CHAPTER –G

TECHNICAL SPECIFICATIONS – SOLAR PV SYSTEM

1. GENERAL:

This section specifies the design, Supply, Installation, Testing and Commissioning of ongrid Solar Photovoltaic Power Plant confirming to MNRE specifications as amended, consisting of Mono Crystalline silicon solar cells, net metering facility, necessary protections, earthing, mounted on Aluminium/GI structure of suitable strength with following components complete as required: -

a) Solar Photovoltaic Module of capacity 500 Wp or above, manufactured in India, confirming to IS 14286/IEC 61215, IS/IEC 61730-Part-1, IS/IEC 61730-Part-2. Solar Photovoltaic Module conversion efficiency shall not be less than 16.5%. PV modules used in solar power plants/ systems must be warranted for their output peak watt capacity, which should not be less than 90% at the end of 10 years and 80% at the end of 25 years.

b) Power Conditioning Unit (PCU) of 350-800 V DC Input voltage range and 400 V AC, three phase, 4 wire, 50Hz +/- 2.5 Hz, output voltage suitable to generate AC Power with efficiency not less than 97%, total harmonic distortion less than 3% and suitable for ambient temperature from 0 to 50 degree C. The PCU shall adjust the voltage and frequency level to suit the Grid Voltage Frequency.

c) Data Monitoring System complete with accessories.

d) Fixing of Array junction box & Main junction box with IP 65 protection and termination arrangement for incoming and outgoing cable along with glands, lugs and other accessories etc. as required.

e) Lightning and surge voltage protection.

f) Connections & Interconnections by supplying & fixing required size Solar cables, XLPE insulated copper conductor 1.1 kV grade armoured power and control cables between solar modules, main power cable to grid supply PCU unit along with supplying & fixing of necessary channel/conduit lugs and other accessories etc. as required.

SOLAR PHOTOVOLTAIC MODULES:

The total Solar PV minimum array should comprise of poly crystalline modules of minimum 500 Wp and above wattage. The Photovoltaic module must be tested and certified by an independent testing laboratory that is accredited in accordance with ISO Guide 25.

a. The PV modules should be of Indigenous make. The PV modules must confirm to the latest edition of any of the following / equivalent BIS standards for PV module design qualification and type approval:

- Crystalline Silicon Terrestrial PV Modules IEC 61215 / IS14286
- In addition, the modules must confirm to IEC 61730 Part 1(requirements for Construction) & Part 2 (requirements for testing, for safety qualification).
- Further, the PV modules must also qualify the Salt Mist Corrosion Testing as per IEC61701 / IS 61701

b. SPV module Conversion efficiency should be equal to or greater than 14% at STC and AM

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1.5 radiations.

c. The PV modules shall perform satisfactorily in humidity up to 100 % with temperature between -40ºC to +85ºC. Since the modules would be used in a high voltage circuit, the high voltage insulation test shall be carried out on each module and a test certificate to that effect be provided.

d. Other general requirement for the PV modules and subsystems shall be the following:

i. Solar cells technology employed in the module production shall have to be certified and a certificate giving details of major materials i.e. cells, Glass, back sheet, their makes and data sheets to be submitted.

ii. The rated output power of any supplied module shall not have negative tolerance.

iii. The peak-power point voltage and the peak-power point current of any supplied module and/or any module string (series connected modules) shall not vary more than 3 (three) percent from the respective arithmetic means for all modules and/or for all module string, as the case may be

iv. Except where specified, the front module surface shall consist of impact resistant, low- iron and high-transmission toughened glass.

v. The module frame, if any, shall be made of aluminum or corrosion-resistant material which shall be electrolytically compatible with the structural material used for mounting the modules.

vi. The module shall be provided with a junction box with either provision of external screw terminal connection or sealed type and with arrangement for provision of by-pass diode. The box shall have hinged, weather proof lid with captive screws and cable gland entry points or may be of sealed type IP65 rated.

vii. Necessary I-V curves at 250 C, 450,600 and at NOC are required to be furnished.

viii. Fill factor of module shall not be less than 0.70

1.1. ARRAY STRUCTURE:

a. The array structure shall be so designed that it will occupy minimum space without scarifying the output from SPV panels.

b. Structural material shall be corrosion resistant and electrolytically compatible with the material used in the module frame, its fasteners, nuts and bolts. Galvanizing should meet ASTM A-123 hot dipped galvanizing or equivalent which provides at least spraying thickness of 70 micron on steel as per IS 5905.

c. Structures shall be supplied complete with all members to be compatible for allowing easy installation at the roof top site and the structure atop sloping roofs shall be done by the Bidder.

d. Each structure shall have a provision to adjust its angle of inclination to the horizontal as per the site conditions.

e. The array structure shall be grounded properly using maintenance free earthing kit.

f. Each panel frame structure should be so fabricated as to be fixed on the rooftop column/wall structures. The structure should be capable of withstanding a wind load of 200 km/hr. after grouting & installation. The front end of the solar array must be one meter above the rooftop. Grouting material for SPV structures shall be as per M15 (1:2:4) concrete specifications.

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g. The Contractor shall specify installation details of the PV modules and the support structures with appropriate diagrams and drawings. Such details shall include, the following:

i. Determination of true south at the site;

ii. Array tilt angle to the horizontal, with permitted tolerance;

iii. Details with drawings for fixing the modules;

iv. Details with drawings of fixing the junction/terminal boxes;

v. Interconnections details inside the junction/terminal boxes;

vi. Structural installation details and drawings;

vii. Electrical earthing;

viii. Inter-panel/Inter-row distance with allowed tolerances; and

ix. Safety precautions to be taken.

k. The array structure shall support SPV modules at a given orientation and absorb and transfer the mechanical loads to the rooftop columns properly. All nuts and bolts shall be of very good quality stainless steel. Detailed design and drawing shall have to be submitted for acceptance and approval before execution of work.

1.2. POWERCONDITIONING UNIT (PCU)

The PCU required of appropriate capacities as follows, should convert DC power produced by SPV modules, in to AC power and adjust the voltage & frequency levels to suit the local grid conditions.PCU should be appropriate capacity of proposed solar PV plants

1.3. POWER CONDITIONING UNIT (INVERTER PLUS MPPT CHARGE CONTROLLER)

Input Voltage:

- From PV Module: Minimum 08KWp, 120V nominal DC from Solar PV Array.
- From AC source 415V, 3 ph, 50 Hz

Output Voltage:

Suitable for charging 120 V, 600AH tubular plate lead acid VRLA Gel type battery bank.

Protection:

- Short Circuit
- Deep discharge
- Over charging (Automatic trickle charge mode on full charge)
- Input surge voltage
- Over current (Load)
- Battery reverse polarity
- Solar Array reverse polarity

Indication (LED/LCD Indication):

- String on
- Mains on

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• Input on

• Control on

• Charge on

• 80% charged, 100% charged

• Charger overload

• Battery on trickle

• Battery disconnected/fault battery reverse polarity

• Low solar power

• System fault

• Charger over temperature

• Input over/under voltage (for

AC) Operating Temp: 0-50 Deg

C Humidity: 0-95% non

condensing Enclosure IP 32

No Load Consumption: < 1%

1.4. INVERTER:

1.4.1. Common Technical Specification:

- Control Type :Voltage source, microprocessor assisted, output regulation
- Output Voltage : 3 phase, 415 Volt AC
- Frequency : 50 Hz
- DC link voltage range : 0 to 800 V
- Total Harmonic Distortion - less than 3%
- Maximum current ripple - 4% PP
- Reactive Power - 0.95 inductive to 0.95 capacitive
- Operating Temp. Range - 5 deg C to 55 deg C
- Housing Cabinet - INVERTER to be housed in suitable switch cabinet, Within IP 65 Degree of ingress protection for outdoor and IP 20 for Indoor.
- Inverter efficiency - 95% and above at full load,
- Power Control- MPPT

1.4.2. Other important Features/Protections required in the INVERTER

- Mains (Grid) over-under voltage and frequency protection
- Array ground fault detection
- Automatic fault conditions reset for all parameter like voltage, frequency and/or black out.
- MOV type surge arrester on AC and DC terminals for over voltage protection from lightening-induced surges.
- INVERTER should be rated to operate at 0-55 deg. centigrade unless provision

for air conditioning is included in INVERTER

- Overload capacity (for 10 sec) should be 150% of continuous rating.
- PCU shall be capable to synchronize independently & automatically/to be phase locked with Power Supply Authority grid power line frequency to attain synchronization & export power generated by the solar panel to Power Supply Authority grid.
- The DC to AC conversion efficiency shall at least be 95percent at full load. The idling current at no load must not exceed 2 percent of the full load current.
- Transformer less inverters shall be preferred. Restriction of DC components on AC side shall be achieved.
- The INVERTER shall be capable of operating in parallel with the grid utility service and shall be capable of interrupting line-to-line fault currents and line-to-ground fault currents.
- The INVERTER shall be able to withstand an unbalance output load to the extent of 30%.
- The INVERTER shall include appropriate self-protective and self-diagnostic features to protect itself and the PV array damage in the event of INVERTER component failure or from parameters beyond the INVERTER's safe operating range due to internal or external causes. The self-protective features shall not allow signals from the INVERTER front panel to cause the INVERTER to be operated in a manner which may be unsafe or damaging. Faults due to malfunctioning within the INVERTER, including commutation failure, shall be cleared by the inverter protective devices and not by the existing site utility grid service circuit breaker.
- The INVERTER shall go to shut down/standby mode, with its contacts open, under the following conditions before attempting an automatic restart after an appropriate time delay;

(i) Insufficient Solar Power Input

When the solar available from the PV array is insufficient to supply the losses of the INVERTER, the INVERTER shall go to a standby/shutdown mode. The INVERTER control shall prevent excessive cycling during rightly shut down or extended periods of insufficient solar radiation.

(ii) Utility-Grid Over or Under Voltage

The INVERTER shall restart after an over or under voltage shutdown where the utility grid voltage has returned to within limits for a minimum of two minutes.

(iii) Utility-Grid Over or Under Frequency

The INVERTER shall restart after an over or under frequency shutdown when the utility grid voltage has returned to within limits for minimum of two minutes.

- The INVERTER generated harmonics measured at the point of connection to the utility services when operating at the rated power shall not exceed a total harmonics current distortion of 3 percent, a single frequency current distortion of 4 percent and single frequency voltage distortion of 1 percent, when the first through the fiftieth integer harmonics of 50 Hz are considered.

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- The INVERTER power factor at the point of utility services connection shall be 0.95 lagging or leading when operating at above 25 percent of the rated output. The internal copper wiring of the INVERTER shall have flame resistant insulation. Use of PVC is not acceptable. All conductors shall be made of standard copper.
- Full protection against accidental open circuit and reverse polarity at the input shall be provided.
- The INVERTER shall have an appropriate display on the front panel to display the instantaneous AC power output and the DC voltage, current and power input. Each of these measurements\ displays shall have an accuracy of 1 Percent of full scale or better.
- The Inverter shall be with Bi-directional full sine wave charge controller 120 V DC output.
- Electrical safety, Earthing and Protections shall be as per CPWD specifications for Electrical works Part I- 2013.

1.5. Factory testing

a. The INVERTER shall be tested to demonstrate operation of its control system and the ability to be automatically synchronized and connected in parallel with a utility service, prior to its shipment.

b. Factory testing shall not only be limited to measurement of phase currents, efficiencies, harmonics content and power factor, but shall also include all other necessary tests/simulations required and requested by the Purchasers Engineers. Tests may be performed at 25, 50, 75 and 100 percent of the rated nominal power.

c. A factory Test Reports (FTR) shall be supplied with the unit after all tests. The FTR shall include detailed description of all parameters tested qualified and warranted.

1.6. Operating modes:

Operational or MPP tracking mode: The control system continuously adjust the voltage of the generator to optimize the power available. The power conditioner must automatically re-enter stand-by mode when input power reduces below the standby mode threshold. Front Panel display should prove the status of the INVERTER, including AC Voltage, Current, Power output & DC Current, Voltage and Power input, pf and fault Indication (if any)

1.7. Codes and standards:

The quality of equipment supplied shall be controlled to meet codes listed in relevant ISI and other standards, such as:

• IEEE 928 Recommended Criteria for Terrestrial PV Power systems.

• IEEE 519 guide for Harmonic Control and Reactive Compensation of Static Power Controllers.

• National Electrical NEPA 70-(USA) or equivalent national standard.

• National Electrical safety Code ANSI C2-(USA) or equivalent national standard.

• JRC Specification 503 (Version 2.2 March 1991) or JPL Block V standard for PV modules.

1.8. Plant metering/data logging

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a. PV array energy production: Digital Meters to log the actual value of AC/DC Voltage, Current & Energy generated by the PV systems shall have to be provided. 1 Nos. two way LT 415V energy meters (import – export) class 0.2S ABT compliant shall be incorporated in the system one for each Solar PV Plant.

b. Data logging systems(Hardware and software) one for each Solar PV Plant, for plant control and monitoring shall be provided with the following features suitable Computers: Desktop Computer 3 GHz Pentium i7 latest (3MB Cache) with 500 GB HDD, 4 GB RD RAM, 2 Parallel & 2 Serial Port, Wi-Fi Lan Card, DVD RW Drive, 20" LED Display, USB Scroll Mouse, along with All in one 1200 dpi/12 ppm Desktop LaserJet printers along with a 1 KVA on-line ups with 1 hour battery backup.

c. Remote Supervisory Control and data acquisition through SCADA software at the purchaser location through Handheld device /GSM cellular device with latest software/hardware configuration and service connectivity for online/real time data monitoring/control complete to be supplied and operation and maintenance /control to be ensured by the Contractor.

d. All major parameters should be available on the digital bus and logging facility for energy auditing through the internal microprocessor and can be read on the digital LCD/LED front panel at any time the current values, previous values for up to a month and the average values. The following parameters should be accessible via the operating interface display:

- AC Voltage
- AC Output current
- Output Power
- DC Input Voltage
- DC Input Current
- Time Active
- Time disabled
- Time Idle
- Temperatures (C)
- Inverter Status

1.9. Disconnection and islanding

Disconnection of the PV generator in the event of loss of the main grid supply is to be achieved by in built protection within the power conditioner. This may be achieved through rate of change of current, phase angle, unbalanced voltage or reactive load variants. Operation outside the limits of power quality as described in the technical data sheet should cause the power conditioner to disconnect the grid. Additional parameters requiring automatic disconnection are:

- Neutral voltage displacement
- Over current
- Earth fault
- Reverse power

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In case of the above, tripping time should be less than 0.5 seconds. Response time in case of grid failure due to switch off or failure based shut down should be well within 5 seconds.

Automatic re - connection after the grid failure is restored

INVERTER shall have facility to reconnect the Inverter automatically to the grid following restoration of grid, subsequent to grid failure condition. The system should have integrated SCADA and software or plant control and remote communication with web monitoring to monitoring individual strings and complete power plant.

1.10. ARRAY JUNCTION BOX, MAIN JUNCTION BOXES WITH STRING MONITORING FEATURE TO THE INVERTER:

The junction boxes are to be provided in the PV yard for termination of connecting cables. The Junction Boxes shall be made of FRP/Powder Coated Aluminum with full dust, water & vermin proof arrangement. All wires/cables must be terminated through cable lugs. The JBs shall be such that input & output termination can be made through suitable cable glands.

- Copper bus bars/terminal blocks housed in the junction box with suitable termination
- Threads
- Confirming to IP65 (for outdoor)/ IP 21 (for indoor) standards and IEC 62208
- Hinged door with EPDM rubber gasket to prevent water entry.
- Single compression cable glands.
- Provision capacity MOVs provided within the box to protect against lightening.

1.11. ENERGY METER

A 3-Phase, 20-60 A Energy Meter shall be provided as approved by SBI/PMC in charge to measure the quantum of energy. Meter must be provided with the necessary data cables. Energy Meter should be 0.5 Class of accuracy.

