DEVELOPMENT OF PERMENENT CAMPUS OF NU, RAJGIR

PACKAGE – 1C

TENDER FOR CONSTRUCTION AND DEVELOPMENT WORKS OF RESIDENTIAL PARCEL WITHIN PROPOSED PERMANENT CAMPUS (PHASE I) FOR
NALANDA UNIVERSITY, AT RAJGIR, BIHAR.

TECHNICAL SPECIFICATIONS PART- II
(SERVICES WORKS)

ARCHITECT AND PLANNERS

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GENERAL NOTES:

1. Detail of sanitary fixtures is for the information of the contractor only. However model / makes of all sanitary fixtures shall be selected by Architect / Interior designer / client and the same shall be binding for execution.
2. No additional fixing cost shall be paid for change in type of sanitary fixture or fitting.
3. Provision of extension piece for final connection of CP fitting shall be supplied and installed by the contractor accordingly (as required).
4. For make of any item refer list of approved makes as given in technical specifications.
5. The rate shall include cost of materials, labor, loading and unloading, transportation, scaffolding and all other incidental charges etc., with all leads and lifts, complete as per specifications, drawings and as directed by the Engineer-in-charge.
6. All required civil work shall be measured and paid in relevant civil tender items. (If not specified in item description)
7. The rate quoted shall be for all floors, all heights and all places. Sample shall be approved prior to procurement
8. All gaps between wall / floor and sanitary vessels shall be filled with sanitary grade sealant.
9. CP Brass or SS screws shall be used for fixing sanitary fixtures and accessories in toilet, bath, and pantry and kitchen area.

GENERAL REQUIREMENTS:

a. All Fixtures and fittings shall be provided with all such accessories as are required to complete the item in working condition whether specifically mentioned or not in the Schedule of Quantities, Specifications and Drawings.
b. All Fixtures and accessories shall be fixed in accordance with a set pattern matching the tiles or interior finish as per Architectural/Interior designer's requirements. Wherever necessary the fittings shall be centered to dimensions and pattern desired.
c. Fixing screws shall be half round head Chromium Plated brass with C.P. washers wherever required as per directions of Project Manager.
d. All Fittings and Fixtures shall be fixed in a neat workmanlike manner true to Levels and Heights shows on the drawings and in accordance with the manufacturer's recommendations. Care shall be taken to fix all Inlet and Outlet Pipes at correct positions. Faulty locations shall be made good and any damage to the finished floor, tiling or terrace shall be made good at Contractors cost.
e. When directed, Contractor shall install Fixtures and accessories in a mock-up room for the approval of the Project Manager. Sample room Fixtures may be reused on the works if undamaged, but no additional payment for fixing or dismantling shall be admissible.
f. Supporting and fixing devices: The contractor shall provide all supporting and fixing devices necessary to install the sanitary fixtures and fittings securely in position. The fixing devices shall be rigidly anchored into the building structure. The devices shall be rust resistant and shall be so fixed that they

do not present an unsightly look in the final assembly. Where the location demands, the Architects may instruct the contractor to provide chromium plated or other similarly finished fixing devices. In such circumstances the contractor shall arrange to supply fixing devices and install them complete with appropriate vibration isolating pads, washers and gaskets.

g. Final Installation: The contractor shall install all sanitary fixtures and fittings in their final position in accordance with approved trial assemblies and as shown on drawings. The installation shall be complete with all supply and waste connections. The connection between building piping system and the sanitary fixtures shall be through proper unions and flanged to facilitate removal/replacement of sanitary fixtures without disturbing the built in piping system. All unions and flanges shall match in appearance with other exposed fittings.
h. Fixtures shall be mounted rigid, plumb and true to alignment. The outlets of water closet pans and similar appliances shall be examined to ensure that outlet ends are butting on the receiving pipes before making the joints. It shall be ensured that the receiving pipes are clear of obstruction. When fixtures are being mounted, attention shall be paid to the possibility of movement and settlement by other causes. Overflows shall be arranged as to give visible warning and discharge. A check shall be made to ensure that necessary anchoring devices have been provided for supporting water closets, wash basins, sinks and other appliances.
i. Joints/gaps between all sanitary appliances/fixtures and the floor/walls shall be caulked with an approved mildew resistant sealant, having antifungal properties, of color and shade to match that of the appliances/fixture and the floor/wall to the extent possible.
j. Protection against Damage: The contractor shall take every precaution to protect all sanitary fixtures against damage, misuse, crazing, staining breakage and pilferage by providing proper wrapping and locking arrangement till the completion of the installation. At the time of handing over, the contractor shall clean, disinfect and polish all fixtures and fittings. Any fixtures and fittings found damaged, cracked chipped, stained or scratched shall be removed and new fixtures and fittings free from defects shall be installed at his own cost to complete the work.

APPROVAL: The materials for water supply, plumbing and sanitary works which are to be procured by the contractor shall conform to the relevant IS specifications and on the approved make list of the tender, and shall be approved by the Architect / Engineer-in-Charge prior to installation of fixture and the approved samples shall be maintained at site till the completion of work. The approved makes of main items are, however specified in the list of approved makes of materials herein before.

PRECAUTIONS: While carrying out pipe line work in case the contractor encounters any interference with other Services such as cables, conduits etc, he shall take sufficient precautions in order to prevent any damage to them. If any damage occurs, it shall be rectified to its original condition at his own cost to the satisfaction of the officers concerned with such services. The contractor shall

ensure that all inserts, pipe lines embedded in structural members or sleeves are placed in position in co-ordination with civil work.
All water supply, plumbing and sanitary work services shall be handed over to Engineer-in-charge complete in all respects on completion of the work. Incomplete work will not be taken over. Any loss or damage to these services due to any reasons by anybody whatsoever before handing over will be at contractor's risk and cost. Any damage to any structural/finishing work done during the testing or rectification shall be made good by the contractor at his own cost and risk.

COST TO COVERE THE FOLLOWING: The rates quoted by the renderer under this contract shall cover the cost of all the Following elements

- **CONNECTION TO MECHANICAL EQUIPMENTS BY OTHER AGENCIES:-**All inlets, outlets, valves, piping and other incidental work connected with installation of all mechanical equipment supplied by other agencies shall be carried out by the Plumbing contractor in accordance with the drawings, requirements for proper performance of equipment, manufacturer's instructions and the directions of the Project Manager. The equipment to be supplied by other agencies consists mainly of Kitchen, Laundry, Air-conditioning, Water Treatment and other similar equipment. The connections to the various equipment shall be effected through proper unions and isolating valves. The work of effecting connections shall be executed in consultation with and according to the requirements of equipment suppliers, under the directions of the Project Manager. The various aspects of connection work shall be executed in a manner similar to the work of respective trades mentioned elsewhere in these specifications.

- **MISCELLANEOUS WORK :** The contractor carrying out the construction work shall take effective measures to carefully open out all existing channels, culverts, bridges, pipelines, conduits, water courses, sewer, drains, electrical cables, transmission lines and their supports and all works buried or otherwise where such services have to be interfered with the purpose of the construction of the works. He shall provide and arrange all necessary temporary supports and diversions if necessary across/under/even through along sides of the trenches and all other parts of construction work for all such channels, culverts, bridges, pipe lines, conduits.

- **CLEARANCE FOR ROADS AND FOOT PATHS :** The contractor shall arrange to carry out all works with least interference practicable with public footpath and vehicular traffic and with existing waste water or storm water drainage arrangements and provide all necessary road barriers, fences, notices, lights, gangways, access crossings, diversions

for traffic, temporary drains, dewatering channels, chutes pumping or water lifting arrangements and all other facilities for the proper execution of the works to the approval and satisfaction in all respects of the Engineer-in-Charge. Any work carried out by the contractor in this connection shall be deemed as temporary works incidental to the construction work.

- **LOCATION:** The rates quoted by the bidder under this contract shall be applicable for the work at all places, all heights and all levels.

- **DEWATERING:** The rates quoted by the bidder under this contract shall include bailing or pumping out all the water which may accumulate during the progress of the work either through seepage, springs, rain or any other cause.

- **FORMALITIES WITH STATUTORY BODIES:** The work shall be carried out in a manner complying in all respects with requirement of relevant bye-laws of the Municipal Committee/Municipal Corporation/Development.Authority/Improvement Trust under the jurisdiction of which the work is to be executed or as directed by the Engineer-in-Charge and, unless otherwise mentioned, nothing extra shall be paid on this account. The contractor has to satisfy all the requirement of fire brigade, drainage and hydraulic engineering department of Municipal Corporation.

WORKMANSHIP – GENERAL

Workmanship and general finish shall be of first class quality and in accordance with best workshop practice. All similar items of the Plant and their component parts shall be completely interchangeable. Spare parts shall be manufactured from the same materials as the originals and shall fit all similar items. All pipe crossing shall be provided with sleeves and fire sealant wherever it's applicable. Machining fits on renewable parts shall be accurate and to specified tolerances so that replacements made to may be readily installed. All equipment shall operate without excessive vibration and with minimum noise. All revolving parts shall be truly balanced both statically and dynamically so that when running at normal speeds at any load up to the maximum there shall be no vibration due to lack of balance. All parts which can be worn or damaged by dust shall be totally enclosed in dust proof housings. All materials incorporated in the work shall be most suitable for duty concerned, free from imperfections, selected for long life and minimum maintenance. All necessary accessories required for satisfactory and safe operation of the Plant shall be supplied by the Contractor unless it is specifically excluded from his scope. All valves shall be closing on clockwise rotation of the hand wheel. The effort required to close / open under all operating conditions shall be limited to 7 kg. The direction of opening / closing shall be cast on the hand wheel. All flanges shall be drilled in accordance with

requirements of IS: 1538 All flanges shall be full or spot faces on the back side. The flange thickness shall be uniform throughout. Flange outside periphery shall be concentric with the bore. Flanges shall be finished smooth on periphery also Castings and fabricated materials shall be finished smooth all over.

SCOPE

Work under this section consists of furnishing all labor, materials equipment and appliances necessary and required to completely install the water supply & drainage system as required by the drawings, specifications given hereinafter and given in the bill of quantities.

The scope of this section comprise of the supply, installation testing and commissioning of piping network for water supply for internal & external services as follows:

- Internal/External Sewer Drainage
- Internal/External Storm water Drainage
- Internal/External Water Supply
- Bore Well / Municipal water
- Drinking Water Supply Distribution
- Flushing water supply Distribution
- Connection to various mechanical and others equipment to be supplied and installed by the other specialist vendors.
- Supply installation, testing & commissioning of RO system for drinking water.

Without restricting to the generality of the foregoing, the water supply system shall include the following:-

i. All water lines to different parts of building and making connection from source etc.
ii. Pipe protection and painting.
iii. Providing Hot water supply and return lines and insulation of hot water pipe lines.
iv. Control valves, masonry chambers and other appurtenances.
v. Connections to all toilets kitchen equipment, tanks and appliances.
vi. Excavation and refilling of pipe trenches, wherever necessary.
vii. Trenches for taking pipe lines for these services if required.

APPLICABLE CODES
AND
STANDARDS – PLUMBING & FIRE FIGHTING WORKS

1.0 APPLICABLE CODES AND STANDARDS

All equipment, supply, erection, testing and commissioning shall comply with the requirements of Indian Standards and code of practice given below as amended up to the date of submission of Tender. All equipment and material being supplied `shall meet the requirements of BIS and other relevant standard and codes.

i. General

IS: 325	Three phase induction Motors
IS: 694	PVC insulated cables for working voltages unto & including 1 100 V.
IS: 779	Specification for water meters (domestic type).
IS: 1172	Code of Basic requirements for water supply drainage and sanitation.
IS: 1726	Specification for cast iron manhole covers and frames.
IS: 1742	Code of practice for building drainage.
IS: 2064	Code of practice selection, installation and maintenance of sanitary appliance.
IS: 2065	Code of practice for water supply in buildings.
IS: 2104	Specification for water meter for boxes (domestic type)
IS: 2373	Specification for water meter (bulk type)
IS: 2379	Color code for identification of pipelines
IS: 2527	Code of practice for fixing rainwater gutters and down pipes for roof drainage.
IS: 2629	Recommended practice for hot dip galvanizing on iron and steel.
IS: 3114	Code of practice for laying of cast iron pipes
IS: 4111(Part– 1)	Code of Practice for ancillary structures in sewerage system: part 1 manhole.
IS: 4127	Code practice for laying glazed stoneware pipes.
IS: 5329	Code of practice for sanitary pipe work above ground for buildings.

IS: 6159	Recommended practice for design and fabrication of material, prior to galvanizing.
IS: 8321	Glossary of terms applicable to plumbing work.
IS: 8419(part- 1)	Requirements for water filtration equipment: Part 1 filtration medium sand and gravel.
IS: 8419 (part-2)	Requirements for water filtration equipment: part 2 under drainage system.
IS: 9668	Code of practice for provision and maintenance of water supplies and firefighting.
IS: 10446	Glossary of terms relating to water supply and sanitation.
IS: 11149	Rubber Gaskets.
IS: 12183 (part – 1)	Code of practice for plumbing in multistoried buildings: part 1 water supply
IS: 12251	Code of practice of drainage of building basements.
IS: 5572	Code of practice for sanitary pipe work.
BS: 6700	Specification for design, installation, testing and maintenance of services supplying water for domestic use within buildings and their cartilages.
BS:8301	Code of practice for building drainage.
BSEN: 274	Sanitary tap ware, waste fittings for basins, bidets and baths. General technical specifications.

ii. PIPES AND FITTINGS:

IS: 458	Specification for pre cast concrete pipes (with and without reinforcement)
IS: 651	Salt glazed stone ware pipes and fittings
BIS : 1239 (Part 1)	Mild steel, tubes, tubular and other wrought steel fittings: Part 1 Mild Steel tubes.
BIS : 1239 (Part 2)	Mild Steel tubes, tubular and other wrought steel fittings: Part 2 Mild Steel tubular and other wrought steel pipe fittings
BIS : 1879	Malleable cast iron pipe fittings
BIS : 2643 (Part 1)	Dimensions for pipe threads for fastening purposes: Part 1 Basic profile and dimensions
BIS : 2643	Dimensions for pipe threads for fastening purposes: Part 2 Tolerances.

(Part 2)	
BIS : 2643 (Part 3)	Dimensions for pipe threads for fastening purposes: Part 3 Limits of sizes. BIS: 3468 Pipe nuts.
BIS : 3989	Centrifugally cast (sun) iron spigot and socket soil, waste and ventilating pipes, fittings and accessories
BIS : 4346	Specifications for washers for use with fittings for water services
BIS : 4711	Methods for sampling steel pipes, tubes and fittings
BIS : 6392	Steel pipe flanges
BIS : 6418	Cast iron and malleable cast iron flanges for general engineering purposes
BIS : 7181	Specification for horizontally cast iron double flanged pipe for water, gas and sewage
IS: 13592	UPVC Pipes & Fittings - Internal Drainage
IS: 4985	UPVC Pipes and Fittings for Rainwater
IS: 15328	External Sewer Drainage
IS: 4346	Specifications for washers for use with fittings for water services.

iii. VALVES:

IS: 778	Specification for copper alloy gauge, globe and check valves for water works purposes.
IS: 780	Specification for sluice valves for water works purposed (50 mm to 300 mm size).
IS: 1703	Specification copper alloy float valves (horizontal plunger type) for water supply fittings.
IS: 2906	Specification for surface valves for water works purposes (350 mm to 1200 mm size)
IS: 3950	Specification for surface boxes for sluice valves.
IS: 12992 (part - 1)	Safety relief valves, spring loaded design.
IS: 13095	Butterfly valves for general purposes.
IS : 15778	CPVC Pipes and Fittings

IS:771(part to 3)	Specification for glazed fire clay sanitary appliances.
IS: 744	Specification for flushing cistern for water closets and urinal (other than plastic cistern)
IS: 781	Specifications for cast copper alloy screw down bib taps and stop valves for water services.
IS: 1700	Specification for drinking fountains.
IS:2548 (part –2)	Specification for plastic seats and covers for water closets part 1 thermo set seats and covers.
IS:2556 (part -1)	Specification for vitreous sanitary appliances (vitreous china) part 1 general requirement.
IS:2556 (part -2)	Specification for vitreous sanitary appliances (vitreous china) part 2 specific requirements of wash – down water closets.
IS:2556 (part -3)	Specification for vitreous sanitary appliances (vitreous china) part 3 specific requirements of squatting pans.
IS:2556 (part -4)	Specification for vitreous sanitary appliances (vitreous china) part 2 specific requirements of washbasins.
IS:2556 (part 6 Sec 2)	Specification for vitreous sanitary appliances (vitreous china) part 3specific requirements of urinals, section 2 half stall urinals.
IS:2556 (part 6 Sec 4)	Specification for vitreous sanitary appliances (vitreous china) part 4 specific requirements of urinals, section 4 partition slabs.
IS:2556 (part 6 Sec 5)	Specification for vitreous sanitary appliances (vitreous china) part 5 specific requirements of urinals, section 5waste fittings.
IS:2556 (part 6 Sec 6)	Specification for vitreous sanitary appliances (vitreous china) part 6 specific requirements of urinals, section 6 water spreaders for half stall urinals.
IS:2556 (part -7)	Specification for vitreous sanitary appliances (vitreous china) part 7 specific requirements of half round channels.
IS:2556 (part -8)	Specification for vitreous sanitary appliances (vitreous china) part 8 specific requirements of siphoning wash down water closets.
2556 (part - 7)	Specification for vitreous sanitary appliances (vitreous china) part 11 specific requirements of shower rose.
IS:2556 (part -12)	Specification for vitreous sanitary appliances (vitreous china) part 12 specific requirements of floor traps.
IS:2556 (part -15)	Specification for vitreous sanitary appliances (vitreous china) part 15 specific requirements of universal water closet.
IS: 2692	Specification for ferrule for water services.

IS: 2717	Glossary of terms relating to vitreous enamel ware and ceramic metal system.
IS: 2963	Specifications for waste plug and its accessories for sinks and wash basins.
IS: 3311	Specification for waste plug and its accessories for sinks and wash basins.
IS: 5961	Specification for cast iron gratings for drainage purposes.
IS: 8931	Specification for copper alloy fancy single taps, combination tap assembly and stop valves for water services.

iv. WATER QUALITY AND TOLERANCE:

IS:3025 (part 1to 44)	Method of sampling and test (physical and chemical) for water and waste water.
IS: 4764	Tolerance limits for sewages effluents discharged into island surface waters.
IS: 10500	Drinking water

v. PUMPS AND VESSELS:

IS: 1520	Specification for horizontal centrifugal pumps for clear cold fresh water.
IS: 2825	Code of unfired pressure vessels.
IS: 5600	Specification for sewage and drainage pumps.
IS: 8034	Specification for submersible pump sets for clear, cold, fresh water.
IS: 8418	Specification for horizontal centrifugal self-priming pumps.

vi. FIRE FIGHTING EQUIPMENT :

NFPA: 14	Installation of Standpipe & Hose System
NFPA: 20	Installation of Stationary pump for Fire Protection
BIS: 636	Non-percolating flexible firefighting delivery hose
BIS: 884	Specification for first aid hose reel for fire fighting
BIS: 901	Specification for couplings, double male and double female, instantaneous pattern for firefighting.
BIS: 902	Suction hose couplings for firefighting purposes
BIS: 903	Specification for fire hose delivery couplings, branch pipe, nozzles and nozzle spanner.
BIS: 904	Specification for 2-way and 3-way suction collecting heads for firefighting purposes
BIS: 907	Specification for suction strainers, cylindrical type for firefightingpurposes.
BIS: 908	Specification for fire hydrant, stand post type
BIS: 909	Specification for underground fire hydrant, sluice valve type
BIS: 910	Specification for portable chemical foam fire extinguisher
BIS: 933	Specification for portable chemical foam fire extinguisher

BIS: 1648	Code of practice for fire safety of building (general): Firefighting equipment and its maintenance
BIS: 2171	Specification for portable fire extinguishers dry powder (cartridge type)
BIS: 2190	Selection, installation and maintenance of first aid fire extinguishers – Code of practice
BIS: 2871	Specification for branch pipe, universal, for fire fighting purposes
BIS: 2878	Specification for fire extinguishers, carbon dioxide type (portable and trolley mounted).
BIS: 3844	Code of practice for installation and maintenance of internal fire hydrants and hose reel on premises.
BIS: 5290	Specification for landing valves
BIS 5714	Specification for coupling, branch pipe, nozzle, used in hose reel tubing for fire fighting
BIS: 8423	Specification for controlled percolation type hose for fire fighting
BIS: 10658	Specification for higher capacity dry powder fire extinguisher (trolley mounted).
BIS: 11460	Code of practice for fire safety of libraries and archives buildings
BIS: 1309	External hydrant systems – Provision and maintenance – Code of practice
BIS: 5514 (Parts 1 to 7)	Reciprocating internal combustion engines: Performance

2.0 MANDATORY TESTS / OPTIONAL TESTS:-

a. All water supply pipes, fittings and valves shall be tested by hydrostatic pressure of min. 1.5 times, the working pressure and subject to minimum of 7 kg/cm^2 in any case and with the consent of Project Manager.

b. All drainage / Non Pressure pipes shall be either mirror /smoke test for proper alignment, and should be laid at invert level as mentioned in approved drawings.

c. Pressure shall be maintained for a period of at least TWELVE hours without appreciable drop in the pressure after fixing at site. (+10 %). A test register shall be maintained and all entries shall be signed and dated by Contractor(s) and Engineer.

d. In addition to the sectional testing carried out during the construction, Contractor shall test the entire installation after connections to the

overhead tanks or pumping system or mains. He shall rectify all leakages, and shall replace all defective materials in the system. Any damage done due to carelessness, open or burst pipes or failure of fittings, to the building, furniture and Fixtures shall be made good during the defects liability period without any extra cost.

e. After completion of the water supply system, Plumbing Contractor shall test each valve by closing and opening it a number of times to observe if it is working efficiently. Valves which do not effectively operate shall be replaced by new ones at no extra cost and the same shall be tested as above

f. Testing charges including incidental charge and cost of sample for testing shall be borne by the contractors for all mandatory tests.

g. Testing charges for optional tests shall be paid by the Dept. However, the incidental charges and cost of sample for testing shall be borne by the contractor.

h. In case of non-I.S. materials, it shall be the responsibility of the contractor to establish the conformity of material with relevant I.S. specification by carrying out necessary tests. Testing charges including incidental charge and cost of sample for testing shall be borne by the contractors for such tests.

i. Cost of Piping network isolation valve, flanges, pipes, pumps and gauges required for pressure testing for all the equipment and piping shall be completely borne by contractor. No additional charges shall be entertained.

3.0 Testing, tolerances, Acceptance and mode of payment:-

a. The materials should pass all tests and tolerance in dimensional, chemical, physical properties should be within the limit as stipulated in relevant I.S. for acceptance. Such materials will be accepted as standard.

b. Payments shall be restricted to standard unit mass, or as specified in the schedule, without making any cost adjustment towards mass or any other properties provided the material pass all the tests and tolerance are within the specified limit.

4.0 MEASUREMENT

a. **Pipes**: Pipes shall be measured per linear meter (to the nearest cm) and shall be inclusive of all fittings e.g. couplings, tees, bends, elbows,

unions, deduction for valves shall be made, cutting holes chases and making good the same and all items mentioned in the specifications and Schedule of Quantities**.**

b. Gunmetal and cast iron valves shall be measured by numbers. Single flanges shall be measured by numbers (per single flange) and shall include bolts, nuts, washers and 3mm thick rubber gasket complete Pair of flanges shall be measured by number of pairs and shall include bolts, nuts, washers, and 3 mm thick rubber gaskets complete.

c. Insulation: Insulation for hot water pipes shall be measured per linear meter (to the nearest cm) along the center line of pipe and shall be measured over all fittings and flanges. No separate or additional payment shall be made for insulation of Bends, Tees, Flanges or Other Fittings and Valves. The rate shall include all items specified in the Schedule of Quantities and given in the specifications.

Aluminum cladding/Plaster over the insulated pipes shall be measured by square meter area of the finished surface. The rate shall be inclusive of all items given in the Schedule of Quantities.

d. **Painting**:Painting for Pipes and over insulation shall be measured per linear meter over finished surface and shall include all valves and fittings for which no deduction shall be made.

e. **Connections to Water Tanks:**

The contractor shall provide all inlets, outlets, washouts, vents, ball cocks, overflow, control valves and all such other piping connections including level indicator to water storage tanks as called for.
Suitable float controls of an approved make, securely fixed to the tank independent of the inlet pipe and set in a position so that water inlet into the tank is cut off when filled up to the water line. The water level in the tanks shall be adjusted to 25mm below the lip of the overflow pipe. Fullway gate/ball valves of approved make shall be provided as near the tank as practicable on every outlet pipe from the storage tank except the overflow pipe.
The Overflow pipe shall be so placed as to allow the discharge of water being readily seen. The overflow pipe shall be of size indicated. A stop valve shall also be provided on the inlet water connection to the tank. The outlet pipes shall be fixed approximately 75mm above the bottom of the tank towards which the floor of the tank is sloping to enable the tank to be emptied for cleaning. The ball valves shall conform to Indian Standard IS: 1703-1968

5.0 DISINFECTION

After completion of the work Contractor shall flush clean the entire system with the city's filtered water after connection has been made. After the first flushing, commercial bleaching powder is to be added to achieve a dosage of 2 to 3 mg/l of water in the system added and flushed. This operation should be performed twice to ensure that the system is fully disinfected and usable. The Commissioning would not be considered complete without performing the Disinfection.

6.0 Post construction Inspection and testing:

After completion of work and during the maintenance liability period of contract, the work shall be subjected to "Post construction and testing". In case, if the materials incorporated in the work are found to be inferior, though the sample collected from the materials might have been passed at the time of execution, it shall be the responsibility of the contractor to replace the same without any cost to the department failing which the department may rectify the same at the risk and cost of the contractor or the department may accept the same as substandard, and cost be adjusted from the outstanding security deposit as per the terms and condition of the contract for the work.

7.0 PRE COMMISSIONING:

Ensure that all pipes are free from debris and obstructions.

8.0 The installation of the sanitary fixtures and fittings shall be as per the shop drawings approved by the Architect/Consultant. The contractor shall have to assemble at least one set of each type of sanitary fixtures and fittings in order to determine precisely the required supply and disposal connections. Relevant instructions from manufacturers shall be followed as applicable. This trial assembly shall be developed to determine the location of puncture holes, holding devices etc. which will be required for final installation of all sanitary fixtures and fittings. The above assembly shall be subject to final approval by the Architect / Interior Designer. The fixtures in the trial assembly can be re-used for final installation without any additional payments for fixing or dismantling of the fixtures.

9.0 OPERATING INSTRUCTION & MAINTENANCE MANUAL

Upon completion and commissioning of part Plumbing / Sanitary & Fire Protection system the contractor shall submit a draft copy of comprehensive operating instructions, maintenance schedule and log sheets for all systems and equipment included in this contract. This shall be supplementary to manufacturer's operating and maintenance manuals. Upon approval of the draft, the contractor shall submit four (4) complete bound sets of typewritten

operating instructions and maintenance manuals; one each for retention by Consultant and Owner's site representative and two for Owners Operating Personnel. These manuals shall also include basis of design, detailed technical data for each piece of equipment as installed, spare parts manual and recommended spares for 4 year period of maintenance of each equipment.

"Preventive Maintenance Schedule for each equipment / panel shall be submitted along withOperation and Maintenance Manual".

10.0 ON SITE TRAINING

Upon completion of all work and all tests, the Contractor shall furnish necessary operators, labour and helpers for operating the entire installation for a period of fifteen (15) working days of ten (10) hours each, to enable the Owner's staff to get acquainted with the operation of the system. During this period, the contractor shall train the Owner's personnel in the operation, adjustment and maintenance of all equipment installed**.**

11.0 MAINTENANCE DURING DEFECTS LIABILITY PERIOD

23.1 Complaints

The Contractor shall receive calls for any and all problems experienced in the operation of the system under this contract, attend to these within 10 hours of receiving the complaints and shall take steps to immediately correct any deficiencies that may exist.

23.2 Repairs

All equipment that require repairing shall be immediately serviced and repaired. Since the period of Mechanical Maintenance runs concurrently with the defects liability period, all replacement parts and labour shall be supplied promptly free-of-charge to the Owner

12.0 UPTIME GUARANTEE

The contractor shall guarantee for the installed system an uptime of 98%. In case of shortfall in any month during the defects liability period, the Defects Liability period shall get extended by a month for every month having shortfall. In case of shortfall beyond the defects liability period, the contract for Operation and Maintenance shall get extended by a month for every month having the shortfall and no reimbursement shall be made for the extended period.

The Contractor shall provide log in the form of diskettes and bound printed comprehensive log book containing tables for daily record of all pressures, power consumption, starting and stopping times for various equipment, daily services rendered for the system alarms, maintenance and record of unusual observations etc. Contractor shall also submit preventive maintenance schedule.

Each tenderer shall submit along with the tender, a detailed operation

assistance proposal for the Owner's site representatives/Consultant's review. This shall include the type of service planned to be offered during Defects Liability Period and beyond. The operation assistance proposal shall give the details of the proposed monthly reports to the Management.

The tenderer shall include a list of other projects where such an Operation Assistance has been provided.

13.0 OPERATION AND MAINTENANCE

Contractor may be required to carry out the operation of the Plumbing / Sanitary installation for the defects liability period. Further, he may also be required to carry out operation and all inclusive maintenance of the entire system for a period of three years beyond the defects liability period**.**

13.1 Operation contract Plumbing / Sanitary & Fire Protection

i. 24 hours a day, year round.

ii. All stand-by equipment to be operated as per mutually agreed programme.

iii. Proper entry and unkeep of relevant log books.

iv. Maintain complaints register. Submit weekly report.

v. Proper housekeeping of all areas under the contract.

vi. Prepare daily consumption report and summary of operation.

13.2 All Inclusive Maintenance Contract

a. Routine Preventive Maintenance Schedule to be submitted

i. Schedule to cover manufacturer's recommendation and/or common engineering practice (for all plant and machinery under contract).

ii. Plant and machinery history card giving full details of equipment and frequency of checks and overhaul.

iii. Monthly status report.

iv. Entire Plumbing / Sanitary & Fire Protection installation to be painted in fourth year (from commissioning) before the expiry of operation and maintenance contract.

b. Uptime during maintenance contract

i. 98% uptime of all systems under contract.

ii. Up time shall be assessed every month and in case of shortfall during any month the contract shall be extended by a month.

iii. There shall be no reimbursement for the extended period.

iv. Break-downs shall be attended to within ten hours of reporting.

v. Spare compressor/motor assembly to be made available within seven calendar days in case of total breakdown/burnout.

c. Manpower

i. Adequate number of persons to the satisfaction of the Owner's site representative shall be provided including relievers.

ii. Statutory requirements of EPF, ESIC and other applicable labour legislations to be complied with; and monthly certification to that effect to be submitted.

iii. Duty allocation and Roaster control shall be contractor's responsibility.

iv. No overtime shall be payable by Owner for any reason whatsoever.

d. Shut Downs

i. Routine shut downs shall be permitted on approval of Project Manager/PMC/Client.

ii. Contractor shall be at liberty to carry out routine maintenance as and when required but with prior permission of the Owner.

14.0 PARTIAL ORDERING

Owner through the Architect/Consultant/ Owner's site representative reserves the right to order equipment and material from any and all alternates, and /or to order high side and /or low side equipment and materials or parts thereof from one or more tenderers**.**

ITEM WISE SPECIFICATIONS
PLUMBING WORKS

A. 14 SANITARY FIXTURES AND FITTINGS

MR 14.001 : Supply, installation , testing & commissioning white vitreous china extended wall mounting water closet of approved make including Supply, installation , testing & commissioning of dual plate concealed cistern with flushing capacity 2 litre/ 4 litre (Low Flow), cost shall be inclusive of providing and fixing of accesories i.e. wall plate for flushing cistern ,seat cover, and cistern fittings, nuts, bolts and gasket, SS rack bolt /anchor bolts / fasteners for EWC hanging, and providing protection cover over cistern, cutting and making good the walls wherever required complete as per manufacturer recommendation
Water closet- Jaquar KUS WHT 35951,Cistern - JCS-WHT-2400 , Flushing Cistern Wall Plate JCP-CHR-852415,Rack Bolt - Jaquar ZPS SNS RB01 OR EQUIVALENT FROM BASKET

1. **Materials: European type water closet** shall be wash down or symphonic wash down type floor or wall mounted set, as shown in the drawings, designed for low volume flushing from 3/6 or 2/4 liters of water, flushed by means of a porcelain flushing cistern or an exposed or concealed type (as detailed in the drawings or as directed by the Owner's Site Representative) 32 mm size CP brass flush valve with regulator valve. Flush pipe / bend shall be connected to the WC by means of a suitable rubber adaptor. Wall hung WC shall be supported by CI floor mounted chair which shall be fixed in a manner as approved by the Owners Site Representative. Each WC set shall be provided with approved quality of seat, rubber buffe s and chromium plated hinges. Seat shall be so fixed that it remains absolutely stationary in vertical position without falling down on the WC. Each WC shall be provided with 110 mm dia. (OD) PVC Pan Connector connecting the ceramic outlet of WC to CI pipe. Water closet shall be vitreous china conforming to IS 2556 (Part-I & II). The closet shall have minimum two hole of 6.5 mm diameter for fixing closet to wall. Closet shall have an integral flushing rim of self-draining type. Each water closet shall have an integral `P` trap with water seal not less than 50 mm. with outlet and trap shall be uniform and smooth in order to enable an efficient flush. It shall be of approved color and make as mentioned in the schedule of quantities. **The seat and cover** shall be of the best Indian make conforming to I.S. 2548-1980. They shall be made of molded from PP heavy duty material which shall be tough and hard with high resistance to solvents and shall be free from blisters and other surface defects and shall have chromium plated brass hinges and rubber buffer of suitable size .**The Concealed Cistern** material shall be of best of quality conforming to IS 776 -1979. It should be green building approved with low flow type with dual flush 2/4 liters capacity.

2. **Workmanship:** Closet shall be fixed to the wall by means of CI chair/ WC fasteners as per manufacturer recommendation and and approved by architect bracket should be 75 mm. long 6.5 mm.

diameter counter sunk bolts and nuts embedded in the wall concrete using rubber or fiber washers so as not to allow any lateral displacement. The joint between the W.C. outlets with soil down take pipe shall be made with rubber seal gasket joint

Installation of seat and cover to water closet- The seat shall be fixed to the pan by means of two corrosion resistant hinge bolts with a minimum length of shank of 65 mm and threaded to within 25 mm of the flange supplied by the manufacturer along with the seat. Each bolt shall be provided with two suitably shaped washers of rubber or other similar materials for adjusting the level of the seat while fixing it to the pans. In addition, one non- ferrous or stainless steel washer shall be provided with each bolt. The maximum external diameter of the washer fixed on the underside of the pan shall not be greater than 25 mm. Alternative hinging devices as supplied by the manufacturer of the seat can also be used for fixing with the approval of Engineer-in-Charge

3. Mode of measurements & payment:

i. European type wall mounted water closet with an integral `P` trap, seat cover, WC connector, concealed dual flush cistern, wall plate. jointing with soil down take
ii. Cutting hole in wall / slab / beam etc. wherever required. and making all damages good to original condition after completion of work
iii. Cost of jointing materials.
iv. Painting all the metallic parts with two coats of flat oil paint over a coat of primer.
v. Testing the entire system and rectification of defect if any.
vi. All necessary labor, material and use of tools.
vii. MODE OF PAYMENT: The rate shall be for a unit of one number and include the cost of all labor and material as specified in item for fixing etc. complete, including testing and commissioning.

MR 14.002 : Supply, installation , testing & commissioning white vitreous china extended wall mounting water closet of approved make including Supply, installation , testing & commissioning of dual plate concealed cistern with flushing capacity 2 litre/ 4 litre (Low Flow), cost shall be inclusive of providing and fixing of accesories i.e. wall plate for flushing cistern ,seat cover, and cistern fittings, nuts, bolts and gasket, anchor bolts / fasteners for EWC hanging, and providing protection cover over cistern, cutting and making good the walls wherever required complete as per manufacturer recommendation
Water closet- Jaquar VGS-WHT-81951,Cistern - JCS-WHT-2400 , Flushing Cistern Wall Plate JCP-CHR-852415 ,Rack Bolt - Jaquar ZPS SNS RB01 OR EQUIVALENT FROM BASKET
Please refer specifications under item no 14.1

MR 14.003 :Supply, installation , testing & commissioning first quality white vitreous china wall mounted with pedetrial washbasin, 32 mm CP brass waste and CP brass cast bottle trap and pipe to wall with CP brass flange and rubber adopter for waste connection complete including filling gap between counter and wash basin with approved type poly sulphide sealant, cutting and making good the walls wherever required as per manufacturer recommendation
Wash Basin-Jaquar CNS -WHT 801 & 805, ALD-705(waste Coupling), ALD-769L (Bottle Trap) OR EQUIVALENT FROM BASKET

MR 14.004:Supply, installation , testing & commissioning first quality white vitreous china under rim counter top washbasins, 32 mm CP brass waste and CP brass cast bottle trap and pipe to wall with CP brass flange and rubber adopter for waste connection complete including filling gap between counter and wash basin with approved type poly sulphide sealant, cutting and making good the walls wherever required as per manufacturer recommendation
Wash Basin-Jaquar CNS -WHT 705, ALD-705(waste Coupling), ALD-769L (Bottle Trap) OR EQUIVALENT FROM BASKET

1. **Materials:** Wash basin shall be of white porcelain first quality best Indian make and it shall conform it I.S. 2556 (Part-IV) 1972 and I.S. 771-1979. The bracket shall conform to IS: 775-1962. Approved GI coated rag bolts shall be used for fixing the wash basin over and above the brackets.
   The type (like over counter, under counter, with/without pedestal etc.) of the wash basin shall be as specified in the item. Wash basin shall be of one piece construction with continued over-flow arrangements. Each basin shall have circular waste hole or 5 sq.cm slot type over flow. All internal angles shall be designed so as to facilitate cleaning. Wash basin shall have single tap hole or two holes as specified. Each basin shall have a circular waste hole which is either rebated or beveled internally with 65 mm diameters at top and 10 mm depth to suit the waste fitting. The necessary stud slot to receive the bracket on the underside of the basin shall be provided. Basin shall have an internal soap holder recess which shall fully drain into the bowl. The C. P. brass waste trap and unions shall be of 32 mm dia. and of best quality, size, color and make as specified in item and as approved by Architect / EIC. PVC water inlet connection shall conform to IS specifications and shall be of standard pattern with braided hose of minimum 450 mm long with CP brass check nut at both the end and shall be able to withstand the testing pressure of 1 Mpa (10 kg/sq. cm.)
   Waste Coupling shall confirm to IS 3311, and as specified in the item and of approved make. Waste fittings shall be with thickness of coating not less than service Grade No.2 of IS 4827 which is capable of receiving polish and will not easily scale off. The fitting shall conform in all respect to IS 2963 and shall sound, free from laps below, holes and fittings and other manufacturing defect. External and internal surface shall be clean and smooth. They shall be neatly dressed. The waste fitting for wash basin shall be of nominal size of

32 mm. The bottle trap shall be as specified in the item and of approved make. The bottle-trap shall be provided with a CP brass extension piece to the wall flange on one hand and on the other with a rubber adopter for waste connection.
Bottle trap shall be of thickness of coating not less than service grade No. 2 of IS 4827 which is capable of receiving polish and will not easily scale off. The fitting shall conform in all respect of IS 2963 and shall be sound, free from laps below, holes and fittings and other manufacturing defects. External and internal surface shall be clean and smooth. They shall be neatly dressed and be truly machined so that nut smoothly moves on the body. The Bottle trap for wash basin shall be of nominal size of 32 mm.

2. **Workmanship:** The wash basin shall be fixed on the wall as and where directed. The wash basin shall be supported on a pair of M. S. or C.I. brackets fixed in C.M. 1:3 (1cement: 3sand). Bracket shall be fixed in the position before dado work is done. The wall plaster on the rear shall be cut to rest the top edge of the wash basin. The gap between counter and wash basin shall be filled with approved sanitary grade silicone sealant. After fixing the basin, plaster shall be made good and surface finished matching with the existing one. The bracket shall be painted with two or three coats of enamel paint of approved shade over a coat of primer. Oval shape or round shape wash basins are required to be fixed in RCC platform with stone tapping either fully sunk in stone top or flush with stone topping. The wall plaster on seat shall be cut to rest over the top edge of the basin so as not to leave any gap for water seepage through between wall plaster & skirting of basin. The gap between counter and wash basin shall be filled with approved sanitary grade silicone sealant. The trap and union shall be connected to 32 mm. dia. waste pipe which shall be suitably bent towards the wall and which shall discharge into an open drain leading to a gully trap or direct into the gully-trap on the ground floor and shall be connected to a waste pipe through a floor trap on the upper floors. C. P. brass trap and union may not be provided where the surface drain or a floor trap is placed directly under the basin and the waste is discharged into vertically. The height of the front edge of the wash basin from the floor level shall be 80 cms. The necessary inlet, outlet connections and fittings such as sensor operated pillar cock. C. P. dress waste trap waste pipe, stop cock, chain with rubber plug etc. shall be fixed.

3. **Mode of Measurement:**

   i. These items shall be measured in numbers and rate quoted shall be per number only. The quoted rate shall include:
   ii. The cost of wash basin with brackets and other items stated.
   iii. Jointing and fixing materials.
   iv. Painting of brackets.
   v. And necessary fittings, hardware, etc. to complete the above.
   vi. Cutting hole in wall / slab / beam etc. wherever required and making all damages good to original condition after completion of work.

vii. The rate shall be for a unit of one number and include cost of all labor, materials, tools and plant etc., required for satisfactory completion of this item as specified.

MR 14.005 :Supply, installation , testing & commissioning first quality white vitreous china wall mounted washbasin with 32 mm CP brass waste and CP brass cast bottle trap and pipe to wall with CP brass flange and rubber adopter for waste connection complete including filling gap between counter and wash basin with approved type poly sulphide sealant, cutting and making good the walls wherever required as per manufacturer recommendation
Wash Basin-Jaquar CNS -WB04, ALD-705(waste Coupling), ALD-769L (Bottle Trap) OR EQUIVALENT FROM BASKET

Please refer specifications under item no MR 14.004

MR 14.006 :Supply, installation , testing & commissioning Stainless Steel AISI 304 (18/8) kitchen sink as per IS 13983 with C.I. brackets, bottle trap, waste coupling and stainless steel plug 40 mm, including painting of fittings and brackets, cutting and making good the walls wherever required.
Kitchen sink with drain board 510x1040 mm bowl depth 200 mm, MODEL NIRALI MAKE OLYMPIA, OR EQUIVALENT FROM BASKET

1. **MATERIAL: -** The item pertains to provide SS sink, chromium plated brass waste coupling including fixing. Waste Coupling shall confirm to IS 3311.Waste fittings shall be of CP with thickness of CP coating not less than service Grade No.2 of IS 4827 which is capable of receiving polish and will not easily scale off. The fitting shall conform in all respect to IS 2963 and shall sound, free from laps below, holes and fittings and other manufacturing defects. External and internal surface shall be clean and smooth. They shall be neatly dressed. Each sink shall be provided with painted MS or CI brackets and clips and securely fixed. Counter top sinks shall be fixed with suitable painted angle iron brackets or clips as recommended by the manufacturer. Each sink shall be provided with 40mm dia CP waste and rubber plug with CP brass chain as given in the Schedule of Quantities. The MS angle shall be provided with two coats of red oxide primer and two coats of synthetic enamel paint of make, brand and colour as approved by the Owner's site representative.
   Sanitary fittings for sinks shall be deck mounted or wall mounted CP swivel faucets with or without hot and cold water mixing fittings as specified in the Schedule of Quantities. Installation of fittings shall be measured and paid for separately.
   The sink waste fitting for wash basin shall be of nominal size of 32 mm and for sink shall be nominal size 50 mm.Each sink shall be provided with R.S. or C.I. brackets and clips and securely fixed. Counter top sinks shall be fixed with suitable angle iron clips or brackets as recommended by the manufacturer. Each sink shall be

provided with 40 mm dia. C.P. waste with chain and plug or P.V.C. waste. Fixing shall be done as directed by Project Manager.

2. **Workmanship:-**Waste coupling shall be fixed to, sink as ordered with necessary specials. Jointing shall be done with white zinc, yarn etc. A few turns of fine hemp yarn dipped in the linseed oil shall be taken over the threaded ends to obtain complete water tightness. Leaky joint shall be remade to make it leak proof. The rate includes forWaster coupling with necessary specials. All necessary labor, material and the use of tools.

3. **MODE OF MEASUREMENT**

   i. The rate shall be inclusive of SS sink with waste coupling, bottle trap, CI brackets, and support for a unit of one number and include cost of all labor, materials, tools and plant, etc. complete as required for satisfactory completion of this item as specified.
   ii. These items shall be measured in numbers and rate quoted shall be per number only. The quoted rate shall include:
   iii. The cost of sink with brackets and other items stated.
   iv. Jointing and fixing materials.
   v. Painting of brackets.
   vi. And necessary fittings, hardware, etc. to complete the above.
   vii. Cutting hole in wall / slab / beam etc. wherever required and making all damages good to original condition after completion of work.
   viii. The rate shall be for a unit of one number and include cost of all labor, materials, tools and plant etc., required for satisfactory completion of this item as specified.

MR 14.007:Providing, Fixing of CP Brass wall mounted sink mixer with wall flange, extended operating lever, swinging spout complete with all accessories as per approved specifications and making good the walls wherever required.
Sink mounted sink tap ARI-39309 OR EQUIVALENT FROM BASKET

1. **Materials:** The item pertains to provide chromium plated brass combination tap assembly wall or floor mounted hot & cold mixing for sink, basin etc. including free flanges and fixing. Basin mixer shall be as specified in item, and as approved by Architect / EIC. The combination tap assembly shall be 15 mm nominal size or as specified in the schedule. It shall be of C.P. brass approved and heavy quality, and shall conform to I.S. 8931. Combination tap assembly shall be chromium plated-brass and shall conform to IS 8931.The nominal size of combination tap assembly shall be 15 mm nominal size or as specified. Casting of combination tap assembly shall be sound and free from laps, blow hole and pitting. External and internal surface shall be clean, smooth and free from sand and be neatly dressed. All the parts fitted to pillar tap shall be axial,

parallel and cylindrical with surfaces smoothly finished. Thickness of C.P coating shall not be less than service grade no.2 of IS 4827 and plating should be capable of taking high polish which shall not easily tarnish or scale.

2. **Workmanship:** Combination tap assembly shall be fixed to the pipe line as indicated in the drawing with necessary special as required or as ordered by Engineer-in-charge. Jointing shall be done with teflon tape, etc. Combination tap assembly shall withstand and internally applied hydraulic pressure of 1.6Mpa (16 kg/sq. cm) for period of 1 minutes during which, it shall neither leak nor sweat. Leaky joint shall be remade to make it leak proof. **Testing:** Combination tap assembly wall / floor mounted as specified in the item, and in drawings, including free flanges and fixing

3. **Mode of Measurement:**

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i. The rate shall be inclusive of washbasin mixer for a unit of one number and include cost of all labor, materials, tools and plant, etc. complete as required for satisfactory completion of this item as specified.
ii. These items shall be measured in numbers and rate quoted shall be per number only. The quoted rate shall include:
iii. Jointing and fixing materials.
iv. And necessary fittings, hardware, etc. to complete the above.
v. Cutting hole in wall / slab / beam etc. wherever required and making all damages good to original condition after completion of work.
vi. The rate shall be for a unit of one number and include cost of all labor, materials, tools and plant etc., required for satisfactory completion of this item as specified.

MR 14.008:Providing, Fixing of CP Brass floor Mounted washbasin mixer with concealed & wall flange, extended operating lever, complete with all accessories as per approved specifications and making good the walls wherever required.
Washbasin Mixer -JAQUAR FUS-29011B OR EQUIVALENT FROM BASKET

Please refer specification under item no. MR 14.007

MR 14.009: Supply, installation, testing & commissioning of C.P. brass dual coat robe hook with all accessories as per approved specifications and making good the walls wherever required.
JAQUAR ACN-CHR-1161N OR EQUIVALENT FROM BASKET

1. **Materials:** The Robe Hook shall be of Make as specified and of size and design as approved by the Architect / Engineer-in-charge. Robe Hook shall conform as per Manufacturer standard and should have

ISI mark. The chromium plating shall be of grade 'B' type conforming to I.S. 1068-2958

2. **Workmanship:** The Robe Hook shall be fixed in position as per drawings or as directed by Architect / EIC to the wall with C.P brass or SS screws as approved by Architect / EIC, with the help of PVC grip of HILTI/Fischer or equivalent.

3. **Measurement:**

   i. The rate includes cost of all labor and materials, tools and plant etc. required for satisfactory completion of the item.
   ii. The rate shall be for a unit of one number.

MR 14.010 : Supply, Supply, installation , testing & commissioning of C.P Braided Copper connection 450 mm long including nuts and washers and making connection to fixtures and fittings complete as per manufacturer recommendation
JAQUAR ALD-805B OR EQUIVALENT FROM BASKET

1. **Materials:** The CP braided copper connection pipe shall be of Make as specified / approved by architect/ consultant and of size and design as approved by the Architect / Engineer-in-charge. Robe Hook shall conform as per Manufacturer standard and should have ISI mark. The chromium plating shall be of grade 'B' type conforming to I.S. 1068-2958

2. **Workmanship:** The CP braided copper connection pipe shall be fixed in position as per drawings or as directed by Architect / EIC to the wall with C.P brass or SS screws as approved by Architect / EIC

3. **Measurement:**

   i. The rate includes cost of all labor and materials, tools and plant etc. required for satisfactory completion of the item.
   ii. The rate shall be for a unit of one number.

MR 14.011 :Supply, Installation, testing & commissioning of CP finish Health Faucet with regulator (angle valve) of approved quality with CP braided flexible pipe 1 m long, wall hooked complete as per manufacturer recommendation.
Jaquar ALD-CHR-579 OR EQUIVALENT FROM BASKET

1. **Materials:** The C. P. Health faucet shall be of best quality, as specified in item and of approved make. The chromium plating shall be of grade 'B' type conforming to I.S. 1068-2958. Each health faucet provided with 1 mtr.Long flexible PVC tube, and wall hook etc.

2. **Workmanship:** The health faucet Hook & health faucet shall be fixed in position as per drawings or as directed by Architect / EIC.

The height shall be approx. 45cm from floor level if not mentioned in the drawing. The one end of 1.0 meter long pipe shall be connected to faucet & other end to the angle cock.

3. **Mode of measurements & payment:**

   i. The rate includes cost of all labor and materials, tools and plant etc. required for satisfactory completion of the item.
   ii. The rate shall be for a unit of one number.

MR 14.012 :Supply, installation, testing & commissioning Heavy class SS grating with Cockroach proof SS strainer of approved design including setting in floor with cement motor to match with floor finish as per architect requirement suitable for waster and FT.
a) Size 100 mm x 100 mm, Make – Chilly(CCTL - SMHC-150)/GMGR

1. **Materials:** The Heavy class SS grating with cockroach proof SS strainer shall be of Make as specified and of size and design as approved by the Architect / Engineer-in-charge. CP brass grating shall confirm to manufacturer standard and should have ISI mark. The chromium plating shall be of grade 'B' type conforming to I.S. 1068-2958

2. **Workmanship:** The Heavy class SS grating with cockroach proof SS strainer shall be fixed in position as per drawings or as directed by Architect / EIC to the wall with C.P brass or SS screws as approved by Architect / EIC, with the help of PVC grip of HILTI/Fischer or equivalent.

3. **Measurement:**

   i. The rate includes cost of all labor and materials, tools and plant etc. required for satisfactory completion of the item.
   ii. The rate shall be for a unit of one number.

MR 14.013 : Supply, installation, testing & commissioning Heavy class SS grating with Cockroach proof SS strainer of approved design including setting in floor with cement motor to match with floor finish as per architect requirement suitable for waster and FT.
a) Size 100 mm x 100 mm, Make – Chilly (CCTL - SMHC-101)/GMGR

MR 14.014:Supply, Installation, testing & commissioning C.P. brass angle valve with wall flange of approved quality conforming to IS: 8931complete as per approved specifications.
a) 15mm nominal bore
Jaquar ARI 39053 OR EQUIVALENT FROM BASKET

1. **Materials:** The item pertains to provide **angle valve**, free flanges (if joined to concealed pipe) including fixing 15 mm. dia. brass screw down with bright polished finish shall conform to I.S. 781-1977. The bib cock shall be **best Indian make and quality as**

specified in item and approved by Architect / engineering consultant. A bib cock (stop tab) is a draw off tap with a horizontal inlet and free outlet and stop cock (stop tap) is a valve with a suitable means of connections for insertion in a pipeline for controlling or stopping the flow. They shall be of specified size and shall be of screw down type. The closing device should work by means of shuts against water pressure on a non-metallic washer, which shuts against water pressure on a seating at right angles to the exit of the threaded spindle, which operates it. The handle shall be either crutch or butterfly type securely seated pattern. The cocks (taps) shall open in anti-clockwise direction. Brass bib taps and stop cocks and angle stop cocks shall conform to IS 781, they shall be polished bright. The minimum finished weight of different sizes of bib tap weight of 15 mm size bib tap and stop cock shall be as per table given below. They shall be sound and free from taps, blow hole and fitting. Internal & External surface shall be clean, smooth and free from sand and neatly dressed. Taps shall be nickel chromium plated and thickness of coating shall not be less than service grade No.2 of IS 4827 and plating shall be capable of taking high polish which shall not be easily tarnished.

MINIMUM FINISHED MASS OF BIB TAPS AND STOP VALVES AS PER IS 781:1984 (Reaffirmed 2001)

Size	MINIMUM FINISHED MASS			
	Bib Taps	Stop valves		
		Internally threaded	Externally threaded	Mixed threaded
MM	KG	KG	KG	KG
8.0	0.250	0.220	0.250	0.235
10.0	0.330	0.330	0.350	0.325
15.0	0.400	0.330	0.400	0.365
20.0	0.750	0.675	0.750	0.710
25.0	1.250	1.180	1.300	1.250
32.0	-	1.680	1.800	1.750
40.0	-	2.090	2.250	2.170
50.0	-	3.700	3.850	3.750

2. **Workmanship:** The body of stop cock of 15mm diameter with adjustable flange shall be as specified above shall be fixed on water supply line keeping the arrow in the direction of flow as per drawing or as directed. Transition male /female adopter with shall be used on either side on PVC pipes. The threaded portion shall be smeared with white or red lead and around with a few turns of fine spun yarn round the screwed end of the cock. On completion the tiling work, the outer part of stop cock shall be fixed to the brass body. Every tap complete with its component shall with stand an internally applied hydraulic pressure of 2 MPa (20 kg/sq.cm) maintained for a period of 2 minutes during the period it shall

neither leak nor sweat. Leaky joint shall be remade to make it leak proof without any extra cost from contractor.

3. **Mode of measurements & payment:**

   i. The rate includes cost of all labor and materials, tools and plant etc. required for satisfactory completion of the item.
   ii. The rate shall be for a unit of one number.

MR 14.015 :Supply, installation, testing & commissioning of C.P Toilet paper roll holder with all accessories as required and making good the walls wherever required.
Model Jaquar ACN-1151N OR EQUIVALENT FROM BASKET

1. **Materials:** The C.P. Toilet paper roll holder shall be of chrome plated of specified size and design as approved by the Architect / Engineer-in-charge. Tissue roll holder shall conform as per IS standard and should have ISI mark. The chromium plating shall be of grade 'B' type conforming to I.S. 1068-2958

2. **Workmanship:** Tissue roll holder shall be fixed in position as per drawings or as directed by Architect / EIC to the wall with C.P brass or SS screws as approved by Architect / EIC, with the help of PVC grip of HILTI/Fischer or equivalent.

3. **Mode of measurements & payment:**

   i. The rate includes cost of all labor and materials, tools and plant etc. required for satisfactory completion of the item.
   ii. The rate shall be for a unit of one number.

MR 14.016 : Supply, installation , testing & commissioning of C.P Towel rod with all accessories as per approved specifications and making good the walls wherever required.
Model No. JAQUAR AEC-1111 OR EQUIVALENT FROM BASKET

1. **Materials:** The Towel rod shall be of make as specified and of size and design as approved by the Architect / Engineer-in-charge. Towel Bar shall conform as per Manufacturers standard and should have ISI mark. The chromium plating shall be of grade 'B' type conforming to I.S. 1068-2958.Towel rail shall be fixed with screws/capping having finish similar to the towel rail in wall with rawl plugs or nylon sleeves and shall include cutting and making good as required or directed by the Owner's Site Representative

2. **Workmanship:** Towel rod shall be fixed in position as per drawings or as directed by Architect / EIC to the wall with C.P brass or SS screws as approved by Architect / EIC, with the help of PVC grip of HILTI/Fischer or equivalent.

3. **Measurement**

i. The rate includes cost of all labor and materials, tools and plant etc. required for satisfactory completion of the item.
ii. The rate shall be for a unit of one number.

MR 14.017 :Supply, installation , testing & commissioning of Soap Dish with all accessories as per approved specifications and making good the walls wherever required.
Jaquar CAN-1131N OR EQUIVALENT FROM BASKET

1. **Materials:** The soap dish shall be of make as specified and of size and design as approved by the Architect / Engineer-in-charge. Soap dish shall confirm as per Manufacturers standard and should have ISI mark. The chromium plating shall be of grade 'B' type conforming to I.S. 1068-2958

2. **Workmanship:** Soap dish shall be fixed in position as per drawings or as directed by Architect / EIC to the wall with C.P brass or SS screws as approved by Architect / EIC, with the help of PVC grip of HILTI/Fischer or equivalent.

3. **Measurement**

i. The rate includes cost of all labor and materials, tools and plant etc. required for satisfactory completion of the item.
ii. The rate shall be for a unit of one number.

MR 14.018 :Supply, installation, testing & commissioning of C.P Towel ring with all accessories as required and making good the walls wherever required.
Model No. Jaquar CAN -1121N OR EQUIVALENT FROM BASKET

1. **Materials:** The Towel ring shall be of Make as specified and of size and design as approved by the Architect / Engineer-in-charge. Towel Ring shall conform as per Manufacturers standard and should have ISI mark. The chromium plating shall be of grade 'B' type conforming to I.S. 1068-2958

2. **Workmanship:** Towel Ring shall be fixed in position as per drawings or as directed by Architect / EIC to the wall with C.P brass or SS screws as approved by Architect / EIC, with the help of PVC grip of HILTI/Fischer or equivalent.

3. **Measurement:**

i. The rate includes cost of all labor and materials, tools and plant etc. required for satisfactory completion of the item.
ii. The rate shall be for a unit of one number.

MR 14.019 :Supply, installation, testing & commissioning C.P. brass Two way bib tap with wall flange of approved quality conforming to IS:8931 with all accessories as per approved specifications and making good the walls wherever required.

a) 15 mm nominal bore.
Jaquar ARI 39041 OR EQUIVALENT FROM BASKET

1. **Materials:** The item pertains to provide chromium plated brass combination tap assembly wall or floor mounted hot & cold mixing for sink, basin etc. including free flanges and fixing. Basin mixer shall be as specified in item, and as approved by Architect / EIC. PVC water inlet connections compatible for hot and cold water as specified in item, shall conform to IS specifications and shall be of standard pattern with braided hose of minimum 450 mm long with CP brass check nut at both the end and shall be able to withstand the testing pressure of 1 Mpa (10 kg/sq. cm.)The combination tap assembly shall be 15 mm nominal size or as specified in the schedule. It shall be of C.P. brass approved and heavy quality, and shall conform to I.S. 8931. Combination tap assembly shall be chromium plated-brass and shall conform to IS 8931.The nominal size of combination tap assembly shall be 15 mm nominal size or as specified. Casting of combination tap assembly shall be sound and free from laps, blow hole and pitting. External and internal surface shall be clean, smooth and free from sand and be neatly dressed. All the parts fitted to pillar tap shall be axial, parallel and cylindrical with surfaces smoothly finished. Thickness of C.P coating shall not be less than service grade no.2 of IS 4827 and plating should be capable of taking high polish which shall not easily tarnish or scale.

2. **Workmanship:** Combination tap assembly shall be fixed to the pipe line as indicated in the drawing with necessary special as required or as ordered by Engineer-in-charge. Jointing shall be done with Teflon tape, etc. Combination tap assembly shall withstand and internally applied hydraulic pressure of 1.6Mpa (16 kg/sq. cm) for period of 1 minutes during which, it shall neither leak nor sweat. Leaky joint shall be remade to make it leak proof. **Testing-** Combination tap assembly wall / floor mounted as specified in the item, and in drawings, including free flanges and fixing

3. **Mode of Measurement:**

   i. These items shall be measured in numbers and rate quoted shall be per number only. The quoted rate shall include:
   ii. Jointing and fixing materials.
   iii. And necessary fittings, hardware, etc. to complete the above.
   iv. Cutting hole in wall / slab / beam etc. wherever required and making all damages good to original condition after completion of work.
   v. The rate shall be for a unit of one number and include cost of all labor, materials, tools and plant etc., required for satisfactory completion of this item as specified.

MR 14.020 : Supply, installation , testing & commissioning of 15mm CP brass single lever concealed bath and shower wall mixer with diverter with 3 way shower head, spout, OH shower with adjustable type arm with wall flange with slip fit connection & hand shower with flexible pipe with bracket.

Diverter Jaquar ARI 39079K with ALD -079, OHS-1757 140mm diameter with Shower arm: Jaquar SHA-477, HANDSHOWER : HSH 5541 , JAQUAR FLEXIBLE TUBE WITH SUPPORT : JAQUAR SHA CHR 549D8, SPOUT - JAQUAR SPJ-CHR-5463 OR EQUIVALENT FROM BASKET

1. **Materials:** The item pertains to provide CP brass combination of overhead shower with arm with all fittings as specified in the item and approved by Architect / EIC.Shower set shall comprise of two CP brass concealed stop cocks, four/five way auto-diverter, adjustable type over-head shower with CP shower arm, all with CP wall flanges of approved quality all as specified in the Schedule of Quantities. Bath spout, hand showers and pop up wastes shall also be provided wherever, specified. Wall flanges shall be kept clear off the finished wall. Wall flanges embedded in the finishing shall not be accepted.

2. **Workmanship:** Combination overhead assembly shall be fixed to the pipe line as indicated in the drawing with necessary special as required or as ordered by Engineer-in-charge. Jointing shall be done with Teflon tape, etc. Combination tap assembly shall withstand and internally applied hydraulic pressure of 1.6Mpa (16 kg/sq.cm) for period of 1 minutes during which, it shall neither leak nor sweat. Leaky joint shall be remade to make it leak proof. **Testing:** Combination assembly including fixing

3. **Mode of Measurement:**

    i. The rate includes cost of all labor and materials, tools and plant etc. required for satisfactory completion of the item.
    ii. The rate shall be for a unit of one number, including shower arm and shower hose.

MR 14.021 : Supply, installation , testing & commissioning of 15mm CP Wall Mixer brass ,shower head, OH shower with adjustable type arm with wall flange with slip fit connection & hand shower with flexible pipe with bracket.

JAQUAR WALL MIXER- FUS-CHR-29273UPR , OHS-1789 120 mm diameter with Shower arm: Jaquar SHA-477, OR EQUIVALENT FROM BASKET

DSR 17.1.1 : Providing and fixing water closet squatting pan (Indian type W.C. pan) with 100 mm sand cast Iron P or S trap, 10 litre low level white P.V.C. flushing cistern, including flush pipe, with manually controlled device (handle lever) conforming to IS : 7231, with all

fittings and fixtures complete, including cutting and making good the walls and floors wherever required. 17.1.1 White Vitreous china Orissa pattern W.C. pan of size 580x440 mm with integral type foot rests

MR 14.022:Supply, installation , testing & commissioning C.P. brass bib tap with wall flange of approved quality conforming to IS:8931 a) 15 mm nominal bore.

A) 15mm nominal bore

Model Jaquar CON 107KN OR EQUIVALENT FROM BASKET

Please refer specification under item 14.20

MR 14.023 : Supply, installation , testing & commissioning of Soap Dispenser with all accessories as required and making good the walls wherever required.

Jaquar1137N OR EQUIVALENT FROM BASKET

1. **Materials:** The Soap Dispenser shall be of Make as specified and of size and design as approved by the Architect / Engineer-in-charge. Towel Ring shall conform as per Manufacturers standard and should have ISI mark. The chromium plating shall be of grade 'B' type conforming to I.S. 1068-2958

2. **Workmanship:** Soap Dispenser shall be fixed in position as per drawings or as directed by Architect / EIC to the wall with C.P brass or SS screws as approved by Architect / EIC, with the help of PVC grip of HILTI/Fischer or equivalent.

3. **Measurement:**
   i. The rate includes cost of all labor and materials, tools and plant etc. required for satisfactory completion of the item.

   ii. The rate shall be for a unit of one number.

MR14.024 :Providing and Fixing 2 Nos. CP support arms and backrest of 35 mm dia to be mounted on the track (vertically and laterally) for handicap toilet complete as required. Model : Parryware T6608A1 or equivalent from Basket

1. **Materials:** These are wall-fixed rails which run in one direction only. They can be fixed in a horizontal or a vertical position, or at an incline / angle. There are specifications for grab rails in the national catalogue which operates equipment prescriptions as per drawings and client requirement.

