used to separate the panels. When the dividing strips are not provided, the bays shall be laid alternately, allowing an interval of at least 24 hours between laying adjacent bays.
 9. Dividing strips shall be either of aluminum, brass, glass or other material as indicated in the item of work. Aluminum strips should have a protective coating of bitumen. The thickness of the strips shall be not less than 1.5mm and width not less than 25mm for flooring work.
 10. Concrete base shall be finished to a reasonably plane surface to a level below the finished floor elevation equal to the specified thickness of terrazzo finish. Before spreading the under-layer, the base concrete surface shall be cleaned of all loose materials, mortar droppings, dirt, laitance etc. and well wetted without allowing any water pools on the surface. Dividing strips or screed strips, if dividing strips are not provided, shall be fixed on the base and leveled to the correct height to suit the thickness of the finish. Just before spreading the under-layer the surface shall be smeared with cement slurry at 2.75 Kg/sq.m. Over this slurry, the under-layer shall be spread and leveled with a screed board. The top surface shall be left rough to provide a good bond for the terrazzo topping.
 11. Terrazzo topping shall be laid while the under-layer is still plastic and normally between 18 to 24 hours after the under-layer is laid. Cement slurry of the same colour as the topping shall be brushed on the surface immediately before laying is commenced. The terrazzo mix shall be laid to a uniform thickness and compacted thoroughly by tamping and with a minimum of trowelling. Straight edge and steel floats shall be used to bring the surface true to the required level in such a manner that the maximum amount of marble chips come up and spread uniformly all over the surface.
 12. The surface shall be left dry for air-curing for a period of 12 to 18 hours. Thereafter it shall be cured by allowing water to stand in pools for a period of not less than 4 days.
 13. Machine grinding and polishing shall be commenced only after a gap of 7 days from the time of completion of laying. The sequence and four numbers of machine grinding operations, usage of the type of carborundum stones, filling up of pinholes, wet curing, watering etc shall be carried out all as specified in IS: 2114. Where machine polishing is



- not possible, polishing shall be carried out by hand in the same sequence and procedure as for machine polishing.
14. Where the dampness from ground may find its way to the top of floor, concrete floor on the ground or basement shall be provided with an effective damp proof.
15. Flooring in toilet and kitchen shall be taken up after fixing water closet, squatting pans and floor trap.

3.7 IN-SITU CEMENT CONCRETE FLOOR TOPPING

The mix proportion for the in-situ concrete floor topping shall be 1:2.5:3.5 (one part cement: two and half parts sand: three and half parts coarse aggregates) by volume unless otherwise specified in the item of work.

The aggregates shall conform for the requirements of IS:383.

Coarse aggregates shall have high hardness surface texture and shall consist of crushed rock of granite, basalt, trap or quartzite. The aggregate crushing value shall not exceed 30 percent. The grading of the coarse aggregates shall be of size 12.5mm and below and shall be as per IS:2571.

Grading of the sand shall be within the limits indicated in IS:2571.

WORKMANSHIP

1. The thickness of the floor topping shall be as specified in the item of work. The minimum thickness of the floor topping shall be 25mm, if it is laid separately. 15mm thick wearing course of cement concrete 1:2 (1 cement:2 stone) aggregate of size 4.75mm & below) by volume shall be applied monolithically over floor topping, if called for in the schedule of item. Wearing course shall be 20mm thick, if it is cast monolithically over ground floor slab. Laying and finishing of in-situ topping shall conform to the requirements of IS 2571.
2. The surface shall be rough to provide adequate bond for the topping. It shall be finished to a level below the finished floor equal to the thickness of topping and / or wearing courses, if specified.
3. Mixing of concrete shall be done thoroughly in a mechanical mixer unless hand mixing is specifically permitted by the ENGINEER. The concrete shall be as stiff as possible, and the amount of water added shall be the minimum necessary to give just sufficient plasticity for laying and compacting. The mix shall be used in the work within 30 minutes of the addition of water for its preparation.
4. Floor finish shall be laid in suitable panels to reduce the risk of cracking. No dimension of a panel shall exceed 2 meters and the length of a panel shall not exceed one and a half times its breadth. Topping shall be laid



- in alternate panels, the intermediate panels being cast after a gap of at least one day. Construction joints shall be plain vertical butt joints.
5. Screed strips shall be fixed dividing the area into suitable panels. Immediately before depositing the concrete topping, neat cement slurry at 2.75 kg/sq.m of area shall be thoroughly brushed into the prepared surface. Topping shall then be laid, very thoroughly tamped, struck off level and floated with wooden float. The surface shall then be tested with a straight edge and mason's spirit level to detect any inequalities from that specified in the drawings and these shall be made good immediately.
 6. Finishing of the surface by trowelling shall be spread over a period of one to six hours depending upon the temperature and atmospheric conditions. The surface shall be trowelled 3 times at intervals so as to produce a smooth uniform and hard surface. Immediately after laying, the first trowelling just sufficient to give a level surface shall be carried out avoiding excessive trowelling at this stage. The surface shall be re-trowelled after sometime to close any pores and to scrap off excess water or laitance, which shall not be trowelled back into the topping. Final trowelling shall be done well before the concrete has become too hard but at a time when considerable pressure is required to make any impression on the surface. Sprinkling of dry cement or cement-sand mixture for absorbing moisture shall not be permitted.
 7. Immediately after the surface is finished, it shall be protected suitably from rapid drying due to wind/ sunlight. After the surface has hardened sufficiently to prevent any damage to it, the topping shall be kept continuously moist for a minimum period of 10 days.
 8. It is preferable to lay the topping on hardened base concrete, as against being laid monolithically with a lesser thickness, since proper levels and slopes with close surface tolerance, is achievable in practice, owing to its greater thickness. Further, as this would be laid after all other building operations are over, there will be no risk of any damages or discoloration to the floor finishes which are difficult to repair satisfactorily.
 9. In severe condition, where dampness from ground may find its way on the top of the floor, the floor slab shall be cast in two equal halves. The top surface of bottom half shall be made plane and smooth after it is cast. A coat of bitumen primer conforming to IS 3384 shall be applied on the hard surface over which two coats of bitumen conforming to IS 1580 shall be applied @ 1.5 kg/m² for each layer. After the bitumen surface is dry, the top half of floor slab shall be cast.

3.8 IN-SITU GRANOLITHIC CONCRETE FLOOR TOPPING

The requirements of materials and workmanship shall be same as in situ terrazzo work floor topping except that the mix proportion of the concrete shall be 1:1:2 (cement:sand:coarse-aggregates) by volume.

The thickness of the floor topping shall be as specified in the item of work. The minimum thickness of granolithic floor topping on hardened concrete



base shall be 40mm, if laid separately. It shall be 20mm, if the topping is laid monolithically over the floor concrete.

Floor finish shall be laid in suitable panels to reduce the risk of cracking. No dimension of a panel shall exceed 2 meters and the length of a panel shall not exceed one and a half times its breadth. Topping shall be laid in alternate panels; the intermediate panels being cast after a gap of at least one day. Construction joints shall be plain vertical butt joints.

3.9 FLOOR HARDENER TOPPING

Floor hardener topping shall be provided either as integrally finished over the structural slab/grade slab or laid monolithically with the concrete/granolithic floor finish on top of hardened concrete base.

Floor hardener of the metallic or non-metallic type suitable for the performance of normal/medium/heavy duty function of the floor, the quantum of ingredients and the thickness of topping shall be as specified in the respective items of work.

For monolithic application with the floor finish/slab, the thickness of the layer shall be 15mm. It shall be 20mm if it is laid separately over floor slab. The topping shall be laid within 2 to 3 hours after concrete is laid and it is still plastic but stiffened enough for the workmen to tread over it by placing planks. The surface of the concrete layer shall be kept rough for providing adequate bond for the topping. Laitance shall be removed before placing the topping. The topping shall be screeded and thoroughly compacted to the finished level. After the surface has hardened sufficiently, it shall be kept continuously moist for at least 10 days.

The procedure for mixing the floor hardener topping shall be as per manufacturer's instructions.

Floor hardener topping shall be prevented from any damages due to subsequent building operations by covering with 75 mm thick layer of sand, if it is laid monolithically with the slab.

3.10 EPOXY LINING WORK

The epoxy resin and hardener formulation for laying of Pointless lining work in floors and walls of concrete tanks/trenches, floor toppings etc shall be as per the requirements of IS:9197. Method of laying shall be as per the requirements of IS 4631.

The epoxy composition shall have the chemical resistance to withstand the conditions of exposure like Hydrochloric acid up to 30% concentration,



Sodium hydroxide up to 50% concentration, Liquid temperature up to 60°C, Ultraviolet radiation, Alternate wetting and drying.

Epoxy resin shall be of liquid type of suitable grade and class as recommended by the manufacturer.

The hardener shall be of the liquid type such as Aliphatic Amine or an Aliphatic/Aromatic Amine Adduct or a polyamide or amido polyamine of suitable characteristics. The hardener shall react with epoxy resin at normal ambient temperature above 5°C.

Sand shall conform to grading zone III or IV of IS 383.

Accelerator, plasticizer, and coal tar may be added for the preparation of epoxy composition, to the proportion as recommended in IS 9197.

BIDDER shall furnish test certificates for satisfying the requirements of the epoxy formulation if so, directed by the ENGINEER.

WORKMANSHIP

1. The minimum thickness of epoxy lining shall be as recommended in IS 4631 based on type of application & usage. The thickness and areas of application shall be as specified in the respective items of work. It is essential that the base concrete is properly cured, dried and made rough at the time of application.
2. The epoxy lining shall be of the trowel type to facilitate execution of the required thickness for satisfactory performance.
3. The concrete surfaces over which epoxy lining is to be provided shall be thoroughly cleaned of oil or grease by suitable solvents, wire brushed to remove any dirt/dust and laitance. The surfaces shall then be washed with dilute hydrochloric acid (10% to 15%) and rinsed thoroughly with plenty of water or dilute ammonia solution. The surfaces shall then be



- allowed to dry. It is essential to ensure that the surfaces are perfectly dry and even before the commencement of epoxy application.
4. Just adequate quantity of epoxy resin which can be applied within the pot life as specified by the manufacturer shall be prepared at one time for laying and jointing.
 5. Rigid PVC/stainless steel/chromium plated tools shall be used for laying. Trowelling shall be carried out to obtain uniformly the specified thickness of lining.
 6. Lining shall be allowed to set without disturbance for a minimum period of 24 hours. The facility shall be put to use only after a minimum period of 7 days of laying of the lining.
 7. For epoxy lining over the inside concrete surfaces of underground tank or trenches, it should be ensured that they are leak proof against water by conducting leakage test.

3.11 SHAHABAD / TANDUR / KOTA STONE / GRANITE / MARBLE SLAB WORK

The slabs shall be of approved selected quality, hard, sound, dense and homogenous in texture, free from cracks, decay, weathering, and flaws. The percentage of water absorption shall not exceed 5 percent as per test conducted in accordance with IS:1124.

The slabs shall be hand or machine cut to the required thickness. Tolerance in thickness for dimensions of tile more than 100 mm shall be $\pm 5\text{mm}$. This shall be + 2mm on dimensions less than 100mm.

Slabs shall be supplied to the specified size with machine cut edges or fine chisel dressed to the full depth. All angles and edges of the slabs shall be true and square, free from any chipping giving a plane surface. Slabs shall have the top surface machine polished (first grinding) before being brought to site. The slabs shall be washed clean before laying.

WORKMANSHIP

1. The type, size, thickness, and colour/shade etc. of the slabs for flooring/dado/ skirting shall be as specified in the respective items of the work.
2. Concrete base shall be prepared and finished below the finished floor level equal to the thickness of stone slab and cement mortar below.
3. The thickness of the slabs for dado/skirting work shall not be more than 25mm. Slabs shall be so placed that the back surface is at a distance of 12mm from the wall. If necessary, slabs shall be held in position temporarily by suitable method. After checking for verticality, the gap shall be filled and packed with cement sand mortar of proportion 1:3. After the mortar has acquired sufficient strength, the temporary arrangement holding the slab shall be removed. The recommended mortar mix for joints and beddings for stone blocks shall be two parts of



white cement and seven parts of stone dust. The thickness of joints shall be 5 mm. For fixing of stones to the walls, fixing clamps of non-ferrous metal should be used.

4. Grinding and polishing shall be as per clause 3.6.4.13 except that first grinding with coarse grade carborundum shall not be done and cement slurry with or without pigment shall not be applied before polishing.

3.12 CARBORUNDUM TILE FINISH

Carborundum tiles shall generally conform in all respects to the standards stipulated in IS: 1237 for heavy duty tiles. Tiles shall be of the best quality manufactured adopting hydraulic pressure of not less than 14 N/mm².

Each tile shall bear on its back, permanent and legible trademark of the manufacturer. All angles of the tiles shall be right angle, all edges sharp and true, colour and texture of the wearing face uniform throughout. Maximum tolerance/allowance for length and breadth shall be +1 mm and thickness +3mm along the wearing surface of the tile and the wearing surface shall be planed free from pinholes and other blemishes.

The backing shall be composed of 1-part ordinary grey cement, 2 parts sand and 4 parts of stone chips by volume and mixed with water.

The topping shall be uniform and of thickness not less than 6mm. The quantity of carborundum grit shall be not less than 1.35 kg/sq.m used with cement with or without pigment. The carborundum grit shall pass through 1.18mm mesh and shall be retained on 0.60mm mesh. The total thickness of tiles including the topping shall be not less than 20 mm.

The tile shall be cured at the shop for at least 14 days before delivery to site. Tiles shall be packed properly to prevent damage during transit and storage. The tiles must be stored carefully to prevent staining by damp, rust, oil and grease or other chemicals. Tiles made in each batch shall be kept and used separately so that the colour of each area of floor may remain uniform.

The manufacturer shall supply along with the tiles the grout mix containing cement and pigment in exact proportions as used in topping of tiles. The containers of the grout mix shall be suitably marked to relate it to the particular type and batch of tiles

The size, thickness, colour and plain or chequered etc. of the tiles for flooring/skirting shall be as specified in the respective items of work. The under bed for floors shall be 1 part cement: 2 parts coarse sand: 4 parts stone aggregate by volume mix with sufficient water to form a stiff workable

Gujarat Industries Power Company Limited (GIPCL)

NIT No.: GIPCL/SLPP/R&M/LHS/FB-RELOCATION/EPC/2026

V2-S2&S3&S4-5 General Building Works — Attachment-5

Package A, B & C



mass. For skirting and dado, it shall be 1 part cement: 3 parts coarse sand by volume.

The total average thickness shall be minimum 50 mm for floors and 30 mm for walls.



WORKMANSHIP

Requirements as detailed for terrazzo/cement tile finish shall be applicable to carborundum tile flooring.

3.13 VITRIFIED TILES / CERAMIC TILES / GLAZED TILE FINISH

Tiles shall be of the best quality from an approved manufacturer. The tiles shall be flat, true to shape and free from flaws such as crazing, blisters, pinholes, specks or welts. Edges and underside of the tiles shall be free from glaze and shall have ribs or indentations for a better anchorage with the bedding mortar. Dimensional tolerances shall be as specified in IS: 13756.

WORKMANSHIP

1. The size, thickness, colour, with or without designs etc of the tiles for flooring/dado/skirting shall be as specified in the respective items of work.
2. The total thickness of glazed tile finish including the bedding mortar shall be maximum 20 mm in flooring/dado/skirting. The minimum thickness of bedding mortar shall be 12mm for flooring and 10mm for dado/skirting work.
3. The bedding mortar shall consist of 1 part of cement to 3 parts of sand mixed with just sufficient water to obtain proper consistency for laying. Sand for the mortar shall conform to IS: 2116 and shall have minimum fineness modules of 1.5
4. Tiles shall be soaked in water for about 10 minutes just before laying. Where full size tiles cannot be fixed, tiles shall be cut to the required size using special cutting device and the edges rubbed smooth to ensure straight and true joints.
5. Coloured tiles with or without designs shall be uniform and shall be preferably procured from the same batch of manufacture to avoid any differences in the shade.
6. Tiles for the flooring shall be laid over hardened concrete base. The surface of the concrete base shall be cleaned of all loose materials, mortar droppings etc well wetted without allowing any water pools on the surface. The bedding mortar shall then be laid evenly over the surface, tamped to the desired level and allowed to harden for a day. The top surface shall be left rough to provide a good band for the tiles. For skirting and dado work, the brick walls shall be raked to a depth of 15mm. In case of concrete walls, the surfaces shall be hacked. The raked / hacked masonry surfaces shall be cleared, wet and then the bedding mortar to specified thickness shall be applied. The mortar surfaces shall be roughened using wire brush and allowed to harden.
7. Neat cement slurry using 3.3 kg cement per one sq.m of floor area shall be spread over the hardened mortar bed over such an area as would accommodate about 20 tiles. Tiles shall be fixed in this slurry one after the other, each tile being gently tapped with a wooden mallet till it is



- properly bedded and in level with the adjoining tiles. For skirting and dado work, the back of the tiles shall be smeared with cement slurry for setting on the backing mortar.
8. Fixing of tiles shall be done from the bottom of the wall upwards. The joints shall be in perfect straight lines and as thin as possible but shall not be more than 1 mm wide. Tiles used for corners shall be suitably beveled to obtain a true and neat joint. The surface shall be checked frequently to ensure correct level/required slope. Floor tiles near the walls shall enter skirting/dado to a minimum depth of 10mm. Tiles shall not sound hollow when tapped.
 9. All the joints shall be finished with flush pointing in color epoxy grout of approved make and shade. Curing shall then be carried out for a minimum period of 7 days for the bedding and joints to set properly. The surface shall then be cleaned using a suitable detergent, fully washed and wiped dry.
 10. Specials consisting of coves, internal and external angles, cornices, beads and their corner pieces shall be of thickness not less than the tiles with which they are used.

3.14 PVC / VINYL SHEET/TILE FLOORING

PVC/VINYL floor covering shall be of either unbacked homogeneous flexible type in the form of sheets/tiles conforming to IS:3462 or homogeneous PVC asbestos tiles conforming to IS:3461.

The surface of the sheets/tiles shall be free from any physical defects such as pores, blisters, cracks etc. which affects the appearance and serviceability. Tiles/sheets shall meet with the tolerance limits in dimensions specified in the IS codes. BIDDER shall submit the test certificates, if so desired by the ENGINEER.

Each tile/sheet shall be legibly and indelibly marked with the name of the manufacturer or his trademark, IS certificate mark and batch number.

The adhesive to be used for laying the PVC/VINYL flooring shall be rubber based conforming to IS 12830 and of the make as recommended and approved by the manufacturer of PVC/VINYL sheets/tiles.

The type, size, thickness, colour, plain or mottled and the pattern shall be as specified in the respective items of work.

WORKMANSHIP

1. Laying of PVC / VINYL sheets / tiles shall conform IS 5318. PVC / VINYL floor covering shall be provided over an under bed of cement concrete floor finish over the base concrete or structural slab. It is essential that the sub-floor and the under bed are perfectly dry before laying the PVC / VINYL flooring. This shall be ensured by methods of testing as stipulated



- in Appendix-A of IS:5318. Concrete floor on the ground / basement shall be treated with an effective damp proof course.
2. The surface of the under bed shall have trowelled finish without any irregularities which creates poor adhesion. Surface shall be free of oil or grease and thoroughly cleaned of all dust, dirt and wiped with a dry cloth.
 3. PVC / VINYL sheets/tiles shall be brought to the temperature of the area in which they are to be laid by stacking in a suitable manner within or near the laying area for a period of about 24 hours. Where air-conditioning is installed, the flooring shall not be laid on the under bed until the A/C units have been in operation for at least 7 days. During this period, the temperature range shall be between 200C and 300C and this shall be maintained during the laying operations and also for 48 hours thereafter.
 4. Layout of the PVC / VINYL flooring shall be marked with guidelines on the under bed and PVC / VINYL tiles/sheets shall be first laid for trial, without using the adhesive, according to the layout.
 5. The adhesive shall be applied by using a notched trowel to the surface of the under bed and to the backside of PVC / VINYL sheets/tiles. When the adhesive has set sufficiently for laying, it will be tacky to the touch, which generally takes about 30 minutes. The time period need be carefully monitored since a longer interval will affect the adhesive properties. Adhesive shall be uniformly spread over only as much surface area at one time which can be covered with PVC / VINYL flooring within the stipulated time.
 6. PVC / VINYL sheet shall be carefully taken and placed in position from one end onwards slowly so that the air will be completely squeezed out between the sheet and the background surface, and no air pockets are formed. It shall then be pressed with a suitable roller to develop proper contact. The next sheet shall be laid edge to edge with the sheet already laid, so that there is minimum gap between joints. The alignment shall be checked after each row of sheet is completed and trimmed if considered necessary.
 7. Tiles shall be laid in the same manner as sheets and preferably, commencing from the centre of the area. Tiles should be lowered in position and pressed firmly on to the adhesive with minimum gap between the joints. Tiles shall not be slid on the surface. Tiles shall be rolled with a light wooden roller of about 5kg to ensure full contact with the underlay. Work should be constantly checked to ensure that all four edges of adjacent tiles meet accurately.
 8. Any excess adhesive which may squeeze up between sheets/tiles shall be wiped off immediately with a wet cloth. Suitable solvents shall be used to remove hardened adhesive.
 9. A minimum period of 24 hours shall be given after laying for the development of proper bond of the adhesive. When the flooring in thus



- completed, it shall be cleaned with a wet cloth soaked in warm soap solution.
10. Metallic edge strips shall be used to protect the edges of PVC / VINYL sheets/tiles which are exposed as in doorways/ stair treads.
 11. Hot sealing of joints between adjacent PVC / VINYL sheet flooring to prevent creeping of water through the Joints shall be carried out, if specified in the item of work, using special equipment as per manufacturer's instructions.
 12. It is desirable that the PVC / VINYL flooring are taken up after completing all other works in the area so as to avoid any accidental damage to the flooring.

3.15 ACID RESISTANT TILES

The ceramic unglazed vitreous acid resisting tiles shall conform to the requirements of IS: 4457.

The finished tile when fractured shall appear fine grained in texture, dense and homogeneous. Tile shall be sound, true to shape, flat, free from flaws and any manufacturing defects affecting their utility. Tolerance in the dimensions shall be within the limits specified in the respective IS code.

The tiles shall be bedded and jointed using chemical resistant mortar prepared from resin type conforming to IS: 4832 (Part II) filter, accelerator and catalyst mixed in proportion as recommended by manufacturers. Method of usage shall generally be as per the requirements of IS: 4443.

WORKMANSHIP

1. The size and thickness of tiles for use in the flooring/skirting/dado shall be as specified in the respective items of work.
2. The base concrete surface shall be free from dirt and thoroughly dried. The surface shall be applied with a coat of bitumen primer conforming to IS: 3384. The primed surface shall then be applied with a uniform coat of bitumen conforming to IS: 1580. Tiles shall be laid directly without the application of bitumen, if epoxy or polyester resin is used for the mortar.
3. Just adequate quantity of mortar which can be applied within the pot life as specified by the manufacturer shall be prepared at one time for bedding and jointing. Rigid PVC/Stainless steel/chromium plated tools shall be used for mixing and laying.
4. For laying the floor 6 to 8 mm thick mortar shall be spread on the back of the tile. Two adjacent sides of the tile shall be smeared with 4 to 6 mm thick mortar. Tile shall be pressed into the bed and pushed against the floor and with the adjacent tile, until the joint in each case is 2 to 3 mm thick. Excess mortar shall then be trimmed off and allowed to harden fully. Similar procedure shall be adopted for the work on walls by pressing



- the tile/brick against the prepared wall surfaces and only one course shall be laid at a time until the initial setting period.
5. The mortar joints shall be cured for a minimum period of 72 hours with 20 to 25% hydrochloric acid or 30 to 40% sulphuric acid. After acid curing, the joints shall be washed with water and allowed to thoroughly dry. The joints shall then be filled with mortar to make them smooth and plane. Acid curing is not required to be carried out if epoxy or polyester resin is used for the mortar.
 6. Resin mortars are normally self-curing. The area tiled shall not be put to use before 48 hours in case epoxy, polyester and furane type of resin is used for the mortar. If phenol or cashew nutshell liquid resin is used for the mortar, the area tiled shall not be put to use for 7 to 28 days respectively, without heat treatment. This period shall be 2 to 6 days respectively if heat treatment is given with infrared lamp.
 7. Temperature during preparation of mortar, its application, curing etc. shall be controlled and maintained as recommended by manufacturer.
 8. It is necessary that the concrete slab / wall shall be made leak proof against water, if necessary, by pressure grouting etc. before taking up any tiling works. Cost of such works shall be deemed to have included in the cost of tiling works, whether same is specifically mentioned or not.

3.16 STAMPED CONCRETE PAVING WORKS

Concrete Mix Design - The concrete shall have a minimum compressive strength of 3,000 psi in non-freeze areas, 3,500 psi in moderate freeze-thaw areas and 4,000 psi in severe freeze-thaw areas. Portland cement & Aggregates shall conform to IS. Mixing water shall be fresh, clean and potable. No admixtures containing calcium chloride shall be permitted.

Dry-Shake Coloured Hardener - Cementitious material containing special hard aggregates, formulated as a high opacity colour hardening material for the top surface of freshly place concrete substrates. Highly UV-resistant. Factory proportioned, mixed and packaged, ready-to-use. Comply with IS 9197.