1.12. DC DISTRIBUTION BOARD:

Each Solar PV Plant shall have its separate DC Distribution panel to receive the DC output from the array field with analog measurement meter for voltage, current and power from different MJBs so as to check any failure in the array field.

DCDBs shall be dust & vermin proof. The bus bars are to be made of copper of desired size. Suitable capacity MCBs/MCCBs to be provided for controlling the DC power output to the INVERTER along with necessary surge arrestors.

1.13. AC DISTRIBUTION PANEL BOARD

Each plant shall be supplied with its dedicated AC Distribution panel which shall be located at an appropriate location in the building itself. ACDBs are to be provided at the cable terminating points emanating from the inverters. The AC power from inverter of each individual Solar PV Plant shall be fed into its dedicated AC Distribution panel. Thereafter, the outputs shall be terminated into the main LT supply.

AC Distribution Panel Board (DPB) shall control the AC power from inverter and should have necessary surge arresters. Interconnection from ACDB to mains at LT bus bar is to be carried out and complete equipment along with metering to be

installed in the ACDB.

Panel type: Wall mounting type & CRCA 2.5 mm thick with IP 32 protection Cable Gland suitable to Incoming & out going cable

1.14. SOLAR CABLES:

- Solar cables of suitable size & cross section shall be provided for the interconnection purpose in photovoltaic power generation. Solar cables shall interconnect solar panels and other electrical components of the photovoltaic system. Solar cables shall be UV resistant and weather resistant. Solar cables shall withstand a large temperature rangefrom -40°C to
  +90°C ambient and shall be generally laid outside.
- Solar cables shall be Tinned Copper XLPO insulated & LSZH sheathed suitable for 1100 VAC/ 1800 VDC.
- All cable tests and methods should confirm to IEC 60189 or other relevant standards.
- Cabling in the yard shall be carried out as per IE rules. All other cabling above ground should be suitably mounted on cable trays with proper covers.
- The size of cable for connecting module to terminal box, terminal box to panel junction box, panel junction box to array junction box and array junction box to PCU to Battery Bank/ACDB shall be as per site requirement. The decision of PMC/Engineer in charge shall be final.
- Cables ends: All connections are to be made through suitable cable/lug/terminals; crimped properly & with use of cable glands.
- Multi Strand, Annealed high conductivity copper conductor
- PVC type ‘A’ pressure extruded insulation
- Overall PVC insulation for UV protection and confirm to IEC 69947.
- Armored cable for underground laying
- Selected cable should carry a current density of minimum 1.2 Amp/Sq.mm
- All electrical/wires inside the building to be fixed in Rigid Steel Conduit for wiring inside the building.
- The cable's insulation must be able to withstand thermal and mechanical loads.
- The insulation and jacket materials shall be extremely resistant to weathering, UV-radiation and abrasion. Additionally, solar cables shall be salt water resistant and resistant to acids and alkaline solutions. Solar cables shall be suitable for fixed installation as well as for moving applications without tensile load. These solar cables shall be especially designed for outdoor use for withstansing direct sun radiation and air humidity. Cables should be halogen free flame retardant and made of cross-linked jacket material. The solar cables shall also be installed in dry and humid conditions indoors.
- For laying/termination of cables, latest BIS/IEC codes/ standards to be followed.

1.15. FIRE EXTINGUISHERS:

- The firefighting system for the fire protection of solar power plants shall be consisting of:
- CO2 type 4.5 kg fire extinguishers in the control room for fire caused by electrical short circuits.

- Sand buckets in the control room. The installation of fire Extinguishers should confirm to TAC regulations and BIS standards. The fire extinguishers shall be provided in the control room housing the batteries and PCUs.

1.16. LIGHTENING PROTECTION

There shall be required number of suitable lightening arrestors installed in the array field.

1.16.1. EARTHING PROTECTION

Each array structure of the PV yard should be grounded properly. In addition the lightening arrester/masts should also be provided inside the array field. Provision should be kept for shorting and grounding of the PV array at the time of maintenance work. All metal casing/shielding of plant should be thoroughly grounded in accordance with Indian Electricity Act. /IE Rules. Earth resistance should be tested in presence of the representative of PMC / Engineer in charge.

1.16.2. DANGER BOARDS

Danger board should be provided as and where necessary as per IE act/IE rules as amended up to date.

IMPORTANT INDIAN STANDARDS

CODES OF PRACTICE GUIDE

Sl.No.	Standard	Title	Reaffirm Date	Amdt.
(1)	IS 732:1989	Code of practice for electrical wiring installations (third revision)	March 2010	
(2)	IS 4648:1968	Guide for electrical layout in residential buildings	August 2012	
(3)	IS 8061:1976	Code of practice for design, installation and maintenance of service lines upto and including 650 V	March 2011	
(4)	IS 8884:1978	Code of practice for the installation of electric bells and call systems	August 2012	
(5)	IS 5578:1984/ IEC 60391 (1972)	Guide for marking of insulated conductors (first revision)	March 2011	
(6)	IS 11353:1985/ IEC 60445 (1973)	Guide for uniform system of marking and identification of conductors and apparatus terminals	July 2012	
(7)	IS 13234:1991/ IEC 60909: 1988	Guide for short circuit current calculations in three-phase ac systems (superseding IS 5728)	August 2012	

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(8)	IS 7752 (Part 1): 1975	Guide for improvement of power factor in consumer installation: Part 1 Low and medium supply voltages	March 2011	
(9)	IS 3646 (Part 1): 1992	Code of practice for interior illumination: Part 1 General requirements and recommendations for working interiors (first revision)	March 2008	
(10)	IS 3646 (Part 2): 1966	Code of practice for interior illumination: Part 2 Schedule of illumination and glare index	March 2008	
(11)	IS 3646 (Part 3): 1968	Code of practice for interior illumination: Part 3 Calculation of coefficients of utilization by the BZ method	March 2008	
(12)	IS 4347:1967	Code of practice for hospital lighting	May 2010	
(13)	IS 6665:1972	Code of practice for industrial lighting	May 2010	
(14)	IS 2672:1966	Code of practice for library lighting	May 2010	
(15)	IS 10118 (Part 1):1982	Code of practice for selection, installation and maintenance of switchgear and controlgear: Part 1 General	March 2011	
(16)	IS 10118 (Part 2):1982	Code of practice for selection, installation and maintenance of Switchgear and controlgear: Part 2 Selection	March 2011	
(17)	IS 10118 (Part 3):1982	Code of practice for selection, installation and maintenance of switchgear and controlgear: Part 3 Installation	March 2011	
(18)	IS 10118 (Part 4):1982	Code of practice for selection, installation and maintenance of switchgear and controlgear: Part 4 Maintenance	March 2011	
(19)	IS 4146:1983	Application guide for voltage transformers (fi rst revision)	September 2011	
(20)	IS 4201:1983	Application guide for current transformers (fi rst revision)	September 2011	
(21)	IS 5547:1983	Application guide for capacitor voltage transformers (first revision)	September 2011	
		Code of practice for protection of buildings and allied		

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(22)	IS 2309:1989	structures against lightning (second revision)	March 2010	1
(23)	IS 3043:1987	Code of practice for earthing	March 2011	2
(24)	IS 5216 (Part 1):1982	Recommendations on safety procedures and practices in electrical work: Part 1 General (fi rst revision)	March 2010	
(25)	IS 5216 (Part 2):1982	Recommendations on safety procedures and practices in electrical work: Part 2 Life saving techniques (fi rst revision)	March 2010	

ELECTRIC FANS

CODES OF PRACTICE GUIDE

Sl.No.	Standard	Title	Reaffirm Date	Amdt.
(1)	IS 555:1979	Electric table type fans and regulators (third revision)	July 2010	2
(2)	IS 1169:1967	Electric pedestal type fans and regulators (first revision)	Mar 2009	6
(3)	IS 374:1979	Electric ceiling type fans and regulators (third revision)	September 2010	6
(4)	IS 2997:1964	Air circulator type electric fans and regulators	July 2010	8
(5)	IEC: 60665 (1981) IS 2312:1967	Propeller type ac ventilating fans (first revision) Draft Standard issued in wide circulation	July 2010	8
(6)	IS 3588:1987	Electric axial flow fans (first revision)	August 2009	1
(7)	IS 3963:1987	Roof extractor units (first revision)	August 2009	3
(8)	IS 4283:1981	Hot air fans (first revision)	August 2009	3
(9)	IS 6272:1987	Industrial cooling fans (man coolers) (fi rst revision)	August 2009	2
(10)	IS 4894:1987	Centrifugal fans (first revision)	August 2009	3
(11)	IS 11037:1984	Electronic type fan regulators	August 2010	3
(12)	IS 12155:1987	General and safety requirements for fans and regulators for household and similar purposes		

LOW VOLTAGE SWITCH GEAR AND CONTROL GEAR

CODES OF PRACTICE GUIDE

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Sl.No	Standard	Title	Reaffirm Date	Amdt.
(1)	IS 4237:1982	General requirements for switchgear and controlgear for voltages not exceeding 1000 volts ac or 1200 volts dc (first revision) [superseded by IS 13947 (Part 1):1993]		
(2)	IS 6875 (Part 1): 1973	Control switches (switching devices for control and auxiliary circuits including contactor relays) for voltages upto and including 1000 V ac & 1200 V dc: Part 1 General requirements [superseded by IS 13947 (Part 5/Section 1)]		
(3)	IS 6875 (Part 2): 1973	Control switches (switching devices for control and auxiliary circuits including contactor relays) for voltages upto and including 1000 V ac and 1200 V dc: Part 2 Push-buttons and related control switches [Superseded by IS 13947 (Part 5/Section1)]		
(4)	IS 6875 (Part 3): 1980	Control switches (switching devices for control and auxiliary circuits including contactor relays) for voltages upto and including 1000 V ac and 1200 V dc: Part 3 Rotary control switches [superseded by IS 13947 (Part 5/ Section 1)]		
(5)	IS 10027:2000	Composite units of air-break switches and rewirable type fuses for voltages not exceeding 650 volt ac - Specifi cation (first revision)	March 2010	
(6)	IS 4064 (Part 1): 1978	Air-break switches, air break disconnectors, air-break switch disconnectors and fuse-combination units for voltages not exceeding 1000 V ac or 1200 V dc: Part 1 General requirements (revised) [superseded by IS 13947		

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		(Part 3): 1993]		
(7)	IS 2675:1983	Enclosed Distribution Fuse Boards and Cut Outs for voltages not exceeding 1000 V A.C. or 1200 V D.C.	March 2011	
(8)	IS 8828:1996	Circuit-breakers for over current protection for household and similar installations (second revision)		
(9)	IS 13032:1991	Miniature circuit breaker boards for voltage upto and including 1 000 Volt ac	March 2011	1
(10)	IS 12640 (Part 1): 2008	Residual current operated circuit-breakers for household and simililar uses: Part 1 circuit-breakers without integral over current protection (RCCBs) (First Revision)		
(11)	IS 12640 (Part 2): 2008	Residual current operated circuit-breakers for household and similar uses: Part 2 circuit breakers with integral over current protection (RCBOs) (First Revision)		
(12)	IS 2959:1985	Contactors for voltages not exceeding 1000 V ac or 1200 V dc (fi rst revision) [superseded by IS 13947 (Part 4/ Section 1)]		
(13)	IS 12021:1987	Specifi cation for control transformers for switchgear and controlgear for voltages not exceeding 1000 Volt AC	March 2010	2
Sl.No.	Standard	Title	Reaffirm Date	Amdt.
(14)	IS 5039:1983	Distribution pillars for voltages not exceeding 1000 volts (first revision)	March 2011	2
(15)	IS 8623 (Part 1): 1993/ IEC 60439-1 (1985)	Specifi cation for low voltage switchgear and controlgear assemblies: Part 1 Requirements for type-tested and partially type tested assemblies (first revision).	March 2008	2
(16)	IS 8623 (Part 2):1993/	Specifi cation for low voltage switchgear and controlgear assemblies: Part 2 Particular requirements for busbar	March 2008	2

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	IEC 60439-2 (1987)	trunking systems (busways)-(first revision)		
(17)	IS 8544 (Part 1): 1977	Motor starters for voltages not exceeding 1000 V: Part Direction line ac starters [superseded by IS 13947 (Part 4/Section 1): 1993]		2
(18)	IS 8544 (Part 2): 1977	Motor starters for voltages not exceeding 1000 V: Part 2 Star-delta starters [superseded by IS 13947 (Part 4/ Section 1): 1993]		
(19)	IS 8544 (Part 3/ Sec 1): 1979	Motor starters for voltages not exceeding 1000 V: Part 3 Rheostatic motor starters, Section 1 General requirements [superseded by IS 13947 (Part 4/Section 1): 1993]		
(20)	IS 8544 (Part 4): 1979	Motor starters for voltages not exceeding 1000 V: Part 4 Reduced voltage ac starters: two step auto-transformer starters [superseded by IS 13947 (Part 4/Section 1): 1993]		

POWER CABLE

CODES OF PRACTICE GUIDE

Sl.No.	Standard	Title	Reaffirm Date	Amdt.
(1)	IS 694:1990/ IEC 60227- 1 to 5 (1979)	PVC Insulated cables for working voltages upto and including 1100 V	February 2010	5
(2)	IS 694: 2010	Polyvinyl chloride insulated sheathed and unsheathed cables with rigid and flexible conductor for rated voltages upto and including 450/750 V: Part 1 General requirements (fourth revision)		1
(3)	IS 1554 (Part 1): 1988/ IEC 60502 (1983)	PVC insulated (heavy duty) electric cables: Part 2 For working voltages upto and including 1100 V (Third revision)		
(4)	IS 3961 (Part 1):	Recommended current ratings for cables:	November 2011	

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	1967	Part 1 Paper insulated lead sheathed cables		
(5)	IS 4288:1988	PVC insulated (heavy duty) electric cables with solid aluminium conductors for voltages upto and including 1100 V (second revision) (withdrawn)		
(6)	IS 4289 (Part 1): 1984/ IEC 60245-5	Flexible cables for lifts and other flexible connections: Part 1 Elastomer insulated cables (first revision)		

ELECTRIC WIRING ACCESSORIES

CODES OF PRACTICE GUIDE

Sl.No.	Standard	Title	Reaffirm Date	Amdt.
(1)	IS 9537 (Part 1): 1980/ IEC 60614-1 (1978)	Conduits for electrical installations: Part 1 General Requirements	November 2010	(1)
(2)	IS 9537 (Part 2): 1981	Conduits for electrical installations: Part 2 Rigid steel conduits (superseding IS:1653)	May 2012	(2)
(3)	IS 3480:1966	Flexible steel conduits for electrical wiring	May 2012	(1)
(4)	IS 2667:1988	Fittings for rigid steel conduits for electrical wiring (first revision) [Superseded by IS 14768 (Part 2): 2003]	February 2008	
(5)	IS 3837:1976	Accessories for rigid steel conduits for electrical wiring (first revision)	May 2012	(1)
(6)	IS 9537 (Part 4): 1983	Conduits for electrical installations: Part 4 Pliable self- recovering conduits of insulating materials	May 2012	
(7)	IS 9537 (Part 5): 2000/ IEC 60614-2-3 (1990)	Conduits for a electrical installations: Part 5 Pliable conduits of insulating material [Superseding IS 6946]	June 2010	
(8)	IS 3419:1989	Fittings for rigid non-metallic conduits (second revision)	May 2012	
	IS 14772:2000/	Enclosures for accessories for household and similar		