2. **Workmanship:** Support arms shall be fixed on wall as indicated in the drawing with necessary special as required or as ordered by Engineer-in-charge.

3. **Mode of Measurement:**

i. These items shall be measured in numbers and rate quoted shall be per number only.
ii. The quoted rate shall include:
   a. Jointing and fixing materials.
   b. And necessary fittings, hardware, etc. to complete the above.
   c. Cutting hole in wall / slab / beam etc. wherever required and making all damages good to original condition after completion of work.
   d. The rate shall be for a unit of one number and include cost of all labor, materials, tools and plant etc., required for satisfactory completion of this item as specified.

MR 14.025:Providing and Fixing Grab Bar 600mm long for handicap toilet.
Model - JAQUAR AHS-1507 /Parryware T660A1 or Equivalent from basket
Please refer specifications under item no MR 14.024

15 INTERNAL DRAINAGE

MR 15.001 :Providing, fixing , Testing and Commissioning of Type B Ringfit UPVC SWR pipes for vent, soil, waste, confirming to IS 13592 and Fittings confirming IS 14735. Cost shall be inclusive of providing and fixing of all fittings (plain or door) e.g. bends, junctions, cowls, offsets, access pieces in pipes, & G.I. clamps spaced at 1.0 m centre to centre for wall and roof, jointing with solvent cement joints including cutting chase or making holes in walls and floors and making good as per specification and directed by Engineer Incharge

a)75mm Outer Dia.

MR 15.002 :b)110 mm Outer Dia.

1. **Materials:** The pipes shall be round and shall be supplied in straight lengths with socketed ends. The internal and external surfaces of pipes shall be smooth, clean, and free from grooving and other defects. The ends shall be cleanly cut and square with the axis of the pipe. The pipes shall be designed by external diameter and shall conform to IS 13592 shall be Type B,6 Kg/sq.cm pressure rating.

   Fittings: Fittings shall be of the same make as that of pipes, injection molded and shall confirm to Indian Standard. The specials and fitting shall be confirms to IS: 7834 shall be of best quality. The pipe shall be provided with bends, junctions, inspection doors, offsets, cowl, access pieces/plugs etc. jointing with Solvent cement (lubricant) including cutting holes in walls and making good the same. The Access door shall be secured air and water tight with 3mm thick insertion rubber washer and white lead. The bolts shall be lubricated with grease or white lead for easy removal.

   Lubricant: Lubricant is available in 100 gms, 250 gms& 500 gms packing. It is specially formulated for compatibility with rubber seal as well as PVC. It does not support the growth of bacteriaor fungi. Solvent joints shall be used as per manufacturer's recommendations.

2. **Workmanship:** The P.V.C. Pipes of specified diameter shall be fixed as directed. Due to thermal expansion of rigid P.V.C. Pipes, due allowance shall be made particularly in over ground pipe lines for any change in length of pipe line which may occur during installation or when pipe line is in service. All pipes shall be fixed in gradient towards the outfalls of drains. Pipes inside a toilet room shall be in chase unless otherwise shown on drawings. Where required pipes may be run at ceiling level in suitable gradient and supported on structural clamps

2.1 **Jointing the pipes:**

The jointing of the pipes to the fittings shall be done as per the manufacturer's instructions / recommendation. The rubber ring socket fittings and pipes shall be jointed as follows. The pipes and sockets shall be accurately cut. Clean the outside of the pipes spigot end and the inside of the ceiling groove of the fitting. Apply the lubricant uniformly to the spigot end, sealing ring and pass the spigot end into the socket containing sealing ring until fully home. Since solvent cement is aggressive to P.V.C., care must be taken to avoid applying excessive cement to the inside of pipe sockets as any surplus cement cannot be wiped off after jointing. Mark the position of the socket edge with pencil or felt open on the pipe, then withdraw the pipe from the socket by approximately 10 mm to make the pipe fully fitted to the fitting.

If manufacture recommends its own methods of jointing, the same shall be adopted after necessary approval from the Engineer-in-charge. Fixing of the pipe with fittings on the sunk and in below ground or in plinth.

In case of fixing of pipes and fittings on the slab & below flooring these shall run on the surface of the slab Under the floors, the pipe shall be laid in layer of sand filling &then apply PCC cover of 1:4:8 on the pipe.

2.2 **Supports**

UPVC pipes require supports at close intervals. Pipes shall be aligned properly before fixing them on the wooden plugs with clamps. Even if the wooden plugs are fixed using a plumb line, pipe shall also be checked for its alignment before clamping, piping shall be properly supported on, or suspended from clamps, hangers as specified and as required. The Contractor shall adequately design all the brackets, saddles, anchors, clamps and hangers and be responsible for their structural sufficiency. Pipe supports shall be primer coated with rust preventive paint.

All vertical pipes shall be fixed by galvanized clamps and galvanized angle brackets truly vertical. Branch pipes shall be connected to the stack at the same angle as that of the fittings. No collars shall be used on vertical stacks. Each stack shall be terminated at top with a cowl (terminal guard).

Horizontal pipes running along ceiling shall be fixed on galvanized structural adjustable clamps of special design shown on the drawings or as directed. Horizontal pipes shall be laid to uniform slope and the clamps adjusted to the proper levels so that the pipes fully reset on them.

Contractor shall provide all sleeves, openings, hangers, inserts during the construction. He shall provide all necessary information to the building contractor for making such provisions in the structure as necessary. All damages shall be made good to restore the surfaces.

All pipes clamps, supports and hangers shall be galvanized. Factory made prefabricated clamps shall be preferred. Contractor may fabricate the clamps of special nature and galvanize them after fabrication but before installation. All nuts, bolts, washers and other fasteners shall be factory galvanized.

Clamps shall be of approved design and fabricated from MS flats (which shall be galvanized after fabrication) of thickness and sizes as per drawings or contractor's shop drawings. Clamps shall be fixed in accordance to manufacturer's details/shop drawings to be submitted by the contractors.

When required to be fixed on RCC columns, walls or beam they shall be fixed with approved type of galvanized expansion anchor fasteners (Dash fasteners) of approved design and size according to load.

Structural clamps e.g. trapeze or cluster hangers shall be fabricated by electro-welding from MS structural members e.g. rods, angles, channels flats as per contractors shop drawings shall be galvanized after fabrication. All nuts, bolts and washers shall be galvanized.

Galvanized slotted angle/channel of approved sizes supports on walls shall be provided wherever shown on shop drawings. Angles/channels shall be fixed to brick walls with bolts embedded in cement concrete blocks and to RCC walls with anchor fasteners mentioned above. The spacing of support as specified below:

(mm)	Horizontal(m)	Vertical (m)
Upto 15	1.00	1.50
20 - 25	1.50	2.00
32 - 125	2.00	3.00
Over 125	3.00	4.00

2.3 **Repairs:**

While temporary or emergency repairs may be made to the damaged pipes, permanent repairs should be made by replacement of the damaged section. If any split or chip out occurs in the wall of the pipe, a short piece of pipe of sufficient length to cover the damaged portion of the pipe is cut. The sleeve is cut longitudinally and heated sufficiently to soften it so that it may be slipped over the damaged hard pipe.

3. Testing

After laying and jointing the pipes and fittings shall be inspected under working conditions of pressure and flow. PVC pipes and fittings shall be tested for 1.5 times the maximum working pressure. The openings of the pipes shall be sealed for thesection to be tested. The pipe shall be slowly and carefully charged with water allowing all air to escape and avoiding all shock and water hammer. The draw off takes and stop cock shall then be closed and specified hydraulic pressure shall be applied gradually. The pressure gauge must be accurate. The pipes and fittings shall be tested in sections as the work of laying proceeds keeping the joints exposed for inspection during the testing. The water pressure shall be maintained for minimum of two hour. The engineer shall examine carefully all the joints for leakage. Any joint found leaking shall be redone, and all leaking pipes removed and replaced without extra cost.

4. Mode of measurement:

i. The description of each item shall unless otherwise stated, be held to include where necessary, conveyance, and delivery, handling unloading, storing fabrication, hoisting, all labor for finishing to required shape and size; testing, fitting in position, straight, cutting and waste, return of packing
ii. The length shall be measured on running meter basis of finished work. The length shall be taken along the center line of the pipe and fittings. The pipes fixed to floors etc. shall be measured and paid under this item.
iii. All measurements of cutting shall unless otherwise stated be held to include the consequent waste.
iv. In case of fitting of unequal bore, the largest bore shall be measured for the rest.
v. Connection to down take pipe
vi. Testing of pipe lines fittings and joints include for providing all plant and appliances necessary for obtaining access to the work to be tested and carrying out the tests.
vii. The rate shall be for a unit of one running meter.

MR 15.003 :Supply, installation , testing & commissioning in position SWR PVC P trap of self-cleaning design of following sizes. Making proper connection with Cutting chase / hole in floors /slabs and bringing the same in proper condition in cement concrete 1:2:4 mix complete as per specifications. including cost of cutting and making good the walls and floors after installation of P traps wherever required.

a) 100mm inlet and 75mm outlet

MR 15.004:b) 100mm inlet and outlet

1. **Materials:** Floor traps gratings shall be in two pieces. Outer frame 150mm square with round SS-316 grating with hinge or without hinge as approved by Architect / EIC shall be used.

2. **Workmanship:** The grating shall be embedded in white cement sand mortar 1:2. The joint shall be leakage proof as per drawings and as directed. Rate shall be inclusive of cutting of floor in best workmanship manner. Centre of jali and center of the floor trap shall be coinciding. The trap shall be installed at lowest point to ensure no pending occurs at perimeters of the drain

3. **Mode of measurements & payment:**

   i. The rate includes cost of all labor, materials, tools and plants etc. required for satisfactory of this item.
   ii. The rate shall be for a unit of one number.

MR 15.005 : Supply, installation , testing & commissioning PVC saddle for connecting two or three inlet waste connection of 32/40 and 50mm nominal dia. , including cutting and chasing as required

Please refer specifications under item no MR 15.002

MR 15.006 : Supply, installation, testing & commissioning100mm x 63mm PVC waste reducing elbow including cutting chases, making holes in the floor / slab, repairs complete as required and connection to PVC pipes

Please refer specifications under item no MR 15.002

MR 15.007:Supply, installation, testing & commissioning brass floor/ceiling clean out plug with suitable inlet key for opening male threaded joint with UPVC pipe& socket. Including socketed joint complete as required

a) For 75 mm dia. Pipe

MR 15.008:b) For 110mm dia. pipe

Please refer specifications under item no MR 15.002

MR 15.009 : Supplying, installation , testing & commissioning of uPVC pipes and fittings (For Internal drainage & roof drainage) confirming to IS 4985 for drain in wall / floor / open, pressure rating 6 kg/cm2 tested to IS 2556 (XIII), seals to traps as per IS 5329, including all accessories, breaking / chasing walls, making necessary holes in floor, walls etc. as per approved specifications and making good etc., Cement mortar encasing under floor within toilets.

(a)32 mm dia. OD waste pipe (8 kg/cm^2)

MR 15.010 : b) 40 mm dia. OD Waste pipe
MR 15.011 :c) 50mm dia. OD waste pipe
MR 15.012 :d) 110mm dia. OD waste pipe
MR 15.013 :e) 160mm dia. OD waste pipe

Please refer specifications under item no MR 15.002

WASTE PIPE FROM APPLIANCES

1. Waste pipe from appliances e.g. wash basins, sinks, urinals, bathtubs, water coolers shall be of PVC as given in the Schedule of Quantities or as shown on the drawings.

2. All pipes shall be fixed in gradient towards the outfalls of drains. Pipes inside a toilet room shall be in chase unless otherwise shown on drawings. Where required pipes may be run at ceiling level in suitable gradient and supported on structural clamps. Spacing for clamps for such pipes shall be as follows:-

	Vertical	**Horizontal**
PVC pipes	300 cms	240 cms

PVC Pipes

Pipes shall be galvanized steel tubes conforming to IS: 4985-2000 (Class -3) and quality certificates shall be furnished. Pipes shall be provided with all required fittings e.g. Tees, Couplings, Bends, Elbows, Unions, Reducers, Nipples, and Plugs. All PVC waste pipes shall be terminated at the point of connection with the appliance with an outlet of suitable diameter.

Dimension of Pipes as shown under:

WALL THICKNESS FOR WORKING PRESSURE (IS4985:1988(Extract)

SI.No	**Outer Dia. mm**	**Tolerance Outside diameter**	**Class 3 (6kg/cm^2)**		**Class 4 (10kg/cm^2)**	
			Minimum	**Maximum**	**Min.**	**Max**
1	20	+0.3	-	-	1.1	1.5
2	25	+0.3	-	-	1.4	1.8
3	32	+0.3	-	-	1.8	2.2
4	40	+0.3	1.4	1.8	2.2	2.7
5	50	+0.3	1.7	2.1	2.8	3.3
6	63	+0.3	2.2	2.7	3.5	4.1
7	75	+0.3	2.6	3.1	4.2	4.9
8	90	+0.3	3.1	3.7	5.0	5.7

9	110	+0.4	3.7	4.3	6.1	7.0
10	140	+0.5	4.8	5.5	7.7	8.7
11	160	+0.5	5.4	6.2	8.8	9.9
12	180	+0.6	6.1	7.0	9.9	11.1
13	200	+0.6	6.8	7.7	11.0	12.3
14	225	+0.7	7.6	8.6	12.4	13.9
15	250	+0.8	8.5	9.6	13.8	15.4

DSR 12.44 : Providing and fixing to the inlet mouth of rain water pipe cast iron grating 15 cm diameter and weighing not less than 440 grams.

INTERNAL & EXTERNAL WATER SUPPLY

DSR Item No. 18.8.1 :Providing and fixing Chlorinated Polyvinyl Chloride (CPVC) pipes SDR-11 confirming to IS 15778, having thermal stability for hot & cold water supply, including all CPVC plain & brass threaded fittings, i/c fixing the pipe with clamps at 1.00 m spacing. This includes jointing of pipes & fittings with one step CPVC solvent cement and the cost of cutting chases and making good the same including testing of joints complete as per direction of Engineer in Charge.Concealed work, including cutting chases and making good the walls etc.

15 m nominal outer dia.

DSR Item No. 18.8.2 :20mm nominal outer dia.

DSR Item No. 18.8.3 :25mm nominal outer dia.

MATERIAL:CPVC pipes & fittings used in hot & cold potable water distribution system shall conform torequirement of IS 15778. The material from which the pipe is produced shall consist of chlorinated polyvinyl chlorides. The polymer from which the pipe compounds are to be manufactured shall have chlorine content not less than 66.5%.

The internal and external surfaces of the pipe shall be smooth, clean and free from grooving and other defects. The pipes shall not have any detrimental effect on the composition of the water flowing through it.

Diameter and wall thickness of CPVC pipes are as per given in Table 18.16 below:

TABLE 18.16

Sl. No.	Nomi-nal Size	Nominal Outside Diameter	Mean Outside Diameter		Outside Diameter at any point		Wall thickness					
							Class 1, SDR 11			Class 3, SDR 17		
			Min	Max	Min	Max	Avg.	Min	Max	Avg.	Min	Max

							Max			Max		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
(i)	15	15.9	15.8	16.0	15.8	16.0	2.2	1.7	2.2	-	-	-
(ii)	20	22.2	22.1	22.3	22.0	22.4	2.5	2.0	2.5	-	-	-
(iii)	25	28.6	28.5	28.7	28.4	28.8	3.1	2.6	3.1	-	-	-
(iv)	32	34.9	34.8	35.0	34.7	35.1	3.7	3.2	3.7	-	-	-
(v)	40	41.3	41.2	41.4	41.1	41.5	4.3	3.8	4.3	-	-	-
(vi)	50	54.0	53.9	54.1	53.7	54.3	5.5	4.9	5.5	-	-	-
(vii)	65	73.0	72.8	73.2	72.2	73.8	-	-	-	4.8	4.3	4.8
(viii)	80	88.9	88.7	89.1	88.1	89.7	-	-	-	5.9	5.2	5.9
(ix)	100	114.3	114.1	114.5	113.5	115.1	-	-	-	7.5	6.7	7.5
(x)	150	168.3	168.0	168.6	166.5	170.1	-	-	-	11.1	9.9	11.1

Notes

For CPVC pipes SDR is calculated by dividing the average outer diameter of the pipe in mm by the minimum wall thickness in mm. If the wall thickness calculated by this formula is less than 1.52 mm, it shall be increased to 1.52 mm. The SDR values shall be rounded to the nearest 0.5.

Dimensions of Pipes

The outside diameter, outside diameter at any point and wall thickness shall be as given in Table 18.16.

Diameter: The outside diameter and outside diameter at any point as given in Table 18.16shall be measured according to the method given in IS 12235 (part 1).

Diameter at any point: The difference between the measured maximum outside diameter and measured minimum outside diameter in the same cross-section of pipe (also called tolerance on ovality) shall not exceed the greater of the following two values:

(a) 0.5 mm, and
(b) 0.012 d_n rounded off to the next higher 0.1 mm.

Wall Thickness: The wall thickness of the pipes shall be as given in Table 18.16. Wall thickness shall be measured by any of the three methods given in IS 12235 (part 1). To check the conformity of the wall thickness of the pipe throughout its entire length, it is necessary to measure the wall thickness of the pipe at any point along its length. This shall be done by cutting the pipe at any point along its length and measuring the wall thickness as above. Alternatively, to avoid destruction of the pipe, nondestructive testing methods such as the use of ultrasonic wall thickness measurement gauges shall be used at any four points along the length of the pipe.

Tolerance on Wall Thickness

For pipes of minimum wall thickness 6 mm or less, the permissible variation between the minimum wall thickness (eMin) and the wall thickness at any point (e), (e - eMin) shall be positive in the form of +y, where y=0.1 eMin+0.2 mm.

For pipes of minimum wall thickness greater than 6mm, the permissible variation of wall thickness shall again be positive in the form of +y, where y would be applied in two parts.

The average wall thickness shall be determined by taking at least six measurements of wall thickness round the pipe and including both the absolute minimum and absolute maximum measured values. The tolerance applied to this average wall thickness from these measurements shall be within the range 0.1 eMin+0.2 mm (see Table 18.16).

The maximum wall thickness at any point shall be within the range 0.15eMin (see Table 18.16).

The results of these calculations for checking tolerance shall be rounded off to the next higher 0.1 mm.

Effective Length (Le): If the length of a pipe is specified, the effective length shall not be lessthan that specified. The preferred effective length of pipes shall be 3, 5 or 6 m. The pipes may be supplied in other lengths where so agreed upon between the manufacturer and the purchaser.

Pipe Ends

The ends of the pipes meant for solvent cementing shall be cleanly cut and shall be reasonably square to the axis of the pipe or may be chamfered at the plain end.

Physical and Chemical Characteristics

Visual Appearance: Thecolor of the pipes shall be off-white. Slight variations in theappearance of the color are permitted.

The internal and external surface of the pipe shall be smooth, clean and free from grooving and other defects.

Opacity : The wall of the plain pipe shall not transmit more than 0.1 per cent of the visible lightfalling on it when tested in accordance with IS 12235 (Part 3).

Effect on Water: The pipes shall not have any determinate effect on the composition of thewater flowing through them, when tested as per 10.3 of IS 4985.

Reversion Test: When tested by the method prescribed in IS 12235 (Part 5/ Sec 1 and Sec 2),a length of pipe 200 ±20 mm long shall not alter in length by more than 5 per cent.

Vicat Softening Temperature: When tested by the method prescribed in IS 12235 (part 2),the Vicat softening temperature of the specimen shall not be less than 110°C.

Density: When tested in accordance with IS 12235 (Part 14), the density of the pipes shall bebetween 1450kg/m^3 and 1650kg/m^3.

Mechanical Properties

Hydrostatic Characteristics: When subject to internal hydrostatic pressure test in accordancewith the procedure given in IS 12235 (part 8/Sec 1), the pipe shall not fail during the prescribed test duration. The temperatures, duration and hydrostatic (hoop) stress for the test shall conform to the requirements given in Table 18.17. The test shall be carried out not earlier than 24 h after the pipes have been manufactured.

TABLE 18.17
Requirements of Pipes for Internal Hydrostatic Pressure Test

Sl. No.	Test	Test Temperature Min	Test Period	(Hoop) Hydrostatic Stress
		°C	H	MPa
(1)	(2)	(3)	(4)	(5)
(i)	Acceptance	20	1	43.0
(ii)	Type	95	165	5.6
(iii)	Type	95	1000	4.6
(iv)	Type	95	8760	3.6 (Test for thermal stability)

Thermal Stability by Hydrostatic Pressure Testing : When subject to internal hydrostaticpressure test in accordance with the procedure given in IS 12235 (Part 8/Sec 1) and as per requirement given in Table 18.17, Sl. No. (iv), the pipe shall not burst or leak during the prescribed test duration.

Resistance to External Blow at 0°C: When tested by the method prescribed in IS 4985, withclassified striker mass and drop height as given in Table 18.18, the pipe shall have a true impact rate of not more than 10 per cent.

TABLE 18.18
Classified Striker Mass and Drop Height Conditions for the Falling Weight Impact Test
(Clause 18.9.5.3)

Sl. No.	Nominal Pipe Size	Mass of Falling Weight	Falling Height
	mm	Kg	mm
(1)	(2)	(3)	(4)
(i)	15	0.5±0.5%	300±10
(ii)	20	0.5±0.5%	400±10
(iii)	25	0.5±0.5%	500±10
(iv)	32	0.5±0.5%	600±10
(v)	40	0.5±0.5%	800±10
(vi)	50	0.5±0.5%	1000± 10
(vii)	65	0.8±0.5%	1000±10

(viii)	80	0.8±0.5%	1200±10
(ix)	100	1.0±0.5%	1600±10
(x)	150	1.6±0.5%	2000±10

Flattening Test: When tested by the method prescribed in IS 12235 (part 19), pipe shall showno signs of cracking, splitting and breaking.

Tensile Strength: When tested by the method prescribed in IS 12235 (Part 19), the tensilestrength at yield shall not be less than 50 MPa at 27 ± 2°C.

Sampling and Criteria for Conformity
The sampling procedure and criteria for conformity shall be as given in Annexure F.

Marking
Each pipe shall be clearly and indelibly marked in ink/paint or hot embossed on white base at intervals of not more than 3 m. The marking shall show the following:
Manufacturer's name or trade-mark
Outside diameter,
Class of pipe and pressure rating, and
Bath or lot number

BIS Certification Marking: Each pipe may also be marked with the Standard Mark.

Fittings
The fittings shall be as follows:
Plain CPVC solvent cement fittings from size 15 mm to 160 mm.
Brass threaded fittings.
Valve from size 15 mm to 160 mm
Brass Threaded Fittings: All types of one end brass threaded male/female adaptors in various fittings like coupler, socket, elbow, tee are available for transition to other plastic/metal piping and for fixing of CP fittings. Ball, Gate valves in CPVC are available in all dimensions. All fittings shall carry the following information:

1. Manufacturer's name/trade mark.
2. Size of fitting

Piping Installation Support and Spacing

Concealed Piping: Pipes can be concealed in chases. The pipes and fitting are to be pressuretested prior to concealing the chases. To maintain alignment of CP fittings while joining, all alignment of fittings and pipe shall be done correctly. DO NOT USE NAILS FOR HOLDING OF PIPES IN THE
CHASES.

External Installations: For pipes fixed in the shafts, ducts etc. there should be sufficient spaceto work on the pipes. Pipes sleeves shall be fixed at a place the pipe is passing through a wall or floor so as to allow freedom for expansion and

contraction. Clamping of the pipe is done to support it while allowing the freedom for movement.

All pipes exposed to sunlight shall be painted with a water based acrylic paint emulsion to enhance UV protection. Pipes in trenching shall be laid in accordance to the Good Plumbing practices followed for Metal piping.

Recommended Support Spacing (Distance between Pipe Clamps Horizontal Support)

Pipe Size	Horizontal Support (In meters)			
	Temperature			
	23°C	38°C	60°C	82°C
16 mm (1/2")	1.22	1.22	1.07	0.92
20 mm (3/4")	1.53	1.37	1.22	0.92
25 mm (1/0")	1.68	1.3	1.37	0.92
32 mm (1 1/4")	1.83	1.68	1.53	1.22
40 mm (1 1/2")	1.98	1.83	1.68	1.22
50 mm (2")	2.29	2.14	1.98	1.22

Expansion LOOP: CPVC systems, like all piping materials, expand and contract with changesin temperatures. CPVC pipes shall expand 7.5 cm per 30 m length for a 40^0C temperature change.
Expansion does not vary with Pipe size. Thermal expansion can be generally be accommodated at changes in direction. On a long straight run, an offset or loop based on the following chart is required.

Nominal Pipe Size	Length of Run (Meter), Loop length in cms.				
	6 metre	12 metre	18 metre	24 metre	30 metre
15 mm	43	56	69	79	86
20 mm	48	66	81	91	104
25 mm	53	74	91	104	117
32 mm	58	81	102	117	130
40 mm	63	89	109	127	142
50 mm	71	102	124	145	63

Testing

All water supply systems shall be tested to hydrostatic pressure test. The pressure tests are similar to the test pressure used for other plastic/metal pipes. System may be tested in sections and such section shall be entirely checked on completion of connection to the overhead tank or pumping system or mains.

PROCEDURE FOR PRESSURE TEST

Each valved section of the pipe shall be slowly filled with water and all air shall be expelled from the pipe through hydrants and blow-offs. If these are not available at high places, necessary tapping may be made at points of highest elevation before the test is made and plugs inserted after the tests have been completed.

If the trench has been partially back-filled the specified pressure based on the elevation of the lowest point of the line or section under test and corrected to the elevation of the test gauge, shall be applied by means of a pump connected to the pipe in a manner satisfactory to the Engineer-in-Charge. The duration of the test shall not be less than 5 minutes.

Examination under Pressure: All exposed pipes, fittings, valves, hydrants and joints should be carefully examined during the open-trench test. When the joints are made with lead, all such joints showing visible leaks shall be re-caulked until tight. When the joints are made with cement and show seepage or slight leakage, such joints shall be cut out and replaced as directed by the authority. Any cracked or defective pipes, fittings, valves or hydrants discovered in consequence of this pressure test shall be removed and replaced by sound material and the test shall be repeated until satisfactory to the Engineer-in-Charge.

If the trench has been back-filled to the top, the section shall be first subjected to water pressure normal to the area and the exposed parts shall be carefully examined. If any defects are found, they shall be repaired and the pressure test repeated until no defects are found. The duration of the final pressure tests shall be at least one hour

Procedure for Leakage Test

Leakage is defined as the quantity of water to be supplied into the newly laid pipe, or any valvedsection thereof, necessary to maintain the specified leakage test pressure after the pipe has been filled with water and the air expelled.

No pipe installation shall be accepted until the leakage is less than the number of cm^3/h determined by the formula:

$$Ql = ND\sqrt{p}/3.3$$

Where
Ql = the allowable leakage in cm3/h.
N = number of joints in the length of the pipe line.
D = diameter in mm, and the average test pressure during the leakage testing
kg/cm2.

Variation from Permissible Leakage: Should any test of pipe laid in position discloses leakagegreater than that specified in Para 5 the defective joints shall be repaired until the leakage is within the specified allowance.

GUIDELINES FOR STORAGE AND INSTALLATION OF CPVC PIPES

STORAGE
CPVC pipes of all sizes are packed in polyethylene packing rolls and both the ends of the packed roll are sealed with air bubble film cap in order to provide protection during handling and transportation. After packing, the whole bunch of pipes is tightened with polypropylene/ HDPE strapping. Each role is then marked

with size/type of the pipe, lot number and quantity. The packed pipe rolls are stored in their respective racks in properly covered storage area. Apart from providing protection during handling and transportation, the packing rolls also protect the pipe from ultra violet rays.

INSTALLATION GUIDELINES

Visually inspect pipe ends before making the joint. Use of a chamfering tool will help identify andcrakes, as it will catch on to any crack.

Pipe may be cut quickly and efficiently by several methods. Wheel type plastic tubing cutters arepreferred. Ratchet type cutter or fine tooth saw are another options. However, when using the ratchet cutter be certain to score the exterior wall by rotating the cutter blade in circular motion around the pipe. Do this before applying significant downward pressure to finalize the cut. This step leads to a square cut. In addition, make sure ratchet cutter blades are sharp. Cutting tubing as squarely as possible provides optimal bonding area within a joint.

Burrs and filings can prevent proper contact between the tube and fittings during the assembly,and should be removed from the outside and inside of the tube. A chamfering tool is preferred, but a pocket knife or file is also suitable for this purpose.

Use only CPVC cement jointing. Use CPVC cement, which is fully recommended by themanufacturer.

When using adhesive solution/solvent cement be certain of proper ventilation.

When making a join, apply a heavy, even coat of cement to the pipe end. Use the sameapplicator without additional cement to apply a thin coat inside the fitting socket. Too much cement can cause clogged waterways. Do not allow excess cement to puddle in the fitting and pipe assembly. This could result in a weakening of the pipe wall and possible pipe failure when the system is pressurized.
Rotate pipe one-quarter to one-half turn while inserting it into the fitting socket and remove theexcess adhesive solution/solvent cement from the joint with clean rag.

When making a transition connection to metal threads, use a special transition fitting or CPVCmale threaded adapter whenever possible. Do not over-torque plastic threaded connections. Hand tight plus one-half turn should be adequate.

Hang or strap CPVC systems loosely to allow for thermal expansion. Do not use metal strapswith sharp edges that might damage the tubing.

CPVC stub outs for lavatories, closets and sinks are appropriate. However, on areas where thereis a likelihood that movement or impact abuse will occur, metal pipe nipples may be amore appropriate stub-out material. Showerheads, tub spouts and outside still cocks are examples.

When connected to a gas water heater, CPVC tubing should not be located within 50 cm of theflue. For water heaters lacking reliable temperature control, this distance may be increased up to 1 m a metal nipple or flexible appliance connector should be utilized. This measure eliminates the potential for damage to plastic piping that might result from excessive radiant heat from the flue.

(Clause 18.9.6)

ACCEPTANCE TESTS

Acceptance test are carried out on samples selected from a lot for the purpose of acceptance ofthe lot.

Lot

All CPVC pipes in a single consignment of the same class, same size and manufactured under essentially similar conditions shall constitute a lot.

For ascertaining conformity of the lot to the requirements of the specification, samples shall betested from each lot separately.

Visual and Dimensional Requirements

The number of test samples to be taken from a lot shall depend on the size of the lot and theoutside diameter of the pipe, and shall be in accordance with Table F-1.

TABLE F-1

Scale of Sampling of Visual Appearance and Dimensional Requirements

(Clause F-1.4.1 and F-1.4.3)

Sl. No.	Number of pipes in the lot	Sample number	Sample size	Cumulative sample size	Acceptance number	Rejection number
(1)	(2)	(3)	(4)	(5)	(6)	(7)
(i)	Up to 1000	First Second	13 13	13 26	0 1	2 2
(ii)	1001 to 3000	First Second	20 20	20 40	0 1	2 2
(iii)	3001 to 10000	First Second	32 32	32 64	0 3	3 4
(iv)	10001 & above	First Second	50 50	50 100	1 4	4 5

These pipes shall be selected at random from the lot and in order to ensure the randomness ofselection, a random number table shall be used. For guidance and use of random number tables, IS-4905 may be referred to. In the absence of a random number table, the following procedure may be adopted:

Starting from any pipe in the lot, count them as 1, 2, 3, etc, up to r and so on, where r is the integral part of N/n, N being the number of pipes in the lot, and n the number of pipes in the sample. Every r^{th} pipe so counted shall be withdrawn so as to constitute the requires sample size.

The number of pipes given for the first sample in col. 4 of Table F-1, shall be taken from the lotand examined for visual and dimensional requirements given in Table 18.16 and 18.9.4.1. A pipe failing to satisfy any of these requirements shall be considered as defective. The lot shall be deemed to have satisfied these requirements, if the number of defectives found in the firm sample is less than or equal to the corresponding acceptance number given in col. 6 of Table F-1.

The lot shall be deemed not to have met these requirements, if the number of defectives found in the first sample is greater than or equal to the corresponding rejection number given in col. 7 of Table F-1. If, however, the number of defectives found in the first sample lies between the corresponding acceptance and rejection numbers given in

cols. 6 and 7, a second sample of the size given in col. 4 shall be taken and examined for the requirements. The lot shall be considered to have satisfied these requirements. The lot shall be considered to have satisfied these requirements if the cumulative sample is less than or equal to the corresponding acceptance number given in col. 6, otherwise not.

Reversion Test

The lot, having satisfied visual and dimensional requirements, shall be tested for reversion asgiven in 18.9.4.4.

For this purpose, the number of pipes given for the first sample in col. 4 of Table F-2 shall betaken from the lot. The sample pipe failing the reversion test shall be considered as defective. The lot shall be deemed to have met the requirements given in this specification for the reversion test, if the number of defectives found in the first sample is less than or equal to the corresponding acceptance number given in col. 6. This lot shall be deemed not to have met these requirements, if the number of defectives found in the first sample is greater than or equal to the corresponding rejection number given in col. 7 if, however, the number of defectives in the first sample lies between the corresponding acceptance and rejection numbers given in col. 6 and col. 7, a second sample of size given in col. 4 shall be taken and examined for the requirements. The lot shall be considered to have satisfied the requirements, if the number of defectives found in the cumulative sample is less than or equal to the corresponding acceptance number given in col. 6, otherwise not.

TABLE F-2
Scale of Sampling for Reversion, Vicat Softening Temperature and Density Test
(Clause F-1.5.2, F-1.6.2 and F-1.7.2)

Sl. No.	Number of pipes in the lot	Sample number	Sample size	Cumulative sample size	Acceptance number	Rejection number
(1)	(2)	(3)	(4)	(5)	(6)	(7)
(i)	Up to 1000	First	5	5	0	2
		Second	5	10	1	2
(ii)	1001 to 3000	First	8	8	0	2
		Second	8	16	1	2
(iii)	3001 to 10000	First	13	13	0	2
		Second	13	26	1	2
(iv)	10001 & above	First	20	20	0	3
		Second	20	40	3	4

Vicat Softening Test

The lot, having satisfied visual and dimensional requirements shall be tested for Vicatsofteningtemperature as described above

For this purpose, the procedure adopted for sampling and criteria for conformity shall be thesame as that for reversion as described above

Density
The lot, having satisfied the visual and dimensional requirements, shall be tested for density as described above

For this purpose, the procedure adopted for sampling and criteria for conformity shall be thesame as that for reversion as described above

TABLE F-3
Scale of Sampling for Resistance to External Blow at 0°C

Sl. No.	Number of pipes in the lot	Sample number	Sample size	Cumulative sample size	Acceptance number	Rejection number
(1)	(2)	(3)	(4)	(5)	(6)	(7)
(i)	Up to 3000	First Second	3 3	3 6	0 1	2 2
(ii)	3001 to 10000	First Second	3 5	5 10	0 1	2 2
(iii)	10000 & above	First Second	8 8	8 10	0 1	2 2

Internal Hydrostatic Pressure Test (Acceptance Test)

Same as described above

TABLE F-4
Scale of Sampling for Internal Hydrostatic Test
(Clause F-1.9.1 and F-1.9.3)

Sl. No.	Number of pipes in the lot	Sample size	Acceptance number
(1)	(2)	(3)	(4)
(i)	Up to 3000	2	0
(ii)	3001 to 10000	3	0
(iii)	10000 & above	5	0

Verification of Malfunction Temperature T_{mal}

For this test, the manufacturer to the testing authority one assembly, selected preferably from a regular production lot.

Opacity
For this test, the manufacturer or the supplier shall furnish to the testing authority one sample of the pipe of the thinnest wall section, selected preferably from a regular production lot.

The sample so selected shall be tested for compliance with requirements for opacity as given in 18.9.4.2.

If the sample passes the requirements of the opacity test, the type of the pipe under consideration shall be considered to be eligible for approval, which shall be valid for a period of one year.

In case the sample fails in the test, the testing authority, at its discretion, may call for a fresh sample and subject the same to the opacity test. If the sample passes the repeat test, the type of pipe under consideration shall be considered eligible for approval. If the sample fails in the repeat test, the type of pipe shall not be approved. The manufacturer or the supplier may be asked to improve the design and re-submit the product for type approval.

At the end of the validity period (normally one year) or earlier, if necessary, the testing authority may call for a fresh sample for opacity test for the purpose of type approval.

Test for Effect on Water

For this type test, the manufacturer or the supplier shall furnish to the testing authority three samples of the smallest size of pipe taken from each machine (selected preferably from a regular production lot).

Three samples so selected shall be tested for compliance with the requirements for effect on water as described above

If all three samples pass the requirements for effect on water, the type test of the pipe under consideration shall be considered to be eligible for approval, which hall be normally valid for a period of one year.

In case any of the samples fails in this test, the testing authority, at its discretion, may call for fresh samples not exceeding the original number, and subject them to the test for effect on water. If, in the repeat test, no single failure occurs, the type of pipe under consideration shall be considered eligible for type approval. If any of the samples fails in the repeat test, the type of pipe shall not be approved. The manufacturer or the supplier may be asked to improve the design and resubmit the product for type approval.

At the end of the validity period (normally one year) or earlier, if necessary, the testing authority may call for fresh samples for effect on water test for the purpose of type approval.

Internal Hydrostatic Pressure Test (Type Test) and thermal Stability

For this type test, the manufacturer or the supplier shall furnish to the testing authority, three samples of pipes of different diameters and different classes (selected preferably from a regular production lot).

Three samples so selected shall be tested for compliance with the requirements of type test given in Table as described above

If all the three samples pass the requirements of the quality test, the type of pipe under consideration shall be considered to be eligible for type approval which shall be normally valid for a period of one year.

In case any of the samples fail in this test, the testing authority, at its discretion, may call for fresh samples not exceeding the original number and subject them to the type test. If, in the repeat test, no single failure occurs, the type of pipe shall be considered for type approval. If any of the samples fails in the repeat tests, the type of pipe shall not be approved. The manufacturer or the supplier may be asked to improve the design and resubmit the product for type approval.

2. Measurements

The net length of pipes as laid or fixed shall be measured in running meters correct to a cm for the finished work, which shall include CPVC pipe and fittings including plain and Brass threaded fittings and jointing solvent cement

DSR Item NO. 18.7.1 : Providing and fixing Chlorinated Polyvinyl Chloride (CPVC) pipes SDR -11 , having thermal stability for hot & cold water supply, including all CPVC plain & brass threaded fittings, including fixing the pipe with clamps at 1.00 m spacing. This includes jointing of & fittings with one step CPVC solvent cement and testing of joints complete as per direction of Engineer in Charge.Internal work - Exposed on wall

(a) 15 mm nominal outer dia. Pipes
DSR Item No. 18.7.2 :(b) 20 mm nominal outer dia. pipes
DSR Item No. 18.7.3 :(c)25 mm nominal outer dia. Pipes
DSR Item No. 18.7.4 :(d) 32mm nominal outer dia. pipes
DSR Item No. 18.7.5 :(e)40 mm nominal outer dia. pipes
DSR Item No. 18.7.6 :(f) 50 mm nominal outer dia. pipes
MR 15.014 :(g) 62.5 mm nominal outer dia. Pipes- Sch 80
MR 15.015 :(h) 75 mm nominal outer dia. Pipes- Sch 80

Please refer specifications under para 18.9 of CPWD Civil work specifications Volume II 2009

MR 15.016 : Supply, installation , testing & commissioning of Nytril Rubber Insulation on Hot/ cold water having thermal conductivity .038 W/mok 0.212 BTU / (Hr-ft2-oF/inch) at an average temperature of 30oC ,temperature range of –40oC to 105oC,Density of material shall not be less than 0.06 gm/cm3, class O type, complete as per manufacturer recommendation

(a) 15 mm nominal outer dia. Pipes

MR 15.017:(b) 20 mm nominal outer dia. Pipes(9mm insulation thickness)

MR 15.018: (c) 25 mm nominal outer dia. Pipes(9mm insulation thickness)

MR 15.019: (d) 32 mm nominal outer dia. Pipes(13mm insulation thickness)

MR 15.020: (e) 40 mm nominal outer dia. Pipes(13 mm insulation thickness)

MR 15.021: (f) 50 mm nominal outer dia. Pipes(13 mm insulation thickness)
MR 15.022: (g) 62.5 mm nominal outer dia. Pipes(13 mm insulation thickness)

1 MATERIAL

Insulation material for Pipe insulation shall be Closed Cell Elastomeric Nitrile Rubber or closed cell cross linked polyethylene foam. Thermal conductivity of elastomeric nitrile rubber shall not exceed 0.038 W/moK or 0.0313 Kcal / MhroC or 0.212 BTU / (Hr-ft2-oF/inch) at an average temperature of 30oC. The product shall have temperature range of –40oC to 105oC. Density of material shall not be less than 0.06 gm/cm3. The insulation shall have fire performance such that it passes minimum CLASS 1 as per BS476 part 7 for surface spread of flame. Water vapor permeability shall not exceed 0.024 per inch (3 x 10-14 Kgs / m.sec.Pa). The material shall have approval from the Chief Fire Officer. Thickness of the insulation shall be as specified for the individual application. Each lot of insulation material delivered at site shall be accompanied with manufacturer test certificate for thermal conductivity values. Samples of insulation material from each lot delivered at site may be selected by Owner's site representative and gotten tested for thermal conductivity and density at Contractor's cost All joints shall be sealed properly with adhesive, which shall provide similar vapor barrier as the original insulating material. All hot water piping shall be insulated in the manner specified herein. Before applying insulation, all pipe shall be brushed and cleaned. Thermal insulation shall be applied as follows or as specified in drawings or schedule of quantity:

Pipe size (mm)	Thickness of Nitrile rubber insulation
15 mm to 25 mm	9 mm
32 mm to 50 mm	13 mm
65 mm and above	19 mm

Insulation for pipes in wall chase and for pipes in shaft / plant room.

Insulating material in tube form shall be sleeved on the pipes. On existing piping, slit opened tube from insulating material shall be placed over the pipe and adhesive (as recommended by the manufacturer) shall be applied as suggested by the manufacturer. Adhesive must be allowed to tack dry and then press surface firmly together starting from butt end and working towards center.

Wherever flat sheets shall be used it shall be cut out in correct dimension. All longitudinal and transverse joints shall be sealed as per manufacturer recommendations. The insulation shall be continuous over the entire run of piping, fittings and valves. All valves, fittings, joints, strainers etc. in hot water piping shall be insulated to the same thickness as specified for the main run of piping and application shall be same as above. Valves bonnet, yokes and spindles shall be insulated in such a manner as not to cause damage to insulation when the valve is used or serviced.

All insulation work shall be carried out by skilled workmen specially trained in this kind of work. All insulated pipes shall be labeled (HWS / HWR / HWRR) and provided with 300 mm wide band of paint along circumference at every 1200 mm for color coding. Direction of fluid shall also be marked. All painting shall be as per relevant BIS codes.

Protective Coating over Insulation

To provide mechanical strength and protection from damage all exposed pipe insulated with nytril rubber as indicated in BOQ shall be covered with fiberglass fabric. The fiberglass fabric shall be applied with one coat of fire proof epoxy or acrylic compound (resin & hardener). The coat shall be allowed to cure to nonstick state. Subsequently second coat of compound shall be applied to give a tough and smooth finish to the insulated surface

2 Measurement of Insulation

Unless otherwise specified measurement for pipe insulation for the project shall be on the basis of center line measurements described herewith Pipe Insulation shall be measured in units of length along the center line of the installed pipe, strictly on the same basis as the piping measurements. The linear measurements shall be taken before the application of the insulation. It may be noted that for piping measurement, all valves, orifice plates and strainers shall not be separately measurable by their number and size. It is to be clearly understood that for the insulation measurements, all these accessories including valves, orifice plates and strainers etc. shall be considered strictly by linear measurements along the center line of pipes and no special rate shall be applicable for insulation of any accessories, fixtures or fittings whatsoever

MR 15.023 : Providing and fixing proprietary polyshield outer mechanical protection over nitrile rubber insulation comprising of wrapping with poly glass tape helically wound and subsequently applying 2 coats of polyshield material (resin & hardner) as per manufacturers specification

(a) 15 mm nominal outer dia Pipes

MR 15.024 : (b) 20 mm nominal outer dia Pipes

MR 15.025 : (c) 25 mm nominal outer dia Pipes

MR 15.026 : (d) 32 mm nominal outer dia Pipes

MR 15.027 : (e) 40 mm nominal outer dia Pipes

MR 15.028 : (f) 50 mm nominal outer dia Pipes

MR 15.029 : (g) 65 mm nominal outer dia Pipes

MR 15.030 : Supplying & fixing full way lever operated forged brass ball valve of brass body with forged brass hard chrome plated steel ball tested to a pressure not less than 25 Kg / sqcm with threaded joints complete with nuts, bolts, male threaded adaptor, washers union etc.

(a) 15 mm nominal outer dia. Pipes

MR 15.031 : (b) 20 mm nominal outer dia. Pipes
MR 15.032 : (c) 25mm nominal outer dia. Pipes
MR 15.033 : (d) 32mm nominal outer dia. Pipes
MR 15.034 : (e) 40mm nominal outer dia. Pipes
MR 15.035 : (f) 50mm nominal outer dia. pipes

The ball valve shall be made brass body and suitable for test pressure of pipe line. The valve shall be internally threaded to receive pipe connections.

The ball shall be made from brass and machined to perfect round shape and subsequently chrome plated. The seat of the valve body-bonnet gasket and gland packing shall be of Teflon.

The handle shall be provided with PVC jacket. The handle shall also indicate the direction of 'open' and 'closed' situations. The gap between the ball and the Teflon packing shall be sealed to prevent water seeping.

The handle shall also be provided with a lug to keep the movement of the ball valve within 90°. The lever shall be operated smoothly and without application of any unnecessary force.

MR 15.036 : Supply, Installation, Testing and commissioning of slim seal type C.I. Butterfly valve (Body : Grey Cast Iron, shaft : SS, Disc : SG Iron (Rilson coated), Liner : HT - EPDM) of approved make with PN 10 rating flange dimensions shall be confirming to IS 6392, washer, nuts & bolts. Rated to temperature of 85 Deg C and tested to a pressure not less than 15 Kg/Sq.cm.

(a) 65mm nominal outer dia.
MR 15.037 : (b) 80mm nominal outer dia.
MR 15.038 : (c) 100mm nominal outer dia.
MR 15.039 : (d) 150mm nominal outer dia.

1. **Material:** The butterfly valve shall be flanged type or as specified conforming to IS 13095 & BS - 5155. The valve shall be bubble tight, resilient sealed suitable for flow in either direction with accompanying flanges and steel handle.The butterfly valve shall be suitable for waterworks and rated for 150 PSI Pressure requirement as mentioned in the Schedule of quantities. The body shall be of cast iron to IS: 210 in circular shape and of high strength to take the water pressure. The disc shall be heavy duty cast iron with anti-corrosive epoxy or nickel coating. The valve seat shall be of high grade elastomeric or nitrile rubber. The

valve is closed position shall have complete contact between the seat and the disc throughout the perimeter. The elastomeric rubber shall have a long life and shall not give away on continuous applied water pressure. The shaft shall be EN 8 grade carbon steel. The valve shall be fitted between two flanges on either side of pipe flanges. The valve edge rubber shall be projected outside such that they are wedged within the pipe flanges to prevent leakages

2. **Workmanship:** The butterfly valve shall be fixed to the pipe line in position as indicated in the drawing and as directed by the Engineer-In-Charge.
   TESTING: The valve and the joints shall be tested to a minimum hydraulically pressure of 16 kg/sq.cm for a duration of two hours or as per testing clause of piping work. The testing shall be done along with the testing of pipe line. The leaky joints shall be rectified to the satisfaction of the Engineer-in-Charge.

3. **Mode of Measurement:**
   a.) Supplying and fixing Butterfly Valve of specified diameter.
   b.) Supplying G.I. pipe and fittings if required.
   c.) All necessary labour, material and use of tools.
   d.) MODE OF MEASUREMENT: The measurement shall be for each unit of butterfly Valve fixed. C.I. and G.I. specials, making lead or flange joint etc. shall be measured under the relevant items

MR 15.040 :Providing & fixing gun metal / Bronze non – return valve of approved make with union / flange, washer, nuts & bolts. Rated to temperature of 85 Deg C and tested to a pressure not less than 15 Kg/Sq.cm.

(a) 15 mm nominal dia.

MR 15.041 : (b) 20mm nominal dia.

DSR 18.19.1.1 : (C) 25mm nominal dia.

1. **Material:** All valves shall be of gun metal suitable for the particular service as specified. All valves shall be of the particular duty and design as specified. Valves shall either be of screwed type or flanged type, as specified, with suitable flanges and non-corrosive bolts and gaskets. Tail pieces as required shall be supplied along with valves. Check valves shall conform to Indian Standard IS:776 and non-return valves

2. **Workmanship:** The non-return valve shall be fixed to the pipe line in position as indicated in the drawing and as directed by the Engineer-In-Charge.
   TESTING: The valve and the joints shall be tested to a minimum hydraulically pressure of 16kg/sq.cm for a duration of two hours or as per testing clause of piping work. The testing shall be done along with the

testing of pipe line. The leaky joints shall be rectified to the satisfaction of the Engineer-in-Charge.

3. Mode of Measurement:

a.) Supplying and fixing Non Return Valve of specified diameter.
b.) All necessary labour, material and use of tools.
c.) The measurement shall be for each unit of non-return valve fixed. CPVC MTA, making screw or flange joint etc. shall be measured under the relevant items

DSR ENM 2014 16.7.3.6 : NON RETURN VALVE with dual plate of CI body SS plates vulcanized NBR seal flanged end & PN 16 pressure rating

(a) 65 mm dia

MR 15.042:Supply, installation, testing & commissioning Gun metal of float valve with cast brass lever arm plastic ball confirming to IS 1703 of approved quality complete as per approved specifications.

(a) 32 mm nominal dia

MR 15.043: (b) 40 mm nominal dia

Ball valves with floats to be fixed in storage tanks shall consist of cast brass lever arm having PVC balls screwed to the arm integrally. The ball shall have bronze welded seams. The closing/opening mechanism incorporating the piston and cylinder shall be non-corrosive metal and include washers. The size and construction of ball valves and float shall be suitable for desired working pressure operating the supply system. Where called for brass valves shall be supplied with brass hexagonal back nuts to secure them to the tanks and a socket to connect to supply pipe.
Globe valves on Hot-water line shall be union bonnet with stem/disc and body seat ring of SS. Suitable for temperature up to 80° C.

SI.No.	Type of Valve	Size	Construction	Ends
a.	Isolating Valve	15 mm to 50 mm 65 mm and above	Gun Metal Gun Metal	Screwed Flanged
b.	Sluice Valve & Butterfly Valve	65 mm and above	Cast Iron	Flanged
c.	G.M. non return valve	15 mm to 50 mm 65 mm above	Gun Metal Gun Metal	Screwed Flanged

All valves shall be suitable for the working pressure involved

16 EXTERNAL PLUMBING WORKS

Please refer to Relevant paras of Specifications for Drainage works as per Sub head 19.0 of CPWD Civil works Specifications Volume II 2009.

DSR Item No. 2.8.1 :Earth work in excavation by mechanical means (Hydraulic excavator)/ manual means in foundation trenches or drains (not exceeding 1.5m in width or 10 sqm on plan), including dressing of sides and ramming of bottoms, lift upto 1.5 m, including getting out the excavated soil and disposal of surplus excavated soil as directed within a lead of 50 m.All kinds of soil.

DSR Item No. 2.10.1.2 :Excavating trenches of required width for pipes, cables, etc. including excavation for sockets, and dressing of sides, ramming of bottoms, depth upto 1.5 m, including getting out the excavated soil, and then returning the soil as required, in layers not exceeding 20 cm in depth, including compacting each deposited layer by ramming, watering, etc. and disposing of surplus excavated soil as directed within a lead of 50 m.
All kinds of soil (a) Pipes, cables etc. exceeding 80 mm dia. but not exceeding 300 mm dia

19.2 PIPES AND SPECIALS

19.2.1 Glazed Stone Ware Pipes and Fittings

All pipes with spigot and socket ends and fittings shall conform to class SP1 of IS 651. 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 tone when struck with a light hammer. There shall be no broken blisters. The thickness of pipes shall be as given in the Table 19.2.

TABLE 19.2
Stoneware pipes

Internal Diameter (mm)	Mean Thickness of the Barrel and Socket (mm)
100	12
150	15
200	16
230	19
250	20
300	25
350	30

400	35
450	37

The length of pipes shall be 60, 75, 90 cm exclusive of the internal depth of the socket. The pipes shall be handled with sufficient care to avoid damage to them.

19.2.1.1 S.W. Gully Trap (Fig. 19.2): Gully traps shall conform to IS 651. These shall be sound, freefrom visible defects such as fire cracks, or hair cracks. The glaze of the traps shall be free form crazing. They shall give a sharp clear tone when struck with light hammer. There shall be no broken blisters.

Each gully trap shall have 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 300 mm the cover weighing not less than 4.50 Kg and the frame not less than 2.70 Kg. The grating, cover and frame shall be of sound and good casting and shall have truly square machined seating faces.

19.2.1.2 Laying and Jointing Stone Ware Pipes : For all sewers and drains, glazed stoneware pipesshall be used as far as possible in preference to other types of pipes. These are suitable, particularly where acid effluents or acid sub-soil conditions are likely to be encountered.

Trenches: Specifications described in 19.2.2.1 shall apply, as far as possible.

The trench shall be so dug that the pipe can be laid to the required alignment and at the required depth. When the pipe line is under a roadway, a minimum cover of 90 cm is recommended for adoption, but it may be modified to suit local conditions. The trench shall be excavated only so far in advance of pipe laying as specified by the Engineer-in-Charge. The trench shall be so shored and drained that the workmen may work therein safely and efficiently. The discharge of the trench dewatering pumps shall be conveyed either to drainage channels or to natural drains.

The excavation shall be carried out with manual labor or with suitable mechanical equipment as approved by the Engineer-in-Charge.

Unless otherwise specified by the Engineer-in-Charge, the width at bottom of trenches for different diameters of pipes laid at different depths shall be as given below:—

For all diameters, up to an average depth of 120 cm, width of trench in cm = diameter of pipe + 30 cm.

For all diameters for depths above 120 cm, width of trench in cm = diameter of pipe + 40 cm.

Notwithstanding (a) and (b) the total width of trench shall not be less than 75 cm for depths exceeding 90 cm.

The width of trench in the upper reaches shall be increased as described in sub-head 'Earthwork'.

Laying (Fig. 19.11): Where the pipes are laid on soft soil with maximum water table lying at invert level of the pipe, the pipes shall be bedded in cement concrete with thickness and mix as specified, projecting on each side of the pipe to the specified width of the trench (Fig. 19.11(i)). The pipes with their crown level at 1.20 m depth and less from ground shall be covered with 15 cm thick. Concrete above the crown of the pipe and sloped off to meet the outer edges of the concrete, to give a minimum thickness of 15 cm all-around the pipe (Fig. 19.11 (iii)). Pipes laid at a depth greater than 1.20 m at crown and maximum water table level rising above the invert level of pipe, shall be concreted at the sides up to the level of the center of the pipe and sloped off from the edges to meet the pipe tangentially (Fig. 19.11(ii)).

The pipe shall be carefully laid to the alignments, 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 ends facing upstream. The body of the pipe shall for its entire length rest on an even bed of concrete and places shall be excavated in the concrete to receive the socket of the pipe.

Where pipes are not bedded on concrete, the trench floor shall be left slightly high and carefully bottomed up as pipe laying proceeds, so that the pipe barrels rest on firm and undisturbed ground. 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 40 mm 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 smooth surface the pipe shall be laid on a levelling course of concrete as desired.

When S.W. pipes are used for storm water drainage, no concreting will normally be necessary. The cement mortar for jointing will be 1:3 (1 cement: 3 fine sand). Testing of joints will also not be done.

Jointing: Tarred gasket or 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 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.

After a day's work any extraneous material shall be removed from the inside of the pipe. The newly made joints shall be cured for at least seven days.

Testing of Joints : Stoneware pipes used for sewers shall be subjected to a test pressure of 2.5 m head of water at the highest point of the section under test. Before commencing test, the pipeline shall be filled with water and maintained full for 24 hours under head of 0.6 m of water. The test shall be carried out by suitably plugging the lower end of the drain and the ends of the connection if any and filling the system with water. A knuckle bend shall be temporarily jointed in at the top end and a sufficient length of vertical pipe jointed to it so as to provide the required test head, or the top may be plugged with a connection to a hose ending in a funnel which could be raised or lowered till the required head is obtained and fixed suitable for observation. The tolerance of two liters per centimeter of diameter per kilometer may be allowed during a period of 10 minutes.

If any leakage is visible, the defective part of the work shall be cut out and made good. A slight amount of sweating which is uniform may be overlooked, but excessive sweating from a particular pipe or joint shall be watched for and taken as indicating a defect to be made good.

Any joint found leaking or sweating, shall be rectified or embedded into 15 cm layer of cement concrete (1:2:4) 30 cm in length and the section retested.

Refilling : In cases where pipes are not bedded on concrete special care shall be taken in refilling trenches to prevent the displacement and subsequent settlement at the surface resulting in uneven street 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 60 cm above the top of pipe so as not to disturb the pipe. No tamping should be done within 15 cm of the top of pipe.
Measurements : The lengths of pipes shall be measured in running meters nearest to a cm as laid or fixed, from inside of one manhole to the inside of the other manhole. The length shall be taken along the center line of the pipes over all fittings such as bends, junctions, etc. which shall not be measured separately.

Excavation, refilling, shoring and timbering in trenches, and cement concreting wherever required shall be measured separately under relevant items of work.

Rate: The rate shall include the cost of materials and labor involved in all the operations described above excluding the cost of concrete which shall be paid for separately.

Fixing S.W. Gully Trap (Fig. 19.2)

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.

Fixing: The gully traps shall be fixed on cement concrete foundation 65 cm square and not less than 10 cm thick. The mix for the concrete will be 1:5:10 (1 cement: 5 fine sand: 10 graded stone aggregate 40 mm nominal size). The jointing of gully outlet to the branch drain shall be done similar to jointing of S.W. pipes described above.

Brick Masonry Chamber : After fixing and testing gully and branch drain, a brick masonry chamber 300 x 300 mm (inside) in brick work of specified class in cement mortar 1:4 (1 cement: 4 fine sand) shall be built with a half brick 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 1:5:10 (1 cement: 5 fine sand: 10 graded stone aggregate 40 mm nominal size). The upper portion of the chamber i.e. above the top level of the trap shall be plas-tered inside with 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 so as to slope towards the grating.

C.I. cover with frame 300 × 300 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 20 mm nominal size) and rendered smooth. The finished top of cover shall be left about 4 cm above the adjoining ground level so as to exclude the surface water from entering the gully trap.

Measurements: The work shall be enumerated. Excavation shall be measured separately under relevant item of earth work.

Rate: The rate shall include the cost of materials and labor involved in all the operations described above, except earth work which shall be paid for separately.

19.2.2 Cement Concrete Pipes (with and without Reinforcement) (Light Duty, Non-Pressure)

The pipes shall be with or without reinforcement as required and shall be of class not lesser than NP2. These shall conform to IS 458 and shall be capable of withstanding a test pressure of 0.07 MPa (7 m head). The reinforced cement concrete pipes shall be manufactured by centrifugal (or spun) process while un - reinforced cement concrete pipes by spun or pressure process. 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 molding.

Concrete used for the manufacture of un-reinforced and 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 20 mm whichever is smaller for pipes above 250 mm internal diameter. But for pipes of internal diameter 80 to 250 mm, the maximum size of aggregate should be 10mm. The reinforcement in the reinforced concrete pipes shall extend throughout the length of the pipe. The circumferential and longitudinal reinforcements shall be adequate to withstand the specified hydrostatic pressure and further bending stresses due to the weight of water when running full across a span equal to the length of pipe plus three times its own weight.

The dimensional requirements of concrete pipes are given in Appendix I.

The minimum clear cover for reinforcement in pipes and collars shall be as given in Table 19.3.

TABLE 19.3

Sl. No.	Precast concrete pipe/collar	Minimum clear cover, mm
(i)	Barrel wall thickness	
(a)	Upto and including 75 mm	8
(b)	Over 75 mm	15
(ii)	At spigot steps	5
(iii)	At end of longitudinal	5

Note : An effective means shall be provided for maintaining the reinforcement in position and forensuring correct cover during manufacture of the unit. Spacers for this purpose shall be of rust proof material or of steel protected against corrosion.

19.2.2.1 Laying and Jointing Cement Concrete Pipes and Specials

Trenches: Trenches shall be as described in 18.4.4. Where the pipes are to be bedded directlyon soil, the bed shall be suitably rounded to fit the lower part of the pipe, the cost for this operation being included in the rate for laying the pipe itself.

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 pulley 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 be used. Pipes shall be laid true to line and grade as specified. Laying of pipes shall proceed upgrade of a slope.

If the pipes have spigot and socket joints, the socket ends shall face upstream. In the case of pipes 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 foundation conditions are unusual such as in the proximity of trees or holes, under existing or proposed tracks manholes etc. the pipe shall be encased all-around in 15 cm thick cement concrete 1:5:10 (1 cement : 5 fine sand : 10 graded stone aggregate 40 mm 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 foundations or on any other suitably designed structure. 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 of the pipe subject to the min. of 10 cm and a maximum of 30 cm. The concrete shall extend up the sides of the pipe at least to a distance of 1/4th of the outside diameter of pipes 300 mm 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 the backfill 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, shale or other hard material the space below the pipe shall be excavated and replaced with an equalising bed of concrete, sand or compacted earth. In no place shall pipe be laid directly on such hard material.

The method of bedding and laying the pipes under different conditions are illustrated in Fig. 19.9.

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 rigid foundations at intervals. Suitable arrangements 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 joints come in the center of the span. Care shall be taken to see that super imposed loads greater than the total load equivalent to the weight of the pipe when running full shall not be permitted.

Suitably designed anchor blocks at change of direction and grades for pressure lines shall be provided where required.

Jointing: Joints are generally of rigid type. Where specified flexible type joints may also beprovided.

Rigid Spigot and Socket Joint (Fig. 19.10): 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 the newly made joint shall be cured.

Rigid Collar Joint (Fig. 19.10): 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 rammed with caulking fool. After a day's work any extraneous materials shall be removed from the inside of the pipe and the newly made joint shall be cured.

Semi Flexible Spigot and Socket Joint (Fig. 19.10): The joint is composed of specially shaped spigot and socket ends on the concrete pipes. A rubber ring shall be placed on the spigot which shall be forced into the socket of the pipe previously laid. This compresses the rubber ring as it rolls into the annular space formed between the two surfaces of the spigot and the socket, stiff mixture of cement mortar 1:2 (1 cement: 2 fine sand) shall then be filled into the remaining annular space and rammed with a caulking tool. After day's work

any extraneous materials shall be removed from the inside of the pipe and the newly made joint shall be cured.

Semi Flexible Collar Joint: This is made up of a loose collar which covers two specially shaped pipe ends as shown in the Fig. 19.10. Each end shall be fitted with a rubber ring which when compressed between the spigot and the collar, seal the joint. Stiff mixture of cement mortar 1:2 (1 cement: 2 fine sand), shall then be filled into the remaining annular space and rammed with a caulking tool. After day's work, any extraneous material shall be removed from the inside of the pipe and the newly made joint shall be cured.

Internal Flush Joint (Fig. 19.10): This joint is generally used for culvert pipe of 60 cm dia and over. The ends of the pipe are specially shaped to form a self-centering joint with an internal jointing space 1.3 cm wide the finished joint is flush with both inside and outside with the pipe wall as shown in Fig. 19.10. The jointing space is filled with cement mortar 1:2 (1 cement: 2 fine sand) mixed sufficiently dry to remain in position when forced with a trowel or rammer. After day's work, any extraneous material shall be removed from the inside of the pipe and the newly made joint shall be cured.

External Flush Joint: This joint is suitable for pipes which are too small for jointing from inside. This joint is composed of specially shaped pipe ends as shown in Fig. 19.10. Each end shall be butted against each other and adjusted in correct position. The jointing space shall then be filled with cement mortar 1:2 (1 cement: 2 fine sand) sufficiently dry and finished off flush. Great care shall be taken to ensure that the projecting ends are not damaged as no repairs can be readily affected from inside the pipe.

In all pressure pipe lines the recess at the end of the pipe line shall be filled with jute braiding dipped in hot bitumen or other suitable approved compound. Pipes shall be so jointed that the bitumen ring of one pipe shall set into the recess of the next pipe. The ring shall be thoroughly compressed by jacking or by any other suitable method.

The number of pipes that shall be jacked together at a time shall depend on the diameter of the pipes and the bearing capacity of the soil, for small pipes up to 25 cm diameter, six pipes can be jacked together at a time.

The quantity of jute and bitumen in the ring shall be just sufficient to fill the recess in the pipe when pressed hard by jacking or by any other suitable method. Before and during jacking care shall be taken to see that there is no offset at the joint.

Testing: For pressure pipes, the completed pipeline shall be tested for pressure (Known as site test pressure) which shall not be less than the maximum pipeline operating pressure plus the calculated surge pressure, but in no case shall it exceed the hydrostatic test pressure. For non-pressure pipes the joints shall be tested as per procedure laid down under Para 19.2.1.2 (iv).