Low VOC Liquid Release Agent - Colourless, odourless liquid formulated to break the bond between imprinting tools and surface of colour-hardened concrete. Evaporates completely, leaving no residue. VOC content less than 450 g/L (3.75lb/gal).

Curing and sealing compound

WORKMANSHIP / FABRICATION AND ERECTION

1. Sub grade Preparation
2. The area to receive imprinted concrete shall have the sub-grade prepared as required as for any concrete slab on grade. Sub grade to



receive stamped concrete paving work must be well drained and have adequate, uniform load bearing characteristics.

3. Concrete Placement
4. Place and spread concrete to completely fill all space inside forms. Move concrete into place with square-tipped shovels or concrete rakes. Consolidate concrete by tamping or vibrating to provide a suitable surface for finishing. Prior to appearance of excess moisture or bleed water, screed concrete with wood or magnesium straight edge or mechanical vibrating screed. Continue concrete surface leveling and consolidation with highway magnesium straight edge and (or) magnesium bull float. Mechanically float concrete surfaces to required flatness and levelness as soon as concrete surface has taken its initial set and will support weight of a power float machine equipped with float shoes or combination blades and operator. Completed concrete placement to result in an open surface suitable to receive colored hardener.
5. Stamped Concrete Paving Installation
6. Sealing
7. Prior to sealing, the following conditions must be present:
8. Release agent has been removed.
9. Moisture content of concrete is low enough that alkali and other salts do not become trapped beneath sealer. This will require a minimum of 28 days subsequent to concrete placement, or longer if required.
10. No evidence of free water on concrete surfaces to receive curing and sealing compound.
11. Seal imprinted concrete with liquid membrane curing and sealing compounds as recommended by manufacturer. Apply two coats of specified curing and sealing compound according to manufacturer's written instructions.
12. Protection of Finished Work
13. Prohibit foot or vehicular traffic on the newly imprinted concrete surface. Protect floor surface from damage throughout remainder of construction period until Final Acceptance of the work. If a covering material is necessary, surfaces must remain uncovered for a minimum of four days after which they may be covered with a new, smooth, non-staining



reinforced Kraft curing paper. Plastic sheeting is unacceptable as a covering material.

STORAGE, HANDLING & DELIVERY

1. Deliver products in original factory unopened, undamaged packaging bearing identification of product, manufacturer, batch number, and expiration date as applicable.
2. Store products in a location protected from damage, construction activity, and adverse environmental conditions according to manufacturer's current recommendations.
3. Imprinting tools must be stored flat, textured face up, with no objects resting on top. Handle products according to manufacturer's printed instructions.
4. Care must be taken to ensure that the products are not damaged while loading / unloading and transporting. Cartons must always be stored with designated side upwards.

3.17 PREFORMED JOINT FILLERS AND JOINT SEALING COMPOUND

Preformed joint filler for expansion/isolation joints shall be non-extruding and resilient type of bitumen impregnated fibres conforming to IS:1838 (Part I).

Bitumen coat to concrete/masonry surfaces for fixing the preformed bitumen filler strip shall conform to IS:702. Bitumen primer shall conform to IS:3384.

Sealing compound for filling the joints above the preformed bitumen filler shall conform to Grade 'B' as per IS:1834.

WORKMANSHIP

1. The thickness of the preformed bitumen filler shall be as specified in the respective items of work. BIDDER shall procure the strips of the desired thickness and width in lengths as manufactured. Assembly of small pieces/thicknesses of strips to make up the specified size shall not be permitted.
2. The concrete/masonry surface shall be cleaned free from dust and any loose particles. When the surface is dry, one coat of bitumen primer conforming to IS 3384 to be applied over which one coat of industrial blown type bitumen of grade 85/25 conforming to IS:702 shall be applied hot by brushing at the rate of 1.20 kg/sq.m. When the bitumen is still hot, the preformed bitumen filler shall be pressed and held in position till it completely adheres. The surface of the filler against which further concreting/masonry work is to be done shall similarly be applied with one coat of hot bitumen at the rate of 1.20 kg/sq.m.
3. Sealing compound shall be heated to a pouring consistency for enabling it to run molten in a uniform manner into the joint. Before pouring the sealing compound, the vertical faces of the concrete joint shall be applied



with a coat of hot bitumen primer conforming to IS:3384 in order to improve the adhesive quality of the sealing compound.

4. Expansion joints between beams/slabs shall be provided with 100mm wide x 4mm thick mild steel plate at the soffit of RCC beams/slabs to support and prevent the preformed joint filler from dislodging. This plate shall be welded to an edge angle of ISA 50 x 50 x 6mm provided at the bottom corner, adjacent to the expansion joint of one of the beams/slabs, by intermittent fillet welding. Steel surfaces shall be provided with 2 coats of epoxy primer and 2 coats of PU paint finish.

3.18 INDIAN PATENT STONE (IPS) FLOORING

MATERIAL

Material shall be 10 mm down clean, well graded, hard, approved granite/basalt /good sound stone chips and clean, sharp, coarse sand. Elongated or thin flake like fragments of stone shall be avoided. Coarse and fine aggregates used shall conforming to IS383. Cement shall conform to IS456.

WORKMANSHIP

1. For flooring, the base Reinforced cement concrete slab or the grade slab shall be cleaned of all dirt with water and hard brush. If required, the base surface shall be backed or otherwise roughened to obtain a good bond. The surface shall be clean, free from grease, oil, dust, loose particles, etc. and thoroughly soaked with water to prevent absorption of mixing water from the base course. Before placing the under bed, any excess standing water shall be mopped out. Before laying the flooring approval of the Engineer-in-charge shall be obtained as to the acceptability of the base, the BIDDER may have to fill it up with the base concrete to achieve the specified top level of the flooring surface. Wherever the level is higher, the BIDDER may have to chip/break the concrete to achieve the specified thickness of the floor topping.
2. The Indian patent stone floor unless otherwise stated, shall have a total thickness of 50 mm laid in two layers. The under-bed shall consist of 25mm thick cement concrete with 10 mm to 6mm size stones. The proportion of the mix shall be 1 part cement, 2 parts sand and 4 parts stone chips by volume. Second layer 15mm shall be with 6mm down aggregates of above proportion.
3. Water content shall be minimum, sufficient to give a workable consistency, which will allow finishing without excessive trowelling. Generally, water cement ratio of 0.4 should suffice. Prior to commencement of laying the under bed, thick cement slurry (cement & water) shall be given on clean surface and then the under-bed layer shall be laid.
4. The floor shall be cast in panels not exceeding 5 sq.m. in area and no side more than 2.5 m long. The casting sequence shall be in a checkered board fashion, no two adjacent panels being cast before the contraction



of the previous one has taken place. The edge of each panel into which the floor is divided shall be supported by flat bars of steel or glass strips duly oiled to prevent sticking. The bars shall be removed before filling in adjoining panels. At least 48 hours shall elapse before the concreting in the adjacent bay is commenced. After laying, the underbed shall be leveled, compacted and brought to proper grade with a screed or float. PVC/Glass floor separator of approved make shall be used between the panels with the approval of Engineer.

5. Final layer of minimum 6 mm thickness shall be laid over the green underbed and trowelled smooth with a mixture of cement and sand (1:1 by volume). The underbed and topping shall be completed in one operation.
6. The topping shall be trowelled smooth to the satisfaction of the Engineer-in-charge. Any marks of trowel shall be mopped with a soft cloth to give a clean, even and smooth surface.

VACUUM DEWATERED FLOOR

The BIDDER shall submit full details of the system with catalogues etc. he proposes to adopt for this work. The BIDDER shall ensure strict adherence to all the steps given therein to ensure good quality work. However, it shall be the BIDDER's entire responsibility to complete the works to the satisfaction of the Engineer. The BIDDER shall mobilize to the site adequate manpower and all the equipment necessary for this work. Standby arrangement of equipment and power shall also be made to ensure uninterrupted work.

WORKMANSHIP

1. After placing the concrete in floor, it shall be properly compacted using needle vibrators combined with surface vibrator to eliminate voids and entrapped air. The surface vibrator shall be run at least twice over the concrete surface. Suction mat shall then be laid over this surface and the mat is connected to the vacuum pump connected with a suction hose. Vacuum process should then be started and continued for at least 20 to 25 minutes, ensuring removal of excess water from concrete and leaving only that much quantity of water that is required for the hydration of cement at the end of this stage. Non metallic hardener to be sprinkled over concrete and finished with trowel.
2. The mat and pump shall then be removed, and mechanically operated power floats shall be rotated on the wet concrete surface. The process shall be repeated, and the surface shall be finally finished with minimum two passes of power trowel.
3. The finished surface shall then be covered with a polythene sheet the following day after sprinkling water on the surface. Ponding of water shall be carried out after 2-3 days and the surface shall be kept wet continuously for at least 21 days.

PLASTERING FOR WALL AND CEILINGS



3.19 GENERAL

This specification covers the general requirements for finishing the plastered brick / concrete surfaces with Plaster of Paris and other related works forming a part of this job, which may be required to be carried out though not specifically mentioned above. The work under this specification shall consist of furnishing of all tools, plants, labour, materials and everything necessary for carrying out the work.

3.20 APPLICABLE CODES AND STANDARDS

Work shall be carried out as per latest edition of Indian Standards and Code of Practices. List given here shall not be considered as conclusive and is for reference and guidance only. Any discrepancies/ conflict noticed shall be brought to the notice of Architect/Engineer in charge for direction / approval. However, as a general rule more stringent specification shall take precedence.

- | | |
|----------|---|
| IS: 63 | Whiting for paint and putty. |
| IS:1635 | Code of practice for field slaking of building lime and preparation of putty. |
| IS: 2333 | Plaster of Paris for ceramic industry |
| IS: 6932 | Methods of test for building limes |
| IS 1661 | Code of practice for application of cement and cement lime plaster finishes. |



3.21 POP PUNNING WORKS

MATERIALS

1. The plaster of Paris powder shall conform to the requirements of IS: 2333.

WORKMANSHIP

2. The plaster on masonry surface shall be allowed to dry before the POP punning is applied.
3. Powder of plaster of Paris shall be mixed with water as specified by manufacturer to form a thick paste and shall be applied on the plastered surface.
4. The POP shall be laid and rubbed and finally trowelled to a fine uniform smooth finish. All unevenness shall be rubbed down from top to bottom in one operation to eliminate joint marks.

3.22 PUTTY WORKS

MATERIALS

Water resistant white cement-based putty ideal for use on concrete / mortar walls (internal and external) and ceiling.

WORKMANSHIP

1. Surface Preparation: All loosely adhered material shall be removed from the wall surface with the help of emery stone, putty blade or white brush and clean water. The substrate shall be clean, free from dust, grease and loose material. Dry and absorbent surfaces shall be moistened with sufficient quantity of clean water.
2. Mixing of putty: Putty shall be mixed with 30-35% clean water slowly to make a paste. Mixing shall be continued for 10-15 minutes till a uniform paste is formed.
3. Application on prepared surface: The first coat shall be applied on already moistened wall surface from bottom to upward direction uniformly with the help of putty blade. This would ensure less wastage and proper finish. After drying of first coat of putty, the surface shall be rubbed gently with wet sponge or very gently with a putty blade in order to remove loose particles. The surface shall be allowed to dry for at least for 3 hours and then second coat of putty shall be applied. The surface shall be allowed to dry completely.
4. Marks if any shall be removed with the help of moist sponge or the surface shall be rubbed very gently with putty blade. The surface shall be allowed to dry completely.
5. Only the required quantity of putty shall be prepared at a time and shall be used within 2-3 hours of mixing of water. The total thickness of the coats should be limited to maximum 1.5 mm. If required, to remove unevenness of surface before applying any kind of paint/ distemper, walls



/ ceiling surface shall be leveled gently with very fine waterproof emery paper of not less than 5900 number to get a glossy white surface.

6. Precautions during application: Utmost care shall be taken for proper and thorough mixing of putty with hand or mechanical stirrer in order to get best results. Putty shall be applied over fully cured surface. It is recommended not to rub putty strongly and harshly with rough emery paper. This breaks the film formed by putty, thus decreasing its water repellent properties. The total thickness of the coats shall be limited to maximum 1.5 mm. In case of fresh concrete/ mortar surface, it is recommended that two coats of white cement wash be done before application of putty.

STORAGE, HANDLING & DELIVERY

1. Material received at site shall be with original packing and labels. It shall be intact till issued for use of site.
2. Material shall be stored at properly covered dry location and shall be safe from damage.
3. Storage life should not exceed 6 months.

3.23 CEMENT PLASTERING WORK

The proportions of the cement mortar for plastering shall be 1:4 (one part of cement to four parts of sand) unless otherwise specified under the respective item of work. Cement and sand shall be mixed thoroughly in dry condition and then water added to obtain a workable consistency. The quality of water and cement shall be as per relevant IS. The quality and grading of sand for plastering shall conform to IS:1542. The mixing shall be done thoroughly in a mechanical mixer unless hand mixing is specifically permitted by the ENGINEER. If so desired by the ENGINEER sand shall be screened and washed to meet the specification requirements. The mortar thus mixed shall be used as soon as possible preferably within 30 minutes from the time water is added to cement. In case the mortar has stiffened due to evaporation of water this may be re-tempered by adding water as required to restore consistency, but this will be permitted only upto 30 minutes from the time of initial mixing of water to cement. Any mortar which is partially set shall be rejected and removed forthwith from the site. Droppings of plaster shall not be re-used under any circumstances.

WORKMANSHIP

1. Preparation of surfaces and application of plaster finishes shall generally conform to the requirements specified in IS:1661 and IS:2402.
2. Plastering operations shall not be commenced until installation of all fittings and fixtures such as door/window panels, pipes, conduits etc. are completed.
3. All joints in masonry shall be raked as the work proceeds to a depth of 10mm/20mm for brick/stone masonry respectively with a tool made for the purpose when the mortar is still green. The masonry surface to be



rendered shall be washed with clean water to remove all dirt, loose materials, etc., Concrete surfaces to be rendered shall be roughened suitably by hacking or bush hammering for proper adhesion of plaster and the surface shall be evenly wetted to provide the correct suction. The masonry surfaces should not be too wet but only damp at the time of plastering. The dampness shall be uniform to get uniform bond between the plaster and the masonry surface.

Interior plain faced plaster - For internal walls 18 thick plaster in CM 1:6 shall be provided on the uneven side of the wall and 12 mm thick plaster in CM 1:4 on the even side of the wall. The mortar shall be dashed against the prepared surface with a trowel. The dashing of the coat shall be done using a strong whipping motion at right angles to the face of the wall or it may be applied with a plaster machine. The coat shall be trowelled hard and tight forcing it to surface depressions to obtain a permanent bond and finished to smooth surface. Interior plaster shall be carried out on jambs, lintel and still faces, etc. as shown in the drawing and as directed by the ENGINEER.

Plain Faced Ceiling plaster - This plaster shall be applied in a single coat of 6mm thickness. The proportion of cement mortar shall be 1:3.

Exterior plain faced plaster - This plaster shall be applied in 2 coats. Unless otherwise mentioned External face of all walls shall be provided with 20 mm thick cement mortar plastering with an under layer 12 mm thick in CM 1:4 and top 8 mm thick layer in CM 1:4 with approved water proofing compound. Water proofing admixture shall conform to the requirement of IS: 2645 and shall be of approved manufacture. The rendering coat shall be applied as stipulated as mentioned, except finishing it to a true and even surface and then lightly roughened by cross scratch lines to provide bond for the finishing coat. The rendering coat shall be cured for atleast two days and then allowed to dry. The second coat or finishing coat shall be 8 mm thick with approved water proofing admixture, if so specified in the item description. Before application of the second coat, the rendering coat shall be evenly damped. The second coat shall be applied from top to bottom in one operation without joints and shall be finished leaving an even and uniform surface. The mortar proportions for the coats shall be as specified in the respective item of work. The finished plastering work shall be cured for at least 7 days.

Interior plain faced plaster 20mm thick if specified for uneven faces of brick walls or for random/coursed rubble masonry walls shall be executed in 2 coats.

Exterior Sand Faced Plaster - This plaster shall be applied in 2 coats. The first coat shall be 12mm thick and the second coat shall be 8mm thick. However, only approved quality white sand shall be used for the second



coat and for the finishing work. Sand for the finishing work shall be coarse and of even size and shall be dashed against the surface and sponged.

4. The mortar proportions for the first and second coats shall be as specified in the respective items of work.
5. Wherever more than 20mm thick plaster has been specified, which is intended for purposes of providing beading, bands, etc. this work shall be carried out in two or three coats as directed by the ENGINEER duly satisfying the requirements of curing each coat (rendering/floating) for a minimum period of 2 days and curing the finished work for at least 7 days.
6. In the case of pebble faced finish plaster, pebbles of approved size and quality shall be dashed against the final coat while it is still green to obtain as far as possible a uniform pattern all as directed by the ENGINEER.
7. Where specified in the drawings, rectangular grooves of the dimensions indicated shall be provided in external plaster by means of timber battens when the plaster is still in green condition. Battens shall be carefully removed after the initial set of plaster and the broken edges and corners made good. All grooves shall be uniform in width and depth and shall be true to the lines and levels as per the drawings.
8. Curing of plaster shall be started as soon as the applied plaster has hardened sufficiently so as not to be damaged when watered. Curing shall be done by continuously applying water in a fine spray and shall be carried out for at least 7 days.
9. When the specification items of work call for waterproofing plaster, the BIDDER shall provide the waterproofing compound as specified while preparing the cement mortar. Payment for water-proofing compound will be made separately if it is not included as a combined item of work.
10. For external plaster, the plastering operations shall be commenced from the top floor and carried downwards. For internal plaster, the plastering operations for the walls shall commence at the top and carried downwards. Plastering shall be carried out to the full length of the wall or to natural breaking points like doors/windows etc.
11. The finished plaster surface shall not show any deviation more than 4mm when checked with a straight edge of 2m length placed against the surface. To overcome the possibility of development of cracks in the plastering work following measures shall be adapted.
12. Plastering work shall be deferred as much as possible so that fairly complete drying shrinkage in concrete and masonry works takes place. Steel wire fabric shall be provided at the junction of brick masonry and concrete to overcome reasonably the differential drying shrinkage/thermal movement. This steel item shall be measured and paid for separately. Ceiling plaster shall be done, with a trowel cut at its



junction with wall plaster. Similarly trowel cut shall be adopted between adjacent surfaces where discontinuity of the background exists.

3.24 CEMENT POINTING

The cement mortar for pointing shall be in the proportion of 1:3 (one part of cement to three parts of fine sand) unless otherwise specified in the respective items of work. Sand shall conform to IS:1542 and shall be free from clay, shale, loam, alkali and organic matter and shall be of sound, hard, clean and durable particles. Sand shall be approved by ENGINEER and if so directed it shall be washed/screened to meet specification requirements.

WORKMANSHIP

1. Where pointing of joints in masonry work is specified on drawings/respective items of work, the joints shall be raked at least 15mm/20mm deep in brick/stone masonry respectively as the work proceeds when the mortar is still green.
2. Any dust/dirt in the raked joints shall be brushed out clean and the joints shall be washed with water. The joints shall be damp at the time of pointing. Mortar shall be filled into joints and well pressed with special steel trowels. The joints shall not be disturbed after it has once begun to set. The joints of the pointed work shall be neat. The lines shall be regular and uniform in breadth and the joints shall be raised, flat, sunk or 'V' as may be specified in the respective items of work. No false joints shall be allowed.
3. The work shall be kept moist for atleast 7 days after the pointing is completed. Whenever coloured pointing is to be done, the colouring pigment of the colour required shall be added to cement in such proportions as recommended by the manufacturer and as approved by the ENGINEER.



PAINTING WORKS

3.25 GENERAL

This specification covers the general requirements for painting of interior and exterior plastered brick / concrete surfaces and partition walls with suitable paints and other related works forming a part of this job, which may be required to be carried out though not specifically mentioned above. The work under this specification shall consist of furnishing of all tools, labour, materials and everything necessary for carrying out the work.

3.26 APPLICABLE CODES AND STANDARDS

Work shall be carried out as per latest edition of Indian Standards and Code of Practices. List given here shall not be considered as conclusive and is for reference and guidance only. Any discrepancies/ conflict noticed shall be brought to the notice of Architect/Engineer in charge for direction / approval. However, as a general rule more stringent specification shall take precedence.

IS: 77	Linseed oil, boiled, for paints
IS: 103	Ready mixed paint, brushing, white lead for priming and general purposes
IS: 133	Enamel, interior (a) under coating (b) finishing
IS: 137	Ready mixed paint, brushing, bituminous, black lead-free acid alkali water and heat resisting.
IS: 168	Ready mixed paint, air drying for general purposes.
IS: 337	Varnish, finishing interior
IS: 348	French polish
IS: 427	Distemper, dry, colour as required
IS: 428	Distemper, oil emulsion, colour as required
IS: 524	Varnish, finishing exterior, synthetic
IS: 525	Varnish, finishing exterior and general purposes
IS: 712	Specification for building limes
IS: 1200 Part x	Ceilings and Linings
IS: 1200 Part xiii	White washing, Colour washing, distemping and other finishes



IS: 2074	Ready mixed paint, air drying, red oxide- zinc chrome, priming
IS: 2338	Code of practice for finishing of wood and wood-based materials
IS: 2395	Code of practice for painting concrete, masonry, and plaster surfaces
IS: 2932	Specification for enamel, synthetic, exterior type (a) undercoating, (b) finishing
IS: 2933	Enamel exterior type (a) undercoating, (b) finishing
IS: 3536	Specification for ready mixed paint, brushing, wood primer, pink
IS: 5410	Cement paint, colour as required
IS: 5411	Specification for plastic emulsion paint (Parts 1 & 2) for interior
IS: 6278	Code of practice for white washing & colour washing
IS: 9862	Specification for ready mixed paint, brushing, bituminous, black, lead-free, acid, alkali, water and chlorine resisting
IS: 384	Brushes for painting
IS: 1477	Code of practice for painting



3.27 PAINTING OF CONCRETE MASONRY, PLASTERED SURFACES & PARTITION WALLS

MATERIALS

1. All paint products shall have no added lead, mercury, chromium, arsenic and antimony content.
2. Oil bound distemper shall conform to IS: 428. The primer shall be alkali resistant primer of the same manufacture as that of the distemper.
3. Cement paint shall conform to IS: 5410. The primer shall be a thinned coat of cement paint.
4. Acrylic emulsion paint shall be of an approved manufacture.
5. Plastic emulsion paint shall conform to IS: 5411.
6. Lead free acid, alkali and chlorine resisting paint shall conform to IS: 9862.
7. All paints shall have low VOC with VOC for non-flat (gloss finish) paints shall be 150g/l and VOC for flat (mat finish) paint shall be 50 g/l.
8. Whitewash shall be made from good quality fat lime conforming to IS: 712. It shall be slaked at site and mixed with water in the proportion of 5 litres of water to 1 kg of un-slaked lime stirred well to make a thin cream. This shall be allowed to stand for a minimum period of one day and strained through a clean coarse cloth. Four kg of gum dissolved in hot water shall be added to each cu.m of cream. 1.30 kg of sodium chloride dissolved in hot water shall then be added per 10 kg of lime used for the whitewash to be ready for application.
9. Colour wash shall be made by addition of a suitable quantity of mineral pigment, not affected by lime, to the prepared whitewash to obtain the shade/tint as approved by the ENGINEER.
10. All the materials shall be of the best quality from an approved manufacturer. BIDDER shall obtain prior approval of the ENGINEER for the brand of manufacture and the colour/shade. All materials shall be brought to the site of works in sealed containers.

WORKMANSHIP

1. BIDDER shall obtain the approval of the ENGINEER regarding the readiness of the surfaces to receive the specified finish, before commencing the work on painting.
2. Painting of new surfaces shall be deferred as much as possible to allow for thorough drying of the sub-strata.
3. The surfaces to be treated shall be prepared by thoroughly brushing them free from dirt, mortar droppings and any loose foreign materials. Surfaces shall be free from oil, grease and efflorescence. Efflorescence shall be removed only by dry brushing of the growth. Cracks shall be filled with Gypsum. Workmanship of painting shall generally conform to IS: 2395.
4. Surfaces of doors, windows etc. shall be protected suitably to prevent paint finishes from splashing on them.

WHITEWASH - The prepared surfaces shall be wetted, and the finish applied by brushing. The operation for each coat shall consist of a stroke of



the brush first given horizontally from the right and the other from the left and similarly, the subsequent stroke from bottom upwards and the other from top downwards, before the first coat dries. Each coat shall be allowed to dry before the next coat is applied. Minimum of 2 coats shall be applied unless otherwise specified in the item of work. The dry surface shall present a uniform finish without any brush marks.

COLOUR WASH - Colour wash shall be applied in the same way as for whitewash. A minimum of 2 coats shall be applied unless otherwise specified in the item of work. The surface shall present a smooth and uniform finish without any streaks. The finished dry surface shall not show any signs of peeling/powdery and come off readily on the hand when rubbed.