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(9)	IEC 60670-1 (1989)	fixed electrical installations [Superseding IS 5133 (Part 1 and 2)]	May 2010	
(10)	IS 2412:1975	Link clips for electrical wiring (first revision)	May 2012	(2)
(11)	IS 371:1999	Ceiling roses (third revision)	March 2010	(4)
(12)	IS 3854:1997/ IEC 60669-1 (1998)	Switches for domestic and similar purposes (second revision)	July 2012	(6)
(13)	IS 4615:1968	Switch-socket outlets (non-interlocking type) (Withdrawn)		
(14)	IS 4160:2005/ IEC 60884-2-6 (1997)	Interlocking switch socket outlets - Specification (first revision)	June 2010	
(15)	IS 1293:2005/ IEC 60884-1 (2002)	Plugs and socket outlets of rated voltage upto and including 250 volts and rated current upto and including 16 amperes - Specification (third revision)	June 2010	(5)

ELECTRICAL LAMPS AND THEIR AUXILIARIES

CODES OF PRACTICE GUIDE

Sl.No.	Standard	Title	Reaffirm Date	Amdt.
(1)	IS 418:2004/ IEC 60064 (1993)	Tungsten filament lamps for domestic and similar general lighting purposes (fourth revision)	March 2009	(4)
(2)	IS 2418 (Part 1): 1977/ IEC 81 (1974)	Tubular fluorescent lamps for general lighting service: Part 1 Requirements and tests (first revision)	December 2010	(8)
(3)	IS 9900 (Part 1): 1981 / IEC 188 (1974)	High pressure mercury vapour lamps: Part 1 Requirements and test [Superseding IS 2183 and IS 7023]	October 2012	(4)
(4)	IS 9974 (Part 1): 1981/	High pressure sodium vapour lamps: Part 1 General requirements and tests	October 2012	(4)

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	IEC 662 (1980)			
(5)	IS 1258:2005/ IEC 61184 (1997)	Bayonet lamp holders (fourth revision)	June 2010	(3)
(6)	IS 3323:1980/ IEC 60400 (1972)	Bi-pin fluorescent lamp holders for tubular lamps (first revision)	October 2012	(1)
(7)	IS 3324:1982/ IEC 400 (1972)	Holders for starters for tubular fluorescent lamps (first revision)	June 2008	
(8)	IS 2215:2006/ IEC 60155 (1993)	Starters for fluorescent lamps (third revision)	Jun 2010	
(9)	IS 1534 (Part 1): 1977 / IEC 82 (1973)	Ballasts for fluorescent lamps: Part 1 For switch start circuits (second revision)	July 2011	(5)
(10)	IS 1569:1976/ IEC 566	Capacitors for use in tubular fluorescent	July 2011	(1)
(11)	IS 6616:1982/ IEC 262 (1969)	Ballasts for high pressure mercury vapour Lamps (first revision)	July 2011	(1)

LIGHT FITTINGS AND LUMINAIRES

CODES OF PRACTICE GUIDE

Sl.No.	Standard	Title	Reaffirm Date	Amdt.
(1)	IS 1913 (Part 1): 1978	General and safety requirements for luminaires: Part 1 Tubular fluorescent lamps (second revision)		
(2)	*IS 10322 (Part 1):1982 / IEC 598 - 1(1979)	Luminaires: Part 1 General requirements	May 2010	
	IS 10322 (Part 2):	Luminaires: Part 2 Constructional Requirements		

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(3)	1982 / IEC 598 - 1(1979)		May 2010	

CODES OF PRACTICE GUIDE

Sl.No.	Standard	Title	Reaffirm Date	Amdt.
(4)	IS 10322 (Part 5/ Sec. 2):2012	Luminaires: Part 5 Particular requirements, Sec 2 Recessed luminaires (First Revision)	March 2012	
(5)	IS 10322 (Part 5/ Sec. 3):2012/ IEC 60598-2-3 (1979)	Luminaires: Part 5 Particular requirements, Sec 3 Luminaires for road and street lighting (First revision)	March 2012	
(6)	IS 10322 (Part 5/ Sec 4):1987/ IEC 60598-2-4 (1979)	Luminaires: Part 5 Particular requirements, Section 4 Portable general purpose	May 2010	1
(7)	IS 10322 (Part 5/ Sec 5):1987/ IEC 60598-2-5	Luminaires: Part 5 Particular requirements, Section 5 Flood lights [superseding IS 1947]	May 2010	(1)
(8)	IS 3287:1965	Industrial lighting fittings with plastic reflectors		
(9)	IS 1777:1978	Industrial luminaires with metal reflectors (first revision)		
(10)	IS 2206 (Part 1): 1984	Flameproof electric lighting fittings: Part 1 Well-glass and bulkhead types (first revision)		
(11)	IS 3528:1966	Waterproof electric lighting fittings	May 2010	
(12)	IS 3553:1966	Watertight electric lighting fittings	May 2010	
(13)	IS 8030:1976/ IEC 162 (1972)	Luminaires for hospitals	March 2008	
(14)	IS 7537:1974	Road traffic signals	March 2008	
(15)	IS 9583:1981/ IEC 598-2-22	Emergency lighting units	March 2008	

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	(1980)/ EN 60598-2-22 Luminaires – Part 2-22,			

ELECTRICAL APPLIANCES

CODES OF PRACTICE GUIDE

Sl.No.	Standard	Title	Reaffirm Date	Amdt.
(1)	IS 302 (Part 1): 2008/ IEC 60335-1 (2006)	Safety of household and similar electrical appliances: Part 1 General requirements (sixth revision)		(1)
(2)	IS 2268:1994	Electric call bells and buzzers for indoor use (second revision)	March 2009	
(3)	IS 3412:1994	Electric water boilers (second revision)	March 2009	

ELECTRICAL INSTRUMENTS

CODES OF PRACTICE GUIDE

Sl.No.	Standard	Title	Reaffirm Date	Amdt.
(1)	IS 6236:1971/ IEC 60258 (1968)	Direct recording electrical measuring Instruments	January 2010	
(2)	IS 1248(Part 1): 2003/ IEC 600 51-1 (1997)	Direct acting indicating analogue electrical measuring instruments and their accessories: Part 1 General requirements (fourth revision)	Sep 2008	
(3)	IS 1248(Part 2): 2003/ IEC 600 51-2 (1984)	Direct acting indicating analogue electrical measuring instruments and their accessories: Part 2 Ammeters and voltmeters (third revision)	Aug 2008	
(4)	IS 1248(Part 3): 2003/ IEC 600 51-3 (1984)	Direct acting indicating analogue electrical measuring instruments and their accessories: Part 3 Wattmeters and varmeters (third revision)	Aug 2012	
	IS 1248(Part 4):	Direct acting indicating analogue electrical measuring		

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(5)	2003/ IEC 600 51-4 (1984)	instruments and their accessories: Part 4 Frequency meters (third revision)	Aug 2008	
(6)	IS 1248 (Part 5): 2003/ IEC 600 51-5 (1984)	Direct acting indicating analogue electrical measuring instruments and their accessories: Part 5 Phase meters, power factor meters and synchroscope (third revision)	Aug 2008	
(7)	IS 722(Part 1): 1998	AC electricity meters: General requirement and tests		
(8)	IS 722 (Part 2): 1977	AC electricity meters: Part 2 Single-phase whole-current watt-hour meters, Class 2 (first revision)		
(9)	IS 722 (Part 3): 1988	AC electricity meters: Part 3 Three-phase whole current and transformer operated and single-phase transformer operated watt-hour meters, class 2 (second revision)		
(10)	IS 722 (Part 5): 1980	AC electricity meters: Part 5 Volt-ampere hour meters for restricted power factor range, class 3.5 (first revision)		
(11)	IS 722 (Part 7/Sec 1): 1987	AC electricity meters: Part 7 Volt-ampere hour meters for full power factor range, Section 1 General requirements (first revision)		
(12)	IS 722 (Part 8): 1972	AC electricity meters: Part 8 Single-phase 2-wire whole current watt-hour meter (class 1.0)		
(13)	IS 722 (Part 9): 1972	AC electricity meters: Part 9 Three-phase whole current and transformer operated watt-hour meters and single- phase two-wire transformer operated watt-hour meters (class 1.0)		
(14)	IS 8530: 1977	Maximum demand indicators (class 1)		
	IEC 60211:1966 *IS 2992:1987	Insulation resistance testers, hand operated (magneto		

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(15)		generator type) (second revision)	Jan 2010	

INSTRUMENT TRANSFORMERS

CODES OF PRACTICE GUIDE

Sl.No.	Standard	Title	Reaffirm Date	Amdt.
(1)	IS 2705 (Part 1): 1992/ IEC 60185 (1966)	Current transformers: Part 1 General requirements (second revision)	Aug 2012	(1)
(2)	IS 2705 (Part 2): 1992/ IEC 60185 (1966)	Current transformers: Part 2 Measuring current transformers (second revision)	Aug 2012	
(3)	IS 2705 (Part 3): 1992/ IEC 60185 (1966)	Current transformers: Part 3 Protective current transformers (second revision)	Aug 2012	
(4)	IS 2705 (Part 4): 1992/ IEC 60185 (1966)	Current transformers: Part 4 Protective current transformers for special purpose applications (second revision)	Aug 2012	
(5)	IS 6949:1973	Summation current transformers	Sep 2011	

FUSES

CODES OF PRACTICE GUIDE

Sl.No.	Standard	Title	Reaffirm Date	Amdt.
(1)	IS 9224 (Part 1): 1979	Low voltage fuses: Part 1 General requirements [superseded by IS 13703 (Part 1):1993]		
(2)	IS 9224 (Part 2): 1979	Low voltage fuses: Part 2 Supplementary requirements for fuses for industrial applications (superseding IS 2208) [superseded by IS 13703 (part 2/Section 1):1993]		
(3)	IS 2086:1993	Carriers and bases used in rewirable type electric fuses for voltages upto 650 V (third revision) [Superseding IS	Mar 2009	(1)

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		8724]		
(4)	IS 9926:1981	Fuse wires used in rewirable type electric fuses upto 650 volts	Mar 2011	
(5)	IS 8187:1976/ IEC 269-3 (1973)	D-type fuses		

MISCELLANEOUS

CODES OF PRACTICE GUIDE

Sl.No.	Standard	Title	Reaffirm Date	Amdt.
(1)	IS 2551:1982	Danger notice plates (first revision)	Mar 2010	
(2)	IS 2448 (Part 1): 1963	Adhesive insulating tapes for electrical purposes: Part 1 Tapes with cotton textile substrates	Oct 2010	(5)

ELECTROTECHNICAL VOCABULARY

CODES OF PRACTICE GUIDE **Date** **Amdt**

Sl.No.	Standard	Title	Reaffirm Date	Amdt.
(1)	IS 1885 (Part 1): 1961	Electrotechnical vocabulary: Part 1 Fundamental Defi nitions	Jul 2012	(2)
(2)	IS 1885 (Part 9): 1992/ IEC 60050 (446):1983	Electrotechnical Vocabulary: Part 9 Electrical relays (second revision)	Jul 2012	
(3)	IS 1885 (Part 11): 1966	Electrotechnical vocabulary: Part 11 Electrical Measurements	Jul 2012	
(4)	IS 1885 (Part 16/	Electrotechnical vocabulary: Part 16 Lighting,	Jul 2012	

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	Sec 1):1968	Section 1 General aspects		
(5)	IS 1885 (Part 16/ Sec. 2):1968	Electrotechnical vocabulary: Part 16 Lighting, Section 2 General illumination, lighting fittings and lighting for traffic and signaling	Jul 2012	
(6)	IS 1885 (Part 16/ Sec. 3):1967	Electrotechnical vocabulary: Part 16 Lighting, Section 3 Lamps and auxiliary apparatus	Jul 2012	
(7)	IS 1885 (Part 17): 1979	Electrotechnical vocabulary: Part 17 Switchgear and controlgear (fi rst revision)	Jul 2012	
(8)	IS 1885 (Part 32):1993/ IEC 60050 (461): 1984	Electrotechnical Vocabulary: Part 32 Electric cables (first revision)	Mar 2009	

SAFETY

CODES OF PRACTICE GUIDE

Sl.No.	Standard	Title	Reaffirm Date	Amdt.
(1)	IS 4770:1991	Rubber Gloves for electrical purposes		
(2)	IS 5424:1969	Rubber mats for electrical purpose (Superseded by IS 15652:2006)	April 2011	(2)

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CHAPTER- H

TECHNICAL SPECIFICATION - LIFTS

1. GENERAL

The scope of work shall cover design, supply delivery, installation, testing and commissioning of passenger lifts/ passenger cum bed lifts/Service lifts. All lifts shall be VVVF operated, gearless, Central opening and with Machine room less. The Lifts shall be with facility for duplex/triplex seclective/collective operation. Car enclosure fininsh shall be SS (as per OEM) scratch proof moonrock/honeycomb. SS handrail not less than 600mm long at 900mm above floor level , to be provided inside the lift car as per requirement. Suitable lights and fans as per requirement shall be provided. Lift car size, Lift well size, Lift pit overhead, entrance width, car height etc. shall be as per NBC 2016 or OEM standards. The dimensions of Lift well shown in tender drawings are only indicative and EPC Contractor shall provide the same as required by OEM. The scope of work shall also include the following item of civil works.

a) Necessary scaffolding temporary barricade in the hoist way required during the erection of the elevators.

b) Minor building work comprising of cutting holes and making good the car and counterweight rail brackets, hall buttons and indicators including laying of sills in position.

c) Steel items such as machine beams, bearing plates buffer support channels, sill angles and fascia plates etc.

d) Suitable trap doors with steel chequered plate covers.

e) Providing and install a suitable vertical iron ladder for access to the pit.

f) Fire Lift shall have UPS with 15 minute battery backup as per Bill -22, HLA-2020.

g) Lift Shaft Shall be provided with LED Bulkhead Light, Light point & Power Socket with Switch at each floor as per CPWD Norms

h) Entire Shaft shall run with 2Runs of Suitable Earth Flat as per OEM requirements & CPWD Norms

i) Necessary Distribution Board as per OEM requirements & CPWD Norms

j) Any other item required for successful completion and commissioning of lifts. (including the hoisting beam in the machine room)

The work shall be done in accordance with regulations of any local code and following ISI codes which govern the requirements of installations.

- IS: 1860-1980 code of practice for installation, operation and maintenance of Electric Passenger and Goods Lifts.
- IS: 3534-1976 Outline dimensions of Electric Lifts.
- IS: 4666-1980 Specifications for Electric passenger and Goods Elevators.
- Indian Electricity Act 1910.
- Indian Electricity Rules, 1956.

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The lift motor shall be controlled by a variable voltage variable frequency (V.V.V.F.) micro- processor control system which shall control and monitor every aspect of lift operation at all stages of the car motion cycle on real time basis. Variable voltage variable frequency drive system (with close loop) shall be used.

2. SHOP DRAWINGS AND APPROVAL OF ELECTRICAL INSTALLATIONS:

The selected tenderer shall prepare a furnish shop drawings for approval by The Client, such shop drawings shall be based on the Architectural drawings and requirements laid down in specifications, local laws and regulations etc.The detailed drawings shall be submitted within one month of placement of order. The successful tenderer shall obtain the approval of electrical Inspector and other local authorities as per requirements before submitting the drawings to Client/ Engineer. The Contractor shall not proceed with in installation work till the drawings are approved by the PMC/Engineer in charge.

Approval of Contractor's drawings shall not absolve the Contractor of any of his obligations to meet the requirements of specification under this contract

Five sets of completion drawings operation manual, maintenance manual, spare parts details shall be submitted to the Client/ Engineer after completion of work.

3. GUARANTEE

The Contractor shall guarantee the equipment against all defects of materials and workmanship for a period as mentioned in the Tender from the date of Handing over of the equipment as certified by the owner. Any defects arising during the guarantee period shall be rectified and replaced by the tenderer, at his own expense, to the satisfaction of the Client.