Refilling of Trenches: The specification described in 19.2.1.2 (v) shall apply. In case where pipes are not bedded on concrete special care shall be taken in refilling, trenches to prevent the displacement and subsequent settlement at the surface resulting in uneven street 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 and continued up to 60 cm above the top of pipe so as not to disturb the pipe. No tamping shall be done within 15 cm of the top of pipe. The tamping shall become progressively heavier as the depth of the backfill increases.

Measurements : The lengths of pipes shall be measured in running meters nearest to a cm as laid or fixed, from inside of one manhole to the inside of the other manhole. The length shall be taken along the center line of the pipes over all fittings such as bends, collars, junctions, etc. which shall not be measured separately.
Excavation, refilling, shoring and timbering in trenches, and cement concreting wherever required shall be measured separately under relevant items of work.

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

Cast Iron (Centrifugally Cast) Pipes and Specials
Cast iron (centrifugally cast) pipes and specials shall conform to the specifications described in 18.3.10.

19.2.4 Road Gully Grating (Fig. 19.13)
Horizontal Gully Grating: The casting of the grating and frames shall be the same as that ofmanhole covers described in 19.2.2.1. The gully grating cover shall be hinged to the frame to facilitate its opening for cleaning and repairs. A typical grating is shown in Fig. 19.13 & 19.14. The weight of grating shown in Figure shall be minimum 75 Kg. In case of R.C.C. horizontal gully grating it shall be in cement concrete 1:1:2 (1 cement: 1 coarse sand: 2 graded stone aggregate 20 mm nominal size) as shown in Fig. 19.13.

Vertical Gully Grating: The chamber shall be of brick masonry, 12 mm dia, round bar shall befixed in cement concrete block at the bottom. The bars at the top shall be welded or riveted to M.S. flat 40×6 mm as shown in Fig. 19.14.

Horizontal and Vertical Gully Grating: The details of typical road gully chamber of brickmasonry with horizontal and vertical grating shall be as given in Fig. 19.14.

MANHOLE COVERS & FRAMES

19.3.1 Manhole Covers
The covers and frames shall conform to IS 1726 for cast Iron and IS 12592 for pre-cast concrete covers and shall be of the following grades and types.

Grades	Grade Designation	Type/shape of cover
Light Duty	LD - 2.5	Rectangular, Square, Circular
Medium Duty	MD - 10	Rectangular, Circular and Square (for pre-cast concrete manhole covers)
Heavy Duty	HD - 20	Circular-Square, Rectangular, (Scrapper Manhole)

Extra Heavy Duty	EHD - 35	Circular, Square, Rectangular, (Scrapper Manhole)

19.3.1.1 Cast Iron Manhole Covers and Frames

Manhole covers and frame shall be manufactured from appropriate grade of grey cast iron not inferior than FG150 grade of IS 210.

They shall be cleanly cast and shall be free from air and sand holes, cold shuts and warping.

Covers shall have on its operative top a raised chequered design to provide for an adequate no-slip grip. The rise of chequers shall be not less than 4mm.

Key holes, keys and lifting devices shall be provided in the manhole covered to facilitate their placement in the frames and their operative maintenance.

Manhole covers and frames shall be coated with materials having base with a black bituminous composition. The coating shall be smooth and tenacious. It shall not flow when exposed to temperature of 63°C and shall not be so brittle as to chip off at temperature of 0°C.

Size and shape and performance requirement of manhole covers and frames shall conform to IS 1726.

Each manhole covers and frame shall have cast on them the following information:

Manufacturer's name or trade-mark

Grade designation

Date of manufacturer

The words SWD or 'Sewer' to denote 'storm water drain' or 'sewer' respectively

Identification marks as required by Engineer-in-Charge.

The cover shall be gas tight and water tight.

The sizes of covers specified shall be taken as the clear internal dimensions of the frame.

The approximate weight of the various type of manhole covers and frames shall be as per IS 1726.

The cover shall be capable of easy opening and closing and it shall be fitted in the frame in workmanship like manner.

19.3.2 Pre-Cast Concrete Manhole Covers & Frames

Pre-cast reinforced cement concrete manhole covers intended for use in sewerage and water works shall generally conform to IS 12592.

19.3.2.1 Materials

Cement: Cement used for the manufacture of pre-cast concrete manhole covers shall be 43 grade Portland cement conforming to IS-8112.

Aggregates: The aggregates used shall be clean and free from deleterious matter and shall conform to the requirements of IS -383. The aggregates shall

be well graded and the nominal maximum size of coarse aggregate shall not exceed 20 mm.

Concrete: The mix proportions of concrete shall be determined by the manufacturer and shall be such as will produce a dense concrete without voids, honey combing etc. The minimum cement content in the concrete shall be 410 kg/m^3 with a maximum water cement ratio of 0.45. Concrete weaker than grade M-30 (design mix) shall not be used. Compaction of concrete shall be done by machine vibration.

Reinforcement
The reinforcement steel shall conform to IS 1786. Reinforcement shall be clean and free from loose mill scale, loose rust, and mud, oil, grease or any other coating which may reduce or destroy the bond between the concrete and steel. A light film of rust may not be regarded as harmful but steel shall not be visibly pitted by rust.

Fibers Steel: The diameter/equivalent diameter of steel fibers where used, shall not be greater than 0.75 mm. The aspect ratio shall be in the range of 50 to 80. The minimum volume of fibers shall be 0.5 percent of the volume of concrete.
The reinforced concrete manhole cover and frame shall be designed in accordance with the provisions of IS 456. Clear cover to reinforcement shall not be less than 15 mm.

19.3.2.2 Shapes and Dimensions: Shape, dimensions and tolerance of pre-cast concrete manhole covers and frames shall conform to IS 12592. Outside dimension of cover at top shall match with corresponding frame so that the maximum clearance at top between the frame and the cover all round the periphery is not more than 5 mm and the top surface of the frame and covers, is in level within a tolerance of $\pm$5 mm.

For facility of removing the cover from the frame, suitable taper matching with taper given for the frame shall be provided to the periphery of the cover.

Lifting Device: The minimum diameter of mild steel rod used as lifting device shall be 12 mmfor light and medium duty covers and 16 mm for heavy and extra heavy duty covers. The lifting device shall be protected from corrosion by hot galvanizing or epoxy coating or any other suitable treatment.

Finishing & Coating: To prevent any possible damage from corrosion of steel the underside ofthe covers shall be treated with anticorrosive paint. The top surface of the covers shall be given a chequered finish.

In order to protect the edges of the covers from possible damage at the time of lifting and handling it is necessary that the manhole covers shall be cast with a protective mild steel sheet of minimum 2.5 mm thickness around the periphery of the covers. Exposed surface of mild steel sheet shall be given suitable treatment with anticorrosive paint or coating. To prevent the top outer edge of frame from possible damages, it shall be protected by 25 mm X 3 mm mild steel flat as part of the frame.

19.3.2.5 Physical Requirements

General: All units shall be sound and free from cracks and other defects which interface with the proper placing of the unit or impair the strength or performance of the units. Minor chipping at the edge/surface resulting from the customary methods of handling during delivery shall not be deemed for rejecting.

Load Test: The breaking load of individual units when tested in accordance with the method described in IS 12592 shall be not less than the values specified in Table 19.4.

TABLE 19.4

Grade of Cover	Type	Load in Tonnes	Diameter of Blocks in mm
EHD - 35	Circular, Square or Rectangular	35	300
HD - 20	Circular, Square or Rectangular	20	300
MD - 10	Circular or Rectangular	10	300
LD - 2.5	Rectangular, Square or Circular	2.5	300

Fixing: The frames of manhole shall be firmly embedded to correct alignment and level in RCCslab or plain concrete as the case may be on the top of masonry which shall be paid as extra unless specified otherwise.

Measurements: The manhole covers shall be enumerated under relevant items.

Rates: The rate shall include the cost of materials and labour involved in all the operationdescribed above except fixing of frames and covers which shall be paid as extra unless specified otherwise in the item.

19.3.2.9 Foot Rests: Foot rests shall be of 20 mm M.S. square or round bars as specified.

19.4 MANHOLES (FIG. 19.3 to 19.8)

At every change of alignment, gradient or diameter of a drain, there shall be a manhole or inspection chamber. Bends and junctions in the drains shall be grouped together in manhole as far as possible. The maximum distance between manholes shall be 30 m.

Manholes of different types and sizes as specified shall be constructed in the sewer line at such places and to such levels and dimensions as shown in the drawings or as directed by the Engineer -in-Charge. The size specified shall indicate the inside dimensions between brick faces of the manholes.

Where the diameter of the drain is increased, the crown of the pipe shall be fixed at the same level and necessary slope given in the invert of the manhole chamber. In exceptional cases and where unavoidable, the crown of the branch sewer may be fixed at lower level but in such cases the peak flow level of the two sewers shall be kept the same.

Sewers of unequal sectional area shall not be jointed at the same invert in a manhole. The invert of the smaller sewer at its junction with main shall be at least 2/3 the diameter of the main above the invert of the main. The branch sewers shall deliver sewage in the manhole in the direction of main flow and the junction must be made with care so that flow in main is not impeded.

No drain from house fittings, e.g. gully trap or soil pipe, etc. to manhole shall normally exceed a length of 6 m unless it is unavoidable.

Manholes 90 × 80 cm are generally constructed within compound for house drainage only and near the buildings for house drainage. Manholes 1.2 m × 90 cm are generally constructed for main drainage work for depths less than 1.5 m.

Manhole 1.4 m × 90 cm is of the arched type and is generally constructed for main drainage works where depth is 1.50 m or more. The width of manholes shall be increased more than 90 cm on bends or junctions or pipes with diameter greater than 450 mm and that the benching width on either side of the channel is minimum 20 cm.

Manholes 1.4 m internal diameter are generally constructed for main drainage works where depth is 2.45 m or more as an alternative to manholes of arch type. The diameter shall be increased suitably, for pipes with diameter greater than 450 mm in the same manner as in the case of rectangular manholes.

Before deciding size of manholes, Local Municipal Bye Laws shall be consulted. As a general guide some typical type designs of manholes followed in Delhi have been shown in Fig. 19.4 to 19.7. When manholes are constructed on foot path, these shall be provided with cover of medium duty casting and when built within the width of the road under vehicular traffic, these shall be provided with cover of heavy duty casting.

19.4.1 Excavation

The excavation for manhole shall be true to dimensions and levels shown on the plans or as directed by the Engineer-in-Charge.

19.4.2 Bed Concrete

The manhole shall be built on a bed of cement concrete 1:4:8 (1 cement: 4 coarse sand: 8 graded stone aggregate 40 mm nominal size) unless required by local authorities. The thickness of the bed concrete shall be 20 cm for manholes up to 4.25 m depth and 30 cm for depths beyond 4.25 m unless otherwise specified or directed by the Engineer-in-Charge. In bad ground, special foundations as suitable shall be provided.

19.4.3 Brick Work

The brick work shall be with class 75 bricks in cement mortar 1:4 (1 cement: 4 coarse sand). The external joints of the brick masonry shall be finished smooth, and the joints of the pipes with the masonry shall be made perfectly leak proof. For arched type and circular manholes, brick masonry in arches and arching over the pipes shall be in cement mortar 1.3 (1 cement: 3 fine sand). In the case of manholes of circular type the excess shaft shall be

corbelled inwardly on three sides at the top to reduce its size to the cover frame to be fitted.

The walls shall be built of one brick thickness for depths up to 4.25 m. Below a depth of 4.25 m in ordinary subsoil the wall thickness shall be increased to one and half brick and at 9.75 m below ground two brick thick walls shall be built.

19.4.4 Plaster and Pointing

The walls of the manholes shall be plastered inside with 12 mm thick cement plaster 1:3 (1 cement: 3 coarse sand) finished smooth. In the case of arched type manhole the walls of the manhole shall be plastered inside all-around only up to the crown level, and flush pointed for the shaft with cement mortar 1:2 (1 cement: 2 fine sand). Where the saturated soil is met with, also the external surface of the walls of the manhole shall be plastered with 12 mm thick cement plaster 1:3 (1 cement: 3 coarse sand) finished smooth up to 30 cm above the highest sub-soil water level with the approval of the Engineer-in-Charge. The plaster shall further be water proofed with addition of approved water proofing compound in a quantity as per manufacturer's specifications. In case Local Authorities/Bye Laws specify richer specifications, the same shall be adopted.

For earth work excavation, bed concrete brick work, plaster and pointing, R.C.C. work and refilling of earth, respective specifications shall be followed.

19.4.5 Benching

The channels and benching shall be done in cement concrete 1:2:4 (1 cement: 2 coarse sand: 4 graded stone aggregate 20 mm nominal size) and rendered smooth with neat cement. The depth of channels and benching shall be as given in Table 19.5.

19.4.6 Foot Rests (Fig. 19.8)

All manholes deeper than 0.8 m shall be provided with M.S. foot rests. These shall be embedded 20 cm deep in 20 x 20 x 10 cm blocks of cement concrete 1:3:6 (1 cement: 3 coarse sand 6 graded stone aggregate 20 mm nominal size). The concrete block with M.S. foot rest placed in its centre shall be cast in situ along with the masonry and surface finished with 12 mm thick cement plaster 1:3 (1 cement: 3 coarse sand) finished smooth.

TABLE 19.5

Sizes of drain mm	Top of channel at the centre above bed concrete Cm	Depth of benching at side walls above bed concrete cm
100	15	20
150	20	30
200	25	35
250	30	40
300	35	45

350	40	50
400	45	55
450	50	60

Foot rests which shall be of 20 × 20 Sq. M.S. bars as shown in Fig. 19.8 shall be fixed 40 cm apart vertically and staggered laterally and shall project 10 cm beyond the surface of the wall. The top foot rest shall be 45 cm below the manhole cover.

Foot rests shall be painted with coal tar, the portion embedded in the cement concrete block being painted with thick cement slurry before fixing.

19.4.7 Manhole Covers and Frames

The frame of manhole shall be firmly embedded to correct alignment and levels in R.C.C. slab or plain concrete as the case may be on the top of the masonry. After completion of the work, manhole covers shall be sealed by means of thick grease.

19.4.8 Measurements

Manholes shall be enumerated under relevant items. The depth of the manhole shall be reckoned from the top level of C.I. cover to the invert level of channel. The depth shall be measured correct to a cm. The extra depth shall be measured and paid as extra over the specified depth.

19.4.9 Rate

The rate shall include the cost of materials and labour involved in all the operations described above but excludes the cost of (i) excavation, (ii) M.S. foot rests and (iii) 12 mm thick cement plaster with water proofing material applied at the external surface of the manhole if required. These items shall be paid for separately under relevant items of work.

Payment for extra depths of manholes shall be made separately under relevant items of work.

DROP CONNECTION (FIG. 19.8)

19.5.0 In cases where branch pipe sewer enters the manhole of main pipe sewer at a higher level thanthe main sewer, a drop connection shall be provided. The work shall be carried out as per Fig. 19.8. S.C.I. pipes and special conforming to IS 1729 shall be of the same size as that of the branch pipe sewer.

For 150 and 250 mm main line, if the difference in level between the water line (peak flow level) and the invert level of the branch line is less than 60 cm, a drop connection may be provided with in the manhole by giving suitable ramp. If the difference in level is more than 60 cm, the drop shall be provided externally.

The main lines up to 350 mm dia, are designed for half depth of flow, from 350 mm to 900 mm for 2/3 depth of flow and beyond 900 mm for 3/4 depth of flow.

19.5.1 Excavation

The excavation shall be done for the drop connection 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.

19.5.2 Laying

At the end of branch sewer line S.C.I. cross shall be fixed to the line which shall be extended through the wall of the manhole by a horizontal piece of S.C.I. pipe to form an inspection or cleaning eye. The open end shall be provided with chain and lid. The S.C.I. drop pipe shall be connected to the cross at the top and to the S.C.I. bend at the bottom. The bend 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 20 mm nominal size) and finished smooth to connect the main channel. The joint between S.C.I. pipe and fittings shall be lead caulked as described in 18.5.3. The joint between S.C.I. cross and S.W. branch line shall be made with cement mortar 1:1 (1 cement: 1 fine sand). The exposed portion of the drop connection shall
be encased all-around with minimum 15 cm thick concrete 1:5:10 (1 cement: 5 fine sand: 10 graded stone aggregate 40 mm nominal size) and cured. For encasing the concrete around the drop connection, the necessary centering and shuttering shall be provided. The holes made in the walls of the manhole shall be made good with brick work in cement mortar 1:4 (1 cement: 4 coarse 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 back filled in the trench in level with the original ground level.

19.5.3 Measurements

Drop connection shall be enumerated. The depths beyond 60 cm shall be measured in running meters correct to a cm under relevant items.

19.5.4 Rate

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

19.6 OPEN SURFACE DRAIN (FIG. 19.12)

The open drains shall be of the size, as specified in the item and laid to such gradients and in such locations as may be shown in the relevant drawing or as directed by the Engineer-in-Charge.

The size of the drain as specified shall be the width of the drain at the top, measured between the masonry walls. The drain shall be given, as far as possible, uniform slope from the starting point to the discharge point.

The average depths of the various sizes of drains shall be as follows:—

Drain size	Depth
10 cm	20 cm
15 cm	20 cm

25 cm	30 cm

19.6.1 Measurements

The drains shall be measured in running metres, correct to a cm.

19.6.2 Rate

The rate shall include the cost of labour and materials required for all the operations described above, suitable deduction or extra payment, per cm basis shall be made in case there is a variation in average depths from those stated above.

19.7 ROAD GULLY CHAMBER WITH GRATING

19.7.1 Road Gully Chamber with Horizontal Grating (Fig. 19.14)

The chamber shall be of brick masonry of specified class and shall have a C.I. grating with frame fixed in 15 cm thick cement concrete 1:2:4 (1 cement: 2 coarse sand: 4 graded stone aggregate 20 mm nominal size) at the top. The size of the chamber shall be taken as the clear internal dimensions of the C.I. frame. The chamber shall have a connection pipe, the length of which in metre between the road gully chamber and the manhole of the drain shall not be less than one by forty (1/40) times the nominal diameter of pipe in mm (i.e. for 150 mm connection pipe, length shall not be less than 3.7 m and for 250 mm connection pipe length shall not be less than 6.25 m). The chamber shall be built at the location fixed by the Engineer-in -Charge. Generally the spacing of the chambers shall be 18 to 36 m depending upon the grading of the road channel and the area of the drainage. R.C.C. gully grating shall be fixed in cement mortar 1:2 (1 cement: 2 coarse sand) as shown in Fig. 19.13.

19.7.2 Road Gully Chamber with Vertical Grating (Fig. 19.14)

The chamber shall be of brick masonry 12 mm dia round bar shall be fixed in cement concrete block at the bottom. The bars at the top shall be welded or riveted to M.S. flat 40 × 6 mm as shown in Fig. 19.14. The specifications shall be same as described in 19.7.1.

19.7.3 Road Gully Chamber with Horizontal and Vertical Grating

The details of typical road gully chamber of brick masonry shall be same as shown in Fig. 19.14.

19.7.4 Measurements

Road gully chambers shall be enumerated.

19.7.5 Rate

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

19.8 BRICK MASONRY GULLY TRAP (FIG. 19.2)

The internal size of the trap shall be 80 × 40 × 46 cm. The height shall be measured from the top of the floor to the top of the cover. 40 mm thick stone baffles shall be fixed 50 mm deep in masonry with cement mortar 1:4 (1 cement: 4 fine sand), as shown in the Fig. 19.2. The connection of open surface, drain with a soak pit shall be invariably through a grease trap.

19.8.1 Measurements

Gully traps shall be enumerated.

19.8.2 Rate

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

A: DIMENSIONAL REQUIREMENT OF CLASS NP2-REINFORCED CONCRETE LIGHT DUTY, NON PRESSURE PIPES & COLLAR (Clause 19.2.2)

Nominal Internal Diameter of Pipe	Barrel Wall Thickness of pipe	Collar Dimensions			Reinforcements in Collar		
		Minimum Caulking Space	Minimum Thickness	Minimum Length	Longitudinal, Mild steel or Hard Drawn Steel		Spiral Hard Drawn Steel
					Minimum Number	Weight Kg/Collar	Kg/Collar
mm	mm	mm	mm	mm			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
80	25	13	25	150	6	0.08	0.07
100	25	13	25	150	6	0.08	0.08
150	25	13	25	150	6	0.08	0.10
200	25	13	25	150	6	0.08	0.12
225	25	13	25	150	6	0.08	0.14
250	25	13	25	150	6	0.08	0.16
300	30	16	30	150	8	0.11	0.22
350	32	16	32	150	8	0.11	0.25
400	32	16	32	150	8	0.11	0.27
450	35	19	35	200	8	0.15	0.40
500	35	19	35	200	8	0.15	0.60
600	45	19	40	200	8	0.15	0.70
700	50	19	40	200	8	0.23	1.05
800	50	19	45	200	8	0.23	1.85
900	55	19	50	200	8	0.23	2.05
1000	60	19	55	200	8	0.33	2.25
1100	65	19	60	200	8	0.33	3.09
1200	70	19	65	200	8	0.33	4.11
1400	75	19	75	200	12	0.50	5.08
1600	80	19	80	200	12 or 8+8	0.67	6.55
1800	90	19	90	200	12 or 8+8	0.67	9.00
2000	100	19	100	200	12+12	1.00	12.15
2200	110	19	110	200	12+12	1.00	13.30

Note:

If the mild steel is used for spiral reinforcement, the weight specified under col. 7 shall be increased by a factor 140/25.

Soft grade mild steel wire may be used as reinforcement for collars of pipes of nominal internal diameter up to 250 mm only, by increasing the weight by a factor 140/84. Where only soft grade mild steel wire is used for making collar

cages, the weight of reinforcement shall be total weight or col. 6 and 7 multiplied by 140/84. This is allowed as a process requirement.

Internal diameter of collar to suit the actual diameter of pipes with minimum caulking space as given in col. 2

B : REINFORCED CONCRETE PRESSURE PIPES CLASS P1 TESTED TO 20 m HEAD, CLASS P2 TESTED TO 40 m HEAD AND CLASS P3 TESTED TO 60 m HEAD

Internal diameter of pipes (mm)	Barrel dimension		
	Class P1 (mm)	Class P2 (mm)	Class P3 (mm)
80	25	25	25
100	25	25	25
150	25	25	25
200	25	30	35
225	25	30	35
250	25	30	35
300	30	40	45
350	32	45	55
400	32	50	60
450	35	50	70
500	35	55	75
600	40	65	90
700	40	70	105
800	45	80	120
900	50	90	-
1000	55	100	-
1100	60	-	-
1200	65	-	-

Notes:

The effective length of barrel shall be 2 m up to 250 mm nominal diameter pipes and 2.5, 3.0, 3.5 or 4.0 m for pipes above 250 mm.

Collar dimensions will be same as specified for class NP2 pipes.

MR 16.001 : Sewer Drainage - Providing and fixing of uPVC SDR pipes as Under ground Sewerage Pipes as per IS 15328-2003 for underground non pressure applications , placing in trench , jointing the pipes with solvant cement as per manufacturer's specifications complete as per specifications and as directed by the Engineer - in - Charge. Make of the pipe: Supreme/Finolex SN4 (SDR 41, Stiffness Class 4KN/m2). PCC for bedding, haunching or all round the pipe, excavation and backfilling shall be payable separately under relevant head,

a) 160 mm nominal dia

MR 16.002 : b) 200 mm nominal dia
MR 16.003 : c) 250 mm nominal dia
MR 16.004 : d) 315 mm nominal dia

The pipes shall be round and shall be supplied in straight lengths with socketed ends. The internal and external surfaces of pipes shall be smooth, clean, and free from grooving and other defects. The ends shall be cleanly cut and square with the axis of the pipe. The pipes shall be designed by external diameter and shall conform to IS: 15328:2003. The Pipe shall be of SN4- SDR 41, stiffness 4KN/m2.

Laying

UPVC pipes shall be laid on cement concrete bed of cradles as specified and shown on the detailed drawings. The cradles may be precast and sufficiently cured to prevent cracks and breakage in handling. The invert of the cradles shall be left 12 mm below the invert level of the pipe and properly placed on the soil to prevent any disturbance. The pipe shall then be placed on `the bed concrete or cradles and set for the line and gradient by means of sight rails and boning rods, etc. Cradles or concrete bed may be omitted, if directed by the Project Manager.

Jointing

Jointing for UPVC pipes shall be made by means of solvent cement. The type of joint shall be used as per site conditions / direction of the Owner's site representative.

Cement Concrete for Pipe Supports

a. Unless otherwise directed by the Project Manager Cement concrete for bed, all round or in haunches shall be as follows:

	upto 1.5m depth	upto 3m depth	beyond 3m depth
PVC / HDPE pipe	**All round (1:2:4)**	**In Haunches (1:3:6)**	**In Haunches (1:3:6)**
All pipes under building	All round (1:2:4)	In Haunches (1:2:4)	In Haunches (1:2:4)

External Civil Work shall be completely done as per Item No. 39.

TESTING

Mirror Test shall be performed at site.

MEASUREMENTS

i. The description of each item shall unless otherwise stated, be held to include where necessary, conveyance, and delivery, handling unloading, storing fabrication, hoisting, all labor for finishing to required shape and size; testing, fitting in position, straight, cutting and waste, return of packing

ii. The length shall be measured on running meter basis of finished work. The length shall be taken along the center line of the pipe and fittings. The pipes fixed to floors etc shall be measured and paid under this item.
iii. All measurements of cutting shall unless otherwise stated be held to include the consequent waste.
iv. In case of fitting of unequal bore, the largest bore shall be measured for the rest.
v. Connection to down take pipe
vi. Testing of pipe lines fittings and joints include for providing all plant and appliances necessary for obtaining access to the work to be tested and carrying out the tests.
vii. The rate shall be exclusive of encasing of pipe with sand or PCC, and same shall be paid in relevant tender items.

The rate shall be for a unit of one running meter

DSR Item No. 19.6.2 : STORM DRAINAGE - Providing and laying non-pressure NP2 class (light duty) R.C.C. pipes with collars jointed with stiff mixture of cement mortar in the proportion of 1:2 (1 cement : 2 fine sand) including testing of joints etc. complete:
(a) 150mm RCC Pipe

DSR Item No. 19.6.3 :(b) 250mm dia R.C.C. pipe

DSR Item No. 19.6.4 : (c) 300mm dia R.C.C. pipe

Please refer relevant specification of Drainage work Sub head 19.0 of CPWD Civil works specifications 2009 Volume II

DSR Item No. 19.1.1 : Providing, laying and jointing glazed stoneware pipes class SP-1 with stiff mixture of cement mortar in the proportion of 1:1 (1 cement : 1 fine sand) including testing of joints etc. complete:
a) 100mm dia.

Please refer relevant specification of Drainage work Sub head 19.0 of CPWD Civil works specifications 2009 Volume II

DSR Item No. 19.2.2:Providing and laying cement concrete 1:5:10 (1 cement: 5 coarse sand: 10 graded stone aggregate 40 mm nominal size) all-round including bed concrete as per standard design.

(a) 150mm nominal dia

DRS Item No. 19.2.3: (b) 200mm nominal dia

DSR Item No. 19.2.4: (c) 250mm nominal dia.

Please refer relevant specification of Drainage work Sub head 19.0 of CPWD Civil works specifications 2009 Volume II

DSR Item No. 19.3.4:Providing and laying cement concrete 1:5:10 (1 cement: 5 coarse sand :10 graded stone aggregate 40 mm nominal size) up to haunches of pipes including bed concrete as per standard design.

(a) 250mm diameter

DSR Item No. 19.3.5: (b) 300mm nominal dia

Please refer relevant specification of Drainage work Sub head 19.0 of CPWD Civil works specifications 2009 Volume II

DSR Item No. 19.2.4.1:Providing and fixing square-mouth S.W. gully trap class SP-1 complete with C.I. grating brick masonry chamber with water tight C.I. cover with frame of 300x300 mm size (inside) the weight of cover to be not less than 4.50 kg and frame to be not less than 2.70 kg as per standard design 150 x 100 mm size P type
With common burnt clay F.P.S.(non modular) bricks of class designation 7.5

Please refer relevant specification of Drainage work Sub head 19.0 of CPWD Civil works specifications 2009 Volume II

DSR Item No. 19.30.1.1 : Constructing brick masonry chamber for underground C.I. inspection chamber and bends with bricks in cement mortar 1:4 (1 cement : 4 coarse sand) C.I. cover with frame (light duty) 455x610 mm internal dimensions, total weight of cover with frame to be not less than 38 kg (weight of cover 23 kg and weight of frame 15 kg), R.C.C. top slab with 1:2:4 mix (1 cement: 2 coarse sand : 4 graded stone aggregate 20 mm nominal size), foundation concrete 1:5:10 (1 cement : 5 fine sand : 10 graded stone aggregate 40 mm nominal size), inside plastering 12 mm thick with cement mortar 1:3 (1 cement : 3 coarse sand), finished smooth with a floating coat of neat cement on walls and bed concrete etc. complete as per standard design:
Inside dimensions 455x610 mm and 45 cm deep for single pipe line With common burnt clay F.P.S. (non modular) bricks of class designation 7.5

Please refer relevant specification of Drainage work Sub head 19.0 of CPWD Civil works specifications 2009 Volume II

DSR Item No. 19.31.1 Extra for depth beyond 45 cm of brick masonry chamber:
For 455x610 mm size with common burnt clay F.P.S. (non modular) bricks of class designation 7.5

Please refer relevant specification of Drainage work Sub head 19.0 of CPWD Civil works specifications 2009 Volume II

DSR Item No. 19.9.1.1 : Sewer Manhole - Constructing brick masonry circular type manhole 0.91 m internal dia at bottom and

0.56m dia at top in cement mortar 1:4 (1 cement :4 coarse sand), in side cement plaster 12 mm thick with cement mortar 1:3 (1 cement : 3 coarse sand) finished with a floating coat of neat cement, foundation concrete 1:3:6 mix (1 cement : 3 coarse sand : 6 graded stone aggregate 40 mm nominal size), and making necessary channel in cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size) finished with a floating coat of neat cement, all complete as per standard design. 0.91 m deep with S.F.R.C. cover and frame (heavy duty, HD-20 grade designation) 560 mm internal diameter conforming to I.S.12592, total weight of cover and frame to be not less than 182 kg., fixed in cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size) including centering, shuttering all complete. (Excavation, foot rests and 12mm thick cement plaster at the external surface shall be paid for separately) With common burnt clay F.P.S. (non modular) bricks of classdesignation 7.5

Please refer relevant specification of Drainage work Sub head 19.0 of CPWD Civil works specifications 2009 Volume II

DSR Item No. 19.10.1:Extra depth for circular type manhole 0.91m internal dia (at bottom) beyond 0.91 m to 1.67 mt with common burnt clay F.P.S. (non modular) bricks of class designation 7.5

Please refer relevant specification of Drainage work Sub head 19.0 of CPWD Civil works specifications 2009 Volume II

DSR Item 19.13.1.1 : Constructing brick masonry circular manhole 1.52 m internal dia at bottom and 0.56 m dia at top in cement mortar 1:4 (1 cement : 4 coarse sand) inside cement plaster 12 mm thick with cement mortar 1:3 (1 cement : 3 coarse sand) finished with a floating coat of neat cement, foundation concrete 1:3:6 (1 cement : 3 coarse sand : 6 graded stone aggregate 40 mm nominal size) and making necessary channel in cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size) finished with a floating coat of neat cement, all complete as per standard design a 2.30 m deep with SFRC Cover and frame (heavy duty HD- 20 grade designation) 560 mm internal diameter conforming to I.S. 12592, total weight of cover and frame to be not less than 182 kg. fixed in cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size) including centering, shuttering all complete. (Excavation, foot rests and 12 mm thick cement plaster at the external surface shall be paid for separately) With common burnt clay F.P.S. (non modular) bricks of class designation 7.5

Please refer relevant specification of Drainage work Sub head 19.0 of CPWD Civil works specifications 2009 Volume II

DSR Item No. 19.14.1:Extra depth for circular type manhole 1.52 m internal dia (at bottom) beyond 2.30 M: With common burnt clay F.P.S. (non modular) bricks of class designation 7.5

Please refer relevant specification of Drainage work Sub head 19.0 of CPWD Civil works specifications 2009 Volume II

DSR Item No. 19.16 : Providing orange colour safety foot rest of minimum 6 mm thick plastic encapsulated as per IS : 10910, on 12 mm dia steel bar conforming to IS: 1786, having minimum cross section as 23 mmx25 mm and over all minimum length 263 mm and width as 165 mm with minimum 112 mm space between protruded legs having 2 mm tread on top surface by ribbing or chequering besides necessary and adequate anchoring projections on tail length on 138 mm as per standard drawing and suitable to with stand the bend test and chemical resistance test as per specifications and having manufacture's permanent identification mark to be visible even after fixing, including fixing in manholes with 30x20x15 cm cement concrete block 1:3:6 (1 cement : 3 coarse sand : 6 graded stone aggregate 20 mm nominal size) complete as per design.

Please refer relevant specification of Drainage work Sub head 19.0 of CPWD Civil works specifications 2009 Volume II

DSR Item No.19.9.1.1 : Storm Chamber - Constructing brick masonry circular type manhole 0.91 m internal dia at bottom and 0.56m dia at top in cement mortar 1:4 (1 cement :4 coarsesand), in side cement plaster 12 mm thick with cement mortar 1:3 (1 cement : 3 coarse sand) finished with a floating coat of neat cement, foundation concrete 1:3:6 mix (1 cement : 3 coarse sand : 6 graded stoneaggregate 40 mm nominal size), and making necessary channel in cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size) finished with a floating coat of neat cement, all complete as per standard design. 0.91 m deep with S.F.R.C. grating and frame (heavy duty, HD-20 grade designation) 560 mm internal diameter conforming to I.S.12592, total weight of cover and frame to be not less than 182 kg., fixed in cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size) including centering, shuttering all complete. (Excavation, foot rests and12mm thick cement plaster at the external surface shall be paid for separately) With common burnt clay F.P.S. (non modular) bricks of classdesignation 7.5

Please refer relevant specification of Drainage work Sub head 19.0 of CPWD Civil works specifications 2009 Volume II

DSR Item No. 19.10.1 :Extra depth for circular type manhole 0.91m internal dia (at bottom) beyond 0.91 m to 1.67 m

a) With common burnt clay F.P.S. (non modular) bricks of class designation 7.5

Please refer relevant specification of Drainage work Sub head 19.0 of CPWD Civil works specifications 2009 Volume II

DSR Item No. 19.27.1 : Constructing brick masonry road gully chamber 50x45x60 cm with bricks in cement mortar 1:4 (1 cement : 4 coarse sand) including 500x450 mm pre-cast R.C.C. horizontal grating with frame complete as per standard design :
a With common burnt clay F.P.S. (non modular) bricks of class designation 7.5

DSR Item No. 19.27.2 :Constructing brick masonry road gully chamber 45x45x77.5 cm with bricks in cement mortar 1:4 (1 cement : 4 coarse sand) with pre-cast R.C.C. vertical grating complete as per standard design
: a With common burnt clay F.P.S. (non modular) bricks of class designation 7.5

DSR Item No. 19.30.1.1 : Storm Chamber - Constructing brick masonry chamber for underground C.I. inspection chamber and bends with bricks in cement mortar 1:4 (1 cement : 4 coarse sand) C.I. Grating with frame (light duty) 455x610 mm internal dimensions, total weight of cover with frame to be not less than 38 kg (weight of cover 23 kg and weight of frame 15 kg), R.C.C. top slab with 1:2:4 mix (1 cement: 2 coarse sand : 4 graded stone aggregate 20 mm nominal size), foundation concrete 1:5:10 (1 cement : 5 fine sand : 10 graded stone aggregate 40 mm nominal size), inside plastering 12 mm thick with cement mortar 1:3 (1 cement : 3 coarse sand), finished smooth with a floating coat of neat cement on walls and bed concrete etc. complete as per standard design:
Inside dimensions 455x610 mm and 45 cm deep for single pipe line With common burnt clay F.P.S. (non modular) bricks of class designation 7.5

DSR Item No. 19.31.1.1 :Extra for depth beyond 45 cm of brick masonry chamber :
For 455x610 mm size
With common burnt clay F.P.S. (non modular) bricks of class designation 7.5

Please refer relevant specification of Drainage work Sub head 19.0 of CPWD Civil works specifications 2009 Volume II

MR 16.005 :Constructing De-silting chamber (roof water de-silting) with coarse sand, aggregate &nelton mesh, chamber will be constructed (as shown in drawing) of brick work with bricks of class 75 with cement mortar 1:5 (1 cement:5 fine sand) plastering internal face with cement mortar 1:3 (1 cement: 3 fine sand and rough plaster on outer face with a floating coat of neat

cement. R.C.C top slab with medium duty HD -20 SFRC manhole cover and frame of 600 mm dia. The weight of cover & frame not be less than182 Kg as per standard design. Including excavation, dewatering, refilling, watering, ramming and removing the surplus excavated material complete as per approved specifications and indicated tender drawing. (All sizes are clear internal sizes).
a Size 2000 x 2000 x 1500 mm deep

Please refer specification of Drainage work Sub head 19.0 of CPWD Civil works specifications 2009 Volume IIand dwg. ref No. NUC(1)-MP-P6.2

DSR Item No. 19.7.1 : Constructing brick masonry manhole in cement mortar 1:4 (1 cement : 4 coarse sand) with R.C.C. top slab with 1:2:4 mix (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size), foundation concrete 1:4:8 mix (1 cement : 4 coarse sand : 8 graded stone aggregate 40 mm nominal size), inside plastering 12 mm thick with cement mortar 1:3 (1 cement : 3 coarse sand) finished with floating coat of neat cement and making channels in cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size) finished with a floating coat of neat cement complete as per standard design :Inside size 90x80 cm and 45 cm deep including C.I. cover with frame (light duty) 455x610 mm internal dimensions, total weight of cover and frame to be not less than 38 kg (weight of cover 23 kg and weight of frame 15 kg) :With common burnt clay F.P.S. (non modular) bricks of class designation 7.5

Please refer specification of Drainage work Sub head 19.0 of CPWD Civil works specifications 2009 Volume II

DSR Item no. 19.8.1.1:Extra for depth for manholes: Size 90x80 cm With common burnt clay F.P.S. (non modular) bricks of class designation 7.5

Please refer specification of Drainage work Sub head 19.0 of CPWD Civil works specifications 2009 Volume II

DSR Item No. 18.9.10 : DOMESTIC WATER - Providing and fixing Chlorinated Polyvinyl Chloride (CPVC) pipes, having thermal stability for hot & cold water supply including all CPVC plain & brass threaded fittings This includes jointing of pipes & fittings with one step CPVC solvent cement ,trenching ,refilling & testing of joints complete as per direction of Engineer in Charge. External work
a) 150 mm nominal outer dia Pipes Schedule 80

DSR Item No. 18.9.5 : (b) 40 mm nominal outer dia Pipes SDR 11

Please refer specification of Water Supply work Sub head 18.0 of CPWD Civil works specifications 2009 Volume II

MR 16.006 : Providing and fixing G.I. pipes B Class, confirming to IS 1239 Part 2 with G.I. fittings as per IS 1879 Part 1 to X , including painting of pipes, excavation upto 1m depth laying of pipes, backfilling complete as per specifications , excavation, painting and backfilling shall be paid separately under relevant head
External work (a) 32 mm nominal inner dia Pipes

MR 16.007 : (b)40 mm nominal inner dia Pipes

MR 16.008 : (c)50 mm nominal inner dia Pipes

MR 16.009 : (d)65 mm nominal inner dia Pipes

MR 16.010 : (e)80 mm nominal inner dia Pipes

MR 16.011: (f)100 mm nominal inner dia Pipes

MR 16.012 : (g)150 mm nominal inner dia Pipes

Please refer CPWD specs under relevant para of Water Supply sub head 18.0 for fixing and item specs 2 for excavation and dressing of pipes and fittings

DSR Item No. 18.40.4 :Painting G.I. pipes and fittings with two coats of anti-corrosive bitumastic paint of approved quality a) 32 mm nominal inner dia Pipes
DSR Item No. 18.40.5 :(b)40 mm nominal inner dia Pipes
DSR Item No. 18.40.6 :(c)50 mm nominal inner dia Pipes
DSR Item No. 18.40.7: (d)65 mm nominal inner dia Pipes
DSR Item No. 18.40.8 :(e)80 mm nominal inner dia Pipes
MR 16.013 :(f)100 mm nominal inner dia Pipes (Medium duty)
MR 16.015 :(g)150 mm nominal inner dia Pipes (Medium duty)

Please refer relevant CPWD specs under subhead 18.0

DSR Item 18.9.5 : DRINKING WATER DISTRIBUTION -Providing and fixing Chlorinated Polyvinyl Chloride (CPVC) pipes SDR 11, having thermal stability for hot & cold water supply including all CPVC plain & brass threaded fittings This includes jointing of pipes & fittings with one step CPVC solvent cement ,trenching ,refilling & testing of joints complete as per direction of Engineer in Charge..
a) 32 mm nominal outer dia Pipes

DSR Item 18.9.2 : (b) 20 mm nominal outer dia Pipes

DSR Item No. 18.9.6 : (c) 50 mm nominal outer dia Pipes

Please refer specification of Water Supply work Sub head 18.0 of CPWD Civil works specifications 2009 Volume II

DSR Item No. 18.9.8 : FLUSHING WATER DISTRIBUTION - Providing and fixing Chlorinated Polyvinyl Chloride (CPVC) pipes SDR 11, having thermal stability for hot & cold water supply including all CPVC plain & brass threaded fittings This includes jointing of pipes & fittings with one step CPVC solvent cement ,trenching ,refilling & testing of joints complete as per direction of Engineer in Charge.
(a) 80 mm nominal inner dia Pipes

DSR Item No. 18.9.4 : (b) 32 mm nominal outer dia Pipes

DSR Item No. 18.9.5 :(c) 40 mm nominal outer dia Pipes

DSR Item No. 18.9.7 :(c) 62.5 mm nominal outer dia Pipes

Please refer specification of Water Supply work Sub head 18.0 of CPWD Civil works specifications 2009 Volume II

MR 16.015 : Constructing Grease Trap of size as mentioned below of 1200 liquid depth in brick work of class 75 with cement mortar (1:6), inside plastering 16 mm thick with cement mortar 1:3 with floating coat of neat cement and rough plaster on outside. Including aluminium bucket as per detail to collect the grease. RCC top slab with 2 nos. 600 x 600 mm dia medium duty hinged type cover with epoxy coating, double seal manhole covers with frame (weight of covers & weight of frame 75 Kg), necessary 150 mm thick foundation concrete (1:2:4).
2000mm x 1500mm as per detailed drawings and specifications

Please refer specification under Subhead 19.0 and dwg. ref No. NUC(1)-MP-P6.2
MR 16.016 : Supply, Installation, Testing and commissioning of slim seal type C.I. Butterfly valve (Body : Grey Cast Iron, shaft : SS, Disc : SG Iron (Rilson coated), Liner : HT - EPDM) of approved make with PN 10 rating flange dimensions shall be confirming to IS 6392, washer, nuts & bolts. Rated to temperature of 85 Deg C and tested to a pressure not less than 15 Kg/Sq.cm.
(a) 65mm nominal dia

MR 16.017 : (b) 80 mm nominal dia

MR 16.018 : (c) 100 mm nominal dia

MR 16.019 : (d) 150 mm nominal dia

17 PUMPS TREATMENT SYSTEM & EQUIPMENTS

MR 17.001 :STP HOSTEL- Design , Construction, Testing and Commissioning of Sewage Treatment plant of 42 cum per day capacity including settler, Anaerobic baffle Reactor + Anaerobic Filter & plant gravel filter (DEWAT Technology), and Polishing/finishing pond. The cost shall be inclusive of design, detailed engineering, submission and approval of drawings, testing and commissioning of complete system in all respect along with establishing the guarantee outlet quality parameters

The work should be completed as specified in Technical specification.

MR 17.002:STP FACULTY HOUSING- Design , Construction, Testing and Commissioning of Sewage Treatment plant of 76 cum per day capacity including settler, Anaerobic baffle Reactor + Anaerobic Filter & plant gravel filter (DEWAT Technology), and Polishing/finishing pond. The cost shall be inclusive of design, detailed engineering, submission and approval of drawings, testing and commissioning of complete system in all respect along with establishing the guarantee outlet quality parameters

The work should be completed as specified in Technical specification.

Scope:

The system should comprises of design , construction and approval of drawings for an STP with anaerobic digester / baffle reactor , anaerobic filter and plant gravel filter for solid separation and treatment to ensure treated water parameters within the range central pollution controlled board.

The water from polishing pond will be further transfer to treated water collection tank for tertiary treatment where it would be further treated with sand carbon filter and UV filtration/ killing of microorganisms. Tenderer to be please note that tertiary treatment system comprising sand carbon filter and UV treatment would be under separate tender. All civil work shall be completely executed as specified under civil work heads, no extra cost shall be paid for civil / excavation, backfilling, and civil construction this contract item shall be inclusive of everything that is required for execution. Contractor shall fulfill requirements as specified in contract conditions for experience in design and implementation of technology with at least 5 successful installation with capacity equivalent to project requirement or higher in any case low capacity of installation shall be considered as point in above captioned system, client may ask to

submit test report of existing projects for consequent years where parameters are maintained.

The tenderer for this item shall be completely responsible for design, execution and supervening of system inclusive providing test report for inlet and outlet parameters of system

Testing, commissioning and establishment of guarantee parameters

The tenderer shall guarantee for the design , engineering, construction , erection testing and commissioning and establishing of the guarantee parameters of the STP outlet quality, as specified under the specification given below, in case if during commissioning and establishing of the STP, the guarantee parameters are not achieved the tenderer himself would identify the cause of the same and rectify the system by providing additional units as required at his own cost, and there shall be not claim in this aspect.

Training

After successfully commissioning of STP system, the tenderer should arrange 15 days training for building operator during which representatives of client and consultants would take part and inlet and outlet quality of water should be tested by tenderer from approved laboratory to all parameters are maintained under varying loads.

Fundamental Requirements: All below mentioned scope is only for representation not exhaustive, contractor shall be completely responsible for design and implementation of system, all civil work shall be done as specified under relevant specification and paid under this item only. In case of any deviation preapproval should be taken from consultant prior to execution of work at site

Excavation:
All excavation should be done to accommodate STP as per system capacity, extra excavation should be refilled back with compaction as per system requirement.

Gravel Bedding:
The gravel bedding crash must be clean of any comical materials and not from river. The shale in the bedding of STP system has to be minimum 2 inches and maximum on 4 inches.

Work process:

The process of the gravel bedding is to bring exact to site. After that it must be used on the specific area which is excavated for the STPS System. It needs to be compact for next steps of installation.

Form work:
Form work shall be completed and approved. Debris and foreign materials shall be removed from interior of farms before start of concrete placing.

PCC process:
In this process we have a specific mixing ratio, which is (1:2:2). It may be used to cover top and bottom slab, beams, column and CMU filling. PCC must get watered for 28 days.

Partition Wall:
When a partition wall is used to divide the prefabricated tanks into different compartments, assumptions regarding the arrangement of liquid loading shall cause the most critical effects such as:

a. Particular attention shall be paid to possible sliding and overturning due to differential moment;
b. The partition shall be structurally sound and fixed without diminishing the integrity of the tank;
c. The tank partition wall during pumping out shall not collapse, or get permanently deformed.

Joints and edge:
The joints of the STPS system must be construct in a proper manner, plastered well, water tied, and also the edge of the STPS system should be chamfer at each wall corners.

Septic Tank:
Septic tanks provide suitable conditions for the settlement, storage and partial decomposition of solids which need to be removed at regular intervals. The discharge can still be harmful and further treatment from a percolation area, percolation mound or intermittent filter will be required.
An effluent screen on the outlet is optional but is recommended as it gives extra protection to the percolation/filter system and gives early warning of the need for de-sludging. They can incorporate an alarm system.

Plaster work:
After separating material from sand that will be used on plaster work by mixing (1:4). Plaster must be 2.5 cm on both sides. Plastering has to be soaked for 7 days at the end of the every working day.

Piping System:
The piping system for the package shall comply with the following criteria:

All baffle pipes into the anaerobic reactor should be provide accurate well and in one level and should be checked into the three directions (X, Y, Z).
The arrangement of the piping system and interconnection pipes in the prefabricated tanks shall not obstruct maintenance work of the equipment in the tanks;
All the buried piping shall be properly bedded and supported with the selected compacted fill material;
The arrangement of the above ground piping shall minimize obstruction and maneuverability;
Any on-site installation or assemblies of pipe support to the prefabricated tank shall not be allowed;
No bending is allowed at any sewage distribution pipe excluding the force main piping. Instead, a chamber shall be provided to any change of direction in sewage flow.

Inlet and Outlet pipe:
All opening for pipe connections of the prefabricated tanks shall be pre-fitted at the factory with a socket, a spigot, a flange or a 300 mm length short piece of pipe. On-site drilling of openings for pipe connection shall be prohibited.

Vent Pipe:
The vent pipe shall be provide and construct at the beginning of anaerobic systems (Settler, ABR) to remove CH4, S20gases from the STPS system, where it should construct well protected with concrete around the pipe and should install higher than the buildings height.

Rebar:
Different kinds of rebar used for construction have to be in good condition not damage by corrosion. The size of designed rebar is 10mm, 12mm, 14mm and 16mm and the grade of these rebar must be (Grad 60).

Cast iron manhole cover:
Cast iron manhole cover must be ordered during construction as designed in drawing details. The manhole cover design should be ideally being in size of (60x60), (65x65) and (70x70). In case of deviation from given size, all manhole covers should have perfect fit for cast iron covers.

Pumps:
The minimum control mechanism for the pumps installed within the package shall be:
Automatic by float switch for sewage transfer pump;
Automatic by timer and interlock with solenoid valve for return and waste sludge pump in sedimentation tank;
Manual by push button for sludge transfer pump to remove the sludge from sludge holding tank.

Backfill Material:

The backfill material for the STPS system shall be of particle size and grading that allow the specified relative compaction to be achieved with the intended compaction methods. The material shall not contain organic matter that affects the backfill material performance. It should be free of materials that are physically and chemically harmful to the system. The support and overlay material shall be placed in layers of appropriate thickness for the method of compaction, to achieve the relative compaction or soil modulus.

RAW SEWAGE EFFLUENT PARAMETERS

Parameters	Range
Nature of Waste	Sewage
BOD5	300 – 350 Mg/Ltr.
TSS	20-50 mg/ltr.
COD	400 to 450 Mg/Ltr.
Oil and grease	50 Mg/Ltr
Suspended Solids	250 Mg/Ltr.
pH	6 to 8

QUALITY OF STP TREATED WATER (REQUIRED FROM STP)

Parameters	Range
BOD	< 10 Mg/Ltr.
COD	< 50 Mg/Ltr.
Suspended Solids	< 20 Mg/Ltr.
Color	Clear/ Unobjectionable
Oil & Grease	< 5 Mg/Ltr
Odor	Unobjectionable
pH	6.5-8.5

MR 17.003 : Sewage Water Transfer Pump- Submersible Centrifugal pump - Supply, installation , testing & commissioning of submersible pumps for suitable rating, with non-clog free flow open impeller, mechanical seal, suitable for operation on 415 volts + 5% -15%, 50 C/s , speed 960/1440R&M including oil chamber, guide wire/ guide pipes for lifting & lowering of pump,mechanical seal, electrical control panels fabricated from 14 gauge CRCA sheet volt meter ammeter with selector switch, TPMPCB, 5 VA CL : CTs, phase indicating lamps protected by 2 amp SP MCB, DOL starter, necessary wiring, cable alleys, earthling, interlocking with Automatic float type

level controller, provision of high level alarm, sequence timer, potential free contact to starter , S.S. galvanized lifting chain, duck foot bend with following specifications:
(a) Set of Total 2 nos. of Pumps (Both operating in cyclic operation)
(b) Necessary cables from pump set to control panel including termination as required (panel shall be located in flushing water treatment plant room , cost of cable and termination shall be paid seperately under relevant head).-- 1 Set
(b) Electrical switch panel having all necessary accessories & safety devices of standard specifications. Panel shall be compatible for integration with Building Management / Automation system with adequate potential free contacts etc.--1 Set
(c) Automatic water level controller with necessary length of cable upto control panel, complete as required
Location : Collection chamber to respective STP inlet , MOC : CI body; SS Impeller & Shaft
Solid Handling : 15-20 MM
a) Flow rate : 20m3/hr. Head : 10 Mts (Student Hostel)

MR 17.004 :Flow rate 30m^3/hr. Head 15 M

MR 17.005 : Submersible Centrifugal pump - Supply, installation, testing and commissioning of continuous duty submersible centrifugal non-clogging drainage pumps complete with 3 phase motor with all necessary protection and mechanical seal etc. complete with all ancillaries including float type level controllers, electrical control panels fabricated from 14 gauge CRCA sheet volt meter ammeter with selector switch, TPMPCB, 5 VA CL : CTs, phase indicating lamps protected by 2 amp SP MCB, DOL starter, necessary wiring, cable alleys, earthling, interlocking, starter with Automatic float type level controller, provision of high level alarm, sequence timer, potential free contact to starter for connection to BAS, both pumps may run simultaneously at pre-determined level. (1 Working + 1 Standby) - Flushing water Transfer from polishing pond

a) Flow rate : 20m^3/hr. Head : 15 Mts Solid Handling : 15-20 MM Location : Polishing Pond to transfer sewage to STP collection tank : MOC : CI body; SS Impeller & Shaft

MR 17.006 :Flow rate 30m^3/hr. Head 15 M

1. MATERIAL :-

a. These shall be fully submersible with a fully submersible motor. The pumps shall be provided with an automatic level controller and all interconnecting power and control cabling which shall cause the pumps to operate when the water level in the sump rises to a preset level and stop when the preset low level is reached.
b. Pumps for drainage shall be single stage, single entry.
c. Pump shall be C.I. casing and C.I. two vane open type with a dynamically balanced impeller connected to a common shaft of the motor. The vane for sewage pump will be open type, while for drainage pump, etc. it will

be of semi open type. The MOC of the sump shall be in accordance to schedule of quantity.

d. Stuffing box shall be provided with mechanical seals.
e. Each pump shall be provided with a suitably rated induction motor suitable for 415 volts, 3 phase, 50
f. Hz A.C. power supply.
g. Each pump shall be provided with in built liquid level controller for operating the pump between predetermined levels.
h. The pumping set shall be for stationary application and shall be provided with pump connector unit.
i. The delivery pipe shall be joined to the pump through a rubber diaphragm, and bend and guide pipe for easy installation.
j. Pump shall be provided with all accessories and devices necessary and required for the pump to make it a complete working system.
k. Sump pump shall be complete with level controllers, power and control switch gear, Auto/off/Manual switches, pumps priority selections and control and power cabling upto motor and controller/probes etc. (Including earthing). Level control shall be such that one pump starts on required level, 2nd pump cuts in at high level and alarms is given at extra high level. All level controllers shall be provided with remote level indications.

l. Motor Design

i. The pump motor shall be a squirrel cage induction, housed in air filled water-tight enclosure. Oil filled motors are not acceptable. The stator windings shall be Class "F" insulation (155 degree C or 311 degree F) for general usage and class `H' insulation (180 degree C or 317-8 grade 2) for submersible type.
ii. The stator shall be heat shrunk fitted into the enclosure and shall not use bolts, pins or other fasteners that penetrate through the stator enclosure. The starter shall be equipped with a thermal switch embedded in series in the coils of the stator windings to protect the stator from wheel.
iii. The motors shall be designed for continuous running duty type at 415 volts, 3 phase, 50 Hz power supply and capable of sustaining a minimum of 20 starts/stops per hour.
iv. Between stator housing and pump, a tandem seal arrangement will be provided with an oil barrier. Both seals run in oil, allowing dry running without seal damage. Both seals shall be of the rubber bellows or metallic bellow type with positive drive between shaft and rotating seal face.

2. Measurement : Pumps shall be measured by the number and rate which shall include supply, testing and commissioning of pumps

MR 17.007:Supply, installation, testing & commissioning M.S. puddle flanges fabricated of 750 mm long pipe pieces to R.C.C. water tanks wall / slab. The entire fitting shall be hot dipped galvanized (Flanges shall confirm to BS10 Table E)

(a) 32 mm dia (Screwed ends MS plate 6 mm thick; 100 mm x 100 mm plus dia of pipe).

MR 17.008: (b) 40 mm dia (Screwed ends MS plate 6 mm thick; 100 mm x 100 mm plus dia of pipe).

MR 17.009: (c) 50 mm dia (Screwed ends MS plate 6 mm thick; 250 mm x 250 mm plus dia of pipe).

MR 17.010: (d) 80 mm dia (Flanged ends MS plate 6 mm thick; 250 mm x 250 mm plus dia of pipe).

MR 17.011: (e) 100 mm dia (Flanged ends MS plate 6 mm thick; 300 mm x 300 mm plus dia of pipe)

MR 17.012: (f) 150 mm dia (Flanged ends MS plate 6 mm thick; 300 mm x 300 mm plus dia of pipe).

MR 17.013: (g) 200 mm dia (Flanged ends MS plate 6 mm thick; 300 mm x 300 mm plus dia of pipe).

Puddle Flanges shall be fabricated from MS pipe, Heavy duty confirming to IS 1239 part 1 and 6mm thick MS plate of specified dimension and flange shall be welded at one end of the puddle for connection with header the complete arrangement shall be made as per typical details drawings provided by consultant and the complete arrangement shall be galvanized post fabrication of set as required. Installation of puddle flanges under RCC tank should be done as per drawing provided by consultant / approved drawings. In any case no puddle flange should be installed prior approval of drawings from engineering consultant

18 FIRE FIGHTING

SCOPE

The scope of this section consists of but is not necessarily limited to supply, installation, testing and commissioning of the fire protection system. The philosophy of the system is as follows :
The Fire protection System shall comprise the Fire Hydrants System, the Sprinkler System (Wet type), and Hand Appliances along with fixed fire protection system.

Water from the underground RCC Fire Water Storage Tanks of 200 cum capacity, shall be supplied for the uses listed below.

Fire Hydrant System (Pressurized) both for the external hydrants, the internal landing valves and the hose reels at landings.

The Hydrant System, under normal conditions, shall be lowest pressurized by means of the electric motor driven Jockey Pump.

The Hydrant System shall be provided with two pump sets, one of which will be diesel engine driven and the other electric motor driven.

The piping and valve connections shall be done so that the water from the discharge of the Hydrant Pump sets is able to supply water, automatically to the Sprinkler System whenever, the Sprinkler Pump is unable to maintain the pressure or fails and not vice versa.

The starting and stopping of the Jockey pump shall be automatic based on the pressure switches at preset low and high pressure.

The electric motor driven Hydrant Pump starts automatically at a preset pressure by means of a pressure switch. As soon as the Hydrant Pump starts, the Jockey Pump Stops. If for any reason the electric motor driven Hydrant Pump does not start at the preset pressure or is unable to maintain the pressure, the diesel engine driven Hydrant Pump starts at the preset pressure.

The Hydrant Pump, whether electric motor driven or the diesel engine driven shall be stopped only manually.

Contractor shall ensure Hydro Testing for the complete system.

DRAWING :-
The work shall be carried out in accordance with the Architectural drawings, structural drawings and approved shop drawings. The shop drawings shall be correlated before the executions of work.

The tender drawings accompanying these specifications are design drawings and generally are schematic. They do not show every offset,

T, Cross, Y, junction coupling/flanges etc., which are required for installation in the space provided. The contractor shall prepare detailed shop drawings by following these drawings, as closely as is practicable, with necessary additional bends, elbows or junctions etc., where required to suit local site conditions, from actual site measurement taken, get the same approved from the Consultants in good time & follow then at site, without additional cost to the Owner.The Owners reserve the right to make any reasonable change in outlet location prior to roughing in. All connections and appurtenances, shown in the various diagrams, shall be included in the finished job. The contractor shall visit the site prior to bidding, to familiarize himself with all conditions.

It shall be the contractor's responsibility to co-ordinate with all others for proper and adequate installation clearances.

ORDINANCE, CODE AND REGULATIONS:-

The Contractor shall obtain the necessary approval of the drawings and the schemes from the local authority / IS /NBC as called for. The contractor shall also take care of any other requirement so that insurance cover can be obtained, if required at minimum premium at a later date.

Unless, otherwise approved the product shall bear the mark of approval of ISI as required by the Governing bodies, code and ordinances and local authorities, whose permission are required for occupation of the building on completion.

MEASUREMENT LINES &LEVELS:-

Check dimension at the building site and establish lines and levels for the work specified.

All pipes, water mains, or gas mains, telephone and electric cables etc., met within the course of excavation, shall be carefully protected and supported without any extra charge.

GENERAL REQUIREMENTS

All materials shall be of the best quality conforming to the specifications and subject to the approval of the Consultants.

Pipes shall be fixed in a manner as to provide easy accessibility for repair and maintenance and shall not cause obstruction in shafts, passages etc.

Pipes shall be securely fixed to walls and ceilings by suitable clamps and supports (galvanized after fabrication) at intervals specified. Only approved type of anchor fasteners shall be used for RCC slabs and walls / floors etc.

Valves and other appurtenances shall be so located that they are easily accessible for operations, repairs and maintenance.

Pipes and fittings shall be fixed truly vertical, horizontal or in slopes as required in a neat workman like manner.

Pipe accessories such as gauges, meters, control devices, etc. shall have the same working pressure rating as the associated pipe work. All pipe work shall be free from burrs, rust and scale and shall be cleaned before installation. All personnel engaged on welding operations must possess a certificate of competence issued by an acceptable / recognized authority.

ITEMIZED SPECIFICATIONS FOR FIRE FIGHTING WORKS

MR 18.001 :Supply, installation, testing and commissioning of booster pump comprising of the following:
(a). Horizontal certifugal pump, suitable for operation on 415 volts ± 6%, 3 phase, 50 HZ A.C supply. The pump casing shall be CI, shaft shall be CS & impeller /shaft sleeve / casing wearing ring shall be bronze. The system shall be complete with necessary pressure gauge with gun metal shut off cock on delivery side. (The pump should meet the condition and shall be gotten approved by the Local fire Authority)
(b). Squirrel cage induction motor TEFC type for operation on 415 V, 3 phase 50 HZ AC supply for the above pump with a synchronous speed of 2900 R.P.M. with flexible coupling and coupling guard etc. as required.

(c). Common base plate for (a) and (b) from M.S. channel as required size.d. Common base plate for (a) and (b) from M.S. channel of required size.d. Suitable cement concrete foundation with plaster, (design and drawing to be provided by the Contractor while the foundation will be done by others) complete with antivibration arrangement of cushy foot mountings.

For pump defined above & of duty as follows :

a) Flow :450 LPM Head : 30 mts

SCOPE

Work under this section shall consist of furnishing all labor, materials, equipment and appliances necessary and required to completely install electrically operated and diesel driven pumps and as required by drawings and specified hereinafter or given in the schedule of rates.
Multi-outlet electrically operated pumps with motors, common base plates, coupling, coupling guard and accessories.
Automatic starting system with all accessories, wiring and connections and pressure switches.
Motor control centre.
Annunciation system with all accessories wiring and connections.
Pressure gauges with isolation valves and piping, bleed and block valves.
Suction strainers and accessories.
Vibration eliminator pads and foundation bolts.
Leak-off drain shall be led to the nearest floor drain.

GENERAL REQUIREMENTS

Pumps shall be installed true to levels on suitable concrete foundations. Base plate shall be firmly fixed by properly grouted foundation bolts.

Pumps and motors shall be truly aligned by suitably instruments. Record of such alignment shall be furnished to the Project Manager.

All pump connections shall be standard flanged type with number of bolts as per relevant standard requirement for the working pressure. Companion flanges shall be provided with the pumps.
Manufacturers' instructions regarding installation, connections and commissioning shall be strictly followed.
Contractor shall provide necessary test certificates, type test certificates, performance curves and NPSH curves of the pumps from the manufacturer when called for. The contractor shall provide facilities to the Project Manager & Consultant for inspection of equipment during manufacturing and also to witness various tests at the manufacturer's works without any cost to the Project Manager or Consultant.
Seismic isolation and clamping for each pump and flexible connection on the suction as well as the discharge side shall be provided.
The contractor shall submit with this tender a list of recommended spare parts for three years of normal operation and quote the prices for the same as a separate submittal / annexure.

ELECTRIC FIRE PUMP

General

The electric fire pump shall be suitable for automatic operation complete with necessary electric motor and automatic starting gear, suitable for operation on 415 volts, 3 phase, 50 Hz. A.C. system. Both the motor and the pump shall be assembled on a common base plate, fabricated M.S. channel type or cast iron type.

Drive

The pump shall be direct driven by means of a flexible coupling. Coupling guard shall also be provided.

FIRE PUMP

The fire pump shall be multistage pump with Multi outlets, horizontallymounted, centrifugaltype. It shall have a capacity to deliver 2800 lpm as specified and developing adequate heads so as to ensure a minimum pressure of 3.5 kg/sq.cm at the highest and the farthest outlet.

The pump shall be capable of giving a discharge of not less than 150 per cent of the rated discharge, at a head of not less than 65 per cent of the rated head. The shut off head shall be within 120 per cent of the rated head.

The pump casing shall be of cast iron to grade FG 200 to IS: 210 and parts like impeller, shaft sleeve, wearing ring etc. shall be of non-corrosive metal like bronze/brass/gun metal. The shaft shall be of stainless steel. Provision of mechanical seal shall also be made.