CEMENT PAINT - The prepared surfaces shall be wetted to control surface suction and to provide moisture to aid in proper curing of the paint. Cement paint shall be applied with a brush with stiff bristles. The primer coat shall be a thinned coat of cement paint. The quantity of thinner shall be as per manufacturer's instructions. The coats shall be vigorously scrubbed to work the paint into any voids for providing a continuous paint film free from pinholes for effective water- proofing in addition to decoration. Cement paint shall be brushed in uniform thickness and the covering capacity for two coats on plastered surfaces shall be 3 to 4 kg/sq.m. A minimum of 2 coats of the same colour shall be applied unless otherwise specified in the item of work. At least 24 hours shall be left after the first coat to become sufficiently hard before the second coat is applied. The painted surfaces shall be thoroughly cured by sprinkling with water using a fog spray at least 2 to 3 times a day. Curing shall commence after about 12 hours when the paint hardens. Curing shall be continued for at least 2 days after the application of final coat. Paint may also be applied using rollers.

OIL BOUND DISTEMPER - The prepared surfaces shall be dry and provided with one coat of alkali resistant primer by brushing. The surface shall be finished uniformly without leaving any brush marks and allowed to dry for at least 48 hours. A minimum of two coats of oil bound distemper shall be applied unless otherwise specified in the item of work. The first coat shall be of a lighter tint. At least 24 hours shall be left after the first coat to become completely dry before the application of the second coat. Broad, stiff, double bristled distemper brushes shall be used for the work. Paint may also be applied using rollers.

PLASTIC EMULSION PAINT - The prepared surface shall be dry and provided with one coat of primer which shall be a thinned coat of emulsion paint. The quantity of thinner shall be as per manufacturer's instructions. The paint shall be laid an evenly and smoothly by means of crossing and laying off. The crossing and laying off consists of covering the area with paint, brushing the surface hard for the first time over and then brushing alternately in opposite directions two or three times and then finally brushing



lightly in a direction at right angles. In this process, no brush marks shall be left after the laying off is finished. The full process of crossing and laying off constitutes one coat. The next coat shall be applied only after the first coat has dried and sufficiently become hard which normally takes about 2 to 3 hours. A minimum of 2 finishing coats of the same colour shall be applied unless otherwise specified in the item of work. Paint may also be applied using rollers. The surface on finishing shall present a flat velvety smooth finish and uniform in shade without any patches. Paint may also be applied using rollers.

ACRYLIC EMULSION PAINT - Acrylic emulsion paint shall be applied in the same way as for plastic emulsion paint. A minimum of 2 finishing coats over one coat of primer shall be provided unless otherwise specified in the item of work. Paint may also be applied using rollers.

ACID, ALKALI RESISTING PAINT - A minimum of 2 coats of acid/alkali resisting paint shall be applied over the prepared dry surfaces by brushing. Primer coat shall be as per manufacturer's instructions.

SYNTHETIC ENAMEL PAINT - The prepared surface shall be dry and provided with one coat of primer which shall be a thinned coat of enamel paint. The quantity of thinner shall be as per manufacturer's instructions. The paint shall be laid on evenly and smoothly by means of crossing and laying off. The crossing and laying off consists of covering the area with paint, brushing the surface hard for the first time over and then brushing alternately in opposite directions two or three times and then finally brushing lightly in a direction at right angles. In this process, no brush marks shall be left after the laying off is finished. The full process of crossing and laying off constitutes one coat. The next coat shall be applied only after the first coat has dried and sufficiently become hard which normally takes about 2 to 3 hours. A minimum of 2 finishing coats of the same colour shall be applied unless otherwise specified. Paint may also be applied using rollers. The surface on finishing shall present a flat velvety smooth finish and uniform in shade without any patches.

ACRYLIC DISTEMPER - The prepared surfaces shall be dry and provided with one coat of alkali resistant primer by brushing. The surface shall be finished uniformly without leaving any brush marks and allowed to dry for at least 48 hours. A minimum of two coats of acrylic distemper shall be applied, unless otherwise specified. The first coat shall be of a lighter tint. At least 24 hours shall be left after the first coat to become completely dry before the application of the second coat. Broad, stiff, double bristled distemper



brushes shall be used for the work. The operations for brushing each coat shall be as detailed above.

3.28 PAINTING & POLISHING OF WOODWORK

MATERIALS

Wood primer shall conform to IS: 3536E.

Varnish shall conform to IS: 337.

French polish shall conform to IS: 348.

Synthetic enamel paint shall conform to IS: 2932.

All the materials shall be of the best quality from an approved manufacturer. CONTRACTOR shall obtain prior approval of the ENGINEER for the brand of manufacture and the colour/shade. All materials shall be brought to the site of works in sealed containers.

WORKMANSHIP

1. The type of finish to be provided for woodwork, either for painting or polishing, the number of coats, etc. shall be as specified in the respective items of work.
2. Primer and finish paint shall be compatible with each other to avoid, cracking and wrinkling. Primer and finish paint shall be from the same manufacturer.
3. Painting shall be either by brushing or spraying. BIDDER shall procure the appropriate quality of paint for this purpose as recommended by the manufacturer. The workmanship shall generally conform to the requirements of IS: 2338 (Part I).
4. All the wood surfaces to be painted shall be thoroughly dry and free from any foreign matter. Surfaces shall be smoothened with abrasive paper using it across the grains and dusted off. Wood primer coat shall then be applied uniformly by brushing. The number of primer coats shall be as specified in the item of work. Stopping as per IS 426 shall be used to fill up large holes & cracks on the surface. For small holes or minor cracks, fillers as per IS 110 should be used. Any slight irregularities of the surface shall then be made up by applying an optimum coat of filler conforming to IS: 110 and rubbed down with an abrasive paper for obtaining a smooth surface for the undercoat of synthetic enamel paint conforming to IS: 2932.
5. Paint shall be applied by brushing evenly and smoothly by means of crossing and laying off in the direction of the grain of wood. After drying, the coat shall be carefully rubbed down using very fine grade of sandpaper and wiped clean before the next coat of finishing is applied. At least 24 hours shall elapse between the applications of successive coats. Each coat shall vary slightly in shade, and this shall be got



- approved by the ENGINEER. The number of coats of paint to be applied shall be as specified in the item of work.
6. All the wood surfaces to be provided with clear finishes shall be thoroughly dry and free from any foreign matter. Surfaces shall be smoothened with abrasive paper using it in the direction of the grains and dusted off.
 7. Any slight irregularities of the surface shall be made up by applying an optimum coat of transparent liquid filler conforming to IS 345. The Surface when hard shall be rubbed down with fine abrasive paper. All dust and dirt shall be cleaned and on this surface water or spirit stains shall be applied to enhance the natural grain or figuring effect of wood.
 8. After the surface is dry, a suitable sealer shall be applied to prevent bleeding of stain and filler into the finish coat. The surface shall be rubbed down lightly, wiped off and allowed to dry.
 9. Over this prepared surface, varnish conforming to IS: 337 shall be applied by brushing. Varnish should not be retouched once it has begun to set. Staining if required shall be provided as directed by the ENGINEER. When two coats of varnish is specified, the first coat should be a hard-drying undercoat or flatting varnish which shall be allowed to dry hard before applying the finishing coat. The number of coats to be applied shall be as per the item of work.
 10. For works where clear finish of French polish is specified the prepared surfaces of wood shall be applied with the polish using a pad of woolen cloth covered by a fine cloth. The pad shall be moistened with polish and rubbed hard on the surface in a series of overlapping circles to give an even finish over the entire area. The surface shall be allowed to dry before applying the next coat.
 11. Finishing shall be carried out using a fresh clean cloth over the pad, slight dampening with methylated spirit and rubbing lightly and quickly in circular motions. The finished surface shall have a uniform texture and high gloss. The number of coats to be applied shall be as per the item of work.

MOCK-UP

1. The BIDDER shall prepare and install mock-up samples as per approved shop drawings.
2. Mock-up samples shall be of full size and shall be true representation of actual works to be carried out at site. Mock-ups may be part of completed work if undisturbed.

STORAGE, HANDLING & DELIVERY

1. Material received at site shall be with original packing and labels. It shall be intact till issued for use of site.



2. Material shall be stored at properly covered dry location and shall be safe from damage.
3. Paints shall be kept covered at all times and mixing shall be done in suitable containers.
4. All necessary precautions shall be taken against fire hazards.

3.29 PAINTING OF STEEL WORK

For painting of structural steel refer Section 11 & as per specification.

4 DOORS, WINDOWS, AND VENTILATORS

4.1 GENERAL

This specification covers the general requirements for doors, windows and ventilators and other related works forming a part of this job, which may be required to be carried out though not specifically mentioned above. The work under this specification shall consist of furnishing of all tools and tackles, plants, labour, materials and everything necessary for carrying out the work.

4.2 APPLICABLE CODES AND STANDARDS

Work shall be carried out as per latest edition of Indian Standards and Code of Practices. List given here shall not be considered as conclusive and is for reference and guidance only. Any discrepancies/ conflict noticed shall be brought to the notice of Architect/Engineer in charge for direction / approval. However, as a general rule more stringent specification shall take precedence.

IS: 287	Recommendation for maximum permissible moisture contents of timber used for different purposes
IS: 303	Plywood for general purpose
IS: 419	putty for use on window frames
IS: 710	Marine plywood
IS: 733	Wrought aluminum and aluminum alloys, bars, rods and sections for general engineering purposes.
IS: 1003	Timbered paneled and glazed shutters for doors and windows.
IS: 1038	Steel doors, windows and ventilators



- IS: 1081 Code of practice for fixing and glazing of metal (steel and aluminum) doors, windows and ventilators
- IS: 1361 Specification for steel windows for industrial buildings
- IS: 1477 Code of practice for painting of ferrous metals in buildings
- IS: 1911 Schedule of unit weights of building materials
- IS: 1659 Block boards
- IS: 1868 Anodic coating on aluminum and its alloys
- IS: 1948 Specification for aluminum doors, windows and ventilators
- IS: 1949 Specification for aluminum windows for industrial buildings
- IS: 2074 Ready mixed paint, air drying, red oxide zinc chrome, priming
- IS: 2191 Wooden flush doors (cellular and hollow core type), plywood faced panels, particle board faced panels.
- IS: 2202 Wooden flush doors (solid core type), plywood faced panels, particle board faced panels.
- IS: 2835 Flat transparent sheet glass
- IS: 3614 Metallic and non-metallic fire check doors - resistance test and performance criteria.
- IS: 4020 Methods of test for wooden flush doors
- IS: 4021 Timber door, window and ventilator frames
- IS: 4351 Steel door frames
- IS: 5437 Figured rolled and wired glass
- IS: 5523 Methods of testing anodic coatings on aluminum
- IS: 6248 Metal Rolling shutters and rolling grills
- IS: 7452 Hot rolled steel sections for doors, windows and ventilators.
- IS: 13871 Powder Coatings
- IS: 15380 Moulded raised high-density fibre (HDF) doors.
- IS: 15931 Solid panel foam UPVC door shutters



BS: 476 Fire tests for building materials and structures.

NFPA 80 Standards for fire doors and other opening protectives.

4.3 WOODWORK IN DOORS, WINDOWS, & VENTILATORS

MATERIALS

1. Timber to be used shall be first class Teak wood as per IS: 4021. Timber shall be of the best quality and well-seasoned by a suitable process before being planned to the required sizes. The maximum permissible moisture content shall be from 10 to 16 percent for timber 50mm and above in thickness and 9 to 14 percent of timber less than 50mm in thickness for different regions of the country as stipulated In IS: 287. Timber shall be close grained, of uniform colour and free from decay, fungal growth, boxed heart, pitch pockets or streaks on the exposed edges, borer holes, splits and cracks.
2. Flush door shutters of the solid core type with plywood face panels shall conform to IS: 2202 (Part 1) and with particle board/hard board face panels shall conform to IS: 2202 (Part 2).
3. Transparent sheet glass shall conform to the requirements of IS: 2835. Wired and figured glass shall be as per IS: 5437.
4. Builder's hardware of fittings and fixtures shall be of the best quality from approved manufacturers.

WORKMANSHIP

1. The workmanship and finish of woodwork in doors, windows, ventilators and partitions shall be of a very high order. BIDDER shall ensure that work is executed in a professional manner by skilled carpenters for good appearance, efficient and smooth operation of the shutters.
2. All works shall be executed as per the detailed drawings and/or as directed by the ENGINEER.
3. All members of the door, window, and ventilator shall be straight without any warp or bow and shall have smooth well planed faces. The right angle shall be checked from the inside surfaces of the respective members of the frame.
4. Frames shall have mortise and tenon joints which shall be treated with an approved adhesive and provided with metal or wood pins. The vertical members of the door frame shall project 50 mm below the finished floor level with a spacer bar. The finished dimension of frames shall be rebated on the solid for keying with the plaster and for receiving the shutters. The depth of rebate for housing the shutter shall be 15 mm. The size of the frames shall be as specified in the respective items of work. The



workmanship shall generally conform to the requirements specified in IS: 4021.

5. The face of the frames abutting the masonry or concrete shall be provided with a coat of coal tar.
6. Three/sufficient numbers of hold fasts using 25 mm x 6 mm mild steel flats 225 long with split ends shall be fixed each side of door and window frames, one at the centre and the other two at 300 mm from the top and bottom of the frame. For window and ventilator frames less than 1 m in height, two hold fasts on each side shall be fixed at quarter points.
7. Timber paneled shutters for doors, windows and ventilators shall be constructed in the form of framework of stiles and rails with panel insertion. The panels shall be fixed by either providing grooves in the stiles and rails or by beading. Glazing bars shall be as detailed in the drawings. The stiles and rails shall be joined by mortise and tenon joints at right angles. All members of the shutter shall be straight without any warp or bow and shall have smooth, well planed faces at right angles to each other. The right angle for the shutter shall be checked by measuring the diagonals and the difference shall not be more than + 3 mm. Timber panels made from more than one piece shall be jointed with a continuous tongued and grooved joint, glued together and reinforced with metal dowels. The workmanship shall, generally conform to the requirements specified in IS: 1003 (Parts 1 & 2). The thickness of the shutter, width/thickness of the stiles/rails/panel type shall be as indicated in the bid drawings/item of work. Marine plywood panels conforming to IS: 710 shall be used for doors where specified.
8. Details of the wooden flush door shutters, solid core type with specific requirement of the thickness, core, face panels, viewing glazed panel, Venetian louver opening, teak wood lipping etc. shall be as indicated in the respective items of work. Panels of shutter shall be of marine plywood conforming to IS: 710, if so, specified in the item of work. Flush door shutters shall be from reputed manufacturers and BIDDER shall submit test results as per IS: 4020, if so desired by the ENGINEER.
9. The material of the fittings and fixtures either of chromium plated steel, cast brass, copper oxidized or anodized aluminum shall be as specified in the item of work. The number, size and type of the fittings and fixtures shall be as indicated in the drawings/item of work.
10. Woodwork shall not be provided with the finishes of painting, galvanizing etc. unless it has been approved by the ENGINEER. The type of finish and the number of coats shall be as stipulated in the respective items of work. Preparation of the wood surface and application of the finishes shall be as per Painting and Polishing of wood works.
11. Any carpentry work which shows defects due to inadequate seasoning of the timber or bad workmanship shall be removed and replaced by BIDDER with work as per specification requirements, at no extra cost to the OWNER.



4.4 STEEL DOORS, WINDOWS AND VENTILATORS

MATERIALS

1. Hot rolled steel sections for the fabrication of steel doors, windows and ventilators shall conform to IS: 7452, which are suitable for single glazing.
2. Pressed steel door frames for steel flush doors shall be out of 1.25 mm thick mild steel sheets of profiles as per IS:4351.
3. Transparent sheet glass shall conform to the requirements of IS: 2835. Wired and figured glass shall be as per IS: 5437.
4. Builder's hardware of fittings and fixtures shall be of the best quality from approved manufacturers.

WORKMANSHIP

1. All steel doors, windows and ventilators shall be of the type as specified in the respective items of work and of sizes as indicated in the drawings. Steel doors, windows and ventilators shall conform to the requirements as stipulated in IS: 1038. Steel windows shall conform to IS: 1361, if so specified.
2. Doors, windows and ventilators shall be of an approved manufacture. Fabrication of the units shall be with rolled sections, cut to correct lengths and mitred. Corners shall be welded to form a solid fused welded joint conforming to the requirements of IS: 1038. Tolerance in overall dimensions shall be within $\pm 1.5\text{mm}$. The frames and shutters shall be free from warp or buckle and shall be square and truly plane. All welds shall be dressed flush on exposed and contact surfaces. Punching of holes, slots and other provisions to install fittings and fixtures later shall be made at the correct locations as per the requirements. Samples of the units shall be got approved by the ENGINEER before further manufacture/purchase by the BIDDER.
3. Type and details of shutters, hinges, glazing bar requirement, couplings, locking arrangement, fittings and fixtures shall be as described in the respective items of work and/or as shown in the drawings for single or composite units.
4. For windows with fly proof mesh as per the item of work, rotor operator arrangement, for the operation of the glazed shutters from the inside shall be provided.
5. Pressed steel door frames shall be provided with fixing lugs at each jamb, hinges, lock-strike plate, mortar guards, angle threshold, shock-absorbers of rubber or similar material as per the requirements of IS:4351. Pressed steel door frames shall be fixed as 'built-in', as the masonry work proceeds. After placing it plumb at the specified location, masonry walls shall be built up solid on either side or each course grouted with mortar to ensure solid contact with the door frame, without leaving any voids. Temporary struts across the width shall be fixed, during erection to prevent bow/sag of the frame.
6. Door shutters of flush welded construction shall be 45mm thick, fabricated with two outer skins of 1.25mm thick steel sheets, 1.00mm thick



steel sheet sufferers and steel channels on all four edges. Double shutters shall have meeting stile edge bevelled or rebated. Provision of glazed viewing panel, louvers shall be made as per the item of work and/or drawings. Shutters shall be suitably reinforced for lock and other surface hardware and to prevent sagging/twisting. Single sheet steel door shutters shall be fabricated out of 1.25mm thick steel sheets, mild steel angles and stiffeners as per the drawings.

7. Doors, windows and ventilators shall be fixed into the prepared openings. They shall not be 'built-in' as the masonry work proceeds, to avoid distortion and damage of the units. The dimensions of the masonry opening shall have 10mm clearance all-round the overall dimensions of the frame for this purpose. Any support of scaffolding members on the frames/glazing bars is prohibited.
8. Glazing of the units shall be either with flat transparent glass or wired/figured glass of the thickness as specified in the item of work. All glass panels shall have properly squared corner and straight edges. Glazing shall be provided on the outside of the frames.
9. Fixing of the glazing shall be either with spring glazing clips and putty conforming to IS: 419 or with metal beads. Pre-formed PVC / VINYL or rubber gasket shall be provided for fixing the beads with concealed screws. The type of fixing the glazing shall be as indicated in the item of work and/or in drawings.
10. Steel doors, windows and ventilators shall be provided with finish of either painting as specified or shall be hot dip galvanized with thickness of zinc coating as stipulated all as described in the respective items of work.
11. The material of the Builders hardware of fittings and fixtures of chromium plated steel, cast brass, brass copper oxidized or anodized aluminum shall be as specified in the item of work. The number, size and type of fittings and fixtures shall be as in the bid drawings/item of work.
12. Installation of the units with fixing lugs, screws, mastic caulking compound at the specified locations shall generally conform to the requirements of IS:1081. Necessary holes etc required for fixing shall be made by the BIDDER and made good after installation. Workmanship expected is of a high order for efficient and smooth operation of the units.



4.5 ALUMINUM DOORS, WINDOWS, & VENTILATORS

MATERIALS

1. Aluminum alloy used in the manufacture of extruded sections for the fabrication of doors, windows, ventilators shall conform to designation 63400 WP of IS:733.
2. Transparent sheet glass shall conform to the requirements of IS: 2835. Wired and figured glass shall be as per IS: 5437.
3. Builder's hardware of fittings & fixtures shall be of the best quality from approved manufacturers.

WORKMANSHIP

1. All aluminum doors, windows, and ventilators shall be of the type as specified in the respective items of work and of sizes as indicated in the drawings. The doors, windows, ventilators shall conform to the requirements of IS: 1948. Aluminum windows shall conform to IS: 1949, if so specified.
2. All aluminum units shall be supplied with anodized/powder coated finish. The minimum anodic film thickness shall be 0.015 mm.
3. Doors, windows and ventilators shall be of an approved manufacture. Fabrication of the units shall be with the extruded sections, cut to correct lengths, mitered and welded at the corners to a true right angle conforming to the requirements of IS: 1948. Tolerance in overall dimensions shall be within $\pm 1.5\text{mm}$. The frames and shutters shall be free from warp or buckle and shall be square and truly plane. Punching of holes, slots and other provisions to install fittings or fixtures later shall be made at the correct locations, as per the requirements.
4. Aluminum swing type doors, aluminum sliding windows, partitions shall be as described in the item of work and/or bid drawings which indicates generally the arrangement along with the overall size of the various components and weight per running meter of the extruded sections to be adopted.
5. IS:1948 and IS:1949 referred to incorporates the sizes, shapes, thicknesses and weight per running meter of extruded sections for the various components of the units. However, new sizes, shapes, thicknesses with modifications to suit snap-fit glazing clips etc. are continuously being added by various leading manufacturers of extruded sections, which are available in the market. As such, the sections of the various components of the unit proposed by the BIDDER, will be reviewed by the ENGINEER and will be accepted only if they are equal to or marginally more than that specified in the codes/ item of works.
6. The framework of the partitions with mullions and transoms shall be with anodized/powder coated aluminum box sections of dimensions as per the item of work. Anodized/powder coated Aluminum box sections shall be in-filled with timber of class 3 (silver oak or any other equivalent) as per IS:4021. Panels of double/single glazing/plywood shall be fixed as per details indicated in the drawing. Partitions shall be fixed rigidly



between the floor and the structural columns/beams including provision of necessary shims for wedging etc. Finished work shall be of rigid construction, erected truly plumb to the lines and levels, at locations as per the construction drawings.

7. Specific provisions as stipulated for steel doors, windows, ventilators shall also be applicable for this item work. Glazing beads shall be of the snap-fit type suitable for the thickness of glazing proposed as indicated in the item of work.
8. A layer of clear transparent lacquer shall be applied on aluminum sections to protect them from damage during installation. This lacquer coating shall be removed after the installation is completed.



4.6 METAL ROLLING SHUTTERS AND ROLLING GRILLS

MATERIALS

1. Metal Rolling shutters and rolling grills shall be of an approved manufacture, conforming to the requirements specified in IS: 6248.
2. The type of viz. self-coiling type (manual) for clear areas up to 12 sq.m, gear operated type (mechanical) for clear areas up to 35 sq.m and electrically operated type for areas up to 50 sq.m shall be as specified in the IS Code 6248. Mechanical type shall be suitable for operation from both inside and outside with the crank handle or chain gear operating mechanism duly considering the size of wall/column. Electrical type shall also be provided with a facility for emergency mechanical operation.

WORKMANSHIP

1. Rolling shutters / grill shall be supplied duly considering the type, specified clear width/height of the opening and the location of fixing as indicated in the drawings.
2. Rolling Shutter curtain shall be built-up of interlocking laths 75mm width between rolling centers formed from cold rolled steel strips. The thickness of the steel strip shall not be less than 0.90 mm for shutters up to 3.50m width and not less than 1.20 mm for shutters above 3.50 m width. Each lath section shall be continuous single piece without any welded joint.
3. Fabrication and assembly of rolling grill curtain shall have the type of links and other additional requirements as specified in the item of works.
4. The guide channels out of mild steel sheets of thickness not less than 3.15 mm shall be of either rolled, pressed or built up construction. The channel shall be of size as stipulated in IS: 6248 for various clear width of the shutters / grill.
5. Hood covers shall be of mild steel sheets not less than 0.90mm thick and of approved shape.
6. Rolling shutters / grill shall be provided with a central hasp and staple safety device in addition to one pair of lever locks and sliding locks at the ends.
7. Where a rolling shutter is combined with rolling grill, height of rolling grill shall be 500mm maximum.
8. All steel components (excepting springs and insides of guide channels) shall be provided with one coat of zinc chrome primer conforming to IS: 2074 at the time of work.
9. Where galvanizing is called for, the curtain sections, guides, lock plate, bracket plates, suspension shaft and the hood cover shall be hot dip galvanized with a zinc coating containing not less than 97.5 percent pure zinc. The weight of the zinc coating per sq.m shall be as specified in the item of work.
10. Guide channels shall be installed truly plumb at the specified location. Bracket plate shall be rigidly fixed with necessary bolts and holdfasts.



- Workmanship of erection shall ensure strength and rigidity of rolling shutter for trouble free and smooth operation.
11. Rolling shutter/grills manufactured by reputed manufacturer as part of their standard product can also be used, provided the quality and size of members satisfy the stipulations above.

4.7 AUTOMATIC SLIDING DOOR

MATERIALS AND WORKMANSHIP

1. These doors shall be from reputed approved manufacturers specialized in this area of works. However, it shall have following minimum features.
2. Size of module shall be as specified in the drawing.
3. Size of the frame and material for frames will be decided as per project requirement.
4. It should consist of microprocessor control unit, monitoring device for opening and closing, automatic reverse system on contact with obstruction. In general, it should be operable without the use of any additional instrumentation or gadgets by the user.
5. The module should be provided with short circuit proof power supply unit for power rating of 220/240 V, 50/60 Hz. A power point will be made available at a suitable location by electrical BIDDER.
6. The door shall have facilities for activation by infrared movement detector on both sides.
7. Opening and closing speed – 10 to 60 cm/sec/leaf.
8. Creep speed – 3 to 9 cm/sec/leaf
9. Opening time – 0 to 180 sec.
10. Both the fixed and sliding panels shall be made of 12 mm thick toughened glass with or without etching. It should be provided with all required fittings and fixtures, digital entry – exit function on the top and electro-mechanical locking system.