4. PERMITS, INSPECTION & LICENSE FEE

The Contractor shall arrange all necessary local, provincial or national government permit/License and shall make arrangements for inspection and tests required thereby. Expenses to be borne by EPC Contractor.

5. POWER SUPPLY

The apparatus shall be designed to operate on 415 + 10% - 20% Volts, 3 Phase, 4 wires, 50 Hz A.C. Supply for illumination signal equipment shall be 240 Volts single phase 50Hz A.C.

6. ELECTRICAL WIRING

The necessary A.C. supply of 3 Phase, 415 Volts 50 HZ shall be made available in the main control switch unit to be provided by the Contractor. All the electrical works beyond the main supply switch shall be carried out by the Contractor i.e. supply and installations of panels for drive motors, switches and control complete with wiring as per system requirement and approval of the Engineer.

The wiring shall be carried out strictly in accordance with Indian Electricity Rules and Indian code of Practice for Electrical Wiring Installation IS-732-1963 System Voltage not exceeding 650 V).

The cable and conduits to be used shall be of suitable size and grade confirming to relevant IS specification. Wiring for LT switchboard to the motor terminal shall be with heavy duty 1.1 KV grade XLPE insulated PVC sheathed, FRLS aluminium cable. All the trailing cables used for control and safety device shall confirm to IS: 4289-1967, Specifications for lifts cables. The trailing cable circuits for controls, safety devices, lighting and signaling shall be separate and distinct.

Power wiring between controller and main board to various landings shall be drawn in suitable size heavy gauge conduit stove enameled/painted confirming to I.S specifications.

The Voltage and frequency of the supply shall be subjected to variations permissible under Indian Electricity Acts and Rules.

7. CAR FRAME:

The car frame, which supports the car platform and enclosures, shall be made of structural steel and equipped with suitable guides and a car safety device mounted underneath the car platform. The hoist ropes shall include adjustable self/ aligning hinges. The car shall be so mounted on the frame that vibration and noise transmitted to the passenger is minimized.

8. CAR SAFETY AND GOVERNER:

Suitable car safety to stop the car whenever excessive descending speed is attained shall be operated by a centrifugal speed governor connected to the governor through a continuous steel rope.

The governor shall be provided with self tensioning device to keep governor rope in proper tension even after rope stretch. Suitable means shall be supplied to cut off power from the motor and apply the brake on application of the safety.

9. COUNTER BALANCE:

A Suitable guided structural steel frame with appropriate filler weights of cast iron shall be furnished to promote smooth and economic operation.

10. TERMINAL AND FINAL LIMITS:

Terminal limit switches shall be provided to slow down and stop the car automatically at the terminal landings within permissible over travel and final limit switches shall be provided to automatically cut off the power and apply the brake, should the car travel beyond the permissible over travel. They shall act independently of the operating devices and buffers.

11. TERMINAL BUFFERS:

Heavy duty spring buffers shall be installed as a means of stopping the car and counterweight at the extreme limits of travel. Buffers in the pit shall be mounted on steel channels which shall extend between both the car and counterweight rails.

12. **CONTROLLER:**

A Controller shall be provided to control starting stopping and speed of the elevator motor and also be automatically able to apply the brake if any of the safety devices operate or if power fails from any cause. In case of power failure and again restore of power the lift shall land to next floor and shall not go to basement/lowest level. Suitable software/hardware or rescue device shall be provided.

13. REVERSE PHASE RELAY:

A reverse phase relay shall be provided on the controller which is designed to protect the lift equipment against phase reversal and phase failure.

14. GUIDES:

Machined steel tee guides shall be furnished for the car and counterweight. The guide rails should be of steel solid and shall have tongued and grooved joints. Sliding clips shall be used for fastening the guides to allow building settlement without distorting the guide rails. To keep down the noise level and to reduce wear and tear of the sections, only Nylon Ribs shall be used in the guide shoes, after smoothening of the rails. The flanges shall be machined for the fish plate mounting such that rail alignment at joints almost remain constant.

15. FOUNDATIONS:

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The machine shall be placed directly above the hoist way upon the machine room slab or as per design.

16. ROPES:

The elevator shall be provided with traction steel ropes. Steel wire rope having a tensile strength of not less that 12.5 Ton/cm^2 of good flexibility shall be used for lift. The lift rope shall confirm to IS: 14665 – (Part-4- Sec-8):2001.

17. MACHINE:

The machine shall be gearless type.

18. BRAKE:

The direct current brake shall be spring applied and electrically released and designed to provide smooth stop under variable loads. The brake should be capable of operation automatically by various safety devices, current failure, and by normal stopping of car. It should be possible to release the brake manually, such releases brake manually, such releases requiring the permanent application of manual force so as to move the lift car in short sties. For this purpose one set of brake release equipment shall be supplied.

19. MOTOR:

The motor shall be suited to the service proposed and arranged for adequate lubrication. The motor shall be class F insulation and one (1) hour rated squirrel cage induction type having high starting torque. It shall also be provided with Thermisters embedded in the stator windings for the highest degree of thermal motor protection.

20. CONTROL

The control shall be variable voltage variable frequency A.C. variable voltage, closed loop control system using solid state devices and electronic speed pattern generator to command the motor from a velocity transducer and load compensation circuits for a comfortable ride.

In Normal operation, the electromagnetic brake shall only be applied when the lift has come to a complete standstill. The brake shall only be meant for holding the lift in position at every landing, providing stopping without any jerking effect.

Each controller cabinet containing memory equipment shall be properly shielded from the pollution.

21. MICROPROCESSOR

The control shall employ a microprocessor working on a program such that precision leveling and highly efficient handling of passengers for least possible waiting and reduced travel time is ensured. The microprocessor system should be designed to accept programming with minimum downtime. It should be able to monitor the state of input calls (such as car calls from COP and hall calls from hall fixtures) and output commands such as starting, decelerating and stopping the elevator. It should be able to generate floor location data, thereby, providing a reference position to establish the safety zones for door opening and closing, and also to initiate leveling slowdown.

22. DUPLEX COLLECTIVE OPERATION

The operation shall be duplex collective with/without attendant for each elevator and shall consist of the following: -

a. IN THE CAR

There shall be furnished a flush type attractively finished stainless steel panel which contains a series of luminous buttons numbered to correspond to the landings served, an

emergency stop switch and an emergency call button connected to a bell which serves as an emergency signal.

b. AT HOISTWAY LANDINGS

There shall be provided an UP luminous push button and a DOWN luminous push button at each intermediate landing and a single button at the terminal landings.

The car shall not start unless the door is in the closed position and all hoistway doors are closed in the locked position.

If the car is idle and one or more car or landing buttons above the landing at which the car is standing are pressed, the car shall start in the UP direction and proceed to the highest landing for which any button is pressed and stops at intermediate landing for which a car button or up landing button is pressed sufficiently in advance of the car's arrival at such landings to permit these stops to be made. After each stop, the car shall proceed in the UP direction until it reaches the highest landing for which a call is registered. The car shall not stop on the UP trip at any landing in response to a DOWN call.

Similarly, if the car is idle and one or more car or landing buttons below the landing at which the car is standing are pressed, the car shall start in the DOWN direction, proceed to the lowest landing for which any button is pressed and stop at each intermediate landing for which a car button is pressed.

When the car is idle and a button for a landing above the car and a landing below the car are pressed, the car shall start towards the landing corresponding to the button pressed first. The call registered for the landing in the opposite direction from the car shall be answered after the car has responded to the farthest call in the direction established by the button pressed first.

A time relay shall hold the car for an adjustable interval of few seconds at the landings at which stops are made to enable passengers to enter or leave the car.

23. Lift Voice Announcement:

The lift shall be provided with floor announcement system with volume control.

24. Lift instructions:

Steel plate containing following instructions shall be provided inside each lift car:

i. Lift number ____

ii. Capacity _____Kg, _____persons.

iii. Any other instruction as per manufacturer's standard or other relevant codes.

Steel plate containing following instructions shall be provided outside each lift car, on all floors:

i. Lift number _____

ii. Capacity _____Kg, _____persons.

iii. Any other instruction as per manufacturer's standard or other relevant codes.

25. Other Details

a. Work shall be carried out as per CPWD specifications unless otherwise specified.

b. Suitable scaffolding in the hoist way, cutting work and all minor civil works, if any, required shall be done by Contractor without any extra cost.

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d. All steel items in machine room, hoist way and lifting arrangement in the lift machine room shall be provided by the Contractor without any extra cost.

e. At the time of erection, testing & commissioning of lift works all the landing door openings shall be suitably protected by the Contractor to avoid any miss happening.

f. All exposed metal parts will be painted with good quality anticorrosive low VOC paint after erection and before commissioning of the lift.

It should be possible for an attendant to operate any car.

26. CAR DOOR/LANDING DOOR

The car entrance shall be provided with stainless steel centre opening doors with 50% vision Glass for Passenger Lift in moon rock finish or as per direction of PMC / Engineer in charge. The lift car door shall have a fire resistance rating of two hours.

27. HOISTWAY DOORS:

At each landing, a center/ telescopic opening, stainless steel sliding door with 50% vision Glass for Passenger Lift giving a clear opening as per CPWD general specifications for electrical works –Part-III – Lifts & Escalators, shall be provided.

28. SIGNAL AND OPERATIVE FIXTURES:

The following signal and operative fixtures shall be provided for each lift in stainless steel face plates except in fireman's switch which shall have a glass face plate.

a. **CAR OPERATING PANEL**

There shall be one (1) No. panel in car, with hinged stainless steel face plate and shall comprise Braille illuminated floor buttons, door open and emergency stop controls emergency call buttons, door open and emergency stop controls emergency call button, two position key operated switch, a Buzzer, UP and DOWN direction light panels, a non stop button, and an integral interphone. The jewels and accentuator shall be of modular construction, face plate mounted, rewired using snap on lugs.

b. **HALL BUTTONS AND HALL POSITION INDICATOR**

There shall be provided combined signal fixture (one riser) of compact design and of attractive hairline stainless steel face plate at the elevator entrance on each floor which for terminal landings shall have a single luminous push button and for intermediate landings shall have an UP Braille illuminated push button and a DOWN Braille illuminated push button. The jewels shall be of modular construction mounted on a stainless steel face plate. Whenever a button is pressed, the jewel shall light up to indicate registration of the call and shall remain enlighted till the car arrives.

c. **CAR POSITION INDICATOR IN CAR**

This shall be of compact design and of attractive hairline finish stainless steel face plate with easy to read digital display of the floors, indicating through which floor the elevator is passing or on which floor the elevator is stopped. This shall also incorporate illuminated arrows showing the direction of travel.

d. **BATTERY OPERATED ALARM BELL AND EMERGENCY LIGHT**

A solid state siren type alarm unit operated by 2 Nos. 9 volt rechargeable Nickel Cadmium batteries shall be provided which shall give a waxing and waning siren when alarm bell in the car is pressed momentarily.

An emergency light unit using a 9 volt dry battery power pack and incandescent lamp with stainless steel face plate shall be provided inside the car which shall operate automatically in the case of power failure.

e. **OVERLOAD WARNING**

Overload warning radars with audio-visual indication (visual indication shall show OVERLOADED) with stainless steel face plate shall be installed in the elevator car, so that when there is overload in the car the sign shall light up a flash indicating OVERLOADED and a buzzer shall operate during this period and the doors shall remain open unit the overload is removed.

f. **FIREMAN'S SWITCH**

A toggle switch covered by a glass cover shall be provided on the ground floor for each elevator which shall permit a fireman to call the elevator to the ground floor by canceling all car and landing calls. The elevator shall then stop at the ground floor with the door open to permit the fireman to have exclusive use of the elevator without any interference from the landing calls.

g. **INTERPHONE**

Interphone shall have one master unit in each machine room, one master unit on the ground floor for each 1 (outside hoist way) and one slave unit in each elevator car.

29. ELECTRIC DOOR OPERATOR FOR CAR DOOR AND HOISTWAY DOOR:

An electric door operator for opening and closing the car door shall be provided. The opening of a car and hoist way doors shall be such that the doors shall start opening meant for so that by the time the elevator stops completely, the elevator and hoist way doors shall be fully open.

The equipment shall consist of a machine on the elevator car operating the car door when the car is stopping at a landing.

The car door and hoist way door shall be mechanically connected and shall move simultaneously in opening and closing.

The car and hoist way doors shall be power opened and closed and shall be checked in opening and closing with an oil cushioning mechanism built into the gear unit.

Each hoist way door shall be provided with an interlock which will prevent movement of the car away from the landing unit.

The doors are closed in the closed position as defined in the ISI codes.

An electric contact for the car door shall be provided which shall prevent car movement from the landing unless the door is in the closed position as defined in the ISI codes. The locking arrangement shall be so designed that the electrical circuit cannot be completed unless the doors are in the closed position and mechanical latching is effected.

Necessary switches shall be provided in the elevator machine room to control the operation of the doors.

The car and hoist way, doors shall open automatically as the car is stopping at a landing. The closing of the car and hoist way door must occur before the car can be started. Doors can be stopped and reversed during their closing motion.

30. DOOR HANGER AND TRACKS:

For the car and each landing door, sheave type two-point suspension hangers complete with tracks shall be provided. Means shall be provided to prevent the door from jumping off the track and for vertical and literal adjustment of doors.

Sheaves and rollers shall be of steel and shall include shielded ball bearing to retain grease lubrication. Adjustable ball bearings rollers shall be provided to take the upward thrust of the doors. Tracks shall be of suitable steel section with smooth surface. The locking of the two leaf parting type doors should be positive.

31. SAFETY SENSOR:

A safety sensor(one on each door panel) shall extend to the full height of the car door.

32. LANDING ENTRANCE MATERIAL'S:

These shall consist of headers, extruded aluminium sills and strut angles.

33. WIRING:

Complete wiring in the equipment room from controller to various landings shall be done in heavy gauge conduit / metal duct & shall confirm to IE rules 1956 . DC power & AC power shall not run in same conduit / duct and they shall be laid as per IE rules.

34. AUTOMATIC RESCUE DEVICE:

Automatic Rescue Device to be provided for all the lifts with battery backup so that it can land to the nearest level in case of power failure. Automatic Rescue Device shall have suitable battery backup so that it can operate minimum seven times in a day provided the duration between usage is at least 30 minutes.

35. TESTING OF LIFTS

The Contractor after the installation of the lifts has to conduct the following test and furnish the readings to ascertain the performance of the lifts.