Bearings of the pump shall be effectively sealed to prevent loss of lubricant or entry of dust or water. The pump shall be provided with a plate indicating the suction lift, delivery head, discharge, speed and number of stages. The pump casing shall be designed to withstand 1.5 times the working pressure.

The pump shall be preferably Non-overloading type with continuous rising head characteristic.

The pumps should be factory assembled and aligned with the motor mounted on a motor stool.

The impeller shall be enclosed type, statically & dynamically balanced.

The impeller shall be same size & same diameter.

The Shut off head of the pump shall not exceed 120% of rated head.

Pumps shall deliver not less than 150% of rated capacity at total head of not less than 65% of rated head.

Pump should be with gland packing

Provision of Jockey Pump of multioutlet for low and high zone shall be made. The pump shall be vertical SS type and of detail as in schedule of quantity. Contractor shall verify that the capacity of the Jockey pump shall not be less than 3% (Minimum 230 LPM) and not more than 10% of the installed pump capacity. The pump should factory assemble and aligned with motor mounted on motor stool.

Motor

The motor shall be squirrel cage A.C. induction type suitable for operation on 415 volts 3 phase 50 Hz. system. The motor shall be totally enclosed fan cooled type conforming to protection clause TEFC IP 55 suitable for DOL starting. The class of insulation shall be F. The synchronous speed shall be 1500 RPM as specified. The motor shall be rated for continuous duty and shall have a horse power rating necessary to drive the pump at 150 per cent of its rated discharge with at least 65 per cent rated head. The motor shall conform to I.S.325-1978.

Motor Starter

The motor starter shall be as per detail in MCC. The unit shall include suitable current transformer and ammeter of suitable range on one line to indicate the current. The starter shall not incorporate under voltage, overload voltage trip overload or SPP.

The starter assembly shall be suitably integrated in the power and control panel for the wet riser system & sprinkler system.

MOC of Pump

Sr.	Description	Main Pump	Jockey Pump
	Casing	CI IS 210 Gr. FG 260	CI IS 210 Gr. FG 260
	Impeller	Bronze LT BR IS 318 - LTB 2	Bronze LT BR IS 318 - LTB 2
	Shaft	Carbon Steel, CS IS 1570 40C8 NOM	Carbon Steel, CS IS 1570 40C8 NOM
	Shaft Sleeve	ST ST ASTMA 276 -410	ST ST ASTMA 276 - 410

PUMP SETS ASSEMBLY

a. Each and every pump set assembly shall be provided with suction valve (only for positive suction head), discharge valve, non-return valve and 150 mm dia Bourdon type pressure gauge with isolation valve.

FLEXIBLE CONNECTORS

a. On all suction and delivery lines double flanged reinforced neoprene flexible pipe connectors shall be provided. Connectors should be suitable for maximum working pressure of each pipe line on which it is mounted and tested to a test pressure of 1:5 time the operating pressure. Length of the connector shall be as per manufacturer's standard.

INTERLOCKING

a. The following inter-locking between the two main fire pumps (i.e. wet riser pump & sprinkler pump), the jockey pump and the diesel engine driven pump.

b. Only one category of pumps will work at a time i.e. either jockey pump or main fire pumps (wet riser and sprinkler, both the wet riser and sprinkler can come up at a time) or Standby (diesel driven) pump.

Sr.	**JOCKEY**	**WET RISER**	**SPRINKLER**	**STANDBY**

	PUMP	PUMP	PUMP	PUMP
1.	ON	OFF	OFF	OFF
2.	OFF	ON	OFF	OFF
3.	OFF	OFF	ON	OFF
4.	OFF	ON	ON	OFF
5.	OFF	OFF	ON	ON
6.	OFF	OFF	OFF	ON
7.	OFF	ON	OFF	ON

VIBRATION ISOLATION

The pump set shall be mounted on rolled steel channels and 150 mm thick inertia block spring and ribbed neoprene vibration isolation mounting shall support the inertia block onto a 100 mm thick concrete plinths. The spring mountings shall have a maximum deflection of 15 mm. Reference shall be made to the section on "Nose and Vibration" for further technical requirements.

PERIODICAL TESTING AND MAINTENANCE CHART

Sr.	SUBJECT	ACTIVITIES	DURATION
1.	Reservoir	Level checking Clearing	Weekly Once in two years
2.	Pump	Running test Test flow Lubrication G1and packing Overhaul	Daily 5 minutes Annually Quarterly Weekly Once in two years
3.	Engine	Running Lubrication Battery Load test Overhaul Fuel tank check	Once in day (5 mins) Quarterly Status weekly Annually Once in two years Daily
4.	Motor	Lubrication Starter contact checking insulation resistance check	Weekly Weekly Half yearly
5.	Main piping	Flushing Gauge pressure	Once in two years Check daily
6.	Sluice valves	Operation Gland packing Lubrication	Monthly Monthly Quarterly
7.	Deluge valves	Operation Alarm check	Weekly Weekly

Sr.	SUBJECT	ACTIVITIES	DURATION
		Overhaul Cleaning	Annually Quarterly
8.	Sprayers	Cleaning Flow test	Quarterly Quarterly
9.	Detectors	Performance	Six monthly
10.	Spray installation	Performance Physical checkup of piping for seeing dis-location of support, wrong orientation, over-loading etc	Quarterly Monthly
11.	Pressure gauges	Calibration	Annually
12.	Painting	Painting of entire installation	Every two years

MR 18.002 :Supply, installation, testing & commissioning of pressure switch for auto cut in & cut out of pump. The pressure switch shall decide maximum pressure at which the switch has to changeover, On-OFF differential, and maximum/minimum changeover pressure. Pressure switch shall be mounted on pipe with electrical contact, connection from fire panel, Cost shall be inclusive of providing any short pieces, nipples, and elbows etc. as per approved specifications.

The pressure switches shall be employed for starting and shutting down operation of pumps automatically, dictated by line pressure. The Pressure Switch shall be diaphragm type. The housing shall be die cast aluminum, with SS 316 movement, pressure element and socket. The set pressure shall be adjustable.

The Switch shall be suitable for consistent and repeated operations without change in values. It shall be provided with IP:55 water and environment protection.

MR 18.003 : Supply, installation, testing & commissioning dial type (100 mm) pressure gauge with isolation ball valve suitable for working pressure of 250 PSI. Cost shall be inclusive of providing any short pieces, nipples, elbows etc as required.

Pressure gauge shall be provided near all individual connections of the hydrant system with isolation valves and near each flow switch assembly of the sprinkler system. Pressure gauge shall be 50 mm dia gunmetal bourdon type with gunmetal isolation ball valve, tapping and connecting

pipe and nipple. The gauge shall be installed at appropriate height for easy readability.

MR 18.004 :Providing, laying, jointing, testing and commissioning of following sizes of pipes conforming to IS-1239 , Heavy class with all accessories like all fittings (standard MS fitting with welded joint shall be used on the pipes) including tees, elbows, reducers, union, flanges, rubber gaskets, GI nuts bolts, washer including supporting/fixing the pipe on floor / wall /ceiling with clamps, hangers (using anchor fasteners) as per specification. G.I. pipe sleeve of suitable higher size shall be provided and fixed wherever the pipes are crossing the walls/floors and sealing the sleeves with glass wool in between & fire sealant compound at either end all as directed by Engineer - in - Charge / mandatory requirements including cutting holes and chases in brick, RCC work and making good the same to original conditions complete in all respects. All hangers, clamps, brackets etc. shall be of galvanized iron unless specified otherwise and the supply of the same shall also be included in the quoted rates under this head. (Welding of any kind on the galvanized support / hanger shall not be permitted.) Synthetic enamel paint of approved shade over a coat of zinc primer will be applied as required by Engineer - in - Charge/mandatory requirement, without extra cost.

(a) 25mm nominal dia

MR 18.005 : (b) 65 mm nominal dia

MR 18.006 :(c) 80 mm nominal dia

MR 18.007 : (d) 100mm nominal dia

Pipes of following types are to be used:

Mild steel black pipes as per IS:1239 heavy grade(for pipes of sizes 150 mm N.B. and below) suitably lagged on the outside to prevent soil corrosion. M.S. pipes buried below ground shall also be suitably be lagged with 2 layers of 400 micron polythene sheet over 2 coats of bitumen.

Steel pipelines up to 150 mm dia shall be as per IS: 1239, Part-II (heavy grade) while pipelines above 150 mm dia shall be as per I.S.:3589.

All pipe clamps and supports shall be fabricated from MS steel sections and shall be factory galvanized before use at site. Welding of galvanized clamps and supports shall not be permitted.

Pipes shall be hung by means of expandable anchor fastener of approved make and design. The hangers and clamps shall be fastened by means of galvanized nuts and bolts. The size/diameter of the anchor fastener and the clamps shall be suitable to carry the weight of water filled pipe and dead load normally encountered.

Hangers and supports shall be thoroughly galvanized after fabrication. The selection and design of the hanger & support shall be capable of carrying the sum of all concurrently acting loads. They shall be designed to provide the required supporting effects and allow pipeline movements as necessary. All guides, anchor braces, dampener, expansion joint and structural steel to be attached to the building/structure trenches etc. shall be provided. Hangers and components for all piping shall be approved by the Consultants.

The piping system shall be tested for leakages at 2 times the operating pressure or 1.5 time shut-off pressure, whichever is highest including testing for water hammer effects.

Flanged joints shall be used for connections for vessels, equipment, flanged valves and also on two straight lengths of pipelines of strategic points to facilitate erection and subsequent maintenance work.

For pipes underground installation the pipes shall be buried at least one meter below ground level and shall have 230 mm x 230 mm masonry or concrete supports at least 300 mm high at 3m intervals. Masonry work to have plain cement concrete foundation (1 cement: 4 coarse sand: 8 stone aggregate) of size 380x380x75 thick resting on firm soil.

Mains below ground level shall be supported at regular intervals not exceeding 3.0 meters and shall be laid at least 2.0 meter away from the building.

PIPING INSTALLATION & SUPPORT

a) Tender drawings indicate schematically the size and location of pipes. The Contractor, on the award of the work, shall prepare detailed working drawings, showing the cross-sections, longitudinal sections, details of fittings, locations of isolating and control valves, drain and air valves, and all pipe supports. He must keep in view the specific openings in buildings and other structure through which pipes are designed to pass.

b) Piping shall be properly supported on, or suspended from, on stands, clamps, hangers as specified and as required. The Contractor shall adequately design all the brackets, saddles, anchor, clamps and hangers, and be responsible for their structural stability.

c) Pipe work and fittings shall be supported by hangers or brackets so as to permit free expansion and contraction. Risers shall be supported at each floor with Galvanized steel clamps. To permit free movement of common piping support shall be from a common hanger bar fabricated from Galvanized steel sections.

d) Pipe hangers shall be provided at the following maximum spacing:

Pipe Dia (mm)	Hanger Rod Dia (mm)	Spacing between Supports (m)
Up to 25	6	2
32 to 50	6	2.5
65 to 80	8	2.5
80 to 100	10	2.5
125 to 150	10	3.0
200 to 300	12	3.5

e) The end of the steel rods shall be threaded and not welded to the threaded bolt.

f) All pipe work shall be carried out in a proper workman like manner, causing minimum disturbance to the existing services, buildings, roads and structure. The entire piping work shall be organized in consultation with other agencies work, so that area can be carried out in one stretch.

g) Cut-outs in the floor slab for installing the various pipes area are indicated in the drawings. Contractor shall carefully examine the cut-outs provided and clearly point out wherever the cut-outs shown in the drawings, do not meet with the requirements.

h) Pipe sleeves, larger diameter than pipes, shall be provided wherever pipes pass through walls and slab and annular space filled with fiberglass and finished with retainer rings.

i) The contractor shall make sure that the clamps, brackets, saddles and hangers provided for pipe supports are adequate or as specified / approved by Consultants. Piping layout shall take due care for expansion and contraction in pipes and include expansion joints where required.

j) All pipes shall be accurately cut to the required sizes in accordance with relevant BIS codes and burrs removed before laying. Open ends of the piping shall be closed as the pipe is installed to avoid entrance of foreign matter. Where reducers are to be made in horizontal runs, eccentric reduces shall be used for the piping to drain freely. In other locations, concentric reduces may be used.

k) Automatic air valves shall be provided at all high points in the piping system for venting. All valves shall be of 15mm pipe size and shall be associated with an equal size gate valves. Automatic air valves shall be provided on hot water risers.

l) Discharge from the air valves shall be piped through a pipe to the nearest drain or sump. All pipes shall be pitched towards drain points.

m) Pressure gauges shall be provided as shown on the approved drawings. Care shall be taken to protect pressure gauges during pressure testing.

PIPE FITTINGS

Pipe fittings mean tees, elbows, couplings, unions, flanges, reducers etc and all such connecting devices that are needed to complete the piping work in its totality.

Forged steel fittings of approved type with "V" groove for welded joints shall be used for pipes of all sizes.

Fabricated fittings shall not be permitted for pipes diameters 50mm and below.

When fabricated fittings are used, they shall be fabricated, welded in workshops. They shall be inspected by Project Manager before dispatch from the workshop. The welding procedures of the workshop should have been approved by the rules for sprinkler system and applicable to hydrant and sprinkler system. For "T" connection, pipes shall be drilled and reamed. Cutting by gas or electrical welding shall not be permitted.

PROCEDURE FOR PYPKOTE / COATEK APPLICATION

Surface Preparation - The pipe surface shall be cleaned by a wire brush.
Application of Primer - Pypkote / Coatek primer is to be applied on pipes immediately after cleaning. This is to prevent any further accumulation of rust on the pipe. This is a cold applied primer and is applied by brush.

Application of Pypkote / Coatek 4 mm Tape - After the primer is applied on the pipe, it is allowed to dry for about 30 min. till it becomes touch dry. Before adhering the tape to the pipe, it is advisable to gently heat the primer coated pipe by a run of LPG torch. Remove the bottom polyethylene from the tape & then heat bottom surface of the tape by LPG torch or any heat source & start wrapping the tape to the pipe by heating the primer coated pipe & by removing the bottom polyethylene from the tape before wrapping better adhesion between the tape & pipe is obtained. Overlaps are maintained with a minimum of 12.5 mm.

Tape coating of weld joints - The tape is applied over the weld joints after the necessary welding & testing methods of the joints is completed. The procedure for application of tape shall be the same as bare pipe procedure. Overlaps on each side of the weld joints shall be 50 mm.

A final coat of White wash with water based cement paint is done immediately over the entire coated pipe.

JOINTING

Welded Joints:

Joints between MS pipes and fittings shall be made with the pipes and fittings having "V" groove and welded with electrical resistance welding in an approved manner. But welding without "V" groove shall not be permitted.

All joints in the pipe line with screwed fittings shall be seal welded after testing and the weld plus the adjoining portion shall be given two coats of zinc rich primer.

Flanged joints (65 mm dia. and above)

Flanged joints with flanges conforming to IS: 6392 shall be provided onStraight runs at intervals not exceeding 25-30m on pipe lines of 50 mm diaand above and as directed by the Project Manager.
For jointing all types of valves, appurtenances, pumps, connections with other type of pipes, to water tanks and other places necessary and as required for good engineering practice and as shown/noted on the drawings.
Flanges shall be with GI bolts and nuts and 3mm insertion gasket of natural rubber conforming to IS: 11149.

Unions (up to 50 mm dia)

Approved type of dismountable unions shall be provided on pipe lines of 40 mm diaandsmaller dia, in locations similar to those specified for flanges.

PAINTING

All Hydrant and Sprinkler pipes shall be painted with post office red colour paint. All M S pipes shall first be cleaned thoroughly before application of primer coat. After application of primer coat two coats of enamel paint shall be applied. Each coat shall be given minimum 24 hours drying time. No thinners shall be used. Wherever required all pipe headers shall be worded indicating the direction of the pipe and its purpose such as "TO RISER NO.1" etc.

Painting shall be expertly applied, the paint shall not over run on surfaces not requiring painting such as walls, surfaces etc. Nuts and bolts shall be painted black, while valves shall be painted blue.

EXCAVATION

Excavation for pipe lines shall be in open trenches to levels and grades shown on the drawings or as required at site. Pipe lines shall be buried with a minimum cover of 1 meter or as shown on drawings.

Wherever required Contractor shall support all trenches or adjoining structures with adequate timber supports, shoring and strutting.

On completion of testing in the presence of the Project Manager and pipe protection, trenches shall be backfilled in 150 mm layers and consolidated.

Contractor shall dispose of all surplus earth as directed by the Project Manager.

ANCHOR / THRUST BLOCK Contractor shall provide suitably designed anchor blocks in cement concrete/steel support to cater to the excess thrust due to work hammer and high pressure

Thrust blocks shall be provided at all bends, tees and such other location as determined by the Project Manager.

Exact location, design, size and mix of the concrete blocks/steel support shall be as shown on the drawings or as directed by the Project Manager prior to execution of work.

MR 18. 008:Supply, installation , testing & commissioning forged brass ball valve with forged brass ball, suitable for working pressure of 16kg/sq.cma) 25mm nominal dia (Cost shall be inclusive of providing necessary union / flange connection).

MR 18.009: (b) 40 mm nominal dia.

MR 18.010: (c) 50 mm nominal dia

The ball valve shall be rated to IS778

The ball valve shall be made bronze and suitable for test pressure of pipe line. The valve shall be internally threaded to receive pipe connections.

The ball shall be made from brass and machined to perfect round shape and subsequently chrome plated. The seat of the valve body-bonnet gasket and gland packing shall be of Teflon.

The handle shall be provided with PVC jacket. The handle shall also indicate the direction of 'open' and 'closed' situations. The gap between the ball and the Teflon packing shall be sealed to prevent water seeping.

The handle shall also be provided with a lug to keep the movement of the ball valve within 90°. The lever shall be operated smoothly and without application of any unnecessary force.

The ball valve shall be rated to IS778

The ball valve shall be made bronze and suitable for test pressure of pipe line. The valve shall be internally threaded to receive pipe connections.

The ball shall be made from brass and machined to perfect round shape and subsequently chrome plated. The seat of the valve body-bonnet gasket and gland packing shall be of Teflon.

The handle shall be provided with PVC jacket. The handle shall also indicate the direction of 'open' and 'closed' situations. The gap between the ball and the teflon packing shall be sealed to prevent water seeping.

The handle shall also be provided with a lug to keep the movement of the ball valve within 90°. The lever shall be operated smoothly and without application of any unnecessary force.

DSR E & M Item No. 16.7.1.6:Supplying Installation Testing and Commissioning of Butterfly Valve (Manual) with CI body, SS Disc, Nitrile Rubber seal & O Ring, flanges, PN 16 pressure rating complete as required

a)65mm nominal dia

DSR E & M Item No. 16.7.1.5 :b) 80mm nominal dia

DSR E & M Item No. 16.7.1.4 :b) 100mm nominal dia

The butterfly valve shall be suitable for waterworks and rated for 300 P.S.I

The body shall be of cast iron to IS:210 in circular shape and of high strength to take the water pressure . The disc shall be heavy duty cast iron with anti-corrosive epoxy or nickel coating.

The valve seat shall be of high grade elastomer or nitrile rubber. The valve is closed position shall have complete contact between the seat and the disc throughout the perimeter. The elastomer rubber shall have a long life and shall not give away on continuous applied water pressure . The shaft shall be EN 8 grade carbon steel.

The valve shall be fitted between two flanges on either side of pipe flanges. The valve edge rubber shall be projected outside such that they are wedged within the pipe flanges to prevent leakages.

DSR E & M Item No. 16.7.1.2 : Supply, installation , testing & commissioning CI `Y' strainer with Stainless steel strainer including rubber gasket, flanges, nuts, bolts and washers, complete as per approved specifications.

(a). 80 mm nominal dia.

DSR E & M Item No. 16.7.4.4 :(c). 100mm nominal dia

CI Y strainer shall be confirm of IS standard of approved make, flanged end and SS -304 screen with fixing on pipes with flanges as per IS 6392 pressure rating PN 10.

DSR E & M Item No. 16.7.3.6 :Supply, installation, testing & commissioning dual plate CI wafer type check valve tested to a pressure of 15 Kg/sq.cm. Including rubber gasket, flanges, union, nuts, bolts, washers & painting complete as per approved specifications.
(a). 65mm nominal dia.

DSR E & M Item No. 16.7.3.5 :b) 80mm nominal dia.

Complete as per CPWD E&M manual specs 16.7.3.6

MR 18.011 :Supply, installation , testing & commissioning swinging type First Aid hose reel in red colour drum with 36 mts long and 20 mm dia heavy duty rubber water hose, 20 mm dia globe valve stop cock, terminating with G.M. coupling & nozzle of 6mm outlet with shut off valve confirming to IS 8090 - 1976 complete with MS socket for tap-off, drum and brackets (including painting) for fixing on wall with anchor fastener, bolts & nuts conforming to IS:884-1969 complete as per approved specifications.

Contractor shall provide standard fire hose reels of 20mm dia high pressure Dunloprubber hose 36 m long with gunmetal nozzle, all mounted on a circular hose reel of heavy duty mild steel construction having cast iron brackets. Hose reel shall be connected directly to the wet riser with an isolating valve. Hose reel shall conform to IS:884 and shall be mounted vertically This shall be measured and paid for separately.

MR 18.012 :Fire duct Shutter fabricated out of M.S.sheet of 16swg and frame, door shall be 900mm x 1200 mm min. & fixed with 4 mm thick Glass, suitable Rubber beading and Locking arrangement. Quoted rate shall include all fasteners etc., and complete shutter shall be powder coated of approved colour both inside and out side etc., complete.

Please refer item specs for MR 18.034

MR 18.013 :Mechanical Foam type Fire Extinguisher (ISI marked). In HP Mild Steel Cylinders ISI marked fitted with pressure indicating gauge, internal tube, squeeze lever type valve fully

charged complete in all respects including wall suspension bracket / trolley mounted and conforming to IS:910

a) 50 Litres (trolley mounted)

MR 18.014:Supply, installation, testing and commissioning of following types of extinguisher with provision of wall bracket (fixed with anchor fastener).ISI marked (IS:940) portable chemical fire extinguisher, water (gas pressure) type capacity 9 litres with gun metal cap and nozzle and complete in all respects including initial fill and wall suspension brackets (As approved by IS 15683)

MR 18.015 :ISI marked (IS:2878) Fire Extinguisher, Carbon-di-oxide type capacity 4.5 Kg (circular should be PESO approved). Flat base including valve, discharge hose of not less than 10 mm dia, 1M long and complete in all respects including initial fill with CO2 gas conforming to IS:307-1966 filled to a filling rate of not more than 0.667 and wall suspension bracket.

Scope

a. Work under this section shall consist of furnishing all labor, materials, appliances and equipment necessary and required to install fire extinguishing hand appliances as per relevant specification of various authorities.
b. Without restricting to the generality of the foregoing, the work shall consists of the following:
c. Installation of fully charged and tested fire extinguishing hand appliances of A B C powder type as required and specified in the drawings and schedule of rates.

General Requirements

i. Hand appliances shall be installed in easily accessible locations with the brackets fixed to the wall by suitable anchor fasteners.
ii. Each appliance shall be provided with an inspection card indicating the date of inspection, testing, change of charge and other relevant data.
iii. All appliances shall be fixed in a true workmanlike manner truly vertical and at correct locations.
iv. Distribution / installation of fire extinguisher to be in accordance to IS: 2190.

1. Material :-

a. **Carbon Dioxide Extinguisher**

i. The Carbon Dioxide Extinguisher shall be as per IS: 2878
ii. The body shall be constructed of seamless tube conforming to IS: 7285 and having a convex dome and flat base. Its dia shall

be maximum 140 mm, and the overall height shall not exceed 720 mm.

iii. The discharge mechanism shall be through a control valve conforming to IS: 3224. The internal syphon tube shall be of copper aluminum conforming to relevant specifications.

iv. Hose Pipe shall be high pressure braided Rubber hose with a minimum burst pressure of 140 Kg/cm2 and shall be approximately 1.0 meter in length having internal dia of 10 mm. The discharge horn shall be of high quality unbreakable plastic with gradually expanding shape, to convert liquid carbon dioxide into gas form. The hand grip of Discharge horn shall be insulated with Rubber of appropriate thickness.

v. The gas shall be conforming to IS: 307 and shall be stored at about 85 Kg/cm2. The expansion ratio between stored liquid carbon dioxide to expanded gas shall be 1:9 times and the total discharge time (effective) shall be minimum 10 secs and maximum 25 secs.

vi. The extinguisher shall fulfill the following test pressures:

vii. Cylinder: 236 Kg/cm2

viii. Control Valve: 125 Kg/cm2

ix. Burst Pressure of Hose: 140 Kg/cm2 minimum

x. It shall be an Upright type. The cylinder, including the control valve and high pressure Discharge Hose must comply with relevant Statutory Regulations, and be approved by Chief Controller of Explosives, Nagpur and also bear IS marking.

xi. The Extinguisher including components shall be IS marked.

b. ABC Type Dry Powder Extinguisher

i. The Extinguisher shall be filled with ABC grade 40, Mono Ammonium Phosphate 40% from any approved manufacturer.

ii. The capacity of the extinguisher when filled with Dry Chemical Powder (First filling) as per IS 4308, Part

iii. II, shall be 5 Kg +/-2% or 10 Kg +/- 3%.

iv. The distribution of fire extinguishers to be as per IS 2190 – 1992.

v. It shall be operated upright, with a squeeze grip valve to control discharge. The plunger neck shall have a safety clip, fitted with a pin, to prevent accidental discharge. It shall be pressurized with Dry Nitrogen, as expellant. The Nitrogen to be charged at a pressure of 15 Kg/cm2

vi. Body shall be of mild steel conforming to relevant IS Standards. The neck ring shall be also mild steel and welded to the body. The discharge valve body, shall be forged brass or leaded bronze, while the spindle, spring and siphon tube shall be of brass. The nozzle shall be of brass, while the hose shall be braided nylon. The body shall be cylindrical in shape, with the dish and dome welded to it. Sufficient space for

vii. Nitrogen gas shall be provided inside the body, above the powder filling.

viii. The Neck Ring shall be externally threaded - the threading portion being 1.6 cm. The filler opening in the neck ring shall not less than 50 mm. Discharge nozzle shall be screwed to the hose. The design of the nozzle shall meet the performance requirement, so as to discharge at least 85% of contents up to a throw of 4 mtrs, continuously, at least for 15 seconds. The hose, forming part of discharge nozzle, shall be 500 mm long, with 10 mm dia internally for 5 Kg capacity and 12 mm for 10 Kg capacity. It shall have a pressure gauge fitted to the valve assembly or the cylinder to indicate pressure available inside. The extinguisher shall be treated with anti-corrosive paint, and it shall be labelled with words ABC 2.5 cm long, within a triangle of 5 cm on each face. The extinguisher body and valve assembly shall withstand internal pressure of 30 Kg/cm2 for a minimum period of 2 minutes. The pressure gauge shall be imported and suited for the purpose.

c. Water Type Extinguisher (Gas Pressure Type)

i. The Extinguishing medium shall be primarily water stored under normal pressure, the discharge being affected by release of Carbon Dioxide Gas from a 120 gms cylinder.
ii. The capacity of Extinguisher, when filled up to the indicated level, shall be 9 ltr +/- 5%
iii. The skin thickness of the Cylinder shall be minimum 4.0 mm, fabricated from Mild Steel sheet, welded as required, with dish and dome, being of same thickness, and of size not exceeding the diameter of body.
iv. The diameter of body to be not less than 150 mm and not exceeding 200 mm. The neck shall be externally threaded up to a minimum depth of 16 mm, and leaded tin bronze.
v. The cap shall be of leaded tin bronze, and screwed on the body up to a minimum of 1.6 cm depth, with parallel screw thread to match the neck ring. The siphon tube to be of brass or G.I. and the strainer of
vi. Brass. The cartridge holder, knob, discharge fittings and plunger to be of Brass/Leaded tin bronze, and plunger of stainless steel, spring of stainless steel. The cap to have handle fixed to it. The discharge hose shall be braided nylon, of 10 mm dia and 600 mm long, with a nozzle of brass fitted at end.
vii. The extinguisher shall be treated for anti-corrosion internally and externally, and externally painted with
viii. Fire Red paint. The paint shall be stove enameled/powder coated. The cartridge shall be as per IS, and have 60 gm net carbon dioxide gas for expelling. The extinguisher, body and cap shall be treated to an internal hydraulic pressure of 25 Kg/cm2. It shall have external marking with letter A, of 2.5 cm height, in block letters within a triangle of 5 cm each side. The extinguisher shall be upright in operation, with the body placed on ground and discharge tube with nozzle held in one hand to give a throw of not less than 6 mtr, and continue so for at least

60 secs. The extinguisher body shall be clearly marked with ISI stamp (IS 940).

2. Measurement

Fire extinguishers shall be counted in numbers and include installation of all necessary items required as given in the specifications

MR 18.016 : Supplying and installing at approved location approved make fire buckets of 24 gauge galvanized steel sheet, standard 9 litre capacity and of round bottom shape, painted white inside and red outside and black on the bottom, inscribed with letters "FIRE" in black and gold. Cost shall be inclusive of providing MS stand duly painted over a coat of primer complete as per specification- Set of 6 Buckets/Stand.

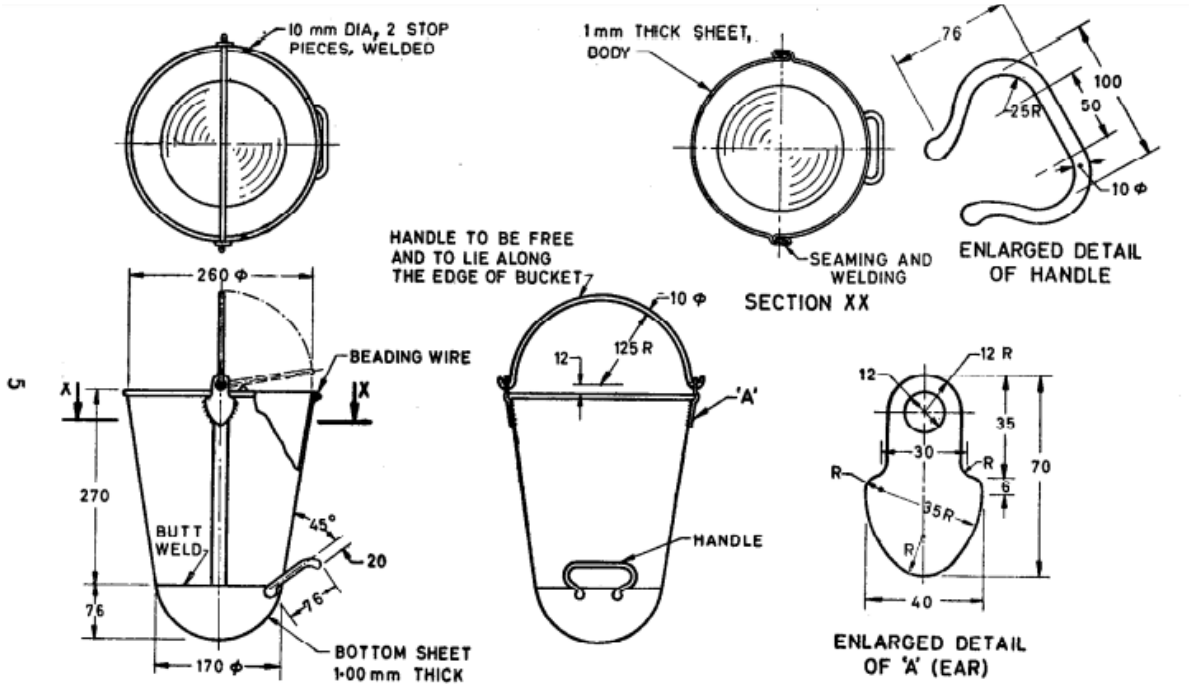
1. **Material:** The fire bucket shall be conforming to IS 2574 – 1974. Mild steel black sheets used for the manufacture of buckets shall conform to Grade St 34 or Grade St 42 of IS : 1079-1968.Mild steel rod used for the top and bottom handles shall conform to IS : 226-1969.Mild steel wire used for stiffening the top rim shall conform to IS : 280-1962. Paints used for painting of fire buckets shall conform to the appropriate Indian Standards given in Table 1 :

Table 1 – Paints for Painting of Fire Buckets

Sr. No.	Purpose	Reference to IS Standards	
		When Oil Paint Finish is required	When Enamel Finish is required
(1)	(2)	(3)	(4)
i)	White paints for painting the inside	IS : 641-1964	IS : 2932-1964
ii)	Red paints for painting the outside	IS : 120-1962	
iii)	Black paint for painting handles, cars and letters	IS : 128-1962	

SHAPE AND ESSENTIAL DIMENSIONS

The shape and the essential dimensions of fire bucket shall conform to those shown in Fig. 1.



All dimensions in millimetres.

FIG. 1 FIRE BUCKET — SHAPE AND ESSENTIAL DIMENSIONS

MANUFACTURE:

1. Body - The together by butt uniformly beaded body shall be in two halves which shall be joined welding. The top rim of the body shall be wired and the beading shall be fully formed without gaps. The thickness of body shall be 1 mm and diameter of beading wire 3’55 mm.
2. Bottom- The bottom shall be dished and shall be joined to the body by butt welding so that there is no raw edge or crevice on the inside of the bucket. The thickness of the bottom sheet shall be 1 mm.
3. Ears - The ears shall be made of mild steel sheet and shall be fitted to the body at the top by means of welding with the flat head on the side. The thickness of sheet for ears shall be 2’8 mm.
4. Top Handle - The top handle shall be of mild steel rod of 10 mm in diameter with its ends bent up as shown in Fig. 1.
5. Bottom Handle - The bottom handle shall be of mild steel rod of 10 mm in diameter and it shall be joined to the bottom by welding as shown in Fig. 1. The grip shall have no sharp edges.

FINISH

1. All parts of the bucket shall be finished smooth and sharp edges rounded off.

2. The bucket shall be galvanized after manufacture as per IS : 2629- 1966*. The thickness of coating of zinc on any portion shall be not less than 0.06 g/cma(both sides inclusive).
3. Bucket shall, in addition to galvanizing, be painted with two coats of white paint on the inside and two coats of red paint on the outside (scc also 2.4). The handles and the. ears shall be painted with two coats of black paint.

The word ' FIRE ' shall be painted in black. centrally on the outside; its letters shall be 75 mm high, and approximately 12 mm thick.

PERFORMANCE REQUIREMENTS

1. The bucket shall be water tight and tested for leakage
2. The bucket shall be filled with water to the brim and kept for 15 minutes. The bucket shall not show any sign of leakage during this period.
3. A water tank of suitable size and full of water shall be used for conducting the test. The dry empty bucket with its top facing upwards shall be pressed down the water vertically taking care that the top is at least 6 mm above the water level. It shall be observed whether any watergets into the bucket from the bottom or sides of the bucket. If any water enters the bucket, it shall be considered to have failed the test.
4. The bucket shall be withdrawn, reversed (with top downwards) and again pressed down the water vertically without agitating the water. Should any air bubble be seen escaping through the water, the bucket shall be considered to have failed the test.

INSPECTION:

The purchaser or his representative shall, if desired, be granted facilities for inspection of finished goods prior to dispatch at the manufacturer's works.

Mode of Measurement:

Fire Bucket Stand shall be counted as set of 6 bucket / stand and inclusive of all placing at location and necessary items required as given in the specifications

ELECTRICAL SYSTEM, INSTRUMENTATIONS & MCC CONTROLS FOR FIRE PROTECTION SYSTEM

CABLES AND END TERMINATIONS

MR 18.017 :Supply, Installation, Testing and Commissioning of following armoured cables from main panel to sub panels and from sub panels to final DBs. All the below mentioned cables shall be 1.1kV grade, XLPE insulated, FRLS type armoured cables of Al / Cu, whichever applicable with inner and outer PVC sheath. The said cables shall confirm IS 7098-1, BS 5467, IEC 60502-1, BS 7889 all supplymentary.The rate shall include complete Supply, Installation, Testing and Commissioning rates including cost of fire retardant sealant all tools and accessories required to Complete the job in full respect.
4C X 25 sq.mm Cu. 2XWY

MR 18.018 :2C X 2.5 sq.mm. 2XY for instrumentation

DSR 9.1.34 : Supply, Installation, Testing and Commissioning of end terminations of following armoured cables. All the lugs shall be of Cu/Al lugs and glands shall be double compression brass glands as per the technical specifications. The cost shall include the cost of crimping and all tools and accessorised required to complete the job in full respect.

4C X 25 sq.mm Cu. 2XWY

DSR 9.1.1: 2C X 2.5 sq.mm. 2XY for instrumentation

DSR 5.15: Providing and Fixing of 25 x 3 mm G.I. strip on surface or in recess for connections etc. as required

DSR 5.16: Providing and Fixing of 6 SWG dia G.I. wire on surface or in recess for loop earthing as required

MR 18.019 : Design, fabrication, assembling, wiring, supply, installation, testing and commissioning of motor control centre shall be fabricated out of 14 gauge CRCA sheet steel in form in 3b formation with reinforcement of suitable size angle iron, channel 'T' sections irons and /or flats wherever necessary.

MCC-1 for Fire Fighting equipment's
Incoming
63 amps TPN MCCB with the following accessories:
a.) 0-500 volts 96 x 96 mm square voltmeter with selector switch protected by 2 amps TP MCB. 1 Set
b). Phase indicating lamps protected by 2 amp SP MCB 3 Sets
Outgoings
a.) 1 Nos. 32 amps TPN MPCB, 5.5 KW DOL starter, replay range 13.5 - 20.0 A with single phase preventer and outgoing feeder to terrace pump motor. The compartment shall contain CT

operated ammeter of 0-63 amps and indicating lamps with MCBs for `ON'/OFF`TRIP' status of pump motors.
b.) Necessary cable alleys, internal wiring, and interlocking, earthling for all equipment shall also included.
c). Necessary cable alleys space for spare switches, internal wiring and copper earthling of all equipment shall also be included. All switch gears/control gears shall be motor duty rating.
d) Complete Auto Start and stop of pumps at set pressure as per specifications
Provision shall be made for providing potential free contacts to all pumps starters for connection to building automation system.

ELECTRICAL INSTALLATION

SCOPE

The scope of this section comprises of fabrication, supply, erection, testing and commissioning of fire pump panels

GENERAL

Work shall be carried out in accordance with the accompanying specifications and shall comply with the latest relevant Indian Standards and Electricity Rules and Regulations.

The tenderer should supply necessary starters for motors. Other electrical wiring/earthling up to the control board will be done by another agency. The tenderer will however, be responsible to carry out all further electrical work thru a Licensed electrical contractor.

Electrical Panel:-

The panel (MCC) shall be free standing. Cubical type with copper bus bars and painting by usual tanking treatment. A voltmeter and an ammeter with selector switches and indicating lamps shall be provided at both the incomers. An ammeter with indicating lamp shall be provided on all outgoings. Suitable interlocking to prevent connection of both sources of supply at the same time should be included. A warning beeper and hooter should be provided to operate in case of either a failure of power or low pressure in the delivery main. Earthing of all equipment to be included. Only power line upto the panel board will be arranged by the Owners

SPECIFICATIONS OF LT ELECTRICAL PANELS:

Applicable Standards:

The design, manufacturing process and performance of the L.T. electrical panel boards and all the equipment & instruments incorporated in the same shall comply with the latest Indian Standards set by B.I.S. and particularly to the following :

BRIEF DESCRIPTION	REFERENCE STAND
Switch gear General Requirements	IS : 13947-1993
Factory Built Assemblies of Switch gear and Control gear	IS : 8623
Miniature Circuit Breaker	IS : 8828
HRC Cartridge fuse	IS : 9224 (Part 2)
Current Transformers	IS : 2705
Indicating Instruments	IS : 1248
Busbar Connections and Accessories	IS : 5578, 11353
Code of Practice for Phosphate Iron & Steel	IS : 6005
PVC Wires	IS : 694

The above are minimum standards expected. The technical specifications to follow and those given in schedule of quantities, if found to be more stringent as compared to those listed above, then the more stringent specifications shall prevail.

SHEET METAL WORK

The panel boards frame shall be fabricated using suitable mild steel structural sections or pressed and shaped cold rolled sheet steel of thickness not less than 3.5 mm.
Frames shall be enclosed by cold rolled sheet steel of thickness not less than 3.0 mm. smoothly finished, leveled and free from flaws. Doors, top covers and partitions shall be made of cold rolled sheet steel of thickness not less than 3.6 mm. Stiffeners shall be provided wherever necessary.
As far as wall mountable panels incorporating only Miniature Circuit Breakers and E.L.C.B. & starters are concerned, the thickness of sheet still shall be 3.6 mm for enclosure and door.
All panel edges and door edges shall be reinforced against distortion by rolling, bending or by the addition of welded reinforced members. Cut-outs shall be true in shape and devoid of sharp edges. The complete structure shall be rigid, self-supporting and free from vibration, twists and bends.

PAINTING
All sheet steel work shall be phosphate with applicable standards mentioned above.

The panel manufacturer shall have in-house 7 tank process facility. The type of painting will be as per the direction given in the preamble to the relevant section of the schedule of quantities.

CONSTRUCTIONAL FEATURES

Switch gear shall be:

Indoor, floor mounted modular type (wall mounted wherever so specified in schedule of quantities) of vermin proof construction;

Provided with a degree of protection of IP 52;

provided with a metal sill frame made of structural steel channel section properly drilled for mounting the switch gear along with necessary mounting hardware (hardware shall be zinc plated and passivated);

Provided with gaskets all-round the perimeter of removable covers and doors; and provided with bus bar of adequate rating.

No equipment needing manual operation shall be located less than 250 mm above ground level and exceed 2,100mm from ground level.

Cable alleys shall be provided with suitably hinged doors/cover. It shall be possible to safely carry out maintenance work on cable connections to any one circuit with the bus bar and adjacent circuits live. Adequate number of slotted cable support arms shall be provided for cleating the cables.

All doors shall be folded type. All covers and doors to be provided with neoprene gaskets.

Provision shall be made for insulating covers on outgoing terminals for protection against accidental touch.

Base Channel of ISMC-75 shall be provided in case of free floor standing panels.

Four Lifting Lugs per each shipping section shall be provided.

FUSES

Fuses shall be of the HRC cartridge fuse-link type having a certified rupturing capacity of not less than 50 kA at 440 V. Fuses shall be provided with visible indication to show that they have operated.

MOULDED CASE CIRCUIT BREAKERS (M.C.C.B.)

The M.C.C.B.s shall comprise single units of triple pole construction and shall be rated for 500 V AC.

All live parts shall be totally enclosed in a heat resistant flame retardant molded insulating material housing with high withstand capability against thermal and mechanical stresses. Operating mechanism shall be quick make, quick break and trip free type.

All M.C.C.B.s shall be capable of variable load adjustment.

The M.C.C.B.s shall be provided with the following features:

Inverse-time-current tripping characteristics under sustained overload.

Instantaneous tripping on short circuit.
ICU=100%ICS

MINIATURE CIRCUIT BREAKER (M.C.B.)

M.C.B. shall be quick make, quick break and trip free type.
Miniature circuit breaker shall have minimum short circuit breaking capacity as indicated in the single line diagrams or schedule of quantities. If breaking capacity is not specified then it should not be less than 10 kA.
M.C.B. shall be of current limiting type(Class – 3)
M.C.B. shall be classified as per their tripping characteristic curves.
M.C.B. shall have minimum power loss characteristic curves.

BUSBAR CHAMBER (B.B.C)

This shall be totally enclosed, metal clad type fabrication from rust proofed 16 SWG sheet steel on angle iron frame and provided with sheet steel or cast iron detachable front cover and undrilled detachable end plates, suitable for mounting on wall or angle iron floor stand and painted with high quality enamel paint, G.I bolts and nuts shall be used for assembly with suitable packing materials to ensure dust proof finish. Meters shall be provided on suitable sheet steel boxes. Switch shall be provided with cable end boxes as required.
The depth of B.B.C shall be 250 mm (minimum). Minimum clearance of phase bars to earth shall be 26 mm and between bus bars shall be minimum 32 mm.
H.C (High Conductivity) copper bus bars properly tinned are to be rated at 1000Amps. Per sq. in and Aluminum bus bars (wrought aluminum alloy strip) conforming to relevant I.S. specification at 800 Amps per sq.in.

Neutral Bus bars are to be rated to carry 100% of phase current up to 200A and 60% for higher.
These shall be mounted on DMC/SMC supported of proper dielectric and mechanical strength and shall be appropriately colour coded for identification of phase with PVC selves of 1.1 KV grade throughout the length.
Lettering shall be done for identification of switches, as directed. The contractor shall submit fully dimensioned drawing of the board with the physical position of the switches.

BUSBARS

Bus bar shall be suitable for carrying full load current and short circuit current without overheating of phase and neutral bus bars and shall be extendable on either side. Bus bars and interconnections shall be insulated with heat shrinkable sleeve and shall be color coded. Bus bars

shall be supported on glass fiber reinforced thermosetting plastic insulated supports at regular intervals to withstand the force arising in case of short circuit in the system. All bus bars shall be provided in a separate chamber and all connections shall be done by bolting. Additional cross sectional area to be added to the bus bar to compensate for the holes.

ISOLATOR/ SWITCH FUSE UNITS

All isolators and switches shall be two position type (ON/OFF) heavy duty, load break, quick make and break type and suitable for front of board operation and shall conform to I.S. 4064.

The isolators for motor feeders shall be of "Motor Duty" type adequate for interruption of locked rotor current of motors (excepting for motors rated 50 Kilowatts and above).

Switches and isolators provided in the switch boards shall be interlocked with door to prevent opening and closing of the door in the closed (ON) position of the isolators.

All live terminals on the isolating / switches shall be adequately shrouded to prevent accidental contact and danger to the personnel.

Properly rated co-coordinating fuses (HRC type) shall be provided for every outgoing feeder unless otherwise indicated. The fuse shall be non-deteriorating high rupturing capacity link type mounted in suitable fuse carrier / fuse base and conform to I.S. 3106.

INTERCONNECTION IN B.B.C, SWITCH FUSE, METERS

For rating above 150 Amps these shall consist of insulated copper strips of adequate section considering current density as specified previously. For rating below 150 Amp PVC copper cable tails of appropriate size, terminating in tinned copper sockets may be used to considering 1.5 Amp/sq.mm for copper & 1.0 Amp/sq.mm or aluminum. The above are to be enclose either in sheet metal trucking or conduits so that no part is exposed.

CURRENT TRANSFORMERS

Current transformers shall be of the Cast Resin Type.
All current transformers shall be earthed through a separate earth link.

INDICATING INSTRUMENTS AND METERS

Electrical indicating instruments (Analog type) shall be of minimum 96 mm square size, 90^0 scale deflection and with a class of accuracy of 3.0 and shall have provision for zero adjustment outside the cover. Digital meters should have red colored readout.

CABLE TERMINATIONS

Suitable double compression type, brass cable glands with check nuts, rubber sealing ring and brass washers mounted on a removable gland plate shall be provided to support all cables entering the switchgear. Cable Termination will be measured under separate item in the schedule of quantities.

INTERNAL WIRING

Wiring inside the switchgear shall be carried out with 1100 V grade, single core, PVC insulated, stranded copper conductor wires. Minimum size of conductor for power circuits is 4 sq. mm. Not more than two connections shall be made on any one terminal.

TERMINAL BLOCKS

Terminal blocks shall comprise finely threaded pairs of brass studs of at least 6 mm diameter, links between each pair of studs, washers, nuts and lock nuts. The studs shall be securely locked within the mounting base to prevent their turning. Insulated barriers shall be provided between adjacent terminals.
Terminals shall be shrouded. Terminal blocks shall be adequately rated to carry the current of the associated circuit. Minimum rating of the terminal block shall be 10 A.

LABELS:

All labels shall comprise white letters on a black background and shall be made of non-rusting metal or 3-ply lamicoid or engraved PVC. Size of lettering shall be 6.0 mm.

EARTHING

Switchgear shall be provided with a 30 x 5 mm copper earth bus bar running along the entire length of the board. At either end of the earth bus, one clamp type terminal with nuts, bolts and washers shall be provided for bolting the earthing conductor.
Earth bus bars shall be supported at suitable intervals. Positive connection between all the frames of equipment mounted in the switchboard and earth bus bar shall be provided by using insulated

copper wires/bare bus bars of cross section equal to that of the bus bar or equal to half the size of circuit load current carrying conductor, whichever is smaller.
All instrument cases shall be connected to the earth bus bar using 660 V grade, single core 3.5 sq. mm. stranded, copper earthing conductor.
All non-current carrying metal and hinged doors shall be earthed to the earth bar.

TESTS

Switchgear shall be subjected to following tests as per relevant standards along with following tests:
Mechanical operation test.
H. V. test for one minute.
Insulation resistance at 500 V D.C. before/after one minute H.V. Test.
Testing of panels shall be as per following codes :

IS : 8623 (Part – I) 1977 for factory built assemblies of switch gear for voltages upto and including 1000 VAC.
IS : 13947: 1993 Degree of protection.
IS : 5578 & 11353: 1985 Arrangement of bus bars

OVERALL FIRE FIGHTING SYSTEM REQUIREMENTS

1. QUIPMENT PROTECTION:-

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 replaced at no expense to the Owner.

Accessibility:- The installation of valves, thermometers, cleanout fittings and other indicating equipment or specialties requiring frequent reading, adjustments, 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.

2. EQUIPMENT & PIPING IDENTIFICATION:-

Pipe Markers:- Each piping system shall be provided with a name plate properly clamped or stenciled. Letters are to be 80 mm. Plates on parallel groups of pipes etc. shall be neatly lined up. Wording of lettering shall correspond to the equipment designations used in piping legend and shall be as approved. Name plate to be of G.I. sheets (1 mm thick on 25 x 25 x 3M angle) secured on to sheet metal and angle iron to be welded on main pipes. In case of insulated pipe, the 25 x 25 mm angle bracket

should be projecting beyond insulation thickness. CI markers to be fixed as directed in ground to indicate location of underground services.

Valve Register:- To be submitted in six copies along with location and identification number in final drawing to be furnished by contractor.

3. MODE OF MEASUREMENT:-

All pipes shall be measured in linear length along the centre line is completed. Fittings and specials shall be measured in position as a part of the pipe. The rate shall include lead caulking or nut and bolt joints, etc., complete as specified in the respective items.

Same rate shall be applicable for pipes of same size and materials laid in building at anylevel or floor.
All gate valves, ball valves, non-return valves, sluice valves etc. shall be measured in numbers after excluding them from linear measurements.
The diameter of pipes and fittings mentioned in the specifications are the normal diameter in all cases unless otherwise stated

4. TOOLS & MATERIALS & STORAGE:-

Surplus materials from the site shall be carted away by the Contractor without any cost to the Employer and the storage space provided to the Contractor shall be handed over to the employer clean and ready for occupation.

5. GENERAL SERVICES:-

Any materials brought at site shall not be removed without the written authority of the Owner and when the Contractor shall have received payment in respect of any certificate in which it is stated that the valve of any unfixed materials on the works has been taken into account, such materials shall become the property of the Employer and the Contractor shall be liable for any loss or damage thereto.

6. LABOUR

Workmen approved, by the Engineer for a particular trade only will be allowed to do that work. Each worker will have an identity card issued by the Contractor/Engineer with his photograph. While on duty he shall punch the card. Daily list of workers & the jobs done by them will be submitted to the Engineer. A person approved to do a particular job alone will be allowed to work on it.

The contractor will have to get alignments of lines & locations of fittings approved from the Engineer. He will have to do mockups (rough assembly & sample assembly) well in time and get it approved from the Engineer. Main work should be executed as per the finally approved mockup. Cost of mockups should be included in the quoted rates.

Regular record of testing of systems should be maintained & all measurements got checked before covering up. No item shall be covered without the written confirmation of the Site Engineer.

7. COMMISSIONING & GUARANTEE

SCOPE OF WORK

Work under this section shall be executed without any additional cost. The rates quoted in this tender shall be inclusive of the works given in this section.

Contractor shall provide all tools, equipment, metering and testing devices required for the purpose.

On award of work, Contractor shall submit a detailed proposal giving methods of testing and gauging the performance of the equipment to be supplied and installed under this contract.

All tests shall be made in the presence of the Architect or his representative or any inspecting authority. At least five working days' notice in writing shall be given to the inspecting parties before performing any test.

Water flow rates of all equipment and in pipe lines through valves shall be adjusted to design conditions. Complete results of adjustments shall be recorded and submitted.

Contractor shall ensure proper balancing of the hydraulic system and for the pipes / valves installed in his scope of work by regulating the flow rates in the pipe line by valve operation. The contractor shall also provide permanent Tee connection (with plug) in water supply lines for ease of installing pressure gauge, temperature gauge & rotameters. Contractor shall also supply all required pressure gauge, temperature gauge &rotameters for system commissioning and balancing. The balancing shall be to the satisfaction of Consultant / Project Manager.

Three copies of all test results shall be submitted to the Engineer in A4 size sheet paper within two weeks after completion of the tests.

PRECOMMISSIONNIG

On completion of the installation of all pumps, piping, valves, pipe connections, insulation etc. the Contractor shall proceed as follows:

Prior to start-up and hydraulic testing, the Contractor shall clean the entire installation including all fitments and pipe work and the like after installation and keep them in a new condition. All pumping systems shall be flushed and drained at least once through to get rid of contaminating materials. All pipes shall be rodded to ensure clearance of debris, cleaning

and flushing shall be carried out in sections as the installation becomes completed.

All strainers shall be inspected and cleaned out or replaced.

When the entire systems are reasonably clean, a pre-treatment chemical shall be introduced and circulated for at least 8 hours. Warning signs shall be provided at all outlets during pre-treatment. The pre-treatment chemical shall:
Remove oil, grease and foreign residue from the pipe work and fittings;
Pre-condition the metal surfaces to resist reaction with water or air.
Establish an initial protective film;
After pre-treatment, the system shall be drained and refilled with fresh water and left until the system is put into operation.
Details and procedures of the pre-treatment shall be submitted to the Architect for approval.
Check all clamps, supports and hangers provided for the pipes.
Check all the equipment, piping and valves coming under hot water system and operate each and every valve on the system to see if the valves are functioning properly. Thereafter conduct & hydro test of the system as for (b) above.
Fill up pipes with water and apply hydrostatic pressure to the system as given in the relevant section of the specification. If any leakage is found, rectify the same and retest the pipes.

Fire Protection System

Check all hydrant valves by opening and closing : any valve found to be open shall be closed
Check all the piping under hydro test.
Check that all suction and delivery connections are properly made for all pump sets.
Check rotation of each motor after decoupling and correct the same if required.
Test run each pump set.
All pump sets shall be run continuously for 8 hours (if required with temporary piping back to the tank).

Commissioning and Testing

Pressurize the fire hydrant system by running the jockey pump and after it attains the shutoff pressure of the pump, then Open bypass valve and allow the pressure to drop in the system. Check that the jockey pump cuts-in and cuts-out at the preset pressure. If necessary adjust the pressure switch for the jockey pump. Close by-pass valve. Open hydrant valve and allow the water to below into the fire water tank in order to avoid wastage of water. The main fire pump shall cut-in at the preset pressure and shall not cutout automatically on reaching the normal line

pressure. The main fire pump shall stop only by manual push button. However the jockey pump shall cut-out as soon as the main pump starts,

Switch off the main fire pump and test check the diesel engine driven pump in the same manner as the electrically driven pump,
When the fire pumps have been checked for satisfactory working on automatic controls, open fire hydrant valves simultaneously and allow the hose pipes to discharge water into the fire tank to avoid wastage.

Check each landing valve, male and female couplings and branch pipes, for compatibility with each other. Any fitting which is found to be incompatible and do not fit into the other properly shall be replace by the Contractor. Each landing valve shall also be checked by opening and closing under pressure

8. STATUTORY AUTHORITIES' TESTS AND INSPECTIONS

As and when notified in writing or instructed by the Architect, the Contractor shall submit shop drawing and attend all tests and inspections carried out by Local Fire Authorities, Water Authority and other Statutory Authorities, and shall forthwith execute free of charge any rectification work ordered by the Architect as a result of such tests and inspections where these indicate non-compliance with Statutory Regulations. Some of these tests may take place after the issue of Practical Completion of the Main Contract and the Contractor shall make all allowances in this respect.

The Contractor shall be responsible for the submission of all necessary forms and shop drawings to the Statutory Authorities which shall conform in layout to the latest architectural plans submitted to and kept by these Authorities.

The submission shall comply with the requirements set forth in the current Codes of Practice and circular letters of the Statutory Authorities. The shop drawings to be submitted shall be forwarded to the Architect for checking before submission.

The Contractor shall allow for at least two submissions of complete sets of shop drawings to the Authorities, one to be made within six months after the award of the Contract but not less than six weeks before the inspection. The Architect may at his discretion instruct the Contractor for additional submissions to the Local Authorities whenever necessary.

The Contractor shall notify the Architect at least seven days in advance of his application for local Authority tests and inspections. On receipt of a confirmed date for test and inspection the Contractor shall inform the Architect without delay.

9. FINAL ACCEPTANCE TESTS

Following commissioning and inspection of the entire installation, and prior to issue of the Completion Certificate, the Contractor shall carry out final acceptance tests in accordance with a programme to be agreed with the Architect.

Should the results of the acceptance tests show that plant, systems and/or equipment fail to perform to the efficiencies or other performance figures as given in this Specification, the Contractor shall adjust, modify and if necessary replace the equipment without further payment in order that the required performance is obtained.

Where acceptance tests are required by the relevant Authorities having jurisdiction, these tests shall be carried out by the Contractor prior to the issue of Completion Certificate to the acceptance of the Authorities.

10. REJECTION OF INSTALLATION / PLANT

Any item of plant or system or component which fails to comply with the requirements of this Specification in any respect whatsoever at any stage of manufacture, test, erection or on completion at site may be rejected by the Architect either in whole or in part as he considers necessary/appropriate. Adjustment and/or modification work as required by the Architect so as to comply with the Authority's requirements and the intent of the Specification shall be carried out by the Contractor at his own expense and to the satisfaction of the Authority/Architect.

After works have been accepted, the Contractor may be required to carry out assist in carrying out additional performance tests as reasonably required by the Architect/Employer.

11. WARRANTY AND HANDOVER

The Contractor shall warrant that all plant, materials and equipment supplied and all workmanship performed by him to be free from defects of whatsoever nature before handover to the Owner.

HANDING OVER OF DOCUMENTS

All testing and commissioning shall be done by the Contractor to the entire satisfaction of the Owner’s site representative and all testing and commissioning documents shall be handed over to the Owner’s site representative.

The Contractor shall also hand over all maintenance and operation manuals, all certificates and all other documentation as per the terms of the contract to the Owner's site representative.

12. PIPE COLOUR CODE:

SI.No.	Pipe Lines	Ground / Base Color	First Color Band	Second Color Band
1	Fire System	Post Office Red		

SUB HEAD:19
ELECTRICAL WORK

ELECTRICAL MATERIAL SPECIFICATIONS

SUMMARY PAGE

I. Electrical Works

A. Specification

CHAPTER-0
GENERAL

A. PURPOSE

This document describes the detailed specification of all the items used under the electrical subhead of Tender BOQ along with the basic guidelines for installation, testing and commissioning of all the listed items / Jobs described under this tender package. This document also describes the list of relevant codes and standards to be followed for respective items. Contractor needs to ensure that the items specifications and guidelines laid under this part of the tender document shall be strictly adhered.

B. GENERAL SYSTEM CHARACTERISRICS

System Ambient : 45 degree Celsius

System Voltage :
(a) 415V (Three Phase Four wire for feeder loads)
(b) 230V (Single Phase loads)
(c) 415V (Three phase three wire motor loads)

Voltage Variations : +/- 5%

System Frequency : 50 Hertz

Frequency Variations : +/- 3%

Permissible voltage drop (at each feeding bus) : 3%

Permissible voltage drop (for motors) : 5% at starting and 3% otherwise.

CHAPTER-1
WIRING

A. SCOPE

The scope of this section comprises the supply, delivery, erection, testing and commissioning of following:

1. Wiring for power and UPS outlets, heavy duty sockets, industrial plugs.
2. Wiring from distribution boards to different switchboards and from there onwards to individual points like light points, Bell Buzzers, Fan points, small exhaust fan points etc for all internal areas.
3. Switchboards, power plugs and its accessories like gang box, front plate, switches etc.
4. Wires and its accessories like conduits, Outlet boxes, junction boxes, pull-through boxes etc. but excluding metal boxes if any, provided with switchboards for loose wires/conduit terminations.
5. Ceiling rose, Connectors, Holders etc. for light points, Fan points, Bell buzzers, small exhaust fan points etc for all internal areas.
6. Conduit/channel as the case may be, accessories for the same and wiring cables between the switch box and the point outlet, loop protective earthing of each fan/ light fixture.
7. All fixing accessories such as clips, screws, Phil plug, raw plug etc. as required.
8. Metal or PVC switch boxes (as specified) for control switches, regulators, sockets etc, recessed or surface type, and phenolic laminated sheet covers over the same.
9. Control switch or MCB, as specified.
10. 3 pin or 6 pin socket, ceiling rose or connector as required. (2 pin and 5 pin socket outlet shall not be permitted.)
11. Connections to ceiling rose, connector, socket outlet, lamp holder, switch etc.
12. Bushed conduit or porcelain tubing where wiring cables pass through wall etc. However In areas where false ceiling are provided, termination of wires should beat the fittings. Flexible conduits from ceiling junction box to the fittings shall be provided duly coupled at both ends. This shall be included within the scope of point wiring.)
13. Interconnecting wiring between switches within the switch box on the same circuit.

B. CODES AND STANDARDS

The relevant sections of Indian Standard Specifications as more particularly stated herein and broadly to all the codes, status and regulations as applicable shall be strictly enforced and adhered to. More particularly following codes should be strictly followed.

1. National Electrical Code - 2008
2. National Building Code - 2005
3. IS: 694 - Specification for PVC insulated cables for working voltage up to and including 1100 volts.
4. IS: 732 - Code of practice for Electrical Wiring Installation.

5. IS: 8130 - Specification for Conductors for Insulated Electric Cables & Flexible cords.
6. IS: 9938 -Recommended Colors for PVC Insulation for LF Wires and Cables.
7. IS: 3043 - Code Of Practice of Earthing.
8. IS: 3202 - Climate proofing of Electrical Work.
9. IS: 2509 of 1973 - Rigid non-metallic conduits for Electrical Work

C. DEFINATIONS

Sub-Mains wiring: Sub mains wiring is defined as wiring from distribution boards to respective switchboards (including the first switchboard wired from DB and switchboards looped with this firstswitchboard) and power outlets for all internal areas. Wiring for DB controlled light points are also considered in sub-mains wiring.

Point wiring: Point wiring is defined as wiring from Switchboards to individual points like light points, Bell Buzzers, Fan points, small exhaust fan points etc for all internal areas.

Group A: It is a type of classification for Points measured under 3.4.3 on unit basis. Group 'A', is for point wiring for type I, type II and type III residential quartersand hostels.

Group B: It is a type of classification for Points measured under 3.4.3 on unit basis. Group 'B', is for point wiring for type IV and above type of residential quartersand barracks.

Group C: It is a type of classification for Points measured under 3.4.3 on unit basis. Group 'C' is for all types of non-residential buildings such as offices, hospitals, laboratories, educational institutions, libraries etc.

Master Telephone Sockets: For use as the first socket outlet on a direct exchange.

Secondary Telephone Sockets: For use as extension sockets when connected on the same line as a Master Socket.

D. SPECIFICATION OF ITEMS

DSR Item no. 1.14.2: Wiring of circuit / sub-main wiring along with earth wire with the following sizes of FRLS PVC insulated copper conductor, single core cable in surface / recessed medium class PVC conduit as required.

(a) 2 x 2.5 sq.mm. + 1 x 2.5 sq.mm. earth wire.
DSR Item no. 1.14.3: (b)2 x 4 sq.mm. + 1 x 4 sq.mm. earth wire
DSR Item No. 1.14.4: (c)2 x 6 sq.mm. + 1 x 6 sq.mm. earth wire.

1. Wires:
The wires shall be made from bright electrolytic annealed bare copper conductor with strands as specified under IS:694.Solid conductor wires shall not be accepted. The wires shall be PVC (Poly vinyl chloride) insulated confirming to BIS

specifications and shall be specified by the manufacturer for working voltage up to and including 1100 volts. The total gauge of wire shall be strictly in accordance with what has been specified in IS:694.The wires shall be FRLS (Fire resistant low smoke) with appropriate and acceptable mechanical strength so that the insulation does not gets damaged while pulling these wires in conduit. Unless otherwise specified following sizes of wires shall be used for different applications:

(a) Wires from DB to Lighting switchboard (along with internal loop within such switchboard) shall be 2 x 2.5 sq.mm. + 1 x 2.5 sq.mm. earth wire.
(b) Wires from DB to 6A switchboard (along with internal loop within such switchboard) shall be 2 x 2.5 sq.mm. + 1 x 2.5 sq.mm. earth wire.
(c)Wires from DB to 16A& 6/16A switchboard (along with internal loop within such switchboard) shall be 2 x 4 sq.mm. + 1 x 4 sq.mm. earth wire.
(d)Wires from DB to Industrial sockets shall be 2 x 6 sq.mm. + 1 x 6 sq.mm. earth wire.

