TECHNICAL SPECIFICATION FOR CIVIL WORKS
SPECIFICATIONS FOR CIVIL & ALLIED WORKS

CIVIL AND ALLIED WORKS

Materials shall be of the best-approved quality obtainable and they shall comply with the respective latest Indian Standard Specifications.

Samples of all materials shall be got approved before placing order and the approved sample shall be deposited with the Project consultants. In case of non-availability of materials in metric sizes, the nearest size in FPS units shall be provided with the prior approval of the Project consultants for which neither extra will be paid nor shall any rebate be recovered.

If directed, materials shall be tested in any approved Testing Laboratory and the test certificate in original shall be submitted to the Project consultants and, the entire charges connected with testing including charges for repeated tests if ordered, shall be borne by the Contractor.

The Contractors without any extra cost shall provide all equipment and facilities for carrying out field tests on materials.

It shall be obligatory for the Contractor to furnish certificates, if demanded by the Project consultant's, from manufacturer or the material supplier that the work has been carried out by their material and as per their recommendations.

All materials supplied by the employer/any other specialist firm shall be properly stored and the Contractor shall be responsible for its safe custody until they are required on the works and till the completion of work.

Unless otherwise shown on the Drawings or mentioned in the “Schedule of quantities” or special Specifications, the quality of materials, workmanship, dimensions etc. shall be as specified herein under.

1. All work shall conform to the description given for each of the items in addition to the bye laws of the Municipality / Corporation within whose jurisdiction the work is required to be carried out.

2. Rates quoted for all items shall include the following:

   a. All subsidiary fastenings, fittings and fixtures required in the completion of the items even though they may not have been specially described under particular item.

   b. All fittings fixed to the walls will have approved type of clamps and fixing shall be done as per the Project consultant’s instructions. Before proceeding with the work a sample shall be made and the Project consultant’s approval shall be obtained.

The rates quoted shall include for carrying out all items of work as per specifications even though not specially mentioned in the schedule item unless otherwise modified by schedule description or by written instructions of the Project consultants.

Contractors’ special attention is drawn to the approved brand / manufacture for the various materials of the tender and their rates must be for one of these approved materials. The rates quoted for all items in this schedule shall be applied to the work pertaining to that item in all floors whether specifically mentioned or not.

1. CEMENT:

Cement shall comply in every respect, with the requirements of the latest publication of IS 269 and unless otherwise specified ordinary Portland cement shall be used.

The weight of ordinary Portland cement shall be taken, as 1440 kg per cum (90 lbs. per cft) Cement shall
be measured by weight and in whole bags, an each undisturbed and sealed 50-kg bag being considered equivalent to 35 Ltrs in volume. Care should be taken to see that each bag contains full quantity of cement. When part bag is required cement shall be taken by weight or measured in measuring boxes.

No other make of cement but that approved by the Project consultants will be allowed on works and the source of supply shall not be changed without approval of the Project consultants in writing. Test certificates to show that cement is fully complying with the specifications shall be submitted to the Project consultants and notwithstanding this, the Project consultants may at their discretion, order that the cement brought on site and which they may consider damaged or of doubtful quality for any reason whatsoever, shall be again tested in an approved testing laboratory and fresh certificates of its soundness shall be produced. Cement ordered for re-testing shall not be used for any work pending until result of retest.

Cement shall be stored in weather proof shed with raised wooden plank flooring to prevent deterioration by dampness or intrusion of foreign matter. It shall be stored in such a way as to allow the removal and use of cement in chronological order of receipt i.e., first received being first used. Cement deteriorated and / or clouded shall not be used on work but shall be removed at once from the site. However, the Project consultants shall determine allowing use of warehouse set cement.

Weekly record of cement received and consumed shall be maintained by the Contractor in an approved form and submitted to Project consultants.

2. **FINE AGGREGATE:**
Sand shall conform to IS: 383 and relevant portion of IS 515. It shall pass through a IS Sieve 4.75 mm (3/16 BS) test sieve, leaving a residue not more than 5%. It shall be from natural source or crushed stone screenings, if allowed, chemically inert, clean, sharp, hard, durable, well graded and free from dust, clay, Shale, large pebbles, salt, organic matter, loam, mica or other deleterious substance to acceptable limits. Sand shall not contain any trace of salt and it shall be tested and sand containing any trace of salt shall be rejected. The fine aggregate for concrete shall be graded within limits as specified in IS 383 and the Fineness Modules may range between 2.60 to 3.20.

The fine aggregate shall be stacked carefully on a clean hard dry surface so that it will not get mixed up with deleterious foreign materials. If such a surface is not available a platform or a thin layer of lean concrete shall be prepared.

3. **COARSE AGGREGATE:**
Shall consist of crushed or broken stone 95% of which shall be retained on 4.75 mm IS test Sieve. It shall be obtained from crushing Granite, Quartzite, Trap, Basalt or similar approved stones from approved quarry and shall conform to IS: 383 and IS: 515. Coarse aggregate shall be chemically inert when mixed with cement and shall be cubical in shape and free from soft, friable, thin, porous, laminated or flaky pieces. It shall be free from dust and any other foreign matter. Gravel/Shingle of desired grading may be permitted as a substitute in part or full in plain cement concrete if the Project consultants is otherwise satisfied about the quality of aggregate. For all RCC works the size of coarse aggregate shall be 20mm and down gauge.

4. **REINFORCEMENT:**
Reinforcement shall be of mild steel tested quality conforming to IS: 432-1996 and any other ISS applicable or deformed bar conforming to IS 1786 and IS 1139 or hard drawn steel wire fabric conforming to IS 1566:1967. All finished bars shall be free from cracks, surface flaws, Laminations, Jagged and imperfect edges.

5. **WATER:**
Water for mixing Cement / Lime/ Surkhi mortar or concrete shall not be salty or brackish and shall be clean, reasonably clear and free from objectionable quantities of silt and traces of oil, acid and injurious alkali, salt, organic matter that weaken the mortar or concrete or cause efflorescence or attack the steel in reinforced cement concrete. Water shall be obtained from sources approved by the Project.
consultants. Pottable water is generally considered satisfactory for mixing and curing concrete, mortar, masonry etc. Where water other than main source is used this shall be tested in an approved testing laboratory to establish its suitability. All charges connected therewith shall be borne by the Contractors.

6. CEMENT MORTAR:
Cement mortar shall be of proportions specified for each type of work in the Schedule. It shall be composed of Portland cement and sand. The ingredients shall be accurately gauged by measure and shall be well and evenly mixed together in a mechanical pan mixture, care being taken not to add more water than is required. No mortar that has begun to set shall be used. River sand shall be used unless otherwise specified.

If hand mixing is allowed, then it shall be done on pucca water-proof platform. The gauged materials shall be put on the platform and mixed dry. Water will then be added and the whole mixed again until it is homogeneous and of uniform colour. Not more than one bag of cement shall be mixed at one time and which can be consumed within half an hour of its mixing.

7. MASONRY:

A) BLOCK WORK
Concrete blocks (hollow or solid) shall generally conform to IS: 2185. Blocks shall be regular in size and shape and shall be of specified strength. Blocks shall be properly cured before they are brought to site. Half or three quarter size blocks are to be used wherever required to make up length of wall and broken blocks shall not be used. The texture of the blocks shall be such that plaster will adhere to it. They shall be sound, free from cracks, honeycombing, broken edges and other flaws. They shall have plane rectangular faces with parallel sides and sharp straight angled edges. They shall have a fine, compact, uniform texture and thoroughly dried. The contractor shall supply samples for approval. Blocks supplied shall conform to approved samples.

DIMENSIONS
The size of hollow and solid blocks shall be as specified in the item of work. The maximum variation in dimensions shall not be more than +1.5mm in height and breadth and +/- 3mm in length. The blocks shall be 400 x 200 x 200mm, 400 x 200 x 150mm or 400 x 200 x 100mm as called for.

HANDLING AND STORAGE
The contractor is responsible for transporting hollow concrete blocks in such a manner that the units are adequately protected during transportation. The units shall be handled in a manner which will prevent settling, chipping or damage of any kind. Broken, chipped or otherwise damaged units will be rejected and shall not be used in the work. The blocks shall be stored in next piles free from contact with ground, which shall be located to avoid being disturbed or damage by construction activities.

SAMPLING
At least 3 blocks from a lot manufactured in a day or from 1000 blocks whichever is less, shall be tested for dimension and breaking strength. In case the test result is not up to the standards specified in IS: 2185 the entire lot shall be liable for rejection.

If solid concrete blocks are used in foundation, plinth or basement wall, the hollows must be filled up with cement concrete 1:3:6. In damp soils, the foundation and basement masonry shall be laid in richer mortar as directed by the engineer-in-charge. In addition, a damp proof course consisting of a 25mm layer of cement mortar 1:2 as an approved type of bituminous course shall be provided.

MORTAR
Cement mortar used for jointing and laying of blocks for hollow block masonry shall be as specified in the item of work or as directed by the engineer-in-charge.

PREPARATORY WORK
Wetting of blocks
The blocks need not be wetted before or during laying in the walls. In case the climatic conditions so
require. the top and the sides of the blocks may only be slightly moistened so as to prevent absorption of water from the mortar and ensure the development of the required bond with the mortar.

LAYING CONCRETE BLOCK MASONRY
Each block shall be set with bedding joints and vertical joints filled thoroughly. The wall shall be taken up truly plumb. All courses shall be laid truly horizontal and vertical joints truly vertical. Vertical joints in alternate courses shall come directly over the other. Thickness of the block courses shall be kept uniform.

Necessary tools comprising of wooden straight edge, mason’s spirit level, square, foot rule, plumb line and pins etc. shall be frequently and fully used by the masons to ensure that the walls are taken up true to plumb line and levels. Both the faces of walls of thickness greater than 20 cms shall be kept in proper plans. All the connecting block masonry work shall be carried out at nearly one level and no portion of work shall be raised more than 1 metre above the rest of work. Any dislodged block shall be removed and reset in fresh mortar.

The construction of walls may be started either at the corners first, or started from one end and proceeding in the other direction. If the corners of the walls are built first, they shall be built four or five courses higher than the centre of the walls. As each course is prelaid at the corner, it shall be checked for alignment, level and for being plumb to ensure truly straight and vertical walls. Each course in building is stepped back by half block and the horizontal spacing of the block shall be checked by placing a mason’s level diagonally across the corners of the block, the mason’s line shall be stretched from corner to corner for each course and the top outside edge of each block shall be laid to this line. Handling or gripping the block shall be such as to position the block properly with minimum adjustment. Mortar shall not be spread too far ahead of actual laying of the block that it tends to stiffen and lose its plasticity.

CLOSURE BLOCK
When installing the closure block, all edges of the opening and all four vertical edges of the closure block shall be buttered with mortar the closure block shall be carefully lowered into place. If any of the mortar falls out leaving an open joint the closure block shall be removed, fresh mortar applied and the operation.

JOINTS
Horizontal (bedding) joints
Mortar shall be spread over the entire top surface of the block including front and rear shall as well as the webs to a uniform layer of 10 mm thickness. When filling in the wall between the corners Vertical (cross) joints for vertical joints, mortar shall be applied on the vertical edges of the front and rear shall of the blocks. The mortar shall be applied on the edges of the succeeding unit when it is standing vertically and then placing it horizontally well pressed against the previously laid unit so as to provide well compacted vertical joints. In the case of two cell blocks, depression on either vertical side shall also be filled with mortar.

The thickness of both horizontal and vertical joint shall be not more than 10 mm. All face shall be raked to a minimum depth of 10 mm by raking tool except in the case of extruded joint construction as is laid when the mortar is still green so as to provide proper key to plaster or pointing to be done. Where pointing or plastering is not required to be done, the joints shall be struck flush and finish at the time of laying. The face of concrete block masonry shall be kept cleaned and all mortar droppings removed promptly.

Provision for doors and windows frames. A course of solid concrete block masonry shall be provided under doors and window openings or a 10 cm thick pre-cast concrete sill block under windows. The solid course shall extend for at least 20 cm beyond the opening on either side. For jambs of doors and windows, either solid concrete blocks shall be provided or if hollow units are used, the hollows shall be filled with cement concrete 1:2:4.

All block work shall be plumb, square and properly bonded. The joints shall be broken. The thickness of the courses shall be uniform with courses horizontal. All connected work shall be carried out at nearly one level and no portion of the work shall be left more than one course lower than the adjacent work. Blocks 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 8 mm. The face joints shall be raked to a minimum depth of 10 mm by raking tools daily during the progress of work when the mortar is still green, so as to provide a proper key for the
plaster or pointing. When plastering or pointing is not required, the joints shall be struck flush. For pointed masonry or for masonry without plaster, smooth textured concrete blocks shall be used. The face of block work shall be kept clean at all times. Where blocks are to be used for load bearing walls, the uppermost layer of the blocks supporting slab or other structural members, shall be solid or treated as directed by the Engineer. Pre-cast concrete screen blocks or 'jali' work may be used for decorative purposes. The contractor shall furnish samples for approval.

B) BRICK WORK

BRICKS
Bricks shall be Table moulded bricks, conforming to IS: 1077. Bricks shall be a uniform deep red or copper colour, thoroughly burnt without being vitrified, regular in shape and size. They shall have sharp and square sides and edges and parallel faces to ensure uniformity in the thickness and height of the courses of brickwork.
Bricks shall be free from cracks, chips, flaws, stones or lumps of any kind. They shall be sound, hard and homogenous in texture and shall have a minimum crushing strength of 50 kg per sq.cm.
The nominal size of the brick shall be 230mm x 115mm x 70mm (nominal) unless otherwise specified. The bricks shall be provided with frogs. The water absorption shall not be more than 20 (twenty) percent by volume.

TESTING
Samples of Bricks taken at random from stacks/Trucks by the Project Manager shall be got tested for strength, water absorption, etc. at contractor's expense.

SAMPLES
Samples of each type of brick taken at random from the load shall be deposited with the Project consultant for his approval before being used in the work. All subsequent deliveries shall be upto the standard of sample approved.

SOAKING OF BRICKS
All bricks shall be thoroughly soaked in clean water immediately before use. They shall be placed in specially prepared vats, tubs or tanks for not less than one hour. The Superintendent may amend this time after trials at site. After they have been soaked, the bricks shall be kept on wooden planks or brick platforms to avoid earth being smeared on them.

MORTAR MIXING
Mixing of mortar shall be done in a mechanical mixer. Hand mixing shall be resorted to only when specifically permitted by the project consultant. Cement and sand shall be mixed dry thoroughly and then water shall be added gradually. Wet mixing shall be continued till mortar of the consistency of a stiff paste and uniform colour is obtained. Only the quantity of mortar which can be used within thirty minutes of its mixing shall be prepared at a time.
Mortar shall be used as soon as possible after mixing and before it has begun to set and in any case within thirty minutes after the water is added to the dry mixture. Mortar left unused for more than thirty minutes after mixing shall be rejected and removed from the site of work.

LAYING
If bricks/blocks are of size such that the width of the header course does not come equal to the width of the stretcher course, the difference shall be made up during construction of brick work itself by the same mortar as used for construction of masonry to provide a plane vertical surface. The surface should also be scarified to receive plaster.
All junctions of walls and cross walls shall be carefully bonded into the main walls. The rate of laying masonry will be up to a height of 100cm per day if cement mortar is used. Greater heights may be built only if permitted by the project consultants.
During rains, the work shall be carefully covered to prevent mortar from being washed away, should any mortar or cement be washed away, the work shall be removed and rebuilt at the contractor's expense.
CURING
All fresh brickwork shall be protected from the effects of sun, rain, etc., by suitable covering. All brick works shall be kept constantly moist on all the faces for at least 10 days.

SCAFFOLDING
Unless otherwise instructed by the project consultant, double scaffolding having two sets of vertical metal supports shall be provided for all building work. The supports shall be sound, strong and tied together with horizontal pieces over which scaffolding planks shall be fixed. The contractor shall be responsible for providing and maintaining sufficiently strong metal scaffolding so as to withstand all loads likely to come upon it. Wooden scaffolding shall not be permitted.

8. PLASTER AND WALL FINISHES
The contractor shall furnish all materials, labour, scaffolding equipment, tools, plant & incidentals necessary and required for the completion of all plaster and wall finishes, subject to approval by project consultant.

GENERAL
Plaster as herein specified shall be applied to all internal and external surfaces where called for. Glazed tile dado, marble stone dado and other wall finishes shall be provided where indicated on drawings and schedule of finishes. Areas called for on drawings and typical shall be considered to apply to appropriate adjoining areas whether shown on same drawings or not and whether indicated or not.
All plaster work and other wall finishes shall be executed by skilled workmen in a workmanlike manner and shall be of the best workmanship and in strict accordance with the dimensions on drawings subject to the approval of the project consultant.

PLASTER WORK
The primary requirement of plasterwork shall be to provide absolutely watertight enclosure, dense, smooth and hard and devoid of any cracks on the interior and / or exterior. The contractor shall do all that is necessary to ensure that this objective is achieved. All plastering shall be finished to true plane, without any imperfections and shall be square with adjoining work and form proper foundation for finishing materials such as paint etc.
Masonry and concrete surfaces which call for applications of plaster shall be clean, free from efflorescence, damp and sufficiently rough and keyed to ensure proper bond, subject to the approval of the project consultants.
Wherever directed by the project consultant, all joints between concrete frames and masonry in filling shall be expressed by a groove cut in the plaster. The said groove shall coincide with the joints beneath as directed. Where grooves are not called for, the joints between concrete members and masonry in filling shall be covered by 24 gauge galvanised chicken mesh strips 400mm wide or as called for on drawings / documents which shall be in position before plastering.

CHASING & BREAKAGE
All chasing, installations of conduits, inserts boxes etc., shall be completed before any plastering or other wall finish is commenced on a surface. No chasing or cutting of plaster or other finish on a surface shall be permitted, broken corners shall be cut back not less than 150mm on both sides and patched with Plaster of Paris as directed. All corners shall be rounded to a radius of 8mm or as directed by the project consultants.

SAMPLES
Samples of each type of plaster & other wall finish shall be prepared well in advance of undertaking the work for approval by the project consultants.

MATERIALS
CEMENT:
AS SPECIFIED ABOVE
WATER:
As specified above

SAND:
For internal plaster - washed fine sand.

PROPORTIONS
The materials used for plastering shall be proportioned by volume by means of gauge boxes.

PREPARATIONS OF SURFACES
The joints in all walls, both existing and freshly built shall be raked to a depth of 15mm, brush cleaned with
wire brushes, dusted and thoroughly wetted before starting plastering work. Concrete surfaces to receive
plaster shall be roughened by hacking over the entire surface so that the skin of the concrete is
completely removed, as approved by the project consultants to ensure proper key for the plaster.

PLASTER TO WALLS
Plaster to internal faces of walls shall be 15mm thick comprising of one part cement and six parts of clean
fine sand. The external surfaces of external wall shall have plaster of 10mm thickness comprising of one
part of cement and 4 parts of clean fine sand to form base for vapour barrier.

MORTAR MIXING
Mortar shall be prepared as specified under "brick work". It shall be made in small quantities, as required
and applied within 15 minutes of mixing.

APPLICATIONS
Plaster application shall be commenced only after the preparatory work is approved by the project
consultant. Correct thickness of plaster shall be obtained by laying plaster screeds (gauges) at intervals
of 1.5mtrs as directed.
Mortar shall be firmly applied, well pressed into the joints, rubbed, and finished as approved by the
project consultants to give a smooth and even surface.

CURING
Finished plaster shall be kept wet for at least 10 days after completion. In hot weather, walls exposed to
such shall be screened with matting kept constantly wet or by any other approved means.

CEILING PLASTER
Plaster to ceilings, soffits or stairs flight slabs and similar locations, where called for, shall be 12mm thick
and comprise of one part cement and four parts of clean fine sand.

PLASTER MESH TO WALLS
Plaster mesh of 24 gauge, 12mm size shall be provided at junctions of brick masonry and concrete
members, to be plastered and other locations 150mm on either sides of the junction in double fold or as
called for, properly stretched and nailed, ensuring equal thickness of plaster on both sides of the mesh.

CEMENT MORTAR
Cement mortar shall be of proportion specified for each type of work. It shall be composed of Portland
cement and sand. The ingredients shall be accurately gauged and shall be evenly mixed together in a
mechanical mixer. Care should be taken to add more water than necessary. If hand mix is allowed it
shall be done on pucca waterproof platform. The gauged materials shall be put on platform, and
thoroughly mixed dry. Water shall then be added and the whole mixed thoroughly until the mix is
homogenous and of uniform colour. Quantity of mortar mixed should not be more than what can be
consumed within half an hour of mixing.
Cement mortar mix are specified as 1:2, 1:3, 1:4, 1:5 etc. The first figure will mean one part of Portland
cement by volume, the second figure will mean so many parts of sand by volume. For example, cement
mortar 1:4 would mean one part of cement and four parts of sand.

Cement & sand must conform to relevant IS specification.
LIME FOR RENDERING
The wall shall be prepared out of best quality fat lime slaked at site with fresh water not less than one week or more than two weeks before use. All impurities, ashes, improperly burnt stuff shall be screened and picked out before slaking. Slaked lime shall be screened through to remove all un-slaked materials, stones etc., so that only a fine creamy paste is available for rendering. Slaking lime is diluted with just sufficient water to give a thick consistent liquid suitable for effective covering of base surface. Before the base coat sets the lime rendering is applied and finished smooth and the entire plastered surface is truly plane.

ROUGH CAST PLASTER

GENERAL
The specification for sand faced plaster shall also apply to rough cast plaster, subject to the following:

BASE COAT
The first coat of plaster shall be of cement mortar 1:4 mixed and applied according to the relevant provisions of IS 1661. The finished thickness shall be 12mm for brick masonry and concrete surfaces and 1.5mm for stone masonry. The plaster shall be laid by throwing the mortar by using a strong whipping action and pressing to form a good bond. The surface shall be roughened.

SECOND COAT
The second coat shall be the roughcast mixture consisting of aggregate which may vary in size from 5mm to 8mm and may consist of specially graded mixture mixed with fine sand and cement. The proportion of cement to sand to aggregate shall be 1:1.5:3. It shall be flung upon the first coat with large trowels to form an over protective coat. The second coat must be applied while the first coat is still soft and plastic. The work shall generally conform to requirements IS 1661. The thickness of the coat shall be about 12mm.

FLOORING, SKIRTING, DADOING AND CLADDING

GENERAL
Before the operation for laying any floor is started, the surface of base concrete shall be thoroughly cleaned of all dirt, loose particles, caked mortar droppings, by scrubbing with coir or steel wire brushes. If so directed by the project consultants the surface shall be roughened by chipping or backing at close intervals. The surface shall then be cleaned with water and kept wet for 12 hours and surplus water shall be removed by mopping before the topping is laid.

GRANOLITHIC FLOORING

GENERAL
The flooring shall be of specified thickness and shall consist of 1:1.5:3 concrete base as specified and 12mm thick granolithic wearing coat. The granolithic flooring shall be laid in alternate panels. The size of panels shall be as decided by the project consultants.

LAYING OF 1:1.5:3 CONCRETE BASE
The 1:1.5:3 concrete base shall be of graded coarse aggregate of 20mm and down size, coarse sand & cement. The ingredients shall be thoroughly mixed with sufficient water to obtain the required plasticity. The free water on the surface of the base shall be removed and a coat of cement slurry of the consistency of thick cream shall be brushed on the surface.
The prepared 1:1.5:3 concrete shall be laid immediately after mixing on the fresh grouted base. The concrete shall be spread evenly and leveled carefully. Low places shall be filled, humps removed and the whole surface again leveled. The layer shall be compacted by ramming and trowelled and allowed to set. The base shall be laid in alternate panels not exceeding 4 sqm area.

MIXING AND LAYING OF WEARING COAT
One part of cement in dry state shall be mixed with 1.5 parts by volume of well graded/crushed granite
chips of 6mm maximum size. The ingredients shall be then mixed with sufficient water as for ordinary concrete. The wearing coal shall be laid 12mm thick over 1:1.5:3 cement concrete base immediately after it has set compacted and leveled with a steel trowel. Just sufficient trowelling shall be made to give a level surface. The surface should not be over trowelled as excessive trowelling will bring the cement to the surface which shall be strictly avoided. When the initial set takes place further compaction by steel trowelling shall be done and final brushing shall be made before the topping becomes too hard.