4.8 UPVC DOORS AND WINDOWS

MATERIALS

1. The UPVC windows shall be made of high quality UPVC profile section and GI/Aluminum reinforcement.
2. Generally, the UPVC windows shall comprise of main profiles for outer frames and shutters, beads, coupling mullions, bays and reinforcement.
3. The windows shall be noncombustible, non-corrosive, shall have good sound and heat insulation properties, shall withstand harsh weather



conditions and desert conditions and shall not form stains, blisters or corrosion in salty conditions.

WORKMANSHIP

1. Fabrication and erection of windows shall be done as per the approved fabrication drawings.
2. Windows shall consist of steel and/or aluminum reinforcement secured to UPVC profiles at max 100mm from the ends of the reinforcement and at a spacing of max 400mm c/c between two ends.
3. Reinforcement shall be secured to profiles with self-tapping screws.
4. Drainage slots shall be provided in the outer chamber of the profile. All horizontal members, except heads of the outer frame, shall have drainage slots of min 5mm wide and 30mm long.
5. EPDM weather seals shall be fitted in the continuous lengths, inserted in the weather seal grooves. Joints in the vent weather seals shall be placed at the bottom and at top in the outer frame.
6. Friction stays shall be of high-quality stainless steel and nylon component for improved durability.
7. Windows shall be provided with necessary hardware as per manufacturer's details and specification.
8. The workmanship shall be absolutely top class and of international standards and final finish shall conform to approve sample.
9. Upon delivery, window profiles shall have protective wrapping. On completion of installation work, the cover shall be removed, and windows shall be cleaned for inspection and approval.
10. Manufacturer's guidelines shall be followed for cleaning the surface.
11. BIDDER shall provide warranty for installed hand railing system for the period described herein, starting from date of completion of installation work. When notified in writing from Owner, BIDDER/installer shall promptly correct the said deficiencies, without inconvenience and extra cost to owner.

MOCK-UP

1. The BIDDER shall prepare and install mock-up samples as per approved shop drawings.
2. Mock-up samples shall be of full size and shall be true representation of actual works to be carried out at site. Mock-ups may be part of completed work if undisturbed.

STORAGE, HANDLING & DELIVERY

1. No doors/windows shall be delivered to the building until weatherproof storage space is available. Material received at site shall be with original



packing and labeled. It shall be kept intact under lock and key till issued for use of site.

2. Store finished shop work in weather tight well-ventilated structures or in space in existing buildings designated.
3. Finished shop work shall not be installed in any room or space where concrete, masonry, or plaster work is not completed and dry.
4. BIDDER shall use all means necessary to protect doors, windows and associated fittings from damage prior to, during, and after installation. All damaged items shall be repaired or replaced by the BIDDER at no cost to the owner.

5 BUILDER'S HARDWARE / IRONMONGERY

5.1 GENERAL

This specification covers the general requirements for hardware such as hinges, locks, stays, stoppers, handles etc. for doors, windows, and ventilators and other related works forming a part of this job, which may be required to be carried out though not specifically mentioned above. The work under this specification shall consist of furnishing of all tools, labour, materials and everything necessary for carrying out the work.

5.2 APPLICABLE CODES AND STANDARDS

Work shall be carried out as per latest edition of Indian Standards and Code of Practices. List given here shall not be considered as conclusive and is for reference and guidance only. Any discrepancies/ conflict noticed shall be brought to the notice of Architect/Engineer in charge for direction / approval. However, as a general rule more stringent specification shall take precedence.

IS: 204	Tower bolts (ferrous and non-ferrous metals)
IS: 205	Non-ferrous metal butt hinges
IS: 208	Door handles
IS: 281	Mild steel sliding door bolts for use with padlocks.
IS: 362	Parliament hinges
IS: 1200	Part VII Hardware
IS: 1341	Steel butt hinges
IS: 1823	Floor door stoppers
IS: 2209	Mortise locks (vertical type)
IS: 2681	Nonferrous metal sliding door bolts for use with pad locks
IS: 3564	Door closers (hydraulically regulated)



- IS: 4992 Door handles for mortise lock (vertical type)
- IS: 6607 Rebated mortise locks (vertical type)
- IS: 7196 Hold fasts
- IS: 7197 Double action floor springs (without oil check for heavy doors)
- IS: 7534 Mild steel bolts with holders for pad locks
- IS: 7881 Glossary of items relating to building hardware

5.3 MATERIALS AND WORKMANSHIP

All ironmongery shall be of first quality and shall be obtained from an approved manufacturer. Butt hinges shall be aluminum alloy, stainless steel or brass as specified with double stainless-steel washers.

The size, materials, finishes, type and quality of ironmongery shall be as described in the schedule of ironmongery.

Unless otherwise shown and/or scheduled in the drawings, the BIDDER shall supply and fix all ironmongery as listed in the Schedule of Ironmongery attached in the project document, complete with fixing screws of the same material and finish.

Proper sockets shall be provided for all bolts to fix flush in floors, cills and door/window/ventilator frames. Each lock shall be provided with minimum two keys and no two locks shall have identical keys, unless specifically required.

The use of nails for fixing ironmongery will not be permitted. The BIDDER shall hand over all work in a finished state and to the satisfaction of owner.

On completion of all locks, catches and similar items of ironmongery they are to be properly cleaned, tested and oiled, and all keys are to be clearly labeled. All locks provided shall be anti-theft.

Master-keying, suiting and grouping of locks shall be according to a master key schedule.

5.4 MOCK-UP

BIDDER shall prepare full size mock-up after sample approval for typical Doors and Windows and install at location approved by owner for final



approval at no extra cost as specified in the Special Conditions of the Contract.

5.5 STORAGE, HANDLING & DELIVERY

The material shall be supplied in the manufacturer's original packages and containers with labels intact and legible, including installation instructions, templates and maintenance manuals, if any.

Packaging of hardware shall be in complete individual sets for each door/window/ventilator clearly labeled to show intended locations complete with all required fixings.

Any items or parts which are damaged or defaced or found to be defective shall be replaced at the BIDDER's expense before handing over.

5.6 IRONMONGERY

Ironmongery shall be first quality to be obtained from an approved manufacturer as specified.

The BIDDER shall submit a schedule of ironmongery for the approval of the Engineer before placing any supply order. The Engineer's approval of such schedule shall not relieve the BIDDER from furnishing all items of hardware required under the contract.

6 GLASS AND GLAZING

6.1 GENERAL

This part of the specification covers the requirement of providing fitting and fixing in position of glazing of different thickness comprising of clear float glass, wired glass, tinted glass, including curtain glass and hermetically sealed composite double glazing complete with all clips, putty, mastic, etc.

6.2 APPLICABLE CODES AND STANDARDS

Work shall be carried out as per latest edition of Indian Standards and Code of Practices. List given here shall not be considered as conclusive and is for reference and guidance only. Any discrepancies/ conflict noticed shall be brought to the notice of Architect/Engineer in charge for direction / approval. However, as a general rule more stringent specification shall take precedence.

IS: 1200 Part XIV Glazing

IS: 419 Putty for use on window frames



- IS: 1081 Code of practice for fixing and glazing of metal doors, windows, and ventilators
- IS: 2553 Safety glass for general purpose (Part 1)
- IS: 3548 Code of practice for glazing's in buildings
- IS: 5437 Figured rolled and wired glass
- IS: 5623 Determination of co-efficient of linear thermal expansion
- IS: 14900 Transparent float glass

6.3 MATERIALS

All glass and glazing shall have uniform reflective index and free from flaws, specs and bubbles.

The glass shall be brought to site in the original packing from the manufacturer and cut to size at site. The cut edges shall be straight and free from chips, splits or any other damages.

Clear glass shall be float glass and shall be of thickness as specified in the schedule of items. Properties of float glass shall generally meet the requirements of IS: 14900.

Wired glass shall be thick rolled glass with centrally embedded wire mesh of Georgian type conforming to IS: 5437

Composite double glazing shall be made of two 6mm thick clear float glass on either sides and separated by 12mm air gap. The trapped air shall be kept dry by means of suitable desiccant. The glass shall be hermetically sealed. The composite double glazing shall be procured as finished product.

The curtain glazing shall consist of minimum 8mm thick heat strengthened glass fixed with framework made of aluminum sections designed as per structural requirements.

The silicone sealant shall be of best quality and shall be brought to site in manufacturer's original packing.

6.4 WORKMANSHIP

All glazing clips, putty, mastic etc. shall be provided as required.

All glasses shall be thoroughly cleaned before setting in position. Wherever required, glass pane shall be held in place by special glazing clips of approved type. Minimum four glazing clips shall be provided per glass pane except for large panes where six or more clips shall be used. All holes that



may be necessary on doors/windows/ventilators etc. for holding the clips, glazing beads and all other attachments shall be drilled in position. Glass panes shall be set without springing, and shall be bedded in putty and back puttied, except where moulding or gasket are provided. Putty, mastic etc. shall be smoothly finished to a true even line.

After completing the glazing work, BIDDER shall remove all dirt, stains, excess sealants and clean the glass panes and leave the work in perfectly



acceptable condition. All broken, cracked or damaged glass shall be replaced by new ones without any extra cost to the owner.

The glass must be protected during installation period so that they will not be damaged by splashing of cement, welding, grinding etc.

Labels, tapes, adhesives, writing with chalk or any other tool shall never be done on the coating of glazing.

After completion of installation, the glazing shall be immediately washed with clean water.

When assembling and installing the glazing, the coating shall be positioned as indicated in the drawing.

Glazing shall be carefully done to avoid the contact with metal frames.

6.5 MOCK-UP

The BIDDER shall prepare and install mock-up samples as per approved shop drawings.

Mock-up samples shall be of full size and shall be true representation of actual works to be carried out at site. Mock-ups may be part of completed work if undisturbed.

STORAGE, HANDLING & DELIVERY

1. Material received at site shall be with original packing and labels. It shall be intact till issued for use of site.
2. Material shall be stored at properly covered dry location and shall be safe from damage.
3. All items shall be protected from dampness both during and after delivery to site.
4. Partition shall not be installed in any room or space where concrete, masonry, or plaster work is not completed and dry.
5. Care must be taken to ensure that the frames and panels of partition works are not damaged while transporting/erection.

7 PARTITION WORKS

7.1 GENERAL

This specification covers the general requirements for fabrication and erection of wooden / aluminum / gypsum board partitions and other related works forming a part of this job, which may be required to be carried out though not specifically mentioned above. The work under this specification



shall consist of furnishing of all tools, labour, materials and everything necessary for carrying out the work.

7.2 APPLICABLE CODES AND STANDARDS

Work shall be carried out as per latest edition of Indian Standards and Code of Practices. List given here shall not be considered as conclusive and is for reference and guidance only. Any discrepancies/ conflict noticed shall be brought to the notice of Architect/Engineer in charge for direction / approval. However, as a general rule more stringent specification shall take precedence.

IS: 287	Permissible moisture content for timber used for different purposes.
IS: 303	Plywood for general purpose
IS: 710	Marine plywood
IS: 733	Wrought aluminum and aluminum alloys, bars, rods and sections for general engineering purposes.
IS: 848	Synthetic resin adhesives for plywood
IS: 1328	Veneered decorative plywood
IS: 1868	Anodic coating on aluminum and its alloys.
IS: 1948	Aluminum doors, windows and ventilators
IS: 1949	Aluminum windows for industrial buildings
IS: 2095	Gypsum plaster boards
IS: 2191	Plywood face panels
IS: 2542	Method of test for gypsum plaster
IS: 2835	Flat transparent sheet glass
IS: 3144	Methods of test for mineral wool thermal insulation materials
IS: 3513	Resin treated compressed wood laminates
IS: 3677	Unbonded rock and slag wool for thermal insulation
IS: 4021	Timber door, window and ventilator frames
IS: 5509	Fire retardant plywood
IS: 5523	Methods of testing anodic coatings on aluminum
IS: 5437	Figured rolled and wired glass



IS: 8183 Bonded mineral wool

IS: 13871 Powder Coatings

BS: 2972 Methods of test for inorganic thermal insulating materials

7.3 WOODWORK IN PARTITIONS

MATERIALS

1. Timber to be used shall be first class Teak wood as per IS: 4021. Timber shall be of the best quality and well-seasoned by a suitable process before being planned to the required sizes. The maximum permissible moisture content shall be from 10 to 16 percent for timber 50mm and above in thickness and 9 to 14 percent for timber less than 50mm in thickness for different regions of the country as stipulated In IS: 287.
2. Timber shall be close grained, of uniform colour and free from decay, fungal growth, boxed heart, pitch pockets or streaks on the exposed edges, borer holes, splits and cracks.
3. Transparent sheet glass shall conform to the requirements of IS: 2835. Wired and figured glass shall be as per IS: 5437.
4. Builder's hardware of fittings and fixtures shall be of the best quality from approved manufacturers.

WORKMANSHIP

1. The workmanship and finish of woodwork in partitions shall be of a very high order. BIDDER shall ensure that work is executed in a professional manner by skilled carpenters for good appearance, efficient and smooth operation of the shutters.
2. All works shall be executed as per the detailed drawings and/or as directed by the ENGINEER.
3. The framework of the partitions with mullions and transoms shall be with the sections of dimensions as per the item at work. Panels of double/single glazing/ plywood shall be fixed as per details indicated in the drawings.
4. Partitions shall be fixed rigidly between the floor and structural columns/beams including provision of necessary shims for wedging etc. Finished work shall be of rigid construction, erected truly plumb to the lines and levels, at locations as per the construction drawings.
5. The face of the frames abutting the masonry or concrete shall be provided with a coat of coal tar.
6. Glazing of partitions shall be with either flat transparent sheet glass or figured glass. Transparent sheet glass shall be of 'B' quality as per IS: 2835. The thickness and type of glazing to be provided shall be as specified in the item of work.
7. The material of the fittings and fixtures either of chromium plated steel, cast brass, copper oxidized or anodized aluminum shall be as specified



in the item of work. The number, size and type of the fittings and fixtures shall be as indicated in the drawings/item of work.

8. Woodwork shall not be provided with the finishes of painting, galvanizing etc. unless it has been approved by the ENGINEER. The type of finish and the number of coats shall be as stipulated in the respective items of work.
9. Any carpentry work which shows defects due to inadequate seasoning of the timber or bad workmanship shall be removed and replaced by BIDDER with work as per specification requirements, at no extra cost to the OWNER.

7.4 ALUMINUM PARTITIONS

MATERIALS

1. Aluminum alloy used in the manufacture of extruded sections for the fabrication of doors, windows, ventilators shall conform to designation 63400 WP of IS:733.
2. Transparent sheet glass shall conform to the requirements of IS: 2835. Wired and figured glass shall be as per IS: 5437.
3. Builder's hardware of fittings & fixtures shall be of the best quality from approved manufacturers.

WORKMANSHIP

1. All aluminum partitions shall be of the type as specified in the respective items of work and of sizes as indicated in the drawings.
2. All aluminum units shall be supplied with anodized/powder coated finish. The minimum anodic film thickness shall be 0.015 mm.
3. Aluminum partitions shall be as described in the item of work and/or bid drawings which indicates generally the arrangement along with the overall size of the various components and weight per running meter of the extruded sections to be adopted.
4. IS:1948 and IS:1949 are referred to incorporate the sizes, shapes, thicknesses and weight per running meter of extruded sections for the various components of the units. However, new sizes, shapes, thicknesses with modifications to suit snap-fit glazing clips etc. are continuously being added by various leading manufacturers of extruded sections, which are available in the market. As such, the sections of the various components of the unit proposed by the BIDDER, will be reviewed by the ENGINEER and will be accepted only if they are equal to or marginally more than that specified in the codes/ item of works.
5. The framework of the partitions with mullions and transoms shall be with anodized/powder coated aluminum extruded sections of dimensions as per the item of work. Anodized/powder coated Aluminum extruded sections shall be in-filled with timber of class 3 (silver oak or any other equivalent) as per IS:4021. Panels of double/single glazing/plywood shall be fixed as per details indicated in the drawing. Partitions shall be fixed rigidly between the floor and the structural columns/beams including



provision of necessary shims for wedging etc. Finished work shall be of rigid construction, erected truly plumb to the lines and levels, at locations as per the construction drawings.

6. Specific provisions as stipulated for steel doors, windows, ventilators shall also be applicable for this item work. Glazing beads shall be of the snap-fit type suitable for the thickness of glazing proposed as indicated in the item of work. A layer of clear transparent lacquer shall be applied on aluminum sections to protect them from damage during installation. This lacquer coating shall be removed after the installation is completed.

7.5 GYPSUM BOARD PARTITION

MATERIALS

1. The gypsum board used in partition works shall be of minimum thickness as specified in IS: 2095 & IS: 2542.
2. GI frame shall include 48mm studs (0.55mm thick having one flange of 34mm and another flange of 36mm made of GI steel) placed at 610mm c/c vertically, in 50mm thick floor and ceiling channel (0.55m, m thick having equal flanges of 32mm made of GI steel).
3. Glass wool of density 24Kg/cum shall comply with BS: 476 Part 4, 1970.

WORKMANSHIP

1. Single Skin Partition shall consist of 13mm thick plaster board screw fixed with 25mm dry wall screw at 300mm c/c to either side of stud framework. Necessary cut-outs shall be provided in the partition to receive cable raceways, electrical/HVAC fittings and fixtures, which shall be neatly finished after fixing the fixtures thereby leaving no gaps. Square and tapered edges of the boards shall be jointed and finished to have a flushed look including filling and finishing with jointing compound, joint paper tape and two coats of drywall topcoat suitable for gypsum board. Glass wool shall be rot proof and odourless. The moisture content shall be less than 2% in accordance with BS: 2972. The water absorption shall be less than 2% in accordance with BS: 2972. The gypsum board shall be continued up to true ceiling or shall be stopped 100mm above false ceiling. The partition shall be finished to take on wallpaper / paint directly by applying suitable base coats, prime coats etc. complete.
2. **Double Skin Partition** shall include first skin consist of 13mm thick tapered edge plaster board screw fixed with 25mm dry wall screw at 300mm c/c to either side of stud framework. Necessary cut-outs shall be provided in the partition to receive cable raceways, electrical/HVAC fittings and fixtures, which shall be neatly finished after fixing the fixtures thereby leaving no gaps. The layer shall be finished to take on second skin in gypsum board/Plywood/ MDF directly. The first skin of the partition shall be continued up to true ceiling. Second skin shall consist of 13mm thick tapered edge plaster board screw fixed with 35mm dry wall screw at 300mm c/c to existing first skin of partition. Care shall be taken that the joints are staggered to avoid leakage. Finally square and tapered



edges of the boards shall be joined and finished to have a flush look including filling and finishing with jointing compound, joint paper tape and two coats of drywall topcoat suitable for gypsum board. The second skin of partition shall be stopped 100mm above false ceiling. Necessary cut-outs shall be provided in the partition to receive cable raceways, electrical/HVAC fittings and fixtures, which shall be neatly finished after fixing the fixtures thereby leaving no gaps. The partition shall be finished to take on wall paper / paint directly by applying suitable base coats, prime coats etc. complete. Skirting shall be provided with 100mm high and 12mm thick commercial plywood backing fixed to gypsum backing and finished with 1.5mm laminate. The skirting shall be flushed to the surface of partition in line and level and 6mm wide groove to be made in the partition at the junction and inclusive of SS/Aluminum inserted between the groove formed. The strip shall be glued to the surface with instant glue of approved make. The stone/tile shall be fixed to the ply by means of approved adhesive. 50mm thick glass wool insulation of density 24 Kg/cum shall be wrapped in RP tissues as per manufacturer's specifications. Glass wool shall be non- combustible and shall be chemically inert. Application shall not cause or accelerate corrosion.

STORAGE, HANDLING & DELIVERY

1. Material received at site shall be with original packing and labels. It shall be intact till issued for use of site.
2. Material shall be stored at properly covered dry location and shall be safe from damage.
3. All items shall be protected from dampness both during and after delivery to site.
4. Partition shall not be installed in any room or space where concrete, masonry, or plaster work is not completed and dry.
5. Care must be taken to ensure that the frames and panels of partition works are not damaged while transporting/erection.

8 FALSE CEILING WORKS

8.1 GENERAL

This specification covers the general requirements for fabrication and erection of aluminum / gypsum board false ceilings and other related works forming a part of this job, which may be required to be carried out though not specifically mentioned above. The work under this specification shall consist of furnishing of all tools, labour, materials and everything necessary for carrying out the work.

8.2 APPLICABLE CODES AND STANDARDS

Work shall be carried out as per latest edition of Indian Standards and Code of Practices. List given here shall not be considered as conclusive and is for reference and guidance only. Any discrepancies/ conflict noticed shall be brought to the notice of Architect/Engineer in charge for direction / approval.



However, as a general rule more stringent specification shall take precedence.

IS: 1658 Fibre hard boards

IS: 13871 Powder Coatings

8.3 MINERAL FIBRE BOARD FALSE CEILING

MATERIALS

1. The hard fiber board to be used in false ceiling shall be of an approved manufacture as per IS: 1658 or as approved by the Owner.
2. The fiber boards shall be made from substances compound of vegetable fibers such as wood pulp, wood chips or shavings bonded by a synthetic resin. Veneered particle boards shall have a core of particle board sandwiched or glued in between two or more veneers on outer surfaces.
3. The fiber boards shall be fire resistant, termite and insect resistant, weather resistant, acoustically satisfactory, dimensionally stable, warp-free, easily workable, treated with anti-fungus chemicals, heat insulated and of adequate structural strength and should have good surface finish as approved by the Owner.
4. The size of fiber board ceiling tile shall generally be 600 x 600 x 12 mm thick. All types of boards and ceiling tiles shall be stored flat under cover at a clean dry place on firm ground. The BIDDER should ensure that boards are not stacked on termite infected, wet or loose ground. The boards should be always carried on edges.
5. The metal framework shall be interlocking type and made of sections of light metal, such as extruded anodized aluminum. The shape and cross section shall be such as to facilitate proper suspension and proper fixing of the ceiling boards covering them and shall be structurally sound and rigid.

WORKMANSHIP

1. The BIDDER shall ensure that the frame to support the ceiling is designed for its structural strength to withstand the weight of ceiling boards to be fixed, live load of 75 kg/m², and other loads such as that of air- conditioning ducts, grills, electrical wiring and lighting fixtures, thermal insulation, etc. as shown on the drawings. The BIDDER shall also submit a detailed drawing to show the grid work, sizes of grid members, method of suspension, position of openings for air-conditioning and lighting, access doors, etc.
2. The metal framework of extruded anodized aluminum false ceiling grid system shall consist of aluminum main members of special T-profile of 32 mm x 32 mm interlocking with each other and run both ways at 600 mm centre to centre. The aluminum false work shall be suspended from the roof structures by means of aluminum painted steel hangers at



- suitable intervals and supported at the walls by means of extruded aluminum wall angles.
3. In the case of aluminum grid system, boards are just placed into the frames formed by the main 'T' members and the cross members fitted with the clips for locking the boards. BIDDER should take utmost care so as not to force the boards in position, and a very little gap is preferable to a tight joint. Fixing fiber boards by adhesives shall not be permitted unless approved by the Owner. The fiber boards should be cut with a fine-toothed saw, if required.
 4. The hard boards shall be conditioned by wetting the screen surface with clean water by a sponge or brush. The damp boards should be stacked back-to-back on flat surface at site for 48 hours and then fixed immediately. Conditioning if required shall be done as per the manufacturer's specifications.
 5. As the work of false ceiling may be interconnected with the work of air-conditioning ducts and lighting, the BIDDER shall fully cooperate with other agencies entrusted with the above works and who may be working simultaneously. The BIDDER shall provide necessary openings, in the false ceiling work for air- conditioning, lighting and other fixtures. Additional framing, if required, for the above openings shall also be provided at no extra cost to the Owner. Removable or hinged type inspection or access trap doors shall be provided at locations specified by the Owner.

8.4 THERMAL INSULATION OF CEILINGS

MATERIALS AND WORKMANSHIP

Thermal Insulation material consisting of boards slabs and rolls of approved manufacturer, shall be of approved thermal conductivity for creating the required design conditions and shall be provided as indicated in item of works and as shown in the drawings. The insulation shall be provided after the sample is approved by the Owner.

STORAGE, HANDLING & DELIVERY

1. Material received at site shall be with original packing and labels. It shall be intact till issued for use of site.
2. Material shall be stored at properly covered dry location and shall be safe from damage.
3. Care must be taken to ensure that the floor tiles are not damaged while loading / unloading and transporting. Tile packages shall not be stacked higher than 2m.
4. Cartons must always be stored with designated side upwards.



9 TOILET CUBICLES

9.1 GENERAL

Specification applies to steel toilet partitions / cubicles with doors and hardware for fixing and mounting of the panels as per architect's design, plans and schedules. The scope of work includes design, supply, installation and handling except civil works.