2. Thimbles/lugs:

The wires shall be terminated with the help of crimping lugs at both the terminals. These lugs shall be non-insulated made of tin plated copper, suitable for termination of 1.5 sqmm / 2.5 sqmm / 4 sqmm / 6 sqmm of copper wires. The lugs shall be suitable for 1100V and the min temperature rating for these lugs shall be 150 degree Celsius. The lugs shall be pin type with pin designed in such a fashion to prevent damage to the wire from over tightening and ensure a reliable electrical connection. The lugs shall have good wire contact and good tensile strength. The lugs shall ensure quick and easy wire insertion.

3. PVC conduits and accessories:

All non-metallic conduit pipes and accessories shall be of suitable materialcomplying with IS 2509 : 1973 and IS 3419 : 1989 for rigid conduits andIS 9537 (Part 5) : 2000 for flexible conduits. The conduit shall be of medium dutyThe interior of the conduits shall befree from obstructions. The rigid conduit pipes shall be ISI marked. The conduits shall be circular in cross-section. The conduits shall be designatedby their nominal outside diameter.No non-metallic conduit less than 20 mm in diameter shall be used. The conduit wiring system shall be complete in all respect including accessories.Rigid conduit accessories shall be normally of grip type while flexible conduit accessories shall be of threaded type.Bends, couplers etc. shall be solid type in recessed type of works, and may besolid or inspection type as required, in surface type of works.Saddles for fixing conduits shall be heavy gauge non-metallic type with base.For all sizes of conduit, the size of clamping rod shall be 4.5 mm (7 SWG) diameter. All the conduits shall be FR (Fire resistant) type.
The minimum width and the thickness of the ordinary clips or girder clips shall be as per Table below.

Size of Conduit	Width	Thickness
20 mm & 25 mm	19 mm	20 SWG (0.9144 mm)

32 mm & above	25 mm	18 SWG (1.219 mm)

DSR Item No. 1.21.2: Supplying and fixing of following sizes of medium class PVC conduit along with accessories in surface/recess including cutting the wall and making good the same in case of recessed conduit as required.

(a) : 25 mm
DSR Item No. 1.21.3: (b) : 32 mm
DSR Item No. 1.21.4: (c) : 40 mm
DSR Item No. 1.21.5: (d) : 50 mm

DSR Item No. 1.20.2:Supplying and fixing of following sizes of steel conduit along with accessories in surface/recess including painting in case of surface conduit, or cutting the wall and making good the same in case of recessed conduit as required.

(a) : 25 mm
DSR Item No. 1.20.3: (b) : 32 mm
DSR Item No. 1.20.4: (c) : 40 mm
DSR Item No. 1.20.5: (d) : 50 mm

1. Metallic conduits and accessories :

All rigid conduit pipes shall be of steel and be ISI marked. The wall thicknessshall be not less than 1.6 mm (16 SWG) for conduits upto 32 mm dia and not lessthan 2 mm (14 SWG) for conduits above 32 mm dia. These shall be solid drawn orreamed by welding, and finished with galvanized or stove enameled surface.No steel conduit less than 20 mm in diameter shall be used.The conduit wiring system shall be complete in all respects, including theiraccessories.All conduit accessories shall be of threaded type, and under no circumstances pingrip type or clamp grip type accessories shall be used.
Bends, couplers etc. shall be solid type in recessed type of works and may be solidor inspection type as required, in surface type of works.Saddles for surface conduit work on wall shall not be less than 0.55 mm (24gauges) for conduits upto 25 mm dia and not less than 0.9 mm (20 gauges)for larger diameter. The corresponding widths shall be 19 mm & 25 mm.The minimum width and the thickness of girder clips used for fixing conduitsto steel joists, and clamps shall be as per Table below.

Size of Conduit	Width	Thickness
20 mm & 25 mm	19 mm	20 SWG (0.9144 mm)
32 mm & above	25 mm	18 SWG (1.219 mm)

DSR Item No. 1.19 : Supplying and drawing Co-axial TV cable RG-6 grade,0.7mm solid copper conductor PE insulated, shielded with fine

tinned copper braid and protected with PVC sheath in the existing surface/recessed steel/PVC conduit as required.

TV WIRING AND ACCESSORIES:

• Testing of each TV outlet for proper signal level as per system specifications.
• TV cables shall be run in heavy gauge fire retardant PVC conduits and accessories.
• TV cable laying Coaxial Cable runs shall be in continuous lengths. No splice shall be permitted in any conduit run. Cables shall be installed without sharp bends and the minimum bending radius specified by the manufacturer shall be adhered to. The coaxial cable runs shall be tagged as to function and destination. Each cable shall be left with a loop of approximately 300 mm at the traps and amplifiers to facilitate future changes.
• Coaxial cable connectors shall be solder less with 75 Ohm impedance and be designed for the specific cable being used. All connections shall be made using a crimp tool designed consistent with connector construction and intended use.
• The coaxial cables should be with PE dielectric and PVC jacket suitable for wideband type with operation upto 860 MHz capability. RG – 6 grade Cable shall be used. TV outlets shall be matching with the modular switch sockets.
• The distribution system shall furnish signal to all wired TV outlets. The signal strength of each TV outlet shall be minimum of 65 dB uv across 75 ohms.
• The maximum amplitude variations at system outlets between distributed channels shall not be more than 12 dB over the entire range and not more than 3 dB between adjacent Channels visual carries.
• The Amplitude response as a function of frequency for the entire system shall be such that the variation in gain over any television channel is not more than +/1 2 dB relative to that at vision carrier. Frequency and the gain shall not vary by more than 0.5 dB with in any frequency range of 0.5 MHz.
The TV outlet shall have IEC Male Plug fixed for mating with IEC Female Plug of Connecting Lead.
• The outlet shall have either a screw clamp connection or "F" Connector connections for connecting In-house Cable to Room Outlet.
• The outlet shall provide DC isolation for center conductor between TV Set and Distribution network.

DSR Item no. 1.53 : Supplying and drawing of UTP 4 pair CAT6 LAN cable in the existing surface / recessed steel/PVC conduit as required.

CAT-6, 4 pair, UTP Cable:
Cable shall be 4 Pairs Unshielded Twisted Pair (UTP) Cable made up of solid bare copper and grey in color. The conductor dia shall be 0.560mm nominal, 23 AWG with insulation diameter 0.970mm Nominal. Insulation used shall be HD-PE with jacket material PVC UL94V-0/LSZH. The overall diameter of cable shall be 6mm Nominal with PE Central Cross separator.

DSR Item no. 1.18.2 : Supplying and drawing following pair 0.5 mm dia FRLS PVC insulated annealed copper conductor, unarmored telephone cable in the existing surface/ recessed steel/ PVC conduit as required.
(a)2 Pair
DSR Item no. 1.18.3 :(b)4 Pair

Telephone cable shall be unarmoured made of solid annealed tinned electrolytic copper with high conductivity conductor insulated and sheathed with PVC compound as per BS: 6746 unarmoured twisted pairs with proper colour code bundled together in concentric layers and wrapped with melinix or PVC tape with nylon ripcord. Ripcord shall be laid longitudinally under the sheath as an effective means of slitting the sheath to facilitate removal. The lay shall be chosen so as to minimize cross talk in cable. The cable shall be manufactured to standard for indoor telephone wiring conductor resistance at 20oc max 98-ohms/km conductor diameter 0.5mm to TEC specification no. G/WIR/06/02 may 94.

MR 19.001 :Supplying and drawing following pair 0.5 mm dia FRLS PVC insulated annealed copper conductor, unarmored telephone cable in the existing surface/ recessed steel/ PVC conduit as required.
(c) 10 pair
MR 19.002 :(d) 20 pair

Telephone cable shall be unarmoured made of solid annealed tinned electrolytic copper with high conductivity conductor insulated and sheathed with PVC compound as per BS: 6746 unarmoured twisted pairs with proper colour code bundled together in concentric layers and wrapped with melinix or PVC tape with nylon ripcord. Ripcord shall be laid longitudinally under the sheath as an effective means of slitting the sheath to facilitate removal. The lay shall be chosen so as to minimize cross talk in cable. The cable shall be manufactured to standard for indoor telephone wiring conductor resistance at 20oc max 98-ohms/km conductor diameter 0.5mm to TEC specification no. G/WIR/06/02 may 94.

MR 19.003 Supply, Installation, Testing and Commissioning of 20 Pair telephone terminal blocks confirming to IEC 61754-23(CD),to be installed inside LV shaft. The same shall be made of thermoplastic polyester as insulation and carrier material for the contacts in weather resistant, dust & water proof, wall mounting lockable in 1.6 mm thick CRCA sheet, having suitable back mount frames, jumpering facility, powder coated with connectors complete etc as required.

MR 19.004 Supply, Installation, Testing and Commissioning of 10 Pair telephone terminal blocks confirming to IEC 61754-23(CD),to be installed inside LV shaft. The same shall be made of thermoplastic polyester as insulation and carrier material for the contacts in weather resistant, dust & water proof, wall mounting lockable in 1.6 mm thick CRCA sheet, having suitable back mount frames, jumpering facility, powder coated with connectors complete etc as required.

Telephone terminal blocks shall confirm to IEC 61754-23(CD),and shall be suitable to be installed inside LV shaft. The same shall be made of thermoplastic polyester as insulation and carrier material for the contacts in weather resistant, dust & water proof, wall mounting lockable in 1.6 mm thick CRCA sheet, having suitable back mount frames, jumpering facility, powder coated with connectors complete etc as required.

MR 19.005: Supplying and fixing shuttered type, UTP CAT6 compatible, RJ-45 data connectors suitable for fixing in existing 1M (75 mm x 75 mm) modular plate and complete as required.
RJ-45 data outlet:

RJ -45 data outlet shall comply with AS/NZS 3080:2003, ISO/IEC 11801 2002 and ANSI/TIA/EIA-568-B Series Connecting Hardware Standards, and shall also be compatible with CAT-5e products. Outlet shall be UL 94V-O rated, and shall accept solid 22-24 AWG diameter conductors. Colour shall be universal and Port shall be based on lead frame technology which eliminates the possibility of PCB failures. The port shall be compatible be used in multi-user telecommunication outlet applications (MUTO). Port shall be suitable to get housed in (75 mm x 75 mm) 1 Module plate with clear IDC caps that allow for termination verification and assist in cable retention.

DSR Item No. 1.27.1: Supplying and fixing following size / modules, GI box alongwith modular base and cover plate for modular switches in recess etc as required.

(a) : 1 or 2 Module (75mm x 75mm)

DSR Item No. 1.27.2: (b) : 3 Module (100mm x 75mm)

DSR Item No. 1.27.3: (c) : 4 Module (125mm x 75mm)

DSR Item No. 1.27.4: (d) : 6 Module (200mm x 75mm)

DSR Item No. 1.27.5: (e) : 8 Module (125mm x 125mm)

DSR Item No. 1.27.6: (f) : 12 Module (200mm x 150mm)

1. Modular GI Box:

All the back boxes used shall be concealed GI type with loop in loop out holes marked which shall be removed at the time of jetting conduit inside the same. Size of such holes shall be suitable to take a 32mm diameter conduits. All such back box shall be made from pre-galvanized GI sheet metal with a wall thickness of 1.1mm and confirming to BS:4662:2006. All such back box shall be provided with Brass Earth terminals and adjustable lugs. The metallic box shall be duly painted with anti-corrosive paint before erection. An earth terminal with stud and 2 metal washers and terminal block shall be providedin each back box of protective conductors and for connection tosocket outlet/metallic body of fan regulator etc. A metal strip shall be welded/screwed, to the metal box as support if tumbler control switches, sockets and/or fan regulators in flush pattern.Clear depth of the box shall not be less than 60 mm and this shall beincreased suitably to accommodate mounting of fan regulators in flush pattern.

2. Modular Base and cover plate:

The front plate shall have smooth surface from both the side and shall be properly matching the fixing alignment. Perfect alignment shall be maintained while fixing of the back boxes. The color shall be as per the architect's directives.

DSR Item No. 1.24.4: Supplying and fixing following modular switch / socket on existing modular plate and switch box including connections but excluding modular plate etc asrequired.

(a) : 3 pin 5/6 amp socket outlet

DSR Item No. 1.24.5: (b) : 6 pin 15/16 amp socket outlet

MR 19.006: (c) : Universal 6/16 amp switch socket outlet

DSR Item No. 1.24.1: (d) : 5/6 amps switch

DSR Item No. 1.24.3: (e) : 15/16 amp switch

DSR Item No. 1.24.6: (f) : Telephone socket outlet

DSR Item No. 1.24.7: (g): TV antenna socket outlet

DSR Item No. 1.24.8: (h): Bell Push

1. Switch - Socket Outlets :

Wall receptacle (switch /sockets) outlets shall beenclosed type flush mountedmade up of superior grade GE plastic polycarbonate with high mechanical electrical and thermal properties, suitable for 240 volts,50Hz,ac. All switches socket outlets and fan regulatorsshall be fixed on metal strips which shall be screwed / welded to the box.All switches shall be in accordance with IS 3854:1997. The terminals and contacts shall be bimetallic silver contacts designed to withstand high overload conditions, high quality brass and copper contacts shall be used for fixed / moving contacts and there shall be a sufficient clearance of minimum 5mm between fixed and moving contacts to break the arc during switch operation. The terminals shall also be made from high quality brass. All sockets shall comply IS 1293: 2005.All receptacle outlets shall be shuttered type.Three/Six pin Universal type sockets shall be used and these shall be mounted inside the switch boxes on adjustable flat M S strips / plates with tapped holes and brass machine screws, leaving ample space at the back and sides for accommodating wires. 5pin socket outlets will not be permitted.The third pin shall be connected to earth through protective (loop earthing)conductor. 2 pin or 5 pin sockets shall not be permitted to be used.Conductors connecting electrical appliances with socket outlets shall be of flexible type with an earthing conductor for connection to the earth terminal of plug and themetallic body of the electrical appliance.All such outlets shall be tested for an impact test value of 1NM, through a hammer stroke from a distance of 270mm from such outlets. The universal 6/16A sockets shall be capable to take the plugs for both 6A and 16A. No adapter shall be permitted.

2. Telephone Socket Outlets :

Telephone sockets used shall be RJ-11 suitable for all kind of telephones and cable to take both paired cable and CAT-7 / CAT6e / CAT-6 wires. The operating temperature for such receptacles shall be -20 degree C to +60 degree C and IP-20 rated. Master telephone outlets shall be equipped with surge protection devices and ringing capacitors.

3. TV antenna socket outlet :

TV sockets used shall be suitable for all kind of TV and coaxial cable to take relevant coaxial wires. The terminations shall be single screw type with fully enclosed PCBs with angled connectors provided. The operating temperature for such receptacles shall be -20 degree C to +60 degree C and IP-20 rated.

DSR Item No. 1.38: Supplying and fixing call bell / buzzer suitable for single phase, 230 volts, complete as required.

1. Call Bells or Buzzer :

The call bells or buzzers shall confirm to IS : 2268 : 1994 and shall be so constructed that, in normal use, there will be no electrical or mechanical failure that might impair compliance with the standard. The insulation shall not be damaged and contact and connections shall not work loose as a result of heating, vibration etc. Moreover, overload protection, if any, shall not operate under normal running condition. The call bell or buzzer shall withstand the test of electric strength as given in 16.4 of IS 302-l (1979). The call bells and buzzers shall operate satisfactorily at the over voltage and under voltage as specified below:

Rated Voltage	Under Voltage	Over Voltage
Single value	Rated voltage + 10 percent	Rated voltage - 10 percent
Range of Voltage	Maximumvoltage of the range+ 10 percent	Minimumvoltage of the range - 10 percent

DSR Item No. 1.26: Supplying and fixing modular blanking plate on the existing modular plate & switch box excluding modular plate as required.

1. Blanking Plate :

Blanking plates shall be modular type single module made up of polycarbonate with high mechanical electrical and thermal properties, the minimum thickness shall be 1.7 mm and all such blanking plates shall be suitable for fixing in the existing switchboard. The dimensions of these blanking plate shall be such that there remains no gap between the blank plate and the front plate of the switchboard.

DSR Item No. 1.25: Supplying and fixing stepped type electronic fan regulator on the existing modular plate switch box including connections but excluding modular plate etc. as required.

1. Electronic fan regulator:

Step Type Electronic regulators should be used instead of resistance typeregulators for controlling speed of fans. The fan regulator must be modular type with steps 1 to 5 for speed regulation of fan and another separate step for off. The fan regulator shall be engraved with good quality lettering showing the step range 1 to 5 and "OFF" step. The color shall be as per the architect's directives.

DSR Item No. 2.18: Supplying and fixing 20 amp, 240 Volts, SPN industrial type, socket outlet with 2 pole and earth, metal enclosed plug top along with 20 amps "C curve", SP , MCB, in sheet steel enclosure, on surface or in recess, with chained metal cover for socket outlet and complete with connections , testing commissioning etc. as required.

1. Industrial Socket:

Industrial sockets shall comply to IEC : 60309.1.2002, with minimum IP rating of IP42 or specified otherwise in tender drawings and BOQ. All such sockets shall be splash proof. However where-ever specified in drawings these may be water sealed type sockets. The marking and dimensions shall be as per standards. The plugs shall be provided with suitable earthing terminal and electrical interlocking such that the lug doesn't comes out of the socket till the supply is there in plug. Accessories with earthing contact shall be provided with an earthing terminal. Metal-cladfixed accessories with an internal earthing terminal can, in addition, be provided with anexternal earthing terminal, which, except for flush type socket-outlets, shall be visible from theoutside.Earthing contacts shall be directly and reliably connected to the earthing terminals, except thatthe earthing terminal of socket-outlets incorporated in the output circuit of an isolatingtransformer shall not be connected. Accessible metal parts of accessories with earthing contact, which may become live inthe event of an insulation fault, shall be reliably connected to the internal earthing terminal(s)by construction. Accessories with enclosures of rubber or thermoplastic material, and parts of elastomeric such as sealing rings and gaskets, shall be sufficiently resistant to ageing. The construction of such Industrial plugs shall comply with IEC: 60309.1.2002. All such industrial plugs shall be suitable for 415V/240V, 3Phase/1Phase, 50Hz ac supply as specified in tender drawings and BOQ for the mentioned current ratings.

2. Miniature Circuit Breaker (MCB):

MCB should be trip free, quick make and quick break type.MCB should be suitable for interchangeable line/ load connections. The MCB shall have minimum 10 KA breaking capacity with (Ics=Icu=10kA), where Ics is service breaking capacity and Icu is ultimate breaking capacity defined as per IS-13947. MCBs shall have ISI mark as per IS8828-1996 (IEC60898).The MCB shall be suitable for temperature up to 50 deg C without de-rating. All outgoing feeder MCB shall be provided with clip on type auxiliary contact to interface.Terminal of MCB shall be provided with insulated separators between the phases and also on both end. The size and design of the terminal should be adequate to accommodate aluminum/ copper cable required for the rated current of the MCB.It should confirm to current limiting principle class –3 to ensure extremely low let through

energy (I^2t) under fault conditions. It should have 'two position' DIN clip ensuring easy mounting and removal. It should confirm C.E. Marking (confirmation to European standards),based upon the tripping characteristics the MCB shall be described as B, C or D curves and the same must be mentioned in bold upon the MCB. All MCB shall have a mention of Full load current, short circuit current, utility voltage, frequency, tripping characteristics (B, C, and D), basic 3 line diagram. The poles of MCBs shall have minimum self-resistance as per latest IEC standards.

3. Sheet Steel Enclosure:

The enclosure shall be made from sheet steel of 1.6 mm thickness and of required size and dimensions to accommodate the industrial socket in required manner as directed by Engineer-in-charge. All such enclosures shall be dust / vermin proof, corrosion resistive and as be IP rated as specified in tender drawings / Tender BOQ. All such enclosure shall be provided with a chained metal cover for the socket outlets.

DSR Item No. 2.20: Supplying and fixing 30 amp, 415 Volts, TPN industrial type, socket outlet with 4 pole and earth, metal enclosed plug top along with 30 amps "C curve", TP , MCB, in sheet steel enclosure, on surface or in recess, with chained metal cover for socket outletand complete with connections , testing commissioning etc. as required.

1. Industrial Socket:

Industrial sockets shall comply to IEC : 60309.1.2002, with minimum IP rating of IP42 or specified otherwise in tender drawings and BOQ. All such sockets shall be splash proof. However where-ever specified in drawings these may be water sealed type sockets. The marking and dimensions shall be as per standards. The plugs shall be provided with suitable earthing terminal and electrical interlocking such that the lug doesn't comes out of the socket till the supply is there in plug. Accessories with earthing contact shall be provided with an earthing terminal. Metal-cladfixed accessories with an internal earthing terminal can, in addition, be provided with anexternal earthing terminal, which, except for flush type socket-outlets, shall be visible from theoutside.Earthing contacts shall be directly and reliably connected to the earthing terminals, except thatthe earthing terminal of socket-outlets incorporated in the output circuit of an isolatingtransformer shall not be connected. Accessible metal parts of accessories with earthing contact, which may become live inthe event of an insulation fault, shall be reliably connected to the internal earthing terminal(s)by construction. Accessories with enclosures of rubber or thermoplastic material, and parts of elastomeric such as sealing rings and gaskets, shall be sufficiently resistant to ageing. The construction of such Industrial plugs shall comply with IEC: 60309.1.2002. All such industrial plugs shall be suitable for 415V/240V, 3Phase/1Phase, 50Hz ac supply as specified in tender drawings and BOQ for the mentioned current ratings.

2. Miniature Circuit Breaker (MCB):

MCB should be trip free, quick make and quick break type.MCB should be suitable for interchangeable line/ load connections. The MCB shall have minimum

10 KA breaking capacity with (Ics=Icu=10kA), where Ics is service breaking capacity and Icu is ultimate breaking capacity defined as per IS-13947. MCBs shall have ISI mark as per IS8828-1996 (IEC60898).The MCB shall be suitable for temperature up to 50 deg C without de-rating. All outgoing feeder MCB shall be provided with clip on type auxiliary contact to interface.Terminal of MCB shall be provided with insulated separators between the phases and also on both end. The size and design of the terminal should be adequate to accommodate aluminum/ copper cable required for the rated current of the MCB.It should confirm to current limiting principle class –3 to ensure extremely low let through energy (I^2t) under fault conditions. It should have 'two position' DIN clip ensuring easy mounting and removal. It should confirm C.E. Marking (confirmation to European standards),based upon the tripping characteristics the MCB shall be described as B, C or D curves and the same must be mentioned in bold upon the MCB. All MCB shall have a mention of Full load current, short circuit current, utility voltage, frequency, tripping characteristics (B, C, and D), basic 3 line diagram. The poles of MCBs shall have minimum self-resistance as per latest IEC standards.

3. Sheet Steel Enclosure:

The enclosure shall be made from sheet steel of 1.6 mm thickness and of required size and dimensions to accommodate the industrial socket in required manner as directed by Engineer-in-charge. All such enclosures shall be dust / vermin proof, corrosion resistive and as be IP rated as specified in tender drawings / Tender BOQ. All such enclosure shall be provided with a chained metal cover for the socket outlets.

MR 19.007 : Supplying and fixing 32 amp, 240 Volts, SPN industrial type, socket outlet with 2 pole and earth, metal enclosed plug top along with 32 amps "C curve", SP , MCB, in sheet steel enclosure, on surface or in recess, with chained metal cover for socket outlet and complete with connections , testing commissioning etc. as required.

1. Industrial Socket:

Industrial sockets shall comply to IEC : 60309.1.2002, with minimum IP rating of IP42 or specified otherwise in tender drawings and BOQ. All such sockets shall be splash proof. However where-ever specified in drawings these may be water sealed type sockets. The marking and dimensions shall be as per standards. The plugs shall be provided with suitable earthing terminal and electrical interlocking such that the lug doesn't comes out of the socket till the supply is there in plug. Accessories with earthing contact shall be provided with an earthing terminal. Metal-cladfixed accessories with an internal earthing terminal can, in addition, be provided with anexternal earthing terminal, which, except for flush type socket-outlets, shall be visible from theoutside.Earthing contacts shall be directly and reliably connected to the earthing terminals, except thatthe earthing terminal of socket-outlets incorporated in the output circuit of an isolatingtransformer shall not be connected. Accessible metal parts of accessories with earthing contact, which may become live inthe event of an insulation fault, shall be reliably connected to the internal earthing terminal(s)by construction. Accessories with enclosures of rubber or thermoplastic material, and parts of elastomeric such as sealing rings and gaskets, shall be sufficiently resistant to ageing. The

construction of such Industrial plugs shall comply with IEC : 60309.1.2002. All such industrial plugs shall be suitable for 415V/240V, 3Phase/1Phase, 50Hz ac supply as specified in tender drawings and BOQ for the mentioned current ratings.

2. Miniature Circuit Breaker (MCB):

MCB should be trip free, quick make and quick break type.MCB should be suitable for interchangeable line/ load connections. The MCB shall have minimum 10 KA breaking capacity with (Ics=Icu=10kA), where Ics is service breaking capacity and Icu is ultimate breaking capacity defined as per IS-13947. MCBs shall have ISI mark as per IS8828-1996 (IEC60898).The MCB shall be suitable for temperature up to 50 deg C without de-rating. All outgoing feeder MCB shall be provided with clip on type auxiliary contact to interface.Terminal of MCB shall be provided with insulated separators between the phases and also on both end. The size and design of the terminal should be adequate to accommodate aluminum/ copper cable required for the rated current of the MCB.It should confirm to current limiting principle class –3 to ensure extremely low let through energy (I^2t) under fault conditions. It should have 'two position' DIN clip ensuring easy mounting and removal. It should confirm C.E. Marking (confirmation to European standards),based upon the tripping characteristics the MCB shall be described as B, C or D curves and the same must be mentioned in bold upon the MCB. All MCB shall have a mention of Full load current, short circuit current, utility voltage, frequency, tripping characteristics (B, C, and D), basic 3 line diagram. The poles of MCBs shall have minimum self-resistance as per latest IEC standards.

3. Sheet Steel Enclosure:

The enclosure shall be made from sheet steel of 1.6 mm thickness and of required size and dimensions to accommodate the industrial socket in required manner as directed by Engineer-in-charge. All such enclosures shall be dust / vermin proof, corrosion resistive and as be IP rated as specified in tender drawings / Tender BOQ. All such enclosure shall be provided with a chained metal cover for the socket outlets.

MR 19.008 : Supplying and fixing 63 amp, 240 Volts, SPN industrial type, socket outlet with 2 pole and earth, metal enclosed plug top along with 63 amps "C curve", SP , MCB, in sheet steel enclosure, on surface or in recess, with chained metal cover for socket outlet and complete with connections , testing commissioning etc. as required.

1. Industrial Socket:

Industrial sockets shall comply to IEC : 60309.1.2002, with minimum IP rating of IP42 or specified otherwise in tender drawings and BOQ. All such sockets shall be splash proof. However where-ever specified in drawings these may be water sealed type sockets. The marking and dimensions shall be as per standards. The plugs shall be provided with suitable earthing terminal and electrical interlocking such that the lug doesn't comes out of the socket till the supply is there in plug. Accessories with earthing contact shall be provided with an earthing terminal.

Metal-cladfixed accessories with an internal earthing terminal can, in addition, be provided with anexternal earthing terminal, which, except for flush type socket-outlets, shall be visible from theoutside.Earthing contacts shall be directly and reliably connected to the earthing terminals, except thatthe earthing terminal of socket-outlets incorporated in the output circuit of an isolatingtransformer shall not be connected. Accessible metal parts of accessories with earthing contact, which may become live inthe event of an insulation fault, shall be reliably connected to the internal earthing terminal(s)by construction. Accessories with enclosures of rubber or thermoplastic material, and parts of elastomeric such as sealing rings and gaskets, shall be sufficiently resistant to ageing. The construction of such Industrial plugs shall comply with IEC: 60309.1.2002. All such industrial plugs shall be suitable for 415V/240V, 3Phase/1Phase, 50Hz ac supply as specified in tender drawings and BOQ for the mentioned current ratings.

2. Miniature Circuit Breaker (MCB):

MCB should be trip free, quick make and quick break type.MCB should be suitable for interchangeable line/ load connections. The MCB shall have minimum 10 KA breaking capacity with (Ics=Icu=10kA), where Ics is service breaking capacity and Icu is ultimate breaking capacity defined as per IS-13947. MCBs shall have ISI mark as per IS8828-1996 (IEC60898).The MCB shall be suitable for temperature up to 50 deg C without de-rating. All outgoing feeder MCB shall be provided with clip on type auxiliary contact to interface.Terminal of MCB shall be provided with insulated separators between the phases and also on both end. The size and design of the terminal should be adequate to accommodate aluminum/ copper cable required for the rated current of the MCB.It should confirm to current limiting principle class –3 to ensure extremely low let through energy (I^2t) under fault conditions. It should have 'two position' DIN clip ensuring easy mounting and removal. It should confirm C.E. Marking (confirmation to European standards),based upon the tripping characteristics the MCB shall be described as B, C or D curves and the same must be mentioned in bold upon the MCB. All MCB shall have a mention of Full load current, short circuit current, utility voltage, frequency, tripping characteristics (B, C, and D), basic 3 line diagram. The poles of MCBs shall have minimum self-resistance as per latest IEC standards.

3. Sheet Steel Enclosure:

The enclosure shall be made from sheet steel of 1.6 mm thickness and of required size and dimensions to accommodate the industrial socket in required manner as directed by Engineer-in-charge. All such enclosures shall be dust / vermin proof, corrosion resistive and as be IP rated as specified in tender drawings / Tender BOQ. All such enclosure shall be provided with a chained metal cover for the socket outlets.

DSR Item No. 2.17 : Supplying and fixing TP sheet steel enclosure on surface/ recess along with 16/25/32amps 415 volts "C" curve TP MCB complete with connections, testing and commissioning etc. as required.

1. Miniature Circuit Breaker (MCB):

MCB should be trip free, quick make and quick break type.MCB should be suitable for interchangeable line/ load connections. The MCB shall have minimum 10 KA breaking capacity with (Ics=Icu=10kA), where Ics is service breaking capacity and Icu is ultimate breaking capacity defined as per IS-13947. MCBs shall have ISI mark as per IS8828-1996 (IEC60898).The MCB shall be suitable for temperature up to 50 deg C without de-rating. All outgoing feeder MCB shall be provided with clip on type auxiliary contact to interface.Terminal of MCB shall be provided with insulated separators between the phases and also on both end. The size and design of the terminal should be adequate to accommodate aluminum/ copper cable required for the rated current of the MCB.It should confirm to current limiting principle class –3 to ensure extremely low let through energy (I^2t) under fault conditions. It should have 'two position' DIN clip ensuring easy mounting and removal. It should confirm C.E. Marking (confirmation to European standards),based upon the tripping characteristics the MCB shall be described as B, C or D curves and the same must be mentioned in bold upon the MCB. All MCB shall have a mention of Full load current, short circuit current, utility voltage, frequency, tripping characteristics (B, C, and D), basic 3 line diagram. The poles of MCBs shall have minimum self-resistance as per latest IEC standards.

2. Sheet Steel Enclosure:

The enclosure shall be made from sheet steel of 1.6 mm thickness and of required size and dimensions to accommodate the industrial socket in required manner as directed by Engineer-in-charge. All such enclosures shall be dust / vermin proof, corrosion resistive and as be IP rated as specified in tender drawings / Tender BOQ. All such enclosure shall be provided with a chained metal cover for the socket outlets.

MR 19.009 : Supplying and fixing 40 amp, 415 Volts, TPN industrial type, socket outlet with 4 pole and earth, metal enclosed plug top along with 40 amps "C curve", TP , MCB, in sheet steel enclosure, on surface or in recess, with chained metal cover for socket outletand complete with connections , testing commissioning etc. as required.

1. Industrial Socket:

Industrial sockets shall comply to IEC : 60309.1.2002, with minimum IP rating of IP42 or specified otherwise in tender drawings and BOQ. All such sockets shall be splash proof. However where-ever specified in drawings these may be water sealed type sockets. The marking and dimensions shall be as per standards. The plugs shall be provided with suitable earthing terminal and electrical interlocking such that the lug doesn't comes out of the socket till the supply is there in plug. Accessories with earthing contact shall be provided with an earthing terminal. Metal-cladfixed accessories with an internal earthing terminal can, in addition, be provided with anexternal earthing terminal, which, except for flush type socket-outlets, shall be visible from theoutside.Earthing contacts shall be directly and reliably connected to the earthing terminals, except thatthe earthing terminal of socket-outlets incorporated in the output circuit of an isolatingtransformer shall not be connected. Accessible metal parts of accessories with earthing contact, which may become live inthe event of an insulation fault, shall be reliably

connected to the internal earthing terminal(s)by construction. Accessories with enclosures of rubber or thermoplastic material, and parts of elastomeric such as sealing rings and gaskets, shall be sufficiently resistant to ageing. The construction of such Industrial plugs shall comply with IEC: 60309.1.2002. All such industrial plugs shall be suitable for 415V/240V, 3Phase/1Phase, 50Hz ac supply as specified in tender drawings and BOQ for the mentioned current ratings.

2. Miniature Circuit Breaker (MCB):

MCB should be trip free, quick make and quick break type.MCB should be suitable for interchangeable line/ load connections. The MCB shall have minimum 10 KA breaking capacity with (Ics=Icu=10kA), where Ics is service breaking capacity and Icu is ultimate breaking capacity defined as per IS-13947. MCBs shall have ISI mark as per IS8828-1996 (IEC60898).The MCB shall be suitable for temperature up to 50 deg C without de-rating. All outgoing feeder MCB shall be provided with clip on type auxiliary contact to interface.Terminal of MCB shall be provided with insulated separators between the phases and also on both end. The size and design of the terminal should be adequate to accommodate aluminum/ copper cable required for the rated current of the MCB.It should confirm to current limiting principle class –3 to ensure extremely low let through energy (I^2t) under fault conditions. It should have 'two position' DIN clip ensuring easy mounting and removal. It should confirm C.E. Marking (confirmation to European standards),based upon the tripping characteristics the MCB shall be described as B, C or D curves and the same must be mentioned in bold upon the MCB. All MCB shall have a mention of Full load current, short circuit current, utility voltage, frequency, tripping characteristics (B, C, and D), basic 3 line diagram. The poles of MCBs shall have minimum self-resistance as per latest IEC standards.

3. Sheet Steel Enclosure:

The enclosure shall be made from sheet steel of 1.6 mm thickness and of required size and dimensions to accommodate the industrial socket in required manner as directed by Engineer-in-charge. All such enclosures shall be dust / vermin proof, corrosion resistive and as be IP rated as specified in tender drawings / Tender BOQ. All such enclosure shall be provided with a chained metal cover for the socket outlets.

MR 19.010 : Supplying and fixing 63 amp, 415 Volts, waterproof TPN industrial type, socket outlet with 4 pole and earth, metal enclosed plug top along with 63 amps "C curve", TP , MCB, in sheet steel enclosure, on surface or in recess, with chained metal cover for socket outletand complete with connections , testing commissioning etc. as required.

1. Industrial Socket:

Industrial sockets shall comply to IEC : 60309.1.2002, with minimum IP rating of IP42 or specified otherwise in tender drawings and BOQ. All such sockets shall be splash proof. However where-ever specified in drawings these may be water sealed type sockets. The marking and dimensions shall be as per standards. The

plugs shall be provided with suitable earthing terminal and electrical interlocking such that the lug doesn't comes out of the socket till the supply is there in plug. Accessories with earthing contact shall be provided with an earthing terminal. Metal-cladfixed accessories with an internal earthing terminal can, in addition, be provided with anexternal earthing terminal, which, except for flush type socket-outlets, shall be visible from theoutside.Earthing contacts shall be directly and reliably connected to the earthing terminals, except thatthe earthing terminal of socket-outlets incorporated in the output circuit of an isolatingtransformer shall not be connected. Accessible metal parts of accessories with earthing contact, which may become live inthe event of an insulation fault, shall be reliably connected to the internal earthing terminal(s)by construction. Accessories with enclosures of rubber or thermoplastic material, and parts of elastomeric such as sealing rings and gaskets, shall be sufficiently resistant to ageing. The construction of such Industrial plugs shall comply with IEC : 60309.1.2002. All such industrial plugs shall be suitable for 415V/240, 3Phase/1Phase, 50Hz ac supply as specified in tender drawings and BOQ for the mentioned current ratings.

2. Miniature Circuit Breaker (MCB):

MCB should be trip free, quick make and quick break type.MCB should be suitable for interchangeable line/ load connections. The MCB shall have minimum 10 KA breaking capacity with (Ics=Icu=10kA), where Ics is service breaking capacity and Icu is ultimate breaking capacity defined as per IS-13947. MCBs shall have ISI mark as per IS8828-1996 (IEC60898).The MCB shall be suitable for temperature up to 50 deg C without de-rating. All outgoing feeder MCB shall be provided with clip on type auxiliary contact to interface.Terminal of MCB shall be provided with insulated separators between the phases and also on both end. The size and design of the terminal should be adequate to accommodate aluminum/ copper cable required for the rated current of the MCB.It should confirm to current limiting principle class –3 to ensure extremely low let through energy (I^2t) under fault conditions. It should have 'two position' DIN clip ensuring easy mounting and removal. It should confirm C.E. Marking (confirmation to European standards),based upon the tripping characteristics the MCB shall be described as B, C or D curves and the same must be mentioned in bold upon the MCB. All MCB shall have a mention of Full load current, short circuit current, utility voltage, frequency, tripping characteristics (B, C, and D), basic 3 line diagram. The poles of MCBs shall have minimum self-resistance as per latest IEC standards.

3. Sheet Steel Enclosure:

The enclosure shall be made from sheet steel of 1.6 mm thickness and of required size and dimensions to accommodate the industrial socket in required manner as directed by Engineer-in-charge. All such enclosures shall be dust / vermin proof, corrosion resistive and as be IP rated as specified in tender drawings / Tender BOQ. All such enclosure shall be provided with a chained metal cover for the socket outlets.

DSR Item No. 1.10.1: Wiring for light point / fan point / exhaust fan point / call bell point with 1.5 sq.mm. FRLS PVC insulated copper conductor, single core cable in surface / recessed medium class PVC conduit, with modular switch, modular plate, suitable GI box and earthing the point with 1.5 sqmm FRLS PVC insulated copper conductor single core cable etc. as required.
(a) Group A
DSR Item No. 1.10.2 :(b) Group B

1. Wires :
The wires shall be made from bright electrolytic annealed bare copper conductor with strands as specified under IS:694.Solid conductor wires shall not be accepted. The wires shall be PVC (Poly vinyl chloride) insulated confirming to BIS specifications and shall be specified by the manufacturer for working voltage up to and including 1100 volts. The total gauge of wire shall be strictly in accordance with what has been specified in IS:694.The wires shall be FRLS (Fire resistant low smoke) with appropriate and acceptable mechanical strength so that the insulation does not gets damaged while pulling these wires in conduit. Unless otherwise specified following sizes of wires shall be used for different applications:

2. Thimbles/lug :

The wires shall be terminated with the help of crimping lugs at both the terminals. These lugs shall be non-insulated made of tin plated copper, suitable for termination of 1.5 sqmm / 2.5 sqmm / 4 sqmm / 6 sqmm of copper wires. The lugs shall be suitable for 1100V and the min temperature rating for these lugs shall be 150 degree Celsius. The lugs shall be pin type with pin designed in such a fashion to prevent damage to the wire from over tightening and ensure a reliable electrical connection. The lugs shall have good wire contact and good tensile strength. The lugs shall ensure quick and easy wire insertion.

3. PVC conduits and accessories:

All non-metallic conduit pipes and accessories shall be of suitable materialcomplying with IS 2509 : 1973 and IS 3419 : 1989 for rigid conduits andIS 9537 (Part 5) : 2000 for flexible conduits. The interior of the conduits shall befree from obstructions. The rigid conduit pipes shall be ISI marked. The conduits shall be circular in cross-section. The conduits shall be designatedby their nominal outside diameter.No non-metallic conduit less than 20 mm in diameter shall be used. The conduit wiring system shall be complete in all respect including accessories.Rigid conduit accessories shall be normally of grip type while flexible conduit accessories shall be of threaded type.Bends, couplers etc. shall be solid type in recessed type of works, and may besolid or inspection type as required, in surface type of works.Saddles for fixing conduits shall be heavy gauge non-metallic type with base.For all sizes of conduit, the size of clamping rod shall be 4.5 mm (7 SWG) diameter. All the conduits shall be FR (Fire resistant) type.
The minimum width and the thickness of the ordinary clips or girder clips shall be as per Table below.

Size of Conduit	Width	Thickness
20 mm & 25 mm	19 mm	20 SWG (0.9144 mm)
32 mm & above	25 mm	18 SWG (1.219 mm)

4. Modular GI Box:

All the back boxes used shall be concealed GI type with loop in loop out holes marked which shall be removed at the time of jetting conduit inside the same. Size of such holes shall be suitable to take a 32mm diameter conduits. All such back box shall be made from pre-galvanized GI sheet metal with a wall thickness of 1.1mm and confirming to BS:4662:2006. All such back box shall be provided with Brass Earth terminals and adjustable lugs. The metallic box shall be duly painted with anti-corrosive paint before erection. An earth terminal with stud and 2 metal washers and terminal block shall be providedin each back box fortermination of protective conductors and for connection tosocket outlet/metallic body of fan regulator etc. A metal strip shall be welded/screwed, to the metal box as support if tumbler typeof control switches, sockets and/or fan regulators in flush pattern.Clear depth of the box shall not be less than 60 mm and this shall beincreased suitably to accommodate mounting of fan regulators in flush pattern.

5. Modular Base and cover plate:

The front plate shall have smooth surface from both the side and shall be properly matching the fixing alignment. Perfect alignment shall be maintained while fixing of the back boxes. The color shall be as per the architect's directives.

6. Switches:

Wall receptacle (switch) shall beenclosed type flush mountedmade up of superior grade GE plastic polycarbonate with high mechanical electrical and thermal properties, suitable for 240 volts,50Hz,ac. All switches shall be fixed on metal strips which shall be screwed / welded to the box.All switches shall be in accordance with IS 3854 :1997. The terminals and contacts shall be bimetallic silver contacts designed to withstand high overload conditions, high quality brass and copper contacts shall be used for fixed / moving contacts and there shall be a sufficient clearance of minimum 5mm between fixed and moving contacts to break the arc during switch operation. The terminals shall also be made from high quality brass. All such outlets shall be tested for an impact test value of 1NM, through a hammer stroke from a distance of 270mm from such outlets.

DSR Item No. 1.11: Wiring for twin controlled light point with 1.5 sq.mm. FRLS PVC insulated copper conductor, single core cable in surface / recessed medium class PVC conduit, 2 way modular switch, modular plate, suitable GI box and earthing the point with 1.5 sqmm FRLS PVC insulated copper conductor single core cable etc. as required.

1. Wires :

The wires shall be made from bright electrolytic annealed bare copper conductor with strands as specified under IS:694.Solid conductor wires shall not be accepted. The wires shall be PVC (Poly vinyl chloride) insulated confirming to BIS specifications and shall be specified by the manufacturer for working voltage up to and including 1100 volts. The total gauge of wire shall be strictly in accordance with what has been specified in IS:694.The wires shall be FRLS (Fire resistant low smoke) with appropriate and acceptable mechanical strength so that the insulation does not gets damaged while pulling these wires in conduit. Unless otherwise specified following sizes of wires shall be used for different applications

2. Thimbles/lugs:

The wires shall be terminated with the help of crimping lugs at both the terminals. These lugs shall be non insulated made of tin plated copper, suitable for termination of 1.5 sqmm / 2.5 sqmm / 4 sqmm / 6 sqmm of copper wires. The lugs shall be suitable for 1100V and the min temperature rating for these lugs shall be 150 degree Celsius. The lugs shall be pin type with pin designed in such a fashion to prevent damage to the wire from over tightening and ensure a reliable electrical connection. The lugs shall have good wire contact and good tensile strength. The lugs shall ensure quick and easy wire insertion.

3. PVC conduits and accessories:

All non-metallic conduit pipes and accessories shall be of suitable materialcomplying with IS 2509 : 1973 and IS 3419 : 1989 for rigid conduits andIS 9537 (Part 5) : 2000 for flexible conduits. The interior of the conduits shall befree from obstructions. The rigid conduit pipes shall be ISI marked. The conduits shall be circular in cross-section. The conduits shall be designatedby their nominal outside diameter.No non-metallic conduit less than 20 mm in diameter shall be used. The conduit wiring system shall be complete in all respect including accessories.Rigid conduit accessories shall be normally of grip type while flexible conduit accessories shall be of threaded type.Bends, couplers etc. shall be solid type in recessed type of works, and may besolid or inspection type as required, in surface type of works.Saddles for fixing conduits shall be heavy gauge non-metallic type with base.For all sizes of conduit, the size of clamping rod shall be 4.5 mm (7 SWG) diameter. All the conduits shall be FR (Fire resistant) type.

The minimum width and the thickness of the ordinary clips or girder clips shall be as per Table below.

Size of Conduit	Width	Thickness
20 mm & 25 mm	19 mm	20 SWG (0.9144 mm)
32 mm & above	25 mm	18 SWG (1.219 mm)

4. Modular GI Box:

All the back boxes used shall be concealed GI type with loop in loop out holes marked which shall be removed at the time of jetting conduit inside the same. Size of such holes shall be suitable to take a 32mm diameter conduits. All such back box shall be made from pre-galvanized GI sheet metal with a wall thickness of 1.1mm and confirming to BS:4662:2006. All such back box shall be provided with Brass Earth terminals and adjustable lugs. The metallic box shall be duly painted with anti-corrosive paint before erection. An earth terminal with stud and 2 metal washers and terminal block shall be providedin each back box fortermination of protective conductors and for connection tosocket outlet/metallic body of fan regulator etc. A metal strip shall be welded/screwed, to the metal box as support if tumbler typeof control switches, sockets and/or fan regulators in flush pattern.Clear depth of the box shall not be less than 60 mm and this shall suitably to accommodate mounting of fan regulators in flush pattern.

5. Modular Base and cover plate:

The front plate shall have smooth surface from both the side and shall be properly matching the fixing alignment. Perfect alignment shall be maintained while fixing of the back boxes. The color shall be as per the architect's directives.

6. Switches:

Wall receptacle (switch) shall beenclosed type flush mountedmade up of superior grade GE plastic polycarbonate with high mechanical electrical and thermal properties, suitable for 240 volts,50Hz,ac. All switches shall be fixed on metal strips which shall be screwed / welded to the box.All switches shall be in accordance with IS 3854 :1997. The terminals and contacts shall be bimetallic silver contacts designed to withstand high overload conditions, high quality brass and copper contacts shall be used for fixed / moving contacts and there shall be a sufficient clearance of minimum 5mm between fixed and moving contacts to break the arc during switch operation. The terminals shall also be made from high quality brass. All such outlets shall be tested for an impact test value of 1NM, through a hammer stroke from a distance of 270mm from such outlets.

DSR Item No. 1.34 : Supplying and fixing of brass batten / angle holder / connectors including connections etc as required.

1. Angle Holders / Brass Batten / Connecters :
An Angle holder/ brass batten / ceiling rose / connector shall not be used on a circuit, the voltage of which normallyexceeds 250V. Only one flexible cord shall be connected to an Angle holder/ brass batten / ceiling rose / connector. Specially designedceiling roses/ connectors shall be used for multiple pendants.An Angle holder/ brass batten / ceiling rose / connectorshall not embody fuse terminal as an integral part of it. Angle holders shall be used for wall mounted light fixtures while brass battens shall be used for tube fittings.

DSR Item No. 1.44 : Installation, testing and commissioning of ceiling fan, including wiring the down rods of standard length (upto 30 cm) with 1.5 sqmm FRLS PVC insulated copper conductor single core cables etc. as required.

DSR Item No. 1.44 : (i): Installation of Wall fan suitable for single phase, 230 volts including wiring with 1.5 sqmm FRLS PVC insulated copper conductor single core cables etc., complete as required.

1. Ceiling Fans :

Ceiling fans including their suspension shall conform to relevant Indian Standards. The capacity of a ceiling fan to meet the requirement of a room with thelonger dimension D meters should be about 55 D m3/min.The height of fan blades above the floor should be (3H + W)/4, where H is theheight of the room, and W is the height of the work plane.The minimum distance between fan blades and the ceiling should be about 0.3 meters.Energy efficient fans with BEE 5 star rating or complying with IS 374: 1979,shall be used. The minimum service value of fans shall be 3.5 m3/min/W andair delivery 200 m3/min.All ceiling fans shall be wired to ceiling roses or to special connector boxes,and suspended from hooks or shackles, with insulators between hooks and suspension rods. There shall be no joint in the suspension rod.For wooden or steel joists and beams, the suspension shall consist of GIflat of size not less than 40 mm x 6 mm, secured on the sides of the joistsor beams by means of two coach screws of size not less than 5 cm for eachflat. Where there is space above the beam, a through-bolt of size not lessthan 1.5 cm dia, shall be placed above the beam from which the flats aresuspended. In the latter case, the flats shall be secured from movements bymeans of another bolt and nut at the bottom of the beam. A hook consisting of In the case of 'I' beams, flats shall be shaped suitably to catch the flangesMS rod of size not less than 1.5 cm dia shall be inserted between the MS flatthrough oval holes on their sides. Alternatively, the flats may be bent inwardsto hold tightly between them by means of a bolt and nut, a hook of 'S' form and shall be held together by means of a long bolt and nut for concrete roofs, a 12 mm dia. MS rod in the shape of 'U' with their verticallegs bent horizontally at the top at least 19 cm on either side, and bound tothe top of the roof shall be used.In buildings with concrete roofs having a low ceiling height, where the fan clamp cannot be used, or wherever specified, recessed type fan clamp inside metallic box, shall be used.Canopies on top of suspension rod shall effectively hide the suspension.The leading in wire shall be of nominal cross sectional area not less than 1.5sq. mm. and shall be protected from abrasion.Unless otherwise specified, all ceiling fans shall be hung 2.75 m above the floor.The metallic body of regulators of ceiling fans shall be connected toearth by protective conductor.

DSR Item No. 1.50.1 : Installation of exhaust fan in the existing opening, including making good the damage, connection, testing commissioning etc as required.
(a): Upto 450mm sweep

DSR Item No. 1.51 : Extra for fixing the louvers / shutters complete with frame for a exhaust fan of all sizes.

1. Exhaust Fans:

Exhaust fans shall conform to relevant Indian Standards.Exhaust fans shall be erected at the places indicated in drawings For fixing an exhaust fan, a circular opening shall be provided inthe wall to suit the size of the frame, which shall be fixed by means of rag bolts embedded in the wall. The hole shall be neatly

plastered to the originalfinish of the wall. The exhaust fan shall be connected to the exhaust fanpoint, which shall be wired as near to the opening as possible, by means ofa flexible cord, care being taken to see that the blades rotate in the proper direction. Exhaust fans for installation in corrosive atmosphere, shall be painted withspecial PVC paint or chlorinated rubber paint.Installation of exhaust fans in kitchens, dark rooms and such other speciallocations need careful consideration; any special provisions needed shall bespecified.The metallic body of regulators of exhaust fans shall be connected toearth by protective conductor.

E. INSTALLATIONS, TESTING & COMMISSIONING – WIRING

1. Power' wiring shall be kept separate and distinct from light wiring, from the level of circuits, i.e., beyond the branch distribution boards. Conduits for light/power wiringshall be separate.

2. Essential/non-essential/UPS distribution each will have a completely independentand separate distribution system starting from the main, switchboard upto finalwiring for each system. As for example, conduit carrying non-essential wiring shallnot have essential or UPS wiring. Wiring for essential and UPS supply will have their own conduit system. No mixing of wiring is allowed.

3. Generally, no switchboard will have more than one source of incoming supply. More than one incoming supply will be allowed only at main board with proper safety and interlocking so that only one source can be switched on at a time.

4. Each MDB/DB/Switch Board will have reasonable spare outgoing ways for futureexpansion.

5. Balancing of 3-phase circuit shall be done.

6. Wiring shall be done only by the looping system. Phase/live conductors shall belooped at the switch box. For point wiring, neutral wire/earth wire looping for the1st point shall be done in the switch box; and neutral/earth looping of subsequentpoints will be made from point outlets.

7. In wiring, no joints in wiring will be permitted anywhere, except in switch box orpoint outlets, where jointing of wires will be allowed with use of suitable connector etc.

8. The wiring throughout the installation shall be such that there is no break in theneutral wire except in the form of linked switchgear.

9. Light, fans and call bells shall be wired in the 'lighting' circuits. 15A/16A socketoutlets and other power outlets shall be wired in the 'power' circuits. 5A/6A socketoutlets shall also be wired in the 'power' .

10. Following color coding shall be followed in wiring :
    Phase : Red / Yellow / Green (For Respective phases in three Phase)
    Neutral : Black
    Earth : Green

11. Circuit will consist of phase/neutral/earth wire. Circuit will terminate in a switch board(first tapping point, where from point wiring starts) in following manner:
(a) Phase wire terminated in phase connector.
(b) Neutral wire terminated in neutral connector.
(c) Earth wire terminated in earth connector.
(d) The switchboard will have phase, neutral and earth terminal connector blocks toreceive phase/ neutral/ earth wire.

12. Above false ceiling, in no case, open wiring shall be allowed. Wiring will be done inrecessed conduit or surface steel conduit as specified in tender document.

13. Wiring shall not be bare in any case and has to go under a conduit / channel as specified in tender document.

14. When wiring cables are to pass through a wall, these shall be taken through aprotection (steel/ PVC) pipe or porcelain tube of suitable size such that they passthrough in a straight line without twist or cross in them on either porcelain, PVC orother approved material.

15. All floor openings for carrying any wiring shall be suitably sealed after installation.

16. No bare conductor in phase and/or neutral or twisted joints in phase, neutral, and/or protective conductors in wiring shall be permitted.

17.There shall be no joints in the through-runs of cables. If the length of final circuit or sub-main is more than the length of a standard coil, thus necessitating a through joint, such joints shall be made by means of approved mechanical connectors in suitable junction boxes.

18.Termination of multi-stranded conductors shall be done using suitable crimping type thimbles.

19. Outlets shall be looped in accordance with the scheme proposed in " Good for construction" drawings.

20. Every socket outlet shall be controlled by a switch or MCB, as specified. Thecontrol switch/MCB shall be connected on the ‘live’ side of the line.

21. 5A/6A and 15A/16A socket outlets shall be installed at the following positions, unless otherwise specified.
(a) Bathroom – No socket outlet is permitted for connecting a portable appliancethereto. MCB/IC switch may be provided above 2 m for fixed appliances, andat least 1 m away from shower.

(b)Rooms in residences – 23 cm above floor level, or any other level in specialcases as desired by the Engineer-in-charge.

22. Unless and otherwise specified, the control switches for the 6A and 16A socketoutlets shall be kept along with the socket outlets.

23. Recessed conduit work is generally suitable for all applications. Surface conduit workmay be adopted in places like workshops etc. and where recessed work may not bepossible to be done. The type of work shall be as specified in individual works. Flexible non-metallic conduits shall be used only at terminations, wherever specified.

24. If the pipes are liable to mechanical damages, they should be adequately protected.

25.The maximum number of PVC insulated copper conductor cables of650/1100 V grade conforming to IS 694 : 1990 that can be drawn in one conduitof various sizes shall be as specified in Table -1, Page number 33 of part-8 " electrical and allied installation" of NBC-2005.

26. The erection of conduits of each circuit shall be completed before the cables are drawn in before laying of conduits. The path of conduit shall be clearly marked with the help of Milton chalk or chalk powder in a straight route as far as possible before actually laying the conduit.

27. All joints shall be sealed/cemented with approved cement. Damaged conduitpipes/fittings shall not be used in the work. Cut ends of conduit pipes shallhave neither sharp edges nor any burrs left to avoid damage to the insulationof conductors while pulling them through such pipes. For metallic conduits,Conduit pipes shall be joined by means of screwed couplers and screwed accessories only. Threads on conduit pipes in all cases shall be between13 mm to 19 mm long, sufficient to accommodate pipes to full threaded,portion of couplers or accessories.

28. The Engineer-in-charge, with a view to ensuring that the above provisionhas been carried out, may require that the separate lengths of conduit etc.after they have been prepared shall be submitted for inspection before beingfixed. No barethreaded portion of conduit pipe shall be allowed, in case of metallic conduit unless such barethreaded portion is treated with anticorrosive preservative or covered withapproved plastic compound.

29. All bends in the system may be formed either by bending the pipes by anapproved method of heating, or by inserting suitable accessories such asbends, elbows or similar fittings, or by fixing non-metallic inspection boxes,whichever is most suitable. Where necessary, solid type fittings shall beused. For metallic conduits all necessary bends in the system, including diversion, shall be done eitherby neatly bending the pipes without cracking with a bending radius of notless than 7.5 cm, or alternatively, by inserting suitable solid or inspectiontype normal bends, elbows or similar fittings, or by fixing cast iron inspectionboxes, whichever is most suitable.

30. Radius of bends in conduit pipes shall not be less than 7.5 cm. No length ofconduit shall have more than the equivalent of four quarter bends from outletto outlet.

31. Care shall be taken while bending the pipes to ensure that the conduit pipe is not injured, and that the internal diameter is not effectively reduced.

32. For surface conduit works, conduit pipes shall be fixed by heavy gauge non-metallic saddles with base,secured to suitable approved plugs with screws in an approved manner, at aninterval of not more than 60 cm, but on either side of couplers or bends or similarfittings, saddles shall be fixed at a closer distance from the center of such fittings.Slotted PVC saddles may also be used where the PVC pipe can be pushed inthrough the slots. For metallic conduits Conduit pipes shall be fixed by saddles, secured to suitable approved plugswith screws in an approved manner at an interval of not more than one meter,but on either side of the couplers or bends or similar fittings, saddles shall befixed at a distance of 30 cm from the center of such fittings.

33. Where the conduit pipes are to be laid along the trusses, steel joists etc. the sameshall be secured by means of saddles or girder clips as required by the Engineer-in-charge. Where it is not possible to use these for fixing, suitable clamps with boltsand nuts shall be used. For metallic conduits, conduit fittings shall be avoided as far as possible on conduit system exposed to weather. Where necessary, solid type fittings shall be used. In long distance straight run of conduit, inspection type couplers at reasonableintervals shall be provided, or running threads with couplers and jam nutsshall be provided.

34. It is recommended to start the conduit works in the initial phase when the building is under construction. The conduits shall be buried in thewall before plastering, and shall be finished neatly after erection of conduit. In worst case if a chase is required in the wall for conduit that chase in the wall shall be neatly made and of ample dimensions to permitthe conduit to be fixed in the manner desired and then making it neat plastered again.The conduit pipe in such case shall be fixed by means of staples, J-hooks, or by meansof saddles, not more than 60 cm apart or by any other approved means offixing. Also all threaded joints of conduit pipes in such case shall be treated with some approvedpreservative compound to secure protection against rust.

35.In case of exposed brick work, special care shall be takento fix the conduit and accessories in position along with the building work.

36. While laying the conduit in RCC works following points shall be adhered:
(a) The conduit pipes shall be laid in position and fixed to the steel reinforcementbars by steel binding wires before the concreting is done. The conduit pipesshall be fixed firmly to the steel reinforcement bars to avoid their dislocation during pouring of cement concrete and subsequent tamping of the same.
(b) Fixing of standard bends or elbows shall be avoided as far as practicable,and all curves shall be maintained by bending the conduit pipe itself with along radius, which will permit easy drawing in of conductors.
(c) Location of inspection / junction boxes in RCC work should be identified bysuitable means to avoid unnecessary chipping of the RCC slab subsequentlyto locate these boxes.

37. While fixing inspection box for conduits following points shall be adhered:

(a) Suitable inspection boxes to the minimum requirement shall be provided topermit inspection and to facilitate replacement of wires, if necessary.
(b) The inspection box shall be mounted flush with the wall or ceiling concrete. Minimum 65mm depth junction boxes shall be used in roof slabs and the depth of theboxes in other places shall be as per IS 2667 : 1988.
(c) Suitable ventilating holes shall be provided in the inspection box covers.

38. To facilitate subsequent drawing of wires in the conduit, GI fish wire of1.6 mm/1.2 mm (16/18 SWG) shall be provided along with the laying of therecessed conduit.

39. Cables carrying alternating current, if installed in conduit shall always be bunched so that the outgoing and return cables are drawninto the same conduit. In case of three phase distribution separate conduits shall be planned for R,Y and B phases. Also conduits for lighting, power and UPS circuits be separate. Conduits carrying cable for firefighting / fire alarm circuits shall be marked red with a good quality paint at every 1.8 meters.

40. The entire system of metallic conduit work, including the outlet boxes and othermetallic accessories, shall be mechanically and electrically continuous by proper screwed joints, or by double check nuts at terminations. The conduit shall becontinuous when passing through walls or floor. A protective (loop earthing) conductor(s) shall be laid inside the conduit betweenthe metallic switch boxes and distribution switch boards and terminated with proper earth lugs/ terminals. Only PVC insulated copper conductor cable of specified size green in color shall be allowed. The protective conductors shall be terminated properly using earth studs, earth terminal block etc. as the case may be. Gas or water pipe shall not be used as protective conductor (earth medium).

41. All accessories like switches, socket outlets, call bell pushes and regulatorsshall be fixed in flush pattern inside the switch/regulator boxes. Accessories like ceiling roses, brackets, batten holders etc. shall be fixed on outlet boxes. The fan regulators may also be fixed on outlet boxes, if so directed by the Engineer-in-charge.

42. All circuits shall be tested for their circuit continuity through loop resistance test.

43. Acceptable voltage levels between phases and phase to neutral as well s neutral to earth shall be checked for each socket.

F. MEASUREMENTS

1. Circuit and sub-main wiring shall be measured on linear basis along the run of thewiring. The measurement shall include all lengths from end to end of conduit orchannel as the case may be, exclusive of interconnections inside the

switchboardetc. The increase on account of diversion or slackness shall not be included in the measurement.

2. The length of circuit wiring with two wires shall be measured from the distribution board to the nearest switch box from which the point wiring starts. Looping ofswitch boxes also will be counted towards circuit wiring, measured along the lengthof conduit/channel.

3. When wires of different circuits are grouped in a single conduit/ channel, the same shall be measured on linear basis depending on the actual number and sizes ofwires run.

4. Protective (loop earthing) conductors, which are run along the circuit wiring and the sub-main wiring, shall be measured on linear basis and paid for separately.

5. Conduit carrying sub-main will not carry circuit/point wiring. Similarly conduitcarrying circuit wiring will not carry sub-main/point wiring. Conduit carrying pointwiring will not carry sub-main/circuit wiring.

6. Unless and otherwise specified, there shall be no linear measurement forpoint wiring for light points, fan points, exhaust fan points and call bell points.These shall be measured on unit basis by counting, and classified.

7.Except as specified above for point wiring, circuit wiring and sub-main wiring, othertypes of wiring shall be measured separately on linear basis along the run of wiringdepending on the actual number and sizes of wires run.

8. The light plug (6 A) point and power (16 A) point wiring shall be measured on linearbasis, from the respective tapping point of live cable, namely, switch box, anothersocket outlet point, or the sub-distribution board as the case may be, up to thesocket outlet.

9.In the case of points with more than one point controlled by the same switch, suchpoints shall be measured in parts i.e. (a) from the switch to the first point outlet asone point (b) for the subsequent points, thedistance from that outlet to the next one and so on, shall be treated as separate point(s).

10. A light point controlled by two numbers of two way switches shall be measured astwo points from the fittings to the switches on either side.

11. In the case of call bell points with a single call bell outlet, controlled from more thanone place, the points shall be measured in parts i.e.
(a) From the call bell outlet to one of the nearest ceiling roses meant for connectionto bell push, treated as one point
(b) From that ceiling rose to the next one and so on, shall be treated as separatepoint(s).

12. In the case of measurement of extra down rod for ceiling fan including wiring, the same shall be measured in units of 10 cm. Any length less than 5 cm shallbe ignored.

G. SUBMITTALS

The contractor shall submit following submittals as mentioned in "Procedures" and "Close-out"

1. Product data (P.D)
2. Shop drawings (S.D)
3. Work methodology statement (W.M.S).
4. Material Inspection Request (M.I.R)
5. As built drawings. (A.B.D)
6. Operation & maintenance manuals. (O&M)

H. PROCEDURES

1. The contractor shall study all the drawings and tender document carefully and shall strictly adhere "General conditions of Contract "& "Special Conditions of contract ".

2. Any deviation in "Good for construction" drawings with respect to following shall be brought into the notification of consultant in prior before indenting material and execution of job at site :
(a) Deviations with respect to Bill of quantities.
(b) Deviations with respect to Tender drawings.
(c) Deviations with respect to tender specifications.
(d) Deviations with respect to site conditions.

Shop drawing reflecting the deviation has to be prepared by the contractor and the same shall be approved by "Engineer in Charge" / Consultant / Client's representative.

3. The contractor shall prepare a work methodology statement prior to commencement of wiring job at site with detailed description of how the job shall be carried out at site along with necessary testing and commissioning procedures in detailed manner. This methodology statement has to be duly approved by the concerning "Engineer in Charge" / Consultant / Client's representative and work has to be carried out with respect to this approved work methodology statement.

4. Contractor needs to ensure that a mock up for the job shall be shown to concerning "Engineer in Charge" / Consultant / Client's representative at site and the rest work shall further carry on after the approval of mock up at site by the said personnel.

5. The contractor shall organize a preparation meeting prior to the commencement of job at site describing the work methodology statement in meeting.