CURING
As soon as the surface is hard enough, it shall be covered with sacking or sand and kept continuously wet for a period of at-least one week.

GRANITE & OTHER STONE WORKS
The slabs shall be of selected quality, hard sound, dense, homogenous in texture, free from cracks, decay, weathering and flaws and of thickness as specified. The top exposed faces should have been polished before bringing it to site.

The sizes of slabs shall be as called for in the drawings and shall be of 20 and 40mm thick. They shall be of colour as approved by the Project consultant. They shall have the top surface machine polished before being brought to site. All edges shall be machine cut to have the slabs to required correct sizes and the edges shall be ground smooth and even to full depth. A straight edge laid along the side of the slab shall be in full contact with it. All angles and edges of the slabs shall be true and square and free from chipping.

A bed of cement mortar 1:4 shall be laid and properly levelled to an average thickness of 20mm and the surface should be kept slightly rough to form a satisfactory key for the slabs. Neat cement paste of honey like consistency shall be spread over mortar bed over such an area so that the paste will not harden before laying slabs. Slabs shall be soaked in water for 15 minutes and allowed to dry. The slabs shall then be fixed as per approved pattern with thin coat of cement paste on back of each slab. They will be tapped with a wooden mallet till it is properly bedded in level with adjoining slabs. Joints shall not be more than 1.5mm wide. The surplus cement grout that may have come out of the joints has to be wiped off gently and joints cleaned. Joints shall then be flush pointed with cement based polymer grouts to match the shade of the slab. The flooring shall be cured for 14 days. Then it shall be polished according to IS: 1443, except that (1) First polishing with coarse grade carborandum shall not be done. (2) Cement slurry with or without pigment shall not be applied before polishing.

VITRIFIED/ CERAMIC TILE FLOORING & DADOING
Before the operation for laying or cladding any floor/wall is started, the surface of base concrete shall be thoroughly cleaned of all dirt, loose particles, mortar droppings, by scrubbing with coir or steel wire brushes. If so directed by the Professional Team the surface shall be roughened by chipping or hacking at close intervals. The surface shall then be cleaned with water and kept wet for 12 hours and surplus water shall be removed by mopping before the topping is laid.

Homogenous Vitrified tiles from an approved manufacturer conforming to European standards EN: 176/179 and IS 777 for Ceramic tiles shall be of specified size and thickness and colour. Coves, internal and external angles, corners, beads, etc., shall be used as per the direction by the professional team. Under layer of 12 to 15mm average thickness of cement mortar 1:4 proportion shall be laid. Tiles shall be well soaked in water, washed, cleaned and set in cement mortar and 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 kept as thin as possible and in straight lines or to suit the required pattern. To attain best results 3mm tile spacers to be used for flooring and cladding works. After the tiles have been laid, surplus epoxy grout shall be cleaned off. The joints shall be cleaned off the grey cement grout with a wire brush or trowel to a depth of 5mm and all dust and loose mortar removed. Joints shall then be flush pointed with cement based polymer grouts to match the colour of the tile. The floor/dado shall then be kept wet for 14 days. After curing, the surface shall be washed with mild hydrochloric acid and clean water. The finished floor/dado shall not sound hollow when tapped with a wooden mallet. The works will include the cost of under layer
of cement mortar. The masking tape shall be put before putting the epoxy grout & the grout shall be thoroughly cleaned immediately.

Tiling Work
The type, quality, size, thickness and colour of tiles for flooring, skirting and dados shall be of the best quality as described and approved by the Professional Team. The Contractor shall provide the Professional Team with samples for approval and only approved tiles, skirtings and dados shall be brought on to the Site.

Before laying tiles sub-surfaces shall be thoroughly cleaned and washed of all loose materials, dirt, laitance and the like and then well wetted without forming water pools on the surface.

Tiles shall be laid on Cement mortar bedding 12mm thick in the proportions of one part of cement, two parts lime and six parts sand.

Tiles shall be laid on mortar beds one after another, each tile being gently tapped with a wooden mallet until properly bedded and level with adjoining tiles. Joints shall be perfectly straight and uniform in thickness. Tiles shall be laid perfectly level unless otherwise specified or directed by the Professional Team. After laying joints of tiles shall be finished with epoxy based polymer grouts to match the colour of the tile.

Floor tiles laid adjoining walls shall project at least 12mm under plaster or render, skirtings or dados. Half tiles and cut pieces shall be avoided as far as possible.

After laying flooring shall be allowed to cure undisturbed for 7 (seven) days. Construction traffic and labour movement shall not be allowed on the floor for at least 14 (fourteen) days after laying tiles. Following curing each and every tile shall be lightly tapped with a small wooden mallet. Should this give a hollow sound such tiles, together with any cracked or broken tiles, shall be removed and replaced with new tiles to proper lines and levels.

For skirting and dado vertical surfaces shall be thoroughly cleaned and wetted and evenly and uniformly covered with a 12mm thick coat of cement mortar (1:2).

Backs of tiles for skirtings and dados shall be covered with a thin layer of neat cement paste and tiles gently tapped against the wall with a wooden mallet. Work shall be done from the bottom of the surface proceeding upwards. Joints shall be as close as possible and the work shall be truly vertical and flush. To attain best results 3mm tile spacers to be used for flooring and cladding works. Corners and junctions shall be finished true with external and inner corner PVC beads of colour matching to the tiles. At the tops of dado work border tile/ granite borders, if specified, shall be provided.

Works to include flooring, skirtings & dado work and shall be inclusive of forming angles, corner pieces and approved borders.

Tile Grouts: grout to match the tile colours. Water absorption of these grouts should be less than 5% and comprehensive strength of min 3500 psi. The linear shrinkage should be less than 0.1%. The grout should be non-staining with fortifier and colourfast pigments. The masking tape shall be put before putting the epoxy grout & the grout shall be thoroughly cleaned immediately.

Corner Beadings: External round/ convex and internal concave PVC corner beads to match the colour of the tiles. PVC Inner Corner Tile Beading and External Round edge Tile Beading of nominal thickness 1.2mm of Colours matching the tile colours & depths of, 9.5 and 10.5mm made out of PVCU and PVC co-extrusion equivalent to BS 5750 as protector for tiles inner corners and external edges, for almost vertical and horizontal edges. The size shall be minimum length 2.5m. Joints are not permitted.

Tile Spacers: 3mm spacers made of PVC as per as per manufactures specifications with size of 30 x 30 x 3mm
Pre-polished counters for wash basins

Providing and fixing Granite running counter for a depth 600mm & 300mm front facia finished with Granite, wash basin counter to be fixed with necessary frame work as per detailed drawing. The counter top shall have 20mm thick granite of approved shade supported on 25 x 25mm 4mm thick MS powder coated box section fixed to adjoining masonry wall/partitions as per the detailed drawings. The counter shall be supported on 20mm thick marine grade plywood using 25 x 25 x 4mm thick MS powder coated brackets supports at regular intervals as per the detailed drawings. The counter top granite shall be properly edge polished to shape as per the detail drawings. The counter shall have 4” high 20mm thick granite back splash band with chamfered edges fixed over partitions/masonry/ RCC with cut-out to accommodate switches and sockets with edges properly machine polished.

The provision shall be made in granite for fixing below counter wash basin with edges half bull nosed as per the detailed drawings. The Counter also includes 200mm high 20mm thick granite facia fixed over the 19mm thick ply with edge details as per the detailed drawing. The underside of the counter marine plywood surface shall be laminated with 1mm thick laminate of approved shade with PVC edge lipping as per the detailed drawings.

Marble and Granite Flooring, Dado & Skirting

The type, quality and thickness of marble and granite slabs for flooring, skirting and dados shall be of the best quality as described and approved by the Project Manager or his representative and shall be hard, dense, uniform, homogenous in texture, have even crystallising grains and be free from cracks and other defects. The Contractor shall provide the Project Manager or his representative with samples for approval and only approved slabs shall be brought on to the Site. The slabs shall be machine polished, flamed or honed as mentioned in the drawings at the factory prior to being brought to the Site. All edges shall be machine cut to have the slabs to required correct sizes and the edges shall be ground smooth and even to full depth. A straight edge laid along the side of the slab shall be in full contact with it. All angles and edges of the slabs shall be true and square and free from chipping. Bull nosing, grooves & chamfering of edges for staircases & skirting, etc., shall be as indicated in the detailed drawings.

Flaming on polished granite to achieve the required undulated flame finish shall be done using the thermal torch. The ignited torch shall be held at 45 degrees to the granite slab plane with required temperature using combination of Oxygen and LPG gasses in presence of continuous water jet for immediate cooling. The pressure of the gasses required, depends on the level, intensity and pattern of flaming as approved by the Project consultant.

Granite Slabs for Lift flooring shall have suitable Epoxy underlays & adhesives as per the detailed drawings & manufacturers specifications.

Before laying sub-surfaces shall be thoroughly cleaned and washed of all loose materials, dirt, laitance and the like and then well wetted without forming water pools on the surface.

Slabs shall be laid in cement slurry over a cement mortar bed approximately 18mm thick (one part of cement, and six parts sand) evenly spread over sub-surfaces.

Slabs shall be gently tapped with a wooden mallet until properly bedded and level with adjoining slabs. Joints not exceeding 1mm wide shall be perfectly straight and uniform in thickness. Slabs shall be laid perfectly level unless otherwise specified or directed by the Project Manager or his representative. After laying joints shall be finished with white cement.

The work shall include admixtures & grouts such as S11 IMPREGNATOR (Sealer) & LATICRETE 111 & 4237 all as manufacturers specifications & drawings.
Slabs laid adjoining walls shall project at least 12mm under plaster or render, skirting or dados.

After laying flooring shall be allowed to cure undisturbed for 10 (ten) days. Design traffic shall not be allowed on the floor for at least 14 (fourteen) days after laying slabs. Following curing slabs shall be lightly tapped with a small wooden mallet. Should this give a hollow sound such slabs, together with any cracked or broken slabs, shall be removed and replaced with new slabs to proper lines and levels.

The above procedure shall be followed again after slabs are polished. To ensure that such replaced slabs match those laid earlier the Contractor shall order sufficient extra slabs to meet this requirement.

After joints have developed sufficient strength floors shall be machine polished to the desired finish to the satisfaction of the Project Manager or his representative. Sufficient quantities of water shall always be used during polishing to prevent scratching.

For skirting and dado vertical surfaces shall be thoroughly cleaned and wetted and evenly and uniformly covered with approximately a 12mm thick coat of cement mortar (1:4).

Backs of cut slabs for skirting and dados shall be covered with a thin layer of neat cement paste and tiles gently tapped against the wall with a wooden mallet. Joints shall be as close as possible and the work shall be truly vertical and flush. At the top of dado work borders, if specified, shall be provided.

Once work has set skirting and dados shall be hand polished with Carborundum stone to produce a high glossy finish. Corners and junctions shall be finished true.

The work for flooring, skirting and dado work shall be inclusive of forming angles, corner pieces and approved borders.

**Urinal Partitions**

The Urinal Partitions shall be 19mm thick, double side polished Granite slabs in between Urinals. Top, side and all visible surfaces shall be polished & rounded off and fixed in CM 1:4 to walls with necessary MS cloi sections / cement mortar in niche and joints shall be epoxy based polymer grout of approved make with in the as per detail drawings & approved by Project consultants.

**IPS Flooring**

**General**

The flooring shall be of specified thickness and shall consist of 1:2:4 concrete base/ M15 concrete as specified in the Bill of Quantities and 12mm thick wearing coat. The granolithic flooring shall be laid in alternate panels. The size of panels shall be as decided by the Project Managers.

**Laying of 1:2:4/ M15 Concrete Base**

The 1:2:4/ M15 concrete base shall be of graded course aggregate of 20mm and down size, 10mm course sand & cement. The ingredients shall be thoroughly mixed with sufficient water to obtain the required plasticity. The floor shall be completed with 1:1 cement sand mortar 12mm thick and cement slurry 2.2kg/sqm including Glass divider strips 45/50x4mm thick set in the flooring including necessary levelling, setting, etc.

The free water on the surface of the base shall be removed and a coat of cement slurry of the consistency of thick cream shall be brushed on the surface.

The prepared 1:2:4/ M15 concrete shall be laid immediately after mixing on the fresh grouted base. The concrete shall be spread evenly and leveled carefully. Low places shall be filled, humps removed and the whole surface again leveled. The layer shall be compacted by ramming and trowelled and allowed to set.
Mixing and Laying Of Wearing Coat
One part of cement in dry state shall be mixed with 1.5 parts by volume of well graded/crushed granite chips of 6mm maximum size. The ingredients shall be then mixed with sufficient water as for ordinary concrete. The wearing coat shall be laid 12mm thick over 1:2:4 cement concrete base immediately after it has set compacted and leveled with a steel trowel. Just sufficient trowelling shall be made to give a level surface. The surface should not be over trowelled, as excessive trowelling will bring the cement to the surface, which shall be strictly avoided. When the initial set takes place further compaction by steel trowelling shall be done and final brushing shall be made before the topping becomes too hard.

FLOOR HARDNERS
Where specified in the drawings, floor hardeners, approved by the Project Manager or his representative, shall be supplied and incorporated into surface finishes in accordance with the manufacturer’s recommendations.

CURING
As soon as the surface is hard enough, it shall be covered with sacking or sand and kept continuously wet for a period of at-least one week.

SCREED FLOORING
General
The flooring shall be of specified thickness and shall consist of 1:2:4 concrete base as specified and 12mm thick wearing coat. The screed flooring shall be laid in alternate panels. The size of panels shall be as decided by the Project Managers.

Laying of 1:2:4 Concrete Base
The 1:2:4 concrete base shall be of graded course aggregate of 20mm and down size, 10mm course sand & cement. The ingredients shall be thoroughly mixed with sufficient water to obtain the required plasticity.

The free water on the surface of the base shall be removed and a coat of cement slurry of the consistency of thick cream shall be brushed on the surface.

The prepared 1:2:4 concrete shall be laid immediately after mixing on the fresh grouted base. The concrete shall be spread evenly and leveled carefully. Low places shall be filled, humps removed and the whole surface again leveled. The layer shall be compacted by ramming and trowelled and allowed to set.

Providing & laying screed concrete of following thickness with power trowelled smooth finish screed concrete flooring using M20 Grade Ready Mix / Manual concrete with 20mm and 10mm down size aggregates to line*and level as per the finalized bull works. The screed concrete floor has to be laid in panels of Maximum size 3 mtrs x 3 mtrs by the alternative bay method. The construction joint shall be cut using diamond bit wheel for a width of 3 to 4mm and a depth of 30mm within 20 to 30 hours of concreting, no delay shall be acceptable. On curing and drying of the concrete the construction joints have to be filled with Nitoseal 280 or equivalent as per manufactures specification. The rate to include necessary Base cleaning, chipping of loose mortar/concrete, water wash of the mother slab/ existing concrete surface to the satisfaction of Project consultant / PMC/Consultant with, consolidation, levelling, power trowelling smooth finishing and curing etc., complete with lead and lift to all levels as directed by the Consultants/project consultants / engineer in charge in line with the technical specification.

CURING
As soon as the surface is hard enough, it shall be covered with sacking or sand and kept continuously wet for a period of at-least one week.
VACCUM DEWATERED CONCRETING AND FLOORING

Preparation
The surface to receive flooring shall be clean, free from dirt and free from foreign material.
Any undulations or mortar remaining on the floor shall be trimmed.
Base course shall be trimmed.
The base shall be cleaned and watered before laying the floor.
Work includes at all depths and heights.
The finished surface shall be kept wet for a maximum period of one week.

Concreting (General)
Concreting shall have a concrete base of M20 of specified thickness.
Flooring shall have hardtop on the concrete base.
Flooring shall be laid in strips, the size of which is mentioned on the drawings.

Materials
Cement - Portland
Sand - River sand
Aggregate - Max. Size 10 to 20mm
Water - Potable
Nito hardener (Optional) - @ 3kg/sqm
Poly Sulphide sealant - At all control joints of size 10mmx6mm at every 200 sqm area

Execution
Mix cement, sand and aggregates in proportion 1:1.5:3 thoroughly with water to get an appropriate consistency.
Prepared concrete shall be laid immediately after mixing.
The base shall be free from water and other foreign materials, dust and dirt.
A coat of cement slurry of the consistency of thick cream shall be brushed on the surface of the base course.
The concrete shall then be spread over this base evenly and leveled carefully.
Low areas shall be filled with concrete and humps removed. De-vacuumisation shall be done for removing the voids*

The whole concrete surface shall be leveled, compacted by ramming and trowelling.
Prepared surface shall be allowed to set.

Hardener screed:
Hardtop to be prepared as per the specifications with Nito hardener and one part of dry cement.
The heard top shall be provided over concrete base immediately after it is set, compacted and leveled
with a steel trowel.
The surface shall be trowelled to bring the hardener coat to a leveled surface.
Excessive trowelling shall be avoided.

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After the initial set, further compaction shall be done by steel trowelling.

Final brushing where required (to achieve desired surface finish) shall be made before the floor tcp becomes too hard.

**Curing**

Curing shall commence as soon as the surface is hard enough to receive the water.

The surface shall be covered with sacks or sand and shall be kept continuously wet for a period of at least one week.

**STAINLESS STEEL RAILING FOR DOUBLE HEIGHT AREA**

Fabricating, Supplying and Fixing in position Stainless steel Staircase Handrail of 1200mm high +(150-200) mm with Top hand rail of 50mm dia Hollow SS pipe of 16 gauge to be welded to 19mm wide 8mm thick brushed finish SS flat to shape and size as railing to the verticals made of 50x6 mm SS flats with 8mm spacer welded to SS brackets pipe which is connected with vertical 10mm dia SS pipe bent to profile and placed as per the detail architectural drawing and verticals are connected by 50mm wide 10mm thick brushed finish SS flat vertical supports to be grouted on to the slab. Verticals should be fixed to the concrete slabs with 75mm x 75mm, 10mm SS plate anchored with 4 NOS. of 10mm dia 75mm long SS brush finished Expansion bolts as per the detail drawings. The rate to include 10mm thick laminated glass panels in between the vertical steel pipes, the glass to be fixed for every 1200mm distance.

All SS sections shall be 304 grade with brush finish as per the project consultants and Site in charge approval.

The Contractor to submit the shop drawing of the same including the fabrication details, calculations and stability report. The work to start only on written approval of the same by the Project consultants. They also includes necessary scaffolding /centering and lead lift as per the site conditions.

**MS STAIRCASE RAILING**

Fabricating, Supplying and fixing in position Staircase hand rail of 50mm dia hollow MS pipe of 16 gauge, fixed to 25mm dia MS pipe. Bent to profile and welded to MS insert plates of 100MM x 100MM, 6MM thick, anchored in the wall with 4 nos. of 10mm dia, 75mm long expansion bolts, etc., complete, as per architectural drawings. All MS sections to be finishes as per Project consultants / Site in charge instructions. All MS sections to be finished with one coat of primer and 3 coat of Auto coat spray paint as per the detailed drawing the rate should include necessary scaffolding and supports and welding etc complete.

**MS STAIRCASE RAILING**

Fabricating, Supplying and Fixing in position MS Staircase Handrail with Top hand rail of 50mm dia Hollow MS pipe of 16 gauge to be welded to the verticals made of 40mm dia MS tube (sealed with SS cap) with a connector 12mm dia MS rod bent to profile as per the detail architectural drawing. Balusters should be fixed to the concrete slabs with 60mm x 60mm, 8mm plate anchored with 4 Nos. of 8mm dia 75mm long Expansion bolts as per the detail drawings. The Mid-rails shall consist of 2 Nos 40X25mm MS square tube welded to balusters with a connector of 20mm MS square rod as per detailed drawings. 25mm wide, 6mm thk MS vertical are welded in bet the Mid-rails as per detailed drawings. All MS sections to be finished with Auto coat paint as per Project consultants / Site in charge instructions.
SS RAMP RAILING

Fabricating, Supplying and Fixing in position Stainless Steel Disabled ramp railing of 1000mm high with Tcp hand rail of 50mm dia Hollow SS pipe of 16 gauge to be welded as railing to the verticals made of 50mm dia SS tubular sections as per the detail architectural drawing and 1 no 30 mm dia SS pipe as mid rails placed as per the detail Architectural drawings. Verticals should be fixed to the concrete slabs with 200mm x 150mm, 6mm thick SS plate anchored with 4 Nos. of 10mm dia 75mm long Expansion bolts with 70mm dia SS capping at the top as per the detail drawings. All SS sections to be finishes as per Project consultants / Site in charge instructions. All SS sections to be of grade 304.

STAINLESS STEEL HANDRAIL WITHOUT GLASS

Fabricating, Supplying and fixing in position SS Staircase Handrail with Top hand rail of 50mm dia Hollow SS pipe of to be welded as railing connected to the verticals through 8mm connector plate with 2mm SS flat base plate below the hand rail. The Verticals shall be made of frame work of 2 Nos. 50X6 mm SS flat with 8mm spacer plate and rounded edges finish placed at 1000mm c/c as balusters as per the detail architectural drawing. Mid rails shall be 3 Nos 20mm dia SS rods connecting the verticals. Balusters should be fixed to the concrete slabs with 150mm x 100mm, 6mm SS plate anchored with 4 Nos. of 10mm dia 75mm long Expansion bolts as per the detail drawings. All SS sections will be finish as per Project consultants / Site in charge instructions. All sections to be of grade 304. The Contractor to submit the shop drawing of the same including the fabrication details, calculations and stability report. The work to start only on written approval of the same by the Project consultants.

SS SINGLE PIPE RAIL

Fabricating, Supplying and Fixing in position SS single pipe wall rail of 50mm dia hollow SS pipe of 16 gauge, fixed to 12mm dia SS rod bent to profile and welded to insert plates of 100X100X 6mm thick, anchored in the wall with 4 nos. of 10mm dia, 75mm long expansion bolts, etc., complete, as per architectural drawings. All SS sections to be finished with Auto coat paint as per Project consultants / Site in charge instructions. All sections to be of grade 304.

Glazier's Work

All glass for Railings etc. shall be as specified in the drawings and free from air bubbles, specks and scratches of other defects. All glass shall be cut to fit the sashes or other members as required. All glass shall be properly bedded, securely fixed and finished as indicated on the drawings. Beading finished as specified shall be provided for fixing the glass. No glazing shall be complete until all the stains and marks have been removed from the surface of glass.

Tolerances

Tolerance on nominal width and height shall be +3mm or -0mm and that on thickness shall be +/- 1.2mm. The thickness of the members shall be uniform throughout with a variation not exceeding +/- 0.8mm when measured at two end points.
TECHNICAL SPECIFICATIONS FOR INTERIOR & ALLIED WORKS
INTERIOR AND ALLIED WORKS

PLYWOOD/ FLEXIBLE PLYWOOD:
Plywood of 4/6/9/12/19mm thick layered flat pressed teak wood bonded (Garjan type) with BWP type using only phenol formaldehyde synthetic resin confirming IS code 303. All plywood shall be of (Boiling Waterproof type) as approved by the Project consultants. All exposed plywood edged shall have maple wood lipping of 10mm thick unless otherwise specified. When decorative plywood is used for panelling, the same shall be of matching grains. All Plywood shall be treated for Termite, Borer proofing and painted with fire retardant paint.

PARTICLE/ MDF/ HDF BOARDS
Particle/ MDF/ HDF boards of 6 / 9 / 12 / 18 / 25 / 32mm thick particle board of approved make confirming to E1 – Emission Class as European Standards BS EN 13986 or as American Standards AHFI A208.2 – 1994 manufactured without using any formaldehyde resins or if not possible Phenol formaldehyde based resins shall be used with edges to have PVC lipping unless otherwise specified.

GRANITE:
Shall be of selected quality, hard, dense and homogeneous texture, free from cracks, decay, weathering, and flaws. Stone slabs shall be of uniform colour and as approved by the Project consultants. They shall be machine cut and machine polished where specified and shall conform to the required sizes. Thickness shall be as specified in the respective items.