9.2 APPLICABLE CODES AND STANDARDS

Work shall be carried out as per latest edition of Indian Standards and Code of Practices. List given here shall not be considered as conclusive and is for reference and guidance only. Any discrepancies/ conflict noticed shall be brought to the notice of Architect/Engineer in charge for direction / approval. However, as a general rule more stringent specification shall take precedence.

IS 277 Galvanized steel sheets (plain and corrugated)

9.3 MATERIALS

All clamps, fittings, accessories should be made out of first grade quality galvanized steel conforming to IS 316. All products should be made out of 0.6mm (24g) galvanized sheet.

All galvanized steel fittings and accessories should be cleaned, phosphatized and finished with one coat of epoxy etching primer of 30 microns of polyurethane paint. All panels / doors should be oven baked for durability and finish.

All panels should have a built-in feature to be totally sight proof on all four corners for better privacy. Standard gap of 150mm on sides and on moving element has to be provided unless otherwise specified or scheduled in the drawing or layout.

Cubicles should have a provision for mounting of the toilet hardware like handrails, hinges, locks with indicator, coat hooks, tissue holders and taps



as per scheduled and specified. All panels should be fully protected with the self-adhesive film and to be removed at the handing over of the cubicles.

Compartment Depth and Width: As per the drawings

Door Width: As per the drawings.

Height above Floor: As per Vendor Specifications

Door Height: As per Vendor Specifications

Pilaster Height: As per Vendor Specifications



10 SANITARY FIXTURES & FITTINGS

10.1 GENERAL

The scope of this section consists of but is not necessarily limited to installation, testing and commissioning of Sanitary appliances and fixtures for toilets, Steel, Chromium plated, brass fittings, Stainless steel sinks, Accessories e.g. towel rods, toilet paper holders, soap dish, towel rails, coat hooks, hand dryers, mirrors, liquid soap dispensers etc.

Whether specifically mentioned or not the BIDDER shall provide for all appliances and fixtures, all fixing devices, nuts, bolts, screws, hangers as required.

All exposed pipes within toilets and near appliances/fixtures shall be of chromium plated brass or copper unless otherwise specified.

10.2 APPLICABLE CODES AND STANDARDS

Work shall be carried out as per latest edition of Indian Standards and Code of Practices. List given here shall not be considered as conclusive and is for reference and guidance only. Any discrepancies/ conflict noticed shall be brought to the notice of Architect/Engineer in charge for direction / approval. However, as a general rule more stringent specification shall take precedence.

IS:771 (Part 1 to 3)	Specification for glazed fire clay sanitary appliances.
IS: 774	Specification for flushing cistern for water closets and urinals (other than plastic cistern)
IS: 775	Specification for cast iron brackets and supports for wash basins and sinks
IS: 781	Specification for cast copper alloy screw down bib taps and stops valves for water services.
IS: 1700	Specification for drinking fountains.
IS: 2548 (Part 2)	Specification for plastic seats and covers for water closets: Part 1 Thermoset seats and covers.
IS: 2556 (Part 1)	Specification for vitreous sanitary appliances (Vitreous china) :



	Part 1 General requirement.
IS: 2556 (Part 2)	Specification for vitreous sanitary appliances (vitreous china): Part 2 Specific requirements of wash-down water closets.
IS: 2556 (Part 3)	Specification for vitreous sanitary appliances (vitreous china): Part 3 Specific requirements of squatting pans.
IS: 2556 (Part 4)	Specification for vitreous sanitary appliances (vitreous china): part 4 specific requirements of wash basins.
IS: 2556 (Part 6 Sec 2)	Specification for vitreous sanitary appliances (vitreous china): part 6 Specific requirements of urinals, section 2 half stall urinals.
IS: 2556 (Part 6 Sec 4)	Specification for vitreous sanitary appliances (vitreous china): Part 6 specific requirements of urinals, section 4 partition slabs.
IS: 2556 (Part 6 Sec 5)	Specification for vitreous sanitary appliances (vitreous china): Part 6 Specific requirements of urinals, section 5 waste fittings.
IS: 2556 (Part 6 Sec 6)	Specification for vitreous sanitary appliances (vitreous china): Part 6 Specific requirements of urinals, section 6 water spreaders for half stall urinals.
IS: 2556 (Part 7)	Specification for vitreous sanitary appliances (vitreous china): Part 7 Specific requirements of half round channels.
IS: 2556 (Part 8)	Specification for vitreous sanitary appliances (vitreous china): Part 8 Specific requirements of siphoning wash down water closets.



IS: 2556 (Part 11)	Specification for vitreous sanitary appliances (vitreous china): Part 11 Specific requirements for shower rose.
IS: 2556 (Part 12)	Specification for vitreous sanitary appliances (vitreous china): Part 12 Specific requirements of floor traps.
IS: 2556 (Part 15)	Specification for vitreous sanitary appliances (vitreous china): Part 15 Specific requirements of universal water closets.
IS: 2692	Specification for ferrule for water services
IS: 2717	Glossary of terms relating to vitreous enamelware and ceramic metal systems
IS: 5961	Specification for cast iron gratings for drainage purposes.
IS: 8931	Specification for copper alloy fancy single taps, combination tap assembly and stop valves for water services.
IS: 9758	Specification for flush valves and fitting for water closets and urinals.

10.3 MATERIALS

Water Closet

1. Water Closet shall be wash down or symphonic wash down type floor or wall mounted set, as shown in the drawings, designed for low volume flushing from 2-6 liters of water to be flushed by means of a porcelain flushing cistern or an exposed or concealed type (as detailed in the drawings or as directed by the Owner's Site Representative) 32 mm size CP, brass flush valve with regulator valve.
2. Flush pipe / bend shall be connected to the WC by means of a suitable rubber adaptor. Wall hung WC shall be supported by CI floor mounted



chair which shall be fixed in a manner as approved by the Owners/Site Representative.

3. Each WC set shall be so fixed that it remains absolutely stationary in vertical position without falling down on the WC.
4. Each WC set shall be provided with approved quality of seat, rubber buffers and chromium plated hinges. Seat shall be so fixed that it remains absolutely stationary in vertical position without falling down on the WC.
5. Each WC shall be provided with 110 mm dia (OD) PVC Pan Connector connecting the ceramic outlet of WC to CI pipe.

Cisterns / Flush Valve

Low level flushing cistern (exposed or concealed) shall be provided for WC with dual flushing facility in specified toilets. BIDDER shall install cistern in accordance to the manufacturer's specification to the satisfaction of the Owner/Site Representative.

Wash Basin

1. Wash basins shall be white /coloured glazed vitreous china of size, shape and type specified in the Schedule of Quantities.
2. Each basin shall be provided with painted MS angle or CI brackets and clips and the basin securely fixed to wall/counter slab. Placing of basins over the brackets without secure fixing shall not be accepted. The MS angle shall be provided with two coats of red oxide primer and two coats of synthetic enamel paint of make, brand and colour as approved by the Owner's Site Representative. The cost of fixing the basin shall be inclusive of supply and installation of brackets as described above.
3. Each basin shall be provided with 32mm dia CP waste with overflow, pop-up waste or rubber plug, and CP brass chain as specified in the Schedule of Quantities.
4. Each basin shall be provided with hot and cold-water mixing fitting or as specified in the Schedule of Quantities. Wash Faucets shall be sensor controlled and shall have an added aerator to reduce flow to 2.0 LPM.
5. Flow Rate = 2 Liters per minute @ 58 PSI, all others except private applications. (As per LEED requirement)

Sinks

1. Sinks shall be stainless steel, or any other material as specified in the Schedule of Quantities.
2. Each sink shall be provided with painted MS or CI brackets and clips and securely fixed. Countertop sinks shall be fixed with suitable painted angle iron brackets or clips as recommended by the manufacturer. Each sink shall be provided with 40mm dia CP waste and rubber plug with CP brass chain as given in the Schedule of Quantities. The MS angle shall be provided with two coats of red oxide primer and two coats of synthetic enamel paint of make, brand and colour as approved by the Owner's site representative.
3. Sanitary fittings for sinks shall be deck mounted or wall mounted CP swivel faucets with or without hot and cold-water mixing fittings as



specified in the Schedule of Quantities. Installation of fittings shall be measured and paid for separately.

4. Flow Rate = 2 Liters per minute @ 58 PSI, all others except private applications. (as per LEED requirement)

Janitor's Sink

1. Janitor's sink shall be stainless steel, single bowl type of size as called for in the Schedule of Quantities, provided with painted R.S. or CI brackets and clips and securely fixed. Each sink shall be provided with 40mm dia CP waste. Fixing shall be as directed by the Owner's Site Representative. The supply fittings for Janitor's sink shall be wall mounted type of size as mentioned in Schedule of Quantities.

Drinking Water Fountain

2. Drinking water fountain shall be wall mounting type made of vitreous china, stainless steel or any other material as given in the Schedule of Quantities. The drinking water fountain shall be with anti-squirt bubble less, self-closing valve type with automatic volume regulator. The drinking water fountain shall be provided with an anti-splash back and integral strainer with 32mm or 40mm cast brass trap.

Liquid Soap Dispenser

Liquid Soap Dispenser shall be wall/counter mounted suitable for dispensing liquid soaps, lotions, detergents. The cover shall lock to body with concealed locking arrangement, opened only by key provided. Liquid soap dispenser body and shank shall be of high impact resistance material. The piston and spout shall be stainless steel with 1 litre capacity polyethylene container. The valve shall operate with less than 2.27 Kg (5 lbs) of force.

Hand Drier

The hand drier shall be no touch operating type with solid state time delay to allow user to keep hand in any position. The hand drier shall be fully hygienic, rated for continuous repeat use (CRU). The rating of hand drier shall be such that time required to dry a pair of hands up to wrists is approximately 30 seconds. The hand drier shall be of wall mounting type suitable for 230 V, single phase, 50 Hz, AC power supply.

Shower Set

1. Shower set shall comprise of two CP brass concealed stop cocks, four/five way auto-diverter, adjustable type over-head shower with CP shower arm, all with CP wall flanges of approved quality all as specified in the Schedule of Quantities. Bath spout, hand showers and pop-up wastes shall also be provided wherever, specified. Wall flanges shall be



kept clear off the finished wall. Wall flanges embedded in the finishing shall not be accepted.

2. Flow Rate = < 6.1 Liters per minute @ 58 PSI (as per LEED requirement)
3. Flow Control Device
4. Approved / rated flow control fitment in brass body, chrome outer cover, rated for flow / discharge of the fixture.

Toilet Paper Holder

1. Toilet paper holder shall be white glazed vitreous china or chrome plated of size, shape and type specified in the Schedule of Quantities.
2. Porcelain toilet paper holder shall be fixed in walls and set in cement mortar 1:2 (1 cement: 2 coarse sand) and fixed in relation to the tiling work.
3. The latter (chrome) shall be fixed by means of screws/capping having finish similar to the toilet paper holder in wall/temper partitions with rawl plugs or nylon sleeves. When fixed on timber partition, it shall be fixed on a solid wooden base member provided by the Owner's Site Representative.

Towel Rail

1. Towel rail shall be chromium plated brass or of stainless steel or powder coated brass of size, shape and type specified in the Schedule of Quantities.
2. Towel rail shall be fixed with screws/capping having finish similar to the towel rail in wall with rawl plugs or nylon sleeves and shall include cutting and making good as required or directed by the Owner's Site Representative.

Urinals

3. Urinals shall be lipped type half stall with glazed vitreous China of size as called for in the Bill of Quantities.
4. Half stall urinals shall be provided with 15mm dia CP spreader, 32mm dia CP domical waste and CP cast brass bottle trap with pipe and wall flange and shall be fixed to wall by CI brackets, CI wall clips and CP brass screws as recommended by manufacturer complete as directed by the Owner's Site Representative.
5. Flushing for urinals shall be by means of no hand operation, infrared electric flush valve with complete kit of plumbing, electrical and electronic items, infrared photocells, solenoid valve transformer and electrical connection. The automatic flush sensor plate shall be flush and press



fitted and shall be of high quality mirror polish finish. Each urinal shall be provided with one flush valve unit.

6. Flush pipes shall be GI pipes concealed in wall chase but with chromium plated bends at inlet and outlet.
7. Flow Rate = 4.0 Litres per Flush. 8.5 Liters per minute @ 4 Bar 58 PSI, private applications only (as per LEED requirement)

TOILETS FOR THE DISABLED

1. Where specified, in washroom facilities designed to accommodate physically disabled, accessories shall be provided as directed by the Owner's Site Representative. Stainless steel garb brass of required size suitable for concealed or exposed mounting and opened non-slip gripping surface shall be provided in all washrooms. The flushing cistern/valve shall be provided with chromium plated long handles.
2. The BIDDER shall provide all the necessary supporting and fixing devices to install the sanitary fixtures and fittings securely in position. The fixing devices shall be rigidly anchored into the building structure. The devices shall be rust resistant and shall be so fixed that they do not present an unsightly appearance in the final assembly. Where the location demands, the Architect may instruct the BIDDER to provide chromium plated or other similarly finished fixing devices. In such circumstances the BIDDER shall arrange to supply the fixing devices and shall be installed complete with appropriate vibration isolating pads, washers and gaskets.

10.4 WORKMANSHIP / FABRICATION & ERECTION

All appliances, fixtures and fittings shall be provided with all such accessories as are required to complete the item in working condition whether specifically mentioned or not in the Schedule of Quantities, specifications, and drawings. Accessories shall include proper fixing arrangements, brackets, nuts, bolts, washers, screws and required connection pieces.

The sanitary fixtures and fittings shall be installed at the correct assigned position as shown on the drawings and as directed by the Architect / Owner's Site Representative and shall fully meet with the aesthetic and symmetrical requirements as demanded by the Architect / Interior Designer

All fixtures and accessories shall be fixed in accordance with a set pattern matching the tiles or interior finish as per Architect requirements. Wherever



necessary, the fittings shall be centered to dimensions and pattern as called for.

Fixing screws shall be half round head chromium plated (CP) brass screws, with CP brass washers unless otherwise specified.

Fixtures shall be installed by skilled workman with appropriate tools according to the best trade practice.

All appliances, fittings and fixtures shall be fixed in a neat workmanlike manner true to level and to heights shown on the drawings and in accordance with the manufacturers' recommendations. Care shall be taken to fix all inlet and outlet pipes at correct positions. Faulty locations shall be made good and any damage to the finished floor, tiling, plaster, paint, insulation or terrace shall be made good by the BIDDER at his own cost. Fixtures shall be mounted rigid, plumb and true to alignment.

All materials shall be rust proofed; materials in direct or indirect contact shall be compatible to prevent electrolytic or chemical (bimetallic) corrosion.

Wall flanges shall be provided on all walls, floors, columns etc. wherever supply and disposal pipes pierce through them. These wall caps shall be or chromium plated brass fittings and the receiving pipes and shall be large enough to cover the punctures properly.

Sanitary appliances, subject to the type of appliance and specific requirements, shall be fixed in accordance with the relevant standards and the following:

BIDDER shall, during the entire period of installation and afterwards protect the appliances by providing suitable cover or any other protection so as to absolutely prevent any damage to the appliances until handing over (The original protective wrapping shall be left in position for as long as possible)

The appliances shall be placed in correct position or marked out in order that pipe work can be fixed or partially fixed first.

The appliance shall be fixed in a manner such that it will facilitate subsequent removal if necessary.

The appliance shall be securely fixed. Manufacturer's brackets and fixing methods shall be used wherever possible. Compatible rust-proofed fixings



shall be used. Fixing shall be done in manners that minimize noise transmission.

Appliances shall not be bedded (e.g. WC pans, pedestal units) in thick strong mortar that could crack the unit (e.g. ceramic unit)

Pipe connections shall be made with demountable unions. Pipe work shall not be fixed in a manner that it supports or partially supports and appliance.

Appliances shall be fixed true to level firmly fixed to anchor or supports provided by the manufacturer and additional anchors or supports where necessary.

Sizes of sanitary fixtures given in the Specifications or in the Schedule of Quantities are for identification with reference to the catalogues of make considered. Dimensions of similar models of other makes may vary within + 10% and the same shall be provided and no claim for extra payment shall be entertained NOR shall any payment be deducted on this account.

The BIDDER shall fix all plumbing fittings such as water faucets, shower fittings, mixing valves etc. in accordance with manufacturer's instructions and connect to piping system. The BIDDER shall supply all fixing materials such as screws, rawl plugs, unions, collars, compression fittings etc., as required.

Joints / gaps between all sanitary appliances / fixtures and the floor / walls shall be caulked with an approved mildew resistant sealant, having antifungal properties, of colour and shade to match that of the appliances / fixture and the floor / wall to the extent possible.

The BIDDER shall install all sanitary fixtures and fittings in their final position in accordance with approved trial assemblies and as shown on drawings. The installation shall be complete with all supply and waste connections. The connection between building and piping system and the sanitary fixtures shall be through proper unions and flanges to facilitate removal/replacement of sanitary fixtures without disturbing the built in piping system. All unions and flanges shall match in appearance with other exposed fittings.

Fixtures shall be mounted rigid, plumb and to alignment. The outlets of water closet pans and similar appliances shall be examined to ensure that outlet ends are butting on the receiving pipes before making the joints. It shall be ensured that the receiving pipes are clear of obstruction. When fixtures are being mounted, attention shall be paid to the possibility of movement and settlement by other causes. Overflows shall be made to ensure that



necessary anchoring devices have been provided for supporting water closets, wash basins, sinks and other appliances.

10.5 SUPPORTING AND FIXING DEVICES

The BIDDER shall provide all the necessary supporting and fixing devices to install the sanitary fixtures and fittings securely in position. The fixing devices shall be rigidly anchored into the building structure. The devices shall be rust resistant and shall be so fixed that they do not present an unsightly appearance in the final assembly. Where the location demands, the Architect may instruct the BIDDER to provide chromium plated or other similarly finished fixing devices. In such circumstances the BIDDER shall arrange to supply the fixing devices and shall be installed complete with appropriate vibration isolating pads, washers and gaskets.

FINAL INSTALLATION

The BIDDER shall install all sanitary fixtures and fittings in their final position in accordance with approved trial assemblies and as shown on drawings. The installation shall be complete with all supply and waste connections. The connection between building and piping system and the sanitary fixtures shall be through proper unions and flanges to facilitate removal/replacement of sanitary fixtures without disturbing the built in piping system. All unions and flanges shall match in appearance with other exposed fittings.

Fixtures shall be mounted rigid, plumb and to alignment. The outlets of water closet pans and similar appliances shall be examined to ensure that outlet ends are butting on the receiving pipes before making the joints. It shall be ensured that the receiving pipes are clear of obstruction. When fixtures are being mounted, attention shall be paid to the possibility of movement and settlement by other causes. Overflows shall be made to ensure that necessary anchoring devices have been provided for supporting water closets, wash basins, sinks and other appliance.

10.6 STORING, HANDLING & DELIVERY

Material received at site shall be with original packing and labels. It shall be intact till issued for use of site. Material shall be stored at properly covered dry location and shall be safe from damage.

Care must be taken to ensure that the sanitary fixtures are not damaged while loading / unloading and transporting. Cartons must always be stored with designated side upwards.

The BIDDER shall take every precaution to protect all sanitary fixtures against damage, misuse, cracking, staining, breakage and pilferage by



providing proper wrapping and locking arrangement till the completion of the installation.

At the time of handing over, the BIDDER shall clean, disinfect and polish all the fixtures and fittings. Any fixtures and fittings found damaged, cracked chipped stained or scratched shall be removed and new fixtures and fittings free from defects shall be installed at his own cost to complete the work.

11 WATER PROOFING WORKS

11.1 GENERAL

Specification applies to water proofing of terrace, basement and toilet slabs with elastomeric membrane, water stops, swellable sealant water bars and water proofing admixtures.

11.2 APPLICABLE CODES AND STANDARDS

BS 8102	British Standard- Code of practice for protection of below ground structures against water from the ground
ASTM– C836-89	Historical Revision Information Standard Specification for High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course
IS:1237	- Specification for cement concrete flooring tiles.
IS:2645	- Specification of integral cement water-proofing compounds.
IS:8543	- Methods of Testing Plastics (Part 4 / Section 1)
IS:9766	- Flexible PVC compounds – specification
IS:12200	- Code of practice for provision of water-stops at transverse contraction joints in masonry and concrete dams.
IS:13182	Waterproofing and damp-proofing of wet areas in Buildings



IS:13360 Method of testing plastics (Part5-sec-11)

IS:15058 Water stops at transverse contraction joints – specification.

11.3 DAMP - PROOF COURSE

MATERIALS AND WORKMANSHIP

1. All the walls in a building shall be provided with damp-proof course to prevent water from rising up the wall. The damp-proof course shall run without a break throughout the length of the wall, even under the door or other openings. Damp-proof course shall consist of 50 mm thick cement concrete of 1:2:4 nominal mix with approved water-proofing compound admixture conforming to IS: 2645 in proportion as directed by the manufacturer. Concrete shall be with 10 mm downgraded coarse aggregates The surface of brick or stone masonry work shall be levelled and prepared before laying the cement concrete. Edge of damp proof course shall be straight, even and vertical. Side shuttering shall consist of steel forms and shall be strong and properly fixed so that it does not get disturbed during compaction and the mortar does not leak through. The concrete mix shall be of workable consistency and shall be tamped thoroughly to make a dense mass. When the sides are removed, the surface should come out smooth without honeycoming. Continuity shall be maintained while laying the cement concrete layer and laying shall be terminated only at the predetermined location where damp-proof course is to be discontinued. There shall be no construction joints in the Damp Proof Course.
2. The surface of brick/stone masonry work shall be levelled and prepared before laying the cement concrete. Side shuttering shall be properly fixed to ensure that slurry does not leak through and is also not disturbed



during compaction. The upper and side surface shall be made rough to afford key to the masonry above and to the plaster.

3. Damp-proof course shall be cured properly for at least seven days after which it shall be allowed to dry for taking up further work.

11.4 TERRACE OR ROOF WATER-PROOFING WITH ELASTOMERIC MEMBRANE :- AS PER SPECIFICATION

11.5 BASEMENT TYPE OF STRUCTURE WATER PROOFING WITH ELASTOMERIC MEMBRANE

MATERIAL

1. As specified in clause 14.2.1.
WORKMANSHIP
1. Base slab or raft shall be provided over the lean concrete/PCC. The membrane shall be applied in the similar manner as mentioned in clause 13.4.2. The top surface of elastomeric membrane shall be protected by providing 20mm thick mortar ratio 1:4. Protective coating shall be cured for 3days.
2. The elastomeric membrane for the vertical wall shall be provided on the outer face exposed to water pressure/earth pressure. The membrane shall be applied as explained in clause 13.4.2. There shall be proper continuation of membrane provided below the base slab /raft and over the outer face of wall. The exposed membrane shall be protected by providing extruded high density dimpled polyurethane board.

11.6 TREATMENT TO TOILET –WET AREA SLAB

MATERIAL

1. As specified in clause 14.2.1.
WORKMANSHIP
1. After casting the concrete slab, the surface shall be cured for required period.
2. The inner surface shall be prepared, and membrane coating shall be applied as described above clause 14.2.2. Provisions of IS13182 shall be adopted for making the wet areas watertight.
3. The prepared surface shall be plastered with cement mortar 1:3 – 15 mm thick admixed with – Normal Setting Integral Waterproofing Compound



conforming to IS: 2645, or approved equivalent at 2% by weight of cement. Surface shall be cured for minimum 7 days.

11.7 WATERSTOPS

MATERIAL

1. The material for the PVC water stops shall be a plastic compound with the basic resin of polyvinyl chloride and additional resins, plasticizers, inhibitors, which satisfies the performance characteristics specified below as per IS:15058. Testing shall be in accordance with IS:8543 (Part 4/sec1), IS 13360 (Part 5/sec11) and IS 9766.

Tensile strength : 13.8 MPa minimum

Ultimate elongation : 285% minimum

Hardness (Shore A) : 65, minimum

Water absorption : 0.6 maximum

Cold bend temp

at which samples do not crack : -25oC minimum

Accelerated extraction

i) Tensile strength : 10.3 MPa minimum

ii) Ultimate elongation : 280% minimum

Effect of Alkali : 7 days

i) Weight increase : 0.25% maximum

ii) Weight decrease : 0.10% maximum

iii) Hardness change : +/- 5 points

Effect of Alkali : 28 days

i) Weight increase : 0.40% maximum

ii) Weight decrease : 0.30% maximum

iii) Dimension change : +/- 1%



2. PVC water stops shall be either of the bar type, serrated with centre bulb and end grips for use within the concrete elements or of the surface (kicker) type for external use. The width, type, minimum thickness and safe hydraulic head requirements shall be as specified in the individual items of work.
3. PVC water stops shall be of approved manufacture. Samples and the test certificate shall be got approved by the ENGINEER before procurement for incorporation in the works.