6. The contractor shall organize a preparation meeting prior to the commencement of job at site describing the work methodology statement in

meeting and the concerning attendees of the meeting have to be informed 24 hrs prior to the commencement of meeting.

7.The contractor shall adhere best installation and safety practices.

8. Product data shall be submitted to " The Consultant" before indenting the material along with the specification compliance sheet duly signed and stamped by the concerning Vendor. Once the consultant approves the product data then only the procurement shall be made.

9. The product once reached at site has to be inspected by concerning " Engineer in Charge" / Client's representative and the product needs to be accepted or rejected in the form of a written document called M.I.R (" Material Inspection Request "). In case the material is rejected the same has to be mentioned in the M.I.R form clearly stating the reason for rejection of material. If accepted the same also needs to be mentioned in M.I.R form.

10. The contractor shall co-ordinate well within as well as other agencies prior to the commencement of job so that any deviation / clashes can be resolved prior to the execution of work at site.

11. Testing and commissioning needs to be performed in the presence of Engineer in Charge" / Client's representative.

12. Pre- final Inspection needs to be carried out in the after full execution of concerning work at site with Engineer in Charge" / Client's representative. Any snags identified during inspection shall be attended and rectified by the contractor.

13. The contractor shall follow a better work sequence and final inspection call has to be raised prior to hand over only. The contractor shall incorporate all the comments provided during pre-final inspection. The work shall be locked/sealed by "The client" after final inspection.

I. CLAUSES

1. The Contractor shall strictly adhere "General conditions of Contract "& "Special Conditions of contract ".

2. In the case of group controlled point wiringas described in Clause no.9 of "Measurements" under section "Wiring", no recovery shall be made for non-provision of more than one switch in such cases.

3. In the case of twin controlled point wiring as described in Clause 10 of "Measurements" under section "Wiring", no recovery shall be made for non-provision of more than one ceiling rose in such cases.

4. In the case of multiple controlled call bell point wiring as described in Clause 11 (a & b) of "Measurements" under section " Wiring", no recovery shall be made for non-provision of more than one ceiling rose orconnector for connection to call bell in such cases.

5. In case of ceiling fans the wiring of extra down rod shall be paid as supplying and drawing cable in existing conduit.

6. In case Engineer in Charge" / Client's representative/ consultant requires any test to be conducted at site, in spite of the fact that a type test report or a routine test report from OEM is already available for such test and if such test is mentioned under the specifications of any standard as mentioned under the tender document and if so feasible at site, the contractor shall be liable to conduct such test as required at no additional time and cost.

7. The contractor shall be liable to furnish the recommendations / clarifications / justification / acceptance from respective OEM as and when required by Engineer in Charge" / Client's representative/ consultant.

8. The contractor shall submit the calibration test report for all the testing equipment being used at site as well has used during factory testing as such test reports shall be acceptable only if furnished by NABL accredited laboratory or if required from the laboratory as specified by Engineer in Charge" / Client's representative/ consultant.

J. CLOSE OUT DOCUMENTATION

1. Once the Final inspection is done, the contractor shall submit the following as close out submittals:
(a) 6 Nos. fully laminated, legible hard copies of "As built drawings"
(b) Soft Copy of "As built drawings" in AUTOCAD 2000 version in a pen-drive.
(c) 4 Nos. fully compiled in box file, legible hard copies of " Operation and maintenance manuals ".
(d) Soft Copy of "Operation and maintenance manuals" in pdf format in a pen-drive.
(e) 4 Nos. fully compiled in box file Training document literature and presentation.
(f) Soft copy of Training document literature and presentation.

2. A draft of operational and maintenance manual has to be submitted by the contractor to concerning " Engineer in Charge" / Consultant / Client's representative defining detailed O&M procedures along with product data, List of spare accessories etc. Upon the receipt of their approval. A final copy of O&M then needs to be prepared and submitted by the contractor in required format.

3. The contractor shall impart training to the concerning personnel those will be taking care of operation and maintenance of the facility. The training shall comprise of both classroom and field training.

4.A draft of training document literature and presentation has to be submitted by the contractor to concerning "Engineer in Charge" / Consultant / Client's representative.Upon the receipt of their approval on the same the training shall be then conducted and a final copy of training document literature and presentationneeds to be prepared and submitted by the contractor in required format.

CHAPTER-2
MCCBs, MCBs & DBs

A. SCOPE

The scope of this section comprises the supply, delivery, erection, testing and commissioning of following :

1. Distribution boards considered for all internal and common areas.This also includes items for switchgears used inside the distribution boards and its accessories.
2. All internal wirings including neutral and earthing connections inside DB. This should however not include the earth connection from DB to earth pit.
3. Complete Installation of distribution board in recess / surface as required.
4. Dressing of Distribution board.
5. Testing and commissioning of distribution board in accordance with relevant IS standards.
6. Tagging of each distribution board.
7. Mounting of switchgear inside distribution boards.
8. Switchgears (MCCB/MCB) in existing cubical enclosure.

B. CODES AND STANDARDS

The relevant sections of Indian Standard Specifications as more particularly stated herein and broadly to all the codes, status and regulations as applicable shall be strictly enforced and adhered to. More particularly following codes should be strictly followed.

1. National Electrical Code - 2008
2. National Building Code - 2005
3. IS 8623:1977 - Distribution boards
4. IS 2675: 1983 - Enclosed distribution fuse boards and cutouts for voltages not exceeding 1000 V Ac and 1200 V Dc
5. IEC 439-3 IEC for Distribution boards up to 250A with door
6. BS EN 60439-3 -Low-Voltage Switchgear And Control gear Assemblies.

C. DEFINATIONS

TPN DB : It is defined as a three pole and neutral (TPN) distribution board also call horizontal type TPN DB which consist of a three phase incoming suitable for 415V, 50Hz and single phase outgoings in each phase respectively suitable for 240V, 50Hz. This is suitable for 3 Phase distribution scheme where the load demand or number of circuits are more and one phase is not sufficient.

SPN DB : It is defined as a single pole and neutral distribution board which consist of a single phase incoming and single phase outgoings suitable for 240V, 50Hz distribution scheme.

VTPN DB : It is defined as a Vertical three pole and neutral (VTPN) distribution board which consist of a three phase incoming suitable for 415V, 50Hz and outgoings are provided with module in such a manner that both single phase and three phase outgoings can be tapped from this DB. This DB finds its application where three phase outgoings are required from a distribution boards.

Ways : It is defined as the total number of clear outgoings in each phase (for a three phase DB) and total number of clear outgoings (for a single phase DB).

Module : It is defined as space required by one single pole MCB inside a DB.

Switchgear : It is defined as electrical device used for switching purpose inside a distribution board, distribution panel, cubical or switchboard. It comprises of following :
ISO : Isolater
MCB : Miniature Circuit Breaker
RCCB : Residual current circuit breaker
RCBO : Residual current break over
MCCB : Molded case circuit breaker

D. SPECIFICATION OF ITEMS

MR 19.011 : Supply, Installation, Testing and Commissioning of following three phase and neutral (TPN), MS powder coated with thickness 1.6 mm, horizontal , double door (IP 43), recessed mounting type, MCB distribution boards complying to IS 8623:1977, IS 2675: 1983, IEC 439-3 and BS EN 60439-3 including all supplements. The distribution boards shall have protection against mechanical impact index of minimum IK08. Supplier should provide the testing certificate for Ingress protection and mechanical impact tested at third party location. Outer door shall be hinged type, inner door shall be fixed up with screws with cut-outs for MCB operation, copper bus-bar of 100 Amp rating, along with din bars, neutral bars, earth bars, lockable door arrangement including all internal connections as required. The board shall have adequate space for termination of incoming and outgoing cables, and also a separate space with proper partition of same material and thickness as specified for distribution board or better, to accommodate a TV splitter and a 5 pair telephone terminal block, removable un drilled top & bottom gland plates, should be suitable for wall, column mounting type B.
(b) 6 Way TPN DB with 18 modules for SP MCBs in outgoing, 2 modules per phase for RCCB, min 4 modules for placing incoming MCB/RCDs, space to accommodate a TV splitter and a 5 pair telephone terminal

block complete with earth bar, neutral bars, din rails, connections but excluding the cost ofMCCB/MCB/RCDs

MR 19.012 : (c) 8 Way TPN DB with 24 modules for SP MCBs in outgoing, 2 modules per phase for RCCB, min 4 modules for placing incoming MCB/RCDs, space to accommodate a TV splitter and a 5 pair telephone terminal block complete with earth bar, neutral bars, din rails, connections but excluding the cost of MCCB/MCB/RCDs.

MR 19.013 : (d) 12 Way TPN DB with 36 modules for SP MCBs in outgoing, 2 modules per phase for RCCB, min 4 modules for placing incoming MCB/RCDs, space to accommodate a TV splitter and a 5 pair telephone terminal block complete with earth bar, neutral bars, din rails, connections but excluding the cost of MCCB/MCB/RCDs. (d) 12 Way TPN DB with 36 modules for SP MCBs in outgoing,2 modules per phase for RCCB, 6 modules for placing incoming switchgear, space to accommodate a TV splitter and a 5 pair telephone terminal block complete with earth bar, neutral bars, din rails, connections but excluding the cost of switchgear.

1. Distribution Board (DB) :

Distribution board shall be made up of sheet steel thickness of minimum 2mm with powder coating, completely dust / vermin / corrosion free with ingress protection rating of IP 43. The board shall have adequate space for termination of incoming and outgoing cables, and also a separate space with proper partition of same material and thickness as specified for distribution board or better, to accommodate a TV splitter and a 5 pair telephone tag block. Removable un-drilled top & bottom gland plates, should be suitable for wall, column mounting type B. The distribution shall be double door type with provision of front operated, fully lockable, hinged door.The distribution boards shall have protection against mechanical impact index of minimum IK08. Neoprene gasket, shall be provided to make distribution box air tight and free from moisture. Inner door shall be fixed up with screws with cut-outs for MCB operation. Each such distribution board shall have din rails for mounting switchgears those shall be made up of galvanized steel,passivized with a thick layer. The ampere ratings of these din rails shall typically be 1.5 times the full load current carrying capacity of the mounting switchgear. The dimensions shall be so selected so that the switchgear gets easily and tightly mounted in the din rail. The distribution board shall have neutral bars of current rating equivalent to phase bars for each phase. Neutral bars of individual phases shall be isolated with each other so that leakage on any one phase doesn't affect the other healthy phases. The clearances among various components inside the distribution board shall comply with mentioned codes and standards. Each neutral bar shall have tinned plated bolts to terminate neutrals of respective circuits to the neutral bar and each neutral bar of respective phase shall be provided with arc flash insulating covers.Terminal blocks shall be suitable for termination of conductor/ cable of requiredsize but minimum rated cross section of the terminal blocks should be 6 sq. mm.Terminal block shall be made of flame retardant polyamide material.

Color terminal blocks and FRLS wires for easy identification of RYB Phases,Neutral and Earth.DB shall be provided with a detachable cassette for safe removal ofMCBs, RCCBs.Detachable plate with Knock out holes shall be provided at the top/ bottom ofboard. Copper bus-bar of at least 100A for SPN & TPN DBs and 200A for VTPN DB, along with, neutral bars, earth bars. Board shall be suitable for operation on 3 Phase / single phase, 415 / 240 volts, 50 cycles, 4 wire system, with neutral grounded at transformer.The selection, design and construction of bus bars shall conform to IS specifications and the latest amendments. The bus bars shall be air insulated and made of high conductivity, high strength cu. Bus bars. Direct access or accidental contact with bus bars and primary connections shall not be possible. Bus bars shall be rated in accordance with service conditions and the rated for continuous and short time current ratings specified in SLD / data sheets. Maximum temperature of the bus bar and bus bar connections, under operating conditions, while carrying rated normal current at rated frequency shall not exceed 85 degree C.

MR 19.014: Supply, Installation, Testing and Commissioning of MCB distribution boards complying to IS 8623:1977, IS 2675: 1983, IEC 439-3 and BS EN 60439-3 including all supplements, MS powder coated with thickness 1.6 mm, horizontal , double door (IP 43), recessed mounting type, for following single phase and neutral (SPN) DB. The distribution boards shall have protection against mechanical impact index of minimum IK08. Supplier should provide the testing certificate for Ingress protection and mechanical impact tested at third party location. outer door shall be hinged type, inner door shall be fixed up with screws with cut-outs for MCB operation, copper bus-bar of 100 Amp, along with din bars, neutral bars, earth bars, lockable door arrangement including all internal connections as required. The board shall have adequate space for termination of incoming and outgoing cables, and also a separate space with proper partition of same material specification as distribution board or better to accommodate a TV splitter and a 5 pair krone connector, removable un drilled top & bottom gland plates, should be suitable for wall, column mounting type B.

(b) 8 Way SPN DB with 8 modules for SP MCBs in outgoing , 2 modules for placing incoming MCB/RCDs, space to accommodate a TV splitter and a 5 pair telephone terminal block complete with earth bar, neutral bars, din rails, connections but excluding the cost of MCB/RCDs.

MR 19.015:(c) 12 Way SPN DB with 12 modules for SP MCBs in outgoing, 2 modules for placing incoming MCB/RCDs, space to accommodate a TV splitter and a 5 pair telephone terminal block complete with earth bar, neutral bars, din rails, connections but excluding the cost of MCB/RCDs.

1. Distribution Board (DB) :

Distribution board shall be made up of sheet steel thickness of minimum 2mm with powder coating, completely dust / vermin / corrosion free with ingress protection rating of IP 43. The board shall have adequate space for

termination of incoming and outgoing cables, and also a separate space with proper partition of same material and thickness as specified for distribution board or better, to accommodate a TV splitter and a 5 pair telephone tag block. Removable un drilled top & bottom gland plates, should be suitable for wall, column mounting type B. The distribution shall be double door type with provision of front operated, fully lockable, hinged door.The distribution boards shall have protection against mechanical impact index of minimum IK08. Neoprene gasket, shall be provided to make distribution box air tight and free from moisture. Inner door shall be fixed up with screws with cut-outs for MCB operation. Each such distribution board shall have din rails for mounting switchgears those shall be made up of galvanized steel passivized with a thick layer. The ampere ratings of these din rails shall typically be 1.5 times the full load current carrying capacity of the mounting switchgear. The dimensions shall be so selected so that the switchgear gets easily and tightly mounted in the din rail. The distribution board shall have neutral bars of current rating equivalent to phase bars for each phase. Neutral bars of individual phases shall be isolated with each other so that leakage on any one phase doesn't affect the other healthy phases. The clearances among various components inside the distribution board shall comply with mentioned codes and standards. Each neutral bar shall have tinned plated bolts to terminate neutrals of respective circuits to the neutral bar and each neutral bar of respective phase shall be provided with arc flash insulating covers.Terminal blocks shall be suitable for termination of conductor/ cable of requiredsize but minimum rated cross section of the terminal blocks should be 6 sq. mm.Terminal block shall be made of flame retardant polyamide material.
Color terminal blocks and FRLS wires for easy identification of RYB Phases,Neutral and Earth.DB shall be provided with a detachable cassette for safe removal ofMCBs, RCCBs.Detachable plate with Knock out holes shall be provided at the top/ bottom ofboard. Copper bus-bar of at least 100A for SPN & TPN DBs and 200A for VTPN DB, along with, neutral bars, earth bars.Distribution Board shall be suitable for operation on 3 Phase / single phase, 415/ 240 volts, 50 cycles, 4 wire system, with neutral grounded at transformer.The selection, design and construction of bus bars shall conform to IS specifications and the latest amendments. The bus bars shall be air insulated and made of high conductivity, high strength cu. Bus bars. Direct access or accidental contact with bus bars and primary connections shall not be possible. Bus bars shall be rated in accordance with service conditions and the rated for continuous and short time current ratings specified in SLD / data sheets. Maximum temperature of the bus bar and bus bar connections, under operating conditions, while carrying rated normal current at rated frequency shall not exceed 85 degree C.

MR 19.016 :Supply, Installation, Testing and Commissioning of MCB distribution boards complying to IS 8623:1977, IS 2675: 1983, IEC 439-3 and BS EN 60439-3 including all supplements , MS powder coated with thickness minimum 1.6 mm, horizontal , double door (IP 43), recessed mounting type, for following configuration vertical three phase and neutral (VTPN) DB . The vertical TPN DB shall be recessed mounted vertically with modules suitable to draw out both single phase and three

phase outgoings. The distribution boards shall have protection against mechanical impact index of minimum IK08. Supplier should provide the testing certificate for Ingress protection and mechanical impact tested at third party location. outer door shall be hinged type, inner door shall be fixed up with screws with cut-outs for MCB operation, copper bus bar of 200 Amp. along with din bars, neutral bars, earth bars including all internal connections as required. The board shall have adequate space for termination of incoming and outgoing cables, and also a separate space with proper partition of same material specification as distribution board or better to accommodate a TV splitter and a 5 pair krone connector, removable un drilled top & bottom gland plates, should be suitable for wall, column mounting type B.

(a) 6 Way VTPN DB with 18 modules suitable for both SP and TP MCBs in outgoing, (min 4 modules for placing incoming MCB/RCDs, or required modules for MCCB) along with space to accommodate a TV splitter and a 5 pair telephone terminal block complete with earth bar, neutral bars, din rails, connections but excluding the cost of MCCB/MCB/RCDs.

MR 19.017 :(b) 8 Way VTPN DB with 24 modules suitable for both SP and TP MCBs in outgoing , (min 4 modules for placing incoming MCB/RCDs, or required modules for MCCB) along with space to accommodate a TV splitter and a 5 pair telephone terminal block complete with earth bar, neutral bars, din rails, connections but excluding the cost of MCCB/MCB/RCDs.

1. Distribution Board (DB) :

Distribution board shall be made up of sheet steel thickness of minimum 2mm with powder coating, completely dust / vermin / corrosion free with ingress protection rating of IP 43. The board shall have adequate space for termination of incoming and outgoing cables, and also a separate space with proper partition of same material and thickness as specified for distribution board or better, to accommodate a TV splitter and a 5 pair telephone tag block. Removable un-drilled top & bottom gland plates, should be suitable for wall, column mounting type B. The distribution shall be double door type with provision of front operated, fully lockable, hinged door.The distribution boards shall have protection against mechanical impact index of minimum IK08. Neoprene gasket, shall be provided to make distribution box air tight and free from moisture. Inner door shall be fixed up with screws with cut-outs for MCB operation. Each such distribution board shall have din rails for mounting switchgears those shall be made up of galvanized steel passivized with a thick layer. The ampere ratings of these din rails shall typically be 1.5 times the full load current carrying capacity of the mounting switchgear. The dimensions shall be so selected so that the switchgear gets easily and tightly mounted in the din rail. The distribution board shall have neutral bars of current rating equivalent to phase bars for each phase. Neutral bars of individual phases shall be isolated with each other so that leakage on any one phase doesn't affect the other healthy phases. The clearances among various components inside the distribution board shall comply with mentioned codes and standards. Each neutral bar shall have tinned plated bolts to terminate

neutrals of respective circuits to the neutral bar and each neutral bar of respective phase shall be provided with arc flash insulating covers.Terminal blocks shall be suitable for termination of conductor/ cable of requiredsize but minimum rated cross section of the terminal blocks should be 6 sq. mm.Terminal block shall be made of flame retardant polyamide material.
Color terminal blocks and FRLS wires for easy identification of RYB Phases,Neutral and Earth.DB shall be provided with a detachable cassette for safe removal ofMCBs, RCCBs.Detachable plate with Knock out holes shall be provided at the top/ bottom ofboard. Copper bus-bar of at least 100A for SPN & TPN DBs and 200A for VTPN DB, along with, neutral bars, earth bars.Distribution Board shall be suitable for operation on 3 Phase / single phase, 415 / 240 volts , 50 cycles, 4 wire system, with neutral grounded at transformer.The selection, design and construction of bus bars shall conform to IS specifications and the latest amendments. The bus bars shall be air insulated and made of high conductivity, high strength cu. Bus bars. Direct access or accidental contact with bus bars and primary connections shall not be possible. Bus bars shall be rated in accordance with service conditions and the rated for continuous and short time current ratings specified in SLD / data sheets. Maximum temperature of the bus bar and bus bar connections, under operating conditions, while carrying rated normal current at rated frequency shall not exceed 85 degree C.

DSR Item No. 2.10.1 : Supplying and fixing 5 amps to 32 amps rating, 240/415 volts, "C" curve, miniature circuit breaker suitable for inductive load of following poles in the existing MCB DB complete with connections, testing and commissioning etc. as required.
(a) Single pole

DSR Item No. 2.10.3 : (b) Double pole

DSR Item No. 2.10.4 : (c) Triple pole

1. Switchgear (MCB/RCCB/RCBO) :

MCB should be trip free, quick make and quick break type.MCB should be suitable for interchangeable line/ load connections. The MCB shall have minimum 10 KA breaking capacity with (Ics=Icu=10kA), where Ics is service breaking capacity and Icu is ultimate breaking capacity defined as per IS-13947. MCBs shall have ISI mark as per IS8828-1996 (IEC60898).The MCB shall be suitable for temperature up to 50 deg C without de-rating. All outgoing feeder MCB shall be provided with clip on type auxiliary contact to interface.Terminal of MCB shall be provided with insulated separators between the phases and also on both end. The size and design of the terminal should be adequate to accommodate aluminum/ copper cable required for the rated current of the MCB.It should confirm to current limiting principle class –3 to ensure extremely low let through energy (I^2t) under fault conditions. It should have 'two position' DIN clip ensuring easy mounting and removal. It should confirm C.E. Marking (confirmation to European standards),based upon the tripping characteristics the MCB shall be described as B, C or D curves and the same must be mentioned in bold upon the MCB. All MCB shall have a mention of Full load current, short circuit current, utility voltage, frequency,

tripping characteristics (B, C, and D),basic 3 line diagram. The poles of MCBs shall have minimum self-resistance as per latest IEC standards.
The RCCB shall have sensitivities of 30mA and 100mA as specified in the design drawing or SLD or BOQ. The RCCB shall comprise of a core balance current transformer built in to calibrate the differential current between any phase and neutral. The RCCB shall have a mention of its sensitivities engraved upon it.
Residual current break over shall be rated for overload, short circuit as well as earth leakage and shall be capable to provide protection against all three of these fault conditions. The RCBO shall be quick make quick break type.It should confirm to current limiting principle class –3 to ensure extremely low let through energy (I^2t) under fault conditions. It should have 'two position' DIN clip ensuring easy mounting and removal.

MR 19.018: Supplying and fixing 40 amps rating, 240/415 volts, "C" curve, miniature circuit breaker suitable for inductive load of following poles in the existing MCB DB complete with connections, testing and commissioning etc. asrequired.
(c) Four pole

1. Switchgear (MCB/RCCB/RCBO) :

MCB should be trip free, quick make and quick break type.MCB should be suitable for interchangeable line/ load connections. The MCB shall have minimum 10 KA breaking capacity with (Ics=Icu=10kA), where Ics is service breaking capacity and Icu is ultimate breaking capacity defined as per IS-13947. MCBs shall have ISI mark as per IS8828-1996 (IEC60898).The MCB shall be suitable for temperature up to 50 deg C without de-rating. All outgoing feeder MCB shall be provided with clip on type auxiliary contact to interface.Terminal of MCB shall be provided with insulated separators between the phases and also on both end. The size and design of the terminal should be adequate to accommodate aluminum/ copper cable required for the rated current of the MCB.It should confirm to current limiting principle class –3 to ensure extremely low let through energy (I^2t) under fault conditions. It should have 'two position' DIN clip ensuring easy mounting and removal. It should confirm C.E. Marking (confirmation to European standards),based upon the tripping characteristics the MCB shall be described as B, C or D curves and the same must be mentioned in bold upon the MCB. All MCB shall have a mention of Full load current, short circuit current, utility voltage, frequency, tripping characteristics (B, C, and D),basic 3 line diagram. The poles of MCBs shall have minimum self-resistance as per latest IEC standards.
The RCCB shall have sensitivities of 30mA and 100mA as specified in the design drawing or SLD or BOQ. The RCCB shall comprise of a core balance current transformer built in to calibrate the differential current between any phase and neutral. The RCCB shall have a mention of its sensitivities engraved upon it.
Residual current break over shall be rated for overload, short circuit as well as earth leakage and shall be capable to provide protection against all three of these fault conditions. The RCBO shall be quick make quick break type.It should confirm to current limiting principle class –3 to ensure extremely low

let through energy (I^2t) under fault conditions. It should have 'two position' DIN clip ensuring easy mounting and removal.

MR 19.019: Supplying and fixing 63 amps rating, 240/415 volts, "C" curve, miniature circuit breaker suitable for inductive load of following poles in the existing MCB DB complete with connections, testing and commissioning etc. as required
(b) Four pole

1. Switchgear (MCB/RCCB/RCBO) :

MCB should be trip free, quick make and quick break typeMCB should be suitable for interchangeable line/ load connections. The MCB shall have minimum 10 KA breaking capacity with (Ics=Icu=10kA), where Ics is service breaking capacity and Icu is ultimate breaking capacity defined as per IS-13947. MCBs shall have ISI mark as per IS8828-1996 (IEC60898).The MCB shall be suitable for temperature up to 50 deg C without de-rating. All outgoing feeder MCB shall be provided with clip on type auxiliary contact to interface. of MCB shall be provided with insulated separators between the phases and also on both end. The size and design of the terminal should be adequate to accommodate aluminum/ copper cable required for the rated current of the MCB.It should confirm to current limiting principle class –3 to ensure extremely low let through energy (I^2t) under fault conditions. It should have 'two position' DIN clip ensuring easy mounting and removal. It should confirm C.E. Marking (confirmation to European standards),based upon the tripping characteristics the MCB shall be described as B, C or D curves and the same must be mentioned in bold upon the MCB. All MCB shall have a mention of Full load current, short circuit current, utility voltage, frequency, tripping characteristics (B, C, and D),basic3 line diagram. The poles of MCBs shall have minimum self-resistance as per latest IEC standards.
The RCCB shall have sensitivities of 30mA and 100mA as specified in the design drawing or SLD or BOQ. The RCCB shall comprise of a core balance current transformer built in to calibrate the differential current between any phase and neutral. The RCCB shall have a mention of its sensitivities engraved upon it.
Residual current break over shall be rated for overload, short circuit as well as earth leakage and shall be capable to provide protection against all three of these fault conditions. The RCBO shall be quick make quick break type.It should confirm to current limiting principle class –3 to ensure extremely low let through energy (I^2t) under fault conditions. It should have 'two position' DIN clip ensuring easy mounting and removal.

MR 19.020 : Supplying and fixing 32 amps rating, 415 volts, four pole ,"C" curve, miniature circuit breaker suitable for inductive load of following poles in the existing MCB DB complete with connections, testing and commissioning etc. as required.

1. Switchgear (MCB/RCCB/RCBO) :

MCB should be trip free, quick make and quick break type.MCB should be suitable for interchangeable line/ load connections. The MCB shall have minimum 10 KA breaking capacity with (Ics=Icu=10kA), where Ics is service breaking capacity and Icu is ultimate breaking capacity defined as per IS-13947. MCBs shall have ISI mark as per IS8828-1996 (IEC60898).The MCB shall be suitable for temperature up to 50 deg C without de-rating. All outgoing feeder MCB shall be provided with clip on type auxiliary contact to interface.Terminal of MCB shall be provided with insulated separators between the phases and also on both end. The size and design of the terminal should be adequate to accommodate aluminum/ copper cable required for the rated current of the MCB.It should confirm to current limiting principle class –3 to ensure extremely low let through energy (I^2t) under fault conditions. It should have 'two position' DIN clip ensuring easy mounting and removal. It should confirm C.E. Marking (confirmation to European standards),based upon the tripping characteristics the MCB shall be described as B, C or D curves and the same must be mentioned in bold upon the MCB. All MCB shall have a mention of Full load current, short circuit current, utility voltage, frequency, tripping characteristics (B, C, and D), basic3 line diagram. The poles of MCBs shall have minimum self-resistance as per latest IEC standards.

The RCCB shall have sensitivities of 30mA and 100mA as specified in the design drawing or SLD or BOQ. The RCCB shall comprise of a core balance current transformer built in to calibrate the differential current between any phase and neutral. The RCCB shall have a mention of its sensitivities engraved upon it.

Residual current break over shall be rated for overload, short circuit as well as earth leakage and shall be capable to provide protection against all three of these fault conditions. The RCBO shall be quick make quick break type.It should confirm to current limiting principle class –3 to ensure extremely low let through energy (I^2t) under fault conditions. It should have 'two position' DIN clip ensuring easy mounting and removal.

MR 19.021 : Supplying and fixing following rating, 240 volts, double pole ,"C" curve, residual current break over (RCBO) suitable for inductive load of following poles in the existing MCB DB complete with connections, testing and commissioning etc. as required.
(a) 25A, 30mA, 10 kA DP RCBO

MR 19.022 : (b) 40A, 30mA, 10 kA DP RCBO

1. Switchgear (MCB/RCCB/RCBO) :

MCB should be trip free, quick make and quick break type.MCB should be suitable for interchangeable line/ load connections. The MCB shall have minimum 10 KA breaking capacity with (Ics=Icu=10kA), where Ics is service breaking capacity and Icu is ultimate breaking capacity defined as per IS-13947. MCBs shall have ISI mark as per IS8828-1996 (IEC60898).The MCB shall be suitable for temperature up to 50 deg C without de-rating. All outgoing feeder MCB shall be provided with clip on type auxiliary contact to interface.Terminal of MCB shall be provided with insulated separators between the phases and also on both end. The size and design of the terminal should be adequate to accommodate aluminum/

copper cable required for the rated current of the MCB.It should confirm to current limiting principle class –3 to ensure extremely low let through energy (I^2t) under fault conditions. It should have 'two position' DIN clip ensuring easy mounting and removal. It should confirm C.E. Marking (confirmation to European standards),based upon the tripping characteristics the MCB shall be described as B, C or D curves and the same must be mentioned in bold upon the MCB. All MCB shall have a mention of Full load current, short circuit current, utility voltage, frequency, tripping characteristics (B, C, and D), basic 3 line diagram. The poles of MCBs shall have minimum self-resistance as per latest IEC standards.

The RCCB shall have sensitivities of 30mA and 100mA as specified in the design drawing or SLD or BOQ. The RCCB shall comprise of a core balance current transformer built in to calibrate the differential current between any phase and neutral. The RCCB shall have a mention of its sensitivities engraved upon it.

Residual current break over shall be rated for overload, short circuit as well as earth leakage and shall be capable to provide protection against all three of these fault conditions. The RCBO shall be quick make quick break type.It should confirm to current limiting principle class –3 to ensure extremely low let through energy (I^2t) under fault conditions. It should have 'two position' DIN clip ensuring easy mounting and removal.

DSR Item No. 2.14.2 : Supplying and fixing following rating, double pole, (single phase and neutral), 240 volts, residual current circuit breaker (RCCB) having sensitivity upto 30milliampere in the existing MCB DB complete with connections, testing commissioning etc. as required
(b) 40 amps

DSR Item No. 2.14.3 : (c) 63 amps

1. Switchgear (MCB/RCCB/RCBO) :

MCB should be trip free, quick make and quick break type.MCB should be suitable for interchangeable line/ load connections. The MCB shall have minimum 10 KA breaking capacity with (Ics=Icu=10kA), where Ics is service breaking capacity and Icu is ultimate breaking capacity defined as per IS-13947. MCBs shall have ISI mark as per IS8828-1996 (IEC60898).The MCB shall be suitable for temperature up to 50 deg C without de-rating. All outgoing feeder MCB shall be provided with clip on type auxiliary contact to interface.Terminal of MCB shall be provided with insulated separators between the phases and also on both end. The size and design of the terminal should be adequate to accommodate aluminum/ copper cable required for the rated current of the MCB.It should confirm to current limiting principle class –3 to ensure extremely low let through energy (I^2t) under fault conditions. It should have 'two position' DIN clip ensuring easy mounting and removal. It should confirm C.E. Marking (confirmation to European standards),based upon the tripping characteristics the MCB shall be described as B, C or D curves and the same must be mentioned in bold upon the MCB. All MCB shall have a mention of Full load current, short circuit current, utility voltage, frequency,

tripping characteristics (B, C, and D), basic 3 line diagram. The poles of MCBs shall have minimum self-resistance as per latest IEC standards.
The RCCB shall have sensitivities of 30mA and 100mA as specified in the design drawing or SLD or BOQ. The RCCB shall comprise of a core balance current transformer built in to calibrate the differential current between any phase and neutral. The RCCB shall have a mention of its sensitivities engraved upon it.
Residual current break over shall be rated for overload, short circuit as well as earth leakage and shall be capable to provide protection against all three of these fault conditions. The RCBO shall be quick make quick break type.It should confirm to current limiting principle class –3 to ensure extremely low let through energy (I^2t) under fault conditions. It should have 'two position' DIN clip ensuring easy mounting and removal.

DSR Item No. 2.11 : Supplying and fixing single pole blanking platein the existing MCB DB complete etc. as required.

1. Blanking plate for DB :

Blanking plate shall be made up of minimum 18 gauge sheet steel and shall be suitable for fixing inside any type of distribution board. The dimensions shall be selected in such a fashion so that it completely covers exposed din bars. Holes made in these blanking plates for fixing nuts and bolts shall be made a site only with a drill machine of required dia and extra holes shall be plugged in with a fire sealant.

DSR Item No. 2.13.1 : Supplying and fixing following rating, four pole, 415 volts, isolator in the existing MCB DB complete with connections, testing and commissioning etc. as required.(a) 32 Amp

DSR Item No. 2.13.1 : (b) 40 Amp

DSR Item No. 2.13.2 : (c) 63 Amp

1. Isolator :

All isolators and switches shall be two position type (ON/OFF) heavy duty, load break, quick make and break type and suitable for front of board operation and shall conform to I.S. 4064.The isolators for motor feeders shall be of "Motor Duty" type adequate for interruption of locked rotor current of motors (excepting for motors rated 50 Kilowatts and above).Switches and isolators provided in the switch boards shall be interlocked with door to prevent opening and closing of the door in the closed (ON) position of the isolators. All live terminals on the isolating / switches shall be adequately shrouded to prevent accidental contact and danger to the personnel.

E. INSTALLATIONS, TESTING & COMMISSIONING

1. Distribution boards shall be flushed in the wall and a niche shall be made after measuring the actual depth of DB so that the distribution box gets properly fitted inside niche. In case of surface mounted distribution board the location shall be confirmed in co-ordination with architect and civil team.

2. The distribution board shall be properly aligned and the leveled within tolerance of +/- 2mm and shall be ensured with a water level indicator or a laser gun whichever available.

3. DB shall have peel able poly layer on the cover for protection fromcement, plaster, paints etc. during the construction period.

4. The holes made in sheet steel enclosure for cable termination shall be made only through drill machine or approved cutting tool with marking of dia done prior to cutting or drilling. Extra left out holes shall be filled neatly with fire retardant sealant.

5. The enclosure shall be tightly fixed. No spare nuts-bolts shall be left out un-tightened / open inside the DB enclosure in any case.

6. Gland plates where ever used for cable termination shall be tightly fixed and shall be earthed.

7. Din bar shall be mounted in a linear horizontal fashion in case of TPN/SPN DBs and may be in vertical fashion only in case of VTPN DB. Din bars shall not be allowed to cut once fixed and installed inside DB. The excess exposed part of din shall be covered with blanking plate. In case if the din needs to be cut after installation or if so directed by the engineer in charge. The complete din bar needs to be dismantled from DB first and then cutting shall be done.

8. Switchgears shall be mounted on din tightly and accurately with incoming poles facing top and outgoing pole facing bottom.

9. Internal wiring of distribution board shall be terminated into respective switchgears, earth bars and neutral bars only with the help of pin type lugs / thimbles. However for body earthing of DB cu. C / U type lugs can be used.

10. Termination lugs shall be tightly fixed and connected and there shall not be any bare wire strand jetting out of the lugs. Suitable crimping tool shall be used. And terminal wires shall be coved with heat shrinkable sleeves whose color coding has to match with the color of the wire used.

11. For complete internal wiring the size of phase earth and neutral conductor shall be equal and as specified for that particular circuit.

12. Color coding shall be followed for internal wiring also in a similar pattern as described in chaper-1 wiring under the specification document.

13. Ferruling shall be neatly done after completing the circuit wiring with good quality ferrules and ferrules shall be so installed that the letters are easily visible from front side without adjusting the ferrule. Only factory marked and made ferrules shall be acceptable. The ferrules shall clearly depict circuit name

and number as per GFC drawing.

14. The door of DB shall be aligned properly and there shall be no air gap left after closing the DB door. Gaskets shall be used to make DB free from moisture.

15. Site fabricated DBs shall not be acceptable.

16. DB shall have Padlocking arrangement and shall be pad locked after complete installation.

17. Distribution board shall be fully tested (both type and routine test) for its components as per the specification laid under Indian standards.In particular following test shall be done:
(a) Continuity test (both earth continuity and loop continuity)
(b) Insulation resistance test.
(c) Contact resistance test.
(d) Primary injection test.
(e) Trip test and trip unit reset test with Test knob of breaker.
(f) RCCB sensitivity test with earth leakage test kit ranging up to 50ma, 100ma and 300ma.
(g) Phase rotation test.

18. After testing is done. The distribution board shall be functionally checked for its functioning and shall be commissioned thereafter.

F. MEASUREMENTS

1. Measurement for DBs shall be done in numbers. DB shall be counted as a single entity inclusive of its din bars, neutral bars, earth bars, doors, terminals, internal wiring, terminations, dressing etc. The same shall be paid accordingly
2. Measurements of switchgears fixed inside DBs /cubical shall also be done in numbers. However only switchgears shall be considered and DB/enclosures shall be paid extra.
3. Measurements of blanking inside DBs /cubical shall also be done in numbers and shall be paid accordingly.

G.SUBMITTALS

The contractor shall submit following submittals as mentioned in "Procedures" and "Close out"
1. Product data (P.D)
2. Shop drawings (S.D)
3. Work methodology statement (W.M.S).
4. Material Inspection Request (M.I.R)
5. As built drawings. (A.B.D)
6. Operation & maintenance manuals. (O&M)

H. PROCEDURES

1. The contractor shall study all the drawings and tender document carefully and shall strictly adhere "General conditions of Contract" & "Special Conditions of contract ".

2. Any deviation in "Good for construction" drawings with respect to following shall be brought into the notification of consultant in prior before indenting material and execution of job at site :
(a) Deviations with respect to Bill of quantities.
(b) Deviations with respect to Tender drawings.
(c) Deviations with respect to tender specifications.
(d) Deviations with respect to site conditions.
Shop drawing reflecting the deviation has to be prepared by the contractor and the same shall be approved by "Engineer in Charge" / Consultant / Client's representative.

3. The contractor shall prepare a work methodology statement prior to commencement of Installation of DB at site with detailed description of how the job shall be carried out at site along with necessary testing and commissioning procedures in detailed manner. This methodology statement has to be duly approved by the concerning "Engineer in Charge" / Consultant / Client's representative and work has to be carried out with respect to this approved work methodology statement.

4.The contractor needs to ensure that a mock up for the job shall be shown to concerning "Engineer in Charge" / Consultant / Client's representative at site and the rest work shall further carry on after the approval of mock up at site by the said personnel.

5. The contractor shall organize a preparation meeting prior to the commencement of job at site describing the work methodology statement in meeting.

6. The contractor shall organize a preparation meeting prior to the commencement of job at site describing the work methodology statement in meeting and the concerning attendees of the meeting have to be informed 24 hrs prior to the commencement of meeting.

7. The contractor shall adhere best installation and safety practices.

8. Product data along with General arrangements and type test report shall be submitted to "The Consultant" before indenting the material along with the specification compliance sheet duly signed and stamped by the concerning Vendor. Once the consultant approves the product data then only the procurement shall be made.

9. The product once reached at site has to be inspected by concerning " Engineer in Charge" / Client's representative and the product needs to be accepted or rejected in the form of a written document called M.I.R (" Material Inspection Request "). In case the material is rejected the same has to be

mentioned in the M.I.R form clearly stating the reason for rejection of material. If accepted the same also needs to be mentioned in M.I.R form.

10. The contractor shall co-ordinate well within as well as other agencies prior to the commencement of job so that any deviation / clashes can be resolved prior to the execution of work at site.

11. Testing and commissioning needs to be performed in the presence of Engineer in Charge" / Client's representative.

12. Pre- final Inspection needs to be carried out in the after full execution of concerning work at site with Engineer in Charge" / Client's representative. Any snags identified during inspection shall be attended and rectified by the contractor.

13. The contractor shall follow a better work sequence and final inspection call has to be raised prior to hand over only. The contractor shall incorporate all the comments provided during pre-final inspection. The work shall be locked/sealed by "The client" after final inspection.

I.CLAUSES

1. The Contractor shall strictly adhere "General conditions of Contract "& "Special Conditions of contract ".

2. Supplier should provide the testing certificate for Ingress protection and mechanical impact of distribution board tested at third party location.

3. The contractor shall be paid in accordance with the measurement as described.

4. In case Engineer in Charge" / Client's representative/ consultant requires any test to be conducted at site , in-spite of the fact that a type test report or a routine test report from OEM is already available for such test and if such test is mentioned under the specifications of any standard as mentioned under the tender document and if so feasible at site, the contractor shall be liable to conduct such test as required at no additional time and cost.

5. The contractor shall be liable to furnish the recommendations / clarifications / justification / acceptance from respective OEM as and when required by Engineer in Charge" / Client's representative/ consultant.

6. The contractor shall submit the calibration test report for all the testing equipment being used at site as well has used during factory testing as such test reports shall be acceptable only if furnished by NABL accredited laboratory or if required from the laboratory as specified by Engineer in Charge" / Client's representative/ consultant.

J.CLOSE OUT DOCUMENTATION

1. Once the Final inspection is done, the contractor shall submit the following as

close out submittals:
(a) 6 Nos. fully laminated, legible hard copies of "As built drawings"
(b) Soft Copy of "As built drawings" in AUTOCAD 2000 version in a pen-drive.
(c) 4 Nos. fully compiled in box file, legible hard copies of " Operation and maintenance manuals ".
(d) Soft Copy of "Operation and maintenance manuals" in pdf format in a pen-drive.
(e) 4 Nos. fully compiled in box file Training document literature and presentation.
(f) Soft copy of Training document literature and presentation.

2. A draft of operational and maintenance manual has to be submitted by the contractor to concerning " Engineer in Charge" / Consultant / Client's representative defining detailed O&M procedures along with product data, List of spare accessories etc. Upon the receipt of their approval. A final copy of O&M then needs to be prepared and submitted by the contractor in required format.

3. The contractor shall impart training to the concerning personnel those will be taking care of operation and maintenance of the facility. The training shall comprise of both classroom and field training.

4.A draft of training document literature and presentation has to be submitted by the contractor to concerning " Engineer in Charge" / Consultant / Client's representative.Upon the receipt of their approval on the same the training shall be then conducted and a final copy of training document literature and presentationneeds to be prepared and submitted by the contractor in required format.

CHAPTER-3
CABLES & END TERMINATIONS

A. SCOPE

1. The scope of this section comprises of supply, delivery, store at site, laying of L.T. cables, fixing of Cable glands, cable dressing and termination in proper position.

2. Items under this section covers Armoured / Unarmoured / flexible AL/Cu. cables & their end terminations from Substation to different feeder pillars, from feeder pillars to metering panels / Main LT Panel of different buildings and therefrom to different distribution boards and HVAC Panels.

3. All control cables used for the specified scope of power cables along with their end terminations used are also covered in this section.

4.All tools and accessories required to complete the job in full respect and as per engineer in charge shall be included.

B. CODES AND STANDARDS

The relevant sections of Indian Standard Specifications as more particularly stated herein and broadly to all the codes, status and regulations as applicable shall be strictly enforced and adhered to. More particularly following codes should be strictly followed.

IS : 7098-II XLPE insulated heavy duty cables for working voltages above 1000 V.
IS : 3961-II Recommended current ratings for cables.
IS : 8130 Conductors for insulated cables.
IS : 583 XLPE Insulation and outer sheath of electric cables.
IS : 7098-I Test Procedures for cables.
IS : 10418 Specification for drums for electric cables.
IS : 39751 Mild steel wire, strips, and tapes for armoring of cables.
IS : 1554 PVC insulated.

C. DEFINATIONS

Abbreviation used to define the following are stated in front of the entitiy

Aluminum Conductor A
XLPE Insulation 2X
Steel round wire armor W

Steel strip armor	F
Steel Double round wire armor	WW
Steel Double strip armor	FF
Non-magnetic (A1.) round wire armor	Wa
Non-magnetic (A1.) strip armor	Fa
PVC outer sheath	Y

D. SPECIFICATION OF ITEMS

MR 19.023 : Supply, Installation, Testing and Commissioning of following armoured / flexible / unarmoured cables. All the below mentioned cables shall be 1.1kV grade, XLPE insulated, FRLS type armoured cables of Al / Cu, with inner and outer PVC sheath. The said cables shall confirm IS 7098-1, BS 5467, IEC 60502-1, BS 7889 with all supplementary. The rate shall include complete Supply, laying/installation, testing and commissioning rates including cost of conduits, fire retardant sealant and all tools and accessories required to Complete the job in full respect.
(a) 3.5C X 300 Sqmm A2XFY.

MR 19.024 : (b) 3.5C X 240 Sqmm A2XFY.

MR 19.025 : (c) 3.5C X 185 Sqmm A2XFY.

MR 19.026 : (d) 3.5C X 150 Sqmm A2XFY.

MR 19.027 : (f) 3.5C X 95 Sqmm A2XFY.

MR 19.028 : (h) 3.5C X 50 Sqmm A2XFY.

MR 19.029 : (i) 3.5C X 35 Sqmm A2XFY.

MR 19.030 : (j) 4C X 25 Sqmm A2XFY.

MR 19.031 : (k) 4C X 16 Sqmm 2XWY.

MR 19.032 : (l) 4C X 10 Sqmm 2XWY.

MR 19.033 : (m) 4C X 6 Sqmm 2XWY.

MR 19.034: (n) 4C X 4 Sqmm 2XWY.

MR 19.035 : (o) 4C X 16 Sqmm Cu. 2YY (PVC flexible cable)in a 32 mm dia medium duty PVC conduit

MR 19.036 : (p) 4C X 10 Sqmm Cu. 2YY (PVC flexible cable)in a 32 mm dia medium duty PVC conduit

MR 19.037 (q)4C X 6 Sqmm Cu. 2YY (PVC flexible cable)in a 32 mm dia medium duty PVC conduit

MR 19.038 (r)4C X 4 Sqmm Cu. 2YY (PVC flexible cable)in a 32 mm dia medium duty PVC conduit

MR 19.039 (s) 3C X 10 Sqmm 2XWY

MR 19.040 (t) 3C X 6 Sqmm 2XWY

MR 19.041 (u) 3C X 4 Sqmm 2XWY

MR 19.042 (v) 3C X 6 Sqmm Cu. 2YY (PVC flexible cable)in a 25 mm dia medium duty PVC conduit

MR 19.043 (w) 3C X 4 Sqmm Cu. 2YY (PVC flexible cable)in a 25 mm dia medium duty PVC conduit

MR 19.044 (x) 3C X 2.5 Sqmm Cu. 2YY (PVC flexible cable)in a 25 mm dia dia medium duty PVC conduit

MR 19.045 (bb)2C x 2.5 sqmm cu. control cables

MR 19.046 (cc)4C x 2.5 sqmm cu. control cables

MR 19.047 (dd) 6C x 2.5 sqmm cu. control cables

MR 19.048 (dd) 24C x 2.5 sqmm cu. control cables

1. Cables :

1.1 KV Grade cables shall be XLPE/ PVC insulated PVC sheathed, Al or Copper conductor Armour confirming to IS 1554 with latest amendments.Stranded Aluminum/Copper conductor shall be used. All Aluminum/Copper XLPE cables insulation shall be of high grade Cross-linked Polyethylene for insulation for extrusion process. Cores laid up. The inner sheath should be bonded over with thermoplastic material for protection against mechanical and electrical damage. Armoring should be provided over the inner sheath to guard against mechanical damage. Armoring should be Galvanized steel wires or galvanized steel strips. In single core cables used in A.C. wires/strips, round steel wires should be used; where diameter over the inner sheath does not exceed 13 mm, flat steel armor should be used.Insulation shall be of XLPE type as per latest IS general-purpose insulation for maximum rated conductor temp 90 degree C. The XLPE insulated cables shall conform to latest revision IS read along with these specifications. The Conductor shall be stranded Aluminum/Copper circular/sector shaped and compacted. In multi core cables the core shall be identified by

red, yellow, blue and black coloring of insulation. The XLPE insulated 1100Volts grade power cables shall conform to latest IS . The conductor shall be stranded Aluminum/Copper as called for in the schedule of quantities. The outer sheath shall be as per the requirement of type ST-2 of IS: 5831 of 1984.Conductor shall be of electrolytic Aluminum/Copper conforming to IS: 8130 and are compact circular or compact shaped. In Inner sheath laid up cores shall be bonded over with thermo-plastic material for protection against mechanical and electrical damage. Insulation, inner sheath and outer sheath shall be applied by extrusion and lapping up process only. Armoring shall be of galvanized steel wire/flat. Repaired cables shall not be used. Current ratings of the cables shall be as per IS: 3961.The cables shall be suitable for laying in racks, ducts, trenches, conduits and underground buried installations with uncontrolled back fill and chances of flooding by water. Progressive automatic in line sequential marking of the length of cables in meters at every one meter shall be provided on the outer sheath of all cables. Both ends of the cables shall be properly sealed with PVC/Rubber caps so as to eliminate ingress of water during transportation, storage and erection.

MR 19.049: Supplying and making and termination with double compression brass gland and aluminium lugs for following size of PVC insulated and PVC sheathed /XLPE aluminium conductor cable of 1.1 KV grade of the following sizes as required

(a)3.5 X 300 Sq mm (70mm)

MR 19.050 : (b) 3.5C X 240 Sqmm A2XFY.

MR 19.051 : (c) 3.5C X 185 Sqmm A2XFY.

MR 19.052 : (d) 3.5C X 150 Sqmm A2XFY.

MR 19.053 : (f) 3.5C X 95 Sqmm A2XFY.

MR 19.054 : (h) 3.5C X 50 Sqmm A2XFY.

MR 19.055 : (i) 3.5C X 35 Sqmm A2XFY.

MR 19.056 : (j) 4C X 25 Sqmm A2XFY.

MR 19.057 : Supplying and making and termination with double compression brass gland and copper lugs for following size of PVC insulated and PVC sheathed /XLPE copper conductor cable of 1.1 KV grade of the following sizes are required.
(k) 4C X 16 Sqmm 2XWY.

MR 19.058 : (l) 4C X 10 Sqmm 2XWY.

MR 19.059 : (m) 4C X 6 Sqmm 2XWY.

MR 19.060 : (n) 4C X 4 Sqmm 2XWY.

MR 19.061 : (o) 4C X 16 Sqmm Cu. 2YY (PVC flexible cable) in a 32 mm dia medium duty PVC conduit

MR 19.062 : (p) 4C X 10 Sqmm Cu. 2YY (PVC flexible cable) in a 32 mm dia medium duty PVC conduit

MR 19.063 : (q)4C X 6 Sqmm Cu. 2YY (PVC flexible cable) in a 32 mm dia medium duty PVC conduit

MR 19.064 : (r)4C X 4 Sqmm Cu. 2YY (PVC flexible cable) 2XY in a 32 mm dia medium duty PVC conduit

MR 19.065 : (s) 3C X 10 Sqmm 2XWY

MR 19.066 : (t) 3C X 6 Sqmm 2XWY

MR 19.067 : (u) 3C X 4 Sqmm 2XWY

MR 19.068 : (v) 3C X 6 Sqmm Cu. 2YY (PVC flexible cable) in a 25 mm dia medium duty PVC conduit

MR 19.069 : (w) 3C X 4 Sqmm Cu. 2YY (PVC flexible cable) in a 25 mm dia medium duty PVC conduit

MR 19.070: (x) 3C X 2.5 Sqmm Cu. 2YY (PVC flexible cable) in a 25 mm dia dia medium duty PVC conduit

Control Cables :

MR 19.071 : (bb)2C x 2.5 sqmm cu. control cables

MR 19.072 : (cc)4C x 2.5 sqmm cu. control cables

MR 19.073 : (dd) 6C x 2.5 sqmm cu. control cables

MR 19.074 : (dd) 24C x 2.5 sqmm cu. control cables

1. End termination :

All cable glands shall be made out of brass and of good quality as approved. For all panel's cable glands shall be of double compressions type.Termination/ Joining of power and control cables shall be done by means of compression methods using solder less tinned copper or Aluminum terminal lugs.For control cables terminations, ring tongue or

reducer pin type lugs shall be used to suit the purpose. Proper crimping tools with crimping paste shall be used to maintain proper conductivity and avoid any air gap.

2. Cable Tags :

Cable tag shall be made out of stainless steel minimum 1.2 mm thick and 25 mm x 100 mm size with holes provided to tag the cable. Following information shall be engraved in the cable with good quality material and the lettering height shall be 4.5mm

(a) Source of the Cable from where it is supplied power.
(b) Destination where the cable is terminated to
(c) No of Cores of cables
(d) Cross sectional area of the cable
(e)Complete notation as described under definition part of cable specification.

E. INSTALLATIONS, TESTING & COMMISSIONING

1. Cables shall be stored in a dry covered place to prevent exposure to climate conditions and wear and tear of wooden drums and it should be preferably concrete surface.

2. All drums should be stored in such a manner as to leave sufficient space between them for air circulation. It is desirable for drums to stand on battens directly placed under the flange. In no case should the drums be stored "on the flat" i.e. flange horizontal.

3. Both ends of the cables shall be properly sealed with PVC/Rubber caps so as to prevent ingress of water, miniaturization of cores and armors during transportation, storage and erection.

4. On receipt of cable drums visual inspection of drums should be carried out for any damages to these cables. While unloading the cables certain precautions are to be taken to ensure the safety of cables. The cable end to be opened on one side and tested for its insulation and continuity.

5. The cable drums should not be dropped or thrown from the trucks/railway wagons etc. during unloading operations as shock may cause serious damage to cable layers. A crane may be used for unloading cable drums. While lifting the cable drums with crane, it is recommended that the lagging should be left in place to prevent the flanges from crushing on the cables. If crane is not available a ramp should be prepared with approximate inclination of 1: 3 or 1: 4. The cable drums should be rolled over the ramp by means of ropes and winches.

6. Additionally a sand bed at the foot of the ramp may be prepared to brake the rolling of the cable drum. Cable should not be dragged along the earth surface. Drums should be rolled in the direction of arrow only.

7. For laying of cables special care is to be taken to prevent sharp bending, kinking, twisting. Cable should be unwound from drum by proper mounting the cable drum on a cable wheel making sure the spindle is strong enough to carry the weight without bending and that it is lying horizontally in the bearings, so as to prevent the drum creeping to one side or the other, while it is rotating.

8. The maximum safe pulling force (when pulled by pulling eye) proper and safe method of pulling of cable should be used depending upon the site conditions to avoid any kind of damage to the cables. Following pulling forces to be noted.

Aluminum Conductor cables : 3.0 Kg/mm2

Copper conductor cables : 5 Kg/mm2

Special care is to be taken while laying cable at bends. Following are the recommended bending radius for power and control cables.

Sr. No.	Voltage rating in KV	PVC/XLPE Cables	
		Multi Core	Single Core
1.	Up to 1.1	12 D	15 D
2.	Above 1.1 to 33 KV	15 D	15 D
D = D is over all diameter of cable.			

9. Armored cables are to be laid on cable trays / underground as per relevant design drawing and specifications.

10.All flexible cables shall be laid inside exposed / canceled conduits (rigid / flexible) or as per relevant design drawing and specifications.

11. If the cables are to be buried directly in the ground IS: 1255 is to be followed for code of practice.

12. After the cable trench has been properly excavated and straightened, it shall be covered with 100 mm thick layer of sand, the cable shall then be lifted and placed over the sand cushion.

13. It may be planned to lay down the cables in stacks under the trench and under such circumstances, cables shall be laid with the help of angular supports or cable trays suitable to take the load of the cable. In case the cable is laid with the help of angular supports inside the trench, such supports shall be provided at a regular intervals so that the cable does not sag due to its weight.

14.After laying the cable the complete trench shall be filled with sand / earth upto 200 mm depth from the ground level. A layer of silver sand along with a good quality caution tape with warning written in Hindi and regional language shall be laid throughout along the length of the trench at this level to indicate that electrical cables are running below and the area shall not be further

excavated without suitable precautions and permissions. The complete trench may then be backfilled with earth upto ground level.

14. Riggers shall ensure that while laying, the cable should not be subjected to any form of damage.Cables shall be laid by skilled and experienced workmen using adequate rollers to minimize stretching of the cable.

15. The cables shall not be laid in such a fashion that one cable crosses over the other.

16. Proper spacing shall be left between two cables as mentioned in the GFC or as specified or directed by engineer-in-charge.

17. Drain points shall be ensured inside these trenches so that in case of water logging, the water ejects out through these drain points as a result of natural gradient provided.

18. Man-holes shall be provided at strategic locations so as to ease the pulling of cables and maintenance. The manhole shall be covered with suitable covers of mentioned material and dimensions as per GFC.

19.When laid in cable trays above ground, power cables to be placed at the bottom most layer and control cables at the top most layer. In case of multi core power cables, cables shall be laid side by side with spacing not less than half the diameter of larger cable.

20. Multi-core cables shall be clamped by means of mild steel galvanized saddles. All cables below 1.1 KV single core cables if any should be clamped by means of non-magnetic saddles. The saddles / clamps shall not be placed at the intervals more than 1500 mm for horizontal and 1200 mm for vertical runs.

21.Multi core control cables can be laid touching each other in cable racks and wherever required may be taken in two layers. These cables should be clamped by means of PVC straps for horizontal and vertical runs. Fabricated aluminum clamps may be used at regular intervals.

22. All the cable shall be properly identified at regular intervals and care shall be exercised in laying cables to avoid forming kinks.

23. The relative position of the cables, laid on the cable tray shall be preserved and the cables shall not cross each other.

24. At all changes in direction in horizontal and vertical planes, the cable shall be bent smooth with a radius as recommended by the manufacturers.

25. All cables shall be laid with minimum half diameter gap and shall be clamped at every meter to the cable tray and shall be tagged for identification with Cable tag and clamped properly. Tags shall be provided at both ends and all changes in directions both sides of wall and floor crossings. All cable shall be identified by embossing on the tag the information as laid down under this specification.

26. If there is a need to joint the cable due to finishing of cable in cable drum

such joints shall be made through the approved straight through joints and jointing kits as directed by and approved by engineer-in-charge at site.

27. Cables shall be fully tested (both type and routine test) as per the specification laid under Indian standards. In particular following test shall be done at site.
(a) Insulation resistance test.
(b) Continuity test.

F. MEASUREMENTS

1. Measurement for cables shall be done in running meters and shall be measured from one point of termination of cable to the other.
2. Extra loop length of the cable within, if laid within the measuring points as described in point no. 1 shall only be considered if so directed by " Engineer in Charge" / Consultant / Client's representative.
3. Cable trays, trenches, pipes and conduits to be measured extra under relevantitem head unless specified with the cable and if so specified with the cable the length of these Cable trays,trenches, pipes and conduits shall be measured along the length of the cable.

4. End terminations along with lugs and glands shall be measured in numbers.One termination of cable including 1 gland and requisite no. of lugs shall be counted as 1

G.SUBMITTALS

The contractor shall submit following submittals as mentioned in "Procedures" and "Close out"
1. Product data (P.D)
2. Shop drawings (S.D)
3. Work methodology statement (W.M.S).
4. Material Inspection Request (M.I.R)
5. As built drawings. (A.B.D)
6. Operation & maintenance manuals. (O&M)

H. PROCEDURES

1. The contractor shall study all the drawings and tender document carefully and shall strictly adhere "General conditions of Contract" & "Special Conditions of contract ".

2. Any deviation in "Good for construction" drawings with respect to following shall be brought into the notification of consultant in prior before indenting material and execution of job at site :
(a) Deviations with respect to Bill of quantities.
(b) Deviations with respect to Tender drawings.
(c) Deviations with respect to tender specifications.

(d) Deviations with respect to site conditions.
Shop drawing reflecting the deviation has to be prepared by the contractor and the same shall be approved by "Engineer in Charge" / Consultant / Client's representative.

3. The contractor shall prepare a work methodology statement prior to commencement of Installation of cables at site with detailed description of how the job shall be carried out at site along with necessary testing and commissioning procedures in detailed manner. This methodology statement has to be duly approved by the concerning "Engineer in Charge" / Consultant / Client's representative and work has to be carried out with respect to this approved work methodology statement.

4 The contractor needs to ensure that a mock up for the job shall be shown to concerning "Engineer in Charge" /Consultant / Client's representative at site and the rest work shall further carry on after the approval of mock up at site by the said personnel.

5. The contractor shall organize a preparation meeting prior to the commencement of job at site describing the work methodology statement in meeting.

6. The contractor shall organize a preparation meeting prior to the commencement of job at site describing the work methodology statement in meeting and the concerning attendees of the meeting have to be informed 24 hrs prior to the commencement of meeting.

7. The contractor shall adhere best installation and safety practices.

8. Product data along with General arrangements and type test report shall be submitted to " The Consultant" before indenting the material along with the specification compliance sheet duly signed and stamped by the concerning Vendor. Once the consultant approves the product data then only the procurement shall be made.

9. The product once reached at site has to be inspected by concerning " Engineer in Charge" / Client's representative and the product needs to be accepted or rejected in the form of a written document called M.I.R (" Material Inspection Request "). In case the material is rejected the same has to be mentioned in the M.I.R form clearly stating the reason for rejection of material. If accepted the same also needs to be mentioned in M.I.R form.

10. The contractor shall co-ordinate well within as well as other agencies prior to the commencement of job so that any deviation / clashes can be resolved prior to the execution of work at site.

11. Testing and commissioning needs to be performed in the presence of Engineer in Charge" / Client's representative.

12. Pre- final Inspection needs to be carried out in the after full execution of concerning work at site with Engineer in Charge" / Client's representative. Any snags identified during inspection shall be attended and rectified by the

contractor.

13. The contractor shall follow a better work sequence and final inspection call has to be raised prior to hand over only. The contractor shall incorporate all the comments provided during pre-final inspection. The work shall be locked/sealed by "The client" after final inspection.

I.CLAUSES

1. The Contractor shall strictly adhere "General conditions of Contract " & "Special Conditions of contract ".

2. The contractor shall be paid in accordance with the measurement as described.

3. Extra loop length of the cable within, if laid within the measuring points as described in point no. 1 of measurement of this section, shall only be paid if so directed by " Engineer in Charge" / Consultant / Client's representative.

4.Cable trays, trenches, pipes and conduits to be paid extra under relevant item head unless specified with the cable and if so specified with the cable these Cable trays, trenches, pipes and conduits shall be paid according to the measurement as described in measurement heading under this section.

5. In case Engineer in Charge" / Client's representative/ consultant requires any test to be conducted at site , in spite of the fact that a type test report or a routine test report from OEM is already available for such test and if such test is mentioned under the specifications of any standard as mentioned under the tender document and if so feasible at site, the contractor shall be liable to conduct such test as required at no additional time and cost.

6. The contractor shall be liable to furnish the recommendations / clarifications / justification / acceptance from respective OEM as and when required by Engineer in Charge" / Client's representative/ consultant.

7. The contractor shall submit the calibration test report for all the testing equipment being used at site as well has used during factory testing as such test reports shall be acceptable only if furnished by NABL accredited laboratory or if required from the laboratory as specified by Engineer in Charge" / Client's representative/ consultant.

8. The cost of straight through joints and cable jointing kit used for jointing of cables shall not be paid extra.

J.CLOSE OUT DOCUMENTATION

1. Once the Final inspection is done, the contractor shall submit the following as

close out submittals :
(a) 6 Nos. fully laminated, legible hard copies of "As built drawings"
(b) Soft Copy of "As built drawings" in AUTOCAD 2000 version in a pen-drive.
(c) 4 Nos. fully compiled in box file, legible hard copies of " Operation and maintenance manuals ".
(d) Soft Copy of "Operation and maintenance manuals" in pdf format in a pen-drive.
(e) 4 Nos. fully compiled in box file Training document literature and presentation.
(f) Soft copy of Training document literature and presentation.

2. A draft of operational and maintenance manual has to be submitted by the contractor to concerning " Engineer in Charge" / Consultant / Client's representative defining detailed O&M procedures along with product data, List of spare accessories etc. Upon the receipt of their approval. A final copy of O&M then needs to be prepared and submitted by the contractor in required format.

3. The contractor shall impart training to the concerning personnel those will be taking care of operation and maintenance of the facility. The training shall comprise of both classroom and field training.

4.A draft of training document literature and presentation has to be submitted by the contractor to concerning " Engineer in Charge" / Consultant / Client's representative.Upon the receipt of their approval on the same the training shall be then conducted and a final copy of training document literature and presentationneeds to be prepared and submitted by the contractor in required format.

CHAPTER -4
CABLE TRAYS

A. SCOPE

The scope of this section comprises the supply, delivery, erection, testing and commissioning of following:

1. Cable trays (both ladder type and perforated type) along with its accessories used for all internal areas.
2. All tools and accessories required to complete the job in full respect and as per engineer in charge.