TIMBER – TEAK WOOD
The Teak wood should be of best quality available in India. It should be well seasoned and free from gap, knots, wraps, cracks, and other defects. All woodwork shall be planed and neatly, truly finished to the exact dimensions. All joints shall be neat and strong, truly finished to the exact dimensions shown in the drawings. All joints shall be neat and strong, truly and accurately fitted and glued before being fitted together. All screws used in woodwork shall be of steel nettle fold make.

SALWOOD
The salwood used shall be Gumsal. It should be well seasoned and free from gap, knots, wraps, cracks, and other defects. All woodwork shall be planed and neatly truly finished to the exact dimensions. All joints shall be neat and strong, truly finished to the exact dimensions shown in the drawing. All joints shall be neat and strong and, truly and accurately fitted and glued before being fitted together. All screws used in the woodwork shall be of steel nettle fold make. All salwood sections shall be treated for Termite / Borer proofing.

DRAWER SLIDING CHANNELS:
The drawer channels being used shall be of telescopic type to the size as per the manufacturer's specifications adhering to detail drawings. The makes used here shall be of Blum/ Hettich/ Hafele or approved equivalent make. All the samples to be approved by Project consultants prior to procurement.

ALUMINIUM TUBE SECTIONS/ FRAMEWORK:
The aluminium tube sections shall be of Jindal/ Bhoruka/ Hindalco make of size 50 x 50/ 25mm or 50.8 x 50.8/ 24.4mm x 16SWG (1.626mm thick and consider the tolerance range of 1.60~1.65mm) with heavy duty 3mm thick Aluminium cleats and steel screws. The aluminium tube sections shall be plain anodised for thickness of 15microns as per anodising specifications.

WHEEL CASTORS:
The makes used shall be of Renolle / Classis or Nicholson. Project consultant’s approval shall be taken before procuring / installing these castors.

ADHESIVES:
The adhesives used shall be Fevicol, Jivanjor and Aralidate or approved equivalent make.

GLASS/ MIRROR:
The glass/ Mirror used shall be Saint Gobain, Modi float or Ashai glass. Tinted, Toughened if specified.

VENEER:
The veneer used shall be of 4.6mm thickness with minimum of 4mm thick BWP (Boiling Waterproof type) plywood backing of approved make. The designs will be selected and approved by the Project consultants.

**LAMINATE SHEETS:**
All laminate sheets will be of 1.5mm thick of approved make for all External Surfaces, 1.0mm for all internal surfaces and 0.8mm for Post formed tabletops. The shades will be selected and approved by the Project consultants.

**HINGES:**
These shall be of Dorma/ Hager/ Union/ IR/ Blum/ Hettich or Equivalent make. All the samples to be approved by Project consultants prior to procurement.

**SCREWS:**
All screws shall be of steel screws of nettle told [GKW] make or approved equivalent. In case of non availability of approved make of screws, the alternate makes shall be used only on receipt of written approval from the Project consultants.

**LOCK:**
Locks shall be as approved by the project consultants. These shall be brush finished stainless steel conforming to IS-2000 with handles conforming to IS 0992 of Dorma/ D-line/ IR/ Hager/ Union/ Hettich or equivalent make.

**DOOR CLOSER & FLOOR SPRINGS:**
Door Closures/ Floor Springs used shall be of Dorma/ IR/ Union make or equivalent make. Project consultant’s approval shall be taken before procuring / installing these Door Closers/ Springs.

**ALL OTHER HARDWARE FITTINGS:**
These shall be as specified in the BOQ conforming to the respective BIS applicable and shall be approved by Project consultants.

**PROCEDURE OF WORK:**
The contractor shall arrange the operations that have been agreed to by the Project consultants /Employer. He shall adhere to the schedule presented by him and agreed by the project consultants, and shall complete all works allotted to him in time, giving best workmanship to the entire satisfaction of the Project consultants.

**BUILT IN-JOINERY**
Where joinery work is specified to be built-in, it shall be the responsibility of the contractor to ensure that the joinery works are set in plumb and true in line and shall not be damaged or displaced by subsequent operations.

**PROTECTION OF WORKS**
The contractor shall be responsible for the temporary doors and closing in of opening necessary for the protection of the work during progress. He shall also provide and maintain any other temporary covering that required for the protection of financed / unfinished woodwork that may be damaged during the progress of the work if left unprotected.

**MAKE GOOD DEFECTIVE WORK.**
The contractor shall be responsible for any shrinkage or warping or any other defects, which may appear in any joinery work. All defective or damaged work shall be taken and repaired or repainted to the satisfaction of the Project consultants without any extra charges.

**FURNITURE**
All furniture shall be in accordance with the drawings and the sample piece as approved by the project consultants. The contractor shall first prepare a sample piece and the same shall be got approved by the Project consultants. The contractor will be expected to do all the modifications of the sample for which no claim will be entertained. Glue used shall be of superior synthetic quality such as Fevicol /Araldite.
TECHNICAL SPECIFICATIONS FOR GYPSUM/CALCIUM SILICATE CEILING WORKS
MODULAR FALSE CEILING
Materials shall be of the best-approved quality obtainable and they shall comply with the respective latest Standard Specifications.

Samples of all materials shall be got approved before placing order and the approved sample shall be deposited with the Project consultants, which will be displayed at site as a control sample.

In case of non-availability of materials in metric sizes, the nearest size in FPS units shall be provided with the prior approval of the Project consultants for which neither extra will be paid nor any rebate shall be recovered.

If directed, materials shall be tested in any approved Testing Laboratory and the test certificate in original shall be submitted to the Project consultants and, the entire charges connected with testing including charges for repeated tests if ordered, shall be borne by the Contractor.

The Contractor without any extra cost shall provide all equipment and facilities for carrying out field tests on materials if asked by the Project consultants.

It shall be obligatory for the Contractor to furnish certificates, if demanded by the Project consultants, from manufacturer or the material supplier that the work has been carried out by their material and as per their recommendations and specifications.

The rates quoted for all items in this schedule shall be applied to the work pertaining to that item in all floors whether specifically mentioned or not.

HYDRATED CALCIUM SILICATE & FIBRE MODULAR FALSE CEILING SYSTEM
TILES
Modular false ceiling tiles shall be of the following material composition and specification of recommended make.

Size of the boards : 600 x 600 x 15mm
Edge Style : Tegular suitable for 24 OR 15mm T grids
NRC : In the range of 0.10 - 0.50
Fire performance : Class O/ Class 1 as per BS 476
Relative humidity : In the range of 100%
Light Reflectance : Greater than - 85 %
Colour : White or to shade as approved by Project consultants.
Material Composition: Hydrated Calcium Silicate with reinforcing fibres and natural fibres without formaldehyde and other harmful toxic ingredients.

SUSPENSION SYSTEM AND PROCEDURE OF WORKS
Supply and installation of suspension grid system with main Tee and cross Tees to provide a stable suspension system for quick laying of acoustic ceiling tiles of nominal size 600 mm x 600 x 19/15 mm. The width of flange of all Tees shall be 15 mm as per the manufacturers’ specification.

The Tees shall be double webbed with bake enameled fascia cap and all other exposed surfaces galvanized or suitably treated against corrosion. Free ends of tees shall be mounted with quick release high tensile spring steel clips to provide a plug-in positive-lock for easy removal without tools.

Suspension points shall not exceed centre-to-centre distance of 1200 ~ 1250 mm and shall be professionally executed with twin 4-mm GI suspension rods and adjustable suspension clip of spring steel. The entire grid system shall be designed to bear a distributed load of minimum 18 kg/sqm.
NOTES:
The rate quoted for any of the Modular false ceiling system shall include providing necessary cut-outs for all Light fixtures (all sizes), AC diffuser, AC dampers, AC linear grilles, smoke detectors, speakers etc., and any other openings to be made in the false ceiling as directed by the Project consultants.

There will not be separate measurements for the vertical drops upto 600mm high, double level ceiling, vaulted ceiling, curved ceiling, inclined ceiling and indirect lighting made in Modular false ceiling works.

There will not be additional rates/ measurements for the above cut-outs to be provided in the ceiling.

Deductions will be made for the areas where tiles are not installed due to fixing of Light fixtures and AC diffusers. (Only the suspension system cost will be paid for these areas)
Cut tiles will not be considered or measured as full tiles for the measurements. As such the payment shall be made on actual laid areas immaterial of cut or full tiles.
Deductions for columns areas in false ceiling shall be made based on the final dimension of columns after cladding/ panelling.
There will not be any additional rates/ measurements for the making the machine made painted Tegular edge for all the cut tiles to be laid in the ceiling.

The quantities indicated in the BOQ are excluding the attic stock. The order placement quantity shall be inclusive of adequate quantity for attic stock as/ if required.
Please note false ceiling support system shall be suspended from the true RCC ceiling irrespective of height between false ceiling and true RCC ceiling. In case double height ceiling, if the height between false ceiling and true RCC ceiling is not adequate to support the false ceiling system from the true RCC ceiling, the intermediate MS powder coated box section framework shall be created and the false ceiling suspenders are to hung and supported from the MS powder coated framework. There will not be additional costs paid towards the same for fabrication with material and erection of it at site with necessary anchor bolts as required for the MS powder coated framework.

GYPSUM FALSE CEILING WORKS
GENERAL
Design of grid layout shall be produced with co-ordinating suspension points in tandem with other service duct / cable tray layouts. The grid layout is to be superimposed on the ceiling service ducting / cabling layout and got approved from the Project consultants.

SUSPENSION SYSTEM & MATERIAL
The false ceiling shall include providing and fixing GI perimeter channels of size 0.55 mm, Thk. having one flange of 20 mm and another flange of 30 mm and web of 27 mm along the perimeter of the ceiling, screw fixed to brick wall/ partition with help of nylon sleeves and screws, at 610 mm centers. The suspended GI intermediate channels of size 45 mm, 0.9mm thk with two flanges of 15 mm each from the soffit at 1220 mm centers with ceiling angles with ceiling angle of width 25mm x 10mm x 0.55mm thk fixed to soffit with GI cleat and steel expansion fasteners. Ceiling section of 0.55 mm thk having web of 51.5 mm and two flanges of 26 mm each with lips of 10.5mm are then fixed to the intermediate channels with help of connecting clips and in direction perpendicular to the intermediate channel with centers. The 12.5 mm tapered edge gypboard (Confirming to IS-2095-1982) is then screw fixed to ceiling section with 25 mm dry wall screws at 230mm centers.
Screw fixing is done mechanically either with screwdriver or drilling machine with suitable attachment.
FINISHING
The boards are to be joined and finished so as to have a flush look which includes finishing the tapered and square edges of the board with joining compound, fibre tape and two coats of primer suitable for Gypboard (As per the recommendations / practice of India gypsum or equivalent) This includes providing
the surface of false ceiling to be painted with approved quality of Plastic emulsion paint. The false ceiling surfaces shall be prepared to the satisfaction of the Project consultant, and shall be applied with two coats of primer, two coats of putty and touch up putty if required to achieve smooth finish. The surface shall be painted with two coats of premium silk emulsion paint of approved make to the satisfaction of Project consultants.

NOTES
1) There will not be separate measurements for the vertical drops up to 2'-0" high, double level ceiling, vaulted ceiling, curved ceiling and indirect lighting made in Gypsum board.
2) False ceiling rate quoted shall include providing necessary cut-outs for fixing Light fixtures (Inclusive of all sizes), AC diffuser, AC dampers, AC linear grilles for (supply and return air), smoke detectors, speakers etc., as directed by the Project consultants. (No additional rates will be given for the cut-outs)
TIMBER DOORS

TIMBER DOORS, WINDOWS & VENTILATORS
Doors shall be in accordance with the drawings in every detail and all joiner's work shall be accurately set out, framed and finished in a proper workman like manner.

Frames of doors shutter styles and rails shall be of best solid wood of quality specified in the schedule of quantities. The scantlings shall be accurately planed smooth. Rebates, rounding and mouldings shall be made as shown on the drawings. Patching or plugging of any kind shall not be allowed.

Joints shall be simple, neat and strong. Framed joints shall be coated with suitable adhesive like glue or synthetic resin approved by the Employer/Project Manager or his representative before the frames are put together. All mortise and tenon joints shall fit in fully and accurately without wedging or filling. The joints shall be pinned with hard wood or bamboo pins of 10mm to 12mm dia or rust resisting star shaped metal pins of 8mm diameter. All portions of timber abutting against or embedded in masonry or concrete shall be treated against termites by giving a coat of an approved wood preservative, for which no extra cost will be paid. Putty shall not be used to cover any defects. Unless otherwise specified, all door frames shall have four holdfasts. Holdfasts shall be provided to the ventilators if directed. Holdfasts shall be M.S. flats bent to shape with fish tail and shall be fixed to frame with sufficient number of screws as directed. When door/window frames are to be fixed to RCC column or RCC wall, holdfasts shall be substituted by suitable arrangements such as coach screws, rawl bolts/grip bolts etc., to secure frames to RCC column or RCC wall as directed by the Project Managers. The frame shall be fixed only after getting the approval of the clerk of works/Project Manager or his representative.

PANELED SHUTTERS
Panels shall be of pattern and size as shown in the drawings or as directed by the Project Managers. Solid wood panels shall be in one piece wherever possible. Where two or more pieces are permitted, they shall be of equal width. Panels shall be framed into grooves made in styles and rails to the full depth of groove. Partly paneled and partly glazed shutter shall be similar to paneled shutters except that such parts as are directed shall be glazed as specified, styles and rails shall be rebated 12mm to receive glass. Sash bars shall be moulded and rebated and mitered on sides to receive the glass which shall be fixed with putty and beading.

The fixing of hardware shall be done in the best workmanlike manner and in accordance with the manufacture's specifications. The contractor shall be held responsible for working of all moving parts dependant on the proper fixing.

FLUSH DOOR SHUTTERS
Flush shutters shall be solid core (Blockboard Type Core) construction of kiln seasoned timber, faced with high quality water proof ply or decorative type as specified. They shall be Phenol formaldehyde resin bound. They will have teakwood lippping around as specified with full width machine pressed along with core. The shutter should generally conform to IS:2202, part I.
TECHNICAL SPECIFICATIONS FOR PAINTING WORKS
PAINTING AND DECORATING

Scope
This Specification describes the general requirements of painting and decorating on internal and external surfaces, woodwork and metalwork and varnishing and polishing to be executed on projects and as per paint manufacturers specification / Guide lines / process application

Applicable Codes
IS 75 Specification for raw and refined linseed oil
IS 345 Specification for transparent liquid wood filler
IS 348 Specification for French polish
IS 427 Specification for distemper – dry colour
IS 428 Specification for distemper – oil emulsion colour
IS 533 Specification for gum spirit of turpentine
IS 1477 Code of Practice for painting of ferrous metals in buildings – Parts I and II (Pre-treatment and Painting)
IS 2338 Code of Practice for finishing of wood and wood-based materials – Parts I and II (Operation and workmanship and Schedule)
IS 2395 Code of Practice for painting concrete, masonry and plaster surfaces
IS 2932 Specification for enamel synthetic exterior undercoating and finishing
IS 2933 Specification for enamel exterior undercoating and finishing
IS 3140 Code of Practice for painting asbestos cement building products
IS 3537 Specification for ready-mixed paint, finishing, interior, for general purposes to IS colours
IS 3631 Specification for ready-mixed paint for finishing interior, alkyd and non-alkyd for general purposes to IS colours
IS 4597 Code of Practice for finishing of wood and wood-based products with nitro-cellulose and cold-catalysed materials
IS 5410 Specification for coloured cement paints
IS 6005 Code of Practice for phosphating iron and steel
IS 6278 Code of Practice for whitewashing and colour washing

GENERAL
The specification covers various types of painting and finishing of all surfaces throughout the part of the building. The number of coats required in various situations and also the type of finish required for plastic emulsion paint as specified in the schedule of quantities and specifications.

Before the commencement of the work, the contractor will provide sample panels of painting at his own cost for the approval of the project consultants to enable him to keep an accurate check on the materials supplied and final shade to be painted. It is however the responsibility of the contractor to provide and any deviations shall have to be rectified by the contractor at his own cost.

Contractor shall protect not only his own work at all times but also all the adjacent work and materials by suitable covering, protection or other methods acceptable to the project consultants during progress of painting. It is the responsibility of the contractor upon completion of painting work to remove all paint and varnish spots from floors, walls, glass panes and other surfaces and restore them to original conditions. The work generally to be touched up shall be attended to after all other workmen have left. All accumulated material, rubbish etc., has to be cleared and the premises left in clean, orderly and acceptable conditions.

Contractor shall provide scaffolding wherever necessary erected on double supports tied together by horizontals, no Ballies, bamboos or planks shall rest on or touch the surface that is being painted. Contractor is deemed to have considered the following while tendering no extra claim on account of these will be entertained.

Supplying the paint and other materials required of approved colour and brand.
- Preparing the surfaces to be painted.
- Providing and erecting scaffolding and removing the same after completion of the work.
- Lifting of material to any height and painting at all levels.
- Application of paint as per the specification and to manufacture instructions.
- Curing, protecting the painted surface, adjacent work and thoroughly cleaning of the premises.

PAINTING AND LIME WASHING

General
Paint, lime wash and colour wash shall, except for white wash, be factory made, delivered to Site n manufacturers’ sealed drums in colours approved by the Project Manager or his representative and conform to the relevant Standards.

Paints shall be such as to be capable of withstanding the effects of weather and the atmosphere and the results of wood decay and metal corrosion and shall have good spreading coverage, be easy to apply, form a thin uniform film upon application, not crack when dry and have hard and durable surfaces.

Lime Wash
Materials for lime wash shall be freshly burnt fat lime of good quality free from un-burnt stone and other foreign matter dissolved in sufficient quantities of water (4 to 5 litres per kg. of lime), stirred thoroughly and strained through a clean coarse cloth. Clean gum or fevicol dissolved in hot water shall then be added in the proportion of 2 gm of gum arabic per litre of lime to prevent lime wash being removed when rubbed.

Surfaces shall be prepared by removing all mortar droppings and other deleterious foreign matter and thoroughly cleaned with wire or fibre brushes to the approval of the Project Manager or his representative. Holes and/or depressions shall be stopped with mortar and cured prior to lime washing.

Lime wash shall be applied by brush, the first stroke being from the top downwards, the second from the bottom upwards over the first stroke and similarly with strokes from right and left over the first strokes before they dry. This application forms one coat and each coat shall be allowed to dry and shall be subject to inspection by the Project Manager or his representative before the next coat is applied. When dry surfaces shall not show signs of cracking and present a smooth and uniform finish free from brush marks, not easily removed when rubbed. Patchy or streaky work will be rejected and shall be re-executed at the Contractor’s own expense.

Doors, windows, floors, fittings, fixtures and the like shall be protected from splashes, splashing and droppings, if any, being removed and surfaces thoroughly cleaned to the satisfaction of the Project Manager or his representative.

Oil Bound Distemper
Washable oil bound distemper shall conform to IS 428 and be of approved make and shade and shall be applied only in dry weather with a broad stiff brush in long parallel strokes.

Trimming coats shall be applied to completely dry surfaces as recommended by the manufacturers of patent distempers and approved by the Project Manager or his representative and allowed to dry thoroughly before the next coat is applied.

Surfaces shall be cleaned and all cracks, holes and surface defects repaired with gypsum and allowed to set hard. All irregularities shall be removed by sand papering smooth and wiped clean and surfaces so prepared shall be completely dry and free from dust before distempering is commenced. In the case of newly plastered surfaces special care shall be taken to ensure that they are completely dry before any application is attempted.

Existing, previously distempered surfaces shall be cleaned of grease, dirt, dust and other deleterious matter and cracks, holes and surface defects repaired with plaster of Paris, allowed to set hard, sand papered smooth and wiped clean. Flaking from previous coatings, if any, shall be thoroughly removed.

Plastic Emulsion Paint
Plastic emulsion paint shall be of approved make, colour and shade to the satisfaction of the Project Manager or his representative and applied as per manufacturers process / specifications / guide lines.

Plastic emulsion paint shall be diluted by the addition of a quantity of water equivalent to half the volume
of the paint to be applied. The paint and water shall be thoroughly mixed and then strained through cloth.

Priming coats shall be applied to surfaces by brush and allowed to dry properly, holes and depressions being filled with putty prepared with whitening and plastic emulsion paint and rubbed smooth and dry and touched up with plastic emulsion paint.

Subsequent coats, diluted by the addition of a quantity of water equivalent to about 15% to 20% of the volume of paint to be applied shall be applied to surfaces by brush and allowed to dry thoroughly so that no brush marks shall be seen.

Surfaces shall be cleaned and all cracks, holes and surface defects repaired with gypsum and allowed to set hard. All irregularities shall be removed by sand papering smooth and wiped clean and surfaces so prepared shall be completely dry and free from dust before painting is commenced. In the case of newly plastered surfaces special care shall be taken to ensure that they are completely dry before any application is attempted.

Preparation of surfaces, the application of priming coats, undercoats and the two finishing coats shall be done strictly in accordance with the manufacturer's recommendations and to the satisfaction of the Project Manager or his representative.

**Waterproof Cement Paint**

Waterproof cement paint shall be “Super Snowcem” or other equal and approved of approved colour and shade to the satisfaction of the Project Manager or his representative brought to Site in original airlight containers with seals intact.

Dry cement paint shall be thoroughly mixed with clean fresh water to produce paint of the required consistency to the satisfaction of the Project Manager or his representative and strained through a paint strainer. Paint shall be constantly stirred during application and applied within the specified or recommended time, hardened or damaged paint not being allowed to be used.

Paint shall be applied by brush, each coat being properly cured and inspected and approved by the Project Manager or his representative before the application of each subsequent coat.

Absorbent surfaces shall be thoroughly wetted so as to provide even absorption. In dry weather freshly painted surfaces shall be kept damp for at least two days and protected from direct sunlight.

Surfaces shall be free from dirt, dust, grease and other deleterious matter and thoroughly cleaned by brushing and washing down with clean water.

Existing lime wash and/or water bound distemper shall be thoroughly removed by washing, brushing and, if necessary, accumulated coats of oil paint removed by brushing and/or scraping and washing to obtain clean and even surfaces.

Roughcast and pebbledash surfaces shall be thoroughly brushed and washed to remove dust, dirt, grease and other deleterious matter.

**Enamel Painting**

**General**

Enamel paint shall conform to the relevant Standards and be of the specified make, colours and shades as approved by the Project Manager or his representative. Materials shall be obtained directly from approved manufacturers and brought to Site in manufacturers’ sealed drums and tins for inspection by the Project Manager or his representative.

Paint for undercoats and finishing coats shall be ready mixed. Mixing by the Contractor shall not be allowed except with the prior written permission of the Project Manager or his representative, in which case preparation of the ingredients and the control of quality shall be in strict conformity with the manufacturers’ recommendations and the relevant Standards and Codes of Practice.

Materials shall be properly stored and protected when not in use with the lids of containers kept tightly closed. Paint in open containers during painting operations shall be covered with a thin layer of
turpentine to prevent the formation of skin on the surface.
If required by the Project Manager or his representative paint supplied by the Contractor shall be quality
tested in an approved laboratory as described in IS 101. Rejected paint shall be removed immediately
from Site.

Application
Unless otherwise specified, paint shall be applied by brush. Brushes of appropriate size shall be either
round or oval shaped and shall be maintained carefully throughout the work so as to be pliable and free
from loose bristles. All brushes, rollers, implements and the like used for painting shall be cleaned of all
foreign matter prior to beginning different operations.
Contents of drums and tins shall be well stirred before use and constantly during operations with a small,
clean and smooth stick to prevent sedimentation at the bottom of containers.
Painting shall be carried out, as far as possible, in dry, warm weather.

Primer coats shall be applied as soon as surfaces have been cleaned and before the deterioration of
surfaces by rust and/or contamination by dust, dirt or any other deleterious material. Sufficient time shall
be allowed for one coat of paint to dry before the next is applied.
Painted surfaces shall be protected from sun, rain, condensation, contamination or other surface
damage until they are completely dry, "Wet Paint" boards being placed where necessary.
Surface preparation, the application of priming coats, undercoats and finishing coats shall be carried out
as specified below or as recommended by the manufacturer.