WORKMANSHIP

1. Water stops shall be laid as per IS 12,200. It should be cleaned before placing them in position. Oil or grease shall be removed thoroughly using water and suitable detergents.
2. Water stops shall be procured in long lengths as manufactured to avoid joints as far as possible. Standard L or T type of intersection pieces shall be procured for use depending on their requirement. Any non-standard junctions shall be made by cutting the pieces to profile for jointing. Lapping of water stops shall not be permitted. All jointing shall be of fusion-welded type as per manufacturer's instructions.
3. Water stops shall be placed at the correct location/level and suitably supported at intervals with the reinforcement to ensure that it does not deviate from its intended position during concreting and vibrating. Care shall also be taken to ensure that no honeycombing occurs because of the serrations/end grips, by placing concrete with smaller size aggregates in this region. Projecting portions of the water stops from concrete already poured shall be thoroughly cleaned of all mortar/concrete coating before resuming further concreting operations. The projecting water stop shall also be suitably supported at intervals with the reinforcement to maintain its intended position during concreting so as to ensure that it does not bend leading to formation of pockets. In addition, smaller size aggregate shall be used for concreting in this region also.

11.8 SWELLABLE SEALANT WATER-BARS

MATERIAL

1. Material shall be swellable polyurethane /synthetic elastomeric strips.

WORKMANSHIP

1. Construction joint surface shall be cleaned and swellable water bar shall be placed in the groove or fixed with adhesive and cured as per the manufacturer instruction/specification. before placement of next layer of concrete.

11.9 WATER-PROOFING ADMIXTURE

Water-proofing admixture shall conform to the requirements of IS:2645 and shall be of approved manufacture. The admixture shall not contain calcium chloride. The quantity of the admixture to be used for the works and method



of mixing etc. shall be as per manufacturer's instructions and as directed by the Engineer. Payment shall be made for the actual quantity of such admixture used unless it is already covered in the rate for the relevant item of work.

11.10 INTEGRAL CEMENT BASED WATER PROOFING TREATMENT WITH BRICK BAT COBA

General: Before taking up the water proofing work the construction of parapet walls, including finishing should be completed. Similarly, the ancillary items like haunches, khurras, grooves to tack the fibre cloth layer, fixing up of all down take pipes, water pipes and electric conduits etc. should be completed and no such work should be allowed on the area to be treated during the progress of water proofing treatment or even later.

1. Preparing the Surface: The surface of the slab should be roughened by scrapping when the slab concrete is still green, however, the surface need not be hacked. In case the slab is already cast and surface fairly finished, the same shall be cleaned neatly of all mortar droppings, loose materials etc with brooms/cloth.
2. Providing and Laying of Slurry under Base Coat The quantity of water required to prepare the slurry with 2.75 kg. of blended cement to be painted over an area of 1 sq m. Depending upon the area of surface that has to be covered, the required quantity of slurry should be prepared using 2.75 kg. blended cement + water per sq m. area to be covered, taking particular care to see that only that much quantity of slurry shall be prepared which can be used within half an hour of preparation i.e. before the initial setting time of cement. Page 15 of 42 The prepared slurry shall be applied over the dampened surface with brushes very carefully, including the joints between the floor slab and the parapet wall, holes on the surfaces, joints of pipes, masonry/concrete etc. The application of the slurry should continue upto a height of 300 mm on the parapet wall. Slurry should also be applied upto a height of 150 mm over pipe projections etc.
3. Laying Base Coat 20 mm thick Immediately after the application of slurry and when the application is still green, 20 mm thick cement plaster as base coat with cement mortar 1:5 (1 blended cement: 5 coarse sand) shall be evenly applied over the concrete surface taking particular care to see that all the corners and joints are properly packed and the application of the base coat shall be continued upto a height of 300 mm over the parapet wall.
4. Laying Brick Bat Coba: Brick bat of size 25 mm to 115 mm out of well burnt bricks shall be used for the purpose of brick bat coba. The brick bats shall be properly dampened for six hours before laying. Brick bats shall be laid to required slope/gradient over the base coat of mortar leaving 15-25 mm gap between two bats. Cement mortar 1:5 (1 blended cement: 5 coarse sand) shall be poured over the brick bats and joints filled properly. Under no circumstances dry brick bats should be laid over



the base coat. The haunches/gola at the junction of parapet wall and the roof shall be formed only with brick bat coba. In case the brick bat coba is laid on the base coat immediately on initial set there will be no necessity of applying cement slurry over the base coat before laying the brick bat coba. However, if the brick bat coba is to be laid on the subsequent day, cement slurry prepared as described in clause 5.2.2 shall be applied over the top surface of the base coat, then only the brick bat coba shall be laid.

5. Application of Slurry over Brick Bat Coba: After two days of curing of brick bat coba cement slurry shall be applied on the surface of brick bat coba. The application of slurry shall cover the haunches/gola, and the remaining small portion of parapet wall and also inside the groove.
6. Laying Finishing Layer (Protective Coat) Immediately on applying the cement slurry over the surface of the brick bat coba and when the slurry applied is still green, the fiber glass cloth shall be spread evenly on the surface without any kink & pressed to see that no air spaces exist. The fiber glass cloth shall be taken up to a height of 300 mm on parapet walls & tucked in the groove specially prepared at that height. 20 mm thick layer of cement plaster, without leaving any joints shall be applied with cement mortar 1:4 (1 blended cement: 4 coarse sand) over the entire fibre glass cloth including the haunches/gola and the small portion on the parapet wall. The groove in the parapet wall over the haunches shall also be filled neatly packing the mortar firmly in the groove. The surface of the finishing layer (protective coat) shall be neatly finished with cement slurry. The finished surface shall be allowed to dry for a while and then pattern of 300 mm x 300 mm groove, 8 mm deep shall be made over the entire surface.
7. Providing and Laying of Fibre Glass Cloth The fiber glass cloth shall be of approved brand and shall be thin, flexible uniformly bonded mat composed of chemically resistant borosilicate glass fibre distributed in random open porous structure bonded together with a thermosetting resin. Immediately on applying the slurry on a sufficiently workable area, when the slurry applied is still green, the fiber glass shall be spread evenly on the surface without any kink and pressed in such a way that no air spaces exist. The fiber glass cloth shall be taken upto a height of 30 cm on parapet walls and tucked in the groove specially prepared at that height. A minimum overlap of 100 mm width shall be provided when the fiber cloth has to be joined. The joining of 100 mm overlap shall be done with the same slurry used for the application on surface as first



layer. The fiber cloth shall also be extended upto a height of 100 mm over pipes projecting from the surface.

8. Curing and Testing the Treatment The entire surface thus treated shall be flooded with water by making kiaries with weak cement mortar, for a minimum period of two weeks.

11.11 WATER PROFING WITH BITUMEN FELT:

1. Hessian based tar felt is the most common product for water proofing on the new Roofs. These felts use hessian as the barrier medium for bitumen and bituminous Compound. Bitumen felts are classssified as Type 1, 2 or 3 depending on type of base used in their manufacture and the uses for which the felts are suited. Grades refer to minimum weight of bitumen felt. The bitumen felt should be laid over finished roof surface of slope does not flatter than 1 in 120.
2. In normal weather conditions the treatment should consist of 4 courses as under: -
 - Hot applied bitumen @ 1.2-1.464 Kg/Sqm.
 - Hessian base self- finished felt type 3 Grade I.
 - Hot applied bitumen @ 0.7-1.2 Kg/Sqm.
 - Pea size gravel or grit @ 0.006-0.008 Cum/Sqm.For severe climatic conditions and important structures/courses heavy duty treatment should be given as detailed below: -
 - Hot applied bitumen @ 1.464 Kg/Sqm minimum.
 - Pea size gravel or grit @ 0.008 Cum/Sqm.
3. In the laying of 4 or 6 courses of bitumen felt, as the case may be, over the last course of hot bitumen, stone grit or gravel of 6 mm and downsize shall be spread uniformly on horizontal surfaces. Bitumen felts suffer from following deficiencies:
 - a) Contents of a factory finished felts are not viscous enough to retain the shape and intended characteristics of roofing felt. High viscosity is desirable as it ensures better life and retains its flexibility over longer duration.
 - b) Defective lap joints allow seepage of water.
 - c) Hessian being organic in nature, it is subject to decay over the period, resulting in decrease in tensile strength and life of tar felt. Now a days glass fiber reinforced bitumen felts are also available in the market which can be used in place of organic fiber or hessian felts.

Standard application methodology:

There are certain essential pre-requisites for any bitumen-based water proofing system to be successful. These are.

- The surface to be treated should be smooth, having proper slope.
- There should be no depression or cracks
- The surface should be bone dry.



- Any structural defaults in the roof or the parapet wall should be attended to before starting the treatment.
- Detailed steps in lying of the bitumen-based surface barrier systems will be: -
 - i) Make surface smooth, even and dry, remove local depressions and loose dirt.
 - ii) Paint the dried surface with bituminous primer and allow it to cure.
 - iii) Apply foundation coat of bitumen.
 - iv) Lay surface barrier membrane i.e., bitumen felt.
 - v) Apply on coat of bitumen and finish with grit or coarse sand.

12 METAL SHEETING WORKS

12.1 GENERAL

1. This part of the specification covers the technical requirements of COLOUR COATED SHEET AND ALLIED WORKS FOR ROOFING, DECKING AND CLADDING, WITH OR WITHOUT INSULATION. Supply and installation of the sheeting shall be done by same agency. During handling/ stacking, if any damage is done to sheet like distortion of edges, scratches on sheet etc., then such damaged sheet shall stand rejected and shall be immediately replaced by the BIDDER.

12.2 APPLICABLE CODES AND STANDARDS

- | | |
|---------|---|
| IS:513 | - Cold rolled carbon steel sheets |
| IS:901 | - Practice For Use Of Cold-Formed Light Gauge Steel Structural Members In General Building Construction |
| IS:1397 | - Specification for Kraft paper |
| IS:2062 | Steel for General Structural purposes |
- Australian Code – Steel sheet and strip Hot dipped zinc coated or aluminium-zinc coated.
- NZS/AS 3566:1988- Screws - Self-drilling - For the building and construction industries



12.3 MATERIAL

1. Troughed permanently colour coated metal decking sheet for floor/roof decking shall be made by steel feed material of minimum 0.8mm bare metal thickness. Galvanized to grade 275 as per IS277, of minimum yield strength of 550 Mpa of drawing grade. Sheet shall be colour coated with total thickness of 50 microns comprising of silicon modified polyester SMP (with silicon content 30 -50%) paint or super polyester paint of minimum 20microns dry film thickness (DFT) on one side (exposed face) over 5micron primer coat and 20 micron SMP or super polyester paint over 5micron primer on other face and of approved profile, sectional properties, colour and shade. SMP and super polyester paint systems shall be of category 3 as per AS2728.
2. Troughed permanently colour coated metal sheet for roofing, side cladding, ridges, hips, flashings, trimmings, closure for vertical & horizontal joints, capping etc.,
3. With sheet having minimum 0.6mm (bare metal thickness) thickness galvanised to grade 275 as per IS277, of minimum yield strength of 250Mpa of drawing grade as per IS513.
4. With sheet having minimum 0.5mm (bare metal thickness) thickness coated with zinc aluminum alloy at 150gm/m² of minimum yield strength of 350 as per AS1397.
5. Steel sheet shall be colour coated as per clause 15.2.1 and shall be of approved profile, sectional properties, colour and shade.

12.4 DESIGN REQUIREMENTS

1. For metal decking the sectional properties shall be calculated as per IS801 for satisfying deflection and strength requirements. Deflection shall be limited to span/250 under critical load combinations.
2. No increase in allowable stress is permissible under wind loading conditions.
3. Spacing of fastener shall be calculated based on wind load, self-weight and other associated loads and Maximum spacing of fasteners shall be 400mm, minimum diameter of fastener shall be 5.5mm.
4. Sealant used for cladding shall be butyl based, two parts poly sulphide or equivalent approved, non stainless material and be flexible enough not to interface with fit of the sheets.
5. Filler blocks as a trough filler shall be used to seal cavities formed between the profiled sheet and the support or flashing. Filler block shall



be manufacturer from black synthetic rubber or any other material approved by ENGINEER.

6. Thermal insulation of sheeting panels shall be with mineral wool conforming to IS8183. The density shall be 32kg/m³ for glass wool and 48kg/m³ for rock wool. Minimum thickness of insulation shall be 50mm.
7. Special coated fasteners shall be used conforming to class 3 as per AS3566 and shall be tested to 1000 hours salt spray test.
8. Percentage elongation of the mild steel sheet having minimum yield strength of 250Mpa shall be 23% as per IS: 2062.
9. Tolerance on bare metal thickness of all sheeting material shall be - 0.00mm and +0.06mm.

12.5 WORKMANSHIP

1. The sheeting shall be fixed as per the working drawings. Sheets shall be supplied in required sizes (based on the secondary beams spacing/purlins) according to the cutting schedule. Generally cutting of sheets to lengths shall be used for cutting. Cutting and trimming of small openings which were not finalized at the time of working drawings can be allowed at site. Wherever possible, site cut edges shall be concealed at laps or with flashings. Suitable steel members for stiffening shall be provided at the cut edges. No gas cutting shall be done on the sheet. If any sheet is found with gas cut mark, same shall stand rejected and shall be immediately replaced.
2. Distorted, blemished or water-stained sheets shall not be used. Before installing decking sheet, it shall be ensured that the purlins are in true planes, correctly placed and secured firmly.
3. Side and end laps of the sheets shall be made weatherproof by securing them with the fasteners not less than 4mm dia with 2mm thick neoprene washer. Maximum spacing of the fasteners not to exceed 500mm.
4. Length of the sheet shall be such as to cover minimum 3 span purlin spacings. The roof decking sheets shall be fixed to the purlins with the help of self-drilling and tapping type fasteners and neoprene washers.
5. Sheets shall be laid over the supporting purlins with a minimum bearing of 50mm and end projection of 75mm at lap joints. End and side laps between the sheets shall be sufficiently large to ensure the weather tightness. In no case, the end laps shall be less than 150mm and side laps less than one trough length with proper weather tight arrangement.
6. Cladding erection for each elevation shall commence at the bottom and proceed towards the top, in order to ensure tight fittings laps.
7. In case double skin cladding, inner sheet and outer sheet can be directly fixed to the opposite faces of the sheeting runner totally concealing the supporting steel structure.
8. Flashings, cappings, trimming, closure for vertical/horizontal joints, ridge and hips etc., shall be provided with a minimum lap of 150mm. The lapping of sheets shall provide the dust free, airtight enclosure. If required, this can be achieved by using 2 parts polysulphide sealing compound or butyl tape. The black synthetic rubber external trough fillers



are to be secured by the mechanical fixings to the flashings or parapet capping,

12.6 PERFORATED METAL DECORATIVE PANEL

GENERAL

1. The scope of work under this specification section includes designing, providing and installing metal panel system on wall of any height, as per the approved shop drawing, working specimen and methodology.

Related Sections

2. The works mentioned in this specification sections should be coordinated with the work described in other specification sections, including:
 - 1) General Civil Works
 - 2) All services (MEP)
 - 3) HVAC Works
 - 4) Electrical works
 - 5) IBMS Works

DESIGN CRITERIA

3. The perforated metal panel system shall be designed to accommodate.
 - 1) Applicable wind pressure
 - 2) Seismic force (should take care of the seismic forces as per the applicable seismic zone)

TOLERANCE

The perforated Metal panel shall be manufactured and installed to the tolerances applicable, as per norms.

WORKING SPECIMEN

1. Shape & Finish
2. The perforated panels are to be formed of Metal perforations in moulds to achieve the profiles indicated by the architectural drawings.
3. The manufacturer shall provide a means for producing a replacement panel at any time during the building contract. Moulds shall be adequately cured to eliminate shrinkage and distortion and shall be properly braced.
4. The exposed face of the perforated metal panels surfaces shall be free of blowholes, cracks, undulation or similar imperfections.
5. Support steelwork and fixings
6. The Manufacturer will be responsible for the design, manufacture and installation of all support framing, cleats and fixings inserted into and



affixed to the perforated Metal panels or provided for the support of the Metal panels. Fixing zones are described on the drawings, together with primary structural concrete and steelwork provided by others for use by the BIDDER if required.

7. Fixings shall be concealed and cast into panels unless otherwise specified. They shall be of non-corrosive material and located at suitable spacings to ensure support of panels without creating undue stresses to the panels under thermal movements and/or moisture movement.
8. Steel materials and workmanship shall comply with the relevant codes, and all steel will be free from rust, loose scale, pitting and other defects.
9. Fabricated steel components shall be true to line and free from twists, bends and open joints.
10. All galvanised materials shall be thoroughly cleaned prior to fabrication, by grit blasting to Class 2 in accordance with AS 1627 Part 4 and painted with Red Oxide Zinc Chromate in two coats to a minimum dry film thickness of 80 microns.
11. Fixing cleats to existing steelwork, where indicated on the GRC cladding shop drawings, shall be site-welded unless otherwise arranged with the construction manager.
12. Any damage to protective coatings on steelwork, supplied as part of this contract works, shall be repaired.

HANDLING, TRANSPORTATION AND INSTALLATION

1. The products shall be handled, transported and installed using methods which ensure that no damage or marking of architectural surfaces occurs and so that the panels are not subject to undue stress.
2. The safety and protection of perforated metal panel shall be ensured throughout the whole of the contract works.
3. Site access and, if necessary, storage space shall be provided. The main BIDDER shall also provide true, level and clean support surfaces and shall provide for the accurate placement and alignment of connection hardware on the structure.

WEATHERPROOFING

1. Responsibility for the weatherproofing of the whole installation of Perforated metal panels rests with the manufacturer.
2. The joint details, if any, shown on the drawings represent the appearance required and their minimum standard of weatherproofing acceptable.
3. Joints shall be weather-sealed
4. The Perforated metal panel manufacturer shall submit details of the proposed sealant and the application recommendations for approval by the construction manager prior to commencement of the contract works.
5. Joints located and indicated on the drawings are those required for sealing the Perforated metal cladding against adjacent materials and those required for architectural purposes for division of the panels into the design modules. Should the manufacturer or BIDDER propose to subdivide the cladding into smaller panels for ease of casting, handling and erection, additional joints may be introduced in the design, provided



the location proposed is discreet. The manufacturer shall submit proposed locations and designs of additional panel joints with their tender submission.

SUBMITTALS

1. Samples
2. The BIDDER shall furnish for approval, with reasonable promptness, all samples as specified or directed by the PMC and Architect and particularly samples of all internal and external finishes described in the Contract Documents. The Employer shall check and approve all such samples recommended and approved by the Architect with reasonable promptness for conformance with the design concept of the works and for compliance with the information given in the Contract Documents. One approved sample will be retained by the PMC and Architect/Design Consultants and the remainder returned to the BIDDER. All works shall then be in accordance with the approved samples.

CERTIFICATES AND TEST REPORTS

1. The BIDDER shall present to the PMC, prior to delivery, certificates confirming that the quality of products to be supplied by a particular manufacturer or company for incorporation in the works complies with the standards as required by the Contract Documents.
2. Where specified or required by the PMC, the BIDDER shall carry out the necessary tests. The costs and expenses incurred will be borne by the BIDDER and shall be carried out by a testing laboratory approved by the PMC. Copies of test reports shall be submitted to the PMC and Architect. Sub-standard materials and / or work shall be removed and replaced to comply with the correct standards at the BIDDER's expense.

SHOP DRAWINGS

1. The BIDDER shall produce all shop or setting out drawings and schedules required for the works, or which have mentioned in the specifications in sufficient time, so as not to cause delay in the works. These submittals shall be checked and approved by the PMC & Architect/Design Consultant and returned to the BIDDER. The BIDDER shall make any corrections requested by the PMC and resubmit further copies after the PMC (backed by the approval of the Architects and the respective consultants) have granted approval. The construction programme and the schedules prepared by the BIDDER shall have



- adequate time provision for review and revision of shop drawings prior to approval.
2. The shop drawings shall include and show.
 3. layout (sectional plan and elevation) of complete wall paneling.
 4. full-size section of typical panel and support members.
 5. method of assembly and supports and fixings to the existing structure and provision to withstand imposed stresses.
 6. method of installation, caulking, flashing and provision for vertical and horizontal expansion.
 7. junction and trim to adjoining surfaces; and
 8. fittings and accessories,
 9. The submission of shop drawings shall be supported by engineering design computations to show that cladding and supports comply with the design criteria specified.

Design Calculations

Design calculations for the Perforated metal panel and supporting system located outside the enclosed interior spaces and subjected to wind load shall be submitted.

Manufacturer's Report & Certification

1. The BIDDER shall produce the certificate of the manufacturer for usage of his recommended material at site. The certification shall cover all the major items of the system responsible for the stability & performance of the system.
2. The BIDDER shall produce reports from the manufacturers periodically and the report shall cover following.

Inspection & observation of the material at site.

1. Inspection & observations of the Installation process.
2. Quantity of material supplied by the manufacturer & subsequent consumption at site.
3. Confirmation of the material consumption as per standards.
4. Stage wise certification for installation done at site as per manufacturers standard.
5. The report shall be submitted at each important stage of the installation as recommended by the manufacturer & as mentioned below but not limited to
 - 1) Installation of the perforated metal panel system.
 - 2) Complete installation of the system with installation of the perforated metal panel, finishing of the joints, providing cut outs in for light fixtures etc. before painting of the perforated panel.



OTHER ISSUES

1. Responsibility

The Perforated metal panel manufacturer shall be solely responsible for the design and performance of the Metal Jali panels and their supports. Information provided on the drawings, or this specification shall not affect this responsibility.

2. Guarantees

The Manufacturer shall warrant the perforated metal panels installed, or to be installed, against any and every defect or failure which may occur during the period of practical completion for the works arising out of any fault of the Metal Jali cladding system, workmanship, fabrication, fixing or quality of materials used.

Material:

1. G.I Framework:

The framework shall be as designed by the system provider. The system consists of G.I framework projected from the wall. The following G.I components shall be used for grid work:

- 1) Wall section
- 2) Perimeter channel
- 3) Intermediate channels
- 4) Wall angle
- 5) Connecting clips
- 6) Wall cleat
- 7) Anchor fasteners

2. All the G I components shall be of approved make and bear the embossing in each length.

3. The G.I grid work system shall be projected from the wall using anchor fasteners of 6 mm of approved type and make and connected to wall



cleats and wall angle by means of necessary nuts, bolts and washers etc.

4. The fasteners / screws used to attach the board to the framework shall be as approved by the substrate board manufacturer.
5. Fastener spacing shall be designed to resist deflection of the system and as approved by the substrate board manufacturer.

Perforated metal panel

1. Grid
Manufacturer's grid systems with 15mm wide T - section flanges color white having rotary stitching on the Main Runner, 1200 mm & 600 mm Cross Tees
2. Panels
Perforated metal panel consisting of 120 gsm galvanized steel as per IS 277 (2003) suitable for architectural finishes in 0.5 mm thickness as per IS:513 (1994) in approved RAL colour and paint. Metal panel shall have perforation having hole diameter 2.5mm and open area 16% with linear and diagonal pitch of 5.5mm and 7.7mm respectively and a border of 10mm as per design.
3. Fire Performance of Class A2-s1. d0 as per EN13501 standard in module size as per design suitable for Green Building application, with Recycled content of 25%

13 GRILLS & RAILING WORKS

13.1 GENERAL

The works covered under this specification shall include:

Stainless steel handrailing, glass handrailing, M.S. grills & handrailing, M.S railing with perforated metal decorative panel.

13.2 STAINLESS STEEL HANDRAILING

GENERAL

1. This specification covers the general requirements regarding materials and details of fabrication and erection of Stainless Steel (SS) Handrails. The BIDDER shall design, engineer, document, test, manufacture, deliver, install, protect, and commission SS Railing complete with all necessary accessories, fixings, finishes, flashings, sealants and the like in accordance with the Contract Documents. The scope of this Section is



performance based, and shall be developed, tested and warranted to comply with:

2. The design intentions indicated on the Drawings,
3. Specified performance criteria and requirements,
4. Relevant statutory and project requirements.

APPLICABLE CODES AND STANDARDS

1. Work shall be carried out as per latest edition of Indian Standards and Code of Practices. List given here shall not be considered as conclusive and is for reference and guidance only. Any discrepancies/ conflict noticed shall be brought to the notice of Architect/Engineer in charge for direction / approval. However, as a general rule more stringent specification shall take precedence.



INDIAN STANDARDS:

NBC 2016	Bureau of Indian Standards, the National Building Code of India,
IS: 806	Code of Practice for Use of Steel Tubes in General Building Construction.
IS: 2835	Specification for flat transparent sheet glass (third revision)
IS: 4912	Safety Requirements for Floor and Wall Openings, Railings and Toe Boards

AMERICAN STANDARDS

ASTM A554–13:	Standard Specification for Welded Stainless Steel Mechanical Tubing
ASTM E985:	Standard Specification for Permanent Metal Railing Systems and Rails for Buildings
ASTM E488:	Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements
ASTM E894–88:	Standard Test Method for Anchorage of Permanent Metal Railing Systems and Rails for Buildings
ASTM E935–00:	Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for buildings
ANSI Z97.1:	Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods
ASTM C1172-09:	Standard Specification for Laminated Architectural Flat Glass
ASTM C1036:	Standard specification for flat glass.
ASTM C1376:	Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass



BRITISH STANDARDS

CP 3012: Code of Practice for Cleaning and Preparation of Metal Surfaces

IBC 2407: Glass in Handrails and Guards

BS EN 14179-2: Glass in building. Heat-soaked thermally toughened soda lime silicate safety glass Evaluation of conformity/product standard

BS EN 1096-1: Glass in building. Coated glass Definitions and classification

MATERIALS

1. Guardrails and Handrail System
2. All rails and other horizontal / inclined tubular components shall be constructed using the following:
3. Surface to be 320 grain/grit finish/ polish / matte/ bead blasted Tubes 1-1/2" (38mm) outside diameter by 5/64" (2 mm) wall thickness. All posts and other vertical components shall be constructed using the following:
4. Stainless steel grade AISI type 316,
5. Stainless steel grade AISI, type 304,316/316L
6. Posts to be 2" (50 mm) by 1/2" flat bar,
7. Stainless steel grade AISI type 316, surface to be 320 grain/grit finish/ polish / matte/ bead blasted for component fittings including handrail attachment support and post attachment components Stainless Perforated, Woven Or Welded Metal Infill Panels: As per Custom pattern as specified herein.