B. CODES AND STANDARDS

The relevant sections of Indian Standard Specifications as more particularly stated herein and broadly to all the codes, status and regulations as applicable shall be strictly enforced and adhered to. More particularly following codes should be strictly followed.

1. National Electrical Code - 2008
2. National Building Code - 2005
3. NEMA VE-2 -2013
4. IS 1079,2029,2639 - Cable trays and their accessories

C. DEFINATIONS

Accessory: Components used to supplement the function of a straight section or fitting. Examples include, but are not limited to, dropout, cover, conduit adapter, hold-down device, and divider cable tray support.

Span: The distance between the centerlines of supports.

Cable tray system: A section or assembly of sections, and associated fittings, forming a mechanical system used to support cables.

Channel cable tray: A fabricated structure consisting of a one-piece ventilated- or solid-bottom channel section.

Connector: A component that joins any combination of cable tray straight sections and fittings.

D. SPECIFICATION OF ITEMS

MR 19.075 : Supplying and installing following size of perforated hot dip galvanized G.I cable tray, with galvanizing thickness of 65 micron with perforations not more than 17.5%, in convenient sections, joined with connectors, suspended from ceiling with G.I suspenders including bolts and nuts, etc. as required.
(a)100 mm width x 50 mm depth x 1.6 mm thickness

MR 19.076 : (c)300 mm width x 50 mm depth x 1.6 mm thickness

MR 19.077 : (d)600 mm width x 50 mm depth x 2 mm thickness

MR 19.078 : (e)900 mm width x 50 mm depth x 2 mm thickness

1. Perforated Cable tray :

Cable tray system shall comprise of hot dip galvanized G.I cable trays, with galvanizing thickness of 65 micron and standard length of 2.5 meters made out of 2 mm thick perforated sheet metal for cable trays which are 600mm wide and above and 1.6mm thick for cable trays whose width is below 600mm. The construction of the cable trays shall be as per the approved GA drawing from Vendor. The construction of cable tray shall follow NEMA standards. The cable trays shall be hot dip galvanized with perforations not more than 17.5% and factory fabricated out of G.I., angle iron, tee, bends, sections, flats and perforated sheet for different loads. All accessories shall follow NEMA VE-2 standards

CHAPTER - 5
EARTHING & LIGHTNING PROTECTION

A. SCOPE

The scope of this section comprises the supply, delivery, erection, testing and commissioning of following :

1. Lightning protection of building, earthing pits, earthing conductor and any other accessory required for proper grounding of all exposed and metallic conductors and lightning protection system.

2.Essential requirements of earthing system components and their installation. This shall be read with relevant standards, which lays down criteria for their design. For details not covered in these specifications IS code of Practice on Earthing(IS 3043 : 1987) shall be referred to.

B. CODES AND STANDARDS

The relevant sections of Indian Standard Specifications as more particularly stated herein and broadly to all the codes, status and regulations as applicable shall be strictly enforced and adhered to. More particularly following codes should be strictly followed.

1. National Electrical Code - 2008
2. National Building Code - 2005
3. IS 3043:1987 - Code of Practice for Earthing
4. IE rules - Indian electricity rules
5. IEEE :80 :2000

C. DEFINATIONS

Definitions as per IS:3043 shall be followed for earthing.

D. SPECIFICATION OF ITEMS

MR 19.079 : Supply,installation, connections,testing & commissioning of 17.2 mm dia. rod of 3 meter length having copper bonding of 250 micron, along with 5 kg of maintenance free ground enhancing compound & shall comply as per IEEE 80:2000 Clause 14.5d with fused rod to tape clamp for interconnection of strip from earth pit to equipment.

1. Earth Pit :

Earthing electrode shall consist of 17.2 mm dia. rod of 3 meter length having copper bonding of 250 micron. Theelectrode shall buried vertically in

the ground as far as practicable belowpermanent moisture level with its top not less than 200 mm belowground level. The electrode shall be in one piece and no joints shall beallowed in the electrode. Earth electrode shall not be located in proximity to a metal fence.It shall be kept clear of the building foundations and in no case shall benearer than 2 meters from the outer face of the wall. The pipe earthelectrode shall be kept vertically and surrounded with maintenance free ground enhancing compound & shall comply as per IEEE 80:2000 Clause 14.5d with fused rod to tape clamp for interconnection of strip from earth pit to equipment. The earthing shall be completely maintenance free with no need of pouring water into it. Each earth pit shall be covered with a 300 mm x 300 mm CI inspection chamber.

DSR Item No. 5.7 : Supplying and laying 6 SWG GI wire at 0.50 meter below ground level for conductor earth electrode including connections / termination with GI thimble etc. as required.

1. Earth Conductor:

Protective earthing conductor may be site fabricated or factory fabricated made up of GIof required dimensions as mentioned in the tender document. The earth conductor shall be rust free and shall be painted with silver paint to prevent rusting in due course of time. Bare copper conductors shall not be used as a protective conductor wherever required, a copper cable with insulation shall be used and as specified. The protective earth conductor shall be neatly fabricated with smooth surface.

DSR Item No. 5.9 : Supplying and laying 25mm x 5mm GI strip at 0.50 meter below ground as strip earth electrode including connections / terminating with GI nut, bolts, spring, washer etc.as required (Jointing shall be done by overlapping and with 2 set of G.I nut bolt and spring washer spaced at 50mm).

1. Earth Conductor:

Protective earthing conductor may be site fabricated or factory fabricated made up of GIof required dimensions as mentioned in the tender document. The earth conductor shall be rust free and shall be painted with silver paint to prevent rusting in due course of time. Bare copper conductors shall not be used as a protective conductor wherever required, a copper cable with insulation shall be used and as specified. The protective earth conductor shall be neatly fabricated with smooth surface.

MR 19.080 : Supplying and laying 32mm x 6 mm GI strip at 0.50 metre below ground as strip earth electrode including connections / terminating with GI nut, bolts, spring, washer etc.as required (Jointing shall be done by overlapping and with 2 set of G.I nut bolt and spring washer spaced at 50mm).

1. Earth Conductor:

Protective earthing conductor may be site fabricated or factory fabricated made up of GIof required dimensions as mentioned in the tender

document. The earth conductor shall be rust free and shall be painted with silver paint to prevent rusting in due course of time. Bare copper conductors shall not be used as a protective conductor wherever required, a copper cable with insulation shall be used and as specified. The protective earth conductor shall be neatly fabricated with smooth surface.

DSR Item No. 6.1 : Providing and fixing of lightning conductor finial , made of 25mm dia 300mm long Copper tube, having single prong at top, with 85mm dia 3mm thick Copper base plate including holes etc. complete as required.

1. Conventional lighting protection rod:

Air terminal shall be made up of Copper tube thoroughly protected against corrosion by a zinc coating. The size of the air terminal shall be 20 mm x 3mm. Air termination networks may consist of vertical or horizontal conductors, or combinations of both. For the purpose of lightning protection, the vertical andhorizontal conductors are considered equivalent and the use of pointed airterminations, or vertical finial is, therefore, not regarded as essential. A vertical air termination, where provided, need not have more than one point, and shall project at least 30 cm, above the object, salient point or network on which it is fixed. For a flat roof, horizontal air termination along the outer perimeter of the roof shallbe used. For a roof of larger area a network of parallel horizontal conductors shall be installed. No part of the roof should be more than 9 m from the nearest horizontalprotective conductor horizontal air terminations should be carried along the contours such as ridges,parapets and edges of flat roofs, and, where necessary, over flat surfaces, in sucha way as to join each air termination to the rest, and should themselves form aclosed network.All metallic projections including reinforcement, on or above the main surface ofthe roof which are connected to the general mass of the earth, should be bonded and form a part of the air termination network. If portions of a structure vary considerably in height, any necessary air terminationsor air termination network for the lower portions should be bonded to the downconductors of the taller portions, in addition to their own down conductors.

DSR Item No. 6.5 : Providing and fixing Copper tape 20mm x 3mm thick on parapet or surface of wall for lightning conductor complete as required.(for horizontal run)

DSR Item No. 6.6 : Providing and fixing Copper tape 20mm x 3mm thick on parapet or surface of wall for lightning conductor complete as required.(for vertical run)

DSR Item No. 6.11 : Providing and fixing testing joint , made of 20mm x 3mm thick copper strip, 125 mm long, with 4 Nos. of tinned brass bolts, nuts, checknuts and spring washers etc. complete as required.

1. Earth Conductor:

Protective earthing conductor may be site fabricated or factory fabricated made up of Copper of required dimensions as mentioned in the tender document. The earth conductor shall be rust free and shall be painted with silver paint to prevent rusting in due course of time. Bare copper conductors shall not be used as a protective conductor wherever required, a copper cable with insulation shall be used and as specified. The protective earth conductor shall be neatly fabricated with smooth surface.

E. INSTALLATIONS, TESTING & COMMISSIONING

1. Earth resistance value and nature of soil shall be suitably studied by the contractor and complete installation shall be in accordance with IS :3043 & IEEE:80:2000 whichever more stringent.

2. Land shall be suitably excavated for earthing and pipe electrode shall be suitably laid as per the specification described.

3. Clearances required among various earthing system components shall be in accordance with IS :3043 & IEEE:80:2000 whichever more stringent.

4. In the case of pipe earth electrode, wire type earthing conductor shall be securedusing a through bolt, nuts and washers and terminatingsocket.

5. A double C-clamp arrangement shall be provided for terminating tape type earthingconductor. Galvanized "C" shaped strips, bolts, washers, nuts and check nuts of adequate size shall be used for the purpose.

6. The earthing conductor from the electrode up to the building shall be protected from mechanical injury by a medium class, 15 mm dia. GI pipe in the case of wire,and by 40 mm dia, medium class GI pipe in the case of strip. The protection pipein ground shall be buried at least 30 cm deep (to be increased to 60 cm in case of road crossing and pavements). The portion within the building shall be recessed inwalls and floors to adequate depth in due co-ordination with the building work.

9.Theearthing conductor shall be securely connected at the other end to the earthstud/earth bar provided on the switch board by:
(a)Soldered or preferably crimped lug, bolt, nut and washer in the case of wire, and
(b) Bolt, nut and washer in case of strip conductor.

10. Enclosures and frame work of all current carrying equipment and accessories,
structural steel/columns shall be adequately earthed to a single Earthing system, unless separate Earthing systems are specifically stipulated.

11. If the earth resistance is too high and the multiple electrode Earthing does not give adequate low resistance to earth, then the soil resistivity immediately surrounding the earth electrodes shall be reduced by adding IEEE approved backfill compound.

10. Earth pits along with earth strips shall be fully tested as per the specification laid under IS :3043 & IEEE:80:2000 whichever more stringent.. In particular following test shall be done at site.
(a) Earth continuity test
(b) Measurement of earth resistance (both earth grid and individual)

F. MEASUREMENTS

1. Measurement for earth pits shall be made in number.
2. Measurement for earth conductor shall be made in meters and shall be measured between the equipment or component to earth pit .
3. Extra earthing conductor, if laid within the measuring points as described in point no. 2 shall only be considered if so directed by " Engineer in Charge" / Consultant / Client's representative.
4. Soil treatment compound, earth pit covers and other accessories excluding earth conductor shall not be measured extra as these are considered to be an integrated part of earth pit and shall not be measured separately.

G.SUBMITTALS

The contractor shall submit following submittals as mentioned in "Procedures" and "Close out"
1. Product data (P.D)
2. Shop drawings (S.D)
3. Work methodology statement (W.M.S).
4. Material Inspection Request (M.I.R)
5. As built drawings. (A.B.D)
6. Operation & maintenance manuals. (O&M)

H. PROCEDURES

1. The contractor shall study all the drawings and tender document carefully and shall strictly adhere "General conditions of Contract" & "Special Conditions of contract ".

2. Any deviation in "Good for construction" drawings with respect to following shall be brought into the notification of consultant in prior before indenting material and execution of job at site :
(a) Deviations with respect to Bill of quantities.
(b) Deviations with respect to Tender drawings.
(c) Deviations with respect to tender specifications.
(d) Deviations with respect to site conditions.
Shop drawing reflecting the deviation has to be prepared by the contractor and the same shall be approved by "Engineer in Charge" / Consultant / Client's representative.

3. The contractor shall prepare a work methodology statement prior to commencement of Installation of earth pits at site with detailed description of

how the job shall be carried out at site along with necessary testing and commissioning procedures in detailed manner. This methodology statement has to be duly approved by the concerning "Engineer in Charge" / Consultant / Client's representative and work has to be carried out with respect to this approved work methodology statement.

4 The contractor needs to ensure that a mock up for the job shall be shown to concerning "Engineer in Charge" / Consultant / Client's representative at site and the rest work shall further carry on after the approval of mock up at site by the said personnel.

5. The contractor shall organize a preparation meeting prior to the commencement of job at site describing the work methodology statement in meeting.

6. The contractor shall organize a preparation meeting prior to the commencement of job at site describing the work methodology statement in meeting and the concerning attendees of the meeting have to be informed 24 hrs prior to the commencement of meeting.

7. The contractor shall adhere best installation and safety practices.

8. Product data along with General arrangements and type test report shall be submitted to " The Consultant" before indenting the material along with the specification compliance sheet duly signed and stamped by the concerning Vendor. Once the consultant approves the product data then only the procurement shall be made.

9. The product once reached at site has to be inspected by concerning " Engineer in Charge" / Client's representative and the product needs to be accepted or rejected in the form of a written document called M.I.R (" Material Inspection Request "). In case the material is rejected the same has to be mentioned in the M.I.R form clearly stating the reason for rejection of material. If accepted the same also needs to be mentioned in M.I.R form.

10. The contractor shall co-ordinate well within as well as other agencies prior to the commencement of job so that any deviation / clashes can be resolved prior to the execution of work at site.

11. Testing and commissioning needs to be performed in the presence of Engineer in Charge" / Client's representative.

12. Pre- final Inspection needs to be carried out in the after full execution of concerning work at site with Engineer in Charge" / Client's representative. Any snags identified during inspection shall be attended and rectified by the contractor.

13. The contractor shall follow a better work sequence and final inspection call has to be raised prior to hand over only. The contractor shall incorporate all the comments provided during pre-final inspection. The work shall be locked/sealed by "The client" after final inspection.

I.CLAUSES

1. The Contractor shall strictly adhere "General conditions of Contract" & "Special Conditions of contract ".

2. The contractor shall be paid in accordance with the measurement as described.

3. Extra earthing conductor, if laid within the measuring points as described in point no. 2 shall only be paid if so directed by " Engineer in Charge" / Consultant / Client's representative.

4. Soil treatment compound, earth pit covers and other accessories excluding earth conductor shall not be paid extra as these are considered to be an integrated part of earth pit and shall not be measured separately.

5. In case Engineer in Charge" / Client's representative/ consultant requires any test to be conducted at site, in spite of the fact that a type test report or a routine test report from OEM is already available for such test and if such test is mentioned under the specifications of any standard as mentioned under the tender document and if so feasible at site, the contractor shall be liable to conduct such test as required at no additional time and cost.

6. The contractor shall be liable to furnish the recommendations / clarifications / justification / acceptance from respective OEM as and when required by Engineer in Charge" / Client's representative/ consultant.

7. The contractor shall submit the calibration test report for all the testing equipment being used at site as well has used during factory testing as such test reports shall be acceptable only if furnished by NABL accredited laboratory or if required from the laboratory as specified by Engineer in Charge" / Client's representative/ consultant.

J.CLOSE OUT DOCUMENTATION

1. Once the Final inspection is done, the contractor shall submit the following as close out submittals :
(a) 6 Nos. fully laminated, legible hard copies of "As built drawings"
(b) Soft Copy of "As built drawings" in AUTOCAD 2000 version in a pen-drive.
(c) 4 Nos. fully compiled in box file, legible hard copies of " Operation and maintenance manuals ".
(d) Soft Copy of "Operation and maintenance manuals" in pdf format in a pen-drive.
(e) 4 Nos. fully compiled in box file Training document literature and presentation.
(f) Soft copy of Training document literature and presentation.

2. A draft of operational and maintenance manual has to be submitted by the contractor to concerning " Engineer in Charge" / Consultant / Client's representative defining detailed O&M procedures along with product data, List of spare accessories etc. Upon the receipt of their approval. A final copy of O&M

then needs to be prepared and submitted by the contractor in required format.

3. The contractor shall impart training to the concerning personnel those will be taking care of operation and maintenance of the facility. The training shall comprise of both classroom and field training.

4. A draft of training document literature and presentation has to be submitted by the contractor to concerning "Engineer in Charge" / Consultant / Client's representative.Upon the receipt of their approval on the same the training shall be then conducted and a final copy of training document literature and presentationneeds to be prepared and submitted by the contractor in required format.

CHAPTER - 6
UPS

A. SCOPE

The scope of this section comprises the supply, delivery, erection, testing and commissioning of following un-interrupted power supply (UPS) system:

1. Single Phase input, Single phase output UPS.
2. All internal components of the assembly along with tools and accessories required to complete the job in full respect and as per engineer in charge.

B. CODES AND STANDARDS

The relevant sections of Indian Standard Specifications as more particularly stated herein and broadly to all the codes, status and regulations as applicable shall be strictly enforced and adhered to. More particularly following codes should be strictly followed.

1. National Electrical Code - 2008
2. National Building Code - 2005
3. IS 1652 (1991) - Stationary cells andbatteries, lead-acid type with plantpositive plates
4. IS 8320 (2000)- General Requirements and Methods of tests for Lead-acid Storage Batteries
5. IEC 62040 (2008)- Uninterruptible power systems (UPS)- Part 1: General and safety requirementsfor UPS
6. IEC 62040 (2005)- Uninterruptible power systems (UPS)– Part 2: Electro - magnetic compatibility(EMC) requirements.
7. IEC 62040 (2011) - Uninterruptible power systems (UPS)- Part 3: Method of specifying theperformance and test requirements
8. IEC 61000 (2002) - Electromagnetic compatibility (EMC)- Part 2-2: Environment – Compatibilitylevels for low-frequency conducteddisturbances and signaling in public lowvoltagepower supply systems
9. IEC 61000 (2006) Electromagnetic compatibility (EMC)- Part 4: Testing and measurementtechniques.

C. DEFINATIONS

As per OEM's recommendations and IS 1885

D. SPECIFICATION OF ITEMS

MR 19.081: Design, supply, Installation testing and commissioning of following size and configuration IGBT based UPS system as per the said specifications with inbuilt isolation transformer as per kVA rating with a battery backup of 30 minutes. (12 volt battery comprising of 2 V cells)
(a) 5kVA single phase input single phase output

The UPS system shall conform to IEC 62040 and shall consist of UPS module, battery system, battery protective device, static bypass transfer switch, controls and monitoring. Input ac power shall be connected to the normal source ac input of the UPS module.

Power source shall be connected to bypass/maintenance bypass. The battery shall be connected to the dc input of the UPS module through the battery protective device. The ac output of the UPS system shall be connected to the critical loads.

Power semiconductors shall be fused with fast-acting fuses to prevent cascaded or sequential semiconductor failures. Indicator lamp or display panel denoting blown fuse conditions shall be readily observable by the operator without removing panels or opening cabinet doors.

Provide dual control power supplies. The control power circuit shall have suitable protection, appropriately marked and located in the immediate vicinity of the input protective device.

The components and the system shall be designed to minimize the emission of electromagnetic waves that may cause interference with other equipment. Wiring practices, materials, and coding shall be in accordance with the requirements of applicable standards. Wire runs shall be protected in a manner which separates power and control wiring. Control wiring shall be minimum No. 16 AWG extra-flexible stranded copper. Logic-circuit wiring may be smaller. Ribbon cables shall be minimum No. 22 AWG. Control wiring shall have permanently attached wire numbers.

The printed circuit board (PCB) subassemblies shall be mounted in pull-out and/or swing-out trays where feasible. Cable connections to the trays shall be sufficiently long to allow easy access to all components. Where not feasible to mount PCB subassemblies in pull-out or swing-out trays, they shall be firmly mounted inside the enclosure. Every PCB subassembly shall be monitored. Self-test and diagnostic circuitry shall be included in the logic circuits such that a fault can be isolated down to the PCB subassembly level.
UPS system shall be installed in cabinets of heavy-duty structure for floor mounting. UPS module cabinet shall be structurally adequate for forklift handling or lifting. Removable lifting eyes shall be provided on top of each cabinet. UPS module cabinet shall have hinged and lockable doors on the front only, with assemblies and components accessible from the front. Doors shall be key lockable. Operating controls shall be located outside the locked doors. Input, output, and battery cables shall be installed through the top or bottom of the cabinet.

Equipment cabinet shall be cleaned, primed and painted in the manufacturer's standard colors, in accordance with accepted industry standards. Cabinets shall be labeled for arc flash hazard with warning sign reading: "Warning-Potential Arc Flash Hazard. Appropriate PPE and Tools required when working on this equipment" or similar wording.

Live parts (300 volts and above) that are exposed when front access doors are open shall be adequately protected or covered to minimize the chance of accidental contact.

UPS shall be equipped with instruction plates including warnings and cautions, suitably located, and describing any special or important procedures to be followed in operating and servicing the equipment. The control panel display shall also provide warning messages prior to performing a critical function.

The UPS system shall be compatible with the load characteristics defined in the load profile below and load configuration. Compensation for UPS/load interaction problems resulting from nonlinear loads or transformer and motor inrush shall be provided.

Type of load: emergency lighting / power plugs / non linear loads
Size of load: as defined in relevant drawing
Switching pattern: cycled daily.
Steady-state characteristics: 0.8 lagging power factor.
Special factors: harmonic characteristics - Total Harmonic Distortion 30 percent.
IP Class :IP-20

Following shall be the ratings :

Single Phase input / Single Phase output UPS

1. Input
    - Input Voltage range: 140-300 Vac (load dependent).
    - Nominal Voltage:220 VAC 1 Phase.
    - Frequency Range: 40-65Hz.
    - Frequency : 50-60 Hz
    - Wiring. 1 Phase+ N + PE
    - THD i <5%
    - Power factor =0.9.

2. Output
    - Nominal Voltage:220 VAC 1 Phase.
    - Output receptacle: 6A Indian.
    - On battery voltage regulation : +12% / -18%
    - Overload capability 125%, 1 min.

3. Battery
    - Battery type : 2 x 12V
    - UPS shall be started without being connected to Ac power.

- Battery charger shall have a max charging current of 10A.
- Recharge time shall be 5 hours to recover 90% capacity.

4. Communication
    - Both audible and visual alarms in case of overload, fault, battery discharge and any other abnormal functionality.
    - Shall be equipped with RS-485 port as well as USB port.
    - Shall have data logging facility.
    - Shall be communicable with network racks.

5. Operation environment
    - Temperature 0°C to 40°C
    - noise less than 50dbA at a distance of 4 meters.
    - Humidity 0% to 90%.
    - Storage temperature: 15°C to 50°C.

Each UPS shall have the following transient response :

1. For voltage transients :
At 100% load step +/- 5%
At loss and return of a.c. input +/- 1%
Auto or manual transfer of load from UPS to by-pass +/- 4%
Recovery to 99% steady state condition within 20 ms after any of the above transient.

2. For frequency transients: +/- 0.1 Hz , slew rate shall be 2 Hz max per second (selection in 0.5 Hz / sec increments)

Following shall be the requirement for each UPS module:
1. UPS module shall consist of a rectifier/charger unit and a 3-phase inverter unit with their associated transformers, synchronizing equipment if applicable, protective devices, surge suppression, and accessories as required for operation.

2. The subassemblies in one UPS module shall be interchangeable with the corresponding modules within the same UPS, and from one UPS system to another of identical systems.

3. Rectifier/charger unit shall be solid state and shall provide regulated direct current to the dc bus, supplying power to the inverter and charging the battery plant.

4.Rectifier/charger unit shall be provided with an input protective device. The protective device shall be sized to accept simultaneously the full-rated load and the battery recharge current. The protective device shall be capable of shunt tripping and shall have rated amperes symmetrical interrupting rating as specified. The protective device shall have provision for locking in the "off" position.

5.A surge suppression device shall be installed at the UPS input to protect against lightning and switching surges. Internal components shall be protected from surges that enter at each ac input connection including main input, static bypass transfer switch.

6.Rectifier/charger unit shall be protected by a power walk-in feature such that when ac power is returned to the ac input bus, the total initial power requirement will not exceed 20 percent of the rated full load current. This demand shall increase gradually to 100 percent of the rated full load current plus the battery charging current over the specified time interval.

7. Rectifier/charger unit shall be sized for the following two simultaneous operating conditions:
a. Supplying the full rated load current to the inverter.
b. Recharging a fully-discharged battery to 95 percent of rated ampere-hour capacity within ten times the discharge time after normal ac power is restored.

8. Primary current limiting: Battery-charging current shall be voltage regulated and current limited. The battery-charging current limit shall be separately adjustable from 2 percent to 25 percent of the maximum discharge current. After the battery is recharged, the rectifier/charger unit shall maintain the battery at full float charge until the next operation under input power failure. Battery charger shall be capable of providing equalizing charge to the battery.

Rectifier/charger unit shall minimize ripple current and voltage supplied to the battery; the ripple current into the battery shall not exceed 3 percent RMS of the inverter input rated current; the ripple voltage into the battery shall not exceed 2 percent RMS of the float voltage.

9.Rectifier/charger unit shall have manual means for adjusting dc voltage for battery equalization, to provide voltage within plus 10 percent of nominal float voltage.

10. Module shall have a dc protective device to isolate the module from the battery system. The protective device size and interrupting rating shall be as required by system capacity and shall incorporate a shunt trip as required by circuit design. The protective device shall have provision for locking in the "off" position.

11. Inverter unit shall be a solid-state device deriving its power from the dc bus (rectifier or battery source) and providing ac power within specified limits to the

critical load. Inverter shall utilize microprocessor controlled solid state Pulse Width Modulation (PWM) controlled IGBT power transistor technology to shape the ac output.

12.The inverter shall be able to sustain an overload as specified across its output terminals. The inverter shall not shut off, but shall continue to operate within rated parameters, with inverse-time overload shutdown protection. If the overload condition persists beyond the rated parameters of the inverter, the inverter shall current limit, load shall be transferred to the bypass source, and the inverter shall disconnect automatically from the critical load bus.

If the bypass source is not available and the overload/fault condition continues, the inverter shall current limit for a limited time as determined by the manufacturer and shall shut down to protect the internal components.

13. The inverter shall normally operate in phase-lock and synchronism with the bypass source. When the bypass source frequency deviates by more than ±0.1 Hz, the internal frequency oscillator shall automatically take control and become the new frequency reference. Upon restoration of the bypass source within the required tolerance, the inverter shall synchronize back with that source at a slew rate not exceeding the specified rate. The oscillator shall be temperature compensated and shall be manually adjustable.

14. The output protective device shall be capable of shunt tripping or opening on an applied control signal and shall have the proper frame size and trip rating to supply overload current as specified. External output protective device shall have provision for locking in the "off" position.The inverter output protective device shall work in conjunction with the bypass protective device for both manual and automatic load transfers to and from bypass power.

15. UPS module shall have built-in self-protection against undervoltage, overvoltage, overcurrent and surges introduced on the ac input source and/or the bypass source. The UPS shall also have built-in self-protection against overvoltage and voltage surges introduced at the output terminals by paralleled sources, load switching, or circuit breaker operation in the critical load distribution system.

16. UPS module shall be self-protected against overcurrent, sudden changes in output load and short circuits at the output terminals. UPS module shall be provided with output reverse power detection which shall cause the module to be disconnected from the critical load bus when output reverse power is present. UPS module shall have built-in protection against permanent damage to itself and the connected load for predictable types of failure within itself and the connected load. At the end of battery discharge limit, the module shall shut down without damage to internal components.

17. A static bypass transfer circuit shall be provided as an integral part of the UPS and shall consist of a static switch, made up of two reverse-paralleled SCRs (silicon-controlled rectifiers) per phase conductor, and a bypass protective device or bypass switch, made up of a contactor or motor operated circuit breaker. The bypass protective device shall be in parallel with the static switch.

The inverter output protective device shall disconnect and isolate the inverter from the bypass transfer circuit.

18. The control logic shall contain an automatic transfer circuit that senses the status of the inverter logic signals and alarm conditions and provides an uninterrupted transfer of the load to the bypass ac power source, without exceeding the transient limits specified herein, when a malfunction occurs in the UPS or when an external overload condition occurs. The power section of the static bypass transfer circuit shall be provided as a plug-in type assembly to facilitate maintenance. The static bypass transfer circuit shall be used to connect the input bypass ac power source to the critical load when required, and shall have the following features:

(a)Uninterrupted Transfer

The static bypass transfer switch shall automatically cause the bypass ac power source to assume the critical load without interruption when the bypass control logic senses one of the following conditions and the UPS inverter output is synchronized to the bypass ac power source:
a. Inverter overload exceeds unit's rating.
b. Battery protection period is expired and bypass is available.
c. System failure.
d. Inverter output undervoltage or overvoltage.

(b) Interrupted Transfer

If an overload occurs and the UPS inverter output is not synchronized to the bypass ac power source, the UPS inverter output shall current-limit for 200 milliseconds minimum. The inverter shall then turn off and an interrupted transfer to the bypass ac power source shall be made. If the bypass ac power source is beyond the conditions stated below, an interrupted transfer shall be made upon detection of a fault condition:
a. Bypass voltage greater than plus or minus 10 percent from the UPS rated output voltage.
b. Bypass frequency greater than plus or minus 0.5 Hz from the UPS rated output frequency.
c. Phase differential of ac bypass voltage to UPS output voltage greater than plus or minus 3 degrees.

(c) Manual Transfer

It shall be possible to make a manually-initiated static transfer from the system status and control panel. The transfer shall be make-before-break utilizing the bypass switch.

(d) Automatic Uninterrupted Forward Transfer

The static bypass transfer switch shall automatically forward transfer, without interruption after the UPS inverter is turned "on", or after an instantaneous overload-induced reverse transfer has occurred and the load current has returned to less than the unit's 100 percent rating.

(e) Forced Transfer

The control logic circuitry shall provide the means of making a forced or reverse transfer of the static bypass transfer circuit on an interrupted basis. Minimum interruption shall be 200 milliseconds when the UPS inverter is not synchronized to the bypass ac power source.

(f) Overload Ratings

The static bypass transfer switch shall withstand the following overload conditions:
a. 1000 percent of UPS output rating for one cycle.
b. 150 percent of UPS output rating for one minute.
c. 125 percent of UPS output rating for 10 minutes.

(g) Static Switch Disconnect

A static switch disconnect shall be incorporated to isolate the static bypass transfer switch assembly so it can be removed for servicing. The switch shall be equipped with auxiliary contacts.

MAINTENANCE BYPASS SWITCH

A maintenance bypass switch shall be provided as an integral part of the UPS and located within the UPS module or in a matching cabinet adjacent to the UPS cabinet. The maintenance bypass switch shall provide the capability to continuously support the critical load from the bypass AC power source while the UPS is isolated for maintenance. The maintenance bypass switch shall be housed in an isolated compartment inside the UPS cabinet in such a way that service personnel will not be exposed to electrically live parts while maintaining the equipment. Switch shall contain a maintenance bypass protective device and a module isolation protective device.

1. Load Transfer

The maintenance bypass switch shall provide the capability of transferring the critical load from the UPS static bypass transfer switch to maintenance bypass and then back to the UPS static bypass transfer switch with no interruption to the critical load.

2. Load Bank Protection Device

A load bank protective device shall be provided to allow the UPS system to be tested using a portable load bank. The load bank protective device shall be connected on the line side of the maintenance bypass switch isolation protective device.

MODULE CONTROL PANEL
The UPS module shall be provided with a control/indicator display panel. The display panel shall be on the front of the UPS module. Controls, meters, alarms

and indicators for operation of the UPS module shall be on this panel. The display panel shall be menu driven for browsing all the screens.
2.6.1 Module Meters
2.6.1.1 Monitored Functions
The following functions shall be monitored and displayed:

c. Input frequency.
d. Battery voltage.
e. Battery current (charge/discharge).
h. Output frequency.
i. Output kilowatts.
j. Bypass voltage, phase-to-phase and phase-to-neutral (all three phases).
k. Output kilovars.
l. Battery temperature.
m. Output Percentage load.
n. Remaining battery time.

Meter Construction
The display panel shall display alphanumeric parameters based on true RMS metering with 1 percent accuracy (minimum 4 significant digits).

Module Controls
Module shall have the following controls:

a. UPS/bypass transfer selector switch.
b. Static bypass transfer switch enable/disable selector switch.

Module Alarm Indicators
Module shall have indicators for the following alarm items. Any one of these conditions shall turn on an audible alarm and the appropriate summary indicator. Each new alarm shall register without affecting any previous alarm.
a. Input ac power source failure.
b. Input protective device open.
c. Input power out of tolerance.
d. Overload.
e. Overload shutdown.
f. DC overvoltage/shutdown.
g. DC ground fault.
h. Low battery.
i. Battery discharged.
j. Battery protective device open.
k. Blower fan failure.
l. Low battery shutdown.
m. UPS on battery.
n. Equipment overtemperature.
p. Fuse blown (with indication where).
o. Control power failure.
r. Charger off/problem.
s. Inverter fault/off.
t. Emergency power off.
u. External shutdown (remote EPO activated).
v. Critical load on static bypass.

w. Static bypass transfer switch disabled/failure.
x. Inverter output overvoltage.
y. Inverter output undervoltage.
z. Inverter output overfrequency.
aa. Inverter output underfrequency.
bb. Bypass source voltage outside limits.
cc. Bypass frequency out of range.
dd. Bypass source to inverter out of synchronization.
ee. Overtemperature shutdown.
ff. Hardware shutdown.

Pressing the emergency off button shall cause the module to be disconnected from the system, via its input protective device, output protective device, and battery protective device. The button shall include a protective cover to prevent unintentional activation.

An RS 485 communications and data acquisition port shall be provided. This port shall allow the system parameters, status, alarm indication and control panel functions specified to be remotely monitored and controlled.

Additionally, a second communication port shall be provided for use with the following:
a. A set of remote alarm contacts rated at 240V, 0.5A, shall be provided for remote alarm monitoring.
b. Auto-dial modem communication shall be provided to communicate with a remote modem in case an alarm function is active.
c. A SNMP (Simple Network Management Protocol) adapter shall be provided to communicate UPS monitoring via a network or direct connection to a PC.
d. A standard Web Browser adapter shall be provided to remotely view and monitor UPS functions over the Internet.
All the communication ports and contacts shall be capable of simultaneous communication.

TEMPERATURE CONTROL
Cabinet and enclosure ventilation shall be adequate to ensure that components are operated within their ratings. Forced-air cooled rectifier, inverter, and control unit will be acceptable. The cooling fans shall continue operation if UPS input power is lost. Redundancy shall be provided so that failure of one fan or associated circuit breaker will not cause an overheat condition. Cooling air shall enter the lower front of the cabinets and exhaust at the top. Blower power failure shall be indicated as a visual and audible alarm on the control panel. Air inlets shall have replaceable filters that may be located on the inside of the cabinet doors and shall be easily accessible for replacement.

a) Blower Power Source
Blower power source shall be internally derived from the output side of UPS module, with automatic transfer arrangement.

b) Temperature Sensors
Temperature sensors shall be provided to monitor the air temperature. Separate sensors shall monitor the temperature of rectifier and inverter heat sinks. Separate sensors shall also monitor the transformer temperature. Critical

equipment over-temperature indication shall start a timer that shall shut down the UPS system if the temperature does not return below the setpoint level recommended by the UPS manufacturer.

BATTERIES

Battery system shall contain the battery cells, racks, battery disconnect, battery monitor and cabinet, if required. A storage battery with sufficient ampere-hour rating to maintain UPS output at full capacity for the specified duration shall be provided for each UPS module. The battery shall be of heavy-duty, industrial design suitable for UPS service. The cells shall be provided with flame arrestor vents, inter-cell connectors and cables, cell-lifting straps, cell-numbering sets, and terminal grease. Inter-cell connectors shall be sized to maintain terminal voltage within voltage window limits when supplying full load under power failure conditions. Cell and connector hardware shall be stainless steel of a type capable of resisting corrosion from the electrolyte used.

The battery shall be rated as follows :

a. Type: Sealed Maintenance free lead-acid.
b. Specific gravity when fully charged: [_____As per OEM _].
c. End voltage 1.75 volts per cell.
d. Float voltage: 2.17 to 2.26 volts per cell.
e. Equalizing voltage: 2.33 to 2.38 volts per cell.
f : Backup : 30 minutes

Battery Construction

The battery shall be of the valve-regulated, sealed, non-gassing, recombinant type.

Battery Rack

The battery shall be provided with a suitable number of three-tier racks to fit the room layout shown. Battery rack shall be steel and shall be protected with electrolyte-resistant paint. Battery rack shall be shipped unassembled and shall include hardware necessary for assembly. Each rack shall be complete with bus bars to accommodate cables from UPS module. Bus bar connectors for battery-to-battery connections and high-flex multi-stranded copper cable with proper cable supports for connecting top row of batteries to bottom row of batteries at rack ends shall be provided. End sections shall be cut to length to prevent wasting floor space.

Cell-Terminal Covers

Acid-resistant transparent cell-terminal covers not exceeding 1.83 meters in length and with vent holes drilled on top where needed shall be provided.

Battery Disconnect

Each battery pack assembly shall have a fused disconnect switch provided in a enclosure, finished with acid-resistant paint and located in line with the assembly. Switch shall be complete with line side and load side bus bars for connection to battery cells. Switch shall be rated [_____] V dc, [_____] amperes, 3-pole with interrupting rating as required by system capacity, and shall have an external operator that is lockable in the "off" position.

E. INSTALLATIONS, TESTING & COMMISSIONING

1. The Complete installation of UPS shall be as per OEM's recommendation and relevant standards as specified herein.

2.The contractor shall include wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure a coordinated installation.

3.Wiring diagrams shall identify circuit terminals and indicate the internal wiring for each item of equipment and the interconnection between each item of equipment.

4.Drawings shall indicate adequate clearance for operation, maintenance, and replacement of operating equipment devices. Submittals shall include the nameplate data, size, and capacity.

5. The UPS module rectifier/charger shall convert the incoming ac input power to dc power for the inverter and for float charging the battery. The inverter shall supply ac power to the critical load continuously. Inverter output shall be synchronized with the bypass ac power source, provided that the bypass ac power source is within the specified voltage and frequency range.

6. Whenever the ac input power source deviates from the specified tolerances or fails completely, the inverter shall draw its power from the battery system and shall supply AC power to the critical load without any interruption or switching. The battery shall continue to supply power to the inverter for the specified protection time or until return of ac input source. At the same time, an alarm shall sound to alert operating personnel and a trouble signal shall be sent over thecommunication network, allowing startup of a secondary power source or orderly shutdown of the critical load.

7. When stable ac input power source returns the rectifier/charger shall resume operation and shall simultaneously supply the inverter with dc power and recharge the battery. This shall be an automatic function and shall cause no disturbance to the critical load.

8. Should the ac input power fail to return before the battery voltage reaches the discharge limit, the UPS system shall disconnect from the critical load to safeguard the battery.

9. When the UPS controller senses an overload or degradation of the inverter output, the bypass switch shall automatically transfer the critical load from the inverter output to the bypass ac power source without an interruption of power.

If the bypass ac power source is outside of specified tolerance limits, the UPS and the critical load shall shut down.

10. The static bypass switch shall be capable of automatically retransferring the load back to the inverter output after the inverter output has returned to normal conditions. Retransfer shall only occur if the two sources are synchronized.

11. Manual closure of the maintenance bypass switch shall transfer the critical load from the inverter output to the bypass ac power source without disturbing the critical load bus. UPS module shall be capable of manual return to normal operation after completion of maintenance.

12. The battery protective device shall provide the means of disconnecting the battery from the rectifier/charger and inverter for maintenance. The UPS module shall continue to function and meet the performance criteria specified except for the battery back-up time function.

13. Following test in particular shall be conducted:
(a) Transient Test
(b) Efficiency test
(c) Load Test
(d) Battery discharge test.
(e) Annunciation, data logging and control mechanism tests.

F. MEASUREMENTS

1. Measurement shall be done in numbers.
2. Batteries shall not be measured extra

G.SUBMITTALS

The contractor shall submit following submittals as mentioned in "Procedures" and "Close out"
1. Product data (P.D)
2. Shop drawings (S.D)
3. Work methodology statement (W.M.S).
4. Material Inspection Request (M.I.R)
5. As built drawings. (A.B.D)
6. Operation & maintenance manuals. (O&M)

H. PROCEDURES

1. The contractor shall study all the drawings and tender document carefully and shall strictly adhere "General conditions of Contract" & "Special Conditions of contract ".

2. Any deviation in "Good for construction" drawings with respect to following shall be brought into the notification of consultant in prior before indenting material and execution of job at site :

(a) Deviations with respect to Bill of quantities.
(b) Deviations with respect to Tender drawings.
(c) Deviations with respect to tender specifications.
(d) Deviations with respect to site conditions.
Shop drawing reflecting the deviation has to be prepared by the contractor and the same shall be approved by "Engineer in Charge" / Consultant / Client's representative.

3. The contractor shall prepare a work methodology statement prior to commencement of Installation of UPS at site with detailed description of how the job shall be carried out at site along with necessary testing and commissioning procedures in detailed manner. This methodology statement has to be duly approved by the concerning "Engineer in Charge" / Consultant / Client's representative and work has to be carried out with respect to this approved work methodology statement.

4.The contractor needs to ensure that a mock up for the job shall be shown to concerning " Engineer in Charge" / Consultant / Client's representative at site and the rest work shall further carry on after the approval of mock up at site by the said personnel.

5. The contractor shall organize a preparation meeting prior to the commencement of job at site describing the work methodology statement in meeting.

6. The contractor shall organize a preparation meeting prior to the commencement of job at site describing the work methodology statement in meeting and the concerning attendees of the meeting have to be informed 24 hrs prior to the commencement of meeting.

7. The contractor shall adhere best installation and safety practices.

8. Product data along with General arrangements and type test report shall be submitted to " The Consultant" before indenting the material along with the specification compliance sheet duly signed and stamped by the concerning Vendor. Once the consultant approves the product data then only the procurement shall be made.

9. The product once reached at site has to be inspected by concerning " Engineer in Charge" / Client's representative and the product needs to be accepted or rejected in the form of a written document called M.I.R (" Material Inspection Request "). In case the material is rejected the same has to be mentioned in the M.I.R form clearly stating the reason for rejection of material. If accepted the same also needs to be mentioned in M.I.R form.

10. The contractor shall co-ordinate well within as well as other agencies prior to the commencement of job so that any deviation / clashes can be resolved prior to the execution of work at site.

11. Testing and commissioning needs to be performed in the presence of Engineer in Charge" / Client's representative.

12. Pre- final Inspection needs to be carried out in the after full execution of concerning work at site with Engineer in Charge" / Client's representative. Any snags identified during inspection shall be attended and rectified by the contractor.

13. The contractor shall follow a better work sequence and final inspection call has to be raised prior to hand over only. The contractor shall incorporate all the comments provided during pre-final inspection. The work shall be locked/sealed by "The client" after final inspection.

I.CLAUSES

1. The Contractor shall strictly adhere "General conditions of Contract " & "Special Conditions of contract ".

2. The contractor shall be paid in accordance with the measurement as described.

3. Batteries or any other UPS accessories shall not be paid extra.

4. Factory testing of UPS shall be as described by "The Consultant".

5. In case Engineer in Charge" / Client's representative/ consultant requires any test to be conducted at site, in spite of the fact that a type test report or a routine test report from OEM is already available for such test and if such test is mentioned under the specifications of any standard as mentioned under the tender document and if so feasible at site, the contractor shall be liable to conduct such test as required at no additional time and cost.

6. The contractor shall be liable to furnish the recommendations / clarifications / justification / acceptance from respective OEM as and when required by Engineer in Charge" / Client's representative/ consultant.

7. The contractor shall submit the calibration test report for all the testing equipment being used at site as well has used during factory testing as such test reports shall be acceptable only if furnished by NABL accredited laboratory or if required from the laboratory as specified by Engineer in Charge" / Client's representative/ consultant.

J.CLOSE OUT

1. Once the Final inspection is done, the contractor shall submit the following as close out submittals:
(a) 6 Nos. fully laminated, legible hard copies of "As built drawings"
(b) Soft Copy of "As built drawings" in AUTOCAD 2000 version in a pen-drive.
(c) 4 Nos. fully compiled in box file, legible hard copies of " Operation and maintenance manuals ".
(d) Soft Copy of "Operation and maintenance manuals" in pdf format in a pen-drive.
(e) 4 Nos. fully compiled in box file Training document literature and presentation.

(f) Soft copy of Training document literature and presentation.

2. A draft of operational and maintenance manual has to be submitted by the contractor to concerning " Engineer in Charge" / Consultant / Client's representative defining detailed O&M procedures along with product data, List of spare accessories etc. Upon the receipt of their approval. A final copy of O&M then needs to be prepared and submitted by the contractor in required format.

3. The contractor shall impart training to the concerning personnel those will be taking care of operation and maintenance of the facility. The training shall comprise of both classroom and field training.

4.A draft of training document literature and presentation has to be submitted by the contractor to concerning " Engineer in Charge" / Consultant / Client's representative.Upon the receipt of their approval on the same the training shall be then conducted and a final copy of training document literature and presentationneeds to be prepared and submitted by the contractor in required format.

CHAPTER – 7

CIVIL AND MISC WORKS

Please refer to relevant CPWD specifications for Civil works for items of Excavation, PCC, Reinforced Cement Concrete, Brick work etc. for construction of cable trenches, External Drainage work for Construction of Manholes and Hume pipes, Steel work for Erection Poles etc.

MR 19.089- 091 Supply & Erection of metallic pole of following length over existing foundation with required foundation bolts along with loop in loop out fibre boxes made up of 1.6 mm thick fibre (300mm x 300mm) suitable for Al armoured cable complete with 50A aluminium bus bar inside the box. The box shall have lockable doors made up of fibre. The poles shall be octagonal made up of 3mm thick MS complete with base plates, nut and bolts and bracket arm suitable for mounting the selected fixture etc. complete as required. Cost of foundation and foundation bolts will be paid separately under relevant items.

The pole should be MS pipe of 3 mm thickness with diameters and heights as per BOQ. Pole has to be fitted with MS plate of required dimensions and thickness with suitable stiffeners & T bolts. The pole should have the provision to hold the weather proof lamp housing .The poles shall be compatible for fixing of external lighting fixture. Pole should be painted with two or more coats of a corrosion resistant paint. The metallic arm for holding the light assembly should be set at a suitable angle to maximize uniform illumination of desired level over the specified area. A vented, acid proof and corrosion resistant fibre box 1.6 mm thickness should be provided with the pole for housing the busbars. Lock & Key provision in box should also be provided.

MR 19.092Providing & fixing in position 1000 mm wide , Electrical Insulating Rubber Mats as per IS 15652:2006, 2 mm thick, suitable up to 1.1 KV , fire retardant, no effect of acids, alkalis and transformer oils, moisture proof, high tensile strength and texture finish / cloth impression (Anti slip , marking on top)

The rubber mat shall be of good quality and suitable for 1.1kV grade with good insulating properties. The rubber mat shall be fire retardant with no effect of acids, alkalis and transformer oils, moisture etc. The mat shall have high tensile strength with anti-slip marking at the top of it.

MR 19.093Supply & fixing in position approved shock treatment chart written in English Hindi and Local language. These charts shall be framed in wooden frame & covered with clear glass.

Shock treatment chart written in English Hindi and Local language. These charts shall be framed in wooden frame & covered with clear glass.

MR 19.094Supply of Tool & First Aid Box with all necessary tools for maintenance of electrical installation & First

Minimum quantities for low risk establishments and activities may be considered as a general guidance leaflet on first aid.

- 20 individually wrapped sterile adhesive dressings (assorted sizes) appropriate for the activity (detectable dressings (coloured blue) should be available if catering is to be undertaken)
- 2 sterile eye pads 4 individually wrapped triangular bandages (preferably sterile)
- 6 safety pins
- 6 medium sized individually wrapped sterile unmediated wound dressings (approx. 12cm × 12cm)
- 2 large sterile individually wrapped unmediated wound dressings (approx. 18cm × 18cm)
- 1 pair of disposable gloves. In situations where mains tap water is not readily available for eye irrigation, sterile normal saline solution (0.9%) in sealed disposable containers should be provided.
- Once opened they must not be re-used. The use of eye baths/cups or re-fillable containers is not recommended.

CHAPTER - 8
FIXTURES

A. SCOPE

The scope of this section comprises the supply, delivery, erection, testing and commissioning of following :

1. Ceiling fans and wall fans.
2. Hotel Key cards.
3. Illuminated switches for hotels
4. Installation of lighting fixtures.

B. CODES AND STANDARDS

The relevant sections of Indian Standard Specifications as more particularly stated herein and broadly to all the codes, status and regulations as applicable shall be strictly enforced and adhered to. More particularly following codes should be strictly followed.

1. National Electrical Code - 2008
2. National Building Code - 2005

C. DEFINATIONS

Timer : These are the simplest type of controls and are most popular. Some areas inbuildings may require lighting for specific durations like security lighting, landscapelighting or building floodlighting. Timers allow this type of control by switching 'on' and'off' as per preset times. These can have one setting (same time) for the whole year orseveral (seasonal/ weekly/daily) settings to take care of the changing sunset times.

D. SPECIFICATION OF ITEMS

DSR Item No. 1.35 : Installation of following fixtures in all internal and common areas complete in all respect including fixing and connection from nearby terminal to fixture as required.

DSR Item No. 1.35 : (c) 14W LED Downlighter

DSR Item No. 1.35 : (c) 10W LED Down lighter(recessed)

DSR Item No. 1.35 : (c) 10W LED Down lighter(surface)

DSR Item No. 1.35 : (f) 1x20.8W LED Tubelight

DSR Item No. 1.35 : (h) 1x10W LED Walllight

DSR Item No. 1.35 : (k) 10W Bulk Head Light

DSR Item No. 1.35 : (l) 1 x 3W LED Mirror Light

DSR Item No. 1.35 : (o) 13W LED Recessed Wall Light

MR 19.094 : (a1) 1x12W Underwater Light

MR 19.095 : (d1) 65W LED Pole Mounted Light (IP65) (12M Pole)

MR 19.096 : (e1) 45W LED Post Top Light (IP65)

DSR Item No. 1.35 : (e1) Foot light

DSR Item No. 1.35 : (e1) 9W Foot light

MR 19.098 : (o) Supplying Ceiling Fan 1200mm sweep complete with capacitor starting assembly, stiff pendent for hanging and wiring from connector / ceiling rose to fan complete with good finish and well painted from factory.

1. Ceiling Fan

Ceiling fans shall be complete with fan suspension stem canopies and regulators. 30 cm suspension stem shall be standard accessory and stems shall be heavy duty galvanized steel tubes to IS 1239- 1958.

Fans shall be mounted on a pre-embedded hook with hard rubber isolator. Regulators shall be no-step type mounted in the switch box. The box in all such cases shall be large enough to accommodate the regulator and switches. One sample box with top cover shall be got approved before procurement.

MR 19.099 : (o) Supplying Wall Fan complete with capacitor starting assembly, stiff pendent for hanging and wiring from connector / ceiling rose to fan complete with good finish and well painted from factory.

1. Wall Fan

The fan shall be provided with aluminum sturdy blades that deliver air displacement less than or equal to 5500 cubic meter/hour. Fan motor shall be powerful, energy efficient, rated at >=100W, delivers a top speed of 1500-2000 rpm. The fan shall have sturdy spiral mesh guard, which, besides being functional, adds to the overall beauty and reliability of the design. The mesh shall be easy to clean and maintain. The fan must have features of speed control options for an optimum airflow that is sure to transform the place where you install it.The fan shall have double ball bearing head to ensures a 90 degree oscillation that helps it to cover all the area within its reach.

CHAPTER - 9
LT PANELS, SWITCHGEARS & METERS

A. SCOPE

The scope of this section comprises the supply, delivery, erection, testing and commissioning of following :

1. Low Voltage Panels along with the components.
2. Switchgears in an enclosures.
3. Meters

B. CODES AND STANDARDS

The relevant sections of Indian Standard Specifications as more particularly stated herein and broadly to all the codes, status and regulations as applicable shall be strictly enforced and adhered to. More particularly following codes should be strictly followed.

1. National Electrical Code - 2008
2. National Building Code - 2005
3. IS 8623 - Factory Builds Assemblies of switchgear and control gear.
4. IS 4237 - General requirements for switchgears are control gear for voltage not exceeding 1000 Volts.
5. IS 2147 - Degrees of protection provided and enclosures for low voltage switchgear and control gear.
6. IS 375 - Marking and arrangement of bus bars.

Individual equipment housed in the LT panels shall conform to the following IS specifications

7. IS 13947-2 Low voltage switchgear
8. IS 13703-1993 HRC Fuse Links

IS 2705 Current Transformer
IS 3231 Relay
IS 1248 Indicating Instruments and Energy Measurement Meter
IS 722 Integrating Instruments
IS 6875 Control Switches & Push Buttons
IS 8828 Miniature Circuit Breaker
IS12640 ELCB
IS2804 Shunt Capacitor for Power System

C. DEFINATIONS

As per relevant IS and IEC standards

D. GENERAL SPECIFICATIONS FOR ITEMS OF PANELS

This section pertains to general specifications for Construction, components, wiring, bus bars, painting installation connections and commissioning of All Panel boards as per detailed BOQ. Panels shall be provided as per relevant detailed BOQ descriptions and Single line diagrams. All switchgears, indication lamps, meters, CT, PT etc. shall be as described in relevant BOQ descriptions and sufficient space in compartments shall be provided in the Panel as per approved fabrication drawings to accommodate all the switch gears, bus-bars etc.

Design , fabrication, wiring, Supply, Installation, Testing and Commissioning of following Wall mounted / Floor mounted(including base stand), 415V,3PH, 50Hz extensible and fully compartmentalized panels complying to IS 8623/93. The indoor panels shall be IP 42 and outdoor panels shall be IP 66 type. The Panel shall have proper space with required clearance for cables, incoming / outgoing switchgear, CTs, PTs, Ammeter, Voltmeter, selector switches, Insulated and properly supported compartmentalized bus bars with heat shrinkable sleeves along with the other control circuit accessories within the panel and any other electrical component mentioned in the Panel SLD.The panel shall be fabricated out of CRCA not less than 2.0 mm thick for load bearing members and 1.6mm for the doors of LT panel. The Panel shall have seven tank pre-treatment process comprising of degreasing, rinsing, de-rusting, rinsing, phosphatizing, rinsing and passivation followed by powder coat painting having a paint thickness of 60 microns or as specified. The Panel shall be Dust/Vermin poof with earth studs as per the SLD and specifications. All the digital meters, multifunction meters shall be communicable with communication port available.

Note :

(1) Capacitor bank shall not be considered to be provided in any panel unless specified specifically.
(2) Spare out-going shall not be provided with any meter.
(3) All MCCBs shall be microprocessor based with inbuilt O/L, S/C , E/F and instantaneous trip protection.
(4) ALL MCCBs shall be provided with ON / OFF / TRIP indication.
(5) ACB shall be provided with ON / OFF / TRIP / SPRING CHARGE/ CONTROL SUPPLY indication and all ACBs shall have inbuilt L,S,I,G protection with adjustable settings.

1. Design parameters

The 415V system shall be suitable for the following parameters

Rated Voltage: 415 V, 3 Phase & Neutral.
Rated Frequency: 50Hz.
Fault Level: As specified in SLD.
Enclosure: IP 42 (for all indoor panels) and IP 66 (for all outdoor panels).

Voltage variations +/- 5%

Frequency variations +/- 3%

Maximum Allowable Bus Bar Temperature: 55°C for silver plated joints and 40°C Temperature rise for other joints above 50°C Ambient temperature.

Operation Duty : Continuous

2. Construction

The main Power distribution panel & distribution boards shall be used to provide power to all sort 415 V/ 230 V equipment /systems.

The main Power distribution panel shall be self-supporting, free standing or wall mounted. The enclosure shall confirm to IP66 protection for outdoor panels and IP42 for indoor panels. The main Power distribution panel & distribution boards shall be designed of the requisite vertical sections, which when coupled together shall form continuous switchboards. It should be readily extensible on both sides by addition of vertical sections after removal of the end covers or as otherwise called for the in the bill of quantities. The main Power distribution panel & distribution boards shall be constructed only of materials capable of with-standing the mechanical, electrical and thermal stresses as well as the effects of humidity, which are likely to be encountered in normal service.

The gland plate shall be of minimum 3 mm thick sheet. The gland plates shall have knock able type holes of suitable diameter of cable glands. Minimum 30% extra knock able holes shall be provided on each gland plate. Non-magnetic gland plates shall be used where single core cables are used for three-phase supply. The terminal blocks shall be provided at convenient location for cable termination. The distance between the terminal strip and gland plate shall be kept in such a way that the cables can be properly dressed & no cable tension is transferred on the terminal strip / or equipment. A main horizontal aluminum grounding bus, rated to carry maximum fault current, extending along the entire of the panel shall be provided. The ground bus shall be provided with two-bolt drilling with GI bolts and nuts at each end to receive the main Earthing grid. The front framed structure shall be designed to house the components contributing to major weight of the panel, such as circuit breaker cassettes, fuse switch units, changeover switches, main horizontal bus-bars, vertical risers and other front mounted accessories. The structure shall be mounted on a rigid base frame fabricated using ISMC channel of minimum 75 mm height. The design shall ensure that weight of the components is adequately supported without deformation or loss of alignment during transit or during operation. The design shall ensure generous availability of space for ease of installation and maintenance of cabling, and adequate safety for working in

one vertical section without coming into accidental contact with live parts in an adjacent suction.

Front and rear doors should be fitted with synthetic rubber or neoprene gaskets with fasteners designed to ensure proper compression of gaskets. When covers are provided in place of doors, generous overlap shall be assured between sheet steel surfaces with closely spaced fasteners to preclude the entry of dust.The height of the panel should not be more than 2400 mm. The total depth of the panel should be adequate to cater for proper cabling space and should not be less than 1300 mm for ACB sections and 450 mm for Switch Fuse unit and MCCB sections or should be appropriate.

Doors and compartment partitions shall be fabricated using 14 Gauge thick sheet steel. Sheet steel shrouds and partitions shall be minimum 14 Gauge thickness. All sheet steel work forming the exterior of switch boards shall be smoothly finished. Leveled and free from flaws. The corners should be rounded. The apparatus and circuits in the panels shall be so arranged as to facilitate their operation and maintenance and at the same time to ensure the necessary degree of safety. Apparatus forming part of the panels shall have the following recommended minimum clearances for non-insulated bus bars or should be as per relevant IS Codes.

Distance between	**minimum Clearances in mm**
Phase to Phase	30mm
Phase to Neutral	25mm
Phase to Body	30mm

When, for any reason, the above clearances are not available, suitable insulation shall be provided. Clearances shall be maintained during normal service conditions. Creepage distances shall comply with those specified in relevant standards. Bus bar calculations shall be furnished by the concerned vendor.

All insulating material used in the construction of the equipment shall be of non-hygroscopic material, duly treated to withstand the effects of high humidity, high temperature tropical ambient service conditions. Functional units such as circuit breakers and fuse switches shall be arranged in multi-tier formation. All the Incoming Air Circuit Breakers shall be housed in a single tier formation only. Air circuit breaker for outgoing feeders can be of two-tier formation. Metallic/insulated barriers shall be provided within vertical sections and between adjacent sections to ensure prevention of accidental contact with main bus bars and vertical risers during operation, inspection or maintenance of functional units and front mounted accessories. All doors/covers providing access to live power equipment circuits shall be provided with tool operated fasteners to prevent

unauthorized access. Cable entries and terminals shall be provided in the switchboard to suit the number, type and size of aluminum conductor power cables and copper conductor control cable specified in the detailed specifications. Provision shall be made for top or bottom entry of cables as required. Generous size of cabling chambers shall be provided, with the position of cable gland and terminals such that cables can be easily and safely terminated. The minimum depth of the panel shall be restricted to suit for this purpose. Barriers or shrouds shall be provided to permit safe working at the terminals of one circuit without accidentally touching that of another live circuit. Cable risers shall be adequately supported to withstand the effects of rated short circuit without accidentally touching that of another live circuit.

Necessary connecting bus-bar pieces with bends, offsets and drilled holes with necessary cadmium plated nuts, bolts & washers shall be provided. The details of the flange and bus configuration shall be obtained from the Bus Trunkings supplier.Panel compartments shall be provided with space heaters and lights operated by door limit switches.

3. Painting

All sheet steel work used in construction of panels shall be given for proper shot blasting/surface finish to make it free from all rusts/impurities/deposits. It shall be then provided with two primer coat and then/powder coated (electro-statically) with final paint shade RAL7032.

It shall be the process of Powder Coating with suitable primer and having total coating thickness of 60 micron. The M.S Sheet Steel shall be given for proper shot blasting / surface finish to make it free from all impurities. All sheet steel work used in construction of panels should have undergone a rigorous metal treatment 7 tank process as mentioned below.

All sheet steel work shall be phosphate in accordance with the procedure mentioned below and in accordance with relevant standards for phosphatizing iron and steel.

Oil, grease and dirt shall be thoroughly removed by emulsion cleaning. Rust and scale shall be removed by pickling with dilute acid followed by washing with running water, rinsing with slightly alkaline hot water and drying. A recognized phosphate process to facilitate durable coating of the paint on the metal surface and also to prevent the speared of rustling in the event of the paint film being mechanically damaged. This again, shall be followed by hot water rinsing to remove traces of phosphate solution. After phosphatizing through rinsing shall be carried out with clean water followed by final rinsing with dilute dichromate

solution and oven drying. Passivation in de-oxalate solution to retain and augment the effects of phosphatizing.

4. Bus Bars

The selection, design and construction of bus bars shall conform to IS specifications and the latest amendments. The bus bars shall be air insulated and made of high conductivity, high strength Aluminum Bus bars. Bus bars shall be located in air-insulated enclosures and segregated from all other compartments of the cubicle. Direct access or accidental contact with bus bars and primary connections shall not be possible. Bus bars shall be rated in accordance with service conditions and the rated for continuous and short time current ratings specified in SLD / data sheets. Maximum temperature of the bus bar and bus bar connections, under operating conditions, while carrying rated normal current at rated frequency shall not exceed 85 degree C. Bus bars shall be adequately supported on SMC insulators to with stand dynamic stresses due to short circuit currents specified in SLD / BOQ /Data sheets. Bus bar support insulators shall be of non-hygroscopic material and shall confirm to relevant IS standards. The size of bus-stars should be indicated in the contractor and shall be subject to the purchaser's approval.

The current density of the bus bars shall not be less than 1 Amp / sq mm. The size of the bus bar shall be chosen on the basis of temperature rise limit of bus-bar for continuous rated current at rated frequency and also on the basis of temperature rise limit at rated short circuit current for 1 sec and mechanical stress capacity at rated peak short circuit current. The neutral as well as the earth bar should also be capable of withstanding the electrical & mechanical stresses equivalent to phase bus bars.

Appropriate clearances and creep age distance shall be provided for the bus bars system to minimize the possibility of a fault.

Connections from the main bus bars to functional circuits shall be arranged and supported so as to withstand without any damage or deformations the thermal and dynamic stresses due to short circuits currents.

Bus bars should be color coded for easy identification of individual phases and neutral.

All the bus bars should be provided with colour coded heat shrink sleeves. The size of the Earth shall be same as the size of the neutral bus bar in any case it should not be less than 50 x 6 mm.

5. Performance Characteristics

All switchgears and panels shall be capable of satisfactory operation for the application, duty and other requirements as specified in these

specifications, enclosed data sheets/drawings. Air circuit breakers, molded case circuit breakers and switches shall be suitable for switching duty of motors and other devices shown on drawing.

6. Safety Features

The safety shutter shall be provided in breaker panels, which shall prevent in advertent contact with isolating contacts when breaker is withdrawn from the Cradle. It shall be possible to interchange two breakers of two different rating.

There shall be provision of positive earth connection between fixed and moving portion of the ACB either through connector plug or sliding solid earth mechanism. Earthing bolts shall be provided on the cradle or body of fixed ACB. Arc chute covers shall be provided wherever necessary.

It shall be possible to bolt the draw-out frame not only in connected position but also in TEST and DISCONNECTED position to prevent dislocation due to vibration.

All live parts of MCCB and switches when doors are opened after switching them OFF shall be shrouded with insulators of adequate size and strength so that to prevent accidental contacts of the live parts.

7. Switchgear (MCB/RCCB/RCBO) :

MCB should be trip free, quick make and quick break type.MCB should be suitable for interchangeable line/ load connections. The MCB shall have minimum 10 KA breaking capacity with (Ics=Icu=10kA), where Ics is service breaking capacity and Icu is ultimate breaking capacity defined as per IS-13947. MCBs shall have ISI mark as per IS8828-1996 (IEC60898).The MCB shall be suitable for temperature up to 50 deg C without de-rating. All outgoing feeder MCB shall be provided with clip on type auxiliary contact to interface.Terminal of MCB shall be provided with insulated separators between the phases and also on both end. The size and design of the terminal should be adequate to accommodate aluminum/ copper cable required for the rated current of the MCB.It should confirm to current limiting principle class –3 to ensure extremely low let through energy (I^2t) under fault conditions. It should have 'two position' DIN clip ensuring easy mounting and removal. It should confirm C.E. Marking (confirmation to European standards),based upon the tripping characteristics the MCB shall be described as B, C or D curves and the same must be mentioned in bold upon the MCB. All MCB shall have a mention of Full load current, short circuit current, utility voltage, frequency, tripping characteristics (B, C, and D), basic 3 line diagram. The poles of MCBs shall have minimum self resistance as per latest IEC standards.