New plaster shall be carefully rubbed smooth and thoroughly cleaned with fresh water to leave dry and
smooth surfaces free from dirt. Surfaces shall not be primed or painted until they are completely dry and
hard and have been approved by the Project Manager or his representative.
Steel surfaces shall be degreased using proprietary brand solvent cleaners approved by the Project
Manager or his representative or mineral turpentine or petroleum and other petroleum solvents, such as
Trichloroethylene or other equal and approved alkali solutions or detergents.
De-rusting of steel surfaces shall be done by manual scraping using wire brushes, fine steel-wool, sand
paper and the like, mechanically by sand blasting, shot blasting or by flame cleaning or chemical
cleaning by methods approved by the Project Manager or his representative.
Enamel paint shall not be applied to woodwork that is not well seasoned. Surfaces of woodwork to be
painted shall be thoroughly dry, clean and smooth and prepared by using coarse and medium grime
sandpaper with finished surfaces free from scratches.

Before applying primers to surfaces of woodwork knotting shall be done with two coats of varnish made
by dissolving Shellac in methylated spirits of wine or as directed by the Project consultant.

Plastered surfaces: Priming coats shall consist of equal parts of white and red lead mixed in boiled linseed
oil to the required consistency applied uniformly over surfaces to be painted. When dry, all cracks, holes
and other such defects shall be filled with a mixture of one part of white lead and 3 parts of ordinary
putty. Surfaces shall then be rubbed with sandpaper and dusted clean and an undercoat thinly applied
so that plastered surfaces are saturated.

Steel surfaces: Priming coats shall consist of red lead conforming to IS 102 applied uniformly over surfaces
to be painted. On old or previously painted surfaces and new surfaces already primed with red lead,
surfaces shall be thoroughly cleaned and primed with red lead on exposed surfaces as necessary or over
whole surfaces as directed by the Project Manager or his representative.

Woodwork surfaces: Priming coats shall consist of red lead, white lead, raw and boiled linseed oil and
patent dryers applied uniformly over surfaces to be painted. When dry, small holes, cracks, open joints
and other minor defects shall be stopped with putty made from whitening mixed to proper consistency
with raw linseed oil and white lead to facilitate hardening of putty. Surfaces shall then be lightly rubbed
down smooth with sandpaper and dusted clean.

Finishing coats: Unless otherwise specified, finishing of all surfaces shall consist of two coats of synthetic
enamel paint of approved make, colour and shade. The second coat of paint shall give a flat, semi-
glossy or glossy finish as specified or as directed by the Project Manager or his representative and shall present on even appearance and show no brush marks. Stipple finishes, if directed by the Project Manager or his representative, shall be provided at no extra cost.

Textured Paint
Textured Paint to external faces wherever called for shall be carried out by specialist agencies approved by the Project consultant. The Textured Paint materials shall be prepared and used in accordance with the recommendations of the manufacturer. Preparation of surface, brushing, removal of dust, etc. shall be carried out as described earlier. Mixing and application shall be strictly as per the manufacturers instructions. The finished surface shall be subject to the approval of the Project consultant.

Melamine Polish
A pad of woollen cloth covered by a fine cloth shall be used to apply the polish. The pad shall be moistened with the polish and rubbed hard on the surface on a series of overlapping circles applying the polish sparingly but uniformly over the entire area to give an even surface. A trace of linseed oil on the face of the pad may be added which shall facilitate this operation. The surface shall be allowed to dry and one more coat shall be applied and shall be left for drying. After drying the French polish, two coats of melamine polish shall be sprayed. The finished surfaces shall present a uniform texture and high gloss. Works deemed included for Painting, Polishing and Varnishing Work
The Contractor's work for painting, polishing and varnishing work shall include:
Provision of all materials, labour and equipment required to execute the work as specified.
Provision of scaffolding (single/double) including erection and removal. Preparation of surfaces.
Application of the specified number of coats of approved paint, polish or varnish, including priming coat and where proper, even surfaces or shades are not obtained the application of extra coat(s) as directed and to the final approval of the Project Manager or his representative.
Application of additional priming or other preparatory coat(s) to obtain thoroughly saturated surfaces and filling with putty as required and/or directed.
Painting of smooth and/or rough surfaces, such as precast concrete pards, rough cast plaster, sand faced plaster and the like.

Curing cement paint as directed for a minimum of 7 days.

Protection of doors, windows, floors, furniture and fittings, including ironmongery and metalwork from splashing and droppings, including cleaning surfaces as directed.

Repair of cracks, developing in plaster prior to or after final painting, by filling with suitable putty and painting surfaces again as directed to give even surfaces to the satisfaction of the Project Manager or his representative. Neeru surfaces damaged due to any reason before painting shall be redone by using plaster of Paris as directed.
Cleaning of all surfaces after painting, polishing and varnishing.

WATER BASED POLYURETHANE COATING
All as per manufactures Guide lines / specifications.
All unevenness is rubbed down to smoothness with sandpaper and the surface shall be well dusted. The pores in the wood shall be filled up with filler made of a paste of whiting in water or methylated spirit.

APPLICATION OF WATER BASED POLYURETHANE
A pad of woollen cloth covered by a fine cloth shall be used to apply the polish. The pad shall be moistened with the polish and rubbed hard on the surface on a series of overlapping circles applying the polish sparingly but uniformly over the entire area to give an even surface. A trace of linseed oil on the face of the pad may be added which shall facilitate this operation. The surface shall be allowed to dry and one more coat shall be applied and shall be left for drying. After drying the French polish, two coats of Water based polyurethane shall be sprayed. The finished surfaces shall present a uniform texture and high gloss.

WAX POLISH
Wax polish shall either be prepared on site or obtained ready made from the market. Polish made on site shall be prepared from a mixture of pure bees wax free from paraffin or stearine adulterates, linseed oil, turpentine oil and varnish in the proportion of 2:1.5:1.1:5. by weight. Bees wax and boiled linseed oil shall be heated over a slow fire, when the wax is completely dissolved the mixture shall be cooled till it is just warm and turpentine oil and varnish added to it in the required proportion and the entire mixture is well stirred.

Surface shall be cleaned. All unevenness shall be rubbed down with sandpaper and well dusted. Holes and indentation of the surface will be filled with putty made of whiting and linseed oil. Surface shall be given a coat /filler of 2.25 KGs. of whiting in 1.5 litres of methylated spirit. When it dries surface shall again be rubbed down perfectly smooth with sandpaper and wiped clean

APPLICATION OF BEE WAX /WAX POLISH
The polish shall be applied evenly with a clean soft pad of cotton in such a way that the surface is completely and fully covered. The surface is then rubbed continuously for half an hour. After well rubbing in one coat of wax polish, the waxwork shall be covered with dust proof sheet (cloth for preventing dust falling on the work). Subsequent coat shall be applied after the surface is quite dry and shall be rubbed off with soft flannel until the surface has assumed an uniform gloss and is dry showing no sign of sickness. The final polish depends largely on the amount of rubbing which shall be continuous and with uniform pressure, with frequent changes in the direction.
MISCELLANEOUS
MS DOORS USING PRESSED METAL FRAME

MS doors using pressed metal frame of specified size made of 16G MS sheets pressed to shape, shutter frame of specified size made of 16G MS sheets pressed to shape. Panels made of 16G MS sheets on both sides of the shutter frames to give a thickness of 40 mm. Stiffeners to be made of 16G MS sheets. Hinges/pivots and MS handles powder coated to be heavy duty 125 mm size. Two tower bolts of length 450 mm, 20 mm dia with holdfasts are to be embedded in CC 1:2:4 to walls. One coat of zinc chromate to all members to be applied.

For joints, following principle to be observed.

At joints the weakness of pieces must be minimum as far as possible.

To place each abutting surface in a joint as neatly as possible, perpendicular to pressure.

To form and fit accurately every pair of surface that come in contact.

For external work the joints shall be coated with white or red lead before the members are put together. For internal work where the joints are not likely to be affected by moisture the joints are not likely to be affected by moisture the joints shall glued. The members are then put together and jowls for correct size shall be drilled before inserting screws.

Driving of screws with hammer is prohibited. Screws shall be dipped in oil before being inserted in wood. The heads of nails or screws shall be sunk and putfyll. The type, gauge and length of screws and nails subject to approval of the Project Manager or his representative.

The joints shall be pinned with hard wood or bamboo pins 10 to 15mm diameter after the frames are put together, pressed in position by means of a press. Woodwork shall not be painted, oiled or otherwise treated before each and every member has been approved or selected or signed by Project Manager or his representative. All portion of timber built into or abutting against or embedded in masonry or concrete or buried in ground shall be painted with boiling coal tar, or solignum or approved quality wood primer. The frames shall be fixed with iron holdfast well screwed and not nails and frame shall be fixed in proper position as per drawing or as per instruction of Project Manager or his representative. Holdfast shall not be paid separately. The door frame vertical end should be properly protected and well fixed. Generally, sills are not provided. The frames vertical members shall be buried in floor 38mm deep for which nothing extra shall be paid will not be considered in measurements for out to out of the frames. Where sills are to be provided the measurement for 38mm deep buried vertical members will not be paid for. The frames shall be kept in position during construction against warping and shall be well protected from damage during construction due to sun, heat, fire, wear and tear, against construction materials, scaffolding damages rubbing of gamelas at the time of BK work, plaster and RCC casting operations or falling materials. The flush doors shall be of solid batten core and of approved quality from reputed firm. There should be a proper arrangement for fixing mortise lock or aldarg and there should not be loose. The frame shall be provided with 6 nos. of holdfasts made from MS flats 30 x 5 x 200mm long.

The measurement shall be in sqm, and shall be taken out to out of the frame. The painting or polishing shall be done as specified in the schedule of quantities. When specified or shown on drawing, vision panels or louvers shall be provided as per details and paid separately. The measurement shall be out & cut including frames and shutters (when closed). Overlap of shutters will not be measured.

ROLLING SHUTTER

Rolling shutter of approved quality, make & type, 18 gauge (MS solid laths or grill) with all the accessories such as top cover (in or out), handles, bearings, springs, axles, locking arrangement guide rails, iron pulleys, push & pull arrangements should be purchased from reputed firm and provided and fixed with holding down bolts with PCC 1:3:6 as specified i.e., outside or inside or below lintel or between jambs of the opening. The shutter shall be either push and pull type or operated with special type of reduction/bevel gear arrangements operated with mechanical device.
The payment of latch or push and pull type or operated with mechanical device or grill type will be separately on sqm basis. The spring shall be best Indian make and manufactured from tested high tensile steel wire to balance the shutter in all positions. Spring pipe shaft shall be supported on strong mild steel or CI brackets. Both the side guides and bottom rail shall be jointless and single piece of pressed steel. Powder coated 65micron thick of approved RAL shade.

The top cover of shaft, spring, etc., shall be of same materials as that of latch and no extra payment shall be made for this. The side guides fixed with plates, welded to guides shall be properly fixed with screws, bolts, and concealed in plaster. The operation of shutter should be easy and smooth. The measurement will be in sqm. The width shall be measured as width of the shutter including portion hidden in the guide channels and height shall be measured as the length of the shutter from the bottom of the locking plate to the bottom of lintel. There shall be no additional payment for the cover (450mm ht). The rate includes GI micron powder coating of required shade.

**MS GRILL**
These shall be made from MS section as per the Project consultants details. The item includes fixing with screws or necessary anchor bolts and flats to fix the railing rigid in position. The members shall be welded together and all the welded joints shall be filed to make smooth joints. The rate includes two coats of enamel paint of required shade and primer coat of red oxide. Measurement will be as specified in the Bill of Quantities.

**TOLERANCES**
Tolerance on nominal width and height shall be +3mm or -0mm and that on thickness shall be +/- 1.2mm. The thickness of the shutter shall be uniform throughout with a variation not exceeding +/- 0.8mm when measured at two points.
TECHNICAL SPECIFICATIONS FOR BLINDS
Materials shall be of the best-approved quality obtainable and they shall comply with the respective latest Standard Specifications.

Samples of all materials shall be got approved before placing order and the approved sample shall be deposited with the Architects, which will be displayed at site as a control sample.

In case of non-availability of materials in metric sizes, the nearest size in FPS units shall be provided with the prior approval of the Architects for which neither extra will be paid nor any rebate shall be recovered.

If directed, materials shall be tested in any approved Testing Laboratory and the test certificate in original shall be submitted to the Architects and, the entire charges connected with testing including charges for repeated tests if ordered, shall be borne by the Contractor.

The Contractor without any extra cost shall provide all equipment and facilities for carrying out field tests on materials if asked by the Architects.

It shall be obligatory for the Contractor to furnish certificates, if demanded by the Architects, from manufacturer or the material supplier that the work has been carried out by their material and as per their recommendations and specifications.

The rates quoted for all items in this schedule shall be applied to the work pertaining to that item in all floors whether specifically mentioned or not.

**BLINDS**

**General**
The type of blinds selected shall be free of sharp edges, burrs or other defects. The written approval shall be taken from the Architects on the approved specifications of the blinds prior to fabrication.

**VERTICAL BLINDS**

**Head Rail**
The size of track for head rail shall be in the range of 40~50mm in width and 25~35mm in height. The track shall be with an average wall thickness of 1.1 ~ 1.27mm and made of powder coated aluminium alloy 6063-T5. The powder coating shall be to 50 micron to the shade as approved by the Architects.

**Carrier**
Each vane shall be supported by a low friction thermoplastic carrier, which traverses on rolling acetyl wheels, with each carrier containing a friction clutch mechanism to prevent damages to vanes or the carrier in case of overload. All the above assembly shall be as per the manufacturers specifications.

**Control Unit**
Pulling a steel plate/ metal link chain loop shall be provided for rotation of vanes. A tilt rod shall be passing through each carrier and imparting rotation to each carrier worm and spur gear to each carrier hook in unison. The assembly shall have smooth mechanical rotation by means of
providing a large sprocket wheel in the moulded acetyl control unit as per the manufacturer's specifications. The control unit shall allow the first vane to hang only 3 ~ 4mm from the window jamb offering tight window coverage by vanes and minimal light leakage.

Spacing of vanes for any opening shall be achieved by nylon spacer shims, which lock into the body of the carrier to provide a continuous linkage. Blinds shall also be optionally fabricated with spacer clips to allow visually uniform spacing between each vane as per manufacturers specifications.

Traversing shall be by means of a continuous nylon traverse cord attached to the master carrier and traversing over acetyl pulley wheels supported in acetyl end caps. Blinds may traverse left to right, right to left, or may be of a split draw, centered or otherwise as specified. Tension shall be maintained on this cord by a weight in a plastic housing as per manufacturers specifications.

Vaness shall be selected from respective Manufacturers selection binders based on the specifications. Cloth vanes shall be provided with sewn hems top and bottom and shall contain a polymer spleen to be hung from carrier books by means of a punched hole in top of vanes.

**ROLLER BLINDS**

**Top Section**

Extruded aluminium of size 57mm x 12mm bar with 1.25 mm thick., it can either be anodised or powder coated for corrosion resistance. Top section is mounted to the wall by means of clip-on adaptor, made out of spring steel.

**Fabric Pipe**

Extruded aluminium tube with groove and size 32.5 mm or 38mm dia and 1.25 mm thickness, anodised or powder coated for corrosion resistance. The operating mechanism is fitted to the fabric pipe and then the fabric is inserted into the groove of the fabric pipe.

**Load Bar**

Extruded aluminium tube with groove and of size 22 mm dia and 1.5 mm thick, either anodised or powder coated for corrosion resistance. Bottom end of the fabric is inserted to the load bar for avoiding wrinkles and to hold the screen against wind pressure.

**Clutch Mechanism**

Clutch shall be wrap spring design with high strength fibreglass reinforced plastic, assembly and high carbon steel springs to transmit motion from driving to driver members of clutch mechanism. Clutch shall operate by directionally with the use of an endless beaded chain mechanism shall be crash proof, prevent slippage and shall raise and lower smoothly to any desired height. Clutch shall never need adjustment.

**Idler Mechanism**

Idler shall be of high strength fibreglass reinforced plastic, consisting of an outside sleeve and centre shaft. Sleeve shall provide bearing surface for roller tube and rotate freely on centre shaft, providing smooth, quiet and long wearing operation.

**Installation of Brackets**
Brackets shall be of atomised steel powder-coated to give superior finish. Bracket shall accommodate overhead, side or face mounting with clutch assembly on either end of the roller.

**Bottom Weight**
Bottom of the blind shall be provided with aluminium tube powder coated in a colour matching to the fabric. The fabric shall be enclosed in the suitably created pocket along with the tube. The tube shall be closed from sides with end caps to give a neat look.

**INTERMEDIATE SUPPORT BRACKETS**
It is mandatory that intermediate support brackets shall be fixed for blinds over 1200mm wide with maximum spacing of 900mm as per the manufacturers specifications.

**EXTENSION BRACKETS**
Optional extension brackets shall be made available as/if required as per site conditions.

**SIZE LIMITATIONS**
Maximum width – not greater than 3mtr
Maximum drop – not greater than 5mtr

**FABRICATION, EXECUTION, INSTALLATION AND CLEANING OF BLINDS**

**Fabrication**
Prior to fabrication, verify actual opening dimensions by on site measurements to make sure e blind dimensions to be fitted within specified tolerance as per the manufacturers specifications. The fabricated blinds to fill opening from head to sill and jamb-to-jamb. The clearance between blind-to-blind shall be 4mm minimum with located blind divisions at mullions as per the detail drawings.

**Execution**
Verification of the work area in which the blinds will be installed is free of conditions that interfere with blinds installation and operations.

**Installation**
Installation of blinds shall be in accordance with manufacturer’s approved installation procedures. If required additional intermediate support brackets and extension brackets shall be fixed to avoid deflection in head rail. Install blinds with adequate clearance to permit smooth operation of blinds and any sash operators. Hold blinds 4mm clear from each side of window opening on inside mount unless other clearance is indicated.

**Cleaning**
Vacuum blind surfaces with dust brush attachment on the vacuum nozzle open By-Pass valve on nozzle to reduce air velocity if necessary to avoid damaging cloth surfaces. Do not use steam, hot water, bleach or an abrasive or solvent base cleaners.

**TYPE OF BLINDS**

**Antibacterial and Fungicide Roller Blinds**
The Antibacterial and Fungicide Roller Blinds with Polyster fabric (100% polyster with
antibacterial and fungicide finishing for hygenic and cleanliness) fabric of following specifications:

Thickness of fabric: In the range of 0.3 ~ 0.7mm
100% Polyester with antibacterial and fungicide finishing
Flame retardant according to DIN 4102/B1
Antibacterial and fungicide finishing for a variety of different bacteria and fungi tested according to DIN 53931 and SN 195920
Free of formaldehyde
Aluminium anodised "L" angle to be fixed with 3M make double sides tape to External glazing Mullion on both sides of the blinds as required to avoid seepage of light from the edges/ joints.
Bottom weights: Bottom of the blind shall be provided with aluminium tube powder coated to shade matching to the fabric.
The fabric shall be enclosed in the suitably created pocket along with the tube.
The tube shall be closed from sides with end caps to give a neat look.
Mechanism: Clutch driven roller mechanism with stopper and load bar in powder-coated Aluminium.
Weight of fabric: 250~300GSM
Fire classification: B1/DIN 402-2
Bacterial Classification: DIN 53931
Guarantee for the Blinds including mechanism and fabric: Five years

Note:

Guarantee for Blinds: Five years for mechanism and fabric.

Fabric sample shall be approved by the Architects.
<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>BRANDS/COMPOUNDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>VITRIFIED TILES</td>
<td>RAK / Johnson / Kajaria / Somany / Bellisimo / Pavigres Or as per</td>
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<tr>
<td>WATER PROOFING COMPOUND</td>
<td>Ardex / Roffe / Fosroc / Pidilite / BASF</td>
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<tr>
<td>CEMENT (WHITE)</td>
<td>JK White / Birla Super white</td>
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<tr>
<td>CEMENT (GREY)</td>
<td>ACC / Birla Super / Ultra-tech</td>
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<tr>
<td>REINFORCEMENT STEEL</td>
<td>TATA / SAIL / JSW</td>
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<tr>
<td>STRUCTURAL STEEL</td>
<td>TATA / SAIL / VISL / JSW</td>
</tr>
<tr>
<td>PVC SPACERS / CORNER BEADINGS</td>
<td>Arpitha Exports / BOSS</td>
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<tr>
<td>CEMENT BASED POLYMER / EPOXY GROUT</td>
<td>Ardex Endura / Laticrete / BASF / Kerakoll</td>
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<tr>
<td>PLYWOODS</td>
<td>Somani ply / Kitply / Archid / Century ply</td>
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<tr>
<td>MDF / HDF – EXTERNAL GRADE (HMR)</td>
<td>Action Tesa / Asis / Dura Tuff / Nuwood</td>
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<td>ALUMINIUM SECTIONS</td>
<td>Jinda / Bhoruka / Hindalco</td>
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<tr>
<td>STAINLESS STEEL HINGES</td>
<td>Assa Abloy / Dorma / Geze / Hettich / Hafele Or as per finishing</td>
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<tr>
<td>LOCKS</td>
<td>Dorma / IR / Geze / Hettich / Blum / Assa Abloy / Hafele Or as</td>
</tr>
<tr>
<td>DOOR CLOSURES / FLOOR SPRINGS</td>
<td>Dorma / IR / Geze / Hafele / Assa Abloy or as per finishing</td>
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<td>LAMINATE</td>
<td>Century Laminating Co Ltd (Merino) / Formica / Sundek / Archid</td>
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<tr>
<td></td>
<td>Century Mica or as per finishing schedule</td>
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<tr>
<td>FLUSH DOORS</td>
<td>Somani ply / Kutty / Century / Archid or approved equivalent</td>
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<tr>
<td>SCREWS</td>
<td>Nettle fold (GKW) / Patta make</td>
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<td>ETCHING, FROSTING FILM / VINYL SHEETS / Graphics</td>
<td>3M / Avery / Dermison</td>
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<tr>
<td>VENEER</td>
<td>Uniply / Durian / Timex / Archid / Green ply / Century Plyboards (I) Ltd or as per finishing schedule</td>
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<td>HANDLES</td>
<td>Dorma / Geze / Blum / Hettich / Hafele / Assa Abloy or as per</td>
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<td>GLASS / MIRROR</td>
<td>Saint Gobain / Ashai</td>
</tr>
<tr>
<td>LACQUERED GLASS</td>
<td>Saint Gobain / Form 5 / Vishwas Safety glass</td>
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<tr>
<td>IMPORTED FABRIC</td>
<td>Designtex</td>
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<tr>
<td>INDIAN FABRIC</td>
<td>Reliance / Vimal / Mayur</td>
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<tr>
<td>PAINTS</td>
<td>ICI Dulux / Berger / Nerolac / Asian / J &amp; N / SKK / Jotun</td>
</tr>
<tr>
<td>Item</td>
<td>Supplier</td>
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<tr>
<td>----------------------------------------------------------------------</td>
<td>----------------------------------------------</td>
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<tr>
<td>Autocoat Paint</td>
<td>ICI - Duco/ Asian/ Berger</td>
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<tr>
<td>Acrylic Putty for All Painting Works</td>
<td>RJ London</td>
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<tr>
<td>Texture Paints</td>
<td>Asian/ Zolatone/ Olkos/ Spectrum/ SK/ Jotun</td>
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<td>Adhesives</td>
<td>Fevicol, Jivanjor and Araldite</td>
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<tr>
<td>Wheel Castors</td>
<td>Renolle / Classis / Nicholson</td>
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<tr>
<td>Sliding Channels</td>
<td>Blum/ Hettich/ Hafele</td>
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<tr>
<td>Powder Coating Paint/ Vapour Cure Powder</td>
<td>MRF/ Marpol/ Berger/ Akzonbel</td>
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<td>GRG, Plain Gypsum Board, Duraline Suspension Sym</td>
<td>Saint Gobain Gyproc India Ltd / USG Boral</td>
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<tr>
<td>Gyp Plaster (Punning)</td>
<td>Saint Gobain Gyproc India Ltd / USG Boral</td>
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<tr>
<td>Acoustic Panelles/ Sound Soak Panel</td>
<td>APS/ Anutone/ Buzzskin/ Echo panel</td>
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<tr>
<td>Gypsum Board Partition Frame Work, All</td>
<td>Saint Gobain Gyproc India Ltd / USG Boral</td>
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<td>Related Partition Accessories &amp; False Ceiling Suspension System</td>
<td></td>
</tr>
<tr>
<td>PVC Spacers/ Corner Beadings</td>
<td>Inside spaces/ CATEX SPECIALITIES BUILDING / Flax / Gradus</td>
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<tr>
<td>Water Based Polyurethane Coat</td>
<td>ICA/Asian/ Aquavathane/ Pidilite/ Berger</td>
</tr>
<tr>
<td>Ceramic Tiles</td>
<td>Asper finishing schedule / Somany / Kajaria / RAK / H &amp; R Johnson Bellisimo / Pavigres</td>
</tr>
<tr>
<td>Interface Trims</td>
<td>CS Group/ Gradus / Falanx</td>
</tr>
<tr>
<td>Ceramic Writing Board</td>
<td>Whitemark</td>
</tr>
<tr>
<td>Acoustic/Fire Sealant</td>
<td>Sevax/ Hilti/3m/Mccoy</td>
</tr>
<tr>
<td>Glass Manets Fittings</td>
<td>Dorma/ Geze/ Hafele/ Assa abloy</td>
</tr>
<tr>
<td>Self Levelling Compound</td>
<td>Roffee/ Fosroc/ Ardex Endura/ BASF</td>
</tr>
<tr>
<td>Steel Fire Doors</td>
<td>Signum/ Shakti Met/ MPP shredder (Bangalore Door tech)</td>
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<tr>
<td>Calcium Silicate Board, Suspension Sym</td>
<td>Hilux - Ramco Industries Ltd / USG</td>
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<tr>
<td>Imported Acrylic Solid Surfaces</td>
<td>Du-pond Corian/ LG/ Hanex</td>
</tr>
<tr>
<td>Imported Wall Paper</td>
<td>Mayaramanoff / Arté / muraspe DuraFort/ MuraSpec/ Vescom as per finishing schedule</td>
</tr>
<tr>
<td>Anchor Fasteners/PVC &amp; Metal Plugs</td>
<td>Hilti/Fischer</td>
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<tr>
<td>Autoclaved Aerated Block</td>
<td>Aerocon/ Cecon/ Siporex as per IS 2185 part 3 of class 50</td>
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<td>Stainless Steel Hinges (Storage)</td>
<td>Hettich/ Blum/ Hafele</td>
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<tr>
<td>PVC Edge Lipping</td>
<td>Rehau</td>
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<tr>
<td>Cement Fiber Board</td>
<td>Shera</td>
</tr>
<tr>
<td>Carpet</td>
<td>Interface/ Milliken or approved equivalent</td>
</tr>
<tr>
<td>Blinds</td>
<td>Vista/ Louverline</td>
</tr>
</tbody>
</table>
Wherever applicable only BIS approved first class materials are to be used in other cases where BIS specifications/ certifications are not available the superior range quality are to be used and all the products got approved by the Project consultants.
TECHNICAL SPECIFICATIONS – ELECTRIFICATION WORKS
WIRING SYSTEM