8. Fasteners:
9. Anchors & Fastening bolts to be stainless steel or other high strength material as determined by engineering requirements with capability to sustain, without failure, load imposed within a safety factor of 4, as determined by testing per ASTM E488.

QUALITY ASSURANCE

1. Railing Structural Requirements:
2. Handrail assemblies and guards shall be designed to resist to withstand loading of 0.74 KN/mtr UDL applied in any direction at the top and to transfer this load through the supports to the structure.
3. Infill area of guardrail system shall be capable of withstanding a horizontal concentrated load 90 Kgs to one square foot at any point in the system. Load not to act concurrently with loads on top rail of system in determining stress on guardrail.
4. Bolts, Rivets and Screws
5. When two stainless steel items are joined it is absolutely necessary to use elements of stainless steel or of other materials with an equivalent resistance to corrosion.
6. When stainless steel items are joined to carbon steel structural elements the carbon steel element must be well protected by suitable painting.
7. Stainless steel rivets, screws and bolts must be used, and the carbon steel element must be suitably insulated from the stainless-steel element using EPDM/ neoprene/Teflon
8. Welding Prior Approval to Be Obtained If Necessary:
9. TIG welding to be adopted for SS works. The welded areas to be passivated after welding are completed. When welding dissimilar ferrous metals, the respective IS code to be followed.

WORKMANSHIP

1. Installation work shall not be carried out until substrates have been properly prepared.
2. If substrate preparation is the responsibility of another installer; notify Architect of unsatisfactory preparation before proceeding.
3. All works shown or inferred from the Specifications and Drawings are intended to be the design criteria for the subcontract work. The detailed design development shall be submitted by the BIDDER for Acceptance and Endorsement.
4. The BIDDER shall allow for any additional supports on framework where required so as to ensure the stability and capability of the installation to withstand all specified loads under normal usage encountered during the service life of the works.
5. Coordinate fabrication and delivery schedule of handrails with construction progress and sequence to avoid delay of railing installation.
6. Coordinate post setting drawings, templates, instructions, and directions for installation of anchorages, such as sleeves, concrete inserts, anchor



- bolts, and miscellaneous items having integral anchors that are to be embedded in concrete and masonry construction.
7. Co-ordinate delivery of anchorages to project site.
 8. Co-ordinate that blocking is in place for all mounting fasteners.
 9. Clean surfaces thoroughly prior to installation.
 10. Prepare surfaces using the methods recommended by the manufacturer for achieving proper result for the substrate under the project conditions.
 11. Fabricate railing system for compliance with structural requirements of applicable code.
 12. Pre-assemble railings prior to shipping to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for re-assembly and for coordination with shop drawings.
 13. Stainless steel tubing cuts shall be square, without burrs and where exposed, rounded to produce smooth rigid and hairline joints
 14. Install in accordance with manufacturer's instructions by done a qualified, authorized representative of the manufacturer.
 15. Fit exposed connections accurately together to form tight joints, except as necessary for expansion.
 16. Perform cutting, drilling and fitting required for installation. Set accurately in location, alignment and elevation, plumb, level and true, measured from established lines and levels.
 17. For in-place construction, provide anchorage devices and fittings to secure to in-place construction, including threaded fittings for concrete inserts, toggle bolts and through bolts. Separate dissimilar materials with bushings, grommets or washers to prevent electrolytic corrosion.
 18. Do not cut or abrade finishes which cannot be completely restored in the field. Provide anchors, plates, angles, etc., necessary for connecting railings to structure.
 19. All field welding shall be by a certified welder.
 20. There shall be accuracy in dimensions, precision in fitting of matching sections to line and levels, and perfection in alignment.
 21. All components to be installed in plumb and in-line, accurately fitted, free from distortion or defects and securely anchored to structure.
 22. The workmanship shall be absolutely top class and of international standards, and the final finish and polish shall conform true to approved sample.
 23. Maximum variation from plumb shall be 6.35mm (1/4").
 24. Maximum offset from true alignment for every 50-foot of railing shall be 6.35mm (1/4"), non-accumulative.

STORAGE, HANDLING & DELIVERY

1. Materials to be delivered to the job site in good condition and adequately protected against damage as handrails are a finished product.
2. Store on site in a location and manner to avoid damage. Stacking should be done in a manner that will prevent bending. Store material in a clean,



- dry location away from uncured concrete and masonry. Any protection on the railings during transportation should remain until installed.
3. Keep handling on site to a minimum. Exercise caution to avoid damage to finishes of material.
 4. General BIDDER to provide protective covering on handrails and guardrails until handover.
 5. Adequate protection and periodic inspection to be carried out if construction is not yet finished in the area where the railings are installed.
 6. Upon delivery railing will have protective wrapping over cap only. Immediately upon completion of installation of railing, remove cap cover and clean all work for inspection and approval.
 7. When cleaning surfaces use plain water containing a mild soap or detergent. No abrasive agents or harsh chemicals shall be used.
 8. Touch up, repair or replace damaged products before Substantial Completion.
 9. All deficiencies in work and/or items not meeting specified requirements shall be corrected in order to meet specification requirements at no additional cost to owner.

WARRANTY

Finish Warranty: Manufacturer shall warranty installed system for the periods described herein, starting from Date of Substantial Completion. When notified in writing from Owner, manufacturer / installer shall,



promptly and without inconvenience and cost to Owner, correct said deficiencies.

13.3 GLASS HANDRAILING

MATERIALS

1. Guardrails And Handrail System - All rails and other horizontal / inclined tubular components shall be constructed using the following:
2. Stainless steel grade AISI, type 304, 316/316L. Surface to be 320 grain/grit finish/ polish / matte/ bead blasted. Tubes 1-1/2" (38mm) outside diameter by 5/64" (2 mm) wall thickness.
3. All posts and other vertical components shall be constructed using the following:
4. Stainless steel grade AISI type 316,
5. Surface to be 320 grain/grit finish/ polish / matte/ bead blasted.
6. Posts to be 2" (50 mm) by 1/2" flat bar,
7. Provide 1.0mm radius at all corners with 'v-cut' where necessary.
8. All stainless steel is to be a minimum thickness of 2.0mm.
9. Stainless steel grade AISI type 316, surface to be 320 grain/grit finish/ polish / matte/ bead blasted for component fittings including handrail attachment support and post attachment components.
10. Colour: Where indicated on the Drawings to be colour finished, stainless steel be colour treated by an Accepted permanent process to match Accepted colour samples. Submit details.
11. Provide laminated Heat-Soaked Toughened Safety Glass with polished edges and dubbed (blunt) corners complying with ASTM C1048. Kind FT (fully tempered), condition A (un-coated). Types 1 (transparent glass, flat), quality Q3 (glazing select), class, thickness and manufacturing process as indicated below.
12. Clear glass: Class 1 clear
13. Tinted glass: Class 2 (tinted heat absorbing and light reducing). Manufacturer's standard tint color or custom color as indicated below:
14. Custom pattern, art glass, etch, edges or surface, laminate or embeds, as specified herein.
15. Allowable thickness 17.5mm thick (8 clear toughened +8 clear toughened +1.5mm PVB interlayer) glass.
16. Glass shall be Fully Tempered and 100% Heat Soak Tested to EN 14179 part 1.
17. Provide approved opacifying films of polythene or polyester to restrict vision where required / as specified. Film to match project architect's approved sample. Film shall be fully bonded to glass with solvent based adhesive. Provide safety backing restraint for fallout resistance. Edge deletion of pacifying films shall be provided at all insulating glass and structural glazing unless manufacturer submits test data acceptable to the project architect indicating that edge deletion is not required.
18. Opacifier coatings and films are required to be suitable for the proposed temperature and exposure conditions and are required to function



- without bubbling, blistering or colour shift for the design life of the building.
19. Opacifier coatings are to be applied to surface 2 of monolithic or surface 4 of insulating glass units and prevent “read-through” of the glass.
 20. Anchors & Fastening bolts to be stainless steel or other high strength material as determined by engineering requirements with capability to sustain, without failure, load imposed within a safety factor of 4, as determined by testing per ASTM E488.
 21. Glass Panels:
 22. Glass for laminating is to be cut into individual panels prior to the laminating process.
 23. Glass thickness of successive panes being laminated together is not to exceed a difference of 2mm.
 24. Heat treated glass is to be orientated so that warp, bow and roller wave between successive panels are matched. Two stage convection tempering ovens are to be used to ensure glass distortions are minimized. Edge clamping of glass is forbidden.
 25. Handrail assemblies and guards shall be designed to resist to withstand loading of 0.74 KN/mtr UDL applied in any direction at the top and to transfer this load through the supports to the structure.
 26. Infill area of guardrail system shall be capable of withstanding a horizontal concentrated load 90 Kgs to one square foot at any point in the system. Load not to act concurrently with loads on top rail of system in determining stress on guardrail.
 27. When two stainless steel items are joined it is necessary to use elements of stainless steel or of other materials with an equivalent resistance to corrosion.
 28. When stainless steel items are joined to carbon steel structural elements the carbon steel element must be well protected by suitable painting. Stainless steel rivets, screws and bolts must be used and the carbon steel element must be suitably insulated from the stainless steel element using EPDM/ neoprene/Teflon
 29. TIG welding to be adopted for SS works. The welded areas to be passivated after welding are completed. When welding dissimilar ferrous



metals, the respective IS code to be followed. Any and all field welding shall be by a certified welder.

30. All laminated glass shall have clean cut edges, or polished edges if required to eliminate thermal stress breakage risk. Laminated glass units shall be fabricated with autoclaved edges on all four sides.
31. Edges of laminated glass are to be protected to prevent delamination, contamination or other defects, caused by moisture, sealant contact or other external/internal source.
32. All exposed laminated glass edges shall be protected from blushing by hot rolling the interlayer back into the glass edge, or by use of an approved edge seal material.
33. Install in accordance with manufacturer's instructions by done a qualified, authorized representative of the manufacturer.
34. Fit exposed connections accurately together to form tight joints, except as necessary for expansion.
35. Perform cutting, drilling and fitting required for installation. Set accurately in location, alignment and elevation, plumb, level and true, measured from established lines and levels.
36. For in-place construction, provide anchorage devices and fittings to secure to in-place construction, including threaded fittings for concrete inserts, toggle bolts and through bolts. Separate dissimilar materials with bushings, grommets or washers to prevent electrolytic corrosion.
37. Do not cut or abrade finishes which cannot be completely restored in the field.
38. Provide anchors, plates, angles, etc., necessary for connecting railings to structure.
39. There shall be accuracy in dimensions, precision in fitting of matching sections to line and levels, and perfection in alignment.
40. All components to be installed in plumb and in-line, accurately fitted, free from distortion or defects and securely anchored to structure. Maximum variation from plumb shall be 1/4".
41. The workmanship shall be absolutely top class and of international standards, and the final finish and polish shall conform true to approved sample.
42. Maximum offset from true alignment for every 50-foot of railing shall be 1/4", non-accumulative.
43. Dimensional tolerances of glass generally shall comply with ASTM C1036 Table 2.
44. Do not cut, work, or permanently mark after toughening. Use installation methods which prevent the glass making direct contact with metals or other non-resilient materials.

QUALITY ASSURANCE

45. Quality Plan - Prepare, submit, and implement a detailed project specific Quality Plan prior to execution. Products shall be reputable proprietary products, factory manufactured under ISO 9001. Submit quality assurance documentation for all bought-in products, including ISO 9001



certification, and evidence of satisfactory long-term performance (at least 5 years) in similar commercial conditions.

46. Quality Control Representative - Appoint a Quality Assurance representative responsible for all quality aspects of the work of this Section. Submit name and details.
47. Quality Control Procedures - Submit certifications that the materials comply with specification required and are suitable for intended application.

WORKMANSHIP

1. Do not begin installation until substrates have been properly prepared.
2. If substrate preparation is the responsibility of another installer; notify Architect of unsatisfactory preparation before proceeding.
3. All works shown or inferred from the Specifications and Drawings are intended to be the design criteria for the subcontract work. The detailed design development shall be submitted by the BIDDER for Acceptance and Endorsement.
4. The BIDDER shall allow for any additional supports on framework where required so as to ensure the stability and capability of the installation to withstand all specified loads under normal usage encountered during the service life of the works.
5. Coordinate fabrication and delivery schedule of handrails with construction progress and sequence to avoid delay of railing installation.
6. Coordinate post setting drawings, templates, instructions, and directions for installation of anchorages, such as sleeves, concrete inserts, anchor bolts, and miscellaneous items having integral anchors that are to be embedded in concrete and masonry construction.
7. Co-ordinate delivery of anchorages with project site.
8. Co-ordinate that blocking is in place for all mounting fasteners.
9. Clean surfaces thoroughly prior to installation.
10. Prepare surfaces using the methods recommended by the manufacturer for achieving proper result for the substrate under the project conditions.
11. Fabricate railing system for compliance with structural requirements of applicable code.
12. Pre-assemble railings prior to shipping to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for re-assembly and for coordination with shop drawings.
13. Stainless steel tubing cuts shall be square, without burrs and where exposed, rounded to produce smooth rigid and hairline joints.

Shop Drawing & Method Statement Submissions

1. Submit (within the One month of the award of contract) the Comprehensive, detailed, and dimensioned shop drawings to indicate all set-out and construction/ installation details to include and not limited to



plans, elevations, sections, details of components, anchor details and attachment to adjoining units of work.

2. Time required for examination of shop drawings will be 5 working days for each submission, including re-submissions. The BIDDER shall incorporate required changes due to inaccurate data or incomplete definition so that delivery and installation schedules are not affected. The BIDDER's revision response time is not justification for delivery or installation delay of the subcontract works. Any re-submission shall include requested corrections and shall be responded to previous comments in point-by-point format.
3. Manufacture should not commence until Acceptance and Endorsement has been obtained to use the relevant shop drawings.

Installation Procedures Manual

Submit a comprehensive manual containing all installation procedures, equipment and personnel required for acceptance prior to the commencement of installation works for review and Acceptance.

Operation and Maintenance Manuals

1. The O&M Manual shall include, without limitation, recommendations for operating, and routine cleaning and maintenance, and all information required to ensure the full-service capability of the work, including source of replacement components, and methods of replacement of damaged components. The method of cleaning and timetable shall be specified together with cleaning agents which can and cannot be used.
2. The Operation and Maintenance Manual is to include the following documents:
3. Comprehensive list of all materials suppliers and agents.
4. Finishes information – coating system type colour, supplier.
5. Defective works log to be kept up to date for the duration of the warranty period outlining each defect type location and corrective action to rectify each defect.
6. Clearances and tolerances.
7. Methods of in-service glass replacement
8. All Warranties from suppliers and Contracting Parties.
9. As-built drawings (AutoCAD Files and A3 hard copy)

Test Reports:

10. Submit test reports from qualified independent testing agency.

Glass

11. Roller Wave Distortion: in the installed work shall be horizontal unless otherwise approved in writing. The maximum roller wave shall not exceed 0.15 mm in any 300mm length of glass.
12. Bow Distortion: 'bow' and 'warp' shall have the same meaning. Overall bow across the shorter glass dimension ('the gauge length') shall not



13. exceed 0.00342 times gauge length for gauge length less than 900mm, and 0.00258 times gauge length for gauge length greater than 900mm. 100% heat soak testing will be required for all glass with edge stress exceeding 50mpA (7500 psi). Submit Heat Soak method, temperature, and duration for review and Acceptance, prior to commencement.

MOCK-UP

1. BIDDER shall install a full scale mock up for a length of 7.5m of typical detailing treatment at locations to be confirmed by the Architect.
2. The visual mock-up for the assembly will be required to be Accepted and Endorsed by the Architect with respect to appearance of colour.

STORAGE, HANDLING & DELIVERY

1. Materials to be delivered to the job site in good condition and adequately protected against damage as handrails are a finished product.
2. Store on site in a location and manner to avoid damage. Stacking should be done in a manner that will prevent bending. Store material in a clean, dry location away from uncured concrete and masonry. Any protection on the railings during transportation should remain until installed.
3. Keep handling on site to a minimum. Exercise caution to avoid damage to finishes of material.
4. Adequate protection and periodic inspection to be carried out if construction is not yet finished in the area where the railings are installed.
5. Upon delivery railing will have protective wrapping over cap only. Immediately upon completion of installation of railing, remove cap cover and clean all work for inspection and approval.
6. General BIDDER to provide protective covering on handrails and guardrails until handover.
7. When cleaning surfaces use plain water containing a mild soap or detergent. No abrasive agents or harsh chemicals shall be used.
8. Touch up, repair, or replace damaged products before Substantial Completion.
9. All deficiencies in work and/or items not meeting specified requirements shall be corrected to meet specification requirements at no additional cost to owner.

WARRANTY

Manufacturer shall warranty installed system for the periods described herein, starting from Date of Substantial Completion. When notified in writing from Owner, manufacturer / installer shall, promptly and without inconvenience and cost to Owner, correct said deficiencies.



13.4 M.S. GRILLS & HANDRAILING

MATERIALS

Mild steel tubular sections should be used for hand railing; design should be as per drawing.

WORKMANSHIP

The hand railings will be fitted in staircase and other areas without tampering the finishing material of the stair/area. The fixing will be done as per details shown in drawing.

MOCK-UP

1. BIDDER shall install a full-scale mockup for a length of 7.5m of typical detailing treatment at locations to be confirmed by the Architect.
2. The visual mock-up for the assembly will be required to be accepted and endorsed by the Architect with respect to appearance of colour.

13.5 M.S RAILING WITH PERFORATED METAL DECORATIVE PANEL

GENERAL

The scope of work under this specification section includes providing and installing handrail, and railings including all anchors, fasteners, hardware, and accessories with perforated metal panel system on stair with 850-1100 mm/as per design height, to complete work.

RELATED SECTIONS

1. The works mentioned in this specification sections should be coordinated with the work described in other specification sections, including:
2. General Civil Works
3. Handrail & Railings

TOLERANCE

The perforated Metal panel shall be manufactured and installed to the tolerances applicable, as per norms

HANDLING, TRANSPORTATION, AND INSTALLATION

1. The products shall be handled, transported and installed using methods which ensure that no damage or marking of architectural surfaces occurs and so that the panels are not subject to undue stress.
2. The safety and protection of perforated metal panel shall be ensured throughout the whole of the contract works.
3. Site access and, if necessary, storage space shall also be provided to the BIDDER. The main BIDDER shall also provide true, level and clean



support surfaces and shall provide for the accurate placement and alignment of connection hardware on the structure.

4. Identify and match mark, if applicable, all materials, items, and fabrications for installation or field assembly. Repair damaged finishes.
5. Wherever practicable, deliver items to Project site as complete units, ready for installation with all anchors, hangers, fasteners, and miscellaneous metal items.

WEATHERPROOFING

1. Responsibility for the weatherproofing of the whole installation of Perforated metal panels rests with the manufacturer.
2. The joint details, if any, shown on the drawings represent the appearance required and their minimum standard of weatherproofing acceptable.
3. Joints shall be weather-sealed.
4. The Perforated metal panel manufacturer shall submit details of the proposed sealant and the application recommendations for approval by the construction manager prior to commencement of the contract works.
5. Joints located and indicated on the drawings are those required for sealing the Perforated metal cladding against adjacent materials and those required for architectural purposes for division of the panels into the design modules. If the manufacturer or BIDDER propose to subdivide the cladding into smaller panels for ease of casting, handling and erection, additional joints may be introduced in the design, provided the location proposed is discreet. The manufacturer shall submit proposed locations and designs of additional panel joints with their tender submission.

SUBMITTALS:

1. **SAMPLES**
The BIDDER shall furnish for approval, with reasonable promptness, all samples as specified or directed by the PMC and Architect and particularly samples of all finishes described in the Contract Documents. The Employer shall check and approve all such samples recommended and approved by the Architect with reasonable promptness for conformance with the design concept of the works and for compliance with the information given in the Contract Documents. One approved sample will be retained by the PMC and Architect/Design Consultants and the remainder returned to the BIDDER. All works shall then be in accordance with the approved samples.
2. **SHOP DRAWINGS.**
The BIDDER shall produce all shop or setting out drawings and schedules required for the works, or which have mentioned in the specifications in sufficient time, so as not to cause delay in the works. These submittals shall be checked and approved by the PMC & Architect/Design Consultant and returned to the BIDDER. The BIDDER shall make any corrections requested by the PMC and resubmit further copies after the PMC (backed by the approval of the Architects and the respective consultants) have granted approval. The construction



- programme and the schedules prepared by the BIDDER shall have adequate time provision for review and revision of shop drawings prior to approval.
3. Show sizes, finishes, locations, required hardware and accessories, and details for all fabricated metal work, threaded fasteners and welds.
 4. Indicate welds, both shop and field, by symbols conforming to AWS Standards.
 5. Shop drawings for continually furnished items will be waived provided BIDDER submits a letter naming manufacturer to furnish these items who has on file with Contract Manager a certified standard drawing containing approved required information.
 6. Setting diagrams, erection plans, templates, and directions for installation of backing plates, anchors, and other items.
 7. Catalog descriptions of manufacturers' items.
 8. method of assembly and supports and fixings to the existing structure and provision to withstand imposed stresses;
 9. method of installation, caulking, flashing and provision for vertical and horizontal expansion.
 10. junction and trim to adjoining surfaces; and
 11. fittings and accessories,
 12. The submission of shop drawings shall be supported by engineering design computations to show that cladding and supports comply with the design criteria specified.

CERTIFICATES AND TEST REPORTS

1. The BIDDER shall present to the PMC, prior to delivery, certificates confirming that the quality of products to be supplied by a particular manufacturer or company for incorporation in the works complies with the standards as required by the Contract Documents.
2. Where specified or required by the PMC, the BIDDER shall carry out the necessary tests. The costs and expenses incurred will be borne by the BIDDER and shall be carried out by a testing laboratory approved by the PMC. Copies of test reports shall be submitted to the PMC and Architect. Sub-standard materials and / or work shall be removed and replaced to comply with the correct standards at the BIDDER's expense.

1. Certificate of Compliance for Railings.

2. Manufacturers' test results of identical railings tested by manufacturer.



Project Conditions

Coordinate fabrication schedule with construction progress to avoid delay of work.

MATERIAL:

1. Providing and fixing M.S Railing 1100mm high (from FFL) with 50x15mm MS top rail running along length of the staircase and vertical supports of 35x35mm M.S balustrade fixed on floor/RCC support as per design in 6mm thick and 38mm wide C shape MS plates @ 1200mm c/c, with necessary supports, anchor fasteners, supports.
2. Guard rail 50mm dia. M.s pipe Welded to 35mm dia. M.s pipe and 35mm dia. M.s pipe welded to base plate. 50mm dia. 8mm thk. M.s base plate with counter sunk screws fixed to 35x35mm M.S balustrade at 900mm high (from FFL).
3. Perforated metal panel fixed on M.S. balustrade with necessary supports, anchor fasteners, supports.
4. as per approved design, drawing including cutting steel sections and welding the same to required pattern with a coat of red lead primer, cost of materials, fixtures, labour and HOM of machinery complete. The fixing M.S + Perforated metal decorative panel Railing to be finished with approved Enamel paint from Asian Paints or Equivalent inclusive of all surface preparation as specific etc complete.

M.S FRAMEWORK:

1. The framework shall be as designed by the system provider.
2. The system consists of M.S. framework fixed on Flooring/r.c.c stringer beam support on stair. The following m.s. components shall be used for grid work:
 - 1) 35x35mm M.S balustrade
 - 2) 50mm dia. M.s pipe
 - 3) 35mm dia. M.s pipe
 - 4) 6mm thick and 38mm wide C shape MS plates
 - 5) Angle Supports
 - 6) Connecting clips.
 - 7) Cleats
 - 8) Anchor fasteners
3. All the MS components shall be of approved make and bear the embossing of "GYPSTEEL" or equivalent in each length.

PANELS

1. Perforated metal panel consisting of 120 gsm galvanized steel as per IS 277 (2003) suitable for architectural finishes in 0.5 mm thickness as per IS:513 (1994) in approved RAL colour and paint. Metal panel shall have perforation having hole diameter 2.5mm and open area 16% with linear and diagonal pitch of 5.5mm and 7.7mm respectively and a border of



10mm as per design. The sample of the same shall be approved by the concerned architect or engineer in-charge before fabrication.

2. Fire Performance of Class A2-s1. d0 as per EN13501 standard in module size as per design suitable for Green Building application, with Recycled content of 25%

OTHER ISSUES

1. Responsibility
2. The Perforated metal panel manufacture shall be solely responsible for the design and performance of the Metal Jali panels and their supports. Information provided on the drawings, or this specification shall not affect this responsibility.
3. Guarantees
4. The Manufacturer shall warrant the perforated metal panels installed, or to be installed, against any and every defect or failure which may occur during the period of practical completion for the works arising out of any fault of the Metal Jali, workmanship, fabrication, fixing or quality of materials used.