1. Levelling Test :
2. Safety Gear Test :
3. Contract Speed Test :
4. Lift Balance :
5. Car and Landing Interlock Test :
6. Controllers Test :
7. Normal Terminal Stopping Switches :
8. Final Terminal Stopping Switches :
9. Insulation Resistance Test :
10. Ropes :
11. Buffer Test :
12. Earthing :
13. Performance Test :

36. **List of IS codes for Lift installations applicable is given below**:

1. Code of Practice for installation, operation and IS-
   1860 Maintenance of electric passenger & goods lifts.
2. Code of Practice for installation, operation and IS-

6620 Maintenance of electric service lift.

3. Specification for electric passenger & goods lifts IS-4666
4. Electric service lift. IS-6383
5. Online dimension for electric lifts IS-3534
6. Code of practice for installation and maintenance IS-4591
7. Specification for steel wire suspension ropes for lifts & hoists. IS-2365
8. Glossary of terms relating to wire ropes IS-2363
9. Specification for lifts cables IS-4289
10. Glossary of terms for electrical cables & conduits IS-1591
11. Specification for rubber insulated cables IS-434/1
12. Specification for varnished, cotton cloths & tape for electrical IS-3352 Purpose
13. Specification for lift door locking devices and contracts IS-7759
14. Specification for hot rolled and slit steel bars IS-1173
15. Method of loading rating of worm gear IS-7443
16. Code of practice for selection for selection of standard worn IS-7403 and helical gear box
17. Isometrics screw threads IS-4218
18. Degree for protection provided by enclosure for low voltage IS-2147 Switchgear and control gear
19. Specification for HRC cartridge fuse links upto 650 volts. IS-2208
20. Code of practice for electrical wiring installation IS-732 (System voltage not exceeding 650 volts).
21. Voltage & frequency for AC transmission & distribution system IS-5850
22. Specification for AC Contractors voltage not exceeding 1000V IS-2959
23. Heavy duty air break switched & composite unit of air break IS-4047 Switches& composite unit of air break switches and fuses For voltage not exceeding 1000 volts.
24. General requirements for switch gear & controller for voltage IS-4237 Not exceeding 1000 volts.
25. Specification for motor starter of voltage up to 650 V IS-1822
26. Nomenclature of floors & storeys IS-2332
27. Code of practice for sound insulation of non-industrial buildings. I S -1950
28. Code of practice for installation & maintenance of inducting motor IS-906
29. Specification for three phase induction motor. IS-235
30. Guide for testing three induction motor IS-4029

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31. Specification for degree of protection provided by enclosure for rotating electrical machinery IS-4691
32. Designation of method of cooling for rotating electrical machines. IS-6362
33. Classification of insulating materials for electrical machinery and Apparatus in relation to their thermal stability in service. IS-1271
34. Code of practice for earthing. IS-3043
35. Electrical installation fire safety of building IS-1646
36. Code of practice for the protection of buildings and allied Structures against lighting IS-2309
37. Specification for hoist way door locks IS-7754
38. Rules for the design, installation, testing and operation of the lifts, escalator and moving parts. IS-1735

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CHAPTER- I

TECHNICAL SPECIFICATIONS -FIRE FIGHTING SYSTEM

1. FIRE FIGHTING WORKS- FIRE PROTECTIONS-GENERAL

Scope of work shall include design, engineering, supply, installation, testing & commissioning of fire fighting system. All material shall be of confirming to relevant IS specifications wherever exists and subject to approval of PMC / Engineer in charge. The fire fighting Design/ installation shall be carried out strictly as per NBC -2016/CPWD specifications/ Local Byelaws Testing, commissioning & getting approvals from various inspection authorities and obtaining No objection certificate(NOC) for occupation of buildings.

1.1. SHOP DRAWINGS/TECHNICAL DATA SHEETS

The Contractor shall prepare and furnish all shop drawings including floor plans & Terrace, Schematic Fire Fighting Layout/External Fire Layout showing sprinklers, Fire Hydrants/First Aid Hose, Zonal Control Valves, Extinguishers, Signages, Terrace layout with OHT & Terrace pump.

Plant Room Layout illustrating Static Water Storage Tank details, piping details, valves, pressure vessel, pressure switch, ICV, strainers, diesel tank with its piping & other accessories, foundation details, pump locations, sloping pattern inside pump room, drain/ sumps, fire panel, cable trays etc. at no extra cost for approval by the Engineer before commencing fabrication/ manufacture of the equipment. Such shop drawings shall be based on the Architectural drawings/Tender Drawings and requirements laid down in the specifications, Design Basis Report and as per site conditions. The manufacturing of equipment shall be commenced only after the shop drawings/GA Drawings/ technical data sheet along with pump curves are approved in writing by the Engineer. Such drawings shall be co-ordinated with other services work. These shop drawings will be approved by SBI which will be considered as base for execution of fire fighting work.

1.2. COMPLETION / AS BUILT DRAWINGS

On completion of the work and before issuance of certificate of virtual completion, the Contractor shall submit to the Engineer –in-Charge, General layout drawings, drawn at approved scale indicating layout of pump house piping and its accessories “As installed”. As built drawings shall be prepared taking approved shop drawings as base & incorporating all changes/ modifications as per site conditions. These drawings shall include the following: -

a. General Layout of Pump House including all details mentioned in clause 1.2.

b. Panels and other equipment/accessories location and their dimensions etc.

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c. Fire fighting floor layout including terrace indicating internal hydrants, sprinklers complete with pipe dia. , pipe spacing interval etc.

d. Complete schematic as installed.

e. Static Water Storage Tank, Location of External Hydrants, 2-way/4-way fire brigade inlet connection, Draw out connection, Earth pipes, route of earthling conductors etc.

f. Route of all cables and pipes run along with detail sizes and mode of installation.

1.3. DRAWINGS & DOCUMENTS

The Contractor shall submit to the Engineer, the following documents on completion of the work and before issuance of virtual completion.

a. Warranty for required equipment installed like Pumps, Panels etc.

b. As Built Drawings

c. Material Test Certificates

d. Catalogues/Brochures

e. Name plate details of all equipment

f. Operation, Maintenance Manuals & Technical Catelogues.

g. List of recommended spares and consumables

h. All approvals including technical approvals and sanctions

i. NOC from Fire authority before commencement of execution & after completion of entire work etc.

1.4. SANCTION/ APPROVALS FROM STATUTORY AUTHORITIES/ LOCAL FIRE AUTHORITY

The Contractor shall be fully responsible and shall carry out following activities: -

a. Preparation & submission of working drawings

b. Obtaining the approval of drawings

c. Arranging inspection of site by officials of the Authority

d. Obtaining the final No objection/ completion certificate after submitting required documents.

e. Any other statutory approvals required.

1.5. MANUFACTURING

The responsibility for ensuring the manufacture of the equipment as per the specifications shall be solely that of the Contractor. The Contractor shall be responsible for selection of materials as per agreed specifications.

1.6. MAKE OF MATRIALS/MANUFACTURER'S INSTRUCTION

Only approved makes as mentioned in our approved make list of tender documents of material shall be used. The Contrcator shall furnish Technical data sheets / GA drawings of all items before placing P.O. The Contractor shall get the samples of required items approved from the SBI as conveyed by E-I-C before commencing the supply. In case of any discrepancy/anomolies wrt specifications, prior intimation from Contractor to E-I-C

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to be given. Final decision lies with SBI for according approvals.

Any specific instruction furnished by manufacturer covering the points not mentioned in technical specifications of the tender shall be brought to the notice of E-I-C in writing for further instructions in this regard at appropriate time.

1.7. MATERIAL TESTING

The E-I-C shall have full power to get any material of work to be tested by an independent agency at Contractor's expense in order to prove the soundness and adequacy.

1.8. INSPECTION AND TESTING

a. All equipment shall be inspected and tested as per an agreed Quality Assurance Plan before the same is packed and dispatched from the Contractor's works. The Contractor shall carry out tests as specified/ directed by engineer.

b. Contractor shall perform all such tests as may be necessary to meet requirements of Local Authorities, Municipal or other statutory laws/ bye-laws in force. Nothing extra shall be paid for these.

c. The E-I-C may, at his sole discretion, carry out inspection at different stages during manufacturing and final testing after manufacturing.

d. Approvals or passing of any inspection by the engineer or his authorized representative shall not, however, prejudice the right of the engineer to reject the plan if it does not comply with the specification when erected or give complete satisfaction in service.

1.9. TRAINING OF DEPARTMENT PERSONNEL

a. The Contractor shall train the CLIENT/ SBI's personnel to become proficient in operating the equipment installed. Training shall be done before the expiry of the defects liability period (one year after completion & handing over).

b. The period of training shall be adequate and mutually agreed upon by the Engineer and Contractor.

c. The CLIENT/ SBI's personnel shall also be trained for routine maintenance work and lubrication, overhauling, adjustments, testing, minor repairs and replacement.

d. Nothing extra shall be paid to the Contractor for training CLIENT/ SBI's personnel.

1.10. PERFORMANCE GUARANTEE

At the close of the work and before issue of final certificate of virtual completion by the engineer, the Contractor shall furnish written guarantee indemnifying the CLIENT/ SBI against defective materials and workmanship for a period of one year after completion and handing over. The Contractor shall hold himself fully responsible for reinstallation or replace free of cost to the CLIENT/ SBI.

a. Any defective material or equipment supplied by the Contractor.

b. Any material or equipment supplied by the CLIENT/ SBI which is proved to be damaged or destroyed as a result of defective workmanship by the Contractor.

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2. PIPING FOR WET RISER SYSTEM

2.1. SCOPE

This section covers the details of requirement of piping used in wet riser system, including the associated auxiliary equipment.

2.2. GENERAL

The wet riser system shall remain pressurized at all times during operation, and as such the piping work shall be carried out to withstand the same. The Effective capacity of the reservoir shall be measured above the top of the pump casing (flooded suction).

2.3. PIPES AND FITTINGS

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

Screwed fittings shall be approved type malleable or cast iron with reinforced ring on all edges of the fittings suitable for screwed joints.

Forged steel fittings of approved type with "V" groove for welded joints.

Fabricated fittings shall be not being permitted for pipe diameters 50 mm and below. When used, they shall be fabricated, welded and inspected in workshops whose welding procedures have been approved by the TAC as per TAC rule 4102 for sprinkler system and applicable to hydrant and sprinkler System under the supervision of PMC/Engineer in charge. For "T" connections, pipes shall be drilled and reamed. Cutting by gas or electrical welding will not be accepted.

Pipes for Wet Riser system shall be of black steel MS confirming to IS: 1239/3589 (Heavy Class/ Class C).

Fittings for black steel pipes shall be malleable iron suitable for welding or tapered screwed threads.

2.4. JOINTING

2.4.1. Screwed (50 mm dia pipes and below)

Joint for black steel pipes and fittings shall be metal to metal thread joints. A small amount of red lead may be used for lubrication and rust prevention. Joints shall not be welded or caulked.

2.4.2. Welded (65 mm dia and above)

Joints between M.S. pipes and fittings shall be made with the pipes and fittings having "V" groove and welded with electrical resistance welding in an approved manner. Butt welded joints are not acceptable.

2.4.3. Flanged

Flanged joints shall be provided on:

a. Straight runs not exceeding 30 m on pipe lines 80 mm dia and above.

b. Both ends of any fabricated fittings e.g. bend tees etc. of 65 mm dia or larger diameter.

c. For jointing all types of valves, appurtenances, pumps, connections with other type of pipes, to water tanks and other places necessary and required as per good engineering practice.

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d. Flanges shall be as per Table 17 of IS-6392. with appropriate number of G.I. nuts and bolts, 3 mm insertion neoprene gasket complete.

2.4.4. Unions

Approved type of dismountable unions on pipes lines 65 mm and below in similar places as specified for flanges. Joint for black steel pipes and fittings shall be metal to screw grid up to 50 mm dia and above 65 mm dia welded joints. A small amount of red lead may be used for lubrication and rust prevention in threaded joints. Hold tight will be use for threaded pipes joint.

All the welding shall be radiographic ally tested. Joints between MS pipes, valves and other appurtenances, pumps etc. shall be made with M.S. flanges with appropriate number of bolts. Flanged joints shall be made with 3mm thick insertion rubber gasket.

2.5. DIA OF FLANGE AND HOLE CONFIRMING IS:

Size of pipe →	80 mm	100 mm	150 mm	200 mm
Dia of flange →	200 mm	220 mm	285 mm	340 mm
Flange thickness →	20mm	20mm	22mm	24mm
Dia of bolt →	16 mm	16 mm	16 mm	16 mm
No. of hole →	4 mm	4 mm	8 mm	8 mm

2.6. PIPE PROTECTION

a. All pipes above ground and in exposed locations shall be painted with one coat of red oxide primer and two or more coats of synthetic enamel paint of approved shade.

b. Pipes in chase or buried underground shall be painted with two coats of hot bitumen, wrapped with bituminous pypkote or Hessian cloth and finished with one coat of hot bitumen paint.

c. Pipe passing through structural members will be provided with M.S. pipes.

2.7. PIPE SUPPORTS

All pipe clamps and supports shall be galvanized mild steel. When fabricated from M.S. steel sections, the supports shall be factory galvanized before use at site. Welding of galvanized clamps and supports will not be permitted.

Pipes shall be hung by means of expandable anchor fastener of approved make and design (Dash Fastners or equivalent). The hangers and clamps shall be fastened by means of galvanised nuts and bolts. The size/diameter of the anchor fastner and the clamp shall be suitable to carry the weight of water filled pipe and dead load normally encounted. For pipe spacing, the stringent of the IS Code- clause no. 10.3.10, table -11 & below mentioned table should be opted.

2.8. ORIFICE PLATES

Contractor shall provide orifice flanges fabricated from 6 mm thick SS plates on the branch lines feeding different zones/ floors (as required) so as to allow required flow of water at 3.5 Kg/ sq.cm. Pressure. The Contractor shall furnish design for these orifice flanges. The orifice shall be plain central hole without burs, diameter not less than half of the internal diameter of pipe to which it is fitted.

2.9. AIR CUSHION TANK AND AIR RELEASE VALVE

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Air vessel on top of each wet riser/ sprinkler piping shall be installed before execution for approval fabricated out of at least 8 mm thick steel to withstand the pressure, with dished ends and supporting legs. This shall be of 250 mm dia and 200mm high. This shall be completed with necessary flange connection to the wet riser/ sprinkler piping and air release valve with necessary piping to meet the functional requirement of the system. The air vessel shall be of continuous welded construction and painted with red Colour. This shall be tested for twice the working pressure. The drain arrangement will have 25mm dia GM valve with required accessories and pressure gauge. ARV shall be of 25 mm of forged brass body & chrome plated & its components shall be of anticorrosive material. Test Pressure (Hydrostatic) for Shell: 15 bar (220 psig), Seat: 10 bar(150 psig) & Maxlmum Worklng Temperature: 110 degee C.

2.10. VALVES, GAUGES

Butter-fly, Sluice valves and NRV above 65 mm shall be of cast iron body .They shall confirm to type PN 16 of IS: 13095,780. Valve wheels shall be of right hand type and have an arrowhead engraved or cast thereon the direction for turning open and closing.

Butterfly valves of various dia. as per requirements shall be of wafer type, confirming to PN-16 rating with SS disc. It shall be lever operated. The rubber lining shall be integrally moulded with EPDM/Nitrile rubber. The O-ring sall be made of nitrile rubber. The lever shall be made preferably of carbon steel.

The test pressure of Shell- 24 Bar, Seat:17.6 bar & maximum working pressure-16 bar,maximum working temperature:90 degree celsius. In case of any discrepencies between manufacturer's standards & above specified values, these parameters shall be in compliance with relevant IS codes.

Non-return valves/ Dual plate check valve of various dia. as per requirements shall be of cast iron body. It should have Nitrile Rubber/EPDM Seal & Disc of stainless steel. They shall be swing check type/wafer type in horizontal runs and lift check type in vertical runs of piping. It should be of min. PN-16 rating. Test Pressure (Hydrostatic):Shell: 24.50 kg, Seat:16 kg/sqcm, maximum operating temperature- 80 degree C. In case of any discrepencies between manufacturer's standards & above specified values, these parameters shall be in compliance with relevant IS codes.

Sluice valve shall be of CI construction. The seat shall be of bronze. Hand Wheel shall be of cast iron. It should be of min. PN-16 rating.

The ball valve of various dia. shall be of forged brass construction & shall have screwed female ends. It shall be lever operated with quarter turn & shall be provided with forged brass hard chrome plated ball. It shall be complete with premium quality PTFE gland packing & seating. The ball valve shall be with chrome finish wherever required. Test Pressure (Hydrostatic): Shell:
25 kg, Seat:16 kg/sqcm, maximum operating temperature- 220 degree C. In case of any discrepencies between manufacturer's standards & above specified values, these parameters shall be in compliance with relevant IS codes.