SCOPE

1 The scope of work under this section generally covers internal wiring for lights, fans, call bells, fan coil units, geysers, power sockets etc. The contractor shall provide a materials, labour, equipment, scaffolding, etc., as required for the completion of wiring installation called for the wiring shall generally be done using PVC insulated copper conductor wires in PVC/ M.S./ G.I conduit as called for including providing switches, sockets, plug tops, fan regulators, outlet boxes etc.

1.2 STANDARDS APPLICABLE

1.2.1 The applicable standards for above work shall be listed below:

IS : 732 Code of practice for electrical wiring installation (System voltage not exceeding 650 V).

IS : 1646 Code of practice for fire safety of buildings (General Electrical installation)

IS : 2567 Fittings for rigid steel conduits for electrical wiring.

IS : 3480 Flexible steel conduits for electrical wiring.

IS : 3837 Accessories for rigid steel conduit for electrical wiring.

IS : 694 PVC insulated cables.

Indian Electricity Act and Rules

Regulations for the electrical equipment in buildings issued by the Bombay Regional Council of Insurance association of India. CEIG Karnataka, BESCOM.

The exact scope of work included in the point wiring for the purpose of measurement is enumerated as stated below.

i) Wiring starting from the first switch / light / fan point, where the circuit main is terminated to the various lights / fans / sockets (where 6A sockets connected to light circuit loop), and the looping between the switches / lights / fans / 6A sockets etc.

ii) Providing and installing all necessary switches, switch plates, sockets, pull / junction / fan hook boxes etc. as called for.

iii) Providing and installing insulated earth continuity wire in each conduit along with the wiring system.

iv) Providing and installing ceiling roses, lamp holds where necessary.

v) Providing and installing PVC insulated, PVC sheathed flexible three core 1.5 sq.mm extension cords including flexible conduits from light / fan outlet points mounted at ceiling point to the light / fan outlet.

Wiring for 6A Sockets, 16A Power sockets for equipment Wiring.

Except where 6A sockets connected to the lighting loop which are measured in Number of Points, the measurement for wiring of 6A / 16A sockets and wiring for power outlets in done as follows:

Length of circuit wire including conduit, accessories and earth wire for power wiring is measured together in linear meter.

The socket outlet with outlet box is measured in Numbers.
1.3 SYSTEM OF WIRING

1.3.1 Unless otherwise mentioned on the drawings, the system of internal wiring shall be as follows:

The system of wiring shall consist of single core, PVC insulated, 650 / 1100 Volt grade, stranded Copper conductor wires / cables laid through concealed or exposed PVC / GI / MS conduits as mentioned elsewhere or as directed by Clients / consultant.

1.3.2 GENERAL: Prior to laying and fixing of conduits and light outlet boxes, contractor shall carefully examine the layout drawings and prepare detailed shop drawings, indicating the exact location of light outlets, with distances marked, conduit routing, with sizes, number of wires run in each conduit, control switch location etc. The contractor shall obtain the approval of all shop drawings by the Clients / consultant prior to the installation of conduits. Any discrepancy noticed in the design drawings shall be brought to the notice of the Clients / consultant. Any suggestions or modification suggested by the contractor shall have approval of Client / Consultant before execution.

1.3.3 Type of installation

Unless otherwise specified all conduits wiring shall be heavy gauge rigid GI / MS conduits and all Concealed installation including conduits running above false ceiling shall be heavy gauge rigid PVC.

All conduits buried in grade or in damp wet areas shall be heavy gauge G.I. conduits.

a) Concealed Wiring shall be done using PVC conduits in the following areas

i) Staircase area lighting.

ii) Wiring inside offices.

iii) Wiring in the false ceiling area.

iv) All other areas where surface conduit is not specifically mentioned.

PVC CONDUITS:

Non-metallic conduits and accessories shall conform to IS 9537 (part 3) – 1983, IS 2509 & IS 3419 and each conduits shall bear the ISI Mark. PVC conduits shall be of the black, round, heavy gauge polyvinyl chloride (PVC). The conduit shall be plain end type as specified in IS 2509 – 1973 / IS 2537 – 1983. The conduit internal surface shall be smooth. Only approved Quality factory made bends / accessories shall be used. Minimum size of conduits shall be 20mm diameter. PVC conduits shall be rigid unplasticised, heavy gauge having minimum wall thickness of 2.0mm up to 25mm diameter conduit and 2.5mm wall thickness for all sizes above 25mm diameter.
CONDUIT ACCESSORIES
PVC CONDUIT BENDS & COLLARS

The PVC conduit bends & collars shall be of heavy duty and preferably of the same make as of conduit this shall conform. to IS 9537 / 1983 Part III with ISI Mark where necessary bends or diversion may be achieved by means of using bends and or circular inspection boxes with adequate and suitable inlet and outlet termination. In case of recessed installation system. The bends shall be properly secured & flush with the finished wall surface. Elbows shall not be used. Nos. bends shall have radius less than 2 ½ times the outside diameter of the conduit.

PVC / INSPECTION / JUNCTION / PULL BOXES

The Inspection / pull box / junction box, where used, with relevant PVC conduit installation shall e of heavy gauge PVC and conform. to IS specification and shall match with the conduit sizes. The box shall be round / square, rectangular with conduit stub projection for termination of Conduit. The box shall be of minimum 50mm deep and the size of box shall be suitable to pull / make necessary joints of wires inside the boxes. Extra deep are preferred. The boxes shall have flush type cover. The colour of plate shall match the colour of paint of the surface where installed. The boxes shall have concealed screwed socket for fixing the ceiling rose.

SWITCH OUTLET & SOCKET OUTLET BOXES
CONCEALED TYPE OUTLET BOXES

The concealed outlet boxes of switches, sockets, power outlets, telephone outlet, fan regulator etc. shall be of standard factory made and to match and the exact requirement of combination of outlets. The boxes shall be fabricated out of heavy gauge CRCA cold rolled carbon alloy sheet with Zinc plating (G.I). The size of boxes shall match the type of outlet / switch plate to be mounted on the box. Adequate Nos. And size of knockout holes shall be provided to terminate the conduits in the box. These boxes shall be of standard factory made product and of same make as of switch plates and sockets. Separate screwed earth terminal shall be provided in the box for earthing. The outlet box shall be of minimum depth of 50mm. Boxes shall be suitable for grid mounting type of accessories. Long screw shall be provided to take care of the extra plaster thickness to mount the switch plates. Provision shall be made in the box and switch plate to have the minor adjustment of alignment of switch plate to plumb level.

LIGHT OUTLET BOXES

For concealed PVC conduit installation the light outlet box shall be of PVC round / square with knock-out holes. Conduit projection shall be suitable to terminate the conduit to the box. The box shall be made of heavy gauge PVC and the sample to have the approval of Construction Manager before use. The boxes shall have concealed screwed socket to fix the ceiling rose. The boxes shall be minimum 50mm deep.

CEILING FAN HOOK BOXES

The ceiling fan hook box shall be fabricated of 2mm thick G.I / M.S. with adequately sized G.I / M.S. rod / hook to fix the ceiling fan. The hook shall be concealed within the fan hook box. The side extensions of rod shall be sufficiently long to provide adequate anchorage in the concrete. The size of the box shall be such that it should be totally covered by the plastic canopy of the ceiling fan. The box shall have anticorrosive primer coating.

SWITCHES

Switches shall conform. to IS : 3854, AND IS : 4615. Switches shall be single pole, single or two ways as shown on the drawings. They shall be of the moulded type rated for 250 V,6 / 16A. They shall be provided with insulated dollies and covers.
COVER PLATES FOR SWITCHES & OUTLETS

Switches / sockets / wiring devices plates shall be of the same make as of switches / sockets / wiring devices. These shall be of best quality. Moulded plastic grid mounting type device plates / frames shall be used and these shall match with the type of switches / sockets and boxes.

COVER PLATES FOR INSPECTION / JUNCTION / PULL BOXES

The cover plate for PVC boxes shall be with minimum 3mm thick Perspex / form sheet cover and for the G.I / M.S. boxes, shall be of G.I / black enameled M.S. plates. The shape of the plate shall match with that of the box.

RECEPTACLES

The sockets shall conform. to IS 1293. Each socket shall be provided with control switch of appropriate rating. The sockets shall be moulded type rated for 250 volts and of 6A or 16A capacity as mentioned on the drawings. The 16 Amps sockets shall be multi pin (6 pin) automatic shutter type suitable for plugging 6A / 16A plugs. The shutter shall open when the earth pin of the plug is inserted in the socket. Where called for, the 16A socket shall have indicating lamp. The socket outlets and switches shall be of grid mounting type. Where called for sockets shall be provided with three pin plug top suitable to the socket and of the same make as of socket. The plug shall conform. to IS 6538. The socket outlets installed outside the building / open to sky or in damp / wet areas shall of weather-proof, water – tight type.

PVC INSULATED WIRE (FOR LIGHT & SMALL POWER WIRING)

The PVC cables shall conform. to IS : 696 / 1977. For all internal wiring PVC insulated cables of 650 / 1100V grade, single core shall be used. The wires shall have the approval of Tariff advisory Committee. The conductors shall be plain, circular stranded annealed copper conductors complying with BS : 6360.

The minimum number and diameter of wires for circular stranded conductor shall meet the requirements setout in the relevant British Standards.

The cores of all cables shall be identified by colours in accordance with the following sequence.

Single phase - Red
Three phase - Red, Yellow, Blue
Neutral - Black
Earth - Green or Green / Yellow.

A means of identifying the manufacturer shall be provided throughout the length of cable.

Unless otherwise specified in the drawings, the sizes of the cables / wires used for internal wiring shall be as follows:

In case of circuit wiring for lights, exhaust fans, ceiling fans, bells, convenience socket outlet points :-

2.5 Sq. mm - For Lights / fans / 5A socket wiring from DB’s up to the outlet points including control wiring where the circuit length from the DB’s to 1st outlet is less than 40m.

In case of power socket outlet circuit.

6.0 Sq.mm – From DB’s 20/32 A industrial type sockets.
4.0 Sq.mm – From DB’s to 16 A sockets.

The earth continuity conductor size as indicated in the drawing / BOQ shall be drawn through conduit along with other circuit cables / wires. The size of the earth continuity conductor shall be as follows:-

Separate circuits shall run for each water heater, pantry / kitchen equipment, air conditioner, and similar outlets at locations as shown on drawings.
1.4 INSTALLATION OF CONDUIT

1.5. CONCEALED CONDUIT SYSTEM

Unless otherwise specified, all wiring shall be in heavy gauge rigid PVC conduit embedded in wall, or ceiling and concealed in the false ceiling. The size of the conduit shall be selected in conformity with I. S. code and as specified in the table given below. Factory made conduit bends and accessories shall be used. PVC Conduit shall be jointed using Solvent Cement as recommended by the conduit supplier. The conduit in ceiling slab shall be straight as far as possible. Before the conduits are laid in the ceiling, the position of the outlet points, controls junction boxes shall be set out clearly as per the dimensions and to minimize off-sets and bends. Before the reinforcement rods are kept in position electrical contractor shall mark in paint the position of outlet points and conduit drop on the shuttering. When the outlet boxes are kept in position and before pouring the concrete, all outlet boxes shall be filled with paper to avoid entry of concrete into the box. Conduits in ceiling shall be bonded to the reinforcement’s rods with G. I. bonding wire at intervals not more than 1000mm, to secure them in position. PVC deep light outlet / pull boxes shall be provided as required. The conduit in ceiling slab shall be laid above the first layer of reinforcement rods to avoid cracks in the ceiling surface; in general the conduit shall not be laid directly on the shuttering surface to avoid cracks in the ceiling surface.

Conduits shall be so arranged as to facilitate easy drawing of wires through them. Entire conduit layout shall be done in such a way as to avoid additional junction boxes other than light points. The wiring shall be done in a looping manner. All the looping shall be done in either switch boxes or outlet boxes. Joints in junction or pull boxes are strictly not allowed. Where conduits cross building expansion joints, adequate expansion fittings or other approved devices shall be used to take care of any relative movement.

All conduits shall be installed so as to avoid touching of steam and hot water pipes.

Conduits shall be installed in such a way that the junction and pull boxes shall always be accessible for repairs and maintenance work. The location of junction / pull boxes shall be marked on the shop drawings and approved by the Clients / consultant.

A minimum separation of 200mm shall be maintained between electrical conduits and hot water lines in the building.

All jointing methods shall be subject to the approval of the Clients / consultant. Separate conduits shall be provided for the following system.
- Lighting wiring,
- 16 Amp power outlets,
- 6 Amp outlets and lighting system,
- 24 Volt supply system,
- Telephone / intercom system,
- Computer data cabling system,
- Equipment-wiring.

BUNCHING OF CABLES

Cables of AC supply of different phases shall be bunched in separate conduits. The number of Insulated wires / cables that may be drawn into the conduits shall be as per the following table. In this table, the space factor does not exceed 40 %. However, in any case conduits having less than 20mm diameter shall not be used
MAXIMUM PERMITTED NUMBER OF 650 VOLT GRADE SINGLE CORE WIRES THAT MAY BE DRAWN INTO RIGID PVC CONDUITS.

<table>
<thead>
<tr>
<th>CABLE SIZE IN Sq mm</th>
<th>SIZE OF CONDUITS (mm) (MAX NOS. OF WIRES)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>20</td>
</tr>
<tr>
<td>1.5</td>
<td>4</td>
</tr>
<tr>
<td>2.5</td>
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<td>6.0</td>
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<tr>
<td>10.0</td>
<td>1</td>
</tr>
<tr>
<td>16.0</td>
<td>0</td>
</tr>
</tbody>
</table>

Wires carrying shall be so bunched in the conduit that the outgoing and return wires are drawn into the same conduit. Wires originating from two different phases shall not be run in the same conduit.

WIRING:

All final branch circuits for lighting and appliances, shall be single conductor cables run inside conduits. Branch circuit conductor sizes shall be as shown in the load analysis of drawing and conforming to the requirements of the I. R. Regulations and I. S. Code.

Home runs indicated on the drawings for the final branch circuits shall be kept in a separate conduit up to the panel board via switches wherever called for. Nos. other wiring shall be bunched in the conduit unless the other circuit main of same phase runs in the same conduit.

For each lot of wire supply, Contractor shall supply a certificate issued by the Manufacturer stating its origin, date of manufacture, constitution and standards to which it complies and the test certificates.

Looping system of wiring shall be used. Wires shall not be jointed inside the conduit or pull boxes. Where joints are unavoidable, they shall be made through approved mechanical connectors with prior permission of Client’s / consultants.

Control switches shall be connected in the phase conductors only and shall be ‘ON’ when knob is down. Switches shall be fixed in galvanized steel boxes. Chromium plated screws shall be used.

Power wiring shall be distinctly separate from lighting wiring.

Each circuit phase wire from the distribution boards should be followed with a separate neutral wire of the same size as the circuit wire.
DRAWING CONDUCTORS:

The drawing and jointing of PVC insulated copper conductor wires and cables shall be executed with due regard to the following precautions. While drawing wires through conduits, care shall be taken to avoid scratches and kinks, which cause breakage of conductors. There shall be Nos. sharp bends.

Insulation shall be shaved off like sharpening of a pencil and it shall not be removed by cutting it square.

Only certified wiremen and cable jointers shall be employed to do jointing work. All wires and cables shall bear the manufacturer’s label and shall be brought to site in original packing. For all internal wiring, PVC insulated wires of 650 / 1100 volts grade shall be used. The sub-circuit wiring for point shall be carried out in loop system and Nos. joints shall be allowed in the length of the conductors. If the use of joint connections are unavoidable due to any specific reason, prior permission, in writing, shall be obtained from the Clients / consultant. Nos. wire shall be drawn into any conduit, until all work of any nature, that may cause injury to wire, is completed. Care shall be taken in pulling the wires so that Nos. damage occurs to the insulation of wire. Before the wires are drawn into the conduits, the conduits shall be thoroughly cleaned of moisture, dust, dirt or any other obstruction by forcing compressed air through the conduits. The minimum size of PVC insulated conductor wires for all sub-circuit wiring for light points shall be 2.5 Sq.mm.

JOINTS:

All joints shall be made at main switches, distribution boards, socket outlets, lighting outlets and switch boxes only. Nos. joints shall be made in conduits and in junction boxes. Conductors shall be continuous from outlet to outlet.

MAINS AND SUB - MAINS:

Mains and sub-mains cables or wires where called for shall be of the rated capacity and approved make. Every main and sub-main wire shall be drawn through an independent adequate size conduit. An independent earth wire of the proper rating shall be provided for every single phase submain. For every 3-phase submain, 2 Nos. Earth wires of proper rating shall be provided along with the submain. The earth wires shall be drawn inside the conduits along with the circuit main. Where mains and sub-mains cables are connected to switchgear, sufficient extra lengths of cables shall be provided to facilitate easy connections and maintenance.

LOAD BALANCING:

Load balancing of circuits in three phase installation shall be planned before the commencement of wiring and shall be strictly adhered to.

- COLOUR CODE OF CONDUCTORS:

Colour code shall be maintained for the entire wiring installation: red, yellow, blue for three phases, black for neutral, green / yellow green for earthing.

The control wire from light control switches to the light / fan points shall be the same colour as that of the phase / circuit wires feeding that particular loop.

EARTHING:

All earthing system shall be in accordance with IS 3043 – 1985 Code of practice for Earthing.

The type and size of earthing wire shall be as specified under the heading of cables.

Each conduit originating from the DB to various outlets shall have one earth wire (PVC insulated green colour wire).
TESTING OF INSTALLATION

Before a completed installation is put into service, the following tests shall be complied with:

MEASUREMENTS

Mode of measurement is as follows:

purposes of measurement the point wiring for lights / fans / 6A sockets (where 6A sockets are connected to lighting circuit loop) is divided into two parts.

a) Point Wiring
b) Circuit Main

a) POINT WIRING

The wiring for light / fan / 6A socket (where 6A sockets are connected to lighting circuit loop) point starting from first light / switch / fan and looping between switches / fans / sockets etc., shall be measured either in 'Number' or 'Set'.

One light / fan point controlled by one switch is measured in Numbers (Nos.)

Set of Two or more light points controlled by one switch is measured in 'Sets'.

Where set of light points wired and controlled directly from MCB DB shall be measured in 'Sets'. The rate for this item shall not include the cost of switch & switch box.

6A socket wiring where connected to the lighting circuit loop is measured in Number (Nos.)

b) CIRCUIT MAIN

The length of circuit main including conduit starting from MCB DB to first switch / light / fan shall be measured separately in 'Linear Meters (Rmt.)'. (Further wiring is measured in point wiring).

CIRCUIT MAIN FOR WIRING 6A SOCKETS. 16A SOCKETS AND POWER OUTLETS SHALL BE MEASURED AS UNDER

Length of circuit wire including conduit starting from MCB DB to outlets and looping between outlets shall be measured in linear meters (Rmt).

The commercial type socket outlet with outlet box and cover plate shall be measured in numbers (Nos.)

The industrial type socket outlet including MCB, plug top, outlet box and cover plate shall be measured in numbers (Nos.)

The plug tops where called for shall be measured in numbers (Nos.)
L.T. PANELS AND DISTRIBUTION BOARDS

1.0 MEDIUM VOLTAGE L.T. PANEL:

1.1 GENERAL:

Medium voltage power panels shall be of 16 G sheet steel clad cubicle pattern, free floor standing type, totally enclosed dead front compartmentalized multilayer formation design. The panels shall be of extensible type with provisions for bus bar extensions also. Panels shall conform to the I.S. 8623 – 1980.

1.2 CONSTRUCTION:

Switchboard panels of free standing type shall have a double bus bar chamber. The space between the bus chamber and cable compartment shall be suitable compartmentalized to accommodate switchgears of various ratings and shall be identical to facilitate a modular construction. The cubicle shall be made out of 50 x 50 x 6mm thick angle iron frame work and 16 G M.S. cold rolled sheet steel shall be paneled to angle iron frame work with zinc plated fasteners. The 40 x 40 x 6mm thick iron framework shall be provided inside the panel to mount the outgoing feeders. A minimum space of 300mm shall be provided at the bottom / top of the board for termination of the cable. The cable alley shall have insulated supports for fixing the cable cores.

Flush type hinged construction doors shall be provided for bus bar chambers, cable, alleys, feeder compartments. The door shall be with ‘U’ shape edge to provide square type compressed rubber gasket and lockable. The 16 G M.S. partitions / barriers shall be provided between adjacent top and bottom compartments. All the live parts shall be properly shrouded with Bakelite barriers. All the equipment shall be accessible from the front. Arrangement and marking of bus bars, main connections and wiring shall be in accordance with IS: 375 – 1963.