14 MISCELLANEOUS

14.1 GENERAL

This part of the specification covers miscellaneous items such as Inserts, bolts, cutouts, metal lath and wire fabric.

14.2 APPLICABLE CODES AND STANDARDS

- IS:412 - Expanded metal steel sheets for general purposes.
- IS:4948 - Specification for welded steel wire fabric for general use.

14.3 INSERTS, BOLTS, CUTOUTS ETC.

WORKMANSHIP

1. All the miscellaneous inserts such as bolts, pipes, plate embedment etc. either supplied FREE by the OWNER or to be furnished by the BIDDER shall be accurately installed in the building works at the correct locations and levels, all as detailed in the construction drawings. BIDDER shall prepare and use templates for this purpose, if so directed by the ENGINEER. In the event, any of the inserts are improperly installed, BIDDER shall make necessary arrangements to remove and re-install at the correct locations/levels, all as directed by the ENGINEER without any extra cost to the OWNER.
2. Steel templates shall be used by the BIDDER to locate and very accurately position bolts, groups of bolts, inserts, embedded parts, etc.



at his cost. Such templates shall be got previously approved by the Engineer. Templates shall invariably be supported such that the same is not disturbed due to vibration, movement of labourers, materials, shuttering work, reinforcement, etc. while concreting. The BIDDER will have to suitably bend, cut or otherwise adjust the reinforcement in concrete at the location of inserts, as directed by the Engineer. If the Engineer so directs, the inserts will have to be welded to reinforcement to keep these in place. The BIDDER shall be responsible for the accuracy of dimensions, levels, alignments and centre lines of the inserts in accordance with the drawings and for maintenance of the same until the erection of equipment/structure or final acceptance by the Owner.

3. The BIDDER shall ensure proper protection of all bolts, inserts, etc. from weather by greasing or other approved means such as applying white lead putty and wrapping them with gunny bags or canvas or by other means as directed by the Engineer to avoid damage due to movement of his labourers, materials, equipment, etc. No extra claim from the BIDDER on this account shall be entertained. The BIDDER shall be solely responsible for all damage caused to bolts, inserts, etc. due to his negligence and in case damage does occur, they shall be rectified to the satisfaction of the Engineer at the BIDDER's cost.
4. Cut outs, chamfers, pockets, etc. shall be left as indicated in the drawings and no extra cost shall be payable for providing these at their correct locations. The BIDDER shall take all necessary precautions to protect the cut outs from accidentally getting filled up or the edges getting broken.

14.4 METAL LATH & WIRE FABRIC

MATERIALS

1. Welded steel wire fabric shall conform to IS:4948
2. Expanded metal shall conform to IS:412
3. Galvanized wire mesh shall be of approved quality.

WORKMANSHIP

1. The type and details of the steel material to be used for metal lath plastering work and at the junctions of brick masonry/concrete before wall plastering shall be as specified in the respective items of work.
2. For metal lath plastering work, the weight of steel material shall be not less than 1.6 kg/sq m.
3. Steel material for use at the Junction of brick masonry/ concrete shall have the mesh dimensions not greater than 50 mm.
4. Steel material shall be obtained in maximum lengths as manufactured to restrict joints to the minimum. Overlap at the joints shall be minimum 25 mm which shall be securely tied with wires of diameter not less than 1.25 mm at spacing not more than 100 mm for lath plastering work. Nailing to wall shall be at spacing not exceeding 200 mm. The material shall be



straightened, cut and bent to shape if required for fixing as per the details indicated in the drawings.

15 GFRC JALLI

15.1 GENERAL:

Providing and Fixing of GRC Jaali (Glass Fibre Reinforced Jaali) 50 mm thick of required size, pattern, design, and colour with 50% area covered to be fixed on/between RCC / Block work Column or structural steel work with Dry Fixing method. This specification covers the requirements for the design, manufacture, and installation of GFRC Jaali's for architectural applications. The scope includes material composition, technical specifications, workmanship, handling, storage, and environmental performance. Glass Fibre Reinforced Concrete (GFRC) Jaali's, or perforated panels, are lightweight, durable architectural elements used in facades, screens, or decorative features. The specifications for GFRC Jaali's include the following aspects:

15.2 CODES AND STANDARDS

Indian Standards (IS):

- a. IS 12269: Specification for 53 grade ordinary Portland cement.
- b. IS 383: Specification for coarse and fine aggregates.
- c. IS 456: Code of practice for plain and reinforced concrete.
- d. IS 9103: Specification for admixtures for concrete.
- e. IS 2402: Code of practice for finishing of concrete.
- f. IS 2386: Methods of test for aggregates for concrete.
- g. IS 4082: Recommendations on stacking and storage of construction materials.
- h. IS 7969: Safety code for handling and storage of building materials.
- i. IS 14862: Indian Standard for Glass Fibre Reinforced Cement Products.
- j. IS 1343: Code of Practice for Prestressed Concrete

International Standards:

- a. PCI (Precast/Prestressed Concrete Institute) MNL 128
- b. PCI MNL 130



- c. GRCA Specification: “Specifiers Guide to Glassfibre Reinforced Concrete (GRC)”.
- d. ASTM C150: Standard specification for Portland cement.
- e. BS EN 1170: Precast concrete products - Test method for glass-fibre reinforced cement.
- f. ASTM C947: Standard Test Method for Flexural Properties of Thin-Section Glass-Fiber-Reinforced Concrete (GFRC).
- g. ACI 544.1R: Report on Fiber Reinforced Concrete.
- h. ASTM C33: Standard specification for concrete aggregates.
- i. ASTM C1666/C1666M: Standard specification for alkali-resistant glass fibre.
- j. ASTM C1602: Standard specification for mixing water used in the production of hydraulic cement concrete.
- k. ASTM C494: Standard specification for chemical admixtures for concrete.
- l. ASTM C979: Standard specification for pigments for integrally coloured concrete.
- m. ASTM C511: Standard specification for mixing rooms, moist cabinets, moist rooms, and water storage tanks used in the testing of hydraulic cements and concretes.
- n. ASTM E1486: Standard practice for product specification, documentation, and labelling.
- o. ASTM C138: Standard test method for density (unit weight), yield, and air content (gravimetric) of concrete.
- p. ACI 544.1R: Report on fibre-reinforced concrete.
- q. ACI 544.3R: Guide for specifying, proportioning, and production of fibre-reinforced concrete.
- r. ACI 302.1R: Guide for concrete floor and slab construction.
- s. ACI 308R: Guide to curing concrete.
- t. ASTM E 84 – Standard Test Method for Surface Burning Characteristics



- u. ASTM C144 – Standard Specification for Aggregate for Masonry Mortar
- v. ASTM C109 – Standard Test Method for Compressive Strength of Hydraulic Cement Mortars

15.3 MATERIALS.

The jaali shall be made from 53 grade White Portland Cement, Quartz, Fine Silica Sand, Alkali Resistant Glass Fibre, Super Plasticizers and UV Resistant Synthetic inorganic pigments. The material casting should take place in Synthetic Rubber / FRP mould manufactured by RECKLI or equivalent.

The final product on site and the raw materials must be non-toxic, non-hazardous, and non-inflammable. Raw materials used must confirm to PCI MNL 128 and 130.

15.4 COMPOSITION

Cement: White Portland 53 Grade Cement conforming to IS:12269 or Portland Pozzolana Cement conforming to IS: 1489 or White Portland Cement conforming to IS: 8042 /ASTM C 150 and shall be stored correctly to avoid contamination and kept dry to avoid any deterioration.

Aggregates: Fine aggregates such as Fine silica sand. Washed & dried Silica sand complying with requirements of IS 383-1970; Passing 0.85mm sieve with a maximum of 2% passing 0.15mm sieve. However, recommended & allowable particle sizes for GFRC Products are up to 1.2 mm maximum for GFRC.

Water: Potable water with a water-cement ratio between 0.35–0.40. To be clean to IS:456 and PCI MNL 130. Water shall be potable and free from deleterious materials. Potable water with a water-cement ratio between 0.35–0.40.

Glass Fibers: Alkali-resistant glass fibres. Alkali-resistant glass fibres with a typical dosage of 5-7% of the total weight to provide tensile strength and prevent cracking. Alkali Resistant Glass Fibre which has high durability in cement.



Composition: Na₂O-CaO-ZrO₂-SiO₂ (Zirconium 16 % min.)

Density 2.7g.cm³.

Fibre length varying between 13 to 25 mm specifically produced for use in GFRP and complying with PCI-MNL-130.

Admixtures: Superplasticizers and accelerators may be used to enhance workability and curing. Suitable admixtures to achieve desired properties of finished goods or for Process improvement can be used, they are to BS 5075 or ASTM C 494/ C 494M and PCI MNL 130. Admixtures shall comply with the requirements of EN 934 or other equivalent national standards.

- 1) White Cement
- 2) Quartz fine Silica sand (Graded & Selected)
- 3) Alkali Resistance Glass Fiber
- 4) Super Plasticizer
- 5) Coating of Nano technology based self-cleaning water repellent
- 6) FRP Mould / Synthetic Rubber
- 7) UV & Alkali Resistance Synthetic inorganic pigments

Pigments: Powder pigments or dispersions may be used to produce coloured GRC. The pigments shall conform to any applicable national standards. The Purchaser should recognise that colour variation may occur and must agree an acceptable range of variation with the Producer.

Other component materials: Other component materials (e.g. silica fume, metakaolin, fly ash, reinforcing fillers, admixtures, meshes), may be added to modify the properties of the mix. They shall conform to any applicable national standards and must be used in accordance with the Suppliers' instruction. The Producer shall demonstrate that their use will not adversely affect the properties of the GRC.

Hardware: Stainless Steel-(SS 304), Dash Fastner- Hilti & Fischer or equivalent.



15.5 STRENGTH & DURABILITY:

Table 1 GFRC Specifications as used in Puri Project 12185A

Properties	Units	premix	Spray
Fibre Content	% by Wt	1.5-36	3-5.0
Density (Dry)	gms/cm's	1.8-20	1.9-2.1
Compressive Strength	Mpa	40-60	50-80
Bending			
Ultimate Strength (MOR)	Mpa	10-14	20-30
Elastic Limit (LOP)	Mpa	5-8	7-11
Tensile			
Ultimate Strength	Mpa	4-7	8-11
Elastic Limit	Mpa	4-6	5-7
Shear			
Interlaminar Strength	Mpa	N/a	3-5
In Plane Strength	Mpa	4-7	8-11
Fire		incombustible	incombustible
Co. eff of thermal expn.	Per deg °C	10-20 x 10 ⁴	10-20 x 10 ⁴
Acoustic Transmission Loss at 125 Hz	dB	27	27
Please Note: 1MPa = N/mm ² = 145 Psi			
(Courtesy: PCI Manual 128 Edition 4) :			
Reference : Followed in Puri Project 12185A- received from GFRC vendor:			



15.6 SUBMITTALS AND SAMPLES

Product Data: Manufactures data sheets, including dimensions, finishes, installation recommendations and storage and handling requirements.

Shop Drawings: Provide drawings showing dimensions and joint details.

Samples: Submit two samples, minimum size 6 inches (150 mm) square, representing actual product, color and patterns.

15.7 TRANSPORTATION, HANDLING, DELIVERY & STORAGE

Secure Loading: When transporting GFRC jaali panels, ensure they are securely fastened in an upright position to minimize movement during transit. Use foam or rubber padding between each panel.

Vehicle Protection: The transport vehicle should have soft sidewalls or sufficient padding to prevent impact or abrasion during transit.

Minimize Vibration: Take routes with minimal vibration and avoid rough terrains during transport. Excessive vibration can lead to cracking or internal stress on the GFRC panels.

Handle and deliver GFRC panels without damage. Place non-staining, resilient spacers between panels. Support panels on non-staining material during shipment.

Store GFRC panels to protect from soil, staining and damage. Store panels with non-staining spacers on level and firm supporting surfaces.

No part of the component shall be overstressed.

Bowing or twisting is not induced in the component.

No damage is caused to any part of the component, particularly edges and corners.

No permanent staining or discoloration is caused either by the storage conditions or the stacking/protection material.



15.8 WORKMANSHIP:

EXAMINATION

1. Do not begin installation until substrates have been properly construction; verify that substrates are plumb and true.
2. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
3. Check field dimensions before beginning installation. If dimensions vary too much from design dimensions for proper installation, notify Architect and wait for written instructions before proceeding.

PREPARATION

1. Clean soiled GFRC surfaces with detergent and water, if necessary, using soft fiber brushes and sponges, and rinse with clean water. Prevent damage to GFRC surfaces and staining of adjacent materials.
2. Prepare surfaces using the methods recommended by the manufactures for achieving the best results for the substrate under the project conditions.
3. Install supplementary temporary and permanent supports as required for proper installation.

Installation

1. Install in accordance with applicable code and manufactures recommendations, plumb and true to line where necessary.
2. Provide control joints at not more than 35 feet on centre if not indicated on drawings.
3. Provide expansion joints where moving joints in substrates occur.
4. Patch exposed anchor points to texture of unit

PROTECTION

1. Protect installed products until completion of project.
2. Touch-up, repair or replace damaged products before Substantial Completion.
3. Repairs will be permitted provided the structural adequacy of the GFRC panel is not impaired. Repairs shall be consistent with the colour, texture, and appearance of adjacent surfaces.
4. The surface should be dry and clean before applying finish. The surface should be dry for 48 to 72 hours prior to applying finish.

15.9 MOCK-UP

The BIDDER shall install a full mock-up at site as per approved shop drawings and as per instruction by the Engineer-in-charge.

The BIDDER shall give minimum one-week prior notice for the date of mock-up inspection by the Engineer-in-charge.



The approved mock-up shall be retained, protected and accessible at site for the duration and till the completion of the complete package works.

BIDDER shall bear all the costs related to the mock-up.

15.10 PERFORMANCE GUARANTEE:

The BIDDER shall offer a minimum of 10-year Performance Warranty for the entire installation carried out.

16 MULTIWALL POLYCARBONATE SHEETS

16.1 SCOPE

This specification shall cover the supply, installation, and performance requirements for multiwall polycarbonate sheets to be used in roofing, glazing, and other construction applications.

16.2 SUMMARY

The multiwall polycarbonate sheets shall be impact-resistant, energy-efficient, and UV-protected. These sheets shall offer superior durability, light transmission, and insulation properties, while ensuring protection from UV degradation.

16.3 MATERIAL

The multiwall sheets shall be manufactured from polycarbonate resin, an engineering thermoplastic. The sheets shall come in various configurations, including double, triple, and five-wall structures, offering a balance of optical clarity and mechanical strength. Available types shall include:

Standard multiwall polycarbonate sheets. Panels shall be manufactured with vertical offset standing seam at both sides of the panel.

Condensation-resistant sheets with drip-reduction coatings.

Solar control sheets with specialized coatings to manage heat transmission.

Panels shall be fixed on Purlin with snap on connectors with grip lock locking mechanism and will be secured on MS structure with 3 numbers self-drilling screws and trapezoid SS fasteners holding the base of the standing seam offering best stability having a pull-out load of min. 7000N (7KN) tested as



per ISO 6892:1998 and IS 1608: 2005, or with special Aluminium connectors as per design requirement.

Panels must satisfy Dart drop impact test as per IS 14443-97 shall show no sign of breakage on Polycarbonate sheets which have been exposed to UV for a min. of 500 Hours as per ASTM G 155.

Panels shall not have Yellowness Index as per ASTM D 1925 of 15 units when tested on a sample exposed to UV for 500 Hours as per ASTM G 155.

U value shall not be more than 1.6 W/m²K as per EN ISO 10077-2:2018.

Panel shall be with additional End cap/Aluminium U/F profile/ Glazing Bar for ends as required.

Panel shall be fixed over MS structural steel/MS purlin conforming to the detail technical specifications as per approved architectural drawings.

Colour: As per Approval.

16.4 APPLICABLE CODES AND STANDARDS

The multiwall polycarbonate sheets shall conform to the following codes and standards:

1. ISO 4892: Plastics — Methods of exposure to laboratory light sources. Weathering performance tests.
2. ASTM D570: Standard Test Method for Water Absorption of Plastics. Water absorption.
3. DIN 52612: Thermal conductivity testing.
4. UL 746B: Continuous-use temperature rating for thermoplastics.
5. If the material has been manufactured at foreign land, hence it is advised to make routine tests (after procuring at site) at NABL accredited lab as per ASTM D3935 for knowing the actual property of the material.
6. All relevant local standards related to wind/snow loading, hail resistance, and thermal expansion shall be followed.

16.5 SUBMITTALS

The following documents shall be submitted for approval:

Manufacturer's technical data, including thermal and mechanical properties.

Samples of multiwall polycarbonate sheets for approval.

Certification of compliance with UV protection and performance warranties.

16.6 EXECUTION / WORKMANSHIP



Installation of the sheets shall allow for thermal expansion, with a recommended allowance of approximately 3 mm per meter per 50°C to prevent stress on the sheets.

Sheets shall be mounted with ribs running vertically to ensure proper drainage of condensation.

All edges shall be sealed using UV-resistant tape, as specified by the manufacturer.

Trained and factory authorized labour with supervision to complete the entire panel installation as per drawing & direction of the engineering in charge.

16.7 CLEANING

Cleaning shall be performed regularly to maintain the material's optical properties and performance:



Small areas should be cleaned with mild soap and lukewarm water.

For larger areas, high-pressure water cleaning should be used, ensuring that no abrasives or alcohol-based cleaners are used. Cleaning should be performed out of direct sunlight to avoid damage.

16.8 DELIVERY, STORAGE, AND HANDLING

The sheets shall be delivered covered with protective masking to prevent damage.

Sheets shall be stored stacked horizontally in a clean, dry area, protected from sunlight, rain, and other environmental factors.

Handling of the sheets shall be done with care to prevent scratches or damage to the edges, and the sheets shall remain in their packaging until installation.

16.9 MOCK-UP

A mock-up of the installed polycarbonate sheets shall be required to verify the installation process, appearance, and performance. The mock-up shall be inspected for edge sealing and condensation prevention.

16.10 STRENGTH / DURABILITY AND PERFORMANCE GUARANTEE

The sheets shall offer impact resistance, ensuring that the material withstands hail impacts of up to 20 mm in diameter at terminal velocity without significant damage.

The sheets shall be covered by a 10-year limited warranty against discoloration, loss of light transmission, and loss of impact strength due to weathering.

Fire performance shall comply with European fire safety standards.



17 HPL CLADDING FOR EXTERIOR

17.1 GENERAL

The scope of work under this specification section includes fabricating, supply and installation of Superior Quality of High Pressure Exterior HPL Cladding system on wall of any height, as per the approved drawings, handling, working specimen and methodology.

Specification applies to decorative High-Pressure Laminates (HPL according to EN 438) in exterior use, where they are exposed to: Sun and UV high and low temperatures, change of temperature rain, hail, snow, ice, wind mechanical stress pollution (exhausts, oil, smoke, soot, acid rain).

17.2 SUMMARY

Fabricating, Supply and fixing of Superior Quality exterior panel 8mm thick high-pressure laminates (HPL) confirming to European norm EN 438, consisting of natural fibers and synthetic resins produced in lamination process under great pressure and high temperature. with the AL Sub structure consisting of AL Box section 80 x 100 mm of 2mm thickness, anodized at 20 Micron thickness as per drawing and MS Brackets with Galvanizing as per the drawings with colour Blind Rivet (MBE, German Make), using separators between two different material surfaces.

17.3 MATERIAL

Superior Quality exterior panel 8mm thick high-pressure laminates (HPL) confirming to European norm EN 438, consisting of natural fibers and synthetic resins produced in lamination process under great pressure and high temperature. with the AL Sub structure consisting of AL Box section 80 x 100 mm of 2mm thickness, anodized at 20 Micron thickness as per drawing and MS Brackets with Galvanizing as per the drawings with colour Blind Rivet (MBE, German Make), using separators between two different material surfaces. The cost to also include coping/flashing on top to cover



the plate, also to include cost of sill and jambs up to 250mm wide to be considered in costing and will not be paid separately.

17.4 APPLICABLE CODES AND STANDARDS

The applicable codes and standards for exterior High-Pressure Laminates (HPL) and Aluminium frame include:

IS 2046 (1995): This standard covers decorative thermosetting synthetic resin bonded sheets, including HPL. It specifies the requirements for materials, dimensions, and performance criteria.

IS 438: This standard is similar to the European EN 438 and covers the specifications for HPL, including exterior grades.

IS 4586: This standard applies to compact laminates, including exterior-grade HPL, and specifies requirements for standard and flame-retardant laminates intended for outdoor weather conditions.

These standards ensure that exterior HPL laminates meet the necessary criteria for durability and safety in various outdoor applications.

The members will be made from aluminium alloy corresponding to IS:733 and will consist of extruded sections and of other shapes, and to sized gauges as shown in the drawings/ described in accordance with the relevant IS codes. The members shall be chosen to provide strength/ stability and maximum resistance to wear and tear.

The Sections will be as per approved makes, extruded sections. As indicated in the drawings the tenderer should specifically mention which



sections he is using. For the weight of sections, IS specifications are to be strictly adhered.

17.5 SUBMITTALS

Product Data: Include construction details, material descriptions, dimensions of individual components, profiles, and finishes.

17.6 SHOP DRAWINGS

Fabrication and installation details, including followings.

Plans, elevations, and sections.

Details of fittings of Aluminium frame and exterior HPL cladding.

Hardware quantities, locations, and installation requirements

17.7 SAMPLES

Sample for verification, for each type of exposed finish required for

1. Aluminum frame and supporting hardware, screws, fastener and accessories.
2. High Pressure Exterior HPL Cladding laminate as per approved make.

17.8 EXECUTION

Examine areas and condition for compliance with requirements for installation tolerances and other conditions affecting performance of work.

Install exterior HPL cladding system and associated components according to manufacturer's written instructions.

Set units in level and plumb.

Maintain uniform clearances between adjacent components.

Lubricate hardware and other moving parts according to manufacturer's written instructions.

Set, seal and grout floor closer cases as required suiting hardware and substrate indicated.

17.9 CLEANING

The BIDDER shall ensure that all actions are taken during installation to eliminate the effects of corrosive substances on the finishes.



The BIDDER shall clean both internal and external surfaces to remove corrosive substances, dust or cement / mortar dropping during the installation as may be directed and instructed by the Engineer- in-charge.

The surfaces of HPL cladding and aluminium frame are to be cleaned with compatible cleaning agents prior to the installation of the internal protective sheeting.

The BIDDER shall provide written verification that cleaning agents are compatible with aluminium, stainless steel, glass coatings, granite, glazing materials and sealants. In no case shall alkaline or abrasive agent be used to clean the surface. Care shall be taken during cleaning to avoid scratching of the surface by grit particles.

Prior to snagging inspections, the BIDDER shall, remove the internal protection sheets and carry out a thorough cleaning of all HPL cladding and aluminium.

The BIDDER shall also make sure any physical damage to the structure including scratches, dents, abrasions, pitting, etc. to the satisfaction of the Engineer-in-charge.

Manufacturer's delivery or job markings on glass and adhesive for manufacturer's labels shall be either a neutral or slightly acidic material. In



no case shall such material be alkaline; any staining of glass by alkaline material will be cause for rejection of the glass.

After the installation of each pane of glass all markings and labels shall be carefully and completely removed from the panes. Thereafter no markings or labels of any sort shall be placed on the glass.

As soon as it is practically possible after the issuance of the occupation Permit for the Building, the BIDDER is to carry out a complete cleaning of the external face.

17.10 DELIVERY, STORAGE, AND HANDLING

DELIVERY:

Transportation: HPL cladding should be transported using vehicles that provide protection from moisture and physical damage. Ensure the panels are securely fastened during transit.

Unloading: Carefully unload the panels to avoid any impact or scratches. Use appropriate lifting equipment if necessary.

17.11 STORAGE:

Dry and Covered Area: Store HPL cladding in a dry, covered area to protect it from direct sunlight, rain, and humidity.

Elevated from Ground: Keep the panels elevated from the ground to prevent moisture absorption and potential damage.

Stacking: Stack the panels flat and avoid leaning them against walls or other surfaces. Use spacers to prevent warping.

Ventilation: Ensure good ventilation around the storage area to prevent condensation.

17.12 HANDLING:

Personal Protective Equipment (PPE): Use gloves and safety glasses when handling HPL panels to protect against cuts and scratches.

Lifting Techniques: Lift the panels using the edges and avoid dragging them across surfaces.

Cutting and Drilling: Use appropriate tools and techniques for cutting and drilling to avoid damaging the panels.

17.13 MOCK-UP



The BIDDER shall install a full mock-up at site as per approved shop drawings and as per instruction by the Engineer-in-charge.

The BIDDER shall give minimum one-week prior notice for the date of mock-up inspection by the Engineer-in-charge.

The approved mock-up shall be retained, protected and accessible at site for the duration and till the completion of the complete package works.

BIDDER shall bear all the costs related to the mock-up.

17.14 PERFORMANCE GUARANTEE:

The BIDDER shall offer a minimum of 10-year Performance Warranty for the entire installation carried out.