Pressure gauge (Bourdon Type) shall be of suitable range with SS 316 Construction, case of 150/100mm diameter. The gauges shall have brass cocks. The accuracy range of pressure guage shall be in the range of +- 0.5 % to 1%. It shall confirm to IP 67 protection. The dial shall be Aluminium white background with black letters. The windows shall be made of plain & toughend glass. The suitability of pressure gauge shall be in the temperature range of (-) 20 degree Celsius to 60 degree celsius. The gear mechanism shall be of SS 316 & the connection material shall be of SS-316 L. Pointer shall be of black aluminium. It shall be complete with all accessories such as siphon, gauge cock,

snubber & needle valve etc. Pressure range shall be between 0 to 20 kg/sqcm.

Double flanged MS pot strainers of required dia. with M.S. body and SS 40-grade mesh strainer, PN 16 shall be provided either at tank suction line or at individual pump suction line.

Orifice plates shall be made of 6mm thickness Brass material to reduce pressure on individual hydrants to operating pressure of 3.5-kg/ sq.cm. Design of the same shall be given by the Contractor as per location and pressure condition of each hydrant.

2.11. EXTERNAL YARD HYDRANTS

External yard hydrants shall be of 'Stand Post' type confirming to IS: 908 and comprise stand post for single or double outlet, duck foot bend, flange riser and single headed brass/ gunmetal valve confirming type A/ type-B and confirming to IS: 5290.

The stand post column shall be of cast iron, cast in one piece, confirming to grade 20 of IS: 210 or M.S. pipe. The internal diameter at the top shall be at least 80 mm.

The outlet shall be angled towards ground, with instantaneous spring lock type gunmetal female coupling of 63 mm dia. for connecting to hose pipe. It shall be with ISI marked with Sl. No. clearly mentioned. The landing valve shall be of oblique pattern shall be complete with GI twist release chain with cap. The manufacturer's name & trademark along with year of manufacture & other details like size & type shall, be clearly mentioned. Valves shall be provided with one coat of primer & subsequently painted with 2 coats of red paint with shade no. 536 confirming to IS 5. The paint shall confirm to IS 2932. Hand Wheel shall be painted black. It shall be BIS approved. Blank caps shall be made of gun metal. Hydrostatic pressure test shall be carried out at 21 kg/sqcm for 2.5 mins.

The flow test shall be at 7 kg/sqcm at 900 lpm. The water tightness seat test shall be at 14 kg/sqcm. In case of any discrepencies between manufacturer's standards & above specified values, these parameters shall be in compliance with relevant IS codes. RRL Hose pipe shall be controlled percolating (CP) type, ISI marked (IS:8423), 63 mm dia x 15 m long (2 Nos.) complete with instantaneous type gunmetal 63 mm dia ISI marked Male & Female couplings (IS:903) bound and riveted to hose pipe with copper rivets and 1.5 mm copper wire.

Brusting pressure not less than 22 Kg/Sqcm. External Hydrant post shall also include standard short size 63mm dia. gunmetal branch pipe with gun metal nozzle of 20 mm nominal bore outlet with instantaneous type 63 mm dia coupling complete & confirming to IS:903. M.S. fire hose weather proof cabinet (750x600x250mm approx.) made out of 16 gauge M.S. sheet capable of accommodating landing valve, hose pipes, fittings & accessories. The box shall have a front glass door with lock and key arrangement & shall be painted with one coat of primer & two coat of finished stove enamelled post office red colour paint & "FIRE HOSE" written on front.

2.12. INTERNAL HYDRANTS

The landing valve shall be of oblique pattern shall be complete with GI twist release chain with cap. The manufacturer's name & trademark along with year of manufacture & other details like size & type shall, be clearly mentioned. Valves shall be provided with one coat of primer & subsequently painted with 2 coats of red paint with shade no. 536 confirming to IS 5. The paint shall confirm to IS 2932. Hand Wheel shall be painted black. It shall be BIS approved. Blank caps shall be made of gun metal. Hydrostatic pressure test shall be carried out at 21 kg/sqcm for
2.5 mins. The flow test shall be at 7 kg/sqcm at 900 lpm. The water tightness seat test

shall be at 14 kg/sqcm. In case of any discrepencies between manufacturer's standards & above specified values, these parameters shall be in compliance with relevant IS codes. RRL Hose pipe shall be non percolating type, ISI marked (IS:8423), 63 mm dia x 15 m long (2 Nos.) complete with instantaneous type gunmetal 63 mm dia ISI marked Male & Female couplings (IS:903) bound and riveted to hose pipe with copper rivets and 1.5 mm copper wire.brusting pressure not less than 22 Kg/Sqcm. External Hydrant post shall also include standard short size 63mm dia. gunmetal branch pipe with gun metal nozzle of 20 mm nominal bore outlet with instantaneous type 63 mm dia coupling complete & confirming to IS:903. Internal hydrant shall be with firemans axe with heavy rubber handle. Swing type First Aid hose reel in red colour 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 5mm outlet with shut off valve confirming to IS 8090 - 1976 complete with drum and brackets for fixing on wall, bolts & nuts confirming to IS:884-1969 complete as required to be provided. MS door made up of 16 gauge MS Sheet capable of accommodating fire hose reel, landing valve, hose pipes, fittings, 1 No. CO2 & 1 No. Dry podwer type portable fire extinguishers & accessories. The door shall have a front glass with lock and key arrangement & shall be painted with one coat of primer & two coat of finished stove enamelled post office red colour paint & "FIRE HOSE" written on front.

(Approx. size of door: 2100 mm Height, Width of Door as per Shaft size)

2.13. FIRE BRIGADE INLET CONNECTIONS/ DRAW OFF CONNECTION

One set of 2/4 ways collector head Fire Brigade connection shall be provided at under ground tank, Ring Main, Sprinkler system and individual wet risers as specified confirming to IS 904.

The inlet to the wet riser sprinkler header shall be with 150 mm dia butterfly or sluice valve and non-return valve. The scope shall include necessary reducers, tees bends and special fittings as required.

It should be provided with M.S. enclosure fabricated from 1.5 mm thick M.S. sheet, front glass locking arrangement supported on M.S. structural members, painting with two coats of postal red enamel.

Fire brigade inlet connection (fire department connection) consisting of 4 Nos. 63 mm dia instantaneous inlet arranged on a 50 mm dia header, 1 No. 150 mm diameter sluice valve, with in built Non-return valve and wall mounted box of M.S. construction made out of 16 gauge MS Sheet with glass door to house the above mentioned components.

Fire brigade draw out connection (fire department connection) with suction pipe MS class 'C' 100 mm dia. & 100 mm dia. foot valve & steel chain including wall mounted box M.S. construction made out of 16 gauge MS Sheet with glass door to house the above mentioned componenets.

Inlet breeching having C.I. body Two way gun metal 63 mm dia instantaneous inlets confirming to IS 903 fitted with non return valves, 25 mm dia gun metal drain cock, blank cap, brass chains and 150 mm dia flanges with all accessories suitable for local fire tender complete as required.

3. ELECTRIC DRIVE, HORIZONTAL FIRE PUMPS

Without restricting to the generality of the foregoing, the pumps and ancillary and accessories.

i. Electrically operated pumps with motors, base plates and accessories.

ii. Alarm system with all accessories wiring and connections.

iii. Pressure gauges with isolation valves and piping bleed and block valves.

iv. M.S. pipes, valves, suction strainers, delivery headers and accessories.

v. Foundations, vibration eliminator pads and foundation bolts.

3.1. QUALITY CONTROL

These shall comply with the IS codes as specified.

3.2. SUBMISSIONS

a. Product Manuals

b. Hydraulic Details

3.3. STORAGE

These shall be stored as delivered in original packing.

4. FIRE, SPRINKLER AND JOCKEY PUMPS ELECTRIC DRIVE AND DIESEL ENGINE

4.1. PUMPING SETS

a. All pumps (main sprinkler & hydrant pumps, jockey pumps, diesel driven pump) shall be of suitable capacity & head to meet the requirements of NBC 2016 Table 7.

b. In order to provide positive (flooded) suction to fire pumps, the pump house shall be at a level below or equal to that of static water storage tank.

c. Lower levels in high rise buildings 60m or above in height are likely to experience high pressure and therefore, it is recommended to consider multi stage, multi outlet pumps (creating pressure zones) or variable frequency frive pumps or any other equivalent arrangements.

d. Pumping sets shall be multi stage horizontal split casing/end suction type centrifugal Pump having single outlet with cast iron body and bronze dynamically balanced impellers with mechanical seals. Connecting shaft shall be stainless steel with bronze sleeve and grease- lubricated bearings. The centrifugal pumps shall confirming to IS 1520.

e. Pumps shall be connected to the drive by means of spacer type love joy couplings, which shall be individually balanced.

f. The coupling joining the prime movers with the pump shall be provided with a sheet metal guard. Pump and motor engine shall be mounted on a common base plate fabricated from MS section.

g. Pumps shall be provided with approved type of mechanical seals.

h. Pumps shall be capable of delivering not less than 150% of the rated capacity of water at a head of not less than 65% of the rated head. The shut off head shall not exceed 120% of the rated head.

i. The pump shall meet the requirements of N.B.C. 2016 and N.F.P.A. and the unit shall be design proven in fire protection services.

4.2. ELECTRIC DRIVE

a. Electrically driven pumps shall be provided with totally enclosed fan ventilated induction motors of efficiency rating IE-3. For fire pumps the motors should be rated not to draw starting current more than 3 times normal running current.

b. Motors for fire protection pumps shall be at least equivalent to the horse power required to drive the pump at 150% of its rated discharge and shall be designed for continuous full load duty and shall be design proven in similar service.

c. Motors shall be wound for class F insulation and winding shall be vacuum impregnated with heat and moisture resistant varnish glass fiber insulated.

d. Motors for fire pumps shall meet all requirements and specifications of N.B.C.-2016 and N.F.P.A.

e. Motors shall be suitable for 415 volts, 3 phase 50 cycles A/c supply and shall be designed for 38 deg. C ambient temperature. Motors shall confirm to I.S. 325.

f. Motors shall be designed for two-start system.

g. Motors shall be capable of handling the required starting torque of the pumps.

h. Contractor shall provide inbuilt heating arrangements for the motors for main pumps to ensure that motor windings shall remain dry.

i. Speed of the motors shall be compatible with the speed of the pump.

j. Suitable PCC/RCC foundation with plaster, Antivibration arrangement of cushy foot mounting for all pumps needs to be provided.

4.3. PRESSURE VESSEL

a. Air vessel shall be fabricated from 10 mm M.S. plate with dished ends and suitable supporting legs. Air vessel shall be provided with a 100 mm dia flanged connection from pump, one 25 mm dia. drain with valve, one gunmetal water level gauge and 15 mm sockets for pressure switches. The vessel shall be 450 mm dia x 2000 mm high In Plant Room & 250 mm dia. & 2000 mm high at Terrace or as per requirement and tested to 20 kg/ sq. cm pressure. One pressure vessel for Hydrant system & one for sprinkler system to be provided.

b. The fire pumps shall operate on drop of pressure in the mains. The pump operating sequence shall be arranged in a manner to start the pump automatically but should be stopped manually by starter push buttons only for Electric Pumps.

4.4. VIBRATION ELIMINATORS

All individual suction and delivery lines shall be with double flanged reinforced neoprene flexible pipe connectors (double arch of min. PN 16 rating). Connectors should be suitable for a working pressure of each pump and tested to the test pressure given in the relevant head. Length of the connector shall be as per manufacturer's details.

It shall be resilient rubber lined single arch vibration eliminators suitable for raw water up from (-) 10 deg. C to 150 degree celsius temperature, working pressure 8.8 Kg/cm2 (approx.) and test pressure 24 bar (approx.). It shall be preferably without gaskets & it should compensate for any mis alignment/offset.

4.5. INSTALLATION

a. Pumps shall be installed true to level on suitable concrete foundations. Base plate shall be firmly fixed by foundation bolts properly grouted in the concrete foundations. Angle iron frame of size 35mmx35mmx3mm shall be provided on the edge of foundation.

b. Pumps and motors shall be truly aligned by suitable instruments.

c. All pumps connections shall be standard flanged type with appropriate number of bolts. In case of non-standard flanges companion flanges shall be provided with the pumps.

d. Manufacturer's instructions regarding installation, connections and commissioning shall be followed with respect to all pumps and accessories.

e. Contractor shall provide necessary test certificates and performance charts with NPSH requirement of the pumps from the manufacturer. The Contractor shall provide facilities to the PMC/Engineer in charge or their authorized representative for inspection of equipment during manufacturing and also to witness various tests at the manufacturer's works without any cost to the SBI.

f. Each pump shall be provided with a 150 mm dia pressure gauge, isolation cock and connecting piping, bleed and block valve.

g. Provide vibration eliminating pad and connectors for each pump.

h. A minimum clearance of 1M around the pumps shall be provided.

4.6. DIESEL ENGINE

a. Diesel engine shall be of multi cylinders (4/6 cylinder AS PER REQUIREMENTS) with individual head assemblies. The engine shall be water-cooled and shall include heat exchanger/radiator cooled and connecting piping, strainer, isolating and pressure reducing valves, bye-pass line complete in all respects.

b. Engineer shall be direct injection type with low noise and exhaust emission levels and shall confirm to BS649/IS 1601/IS10002 as amended upto date.

c. The speed of the engine shall match the pump speed for direct drive.

d. The engine shall be capable of being started without the use of wicks, cartridge heater, plugs or either at engine room temperature of 7 deg. C and shall take full load within 15 seconds from the receipt of the signal to start.

e. The Engine shall efficiently operate at 38 deg. C ambient temperature at 50 m above mean sea level.

f. Noise level of the engine shall not exceed 105 DBA (free field sound pressure) at 3 m distance.

g. The engine shall be self starting type up to 4 deg. C and shall be provided with one 24 V heavy duty DC battery, starter, cut-out, battery leads complete in all respects. One additional spare battery shall be provided. The battery shall have a capacity of 180 to 200 ampere hours and 640 amps cold cranking amperage.

h. A battery recharger of 10 to 15 amperes capacity with trickle and booster charging facility and regulator shall be provided.

i. Annunciation panel shall be suitable for working on 24 volts D.C. Arrangement for starting shall be automatic on receiving the signal but shutting off shall be manual.

j. The engine shall be provided with an oil bath or dry type air cleaner as per manufacturer's design.

k. Engine shall be suitable for running on high speed diesel oil.

l. The system shall be provided with a control panel with push button starting arrangement also and wired to operate the engine on a differential pressure gauge.

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m. The entire system shall be mounted on a common structural base plate with ant vibration mountings and flexible connections on the suction and delivery piping.

n. One fully mounted and supported day oil tank fabricated from 5mm thick M.S. sheet electrically welded shall be provided alongwith level indicating gauge glass on the day oil tank and low fuel indication of the control panel. The capacity of tank should be sufficient to allow engine to run on full load for at least 2 hours. The fuel pipe from diesel tank to pump should be of robust construction, preferably of hard rubber.

o. All accessories fittings and fixtures necessary and required for a complete operating engine set shall be provided.

4.7. OPERATING CONDITIONS FOR JOCKEY ,ELECTRIC& DIESEL PUMPS

a. Jockey pump shall start automatically when the Water Pressure in the System falls to a pre-set value and shut down when the system pressure reaches the set value. Both Limits shall be adjustable. The Pressure switch settings for Jockey Pump shall be determined as per relevant codes and Site Conditions.

b. Main Electric Fire Pump shall operate on account of sudden pressure loss. So, long as Main Electric Fire Pump is working, other Fire Pumps will not operate. The Pump shall start when the water pressure falls to a pre-set value in the system The Pressure switch settings for Jockey Pump shall be determined as per relevant codes and Site Conditions.

c. The Diesel Fire Pump will start on sudden pressure loss, only in case supply to main electric Fire Pump is not available or within a pre-set time the main Electric Fire Pump fails to start or fails during operation. No other pump will be working when Diesel Engine fire Pump is in operation. Audio-Visual Alarm shall be available to indicate failure of Main Electric Fire Pump.

d. A three attempts starting facility will be provided for diesel Pump.

e. If within a pre-set time, the pump also fails to start or fails to develop pressure, the diesel pump shall also be shut down and locked out. An audio visual alarm indication shall be given at the Control Panel.

f. The Terrace Pump will start on sudden pressure loss of pressure only when both the Fire Pumps have either failed to start or exhausted water.

g. Only one pump will be working at a time. In manual mode, more than one Pump can be started.

h. Water Level in UG and Terrace Tanks shall be monitored and in case of low water level, pumps connected with the tank shall not operate (even on manual mode) or stop operation as the case may be. An audio-visual alarm shall be given at the Control Panel. The Terrace Fire Tank shall be provided with Baffles to ensure proper circulation of water before overflow/discharge into domestic tank.