1.3 BUS BARS:

The bus bars shall be suitable for 3 phase, 4 wire, 415 volts, 50 Hz system. The bus bars shall be made of high conductivity aluminum alloy strip conforming to IS specifications. The bus bars shall have uniform cross section throughout. The bus bars shall be capable of carrying the rated current at 415 volts continuously. The bus bars shall be designed to withstand a temperature rise of 45 deg. C above the ambient.

A current density of 1.0 Amps / Sq.mm shall not be exceeded for aluminum bus bars. The size of the bus bars shall be designed on the basis of a short circuit rating of 50 KA for one (1) sec.

Bus bars shall be supported on suitable insulating materials such as permali or hylam at sufficiently close intervals to prevent bus bar sag. Bus bars including their supports shall be able to withstand thermal and dynamic stressed due to the system short circuits. All the bus bars shall be insulated with PVC sleeving or heat resistant paint, suitably colour coded.

1.4 MOULDED CASE CIRCUIT BREAKERS:

All MCCB’s shall be quick make, quick break, independent manual type with trip free feature ON, OFF, TRIP indications shall be provided. Facility to test the breaker mechanically shall also be provided. MCCB shall have the following accessories.

- Auxiliary switch.
- Alarm switch.
- Terminal shrouds.
- Rotary front operation kit.
- Remote trip facility.
EARTHING: 25mm x 3mm copper tapes shall be provided for earthing of main distribution boards and connected to the frame work of the distribution boards. Provision shall be made for connection from this earth bar to the main earthing bar on both sides of distribution board.

PAINTING: All sheet steel work shall undergo a process of degreasing, pickling in acid, cold rinsing, hot dipped phosphatising, passivating and then sprayed with a high corrosive resistant primer, and then baked in an oven. The finishing treatment shall be by application of two coats of synthetic enamel paint of approved colour.

TESTING: All the distribution boards shall be subject to tests specified in relevant standards and test certificate shall be furnished.

CONTROL WIRING: The control wiring inside the panel shall be terminated using terminal box.

FINAL DISTRIBUTION BOARDS:

GENERAL:

Distribution boards shall be TP and N type for 415 volts, 3 phase AC supply or 240 V single phase AC supply as required. Distribution boards shall generally confirm to relevant I.S. however the specifications herein after described shall take precedence over the above wherever this specifications call for a higher standard of material or workmanship. The MCB distribution boards shall be of standard factory made with incomer of ELCB's.

MINIATURE CIRCUIT BREAKERS:

Miniature circuit breakers shall be quick make and break type, and shall conform to Relevant Indian Standards. The housing shall be heat resistant and having a high impact strength. The fault current shall Not be less than 9000 A, at 240 volts, MCB's shall be flush mounted and shall be provided with trip free manual operating lever and 'ON' and 'OFF' indications. The contacts shall be provided with magnetic thermal releases for over current and short circuit protection. The over load or short circuit device shall have a common trip bar in the case of DP and TPN Miniature circuit breakers.

TERMINALS:

Distribution Boards shall be provided with a terminal block for neutral and earth terminations of adequate size. The location of the terminal block shall be so located such that crowding of wires in the proximity of live parts is avoided.

DIRECTORY:

Distribution Boards shall be provided with a directory indicating the areas of loads served by each circuit breaker, the rating of breakers, size of conductors, etc. The directory shall be mounted in metal holder with a clear plastic sheet on inside surface of the front door. The Din Plate with a clear Perspex sheet shall be provided on the front door for over flanged door type DB. Suitable size danger plate indicating voltage grade shall also be fixed to front cover.
TECHNICAL SPECIFICATIONS FOR PLUMBING WORKS
MATERIALS AND WORKMANSHIP

1. MATERIALS

1.0 GENERAL

Materials shall be of the best approved quality obtainable and unless otherwise specified they shall conform to the respective Indian Standard specification.

1.1 Samples of all materials shall be got approved before placing order and the approved samples shall be deposited with the Employer.

1.2 In case of non-availability of materials in metric sizes, the nearest size in FPS units shall be provided with prior approval of the Employer / Architects for which neither extra will be paid nor any rebate shall be recovered.

1.3 If directed, materials shall be tested in any testing laboratory and the contractor shall produce the test the entire charges for original as well as repeated tests shall be borne by the contractor. If required by the Employer / Architects, the contractor shall arrange to test portion of work at his own cost in order to prove their soundness and efficiency. If, after any such test, the work or portion of work is found, in the opinion of the Employer / Architects, to be defective or unsound, the contractor shall pull down and re-do the same at his own cost. Defective material also shall be removed from the site.

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

A.1.0 WATER SUPPLY :

A.1.1 G.I. Pipes and sockets:

The pipes shall be galvanized mild steel hot finished seamless or welded pipes screwed and socketed conforming to the requirement of I.S. 1239-1982 for medium grade. They shall be of the diameter (Nominal bore) specified in the description of the item. The sockets shall be designated by the respective nominal bores of the pipes for which they are intended. Unless otherwise indicated the G.I pipes shall be of Tata "B" class.

The pipes and sockets shall be clearly finished, well galvanized in and out and free from cracks, surface flaws, laminations and other defects. All screw threads shall be clean and well cut. The ends shall be cut clean and square with the axis of the tube. Unless otherwise specified, the pipe below ground level or concealed or surface installed on walls or floors shall be "B" class.

All screwed tubes and sockets shall have pipe threads conforming to the requirements of IS : 554 - 1964 (or revised) screwed tubes shall have taper threads while the sockets shall have parallel threads.

The weights of GI pipes for various classes and diameter are as per IS code.

All tubes shall withstand a test pressure of 50 kg / cm² without showing defects of any kind.
A.1.2. Pipe fittings:

The fittings shall be of malleable cast iron or galvanized mild steel tubular as called for complying with all the appropriate requirements given in para A.1.1 or as specified. The fitting shall be designated by the respective nominal bores of the pipes for which they are intended.

The fittings shall have screw threads at the ends and conforming to the requirement of IS:544 - 1955 (or revised). Female threads or fittings shall be parallel and male threads (except on running nipples and collars of unions) shall be taper. Unions shall be provided at regular intervals in the pipe lines, for easy maintenance / Repair / Replacement of pipes.

A.1.3 CUTTING, THREADING, LAYING AND JOINTING:

The pipes and fitting shall be inspected at site before use to ascertain that they conform to the specification given in para A.1.1 above. The defective pipes shall be rejected. Where the pipes have to be cut or re-threaded, the ends shall be carefully filed out so that no obstruction to bore is offered. The ends of the pipes shall then be threaded conforming to the requirements of IS:544 - 1955 with pipe dies and taps carefully in such a manner as will not result in slackness of joints when two pieces are screwed together. The taps and dies shall be used only for the straightening screw threads which have become bent or damaged and shall not be used for turning of the threads so as to make them slack, as the later procedure may not result in a water tight joint. The screw threads of pipes and fittings shall be protected from damage until they are fitted.

A.1.4 JOINTING AND LAYING

The pipes shall be cleaned of all foreign matter before being laid. In jointing the pipes, the inside of the socket and the screwed end of the pipes shall be oiled and rubbed over with white lead and a few turns of spun yarn wrapped round the screwed end of the pipe. The end shall then be screwed in the socket, Tee etc., with the pipe wrench. Care should be taken that all pipes and fittings are properly jointed so as to make the joints completely watertight and pipes are kept at all time free from dust and dirt during the fixing. Burr from the joint shall be removed after screwing. After laying, the open ends of the pipes shall be temporarily plugged to prevent access of water, soil or any other foreign matter. Any threads exposed after jointing shall be painted or in the case of underground piping thickly coated with approved anticorrosive paint to prevent corrosion.

A.1.5. INTERNAL WORK: (Hot and cold water system)

Generally the galvanized iron pipes and fittings shall run in the wall chase inside the toilets and kitchen but on the surface in the service ducts. For exposed pipes, the clamps fixing shall be done by means of steel angle brackets and clamps, keeping the pipes about 2.5cm clear of the wall. When it is concealed, the pipe chasing may be adopted. For pipes fixed in the ducts or recessed etc., provide sufficient space to work on the pipes with the usual tools. The pipes shall not ordinarily be buried for short distances provided adequate protection is given against damage and shall be fixed at a place a pipe is passing through a wall or floor to allow freedom for expansion and contraction and other movements. In the case, the pipes is embedded in walls or floors it should be painted with anti-corrosive bitumastic of approved quality and pipe shall be wrapped in burlap or hessian cloth impregnated with bitumen. The wrapping shall be made to fit tightly over the pipe and where wrapping shall be made to fit tightly over the pipe and where wrapping with a new piece overlap the old pipe and where wrapping one joint it shall be tied with M.S. wire or nylon thread. Where pipes are encased within chases made in the wall, they shall be fixed to the wall with M.S. clamps so as to prevent movement before filling in and making good the chase.

A.1.6 Insulation for Hot water pipes

All hot water piping shall be insulated in the manner specified herein, before applying insulation, all pipe work and fittings shall be brushed and cleaned. Dust, dirt, mortar and oil shall be removed.

For pipes running concealed in wall chases, they shall be provided with one coat of bitumastic paint followed by wrapping with PVC tape tightly over the pipe. The ends and overlap shall be tied with M.S wire of Nylon rope. Asbestos rope of thickness as mentioned below shall be wound tightly and evenly over the entire length of pipe including fittings and valves. The insulated pipe shall then be wrapped with two layers of polythene faced hard felt and tied with M.S wire or nylon rope.
For pipes running exposed in pipe shafts, plant rooms or areas where insulation is prone to mechanical damage the pipes should be insulated as described herein. After cleaning the pipes, they shall be insulated with resin bonded mineral wool/fibre glass crown 15. The material shall have a thermal conductivity value not exceeding 0.3 btu / Hr - sq. ft/hr at mean temperature of 200 deg. C and a density not less than 32 kg's per Cu.m. Samples of insulating material also shall be submitted for approval. All longitudinal and transverse joints shall be sealed. 20 gauge G.I wire shall be wound tight around the insulation to keep it in position. The insulated pipe shall be then wrapped with two layers of polythene faced hessian and covered with two coats of 10mm thick each of smooth sand cement plaster and asbestos powder over chicken mesh lath. Curing of plaster shall be done using wetted jute bags.

The thickness of insulation to be applied shall be as follows:

<table>
<thead>
<tr>
<th>Pipe size</th>
<th>Insulation thickness</th>
<th>Asbestos Rope (Fibreglass insulation) / tape</th>
</tr>
</thead>
<tbody>
<tr>
<td>15mm, 20mm</td>
<td>25 mm</td>
<td>6 mm</td>
</tr>
<tr>
<td>25mm, 32mm</td>
<td>30 mm</td>
<td>8 mm</td>
</tr>
<tr>
<td>40mm &amp; above</td>
<td>40 mm</td>
<td>10 mm</td>
</tr>
</tbody>
</table>

The thickness of insulation mentioned in the table above is exclusive of the thickness of plaster to be applied over the insulation material.

ALTERNATIVELY the pipes may also be insulated using closed cell nitrile rubber insulation materials (recommended brand VIDOFLEX) having the following properties.

1) Density : 60 -90 Kgs / Cu. Mt. Conforming to ASTM D 1667
2) Thermal Conductivity at 20 degree C mean temperature : 0.034 w / m K conforming to STMC 177 and DIN 52613
3) Water vapour diffusion co-efficient (u) >5000 conforming to DIN 52615 + ISO 1663
4) Water absorption by Vol : 1.0 % Max. conforming to ASTM D 1056 – 59T
5) Recommended thickness : up to 15 mm NB pipe – 6 mm thick tubing
   From 50mm and above – 9 mm thick tubing / sheeting

Ancillary materials used like adhesives, tape etc., shall be of proven type and brand which are regularly recommended by the supplied of nitrile rubber insulation materials.

Method of application:

Clean the surface of the pipe to be insulated free from dust, grease and other matter. If the pipes are rusted they need to be cleaned using sandpaper and a coat of anti corrosive primer is to be applied over them.

Select the correct IB of the insulating pipe suitable for the pipes to be insulated and slit the pipe along its length using a sharp knife. Ensure that the cut is straight.

Apply a thin coat of adhesive on both the cut surfaces of the insulating tubing and leave it for 2-3 minutes for drying. Once the adhesive is dry but tacky to touch bring both the ends of insulating tubing where the adhesive is applied in contact and stick them well. Ensure that both the surfaces are matched properly. Apply self adhesive black cotton tape on both the longitudinal and the circumferential joints. Before fixing the tapes it must be ensured that all the joints are sealed properly. In case of pipes exposed to the atmosphere one layer of protective coating has to be applied over the insulation. For internal ducts protective coating is optional. Generally sheets are recommended for insulating the pipes of 100 mm dia NB and above. In this case the adhesive has to be applied on the pipe surface as well as the inside surface of the insulating sheet. Once the adhesive is tacky to touch bring them together to stick. Care must be taken that the joints are sealed properly before fixing the self adhesive tape.
A.1.7 **External Works:**

The galvanized iron pipes and fittings shall be laid in trenches. The widths and depths of the trenches for different diameters of the pipes shall be given as in the table below, and shall be deep enough to have a clear cover of at least 400mm above the top of pipes.

<table>
<thead>
<tr>
<th>Dia. of pipe</th>
<th>width of trench</th>
<th>depth of trench</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 mm to 50 mm</td>
<td>30 cm</td>
<td>60 cm</td>
</tr>
<tr>
<td>65 mm to 100 mm</td>
<td>45 cm</td>
<td>75 cm</td>
</tr>
</tbody>
</table>

At joints the trench, width shall be widened where necessary. The work of excavation and refilling shall be done true to line and gradient.

The pipes shall be painted with two coats of anticorrosive bitumastic paint of approved quality and wrapped with hessian cloth impregnated with bitumen. The pipes shall be laid on a layer of 7.5 cm sand and filled with excavated earth. The surplus earth shall be disposed off as directed. The filling shall be done after testing & rectifying leakages and after final passing of work by EIC.

When the excavation is done in rock the bottom shall be cut deep enough to permit the pipes to be laid on a sand cushion of minimum 7.5 cm. In case of bigger diameter pipes where the pressure is very high thrust blocks of cement concrete 1:2:4 (1 cement : 2 coarse sand: 4 graded stone aggregate of 20 nominal size) shall be constructed on all bends to transmit the hydraulic thrust without impairing the ground and spreading it over a sufficient area, as directed by the engineer-in-charge.

A.1.8 **Testing the Joints:**

After laying and jointing, the pipes and fittings shall be inspected under working conditions of pressure and flow. Any joint found leaking shall be redone and all leaking pipes removed and replaced without extra cost. The pipes and fittings after they are laid shall be tested to hydraulic pressure of 6 kg/cm². (5) meter or double the designed working pressure whichever is more). The pipes shall be slowly and carefully charged with water allowing all air to escape and avoiding all shock or water hammer. The draw off takes and stop cocks shall be then closed and specified hydraulic pressure shall be applied gradually. Pressure gauge at least 2 hrs. The pipes and fittings should be tested in section as the work of laying proceeds, keeping the joints exposed for inspection during the testing.

A.1.9 **Measurements:**

The lengths shall be measured in running meter correct to 1 cm. for the finished work, which shall include G.I. pipes and sockets, G.I. Fittings such as berfs, tees, elbows, reducers, crosses, plugs, sockets, nipples and nuts, but exclude brass or gunmetal taps (cocks), valves, lead connection pipes and shower rose. The length shall be taken along the central line of the pipe fittings. All pipes and fittings shall be classified according to their diameter of the internal bore. The pipe shall be described as including all cuttings and wastage. In case of fittings of unequal bore, the largest bore shall be measured.

Digging and refilling of trenches shall be measured separately or clubbed with main item.
A.2.0 Water Supply and waste Fittings:

General:

The brass or gun metal fitting shall be heavy quality and approved manufacture and pattern with screwed or flanged ends as specified. The fittings shall in all respects comply with the Indian Standard specifications No. I.S. 778-1957 and I.S. 781-1959. The standard size of brass or gun metal fittings shall be designated by the nominal bore of the pipe outlet to which the fittings are attached. A sample of each kind of fittings shall be got approved from the engineer-in-charge and all supplies made according to the approved samples.

All cast fittings shall be sound and free from laps, blow holes and filings. Both internal and external surfaces shall be clean, smooth and free from sand etc. Burning, plugging, stopping or patching of the casting shall not be permissible. The bodies, bonnets, spindles and other parts shall be truly machined so that when assembled the parts shall be axial, parallel and cylindrical with surfaces smoothly finished. The area of the water-way of the fittings shall be less than the area of the nominal bore.

The fittings shall be fully examined and cleared of all foreign matters before being fixed. The fittings shall be fitted in the line in a workman-like manner. The joints and fittings shall be leak-proof when tested to a pressure of 6 kg/sq.cm., as described in para above and the defective fittings and joints shall be replaced or redone, without any extra cost.

A.2.1 Water Supply Fittings:

All water supply fittings (including mixing fittings accessories shall be brass/copper, heavy chromium plated, of the make and design specified. The fittings shall be cast fittings of screw type, machined and threaded properly for fixing to the supply pipes.

The plating shall conform to Indian standard specification IS: 4827-1968 electroplated coating of nickel and chromium on copper and copper alloys.

The fittings shall be supplied complete with chromium plated matching flanges, nuts and extension pieces of required lengths. Metallic washers where required shall also be of chromium plated brass. All bib cocks and stop cocks shall conform to Indian standard specifications IS: 781-1967 - Bib taps and stop valves for water services, sand cast brass screw-down (revised) pillar cocks to IS: 1795-1961 - Pillar taps, mixing fittings to IS: 1701-1960 mixing valves for ablutionary and domestic purpose. Bath filler, shower arm, rose spout and other fittings shall match the supply fittings in construction, performance and appearance.

All fixing accessories and screws shall be similar to fittings with all exposed parts chromium plated. All washers shall conform to Indian standard specification IS: 4326-1967 washers for water taps cold water services.

A.2.2.1 BIBCOCK AND STOPCOCK

<table>
<thead>
<tr>
<th>Size (mm)</th>
<th>Bib tap (kg)</th>
<th>Stop tap (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>0.25</td>
<td>0.25</td>
</tr>
<tr>
<td>10</td>
<td>0.30</td>
<td>0.35</td>
</tr>
<tr>
<td>15</td>
<td>0.40</td>
<td>0.40</td>
</tr>
<tr>
<td>20</td>
<td>0.75</td>
<td>0.75</td>
</tr>
</tbody>
</table>
A.2.2 Waste Fittings:

All waste fittings (waste, chain, pop-up, over-flow) shall be brass/copper, heavy chromium plated of the make shall be brass/copper, heavy chromium plate of the make and design specified and match the supply fittings. They shall conform to Indian Standard specification IS : 2963 - 1964 waste fittings for wash basins and sinks non-ferrous.

A.2.2.1 Bottle Traps:

Bottle traps (for wash basins, sinks, urinals etc.,) shall be deep seal (minimum 6 cm. seal) cast brass bottle traps, heavy chromium plated. All bottle traps shall be provided with suitably cleaning eye, extension piece, flare nuts-all chromium plated. Bottle traps shall be of approved make and design. Traps for wash basins shall be 32mm, for sinks 40mm.

A.2.2.2 Bath Tub/Shower Tray Traps:

Traps of special design made of brass shall be provided for bath tubs and shower trays.

A.2.2.3 Wall Flange:

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

A.2.2.4 Floor Traps:

Floor traps shall be of PVC of the size required, or approved design incorporating a deep seal (6cm. minimum) and venting device unless otherwise indicated.

A.2.3 Lawn Hydrants:

Lawn hydrants shall be 2.5 cms. unless otherwise indicated. All hydrants shall be provided with gate valves that is screwed faucet to receive hose pipes. Lawn hydrants shall be of approved make and design. Where called for lawn hydrants shall be located in brick masonry chambers of appropriate size as per specification given herein after.

A.2.4 VALVES & APPURTANANCES

The ball valve shall of high pressure Type shall be of sizes as specified.

The normal size of a ball valve shall be that corresponding to the size of the pipe to which it is fixed. The ball valve shall be of brass or gun metal as specified, and the float of copper sheet. The minimum thickness of copper sheet used for making the float shall be 0.45mm for float exceeding 115mm dia. Plastic floats may also be used if specified. The body of the high pressure ball valve when assembled in working condition with the float immersed to not more than half of its volume shall remain closed against a test pressure of 3.5 kg/sq.cm. The ball valve shall generally conform to I.S. specification NO. 1703: 1862. The weight of ball cock and the size of the ball cock shall be as per I.S. specification.

A.2.4.2 Brass full way Valve:

Full way valve is a valve with suitable means of connection for insertion in a pipe line for controlling or stopping the flow. The valve shall be of brass fitted with a cast iron wheel and shall be of gunmetal gate valve type opening full way of the size as specified. The valve shall be of best quality or approved by the Engineer-in-charge.
A.2.4.3 **Gun-metal full way valve with wheel:**

These shall be of the gun metal fitting with wheel and shall be of gate valve type opening full way and of the size as per specification. These shall generally conform to I.S. 7780 - 1957.

A. 2.4.4. **Butterfly / Ball Valves**

Valves upto 40mm dia and below shall be carbon steel / heavy duty cast iron body with stainless steel ball, lever operated to I.S : 778 - 1977 class II with female screwed ends.

Valves from 50mm upto 150mm dia shall be of cast iron body butterfly valves lever operated with flange ends. Valves shall carry I.S certification mark. The valves shall be either VALTECH or INTERVALVE make.

All valves shall be approved by Engineer-in-charge before they are followed to be used on work.

Note : All globe, gate and check valves shall have working parts suitable for hot and cold water, as required. Valves shall be tagged with permanent label under hand wheel indicating type or duty.

A.2.4.5 **Foot Valves** :

Provide case iron body with brass disc and strainer of approved quality, wherever shown.

A.2.4.6 **Pressure Reducing Valves** :

Pressure reducing valves shall be "Leader" make bronze pilot operated spring loaded valves for reducing pressure from 2.5kg/cm² to 0.5kg/cm² suitable for specified dia of pipe.

A.2.4.7 **Sluice Valves** :

The sluice valves are used in a pipe line for controlling or stopping flow of water. They shall be of specified size and class and shall be of inside non-raising screw type spindle with either double flange or double sockets ends and cap or hand-wheel.

These shall in all respects comply with the Indian Standard specification I.S. 780 - 1963 for valves upto and including 300mm. size and No. BDC (429) p2 for valves above 300mm. size. Class-I sluice valves are used for maximum working pressure of 10kg/cm², (100 meter head) and class-II sluice valves for 15kg/cm² (150 meter head).

The body, domes, covers, wedge gate and stuffing box shall be of good quality cast iron, the spindle of bronze the nut and valves seats of leaded tin bronze. The bodies, spindles and other parts shall be truly machined with surfaces smoothly finished. The area of the water way of the fitting shall be not less than the area equal to the nominal bore of the pipe. The valve wheel shall be marked with an arrow to show the direction of turn for closing the valves.

The valve shall be fully examined and cleared of all foreign matter before being fixed. The fixing of the valve shall be done by means of bolts, nuts and 3mm rubber insertions or chemically treated compressed fibre board of 1.5mm thick minimum thickness and of weight less than 0.183gm per sq.cm. with the flanges of spigot and the socketed tail pieces drilled, to the same specification in the case of S & S pipe and with flanges in case of flanged pipes. The tail pieces shall conform to I.S. 1938 - 1960. These shall be jointed to the pipe line by means of lead caulked joints.