The RCCB shall have sensitivities of 30mA and 100mA as specified in the design drawing or SLD or BOQ. The RCCB shall comprise of a core balance current transformer built in to calibrate the differential current between any phase and neutral. The RCCB shall have a mention of its sensitivities engraved upon it.

Residual current break over shall be rated for overload, short circuit as well as earth leakage and shall be capable to provide protection against all three of these fault conditions. The RCBO shall be quick make quick break type.It should confirm to current limiting principle class –3 to ensure extremely low let through energy (I^2t) under fault conditions. It should have 'two position' DIN clip ensuring easy mounting and removal.

8. AIR CIRCUIT BREAKERS

i) AIR CIRCUIT BREAKERS

a. The circuit breakers shall be sheet metal enclosed flush front, draw out type and shall be provided with a trip free manual operating mechanism with mechanical "ON" - "OFF" indications. Shunt trip and closing coil suitable for 24 Volts D.C. shall be provided. The Circuit breakers shall be for continuous rating, and shall be suitable for fault level as specified in BOQ at 415 volts. The moving parts of 4 pole circuit breaker shall have operating mechanism, primary and secondary isolating devices, auxiliary switches, mechanical position indicators, all mounted on a rigid sturdy steel frame work. Primary and secondary disconnecting devices shall be self aligning type of fully isolating.

b. Circuit breaker shall be designed to close and trip without opening the circuit breaker compartment door. The operating handle and the mechanical trip push button shall be at the front of the breaker panel and integral with the breaker. The ACB's shall be withdrawal type. The ACB operating spring shall be chargeable with charging motor as well as manually for electrically operated breaker. Spring charging motor will operate on 230V. AC. Once the spring is charged it should be able to close the breaker and also trip without requiring to be charged. Every Trip-Close-Trip operation with one charge of spring shall be possible. The ACB's shall be operable both from the cubicle. Inbuilt anti pumping devices shall be provided both for electrical and mechanical to prevent the breaker from restriking. Spring charge/discharge indication to be provided.

c. Suitable contacts for "Auto-Trip" annunciation and indication shall be provided.

ii) CRADLE

The cradle shall be so designed and constructed as to permit the smooth withdrawal and insertion of the breaker into it. The movement shall be free from jerks, easy to operate and shall be on steel balls/rollers and not on flat surfaces. The modules shall be totally inter changeable, for same rating.

There shall be 3 distinct and separate positions of the circuit breaker on the cradle.

Service : Both main and secondary isolating contacts in service.

Test : Main isolating contacts separate and secondary isolating contacts in service.

Isolated : Both main and secondary isolating contacts in isolated.

There shall be provision for locking the breaker in all of the positions. The breaker shall be provided with interlock to prevent the breaker from being withdrawn or replaced except in the fully isolated position.

Separate limit switches with minimum 4 'NO' + 4 'NC' potential free contacts, each shall be provided for 'Test' & 'Service' position of the breaker. 6 'NO' + 6 'NC' breaker auxiliary contacts shall be provided as spare.

Product data for ACB shall be submitted prior to selection and shall be duly approved by the consultant. Vendor shall submit detailed accessories details for ACB and the selected accessories by the consultant at the time of product data approval shall be provided by the contractor at no additional cost.

9. Switchgear (MCCB) :

MCCB should be provided with door operating mechanism having interlock, defeat and padlocking facility. The Molded Case Circuit Breaker (MCCB) shall conform to IEC 947 – 2.The MCCB shall be suitable for ambient temperature up to 55 deg C without de-rating. The MCCB should trip free, quick make and quick break type and should be equipped with a current limiting feature. MCCB shall have spreader links and terminal shroud as a feature for safety and proper heat dissipation. The MCCB shall indicate its suitability for isolation and this should appear clearly with the symbol as specified in IS 13947. All MCCBs shall be microprocessor type with overload, short circuit and earth fault releases unless otherwise specified. For the entire range, Service Breaking capacity (Ics) shall be equal to Ultimate Breaking capacity (Icu), (Icu = Ics =100%). The MCCB shall have following setting options available. No dip switches shall be installed for settings. and test knob and trip reset unit of the breaker shall be fully activated . Any accessories required for the same shall be included. The complete assembly shall be BMS compatible.

Overload setting (L) 0.4-1 x In
Short circuit setting (with time delay)(S) 2 –10 x Ir
Time delay (td) 0-500 m sec
Short circuit setting (Instantaneous) (I) 11 x In
Where In = nominal current of MCCB & Ir = rated current to which it is set.
Ground Fault Setting with time delay (0-300ms) (G) : 0.1-1 x In

Neutral setting (N) (where ever required): 0.5-1 x In

All MCCB's shall be provided with additional 2 spare NO+NC contact, a shunt trip coil and an under voltage coil auxiliary along with alarm switches, Front door operating mechanism with door interlock defeat facility. Release shall have inbuilt memory and true RMS sensing.

Frame sizes of MCCB's shall be of following standard sizes.

MCCB Rating	Frame Size
100 amps & below 100 amps.	100 amps.
More than 100 amps up to 160 amps	160 amps.
More than 160 amps up to 250 amps	250 amps.
More than 250 amps up to 400 amps.	400 amps.
More than 400 amps up to 630 amps.	630 amps.
More than 630 amps up to 800 amps.	800 amps.

The breaking capacities of MCCB's are mentioned panel wise. MCCB's shall be of following standard ratings.

MCCB Rating	Frame Size
25 KA & above.	25 KA
Above 25 KA up to 35 KA.	35 KA
Above 35 KA up to 50 KA	50 KA
Above 50 KA up to 70 KA	70 KA.

10. CONTACTORS

All contactors and bi-metal relays should conform to IS - 13947 - 4/IEC - 947-4 standards. Contactors should be suitable for requisite duty and the contactor shall be designed to operate even in severe operating conditions.
The Contactors shall be suitable for switching and controlling squirrel cage and slipping motors as well as other AC loads such as solenoids, lighting loads, heating loads and transformer loads.
The contactors shall be suitable for operation in service temperature up to 50° C without de-rating The contactors and bimetal relays shall have been tested for type-2 co-ordination at 50 KA, 415 V 50 Hz as per IS 13947 for both fuse protected as well as fuse-less motor feeders. The Contactor shall have coil of 220/240 V AC or as may be specifically asked for. The design of the current carrying parts, contact system and the magnet system should be such that it should increase reliability of electrical and mechanical endurance. Auxiliary contact should have double break parallel bridge contact mechanism. For operator safety the contactors above 45 Amp. Should have arc-chamber. The construction of the arc chamber should be

such that there is no emission of arc by-products on the surrounding equipment.

The contactor shall have funnel shaped cable entries, cable end stops and predetermined insertion depths. Contactor below 63 Amp shall have captive screws preventing the screws from falling. Main contacts should be of silver alloy to have long contact life; it should withstand to keep the contact bounce to minimum and should be shrouded with an arc chute. Both moving and fix contacts should be accessible for inspection or replacement without disturbing terminal wiring.

The magnet system should have laminated, construction to minimize the losses. Coils should withstand high temperature and ensure low power consumption. Coil should be resin cast/encapsulated. It should have inter layer insulation. Contactor should have facility to mount add-on auxiliary contact block. Mechanical interlocks should be provided for sequential operations if required. Contactor should be comfortably mounted in any position on a vertical plane. Contactor should be capable of handling high transient currents.

It's Insulation voltage level should be – 1000 v. Contactor shall be designed to have Mechanical endurance of the order of minimum 15 million operations or better.

Contactor should operate without deration from - 30° C to +50°C

11. Current Transformer

Current transformers shall comply with the requirements of IS. 2705. They shall have ratios, outputs as specified in SLD. The current transformers shall be core type with cast resin/encapsulated secondary winding.CTs shall withstand stresses originated from short circuit. These shall be mounted on the switchboard stationary part.

The secondary CT leads from all panels should be terminated on the front of the board on easily accessible shorting type terminal connectors so that operation and maintenance can be carried out when the panels are in service.

CT's shall be given heat run test.

CT's shall be of class 1 accuracy unless otherwise specified.

12. Indicating Instrument

All indicating instruments shall be digital of flush mounting industrial patterns, conforming to the requirements of I.S.

The instruments shall have non-reflecting bezels, clearly divided and indelibly marked scales and shall be provided with zero adjusting devices in the front.

Integrating instruments shall be of flush mounting switchboard pattern, complying with the requirements of I.S.

13. Protection Relay

The protection relay should be microprocessor based & have 12 mm, 8 values, Set values, Trip data and Trip History for analysis and troubleshooting.

All Protection Relays should be conforming to following IS/IEC standards:

IEC 61000-4-8	Power Frequency Magnetic Test
IEC 61000-4-11	Voltage Dips and Interruption Test
IEC 61000-4-12	Ring Wave Test
IEC 61000-4-5	Surge Immunity
IEC 61000-4-3	Radiated Electromagnetic Field Test
IEC 61000-4-4	Electrical Fast Transient test
IEC 61000-4-2	Electrostatic Discharge Test
IS 8686/IEC 60255-22-1	High Frequency Disturbance Test
IS 8686/IEC 60255-5	Impulse Test
IS 3231/IEC 60255-5	Dielectric Test

The Protection relay should have built in Self Supervision and Self-Testing Feature & Self diagnostic ensure continuous reliability. The protection relay should have separate indication for Power On, Programming Mode and Relay fault.

The protection relay shall have RS 485 port/MOD BUS for Communication with BMS system. The Hardware/Software Protocol for the same shall be given without any additional cost. The protection Relay shall have minimum 4 No of user programmable output relays. The protection relay should have a test feature for maintenance and checking purpose. The protection relay shall have 3 phase characteristics, which shall be adjustable over wide range to provide discrimination between a multiplicity of devices.

14. Control Switches

Control Switches shall be of the heavy-duty rotary type with escutcheon plates clearly marked to show the operating position. They shall be semi-flush mounting with only the front plate and operating handle projecting.

Circuit breaker control switches shall be of the spring return to neutral type, while instrument selector switches shall be of the stay-put type.

15. Push Button

Push buttons should be of the momentary contact, push to actuate type.

Push Buttons should be panel mounted, flush type having 22.5 mm Ø.

Push Buttons should be spring returns type.

Lock and key head with Push turn facility.

Modular blocks should contain NO-NC contact.

It should be snap-fit type for easy assembly.

Double break self-cleaning contacts for prolong life.
NO-NC contact block should be colour coded for easy identification.
Push Buttons should have transparent shroud and rubber shroud to enhance protection against ingress as per IP- 67.
It should withstand operating voltage as well as frequent operation.
It should have finger proof shrouded terminals.

16. Control Wiring

All Control wiring shall be carried out with 1100 Volts grade single core PVC cable conforming to IS694 having stranded copper conductors of minimum 1.5 sq mm for potential circuits and 2.5 sq. mm. section for current transformer circuit.
Wiring shall be neatly bunched, adequately supported and properly routed to allow for easy access and maintenance.
Wires shall be identified by numbered ferrules at each end. The ferrules shall be of the ring type and of non-deteriorating material. They shall be firmly located on each wire so as to prevent free movement.
All control circuits fuses shall be mounted in front of the panel and shall be easily accessible.

17. Terminal Blocks

Terminal blocks shall be of Elmex /connect well make of the suitable type. Insulating barriers shall be provided between adjacent terminals. CT Terminal blocks shall be shorting type.
Terminal blocks shall have a minimum current rating of 10 Amps & 650 volt grade rating complete with insulated barriers. Provisions shall be made for label inscriptions.
It should have snap fit action.
It should have captive-screws and self-lifting washers.
Withstand temp range from –30° C to 100° C.
Terminal Connectors should have flame retardant property confirming to UL-94, V-2.
Terminal Block should be suitable for commonly used DIN Rail – 35 X7.5 mm and mounting channel 'C' shaped Std.32 mm.
Terminal Block should be suitable for commonly used DIN Rail – 35 X7.5 mm and mounting channel 'C' shaped Std.32 mm.
The construction material should be of high quality like polyamide 6/6 and contacts of Nickel plated brass. Labels shall be of anodized aluminum, with white engraving on black background. They shall be properly secured with fasteners.

18. Digital Energy Meter

The energy meters shall be digital counter type with LCD/LED display. It shall be flush mounted on panel. The size shall be at least 96 mm x 96 mm at the front side. The Class of accuracy of the meters shall be 1. The meters shall be calibrated as per CT secondary current and directly from the LT voltage, self-powered and suitable for 3 phases, 4 wire system.The meters shall be fully communicable with communication port compatible for BMS/SCADA/TCP-IP protocols.

Digital Energy Meter should be confirming to following IS/IEC standards.

- IEC 61000-4-8 Power Frequency Magnetic Test
- IEC 61000-4-11 Voltage Dips and Interruption Test
- IEC 61000-4-12 Ring Wave Test
- IEC 61000-4-5 Surge Immunity
- IEC 61000-4-3 Radiated Electromagnetic Field Test
- IEC 61000-4-4 Electrical Fast Transient test
- IEC 61000-4-2 Electrostatic Discharge Test
- IEC 1036 Accuracy
- IS 8686/IEC 60255-22-1 High Frequency Disturbance Test
- IS 8686/IEC 60255-5 Impulse Test
- IS 3231/IEC 60255-5 Dielectric Test
- IS13779 Operating Temperature
- IS 722 3 Phase Watt -Hour Meter with Maximum Demand Indicator

Digital KW Meter shall have 2 Alarm set Points. This should have multi-function facilities to measure Voltage, Current, Power factor, KW.
This unit should give True RMS Measurements.
This unit should have four quadrant operations.
The unit should have 2 No. of relay type outputs for alarm or control action.
The unit should have wide CT ratio selection range to suit site requirements.
The unit shall have large and clear display with backlit facility.
The unit shall have necessary arrangements communication port RS 485 for energy metering.

23.0 Isolators

All isolators and switches shall be two position type (ON/OFF) heavy duty, load break, quick make and break type and suitable for front of board operation and shall conform to I.S. 4064.The isolators for motor feeders shall be of "Motor Duty" type adequate for interruption of locked rotor current of motors (excepting for motors rated 50 Kilowatts and above).Switches and isolators provided in the switch boards shall be interlocked with door to prevent opening and closing of the door in the closed (ON) position of the isolators. All live terminals on the isolating /

switches shall be adequately shrouded to prevent accidental contact and danger to the personnel. Properly rated co-coordinating fuses (HRC type) shall be provided for every outgoing feeder unless otherwise indicated. The fuse shall be non-deteriorating high rupturing capacity link type mounted in suitable fuse carrier / fuse base and conform to I.S. 3106. All the meters shall be IS or BIS marked.

24.0 Dual Source Meter

The dual source meter shall Suitable for 3 phase 4 wire network with two separate registers for mains and alternate power i.e. Stirling generator generation. The meter shall have flashing indication on display to indicate the source in use. The meter shall have Class- 1.0 accuracy with RS – 485 protocol. The meter shall be flush mounted with sealing facility provided and must also give current reversal indication. Following features shall also be provided:

24.1 Enclosure:

Dimensions: 96 x 96 x 96 mm
Weight: 300 gms

24.2 Front panel:

Display: Backlit LCD display
Digit Height: 8 mm x 4.8 mm
Protection index: IP 54

24.3 Inputs :

Current :
Via transformer with primary 50-200 Amp
Insulated secondary 5A
Current circuit burden < 0.1 VA
Overload 7A
Voltage
Measurement Range 120V AC to 300V AC from phase to neutralvoltage circuit burden 0.1 VA

24.4 Auxillary supply

230 V AC +/- 30%, 50 Hz with burden < 2.5VA

24.5 Accuracy :

Class-1.0

24.6 Pulse Output:

1 pulse = 1 kWH with a minimum pulse duration of 100ms.

25.0 Load Manager

The load manager shall be micro-controller based unit capable to measures a host of electrical parameters and display them on a 128 x 64 mm backlit LCD, It shall have load management feature and shall have six numbers of output relay contacts apart from CT/PT contacts. These outputs shall be individually field programmable for both the parameter on which to generate alarm as well as the values on which to activate alarm and deactivate it. In addition to this flexibility in terms of load management, the load manager shall also have RS485 port. RS485 supports MODBUS RTU protocol for connections to EMS/SCADA. The unit shall be made for three phase four wire system. The installation type, CT ratios and PT ratios shall be site selectable. The Load Manager with its six relay contacts shall be capable to be used as a Demand Controller. The method of Demand calculation i.e. sliding window, fixed window shall be selected at site. The device shall have all the features needed to implement a robust electrical load management system. It shall be programmable / configurable to suit most control and communication needs. The load manager shall be capable to measure following parameters:

1. Voltage (Volts L-N & L-L) VL-N Accuracy: 0.5% of Reading VL-L Accuracy: 1.0% of Reading.
2. Current (Amps IR, IY, IB) Accuracy: 0.25% of Reading.
3. Line Frequency 45 to 55 Hz, Accuracy: 0.3% of Reading.
4. Active Power (P) Accuracy: 0.5% of Reading (For IPFI>0.5).
5. Reactive Power (Q) Accuracy: 1.5% of Reading (Between 0.5 Lag to 0.8 Lead).
6. Apparent Power (S) Accuracy: 0.5% of Reading.
7. Power Factor For Individual phases and System. Accuracy: 0.5% of Reading (IPFI≥0.5) Range of Reading: 0.05 to 1.000 Lag/Lead.
8. Total Active Energy (KWh) Range of Reading: 0 to 9999999.9 KWh Accuracy: Class 0.5 as per IS14697.
9. Total Apparent Energy (KVAh) Range of Reading: 0 to 9999999.9 KVAh Accuracy: Class 0.5 as per IS14697.
10. Total Reactive Energy (KVARh) Range of Reading: 0 to 9999999.9 KVARh Accuracy: Class 1.0
11. 3 rd to 15 th Harmonics(Odd) for all Voltages with THD.
12. 3 rd to 15 th Harmonics(Odd) for all Currents with THD.
13. Active Power (KW) Demand - Sliding & Fixed, Selectable.
14. Apparent Power (KVA) Demand - Sliding & Fixed, Selectable

The device shall also have following features:

1. Display 128 X 64 Graphical LCD with Operating temp 10°C to 50°C.

2. Data Logging Buffer 2 MB, Non-volatile memory, capable of holding 19691 records Logging Duration Site selectable.
3. RS485 Modbus-RTU protocol
4. Communication USB 8.0 Pen-drive For downloading logged data

26.0 Test and report

25.1 Type Test

Type test shall be conducted on one unit of each type of panel with rated bus-bar and circuit breaker mounted with the unit in accordance with relevant IS and shall be as mentioned below:
Verification of Temperature rise limit.
Verification of dielectric properties
Verification of the short circuit withstand strength.
Verification of the effectiveness of the protective circuit.
Verification of clearance and creepage distances.
Verification of mechanical operation
Verification of degree of protection.
Type 2 co-ordination test
Breaker - Duty cycle
Mechanical endurance
Electrical endurance
Routine tests shall be conducted on all panels and Distribution boards in accordance with relevant IS codes and shall be as mentioned below:
Insulation resistance test (IR value) by 1000V megger before HV test.
Dielectric test by applying 2.2 KV for 1 min and noting leakage reactance.
Insulation resistance test by 1000 V megger after H.V test.
Functional controls check for panels.
Logic simulation test.
Current injection test.
Bus-bar purity test
Test reports for all such tests shall be prepared by contractor for submission along with Inspection offer.

27.0 Inspection

Inspection of the panels shall include inspection of wiring and electrical operational tests where necessary, Dimensional & Visual verification.
Checking of Protective Measures and electrical continuity of the protective circuits.
Primary and Secondary Injection Test for Checking of all Meters and Relays
Checking of control Circuit by simulating the conditions. Any such simulator in case required shall be arranged by contractor / manufacturer / sub-contractor etc.

28.0 Acceptance Test

All the tests carried out in the routine test shall be asked for acceptance test and test shall be carried out in similar way except the dielectric test which shall be carried out at 75% of the routine test voltage.

E. INSTALLATIONS, TESTING & COMMISSIONING

1. The complete Panel assembly shall be installed in accordance with the manufacturer's installation drawing duly approved by "The consultant "

2. The panels needs to be grouted considering the seismic zone requirement.

3. Panels shall be properly aligned and the leveled within tolerance of +/- 2mm and shall be ensured with a water level indicator or a laser gun whichever available. No shim shall be allowed to make a panel level suitably.

4. All live sections and compartments shall be covered with insulation barriers.

5. All the components of the panel shall be easily accessible.

6. The location of installation shall be cleaned and co-ordination shall be made with other disciplines.

7. Grouting holes shall be provided from inside and the panel shall be suitably and tightly bolted. No tuck welding with base channel is allowed.

8 Panels shall have peel-able poly layer on the cover for protection fromcement, plaster, paints etc. during the construction period.

9. The holes made in enclosure for cable termination or anything else shall be made only through drill machine or approved cutting tool with marking of dia done prior to cutting or drilling. Extra left out holes shall be filled neatly with fire retardant sealant.

10. The Panel shall be tightly grouted. No spare nuts-bolts shall be left out un-tightened / open inside the DB enclosure in any case.

11. Gland plates where ever used for cable termination shall be tightly fixed and shall be earthed.

12. Size of Horizontal and vertical bus bars shall be equal.

13. Switchgears above 63A shall be mounted on bus bars tightly and accurately.

14. Termination lugs shall be tightly fixed and connected and there shall not be any bare wire strand jetting out of the lugs. Suitable crimping tool shall be used. And terminal wires shall be coved with heat shrinkable sleeves whose color coding has to match with the color of the wire used.

15. Color coding shall be followed for internal wiring also in a similar pattern as described in chaper-1 wiring under the specification document. Bus bar shall be tagged for phase indication.

16. The door of panel shall be aligned properly and there shall be no air gap left after closing the DB door. Gaskets shall be used to make DB free from moisture.

17. Panel shall have Padlocking arrangement and shall be pad locked after complete installation.

18. Panel board shall be fully tested (both type and routine test) for its components as per the specification laid under Indian standards. In particular following test shall be done :

(a) Continuity test (both earth continuity and loop continuity)
(b) Insulation resistance test.
(c) Contact resistance test.
(d) Primary injection test.
(e) Trip test and trip unit reset test with Test knob of breaker.
(f) CT testing (Polarity, Knee voltage)
(g) Phase rotation test.
(h) HV test on bus bar
(i) Space heater Testing
(j) Control wiring checks

F. MEASUREMENTS

1. Measurement shall be done in numbers

G.SUBMITTALS

The contractor shall submit following submittals as mentioned in "Procedures" and "Close out"

1. Product data (P.D)
2. Shop drawings (S.D)
3. Work methodology statement (W.M.S).
4. Material Inspection Request (M.I.R)
5. As built drawings. (A.B.D)
6. Operation & maintenance manuals. (O&M)

H. PROCEDURES

1. The contractor shall study all the drawings and tender document carefully and shall strictly adhere "General conditions of Contract" & "Special Conditions of contract ".

2. Any deviation in "Good for construction" drawings with respect to following shall be brought into the notification of consultant in prior before indenting material and execution of job at site :
(a) Deviations with respect to Bill of quantities.
(b) Deviations with respect to Tender drawings.
(c) Deviations with respect to tender specifications.
(d) Deviations with respect to site conditions.
Shop drawing reflecting the deviation has to be prepared by the contractor and the same shall be approved by "Engineer in Charge" / Consultant / Client's representative.

3. The contractor shall prepare a work methodology statement prior to commencement of Installation of panels at site with detailed description of how the job shall be carried out at site along with necessary testing and commissioning procedures in detailed manner. This methodology statement has to be duly approved by the concerning "Engineer in Charge" / Consultant / Client's representative and work has to be carried out with respect to this approved work methodology statement.

4.The contractor needs to ensure that a mock up for the job shall be shown to concerning " Engineer in Charge" / Consultant / Client's representative at site and the rest work shall further carry on after the approval of mock up at site by the said personnel.

5. The contractor shall organize a preparation meeting prior to the commencement of job at site describing the work methodology statement in meeting.

6. The contractor shall organize a preparation meeting prior to the commencement of job at site describing the work methodology statement in meeting and the concerning attendees of the meeting have to be informed 24 hrs prior to the commencement of meeting.

7. The contractor shall adhere best installation and safety practices.

8. Product data along with General arrangements and type test report shall be submitted to " The Consultant" before indenting the material along with the specification compliance sheet duly signed and stamped by the concerning Vendor. Once the consultant approves the product data then only the procurement shall be made.

9. The product once reached at site has to be inspected by concerning " Engineer in Charge" / Client's representative and the product needs to be accepted or rejected in the form of a written document called M.I.R (" Material Inspection Request "). In case the material is rejected the same has to be mentioned in the M.I.R form clearly stating the reason for rejection of material. If accepted the same also needs to be mentioned in M.I.R form.

10. The contractor shall co-ordinate well within as well as other agencies prior to the commencement of job so that any deviation / clashes can be resolved prior to the execution of work at site.

11. Testing and commissioning needs to be performed in the presence of Engineer in Charge" / Client's representative.

12. Pre- final Inspection needs to be carried out in the after full execution of concerning work at site with Engineer in Charge" / Client's representative. Any snags identified during inspection shall be attended and rectified by the contractor.

13. The contractor shall follow a better work sequence and final inspection call has to be raised prior to hand over only. The contractor shall incorporate all the comments provided during pre-final inspection. The work shall be locked/sealed by "The client" after final inspection.

I.CLAUSES

1. The Contractor shall strictly adhere "General conditions of Contract " & "Special Conditions of contract ".

2. The contractor shall be paid in accordance with the measurement as described.

3. In case Engineer in Charge" / Client's representative/ consultant requires any test to be conducted at site, in spite of the fact that a type test report or a routine test report from OEM is already available for such test and if such test is mentioned under the specifications of any standard as mentioned under the tender document and if so feasible at site, the contractor shall be liable to conduct such test as required at no additional time and cost.

4. The contractor shall be liable to furnish the recommendations / clarifications / justification / acceptance from respective OEM as and when required by Engineer in Charge" / Client's representative/ consultant.

5. The contractor shall submit the calibration test report for all the testing equipment being used at site as well has used during factory testing as such test reports shall be acceptable only if furnished by NABL accredited laboratory or if required from the laboratory as specified by Engineer in Charge" / Client's representative/ consultant.

6. The cost of tools and kits used for installation of cables trays shall not be paid extra.

J.CLOSE OUT

1. Once the Final inspection is done, the contractor shall submit the following as close out submittals :
(a) 6 Nos. fully laminated, legible hard copies of "As built drawings"
(b) Soft Copy of "As built drawings" in AUTOCAD 2000 version in a pen-drive.
(c) 4 Nos. fully compiled in box file, legible hard copies of " Operation and maintenance manuals ".
(d) Soft Copy of "Operation and maintenance manuals " in pdf format in a pen-

drive.
(e) 4 Nos. fully compiled in box file Training document literature and presentation.
(f) Soft copy of Training document literature and presentation.

2. A draft of operational and maintenance manual has to be submitted by the contractor to concerning " Engineer in Charge" / Consultant / Client's representative defining detailed O&M procedures along with product data, List of spare accessories etc. Upon the receipt of their approval. A final copy of O&M then needs to be prepared and submitted by the contractor in required format.

3. The contractor shall impart training to the concerning personnel those will be taking care of operation and maintenance of the facility. The training shall comprise of both classroom and field training.

4.A draft of training document literature and presentation has to be submitted by the contractor to concerning " Engineer in Charge" / Consultant / Client's representative.Upon the receipt of their approval on the same the training shall be then conducted and a final copy of training document literature and presentationneeds to be prepared and submitted by the contractor in required format.

SUB HEAD: 20
ELEVATORS

1.0 SCOPE: This specification covers design, engineering, manufacture, painting at manufacturer's shop as well as at site after erection, inspection and testing at the manufacturer's and / or his sub vendor's works, packing, delivery to site, unloading, storage at site, erection, site testing, commissioning, clearance from elevator inspector, and handing over in perfect working condition the elevators complete with accessories as required for the project.

- Supply of commissioning spares
- Supply of initial requirement of oil, lubricants & cleaning/ flushing fluid including replenishment during erection, testing and commissioning of the elevator
- Any special tools and tackles required for operation and maintenance of the elevator shall be included in the scope of supply. A list of such tools and tackles shall be furnished by the vendor.

It is not the intent of this specification to specify completely herein all the details of design and construction of equipment. However, the equipment offered shall conform in all respects to high standards of engineering, design and workmanship and be capable of performing in commercial operation up to Vendor's guarantee in a manner acceptable to the Purchaser, who will interpret the meaning of drawings, specification and shall have the power to reject any work or materials, which in his judgment, are not in full accordance herewith.

Lift Data Sheet	
	Name of the building
	Faculty Appartments
NUMBER OF LIFT	19
CAPACITY (kgs)	884 kg. 13 persons
Speed (mps)	1 mps
Rise (m) GF Landing level FF Landing Level SF Landing Level TF Landing Level	9.9 m 0.00 m 3.3 m 6.6 m 9.9 m
Approximate Height of Hoist way	15.0 m
Stop	4 Stops with (all opening on the same side)
CONTROLLER TYPE	Controller shall be microprocessor based AC variable voltage frequency (ACVVF) Drive.
DRIVE	VF Regenerative (Closed Loop)
POWER SUPPLY	415 +/- 5%Volts (3 Phase AC)
OPERATION	Full collective operation With or without attendant mode
CAR GROUP	Simplex Type Lifts.
MACHINE	PM Gearless (Located in shaft on top of guide rail)
TRACTION MEDIA	Flat Coated Steel Belt
CAR FRAME	Car Frame shall be in accordance with IS 14665 Part 4 section 3 made of steel sheet of rigid construction and shall be so mounted on MS frame that the noise and vibration transmitted to the passenger inside is minimum. The MS parts of the frame and the sheets exteriors within the shaft shall be painted with approved quality Epoxy paints.
CAR FINISH	• Rear Mid Panel = Stainless Steel #4(Hairline) • Rear Corner Panels = Stainless Steel #4(Hairline) • Side Mid Panels = Stainless Steel #4(Hairline) • Side Corner Panels = Stainless Steel #4(Hairline) • Front Panels = Stainless Steel #4(Hairline) Car enclosure shall withstand a thrust of min 35Kg applied at normally at any points without permanent deformation.
FALSE CEILING TYPE	False ceiling shall be of Stainless steel sheets #4(Hairline) finish with necessary recess mounting of LED lights and cut out for Ventilating Fan. The roof of car shall be capable of supporting a weight of at least 140 Kg.
VENTILLATION	Cross flow fan with automatic sleep provision, size of fan minimum 300 mm dia.
HAND RAILS	Stainless Steel Mirror Finish Handrails on rear car panels

FLOORING	Granite floor As per architectural detail over M.S. Checkered plates base of car.
CAR DOOR FINISH	Stainless Steel #4(Hairline)
LANDING DOORS FINISH	Stainless Steel #4(Hairline)
FIRE RATED DOORS	Fire rating-60mins
PIT DEPTH	As per manufacturer requirement.
OVERHEAD	As per manufacturer requirement.
HOISTWAY DIMENSIONS (W x D – mm)	As per drawing and Manufacturer Specifications
CAR DIMENSIONS (W x D x H - mm)	As per manufacturer Specifications and in confirmation to IS 14665.
CAR & HOISTWAY DOOR TYPE	Central opening (CO) doors
DOOR OPENING (W x H - mm)	900 mm X 2000 mm
DOOR OPERATOR	DC Door Operator
COP	Stainless Steel #4(Hairline) Cover Plate for Car Opening Panel and Led illuminated Push buttons of micro pressure type with Braille markings.
CAR POSITION INDICATOR	Dot matrix(RED LED) Scrolling Display
HALL FIXTURES	Surface mounted combined hall button with position indicator and direction indicator.
HALL FIXTURE FACE PLATE	Stainless Steel #4(Hairline)
HALL BUTTON ARRANGEMENT	Hall Button with HPI Led illuminated push buttons of micro pressure type with Braille markings.
STANDARD FEATURES	Anti-nuisance Car Call Protection (to prevent unnecessary movement of lift due to action of playful children) , Independent Service (for Duplex only) , Overload Device, Nudging (If the door are prevented from closing for a longer period of time than a buzzer sounds and doors start closing slowly,, Emergency Firemen's Service (Emergency alarm bell at GF can be activated by pressing the alarm button in the car, device is operated by battery),, Emergency Car Light Unit, Infrared Curtain Door Protection, Door Time Protection (If the car door does not close completely after a set time of door close command then the car removes itself from group operation in Duplex lift.), Emergency Alarm Button, Extra Door Time of Lobby & Parking (The door open time for Lobby landing at GF is normally longer than the door open time at upper landings)., Door Open/Close Button, Manual Rescue Operation, Belt Inspection Drive, Auto Fan Cut Off,

	Automatic Rescue Device, Intercom,

GENERAL SPECIFICATION FOR ELEVATORS

1.0 General

1.0 The Elevator shall be designed in accordance with IS 14665 (Part 1 to 5) and any other relevant specifications. The tenderer shall also take in to account local and state regulations as in force for the design and installation of the lift. In case there is no local lift act is in force, the Bombay lift act shall be followed.

All electrical works in connection with installation of electric lift shall be carried out in accordance with provisions of Indian Electricity Act 1910 and Indian Electricity Rules 1956 amended up to date. The electrical works shall also confirm CPWD General specifications for electrical works Part I (Internal) 1994 and Part II (External) 1994 as amended up to date wherever relevant.

2.0 The Elevator shall be suitable for 24 hours round the clock operation.

3.0 All parts requiring replacement or inspection or lubrication shall be easily accessible without the need for dismantling of other parts/equipment. All electrical cables shall be so laid that they are not liable to damage and can be easily inspected and maintained.

Safe access for maintenance and removal of all mechanical and electrical parts shall be ensured, without additional scaffolding.

4.0 Lift Power panel for 415V A.C, 50 Hz., 3 phase supply as per power requirement and 230 V A.C, 1 phase for lighting for each elevators shall be provided at single point within lift shaft. All control wiring and necessary cabling for satisfactory operation of lift shall be arranged by the vendor. Ventilation & Lighting for hoist way shall be done by the vendor considering 150 lux illumination level, also lighting & ventilation for elevator shaft shall be a part of bid only.

5.0 The vendor shall furnish drawings for hoist way, arrangement required to fix gearless machine inside the hoist way, permissible vertical centre to centre distance between supports for guide rail etc. to work out civil / structural design and preparation of drawings.

Adequate number of hook shall be provided in the hoist way for erection and maintenance purpose.

2.0 GENERAL PRINCIPLE:

The motive power to the elevator shall be transmitted on electrical principle. For this purpose gearless elevator, the hoisting equipment shall be kept inside the elevator shaft only, no machine room shall be required. The sliding assemble shall slide on a pair of guide rails during upward and downward motion of the elevator car. All other systems i.e. elevator door operations, car entrance, hoist way entrances, car enclosure, signalling and other controls etc. shall be provided as specified below and indicated in the data sheet.

3.0 HOIST MACHINE:

The hoisting machine shall be of the gearless type with a closed loop VF drive at speeds indicated in data sheet, with motor, brake discs and drive sheave compactly mounted within the hoist way. Suitable Sound isolation arrangements shall be installed to reduce vibration or air borne noise. The motor shall be reversible type particularly designed for elevator variable frequency service with high starting torque and low starting current. Sound reducing material shall be installed under machine. The hoisting machinery shall be gearless type with 3 phase AC synchronous motor of suitable speed.

4.0 EMERGENCY CRANKING:

The hoisting machines shall be provided with means of manual cranking and to allow release of hoist brake and provide for manual movement of the car in case of emergency.

5.0 BRAKE:

Disc type Brake shall be spring loaded closed (mechanically applied) and shall open electrically. Braking shall be by using variable input frequency to bring elevator to a stop electrically.

6.0 AUTOMATIC SELF -LEVELLING:

The elevator shall be provided with automatic self - levelling feature that shall bring the elevator car level to within ± 5 mm of the landing floor regardless of load or direction of travel. The automatic self - levelling feature shall correct for over travel and rope stretch.

7.0 SPEED GOVERNOR AND SAFETY GEAR:

The car safety shall be operated by a mechanical centrifugal speed governor. Hook shall be provided in hoist way. The governor shall actuate a switch when excessive descending speed occurs, disconnecting power to the hoist motor and applying the brake and actuate safety gear if necessary.

8.0 PIT SWITCH:

An emergency stop switch shall be located in the pit accessible from the pit access door which when operated shall stop the car regardless of position in the hoist way. Adequate lighting shall be provided in the pit. Ladder shall be provided in the lift pit.

9.0 BUFFERS:

Buffers shall be installed in the pit as a means for slowing and stopping the car and counterweight at the bottom limits of travel, in compliance with local codes. Clearance from underside of car resting on a fully compressed buffer shall be not less than 1.20 m. Buffer shall be designed for design speed + 15%. These shall conform to IS 14665 Part 3.1. Spring or oil buffers only shall be used. Spring buffers shall be capable of supporting, without being compressed solid, a total load equivalent to two times the weight of car and its rated load for car buffers and two times the weight of counter weight for counter weight

buffers. The oil buffers shall be self-resetting type. They will also be provided with means for determining the oil level.

10.0 GUIDE RAILS:

Steel elevator guide rails shall be installed to guide the car and counterweight, erected plumb and securely fastened to the building structure, filled and filled to ensure smooth joints.

11.0 ROLLER GUIDES SHOES:

Rubber encased coil spring tension adjusted roller guides shall be provided for passenger elevators with speed of 1.00 m/sec or greater, mounted on top and bottom of the car frame, and on top and bottom of the counterweight frame to engage their respective guide rails.

12.0 HOISTWAY OPERATING DEVICES:

Redundant series wired terminal stopping devices shall be provided to slow down and stop the car automatically at the terminal landings. Resetting a tripped devices shall be done manually only.

13.0 COMPENSATING ROPE:

Compensating ropes shall be provided to compensate for the shifting weight of the hoist rope. Compensating chain where provided shall be noiseless type polyurethane enclosed chain.

14.0 COUNTER WEIGHT

A structural steel frame with cast iron or steel plate filler weights shall be furnished to provide proper counterbalance for smooth and economical operation. The counterbalance shall be 50% of the rated car load.

15.0 COUNTERWEIGHT GUARD:

A metal (a suitable guided structural steel frame with suitable weights) counterweight guard shall be furnished and installed at the bottom of the hoist way, and shall wrap around counterweight rails for a height of no less than 1.80 m in order to protect accidental contact.

16.0 Belts

Flat coated steel belts of adequate size, construction to insure proper operation of the elevator and give satisfactory and safety assurance. . Belts shall conform to governing codes or regulations. The factor of safety for belt system shall be minimum 12.

The Lift shall be provided with inbuilt system to monitor the integrity of the belt cords for ensuring the safety.

17.0 HOISTWAY MATERIALS:

All hoist way materials shall be non-flammable except travel cable cladding which shall be flame resistant. All other electrical cables / wires shall be FRLS and housed in metal conduit or other metal enclosures. Isolation pads shall be provided in hoist way Cable shall conform to codes and shall anchor to the

frame by means of an equalizing device to insure uniform cable loading. Cable safety shall minimally conform to governing code. Traveling cable shall be secured to the cars underside. Cable shall be clear of all obstructions while car is in motion. Cable jacket shall be rated for immersion in water, salt water and oil. Jacket restraint shall minimize strain on conductor.

18.0 HOISTWAY ENTRANCES:

For each landing served, furnish and install a complete elevator hoist way entrance with stainless steel baked enamel painted steel hoist way door frame. Each entrance shall have centre opening two speed horizontal sliding type doors suitable for a clear opening as per IS codes, and shall include flush doors of hollow metal pan type construction, extruded aluminium sill with anti-slip grooving on the surface door, hanger supports and hanger cover. Exposed surfaces of doors and frames shall be finished as directed by Architect or Interior Designer. Corrosion resistant coating shall be applied, wherever required, prior to completion of the installation.

19.0 HOISTWAY DOORS:

Sheave type two point suspension ball bearing door hangers and tracks complete shall be furnished for each hoist way opening and adjustable ball bearing rollers shall take the up thrust of the doors.

Each car and hoist way door leaf shall be fitted with two Teflon or nylon Gibbs as bottom door stabilizers.

20.0 ARCHITRAVES AND DOORS:

Doors, threshold, door hangers and electro mechanical locks shall be as a system, fire rated for not less than 1 hour.

21.0 DOOR OPEN CLEARANCE:

Clear door opening shall be as per IS codes. Any other dimension shall require Owner's approval. Finishes shall be as directed by Interior Designer.

22.0 CAR AND HOISTWAY DOOR OPERATOR:

For each elevator door, a Variable Voltage Variable Frequency (with harmonic filter) door operator shall be furnished to simultaneously open the car and hoist way doors when the car is at a landing. The doors shall be closed simultaneously by motor power.

Emergency key provision shall be made to open doors at top and bottom landing from outside of the hoist way. The door speeds shall be controlled independent of hydraulic cushioning.

In the event of interruption of electric power or failure of which shall prevent elevator movement away from the landing unless the door is in the closed position. Each hoist way door shall be equipped with a positive

electromechanical interlock and auxiliary door closing device so that the elevator can be operated only after the interlock circuit is established.

The doors shall open automatically while the car is levelling at the respective landing. The doors shall automatically close after a predetermined time interval has elapsed, but the momentary pressure of the "door open" button provided in the car shall reverse the motion and reopen the doors and reset the time interval unless over ridden by the infra - red beams monitoring the open door.

The operation shall be possible with or without attendant with the provision of key in the main operating panel. The emergency push button shall also be provided to facilitate stopping of elevator at particular landing cancelling all the registered calls.

It shall not be possible for the car to be started or kept in motion until all the landing doors and the car door are locked in the closed position.

It shall not be possible to open the landing door from the landing unless the elevator car is within the particular landing zone.

23.0 SHEAVES:

Sheaves shall be mentioned, balanced and shall maintain cable / sheaves ratio well within code requirements. Lubrication points shall be extended to a location that is easily accessible.

24.0 CARFRAME AND SAFETY:

A car frame fabricated from formed or structural steel members shall be provided with adequate bracing to support the platform and car enclosures. The car safety shall be integral with car frame, and shall be of the flexible guide clamp type designed to stop and hold a fully loaded car which exceeds descending speed. It shall withstand without deformation the operation of safety gear.

The car shall be so mounted on the frame that vibration & noise transmitted to the passengers inside is minimum.

The MS parts of the frame and the sheets exteriors within the shaft shall be painted with approved quality Epoxy paints.

25.0 PLATFORM:

The car platform shall be checkered plate steel construction. It shall be equipped with slip resistant threshold. The entire platform shall rest on rubber pads, so designed to form an isolating cushion between the car and car frame. Platform deflection shall be limited to maximum 3 mm under maximum normal operating conditions. Platform shall conform to local codes. Approved coloured granite floor finish shall be provided. The weight of the granite stone shall be considered as the part of dead weight of the car.

26.0 SILL TO SILL CLEARANCE:

Sill to sill clearance shall not exceed 30 mm for all elevators.

27.0 INFRA - RED BEAM DETECTOR:

An infra - red beam device with emitters & receivers shall be installed on passenger elevator. This device shall monitor traffic across the threshold of the door and shall initiate door closing 2 seconds after last beam interruption, thus overriding door open period. There should be minimum of 50 beams criss - crossing across door height. There shall be no zone in the entire opening that is not monitored by the device.

28.0 OVER - LOAD FEATURE:

All elevators shall be fitted with over load warning indicator based on sensing relays fitted in the platform of elevator cabin to illuminate and sound a buzzer to indicate " Over - load " and subsequently defeat the car's operating circuits when car load reaches 110% or more of rated load. Car platform may require stiffening to minimize margin of error resulting from excessive deflection.

When the load exceeds 80 % of the rated load, the car will bypass automatically all the hall calls along the service direction. This feature shall be effective under full automatic mode i.e. without attendant service.

29.0 AUTOMATIC RESCUE DEVICE:

All elevators described in these standards must be equipped with an automatic rescue device which will, upon signal from the central fire alarm system, manually operated key switch or mains power failure, automatically move the stalled elevator to the nearest landing, opening of landing doors and facilitate the rescue of the passenger in the elevator and close their doors and remain at that floor. All floor and car buttons shall be rendered ineffective until the system is manually reset. A key operated switch provided at the ground floor to activate and reset the retrieval system manually. Self-testing facility shall be provided for all the Elevator after restoring mains power.

29.1 Emergency operation shall return the elevator to a designated floor, most commonly the lobby by means of a signal from the automatic fire alarm system.

29.2 On initiation from the fire alarm system, all elevators traveling away from the lobby floors shall stop and reverse with opening their doors indicating fire mode operation to passengers, ignore all car and hall calls and express to the lobby or alternate landing floor.

29.3 Cars traveling toward lobby shall express to lobby ignoring all car and hall calls. Cars parked at intermediate floor shall close their doors and express to lobby. Cars parked at lobby shall open their doors ignoring car and hall calls. At hall and car buttons shall extinguish and shall accept no further hall or car registration.

ARD shall activate rescue within 10 sec of power failure.

Battery capacity shall be adequate so as to operate the ARD at least seven times a day, provided the duration between usage is at least 30 mins.

30.0 TERMINAL & ULTIMATE LIMIT SWITCH:

Limit switches shall be provided to slow down & stop the car automatically at the terminal landings & ultimate limit switches shall be provided to automatically cut off the power & apply the brake, should the car travel beyond the terminal landing.

31.0 ACCELERATION / DECELARATION:

Shall be linear and smooth. Stops shall be made without cable oscillations.

32.0 NOISE LEVELS:

Noise from all stationary equipment shall not intrude into adjoining public areas. Noise from moving equipment including door operation, car motion, fan, wind, etc. shall not intrude into adjoining corridors.

33.0 WIRING:

Al wiring and electrical interconnections shall comply with governing codes and manufacturer standards. Insulated wiring shall have flame retardant and moisture proof outer Covering, and shall be run in metal conduit, tubing or approved electrical . Travelling cables shall be flexible and suspended to relieve strain on individual conductors. A minimum of 10% spare conductors shall be provided in travelling cable.

34.0 CAR POSITION INDICATOR:

A scrolling alpha numeric car position indicator shall be installed above each operating panel. The position of the car in the hoist way shall be shown by illuminating the corresponding landing at which the car is stopped or passing.

35.0 HALL LANTERNS:

Recessed surface mounted directional lanterns with stainless steel faceplates or finish specified by architects shall be provided at all hoist way entrances, with up and down indications at intermediate landings and single indication at terminal landings. When a car is stopping at a landing, the lantern shall indicate the direction in which the car is travelling and shall become illuminated prior to arrival of the car. A soft chime shall sound once for the "UP" direction and twice for the "DOWN" direction to announce the impending arrival of the associated elevator.

36.0 CALL BUTTON:

Call button and face plate for Goods shall be as per Architect selection. Call buttons shall have movement of 1.5 mm.

37.0 CAR OPERATING PANEL:

A full length car operating panel shall be provided in each passenger car. The car operating panel shall contain a bank of mechanical micro movement illuminated buttons with a maximum movement of 1.5 mm marked to correspond to the landings serviced. It shall include a series of push buttons corresponding to the floors served, along with an emergency stop and switches required. Operating panel shall incorporate the following: floor buttons, door open / close, emergency stop / alarm, up / down in manual mode, man / auto key switch and fire operation.

A locked compartment integral with operating panel shall contain

a. Up / down button.

b. Open / shut button

c. Alarm Button

d. Floor Button

e. Emergency stop button

f. Car direction indicator

g. Car position indicator

h. Fireman's service indicator

i. Overload indication

j. Telephone

k. Key for with or without attendant operation.

l. Fire extinguisher as per IS codes shall be provided in the car.

A separate lockless cabinet shall house the emergency telephone.

38.0 LIGHTING:

The cabinet manufacturer shall make all provisions for installation of lighting fixtures specified in datasheet or by interior designer, including integration of emergency lighting fixtures. Car light shall be equipped with Automatic sleep provision.

39.0 FIXTURE FINISHES:

The metal faceplates and required accessories for the operating as well as signal devices in the cars and at the landings, shall be stainless steel as specified in data sheet. All fixtures, form and finishes, etc. are subject to the Architect's and interior designer's approval.

40.0 CAR CLADDING AND FINISHES:

Walls shall be of hair lined stainless steel sheet as per Data sheet.

41.0 INSPECTION OPERATION:

A switch shall be provided in the control panel and also on top of the car to permit operation of the elevator from top of the car for inspection purposes, with car and hall buttons inoperative.

42.0 INDEPENDENT SERVICE:

A key operated switch shall be provided which, when actuated, shall disconnect the elevator from the hall buttons and permit operation from the car buttons only.

43.0 SAFETY AND INSTALLATION ASPECTS:

The placing of equipment in elevators well should be such as to allow free movement of maintenance personnel inside and highest level of safety.

43.1 Perforated M.S frame dully galvanized and painted to achieve fire resistance rating of not less than two hour shall be provided between two hoist-way. One elevator shall act as fire elevator as and when fire occurs.

43.2 Only authorized persons shall be allowed to work on elevators installation and proper record thereof during the tests, inspection and maintenance when necessary shall be taken by in the presence of employer's representative.

43.3 If during installation any safety or protection device is inoperative, due care must be taken in order to avoid accidents.

43.4 The car & landing buttons shall be isolated from circuit by switching the maintenance switch provided on the top of the car / emergency stop switch inside the car / attendant control switch during maintenance of the elevator.

43.5 As a standard precaution, face plate between the door header and the corresponding upper landing, sill on each floor must be provided.

43.6 Before any maintenance / repairing work checked that any electro-mechanical door locks are not short circuited either from the controller or at the landings.

43.7 Provision of lockable storage space for safe custody of material

44.0 PERMITS & INSTALLATIONS:

The Contractor shall arrange all necessary Local Government permit and shall make arrangements for inspections and tests required thereby. Including required license for operation must be obtained

45.0 Submission of Drawings by Lift Vendor and getting the approval from Engineer – in Charge before supply of equipment.

- Supply of following drawings, documents and manuals:

Following Drawings/documents shall be submitted for approval.

i) The General Arrangement drg. of elevator showing the complete elevation and plan views of hoist way with drive assembly & drive mounting detail of elevator, ground pit plan with necessary insert details and load data.

ii) Detail arrangement drawing of elevator car showing all accessories and fittings attached to the car.

iii) Following electrical drgs. Shall also be submitted by the Tenderer for approval and or information prior to start of manufacture:

- ☐ GA of control panel.
- ☐ GA & Data sheet of motor.
- ☐ GA of battery, battery charger & Inverter panel.
- ☐ Calculation for battery.
- ☐ Power and control schematic diagram
- ☐ Cable schedule
- ☐ Schematic control circuit drawing with wiring diagram.
- ☐ Control write-up & detail of interlocking of lift operation.
- ☐ Earthling Layout drawing

iv) Drive power calculation and VVVF drive sizing for the elevator.

v) Leaflets and catalogues for drive, brake, couplings, bearings, wire rope and electrical equipment etc.

Vi) In addition to the above, Purchaser may ask for submission of other drawings, documents, structural, mechanical and electrical calculations for scrutiny and reference if required

vii) Instruction manual giving instruction for erection, pre-commissioning, check-up, operation, abnormal condition, maintenance and repair, Write-up on control and interlock provided, Recommended inspection points and period of inspection, Schedule of preventive maintenance, Ordering information for all replaceable parts, Recommendation for type of lubricants, lubrication points, frequency of lubrication and lubricant changing schedule etc.

Ordering specification including, catalogues and details for all spares

46.0 INSPECTION, TESTING AND COMMISSIONING:

1.0 Bidders shall submit quality assurance plan along with the Bid. The QAP shall be subjected to Purchaser/consultant approval. This quality assurance plan will form part of the Purchase Order to enable the Purchaser to assure the quality of components at various stages of manufacture. The inspection & testing shall be done as per the approved QAP. All the test certificates shall be submitted as per approved QAP. Material shall be dispatched only after receiving dispatch clearance from purchaser/consultant.

2.0 Following test procedures shall be carried out prior to acceptance of elevator system.

a. Test to determine that the insulation resistance between power and control lines and earth is as per specified IS codes.

b. Test to determine that the earthing of all conduit, switch, casings and similar metal works is continuous and of low resistance.

c. Test to determine that the motor, brake, control equipment and door locking devices and limit switches function correctly.

d. Load test with 100% and 110% of rated load as per clause no.8.1.6 of IS 14665 (Part 2/Sec 1): 2000.

e. Brake to be tested to check whether it can sustained a car at rest with 25% of contract load.

f. Test to determine that the lift car achieves the specified speed.

g. Test for rated power against actual power consumption under full load.

h. Check for current drawn by each elevator during starting and full load operation.

i. Sound level check for motors.

j. Visual inspection for all components.

k. The contractor shall guarantee the smooth and noiseless performance of the elevators System

l. Any other test felt necessary by Purchaser and supplier to ensure proper functioning and installation of the lift.

Test load & other equipment (stop watch etc.) shall be arranged by the contractor.

3.0 Vendor shall keep all his testing instruments duly calibrated against standard meters not earlier than 6 months from the date of test of the equipment covered under this specification, in the presence of Purchaser. Calibration certificates shall be made available during inspection.

47.0 DEFECT LIABILITY & GUARANTEE:

After completion of the installation of the respective elevator by the Contractor, maintenance service for the equipment furnished under these specifications shall be provided for a period of twenty (24) months as a defect liability period, free of cost. This service shall include regular monthly examinations of the installations during regular working hours by trained employees and shall include all necessary adjustments, greasing, oiling, cleaning, supply of spares and genuine standard parts to keep the equipment in proper operation, except any parts made necessary by misuse, or neglect caused by others.

All the materials / equipment shall be governed by guarantee during defect liability period against any manufacturing defects, design & workmanship. Also any malfunctioning of equipment / system due to faulty installation / design / manufacturing process etc. shall be replaced / rectified free of cost by the Main contractor.

All necessary co-ordination with regard to sub-contracted equipment shall be carried out by the Main contractor. The Purchaser / Architect / Consultant will communicate only with the Main Contractor for all matters pertaining to this contract.

The Maintenance contract shall be separately executed on annual basis after completion of guarantee period & shall include all consumables required during the contract.

SUB HEAD: 21
LANDSCAPE WORK

MR 21.001 : Providing and laying non-pressure NP2 class (light duty) R.C.C. pipes vertically in tree-pits complete as directed by EIC including supply of all material, labour and equipment up to any lead and lift 900 mm dia R.C.C. pipe

Cement concrete pipes shall be installed in tree-pits along roads and near structures as shown in contract drawings to prevent tree roots from damaging constructed areas.
Precast cement concrete pipes of diameter as specified in contract drawings shall be supplied conforming to IS 458.
Contractor shall unload the pipes on location of laying only just before laying is about to begin, and trench is prepared. Contractor shall unload the pipes with great care. Any crack and chipping shall not be accepted, and Contractor shall replace the pipe at his own cost.
Contractor shall lay the pipe using pulley mechanism such that the pipe is absolutely vertical, checked with plumb line. Contractor shall level the pipe such that its finished level matches that shown in contract drawings.
Contractor shall refill the outside portion of the trench manually with excavated soil with great care not to disturb the laid pipe. Filling shall be done in layers 100 mm thick, and light tamping shall be done such that the pipe is not disturbed. Contractor shall keep checking the level and alignment of the pipe periodically with plumb line and correct any errors found.

Precast cement concrete pipes shall be measured in length just before laying, accurate to the nearest centimetre. This work shall include transport, loading, installation and soil filling around the pipe.The rate includes the cost of all materials, equipment, labour, carting, loading & unloading, removal of debris to local specified within the site, involved in all the operations described above.

MR 21.002 : Supply & application of bentonite clay lining with average thickness of 75mm to bottom & sides surfaces of water bodies, clearing and levelling the surface before application of bentonite using a 500kg roller such that no part of the surface extends out from surroundings by more than 100mm, rolling & consolidating after application with 500kg roller, checking for leaks by local filling of water and sealing the same with bentonite complete, including supply of all material, labour and equipment as required, up to any lead and lift; as directed by Engineer-in-Charge

Bentonite clay shall be sourced from approved sources only. Sample shall be approved by Engineer-in-Charge before supply of bentonite clay.
Area on which bentonite is to be applied shall be cleared of all vegetation, growth, large and small stones, rubble, etc. Area shall then be made even along

the slope or level on flat area such that there is no unevenness more than 100mm in any area.
Bentonite shall be applied on this area in thickness of 75mm as shown in drawing, and directed by Engineer-in-Charge. 500 kg roller shall be used to compact the bentonite. Area shall be filled with water and checked for leaks or cracks, which will be filled with bentonite.
Once area is cleared of leakage, protective soil cover of minimum 300mm shall be laid on top of the bentonite. Protective soil shall be free of any vegetation, growth, stones, etc and laid to line and level as directed by Engineer-in-Charge and shown in drawings.
Measurement shall be in cubic metres volume, accurate to a centimetre in each direction. The rate includes the cost of all materials, equipment, labour, carting, loading & unloading, removal of debris to local specified within the site, involved in all the operations described above.

MR 21.003 :Supply & spreading of graded moorum up to 300 mm for play areas, in layers not exceeding 100mm thick and consolidating with 8 tons roller, complete including supply of all material, labour and equipment, up to any lead and lift as directed by EIC

Graded moorum shall be sourced from approved sources only. Sample shall be approved by Engineer-in-Charge before supply of moorum.
Area on which moorum is to be applied shall be cleared of all vegetation, growth, large and small stones, rubble, etc. Area shall then be level on flat area such that there is no unevenness more than 100mm in any area.
Moorum shall be applied on this area in thickness of 100mm as shown in drawing, and directed by Engineer-in-Charge. 8 ton roller shall be used to compact the moorum.
Measurement shall be in cubic meters volume, accurate to a centimeter in each direction. The rate includes the cost of all materials, equipment, labour, carting, loading & unloading, removal of debris to local specified within the site, involved in all the operations described above.

MR 21.004 : Supply, fabrication and installation of play structure comprising of SS 304 slide for children, wooden deck, ladders, Nylone rope climbing net, Pergola house and the supporting structure of all the components as per final detailed drawing. The rate to include necessary painting of MS structures with approved colour Epoxy paint and all wooden members to be applied with PU coating etc. complete including all labour, equipment, material, upto any lead and lift as directed by EIC.

Play structure shall be Fabricated and installed at the site as per detailed drawings – detail 19 of Drawing number NUC (1) – TD – L3.2 of Landscape details. Relevant materials specifications as per CPWD Civil works specifications shall be followed.

DSR Item No. 23.28 : Preparation of mounds of various size and shape by available excavated / supplied earth in layers not exceeding 20 cm in depth, breaking clods, watering of each layer, dressing etc., lead upto

50 meter and lift upto 1.5 m complete as per direction of Officer-in-charge

DSR Item No. 16.1 : Road Work Preparation and compaction of sub grade with power road roller of 8 to 12 tonne capacity after excavating earth to an average of 22.5 cm depth, dressing to camber and compacting with road roller including making good the undulations etc. and re-rolling the sub grade and disposal of surplus earth with lead upto 50 metres.

DSR Item No. 16.11 : Dry stone pitching 22.5 cm thick including supply of stones and preparing surface complete.

DSR Item No. 16.12 : Dry brick pitching half brick thick in drains including supply of bricks and preparing the surface complete : With common burnt clay F.P.S. (non modular) bricks of class designation 5

DSR Item No. 16.9 : Providing and laying tactile tile (for vision impaired persons as per standards) of size 300x300x9.8mm having with water absorption less than 0.5% and conforming to IS: 15622 of approved make in all colours and shades in for outdoor floors such as footpath, court yard, multi modals location etc., laid on 20mm thick base of cement mortar 1:4 (1cement : 4 coarse sand) in all shapes & patterns including grouting the joints with white cement mixed with matching pigments etc. complete as per direction of Engineer-in-Charge.

Please refer to relevant paras of Sub Head 16.0 of Road work of the Civil Works Specifications 2009 Volume II for the above mentioned DSR items.

SUB HEAD: 22
ROAD WORKS

GENERAL

0.1 These Specifications shall apply to all such road and bridge works as are required to be executed under the Contract or otherwise directed by the Engineer-in-charge.

0.2 The work of CONSTRUCTION OF INTERNAL ROADS WITHIN PROPOSED PERMANENT CAMPUS (AS PART OFRESIDENTIAL PARCEL PHASE I) shall be executed as per the Detailed Items Specifications for Roads & Bridges Works Published by Indian Road Congress on behalf of Ministry of Road Transport and highways (MoRTH) with its latest revision.

0.3 The Items not covered under MoRTH specifications, shall be executed as per relevant specifications of CPWD Civil Works Specifications Volume I & II (2009)

0.4 The specifications for NON Scheduled items not covered by MoRTH Specifications or CPWD Specifications for Civil works are given in this booklet.

0.5 In every case, the work shall be carried out to the satisfaction of the Engineer-in-Charge and conform to the location, lines, dimensions, grades and cross-sections shown on the drawings or as indicated by the Engineer-in-Charge. The quality of materials, processing of materials as may be needed at the site, salient features of the construction work and quality of finished work shall comply with the requirements set forth in succeeding sections. Where the drawings and Specifications describe a portion of the work in only general terms, and not in complete detail, it shall be understood that only the best general practice is to prevail, materials and workmanship of the best quality or to be employed and instructions of the Engineer-in-Charge are to be fully complied with.

0.6 Indian roads Congress Specifications and Recommended Codes of Practice have been used in the preparations of these specifications. The latest edition of all Specifications/Standards till 30 (thirty) days before the final date of submission of the tender, shall be adopted. Reference mentioned herein shall be applicable to all sections to the extent the context permits and are intended to supplement the provisions in the particular section. In case of any discrepancy/ deviation, the provisions in the particular section shall take precedence.

0.3 INTERPRETATIONS

0.3.1 The Tender authority through Engineer-in-Charge shall be the sole deciding authority as to the meaning, interpretationandimplicationsforvariousprovisionsofthespecifications.Hisdecisioninwritingshallbefinal.

0.3.2 Wherever any reference is made to any Indian Standard, it shall be taken as reference to the latest edition with all amendments issued thereto. In the event of any variation between the detailed specifications and the Indian Standard, the former shall take precedence over the latter.

NH SOR Item No. 3.18 Earthwork - Construction of Subgrade and Earthen Shoulders. (Construction of embankment for subgrade and earthen shoulders with approved material obtained from borrow pits with all lifts and lead up to 1000 m, transporting to site, spreading, grading to required slope and compacting to meet requirement of MoRTH table 300-2)

Refer 305. EMBANKMENT CONSTRUCTION As per MoRTH Specifications

311. WORKS TO BE KEPT FREE OF WATER

311.1. The Contractor shall arrange for the rapid dispersal of water collected/accumulated on the earthwork or completed formation during construction or on the existing roadway or which enters the earthwork or any other item of work from any source, and where practicable, the water shall be discharged into the permanent outfall of the drainage system. The arrangements shall be made in respect of all earthwork including excavation for pipe trenches, foundations or cuttings.

311.2. The Contractor shall provide, where - necessary, temporary water courses, ditches, drains, pumping or other means for maintaining the earthwork

free from water. Such provisions shall include carrying out the work of forming the cut sections and embankments in such manner that their surfaces have at all times a sufficient minimum crossfall and, where practicable, a sufficient longitudinal gradient to enable them to shed water and prevent ponding.

The works involved in keeping the earthwork or any other item of works free of water shall be deemed as incidental to the respective item of work and as such no separate payment shall be made for the same.

Refer 1000. Specifications of Materials AS per MoRTH Specifications

Refer 1500. Formwork As per MoRTH Specifications

NH SOR Item No. 4.12 : Wet Mix Macadam : Providing laying, spreading and compacting graded stone aggregate to wet mix macadam specifications including premixing the materials with water at OMC, in mechanical mix plant carriage of mix material by tipper to site, laying in uniform layer with paver in sub base/base course on well prepared surface and compacting with vibratory roller to achieve desired density as per relevant MoRTH clause 406

Refer 406. WET MIX MACADAM SUB -BASE/BASE As per MoRTH Specifications

DSR Item No. 16.68 :Providing and laying 60mm thick factory made cement concrete interlocking paver block of M -30 grade made by block making machine with strong vibratory compaction, of approved size, design & shape, laid in required colour and pattern over and including 50mm thick compacted bed of coarse sand, filling the joints with fine sand etc. all complete as per the direction of Engineer-in-charge.

DSR Item No. 16.94 : Providing and laying factory made chamfered edge Cement Concrete paver blocks of required strength, thickness & size/shape, made by table vibratory method, to attain superior smooth finish using PU or equivalent moulds, laid in required Grey colour & pattern over 50mm thick compacted bed of coarse sand, compacting and proper embedding / laying of inter locking paver blocks into the sand bedding layer through vibratory compaction by using plate vibrator, filling the joints with jamuna sand and cutting of paver blocks as per

required size and pattern, finishing and sweeping extra sand in footpath, parks, lawns, drive ways or light traffic parking etc. all complete as per manufacturer's specifications & direction of Engineer - in-Charge: (a) 80 mm thick c.c. paver block of M-30 grade with approved color design and pattern.

Please refer to relevant paras of Sub Head 16.0 of Road work of the Civil Works Specifications 2009 Volume II for the above mentioned DSR items.