5. ELECTRICAL INSTALLATIONS

5.1. POWER AND CONTROL PANEL AND OTHER CONTROL COMPONENTS

For Fire Fighting Panel & Control Panel, specifications under Technical Specifications for LT Panel under Electrification shall be followed. Power /Control cable of various sizes shall be XLPE insulated & PVC sheathed.

5.2. CABLE LAYING:

Cable shall be laid generally in accordance with CPWD Specifications (Electrical)

External & Internal amended upto date . Cables shall be laid on 14 gauge perforated MS sheet cable trays and cable drops/risers shall be fixed to ladder type cable trays fabricated out of steel angle. Access to all cables shall be provided to allow cable withdrawal/ replacement in the future. Where more than one cable is running, proper spacing shall be provided to minimize the loss in current carrying capacity. Cables shall be suitably supported with Galvanized saddles when run on walls/trays. When buried, they shall be laid in 350 mm wide and 750 mm deep trench and shall be covered with 250 mm thick layer of soft sifted sand & protected with bricks, tiles. Special care shall be taken to ensure that the cables are not damaged at bends. The radius of bend of the cables when installed shall not be less than 12 times the diameter of cable 1.1 KV cable shall be buried 600 mm below ground level.

For additional details pertaining to Cable Laying, Refer the Electrical Works Specifications under the relevant Head.

5.3. WIRE SIZES:

For all Single phase/ Three phase wiring, 1100 volts grade PVC insulated copper conductor wires shall be used. The equipment inside plant room and AHU room shall be connected to the control panel by means of insulated aluminum conductor wires of adequate size. An isolator shall be provided near each motor/equipment wherever the motor/equipment is separated from the supply panel through a partition barrier or through ceiling construction. PVC insulated single strand aluminum conductor wires shall be used inside the control panel for connecting different components and all the wires inside the control panel shall be neatly dressed and plastic beads shall be provided at both the ends for easy identification in control wiring.

The minimum size of control wiring shall be IS marked 2C/5C x 1.5 mm^2 PVC insulated stranded soft drawn copper conductor wires drawn through conduit to be provided for connecting equipment and control panels.

Power wiring cabling shall be of the following sizes:

i. Upto 5 HP motors : - 3.5C x 6 mm^2 Al conductor wires or meeting functional requirement

ii. Above 5HP upto to 15 HP motors : - 1 No. 3.5C x 10 mm2 Al conductor wires or meeting functional requirement

iii. From 20 HP to 25 HP motors : - 2 Nos. 3.5C x 25 mm2 Al conductor armoured cables or meeting functional requirement

iv. From 60 HP to 75 HP motors. : - 2 Nos.3.5C x 50 mm2 Al conductor armoured cables or meeting functional requirement

v. 100 HP motors.: - 2 No. 3.5C x 100 mm^2 Al conductor armoured cables or meeting functional requirement.

All the switches, contactors, push button stations, indicating lamps shall be distinctly marked with a small description of the service installed. The following capacity contactors and overload relays shall be provided for different capacity motors.

The motor starter shall confirm to IS 1822 as amended upto date.

5.4. EARTHING:

For Earthing details, Refer the CPWD Electrical Works Specifications 2013and electrical specification.

5.5. DRAWINGS:

Shop drawings for control panels and wiring of equipment showing the route of conduit/ cable shall be submitted by the Contractor for approval of PMC/Engineer in charge before starting the fabrication of panel and starting the work. On completion, four sets of complete "As- installed" drawings incorporating all details like, conduits routes, number of wires in conduit, location of panels, switches, junction/pull boxes and cables route etc. shall be furnished by the Contractor.

5.6. TESTING:

Before commissioning of the equipment, the entire electrical installation shall be tested in accordance with relevant BIS Codes and test report furnished by a qualified and authorized person. The entire electrical installation shall be got approved by Electrical Inspector and a certificate from Electrical Inspector shall be submitted. All tests shall be carried out in the presence of Supervisor.

5.7. PAINTING:

All sheet steel work shall undergo a process of degreasing, thorough cleaning, and painting with a high corrosion resistant primer. All panels shall then be backed in an oven. The finishing treatment shall be by application of synthetic enamel paint of approved shade.

5.8. LABEL AND TAGS

Engraved PVC labels shall be provided on all incoming and outgoing feeders switches. Circuit diagram showing the arrangements of the circuit inside the control panel shall be pasted on inside of the panel and covered with transparent plastic sheet. All cables terminations at panels and at equipments shall be provided with tags as approved by Project Manager.

1. All panels to have provision for padlocking and all MCCB's/ MCB's to have provision for locking in off position.

5.9. ELECTRIC FIRE PUMP PANEL: -

The main switch board shall be floor mounted/ wall mounted fabricated from 2mm thick CRCA sheet powder coated with IP 42 protection

3Ph 415V Normal supply for fire pumps near UG tank and Essential supply for terrace pump and jockey pumps

The panel shall incorporate the following facilities.

a. TP &N Moulded case circuit breaker of appropriate fault level
b. Control system components and equipment such as relays, Contractors, and timers etc. for automatic operation.
c. Starter unit, current transformer and ammeter
d. Indication lamps, their fuses, terminal block, push button, control and selector switches etc. as required.
e. Pump lock out devices due to faults or abnormalities as specified.
f. Visual/ audio alarms, indications and communications facility as specified.
g. Necessary inter-connection control and power cable work, cable glands, lungs and internal wiring and connections.

5.10. ENGINE SECTION: -

The engine section shall incorporate the following facilities.

a. Control system components and equipment such as relays, Contractors, and timers etc. for automatic operation.

b. Instruments, indicator lamps, fuses, terminal blocks, push buttons, control and selector switches etc. as are required.

c. Engine shut down and block out devices due to faults or abnormalities as specified.

d. Visual/ audio alarm indication and enunciator facility as specified.

e. Inter- connection control and power cable work, cable glands, lungs, all internal wiring and connection etc.

5.11. AUXILIARY PUMP SECTION: -

Each of the auxiliary pump section for priming pump shall incorporate the following:

a. TP&N Moulded case circuit breaker

b. Control system components such as relays, timers, Contractors etc. as are necessary for functional requirements.

c. Starter unit, current transformer and ammeter

d. Indication lamps, fuses, terminal blocks, push buttons selector, switch etc. as required.

e. Inter-connections, power and control cable work, cable plants lugs, internal wiring and connections.

f. Low water level alarm for terrace tank, where provided.

5.12. SYSTEM CONTROLLER: -

The system controller shall consist of relay timer, contactor etc for interlocking of fire pump and fault isolation and incorporate the following:

a. Control components integrating the various sections, so as to satisfy the functional requirements.

b. Battery charger unit with boost/ float charge facility with voltmeter, capable of independently charging 1 set of battery at a time.

c. Visual/ audio alarms not covered in individual sections.

d. Lamps healthy test facility.

e. Instruments, indicating lamps, push buttons, fuse terminal blocks etc. as are required.

f. Test facility to stimulate operation of hydrants.

5.13. OTHER CONTROL COMPONENTS

5.13.1. Pressure Switches:

Pressure switches shall be provided for switching on and off the jockey pump at present pressures and also for switching of the fire pump at priest pressure. Being the main component for initiating the signal for the operation of the pumps, the pressure switches shall be totally reliable, sturdy in construction and of long life. The pressure settings shall be adjustable.

5.13.2. Low water level indication and switch:

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To prevent the dry running of the fire pumps due emptying of the static tank, water level indication and switch shall be provided. This shall trip the electric motor or stop the diesel engine, as the case may be when the water level goes below a present level. This shall also furnish a distinct low water level audiovisual alarm. This should indicate the level of water at different stages is the power and control panel.

5.13.3. Power Supply for Controls:

In order ensure that the control systems remains operational at all times, the control system shall be designed for 24V DC operation, fed from 24 V wet battery. This shall be independent of the starting battery for the engine i.e., battery shall remain trickle charged at the times from the common battery, charges at the control section.

6. GAS BASED FIRE SUPPRESSION SYSTEM:

6.1. For Low Voltage equipment /Laboratories,& other Critical Areas:

The Total Room Flooding system of fire detection and quenching is proposed in all Low Voltage Equipment rooms where Water sprinklers cannot be used. The Gas cylinder assembly should be UL/FM approved with seamless CCOE approved cylinder and will be connected to discharge nozzles through metal Piping. The master cylinder Kit fitted on Gas cylinder will be operated through separate Fire detection Panel and will release zero Ozone depletion potential Gas through the nozzles in case of fire.

6.2. For Electrical panels:

Tube based Fire protection system is used in the Electrical Panels to be installed in substations. UL listed fire detection Tube shall be installed throughout the compartment of panels. The location and spacing of tube shall be above the hazard to be protected. Cylinder equipped with brass valve, pressure Gauge isolation valve will be fitted on the wall of the panel with suitable brackets and will be connected to the detection tube. in case of fire the tube shall rupture at a point. The rupture Tube shall result in formation of discharge point and release Gas Agent in Uniform pattern.

7. PORTABLE FIRE EXTINGUISHERS:

ABC Powder stored pressure type Fire Extinguishers of 6 KG capacity IS: 15683 & CO_2 gas based Fire Extinguisher of 4.5 Kg capacity with IS: 15683 is proposed for all floors near internal hydrant locations.

4.5 kg carbon dioxide extinguisher, IS marked shall be complete with high pressure discharge tube, horn, control valve & CCE approved cylinder. It shall be suitable for extinguishing Class B & C fires.It shall be provided with Wheel type /Squeeze grip type with discharge hose & horn. It shall be suitable for operation within the temperature range of (-)20 degree celsius to 55 degree celsius.The test pressure shall be 250 Bar.The minimum effective discharge shall be 95 percent.

6 kg & 9 kg Mono Ammonium Phosphate (ABC) type cartridge operated extinguishers. The minimum effective discharge shall be 85% & the minimum jet length shall be between 2-3 meters. The discharge pressure time shall be between 8-13 seconds. The hydraulic test pressure shall be 35 kg/sqcm & the charge test pressure shall be 15 kg/sqcm & the operating range shall be within (-)5 to 55 degree C. The operating valve shall be squeeze grip type with discharge hose & nozzle.

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Higher capacity Trolley mounted Dry Chemical; Powder type Fire Extinguisher of capacity 25 kg. confirms to IS 10658, bearing ISI mark, (Outside Cartridge). CO2 type Fire Extinguisher of capacity 22.5 kg filled with Co2 Gas as per IS 15222 with controll discharge mechanism fitted with Hose, Horn & Trolley confirms to IS 2878 bearing ISI mark. Co2 Cylinder as per IS 7285. The hydraulic test pressure shall be 250 Bar. The Operating range shall be between (-) 30 to 55 degree C. It shall be suitable for extinguishing fires of class B &C.

50 Lit. trolley mounted cartridge type fire extinguisher (foam): - It shall be suitable for extinguishing fire of class A & B. The minimum effective discharge shall be 90% & minimum jet length shall be 10 meters. The discharge pressure time shall be between 60- 180 seconds. The hydraulic test pressure shall be 30 kg/sqcm & type of extinguisher media shall be water & AFFF (3 lit. of 6% concentrate).

The ISI marked Extinguisher and their installations shall be in accordance with acceptable standard of NBC 2016. These units shall be mounted at a convenient height to enable to its quick Access. The requirement shall be as per NBC 2016 Part – 4 Table -7.

8. FIRE SIGNAGES: -

Various types of signage are proposed in the complex as per NBC 2016 Part -4. At every floor near Lift landing diagram showing stairways shall be provided mentioning instructions - 'IN CASE OF FIRE USE STAIRS UNLESS INSTRUCTED OTHERWISE'. The signage shall be
above call button in Lift Lobby. Floor Signage indicating Exit path will be provided in each floor within the staircase. The Numerical shall be Bold Type of minimum 75 MM height. Each corridor of every floor will have directional signage indicating Fire Escape route. These Signage may be LED lit with UPS power backup or of Photo Luminescent paint. So that they will be visible in dark in case of power failure. Fire related signages shall be printed on Photoluminescent U1000 aluminium sheet of 1.0 mm (+-10%)/Acrylic Board containing Lumigen II as base chemical, covered under UV stablized coating and of appropriate size including fixing on wall, door, ceiling etc. with proper clamps, hangers, cleats, anchor fasteners etc. complete in all respects. Text shall be double sided or single sided as per requirements.

9. CLEAN AGENT FIRE EXTINGUISHERS

Clean Agent Fire Extinguishers are proposed to be provided in areas proposed in DBR for extinguishing fire of sensitive equipment, the HFC 236fa or equivalent Clean Agent Extinguisher shall be the most eco-friendly extinguisher. FE36 Clean Agent Extinguishers shall leave no residue, pack in mega power and shall be absolutely safe for use on any sensitive electronic equipment.

They should have zero ODP (Ozone Depletion Potential). They shall be extremely lightweight, yet packed with tremendous power and shall throw, to penetrate past even the finest grills and meshes.

It shall be Residue free: It shall leave no residue making it safe for use on sensitive

equipment. Valve Construction: Forging & Machining

Internal Coating of Can: Epoxy Powder coating

External Coating of Can: Epoxy Polyester Powder

coating Tests: Helium Leak Detection

Sheet metal thickness: 1.60 mm (approx.),

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It shall be Lightweight: Extremely lightweight, yet packed with tremendous power and throw, to penetrate past even the finest grills and meshes.

It shall be Easy snap safety seal: A completely tamper proof safety seal that can be broken in seconds.

It shall be complete with pressure gauge, discharge mechanism with Easy Snap Lever Lock, EPDM rubber hose & shall Fight Class A , B and electrically started Fire, extinguisher has ISO 9001 and CE certifications, preferably UL listed & FM approved, and confirms to ISI standards & shall have preferably 5 years of warranty.

It shall be preferably of 4 kg (minimum) capacity with Discharge time: 8 Secs (approx.) & Range: 2 Meters (approx.)

10. INSTALLATION , TESTING AND COMMISSIONING

10.1. SCOPE

This section covers the requirements of installation of the various components of the wet riser system.

A survey of the site of the work shall be made by the Contractor before preparation of the detailed drawings for submission to the department for approval. The installation shall be carrier out strictly in accordance with the approved drawing.

The scope of installation work shall include the following, where or not expressly mentioned in the schedule or work.

i. Cement concrete (1:2:4 Mix) foundation for all pump sets. Iron Angle framing around the Pump foundation (at the edges/periphery) to protect it from chipping/damage etc.

ii. Vibration isolation arrangement for all pump sets

iii. Filling up the hole in flooring with cement concrete, after laying the wet riser pipes

iv. Necessary supports and clamps for wet riser pump room

v. Necessary supports and camps for wet riser plumbing in the building

vi. Supporting bracket/ frame work for the fuel oil tank of the Diesel engine.

vii. Excavation of the earth, consolidation and refilling after laying of wet riser piping in ground.

viii. Provision of necessary brick base or intermediate support as required in approved manner in case of soils which are no strong enough to support the pipes, thereby likely to case different settlement.

ix. Necessary anchor block of ample dimensions in 1:2:4 cement concrete at all bends, tee connections, foot of the wet riser, and other places as required to stand the pressure thrust in pipes.

x. Necessary masonry work/ steel work for supporting hose cabinets near external (yard) hydrants.

xi. Valve chambers of approved design with external (yard) hydrant.

xii. Ground level hydrants of approved design, where specifies.

xiii. Cutting and making good the damages for the installation work of the riser system

xiv. All the required control piping, exhaust piping from engine to outside, oil piping for fuel oil and lubricating oil for the engine, drain piping from the pumps to the

drain point in the pump room, overflow piping from priming tank to the sump. The piping work shall include all necessary fittings, valve and accessories for effective functional requirements.

xv. Inter-connecting cable work with controls, control panel, batteries etc. including battery leads.

xvi. Orifice plates at individual hydrants as required.