A.2.4.8 **Valve Schedules** :

<table>
<thead>
<tr>
<th>Service</th>
<th>Type</th>
<th>Size</th>
<th>Rating</th>
<th>Ends</th>
<th>Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>Gate</td>
<td>Below 65 dia</td>
<td>300 psi /</td>
<td>Screwed</td>
<td>Bronze</td>
</tr>
<tr>
<td>Water</td>
<td>Gate</td>
<td>75 dia &amp; over</td>
<td>20kg/cm²</td>
<td>Flanged</td>
<td>C.I. body bronze trim</td>
</tr>
</tbody>
</table>
ELECTROMECH CONSULTANTS

Water Globe Below 65 dia & under 20kg/cm² Screwed Bronze

Water Globe & Angle 65 & under 20kg/cm² Screwed Bronze

Water Globe & Angle 65 & over 20kg/cm² Flanged Iron body bronze trim

Water Horizontal vertical check 65 & under 20kg/cm² Screwed Bronze trim

Water Horizontal vertical check 65 & over 20kg/cm² Flanged Iron body Bronze trim

Care shall be taken that the factory seal of the meter is not disturbed. Wherever the meter shall be fixed to a newly fitted pipe line, the pipe line shall have to be completely washed before fitting the meter. For this purpose a piece of pipe equal to the length of the meter shall be fitted in the proposed position of the meter in the new pipe line. The water shall be allowed to flow completely to wash the pipe line and then the meter installed as described above by replacing the connecting piece.

A.3.0 Masonry Chambers:

A.3.1 General:

All masonry chambers for stop cocks, sluice valves, etc., shall be built as per supplied drawings.

A.3.2 Excavation:

The excavation for chambers shall be done true to dimension and levels as indicated on plans or as directed by the Engineer-in-charge.

A.3.3 Bed Concrete:

This shall be cement concrete 1:3:6 (1 cement : 3 fine sand : 6 grade stone aggregate 40 mm nominal size).

A.3.4 Brick Work:

This shall be in Class B bricks (Table Moulded) with crushing strength not less than 35 Kg/Sq. cm.in cement mortar 1:6 (1 cement : 6 fine sand ) Conforming to Is.

A.3.5 Plastering:

Plastering not less than 12 mm thick shall be done in cement mortar 1:3 (1 cement : 3 coarse sand) finished with a floating coat of neat cement.

A.3.6 Surface Box:

This shall be of cast iron, well made and free from casting and other defects. All sharp edges shall be removed and finished smooth. The sharp edges shall be removed and finished smooth. The shape and dimensions for surface boxes for stop cocks, sluice valves etc., shall be as per approved samples.

A.3.7 Measurements:

Masonry Chambers shall be enumerated under the relevant items:
A.2.4.9 **Appurtenantances**:  

The other appurtenantances of pipe line are mentioned below:

a) **Air Valves**:

These are placed at every summit in the pipe line to permit the escape of air when the main is filled and afterwards, if any air carried out into the mains. These are also places on long stretches of nearly level main.

b) **Scour Valves**:

These are placed at the bottom of all depressions for emptying the main or letting out the sediment.

c) **Reflux Valves**:

These are fixed so as to open in the direction of flow but automatically close if the water flows back. They are used to diminish the damage done by the escape of water due to a burst or prevent damage to impellers of pumps.

d) **Safety or Relief Valves**:

These are fixed at the down stream ends of long lengths of main or where water hammer may take place so as to reduce from any excessive pressure to the normal if it occurs, like in water pipes of high rise buildings. They are also called pressure reducing valves.

A.2.4.10 **Fixing water meter and stop cock in G.I pipe line**:

Materials - pipe fittings as described in material section.

Cutting G.I. pipe line:

The G.I. line shall be cut to the required length at the position where the meter and stop cock are required to be fixed. The ends of the pipe shall then be threaded. Unions shall be provided in the pipe assembly for fixing water meter.

Fixing meter and stop cock:

The meter and stop cock shall be fixed in position by means of connecting pipes, G.I. jam nut and socket etc. The stop cock shall be fixed near the inlet of the water. The paper disc inserted in the ripples of the meter shall be removed and the meter installed exactly horizontal or vertical in the flow line in the direction shown by the arrow cast on the body of the meter.

A.3.8 **Rating**:

The rate shall include the cost of materials and labour involvement in all the operations described above, except the excavation in soft or decomposed and hard rock.

The difference in cost, between ordinary soil and soft or decomposed or hard rock as the case may be, shall be paid for separately if the rock is met with.
B. DRAINAGE (EXTERNAL WORKS)

B.1.0 Salt Glazed Stoneware Pipes:

All pipes with spigot and socket ends shall conform to IS 651-1965 and shall be of grade 'A' as specified. These shall be sound, free from visible defects such as fire cracks or hair cracks. The glaze of the pipes shall be free from crazing. The pipes shall give a sharp clear note when struck with a light hammer. There shall be no broken blisters or chipping on the spigot or socket. The approximate thickness of 60cm long pipes shall be given in the table below:

<table>
<thead>
<tr>
<th>Internal Diameter of the pipe</th>
<th>Thickness of the barrel &amp; of socket</th>
<th>Weight of each pipe per m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>mm</td>
<td>mm</td>
<td>kg</td>
</tr>
<tr>
<td>100</td>
<td>12</td>
<td>14</td>
</tr>
<tr>
<td>150</td>
<td>16</td>
<td>22</td>
</tr>
<tr>
<td>200</td>
<td>17</td>
<td>33</td>
</tr>
<tr>
<td>230</td>
<td>19</td>
<td>44</td>
</tr>
<tr>
<td>250</td>
<td>20</td>
<td>52</td>
</tr>
<tr>
<td>300</td>
<td>25</td>
<td>79</td>
</tr>
</tbody>
</table>

The length of pipes shall be 60cm exclusive of the internal depth of the socket. The pipes shall be handled with sufficient care to avoid damage to them.

B.1.1 Trenches for SW Stoneware Pipes Drain

Unless otherwise mentioned the widths of trenches for various dia of stonestone pipes shall be as given in the table given below for depth upto 3m.

<table>
<thead>
<tr>
<th>Size of pipes</th>
<th>Width of trench</th>
</tr>
</thead>
<tbody>
<tr>
<td>150</td>
<td>0.8 m</td>
</tr>
<tr>
<td>230</td>
<td>0.9 m</td>
</tr>
<tr>
<td>300</td>
<td>0.9 m</td>
</tr>
</tbody>
</table>

Wherever depth exceeds 3 m, the width will be increased by 1.1m.

B.1.2 Laying of Stoneware Pipes:

All pipes shall be laid on a bed of 15 cm cement concrete of 1:4:8 using 3/4" graded granite aggregates projecting on each side of the pipe to the width of the trench specified. The pipes with their crown level at 1.20m. depth and less from ground shall be covered with 15 cm thick concrete above the crown of the pipe ends sloped off to meet the outer edges of the concrete to give a minimum thickness of 15 cm. all round the pipe.

Pipes laid at a depth greater than 1.20m. at crown shall be concreted at the sides upto the level of the centre of the pipe and sloped off from the edge to meet the pipe tangentially.

The pipes shall be carefully laid to the alignment, levels and gradients shown on the plans and sections. Great care shall be taken to prevent sand, etc. from entering the pipes. The pipes between two manholes shall be laid truly in a straight line without vertical or horizontal undulation. The pipes shall be laid with socket up the gradient.

If the excavation has been carried too low, the desired levels shall be made up with concrete 1:5:10 (1 cement : 5 fine sand : 10 graded stone aggregate 40mm nominal size) for which no extra payment shall be made.

If the floor of the trench consists of rock or very hard ground that cannot easily be excavated to a smooth surface the pipe shall be laid on a levelling course of concrete as desired.
B.1.3. **Jointing:**

Tarred gasket of hemp yarn soaked in thick cement slurry shall first be placed round the spigot of each pipe and the spigot shall then be slipped home well into the socket of the pipe previously laid. The pipe shall then be adjusted and fixed in the correct position and the gasket caulked tightly home so as to fill not more than 1/4th of the total depth of the socket.

The remainder of the socket shall then be filled with stiff mixture of cement mortar in the proportion of 1:1 (1 cement : 1 fine sand). When the socket is filled, a fillet shall be formed round the joint with a trowel forming an angle of 45 degree with the barrel of the pipe. The joints shall be tested hydraulically as per para 3.1.4 and no. concreting for encasement shall be done unless pipes are jointed and tested. After a day’s work any extraneous material shall be removed from the inside of the pipe. The newly made joints shall be cured.

B.1.4. **Testing of Joints:**

Hydraulic tests: Stoneware pipe used for sewers shall be subjected to a test pressure of 1.5m or required head of water at the highest point of the section under test. The test shall be carried out by suitable plugging the low end of the drain and the ends of the connection, if any and filling the system with top and a sufficient length of vertical pipe jointed to it so as to join with a connection to a hose ending in a funnel which could be raised or lowered till the required head is obtained and fixed suitably for observation.

During the test the required head is maintained for 30 minutes by adding water from a measuring vessel at 10 minutes interval and the average quantity added shall not exceed 1 litre per hour per 100m length per 10mm dia of pipe.

Where leakage will be visible the defective part of the work shall be removed and made good, at no extra cost.

B.1.5 **Refilling of Trenches:**

As described under water supply section, in case where pipes are not bedded on concrete, special care shall be taken in refilling trenches to cement the displacement and subsequent settlement at the surface resulting in uneven surfaces and dangers to foundations etc. The backfilling materials shall be packed by hand under and around the pipe and rammed with a shovel and light tamper. This method of filling will be continued up to the top of pipe. The refilling shall rise evenly on both sides of the pipe continued up to 60cm above the top of pipe so as not to disturb the pipe. No tapping should be done within 15cm, of the top of pipe. The remainder of the backfill shall not be done until 7 days have elapsed for brick sewers and 14 days for concrete sewers, unless local conditions or materials are suitable for the earlier placing of a load on the pipes. The tapping shall become progressively heavier as the depth of the backfill increases.

* B.2.0 **S.W. Gully Trap:**

Gully traps shall conform to IS 651-1980 (Fourth Revision). These shall be sound, free from visible defects such as fire cracks or hair cracks. The glaze of the traps shall be free from crazing. They shall give a sharp clear note when struck with a light hammer. There shall be no broken blisters.

The size of the gully trap shall be as specified and all dimensions will be as per drawing.

Each gully trap shall one C.I. grating of square size corresponding to the dimensions of inlet of gully trap. It will also have a water tight C.I. cover with frame inside dimensions 300 x 200 mm, the cover weighing not less than 2.72kg. The grating cover and frame shall be of sound and good casting and shall have truly square machined seating faces.
B.2.1 Excavation:

The excavation for gully traps shall be done true to dimensions and levels as indicated on plans or as directed by the Engineer-in-charge.

B.2.2 Fixing:

The gully trap shall be fixed on cement concrete foundation 600 x 600 cm square and not less than 10cm. thick. The mix for the concrete will be 1:5:10 (1 cement : 5 fine sand:10 graded stone aggregate 40mm nominal size). The jointing of gully outlet to the branch drain shall be done similar to jointing of S.W. pipe.

B.2.3 Brick Masonry Chamber for gully trap:

After fixing and testing gully and branch drain, a brick masonry chamber 450 x 450 (inside) in Class B bricks in cement mortar 1:5 (1 cement :5 fine sand) shall be built with a 9" thick brick work round the gully trap from the top of the bed concrete up to ground level. The space between the chamber walls and the trap shall be filled in with cement concrete a:5:10 (1 cement: 5 fine sand: 10 graded stones aggregate 400mm nominal size). The upper portion of the chamber i.e. above the top level of the trap shall be plastered inside with water proof cement mortar 1:3 (1 cement: 3 coarse sand) finished with a floating coat of neat cement. The corners and bottom of the chamber shall be rounded off as to slope towards the grating and form a hopper. C.I. cover with framed 300 x 200 mm. (inside) shall then be fixed on the top of the brick masonry with cement concrete 1:2:4 (1 cement: 2 coarse sand: & 4 graded stone aggregate 20mm nominal size) and rendered smooth. The finished top of cover shall be left about the adjoining ground level so as to exclude the surface water from entering the gully trap.

B.3.0 Cement concrete pipes:

The pipes shall be with or without reinforcement as required and of the class as specified. These shall conform to IS: 458-1971 (Second Revision). The reinforced cement concrete pipes shall be manufactured by centrifugal (or spun) process. M/s Indian Hume Pipe Company. All pipes shall be true to shape, straight, perfectly sound and free from cracks and flaws. The external and internal surface of the pipes shall be smooth and hard. The pipes shall be free from defects resulting from imperfect grading of the aggregate, mixing or moulding. The pipes shall be R.C.C. light duty, NP type.

Concrete used for the manufacture of reinforced concrete pipes and collars shall not be leaner than 1:2:4 (1 cement:2 coarse sand : 4 graded stone aggregate). The maximum size of aggregate, should not exceed one third of the thickness of the pipe or 20mm whichever is smaller. The reinforcement in the reinforced concrete pipe shall extend throughout the length of the pipe. The circumferential and longitudinal reinforcement shall be adequate to withstand the specified hydrostatic pressure and further bending stresses due to the weight of water when running full across the span equal to the length of pipe plus three times its own weight.

B.3.1 Laying of Pipes:

Loading, transporting and unloading of concrete pipes shall be done with care. Handling shall be such as to avoid impact. Gradual unloading by inclined plane or by chain block is recommended. All pipe sections and connections shall be inspected carefully before being laid. Broken or defective pipes or connections shall not be used. Pipes shall be lowered into the trenches carefully. Mechanical appliances may not be used. Pipes shall be laid true to line and grade as specified. Laying of pipe shall proceed upgrade of a slope.

If the pipes have spigot and socket joints, the socket end shall face upstream. In the case of pipe with joints to be made with loose collars, the collars shall be slipped on before the next pipe is laid. Adequate and proper expansion joints shall be provided where directed. In case where the foundation conditions are unusual such as in the proximity of trees or holes, under existing or proposed manholes etc, the pipe shall be encased allround in 15cm. thick cement concrete 1:5:10 (1 cement :5 fine sand :10 graded stone aggregate 40mm nominal size) or compacted sand or gravel.
In cases where the natural foundation is inadequate the pipes shall be laid either in concrete cradle supported on proper foundation or on any other suitably designed structure as specified. If a concrete cradle bedding is used the depth of concrete below the bottom of the pipe shall be at least 1/4th of the internal dia. and shall extend upto the sides of the pipe at least to a distance of 1/4th of the outside diameter. For pipes 300mm. and over in dia. The pipe shall be laid in this concrete bedding before the concrete has set. Pipes laid in trenches in earth shall be bedded evenly and firmly and as far up the haunches of the pipe as to safely transmit the load expected from back-fill through the pipe to the bed. This shall be done either by excavating the bottom of the trench to fit the curve of the pipe or by compacting the earth under around the curve of the pipe to form an even bed. Necessary provision shall be made for joints wherever required.

When the pipe is laid in a trench in rock, hard clay, or other hard material the space below the pipe shall be excavated and replaced with an equalizing bed of concrete, sand or compact earth. In no place shall pipe be laid directly on such hard material.

When the pipes are laid completely above the ground the foundations shall be made even and sufficiently compacted to support the pipe line without any material settlement. Alternatively the pipe line shall be supported on p.c.c. saddle blocks. Similar arrangement shall be made to retain the pipe line in the proper alignment.

Such as by shaping the top of the supports to fit the lower part of the pipe. The distance between the supports shall in no case exceed the length of the pipe. The pipe shall be supported as far as possible close to the joints. In no case shall the joint come in centre of the span. Care shall be taken to see that superimposed loads greater than the total load equivalent to the weight of the pipe when running full shall not be permitted.

B.3.2 Jointing of Pipes:

Joints are generally of rigid type. When specified flexible type joints may also be provided.

i. Spigot and Socket Joint (rigid):

The spigot of each pipe shall be slipped home well into the socket of the pipe previously laid and adjusted in the correct position. The opening of the joint shall be filled with stiff mixture of cement mortar in the proportion of 1:2 (1 cement : 2 fine sand) which shall be rammed with caulking tool.

After a day’s work any extraneous material shall be removed from the inside of the pipe and newly made joint shall be cured.

ii. Collar Joint (rigid):

The two adjoining pipes shall be butted against each other and adjusted in correct position. The collar shall then be slipped over the joint, covering equally both the pipes. The annular space shall be filled with stiff mixture of cement mortar 1:2 (1 cement : 2 fine sand) which shall be reamed with caulking tool.

After a day’s work any extraneous material shall be removed from the inside of the pipe and the newly made joint shall be cured.

B.3.3 The testing of joints, refilling of trenches:

The testing of joints, refilling of trenches for concrete pipes shall be similar to specification for stone ware pipes.
B.4.0 **Manholes, Inspection Chambers, Gullies etc.:**

B.4.1 **Inspection Chambers:**

Where depth of sewer is less than 1.5m., below outside rectangular made up / finished level of paving. Chambers used shall be having size as specified. Usual size are 600 x 600 or 600 x 900. These shall be constructed in the sewer line at such places and levels and dimensions as indicated on the drawing. Sizes specified shall be clear internal dimensions of the chamber.

B.4.2 **Manholes:**

Where depth of sewer exceeds 1.5m, with respect to outside made up ground / finished level of paving circular conical manholes shall be provided. Various types and sizes of manholes are specified for different depths. Typical drawing of various types of manholes shall be supplied to the contractors. In the absence of such drawings the Manhole details as per IS 4111 to be followed.

Manholes and inspection chambers which are provided on roads or where heavy vehicular traffic is expected are provided with ' heavy duty ' C.I. airtight frame & cover, with double seal as per IS 1726. For those built on footpaths, carriage drives and cycle tracks, medium duty covers shall be provided. For locations within domestic premises or areas not subjected to wheel traffic loads they shall be provided with light duty covers.

B.4.3 **Construction of manholes, Inspection chambers and gullies.**

i. **Excavation:**

This shall be done to dimensions and levels on the drawing.

ii. **Bed Concrete:**

Base of the manhole shall be constructed in P.C.C. 1:2:4. using 3/4" graded stones. Thickness shall be 200mm up to 4.25m and 300mm for depths more than 4.25m or as specified by the Engineer-in-charge.

iii. **Brickwork:**

Brickwork shall be in C.M. 1:4 constructed with Glass B wire cut bricks. Brick masonry in arches and arching over the pipe shall be in C.M. 1:3. Walls shall be generally built in 230 mm thickness for inspection chambers and manholes up to a depth of 2.1 m and 350 mm for depth over 2.2.

iv. **Plastering:**

Walls of manholes shall be plastered inside with 15mm thick cement plaster 1:3 using W.P. Compound and finished smooth. Where ground water table is high, external surfaces of manholes shall also be plastered in C.M. 1:3.

v. **Filleting:**

75 mm fillet shall be made with C.M. 1:3 all round the external joint between the bed concrete and brick masonry wall of manhole.

vi. **Benching:**

Channels and benching inside the manhole or inspection chamber shall be done in C.C. 1:2:4 and rendered smooth with cement.

vi. **R.C.C. Cap:**

RCC M. 150 cap of 1:2:4 150 mm thickness shall be provided on top of manholes for fixing the manhole frame.
viii. **Footrest**

Footrests shall be C.I. runs weighing 5.41 kg and conforming to IS 2064 - 1962 made up of 20mm square or round bars. These shall be embedded 20 cm deep in 20 x 20 x 10 cm blocks of PCC 1:2:4. The blocks with C.I. foot rest placed on its centre shall be cast in-situ along with masonry. Footrests shall be placed 300mm apart vertically and 375 mm horizontally staggered fashion. First footrest shall be 450mm below top. Footrest shall be painted with coal tar or bituminous paint and the portion embedded shall be painted with thick cement slurry before fixing.

ix. **Manhole frames and covers**

Approximate weights for various dimensions of frames and covers of various duties shall be as follows:
(All M.H. cover of Heavy duty & Medium duty shall be of Double seal type and light duty single seal type).

<table>
<thead>
<tr>
<th>Size</th>
<th>Heavy Duty kg</th>
<th>Medium Duty kg</th>
<th>Light Duty kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rect. 910 x 455</td>
<td>230</td>
<td>200</td>
<td>50</td>
</tr>
<tr>
<td>Rect. 910 x 610</td>
<td>275</td>
<td>251</td>
<td>70</td>
</tr>
<tr>
<td>Circular 530 dia.</td>
<td>238</td>
<td>125</td>
<td>-</td>
</tr>
</tbody>
</table>

The covers and frames shall be cleanly cast and shall be free from air and sand holes and from cold shuts. They shall be neatly dressed and carefully trimmed. All castings shall be free from voids either due to shrinkage gas inclusion or other causes.

Covers shall have raised chequer design on the top surface to provide adequate non-slip grip. The cover shall be capable of easy opening and closing and shall be fitted in the frame in a workman-like manner. Covers shall be gas and water tight. Size of the cover shall be the clear internal dimensions of frame. 2-1/2% variation in weights shall be permissible.

Covers and frames shall be coated with a black anticorrosive paint of bituminous composition. The coating shall be smooth and tenacious. It shall not flow at 63 degree C. and shall not drip off at 0 degree C. The covers shall be so fixed as to be flushed with ground surface. After completion the manhole covers shall be sealed by means of grease.

B.4.4 **Testing**

Manhole, after it is raised above highest expected subsoil water level in monsoon, shall be tested for water tightness. The mouths of all pipes entering the manhole shall be suitably plugged with brick masonry or wooden or any other type of plug. Manhole under test shall then be filled with water up to general subsoil water level and the level observed for one hour. If the level does not drop to more than 50 mm in one hour, it shall be deemed as water tight. During testing the pit around shall be kept free of water and contractor shall observe the places where leakage takes place and takes steps to correct the same. Filling earth around Manholes shall be done after testing.

B.4.5 **Drop Connection**

In cases where branch pipe sewer enters the manhole of main pipe sewer at level higher than the main sewer by more than 600mm a drop connection should be provided as per typical drawing for drop connection.

For 150 and 250 mm main line, the difference in level between the water line (Peak-flow-level) and the invert level of branch line is less than 60cm., a drop connection may be provided within the manhole by giving ramp. If the difference in level is more than 60cm., the drop should be provided externally.
1. **Excavation:**

The excavation shall be done for the drop connections at the place where the branch line meets the manhole. The excavation shall be carried up to the bed concrete of the manhole and to the full width of the branch line.

2. **Laying:**

At the end of branch sewer line a stoneware shall be fixed to the line which shall be extended through the wall of the manhole by a horizontal piece of S.W. pipe to form an inspection or cleaning eye. The stoneware drop shall be connected to the tee at the top and the S.W. bend at the bottom. The end shall be extended through the wall of the manhole by a piece of C.I. pipe which shall discharge into the channel. Necessary channel shall be made with cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20mm. nominal size) and finished smooth to connect the main channel. The joint between S.W. pipe and tee and S.W. branch line shall be made with cement mortar 1:1 (1 cement : 1 fine sand) as per para 2.1.3 for S.W. pipes. The exposed portion of the drop connection shall be encased all round with a single brickwork in C.M. 1:4 and pointed. The holes made in the walls of the manholes shall be made good with brickwork in cement mortar 1:4 (1 cement : 4 fine sand) and plastered with cement mortar 1:3 (1 cement : 3 coarse sand) on the inside of the manhole wall. The excavated earth shall be backfilled in the

**B.5.0 DRAINAGE (INTERNAL WORKS)**

**B.5.1 SOIL, WASTE, VENT PIPES AND FITTINGS**

All soil, waste pipes and fittings used within sunken floor areas in services floors or within plumbing shafts vertical run shall UPVC pipes conforming to IS : 4985 of SWR / Agricultural quantity of 4 kg and 6 kg pressure. They shall be rated made of polyvinyl 1 chloride and shall be sound with good surface finish, only those additives shall be added to produce the above characteristics. No additives shall be added separately or together in quantities sufficient to constitute a toxic hazard or impair the fabrication or welding properties of the pipe or impair its physical or chemical properties. All pipes shall be spigot and socket type and shall be supplies in straight lengths. The internal and external surfaces of pipes shall be smooth and clean, free from grooving and other defects. The end shall be designated by external diameter. Tolerances on diameters and wall thickness shall be as per IS : 4985.

**B.5.2 FITTINGS:** All fittings shall be injection moulded socket fittings with or without inspection doors as specified and shall be in accordance with the requirements of DIN : 19531 BS : 4514 and IS: 7834.

**B.5.3 INSTALLATION METHODS**

**A. ABOVE GROUND INSTALLATION:**

The UPVC pipes shall laid and clamped to wooden plugs fixed above the surface of walls. Alternatively plastic clamps of suitable designs where ever manufactured shall be preferred. Use of fittings with door and cleansing pipe may be made at suitable points to provide access for inspection and cleaning. Provisions shall be made for the effect of thermal movement by not gripping or restricting the pipe at supports between the anchors for suspended pipes. Generally the pipes shall be clamped at a run. It is essential that UPVC pipes shall be aligned properly before fixing them. The pipe line will be wavy if aligned properly before fixing them. The pipe

**B. CONCEALED INSTALLATION**

For concealing the drain lines is sunken floors, pipes shall be laid to proper slope and shall be laid to proper slope and shall be aligned first proper P.C.C supports shall be provided near the joints and at regular intervals. Sharp edge objects shall be avoided while filling the sunken portions. All concealed lines shall be tested for leakage before concealing the system.
C. UNDER GROUND INSTALLATION

For laying UPVC pipes in trenches, trench width should not be less than pipe diameter plus 300mm, while trench depth should be about 600 to 1000 mm depending upon the size of the pipe and slope required for gravity flow. Care should be taken to avoid dirt entering the joints. The trench bottom shall be carefully examined for the presence of hard objects such as flints, rock projection or tree roots etc. Pipes shall be bedded in sand or soft soil free from rock and gravel. Back fill 150mm above the pipe shall also be of fine sand or soft soil. Pipes shall not be painted. Testing of the lines shall be done before filling back the trench.

JOINTING

a. QUICK - FIT JOINT

Pipes shall be cut to required lengths with a metal cutting saw or ordinary hand saw and shall be perpendicular to the axis of the pipe length. Pipe ends have to be beveled slightly with a beveling tool at an angle of 30 degree. The total length of insertion socket shall be marked on the pipe and checked how far the pipe end could be inserted into the fitting socket. Attempt shall be made to push the pipe to the marked distance, if not possible, it shall be at least pushed tor 2/3 of this distance.

Dust, oil, water, grease etc. shall be wiped out with a dry cloth from the surface or alternatively with emery paper. Generous coatings of approved make solvent cement shall be evenly applied on the inside of the fitting all round the circumference for the full length of insertion and on the outside of the pipe end upto the marked line with non synthetic brush of suitable dimensions. The pipe shall be pushed into the fitting socket and turned for 90 degree. The pipe is held for 1 to 2 minutes in the same position to avoid slipping out of socket due to slipping nature of solvent cement. The surplus cement on the pipe surface shall be wiped off and the joint shall be allowed to dry.

b. RUBBER RING

Cut the PVC pipes with a fine toothed saw to required length and square to the axis. Chamfer the edge of the pipe to be inserted at angle of about 15 degree to about 1/3rd the wall thickness using a coarse file. Make sure the spigot and socket are thoroughly clean and dry. Insert the pipe into the socket with out the seal ring and mark along the pipe, when it is fully inserted. Fix the rubber ring into the groove without testing it. Apply the jointing lubricant to the chamfer end of the pipe right up to the mark made on spigot or to the socket end of the fitting. Push the pipe firmly into the socket fill the gap between the mark on the spigot and socket is about 10mm to allow for thermal expansion.

B.5.3.5 STORAGE OF UPVC PIPES:

To avoid any possibility of damage to UPVC pipes and fittings, a few points should be observed.

a. Pipes and fittings should not be kept on sharp objects.

b. Pipes and fittings shall be lifted and not dragged.

c. Fittings should be stored in cartons or bags.

d. Rubber rings should be kept tension free.

f. Lubricants and solvent cement should be stored in a cool place away from direct sunlight.

B.5.4 Miscellaneous items:

Supports, pedestals and base for inspection chambers, gully traps and pipes shall be in 1:2:4 cement concrete mix.
B.5.4.1 Pipe sleeves and inserts, etc., through RCC walls either external or internal shall be of C.I or M.S. provided with water bar flange.

B.5.4.2 During installation open ends of pipes shall plugged with wood cut into required shape or gunny bags and to be maintained free from dirt.

B.5.4.3 Wash basin, Bath tub waste pipes and fittings shall be UPVC agriculture series, confirming to IS: 4985 with suitable fittings like elbows and tees etc., joined by approved make solvent cement.

B.5.4.4 The sizes of branch waste pipes for different fittings shall be generally as follows:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Wash Basin</td>
<td>40 dia UPVC</td>
</tr>
<tr>
<td>Urinal</td>
<td>40 dia UPVC</td>
</tr>
<tr>
<td>Sink</td>
<td>40 dia UPVC</td>
</tr>
<tr>
<td>Nahani trap</td>
<td>50 dia / 75 dia UPVC</td>
</tr>
<tr>
<td>Special floor trap</td>
<td>75 or 100 dia as required with sealed PVC grating to match floor tile pattern.</td>
</tr>
</tbody>
</table>

B.5.4.5 W.C. pan connectors shall be to suit the requirements as per drawing, with 75 dia, vent horn for connection to the antisiphonage pipe win pan connector.

B.5.4.6 The pipe connection to the sewage or storm water collection chambers shall be perfectly water tight.

B.5.4.7 The floor traps for toilet blocks shall be UPVC with sealed PVC grating to match floor tile pattern design. The traps shall be provided with minimum water seals of 1 1/2" to 2".

B.4.5.8 Where toilet slabs are sunk, the floor trap shall be of 100 x 75 rigid type UPVC trap with sealed UPVC grating to match floor tile pattern design.

B.6.1 **RAIN WATER PIPES**

B.6.1 **RIGID P.V.C PIPES FOR RAIN WATER**:

a) **General**

P.V.C pipes shall confirm to the relevant specification of IS: 4985 of SWR quality. They shall be made of polyvinyl chloride (PVC) and shall be sound with good surface finish, mechanical strength and capacity. During manufacture only those additives may be added to produce the above characteristics. No additives shall be added separately or together in quantities sufficient to constitute a toxic hazard, or impair the fabrication or welding properties of the pipe or impair its physical or chemical properties. All pipes shall be spigot and socket type (bell end type).

b) **Pipe sizes and wall thickness**:  

<table>
<thead>
<tr>
<th>pipe dia (mm)</th>
<th>Wall thickness (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>110 mm</td>
<td>2.2 mm</td>
</tr>
<tr>
<td>75 mm</td>
<td>1.8 mm</td>
</tr>
</tbody>
</table>

c) **Tolerances**:

Tolerances on diameters and wall thickness shall as per I.S. 4985.
d) **FITTINGS:**

All fittings shall be injection moulded socket fittings with or without inspection doors as specified and shall be in accordance with the requirements of the relevant I.S. 7834. Pressure ratings and tolerances shall be as per I.S. 4985.

e) **LAYING AND JOINTING:**

Pipes shall be cut to length required including the portion to be inserted in the socket with a hacksaw. The pipe shall be cut square. Pipes and sockets shall be clean and dry and burrs removed both inside and outside with a file. The surface to surfaces to be in contact shall be roughened with emery paper, and dry fit checked.

A thick coat of solvent cement shall be applied to the outer surface of the pipe and a thin coat the inside Surface of the socket by means of a brush. Solvent cement shall be of approved make and quality. The pipe shall then be inserted in the socket and turned for 90 degree to ensure even distribution of cement. Excess cement shall be wiped off G.I. clamps of required size shall be used for clamping the pipes to the walls etc, pipe shall be clamped atleast two inch away from the wall surface using G.I. clamps screwed to the wooden plugs, not more than 1 meter apart.

Alternatively for pipes with integral rubber ring type sockets, the following method of jointing shall be adopted.

After cutting and chamfering the pipe as described above, insert the pipe into the socket without seal ring and mark along the pipe, when it is fully inserted. Fix the rubber ring into the groove without twisting it. Apply superior quality jointing lubricant to the chamfer and of the pipe right upto the mark made on the spigot or to the socket till the tap between the mark on the spigot and socket is about 10mm to allow for thermal expansion.

f) **Clean outs:**

At every bend, branches and where necessary suitable clean outs shall be provided into the piping system.

g) **Connecting P.V.C pipes to C.I. pipes:**

P.V.C Collar ring shall be welded to the spigot end of the P.V.C. Pipe by means solvent cement cement. The spigot end of the pipe to be joined shall then be inserted into the socket and aligned. Tarred spun yarn shall be caulked in to the angular space between the spigot and socket upto the height of 20 mm.

The remaining space shall be filled with C.M. 1:2 and well caulked using wooden caulking tool and finished off neatly. Joint shall be kept for 24 hours. Alternatively, if so directed by Architect, the following method may be adopted.

The spigot end of the P.V.C pipe should be jointed to a P.V.C collar using solvent cement as detailed in 7.3.1. The other end of the collar is then joined to the socket of the C.I. pipe using solvent cement.

h) **Connecting C.I. pipe to P.V.C pipes:**

A connector socket shall be used for such connection. A rubber ring is to be placed over the spigot, which is then inserted into the socket connector. Gentle, even heat is applied to the connector socket will shrink making a water tight air joint.

i) **Connecting P.V.C to G.I. pipes:**

Standard threaded couplers shall be used for this purpose.
j) **Rain water collection gratings:**

The rain water collection grating at the terrace level shall be of C.I. Grating with C.I frame embedded on to the water proof surface. Water proofing shall be done around the pipe, frame and grating to ensure the water tightness around the collection point. Adequate slope on the terrace level shall be provided for collecting all rain water at the collection gratings.

The rain water collection detail at the balconies shall be done using PVC pipe bend installed concealed in the concrete slab and connected to the vertical main PVC rain water stack, at the collection point heavy brass c.p frame with c.p grating shall be provided. The c.p frame shall be laid in the slab above the pipe with water seal joint around the frame.

k) **Rain water / storm water, Gulleys / Chambers:**

Storm water gullies shall be constructed for admitting storm water from the courtyard area. It is constructed of specified size and is provided with precast RCC or CI grating on top for admitting storm water run off into it. A typical drawing shall be provided giving all details of construction. For other details of construction refer specification for manhole and inspection chambers.

C. **SANITARY FIXTURES AND FITTINGS**

C.1.0 **Installation of fixtures and fittings:**

All Plumbing and Sanitary Fixtures and fittings should be first 1st (standard) quality and shall be stored in covered stores and handled carefully to prevent damage. The sanitary fittings shall be installed at the correct assigned positions as shown on the drawings and as directed by the Engineer-in-charge/consultants and shall fully meet with the aesthetic and symmetrical requirements as demanded by the Architects. Fixtures shall be installed by skilled workmen with appropriate tools according to the standard practice in the trade. Manufacturer’s instructions shall be followed for the installation of the fixtures.

Fixtures in all toilets shall be standard height mounted rigid, plumb and true to alignment. The outlet of water closet pans and similar appliances shall be examined to ensure that outlet ends are abutting properly 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/settlement by other causes. A check shall be made to ensure that necessary anchoring devices have been provided for supporting water closets, lavatory basin sinks, flushing cisterns and other appliances. Where the built-in types of brackets are used, they shall be securely fixed to the walls and slabs by approved means. It shall be ensured that while fixing the fixtures and fittings, no tool marks or scratches are developed. All steel brackets and supports shall be painted.

C.2.0 **Protection of Fixtures:**

Care shall be taken at all times, particularly after fixing to protect fixtures from damage. All offsets shall be temporarily plugged during progress of work to prevent obstruction. Fixtures shall be finally cleaned to the satisfaction of the Engineer-in-charge.

C.3.0 **PUMPS & OTHER EQUIPMENT:**

a) **Scope:**

The Scope of this section comprises the supply, erection, testing & Commissioning of water pumps and other equipment conforming to these specifications & in accordance with the requirements of Schedule of Quantities.

b) **Pumps:**

All domestic water supply pumps shall be Beacon or Kirloskar only. Pumps shall be End Suction centrifugal Pumps.
i) **End Suction Pumps:**

Frame shall be made of heavy duty close grained cast iron accurately machined and precision bored for ball bearings. Steel Shaft shall be of heavy duty fitted with bronze sleeve to protect the shaft from corrosion. The pumps shall have two Over Size Ball Bearings, Double row deep groove ball bearing at the pulley end to take radial as well as axial load and single row deep groove ball bearing at the impeller end to take radial load. Impeller shall be bronze or gun metal closed type and Hydraulically and dynamically balanced making possible complete servicing without disturbing the alignment. Casing shall be of heavy duty closed grained cast iron, accurately machined and fitted with gun metal wearing ring which can be replaced when worn. Pump shall have mechanical Rotary shaft seal for leak proof operation. Pump shall have suction head fitted with gun metal wearing ring. Suction & Discharge shall have flanged ends. Pumps shall have flexible coupling.

Electric motor shall be of TEFC type suitable for the specified duty. Motor shall be suitable for 415 +/- 10% Colts 3 Phase, 50 cycles AC power supply. Electric motor shall be supplied with required starters. Motors from above 7.5 hp shall have all six leads brought out.

ii) **Horizontal Split Casing Pumps:**

**Casing:** Pump casing shall be close-grained cast iron of heavy section, horizontally split, making possible complete servicing of rotating parts without breaking piping or motor connection. Motor to pump connection shall be of the flexible coupling type. Suction passages shall be volute in form promoting smooth entry to impeller and increased efficiency.

**Impeller:** Impeller shall be bronze or gun metal, double suction, enclosed type and hydraulically balanced so as not to cause any vibration during operation.

Impeller shall be securely keyed to the shafts & means shall be provided to prevent loosening during operation including orientation in reverse direction. Impeller fastening nuts (if provided) shall be of cap type and shall tighten in the direction of normal rotation.

**Wearing Rings:** Wearing rings shall be of renewable type. These shall be held in place by screwing against rotation, press fit and locked with pins, flanged and screwed.

**Shaft:** Shaft shall be steel, protected by gun metal sleeves. It shall be finished to close tolerance at the impeller, coupling pulley and shaft sleeves shall be firmly secured to the shaft by key/nuts. The shaft size shall be calculated on the maximum combined shear stress. This shear stress shall not exceed 30 per cent of the elastic limit in tension or 18 percent of ultimate tensile strength whichever is lower.

**Shaft Sleeves:** Shaft sleeves shall be of gun metal, provided to protect the shaft when it passes through stuffing boxes. Unless the pump is equipped with mechanical seals, in which case sleeves are preferred but not essential, shaft sleeves shall be secured locked or keyed to the shaft sleeves shall be securely locked or keyed to the shaft to prevent loosening of rotating shaft and shaft sleeves shall be machined and assembled for concentric rotation.

**Bearings:** The bearings may be ball, roller or sleeves type provision shall be made to take axial and radial loads. Oil level indicators shall be provided in oil baths.

Where there is a possibility of liquid entering the bearings, the pump shall be provided with suitable preventative arrangement such as water deflectors.

Wherever thrust bearing are fitted, suitable arrangement for adjusting clearance shall be provided.

Bearings shall be easily accessible with out disturbing the alignment of the pump.

**Stuffing Boxes:** Stuffing Boxes shall be of such design that can be repacked, with out removing any part other than the gland and lantern ring. Stuffing boxes shall be so designed that standard packing can be removed and replaced mechanical seals, In case where lantern ring is used, it shall be sandwitched between rows of packing and shall be easily removable. Lantern ring shall be of axially split type.
**Couplings**: Pump shall be furnished complete with an approved type of flexible coupling. Spacer type couplings shall be provided when required to permit disassembling the pump without removing the pipe connections or without disturbing pump driver, coupling guard shall be made of expanded metal and bolted to the base plate, shall be furnished for all coupled pumps.

**Base Plates**: The common base plate for pump and motor shall be in one piece and it shall be made of cast iron or welded steel construction. Suitable holes shall be provided for grouting and they shall be so located that the base can be grouted in place without disturbing the pump and motor. All pumps and motors shall be properly aligned bolted and dwelled to the base plate by contractor.

Adequate space shall be provided between pump drain connections and base plate for installation of minimum 15mm drain piping. Pumps shall be supplied with suitable drain pans or drain rim type base plates with trapped drain connections.

Suitable TEFC Electric motor with starter for operating under 415 +/- 6% V, 50 cycles, 3 phase power supply shall be included along with pump.

iii) **Pumps Installation & Testing**:

The pumps shall be mounted on precast concrete base using anti-vibration pads. After complete installation of the system and before testing, the pump shall be lubricated as per the manufacturer’s instructions.

All pumps, motors and bases shall be supplied with approved finish. Shop coat of paint that have become barred during shipment or erection shall be cleaned off with mineral spirits, wire brushed and spot primed over the affected areas, than coated with enamel paints to match the adjoining areas.

Pumps performance curves and power consumption with operating points clearly indicated shall be submitted, and verified at the time of testing and commissioning of the installation. Pump performance shall be computed from the pump curves provided by manufacturer.

C.3.1 **Sump Pumps**:

Sump pumps shall be “Darling” or KIRLOSKAR Make only. Pump shall consist of integrally casted Stool, Base & Discharge Elbow with flange to ensure permanent alignment. Renewable Intermediate Bearings shall be provided for Pits over 5 to 6 Ft. Deep. Steel shaft of Larger Dia shall be provided to reduce Vibrations. Pump shall consist of Trash guard to prevent stringy Material Winding around shaft. Pump casing shall be of Screen less design & has renewable wearing ring. Pump cover at the bottom shall be of removable type. Pump column shall be of welded construction. Impeller shall be closed type for clear water and screen less type for handling small solids. Top Bearing shall be Grease lubricated and adjustable for clearance & shall carry entire trust load. The bottom bearing shall be self lubricating type making shaft to run in Oil bath & Oil grooves carrying Oil through bearing. Pump shall have double sealed ring as Oil sealed in type. Pump motor shall be TEFC & shall be suitable for 415/220 Volts +/- 6%, 50 cycles power supply. Pump shall have float level control & level control switch for Automatic *On/Off operation. Motor starter & Rig chain hoist arrangement shall be included if the quoted price.

**D.0 Miscellaneous Works**:

**D.1.0 HANGERS & SUPPORTS**:

**D.1.1 General**:

Provide proper solid angle iron/channel section, supports for all pipe Runs in the vertical ducts and run horizontally suspended from the slab, complete with clamps. Wherever insulation comes, to provide wooden guide to support pipe on the angle iron hangers/supports. For attachment in concrete, use 'Dash' fasteners or Anchor plug type inserts or equivalent. Provide hangers within 900mm of all changes in direction of mains. A minimum of three hangers pr expansion band wherever shown in drawing. Provide all additional structural steel angles, channels or other members not specifically shown but are required for proper support.
Where necessary additional hangers to be provided to arrest water hammers or hydraulic resonance with proper rubber padding. Space hangers as noted below, except on all soil pipes which shall have a hanger of multiple fittings. Sufficient hangers shall be provided to maintain proper slope without sagging. In case of angle suspended line, the following is suggested.

a. **Pipe Sizes**
   - 20 through 50 mm
   - 65 through 125 mm
   - 150 and over
   - 10 mm
   - 12 mm
   - 15 mm

b. **Pipe Sizes**
   - Spacing of Supports
   - 12 to 20 mm
   - 25 to 40 mm
   - 50 above
   - 1.5 m apart
   - 2 m apart
   - per IS.

Provide floor stands, wall brackets or masonry piers etc. for all lines running under the floor or near walls for those lines can be properly supported or suspended from the walls or floors. Pipe lines near concrete or masonry walls shall be supported by hangers carried from wall brackets. Hanging of any pipe from another is prohibited.

**D.2.0 Cutting, Patching, Repairing & Making Good:**

D.2.1 Cutting, patching and repairing required for the proper installation and completion of the work specified in each division, including chasing, plastering, masonry work, concrete work, etc. and making good shall be carried out by the contractor wherever required. Holes which are cut oversize shall be refilled, so that a tight fit is obtained around the pipe or other passing through. Any damages to water-proofed location should not be patched up, without rectification by the water proofing agency (specialist contractor) to ensure his guarantee. Repair of water proofing shall be borne by the Sanitary contractor if the damage is done by sanitary contractor.

**D.3.0 Equipment Protection:**

D.3.1 Keep all pipe and conduit openings closed by means of plugs or caps to prevent the entrance of foreign matter. Protect all piping, conduit, fixtures, equipment or apparatus. Any such items damaged prior to final completion or work shall be restored to its original condition or replaced at no expense to the owner.

**D.3.2 Accessibility:**

The installation of valves, thermometers, cleanout fittings and other indicating equipment or specialties requiring frequent reading, adjustment, inspections, repairs, removal or replacement, shall be conveniently and accessibly located with reference to the finished buildings. Thermometers and gauges shall be installed so as to be easily read from the floor. For floor cleanouts minimum distance of 600 mm shall be available from any wall.

**E.0 Cleaning, Operation and Tests:**

E.1.1 Plumbing equipment fixtures, piping etc. shall be free of stampings, marking (except those required by codes) iron cutting and other foreign materials.

E.1.2 Hot, cold and drinking water systems shall be cleaned thoroughly, filled and flushed with water.

E.1.3 The entire mechanical apparatus shall operate at full capacity without objectionable noise or vibrations.

E.1.4 Test all plumbing systems in the presence of the site engineer/supervisor and the Architect as herein specified. Provide all equipment, materials and labour necessary for inspection and tests and repair all work, not passing the tests. After repairs are made, repeat test until units/systems is found satisfactory, to the above authorities. Carry out tests prior to concealing, insulating or back filling over any piping. No exceptions will be made.
E.1.5 Test entire system of soil, waste and vent piping by smoke test after sealing all traps.

E.2.1 Water Test:
Test entire system or sections of system by closing all openings except the highest opening and filling system with water to the point of overflow. If the system is tested in sections, plug each opening except the highest opening of the section filled with water. Keep the water in system or in portion under test for at least 45 minutes before inspection starts with test pressure/head lasting for two hours. The system must be tight at all joints.

E.3.1 Final Test:
After fixtures are set, test the system with smoke test as follows:

E.4.1 Smoke Test:
Fill traps with water, then introduce into system a pungent thick smoke produced by one or more smoke machines. When smoke appears at stacks on the roof, plug stacks and allow pressure of 1-inch water column to build up in systems. The system shall be tight at all joints.

E.4.2 Test all down spouts or rain headers and their branches within the building by water as described for the above soil, waste and vent system.

E.5.1 All Water Piping:
Hydro-static test 6 kg/cm² or twice the working pressure which ever is higher. without drop in pressure as required.

E.5.2 All tests on below ground lines shall be continued until backfill on such lines is completed to disclose any damages caused by back-filling.

E.5.3 All systems shall be tested in sections as required to expedite the work of other trades and meet construction schedules and final test on completion.

E.5.4 On completion of the works, the following tests shall be performed to the satisfaction of the consultants/clients representative before issue of virtual completion certificate, if so required.

a. Smoke Test
b. Hydraulic Test
c. Performance test for fixtures
d. Tests for anti-siphonage system
e. Pump rating and output
f. Inspection of all units and fixtures.

E.5.5 The contractor shall arrange for similar tests during the progress or works to ensure that there are no defects in material/workmanship in portions of work to be concealed or embedded under the floor or walls in ceiling and get this approved by the consultants. The under floor pipe works shall not be closed without the approval of consultant.
F. **Disinfection of Piping System and Storage Tanks:**

Before commissioning the water supply system, the contractor shall arrange to disinfect the entire system as described in the succeeding paragraph. The filtered water storage tanks and pipe shall first be filled with water and thoroughly flushed out. The storage tanks shall be then filled with water again and disinfecting chemical containing chlorine added gradually, while tanks are being filled to ensure thorough mixing. Sufficient chemicals shall be used to give the water a dose of 50 parts of chlorine to one million parts of water. If ordinary bleaching powder is mixed to 1000 litre of water, the 25° powder shall be mixed with water to a creamy consistency before being added to the water in the storage tank. If a proprietary brand of chemical is used, the proportions shall be as specified by the manufacturer. When the storage tank is full, the supply shall be stopped and all the taps on the distributing pipes opened successively, working progressively from storage, tank. Each tap shall be closed when the water discharge begins to smell of chlorine. The storage tank shall then be filled up with water from supply pipe and added with more disinfecting chemical in the recommended proportion. The storage tank and pipe shall then remain charged at least for three hours. Finally, the tank and pipes shall be thoroughly flushed out before any water is used for domestic purpose.