Where provision of MS pipe shall below ground become inescapable, it shall be protected from soil corrosion by two coats of bitumen painting and wrapped with bituminous Hessian cloth and finish with hot bitumen paint.

Each MS pipe shall be subjected to hydraulic pressure test before installation, in presence of the Engineer or his authorized representative.

External (yard) hydrants shall be located at least 2m away from the face of the buildings but not more than 15m and be accessible. Distance between the two hydrants should not be more than 45 metre.

Where external hydrants are below ground level , they shall be enclosed in masonry trenches of size 75sqcm and 8cm above ground level. The hydrant shall be with in 8cm from the top of the enclosure.

Landing Valve of Internal hydrant at each floor shall be located at about 1m above floor level.

Valve chambers in ground shall be of 1sqm in size, with cover.

10.2. PAINTING

Painting of the entire wet riser piping over the ground shall be done with anticorrosive primer and 2 coats of approved paint. The color shall be red to shade No. 536 of IS: 5, Paint shall confirm to IS:2932.

The pumps and engine shall be painted after installation with a coat of approved paint to similar shade as per original supply.

10.3. APPROVAL BY LOCAL BODIES

It shall be the responsibility of the Contractor to obtain the approval of drawings and to get the installation inspected and approved by the concerned authorities as may be necessary as per local by-laws.

10.4. PIPE WORK ASSOCIATED WITH DIESEL ENGINE

a. Pipe works for fuel system, lube oil system and exhaust system shall be complete with all required supports, clamps, hangers etc. for a complete work.

b. Fuel feed is by gravity and the fuel tank shall be located at least 60cm above the fuel injection pump.

c. Fuel pipe of copper shall not be soldered but brazed or welded.

d. No valves or cocks shall be provided in the fuel feed line to engine from the fuel tank.

e. Precautions shall be taken to prevent any air locks in any part of the fuel system. No air relief cock shall be permitted and where inescapable, screwed plugs shall be provided for the purpose.

f. The installation of the fuel supply system shall be such that a completely primed condition is maintained, free from air lock.

g. Filters shall be provided in fuel oil and lube oil circuits allocations that are easily accessible for maintenance.

11. TECHNICAL SPECIFICATIONS FOR SPRINKLER SYSTEM

All the piping for sprinkler work shall be with MS Class C & shall confirm to IS 1239/3589.

11.1. SPRINKLER HEADS

a. Side wall/pendant/upright sprinklers to be provided as per requirements which shall be quick response type, shall be UL & FM certified, complete with rosette plate, glass bulb temperature rating of 68 degree celsius (red colour),Quick response type, chrome plated finish & in compliance with NBC 2016 & relevant IS codes. Wherever false ceiling is there, upright sprinklers to be provided at requisite distance as per codal provisions.

b. Types

i. Conventional Pattern

The sprinklers shall be designed to produce a spherical type of discharge with a portion of water being thrown . The sprinklers shall be suitable for erection in upright position or pendant position. The designing of installation will be as per IS 15105.

ii. Spray Pattern

The spray type sprinkler shall produce a hemispherical discharge below the plane of the deflector.

iii. Ceiling (Flush) Pattern

These shall be designed for use with concealed pipe work. These shall be installed pendant with plate or base flush to the ceiling with below the ceiling.

c. Side Wall Sprinklers

i. These shall be designed for installation along with the walls of room close to the ceiling. The discharge pattern shall be similar to one quarter of sphere with a small proportion discharging on the wall behind the sprinklers.

d. Constructions

i. **Bulb: -** Bulb shall be made of corrosion free material strong enough to with stand any water pressure likely to occur in the system. The bulb shall shatter when the temperature of the surrounding air reaches a predetermined level.

ii. **Valve Assembly**: - Water passage of the sprinkler shall be closed by a valve assembly of flexible construction. The valve assembly shall be held in position by the quartzoid bulb. The assembly be stable and shall withstand pressure surges or external vibration without displacement.

iii. **Yoke:** - The yoke shall be made of high quality gun metal. The arms of yoke shall be so designed as to avoid interference with discharge of water from the deflector. The sprinkler body shall be coated with an approved anti-corrosive treatment if the same is housed in corrosive conditions.

iv. **Deflector:** - The deflector shall be suitable for either upright or pendent

erection. The deflector shall be designed to give an even distribution of water over the area protected by each sprinkler.

e. Colour Code

The following color code shall be adopted for classification of sprinkler according to nominal temperature ratings:

Sprinkler Temperature Rating	**Color of the Bulb**
68 deg. C	Red

f. Size of Sprinklers Orifices

The following sizes of sprinklers shall be selected for various classes or hazards
Stock of replacement sprinkler

The following spare sprinklers shall be supplied along with the system free of cost to be treated as spare.

Moderate hazard systems 24 sprinklers

Type of Sprinkler	Orifice Size (mm)	Typical Use
Standard Response	15 mm (1/2 inch)	Offices, hospitals, schools
Quick Response	15 mm (1/2 inch)	Hotels, residential complexes
Extended Coverage	20 mm (3/4 inch)	Warehouses, commercial buildings
High Hazard	25 mm (1 inch)	Industrial units, chemical storage

g. Temperature Rating

For normal conditions in temperature climates rating of 68 deg. C shall be used. How ever the temperature rating shall be as closed as possible to, but not less than 30 deg. C above the highest anticipated temperature conditions.

h. Maximum & Minimum Distance between sprinklers, between sprinklers & boundary wall shall be as per hazard classification of building & relevant IS codes.

i. Zoning of sprinklers with ICV to be placed in Plant Room in required buildings to be done as per relevant IS codes/NBC 2016/CPWD specifications. The required buildings as specified in DBR (Design Basis Report) where sprinkler provision is to be considered shall be with min. one independent ICV.

j. In order to avoid any kind of leakage from sprinklers, it shall be wound with Teflon tape & any other suitable water resistant sealing material.

k. All measures to be considered so that sprinkler bulb is cleaned & free from any blemishes.

l. Sprinkler type (pendant/upright/sidewall) shall be confirming to requirements & relevant IS codes.

11.2. PIPES AND FITTINGS

a. Pipes

i. Pipes less than 25mm dia shall not be used and shall be Black Steel

confirming to IS: 1239 (Heavy Class) upto 150mm.

ii. Welded Black Steel Pipe, Heavy Class confirming to IS:3589 for size greater than 150mm.

iii. Fittings for black steel pipes shall be malleable iron suitable for welding or approved type cast iron fittings with tapered screwed threads.

b. Jointing

Joint for black steel pipes and fittings shall be metal to metal tapered thread or welded joints. A small amount of red lead may be used for lubrication and rust prevention in threaded joints. For Pipe size upto 50mm, Thread Joints are to be considered and for Pipe size above 50mm, welded joints are to be considered.

Joints between MS pipes, valves and other appurtenances, pumps etc. shall be made with M.S. flanges with appropriate number of bolts. Flanged joints shall be made with 3mm thick insertion rubber gasket.

c. Pipe Protection

i. All pipes above ground and in exposed locations shall be painted with one coat of red oxide primer and two or more coats of synthetic enamel paint of approved shade.

ii. Pipes in chase or buried underground shall be painted with two coats of hot bitumen, wrapped with bituminous Hessian cloth and finished with one coat of hot bitumen paint.

d. Pipe Supports

All pipes shall be adequately supported from ceiling or walls from existing inserts by structural clamps fabricated from M.S. structurals e.g. rods, channels, angles and flats. All clamps shall be painted with one coat of red and two coats of black enamel paint. Where inserts are not provided, the Contractor shall provide anchor fasteners.

e. Orifice Flanges

Contractor shall provide orifice flanges fabricated from 6mm thick Brass plates on the branch lines feeding different zones/ floors so as allow required flow of water at 3.5 kg/ sq.mm pressure. The Contractor shall furnish design for these orifice flanges.

f. Valves

Butterfly or Sluice valves of size 80mm and above shall be double-flanged cast iron confirming to IS: 780.

Check valve shall be of cast iron double flanged confirming to IS: 5312.

Valves on pipes 65mm and below shall be heavy pattern gunmetal valves with cast iron wheel seat tested to 20 kg/ sq.mm pressure. Valves shall confirm to IS: 778.

g. Drain Valves

50 m dia black steel pipe confirming to IS: 1239 heavy class with 50 mm gunmetal full way valve for draining water in the system in low pockets.

11.3. INSTALLATION CONTROL VALVE: -

Installation control valves shall comprise of the following.

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a. One main stop valve of full way pattern with gunmetal pointer to indicate where open/ shut

b. One automatic alarm valve, fitted with handle and cover.

c. One hydraulic alarm motor and gong for sounding a continuous alarm upon out-break of fire.

d. One combined waste and testing valve including 5 mtr of tubing and fittings

e. Alarm stop valve

f. Strainer

g. Drain plug

h. Padlock & strap

i. Wall box for installation of valve

11.4. ZONAL CONTROL VALVE: -

Zonal Control Valve Assembly shall comprise of the following:

a. Butterfly Valve

b. Non-Return Valve

c. Flow Switch

d. Pressure Gauge

e. Drain Valve

f. Sight Glass

g. Necessary MS piping

Flexible connection for sprinklers shall be braided type of various lengths as per site requirements & shall be UL listed & FM approved.

9.5 ANNUNCIATION SPRINKLER PANEL

The equipment for control panel should be compact neatly wired and enclosed in a suitable 2 mm M.S. sheet that is suitably treated against corrosion. The control panel should be painted with enamel paint. The panel shall consist of:

a. Panel should be made in a module of suitable nos. of zones e.g. each module will have audible and visual indications and will monitor the circuit conditions with 24V DC battery.

A.C. Power Supply

Fault and Fire indication lamp

Alarm acknowledgment push buttons

b. The circuits provided in the control panel for each zone shall indicate the following conditions:

i. Open Circuit in zone wiring

ii. Short Circuit in zone wiring

iii. Normal conditions

iv. Power failure

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v. Low battery

c. The Automatic annunciation panel shall suitable for operation on 24V DC and shall be provided with power supply unit suitable to operate on A.C. mains of 230 V with a variation of 10%. The system shall be so designed that in case of failure of A.C. main supply it shall automatically change over to battery supply.

d. Suitable protection may be provided against charging of the battery over and above the specified values.

9.6 BATTERY UNIT

i. The system shall be powered by lead acid storage stationery complete with automatic duel rate charger boost and trick operating form 220 V, 50 Hz, single phase, mains supply. The battery capacity should be adequate for operation of the system connected to it for at least 24 hours in the non-alarm state followed by 30 minutes operation of all sounders and other connected equipments after a power (mains) failure.

ii. The automatic charger should operate at the boost charge when the battery terminal voltage is less than about 2.1 V 20 per cell, and operate at a trickle charge rate of 100 to 200 AH, when the battery terminal voltage exceeded about 2.25 per cell.

iii. The power unit should have the following.

a. Voltmeter of suitable range

b. Ammeter of suitable range

c. Indicator lights for mains

d. Indicator lights for DC output

iv. The preferred nominal DC voltage shall be 24 V and shall preferably be isolated. (IF and isolated supply is provided a line earthing indicator should also be provided).

v. The DC system and the detection and sounder circuits shall be protected against their attaining a voltage to earth exceeding 50V.

vi. The connection to the 230 V, 50 Hz, single phase system shall be through a three pin plug socket especially provided for the connection to the annunciation panel. This connection should in addition utilized for earthling all non-current carrying metal parts of the sprinkler system, except those that are either doubly insulate or mounted at a height exceeding 2.2 meters.

vii. The battery unit shall be housed in a steel cabinet at least 2 mm thick suitably painted with two coats of Post Office Red, Enamel necessary vent holes should be provided for proper ventilation.

12. PRESSURE GAUGES

It shall be provided at the following locations.

a. Just above alarm valve

b. Just below alarms valve, on the installation stop valve

c. One pressure gauge on delivery side of each pump

d. One Pressure Gauge, part of Pressure vessel installation.

e. On the Common Delivery Header of Fire Pumps, one on either side of the Non Return Valve.

f. On the Wet Riser in every Fire Hose Cabinet Shaft.

g. Any other location as per requirement.

13. INSTALLATION OF PIPING

A. BELOW GROUND PIPING:

Under ground piping should be installed in masonry trenches with cover or reinforced concrete. The pipe work shall be supported at regular intervals of 2.5m with masonry or RCC supports. All pipes shall be protected against corrosion with two coats of bituminous painting and wrapped with pypkote or bitumen Hessian cloth and finish with one coat of hot bitumen paint.

B. ABOVE GROUND PIPING: -

a. All above ground piping shall be installed on suitable pipe hangers/ supports as required. The hangers shall be made of MS angles, channels, channels etc. and painted to the required finish (with suitable synthetic enamel paint). The spacing supports shall be as follows.

i.	25 mm - 50 mm dia.	1.5mtr.
ii.	65mm – 100mm dia.	1.75 mtr.
iii.	Above 100mm	2 mtr.
iv.	Vertical Pipingn	2 mtr.

b. Piping shall be screwed type up to 50 mm dia. Welding of joints will be allowed for pipes of 65mm mm of larger diameters.

14. TESTING & COMMISSIONING: -

12.1.1 PRESSURE TESTING OF PIPES

During laying of pipes, the same shall be subjected to 10 Kg/cm2 hydraulic pressure for a period of 24 hrs , in sections. After completion of the work, all valves/fittings shall be installed in position and entire system shall be tested for 24 Hrs. at a pressure of 10 Kg/cm2.The drop of pressure up to 0.5 Kg/cm2 shall be accepted. The pressure Testing may be carried out by means of Electric Driven Pump or Manually operated Test Pump.

All leaks and defects in different joints, noticed during the testing and before commissioning shall satisfaction of engineer.

Testing of fittings/ equipments shall be carried out either at site or at works in the presence of a representative of the engineer. Test certificates shall also be furnished by the Contractor.

The automatic operation of the system and alarms for the various functional requirements, as laid down in this specification, shall be satisfactory carried out in the presence of PMC/Engineer in charge.

12.1.2 INTERNAL HYDRANT/SPRINKLER & EXTERNAL HYDRANT SYSTEM: -

After laying and jointing, the entire piping shall be tested to hydrostatic test pressure. The pipes/sprinkler heads shall be slowly charged with water so that the air is expelled from the pipes. The pipes shall be allowed to stand full of water for a period of not less than 24 hours and then tested under pressure. The test pressure shall be

12 kg/cm2. The test pressure shall be applied by means of manually operated test pump or by a power driven test pump to be provided by the Contractor. The Lines shall be flushed before completion of building work so that any foreign matter which might have entered the system is taken out. The Jockey Pump should be operated and Valves must be open at different locations.

After completion of work, all valves/ fittings shall be installed in position & entire system shall be tested for 24 hours at a pressure of 10 kg/sqcm. The drop of pressure upto 0.5 kg/sqcm shall be accepted.

After completion, all operation checks (operation scheme of pumps & pressure swtich settings) needs to be carried out for automatic operation of the system. landing valves may be opened at different locations repeated couple of times to ensure trouble free operation.

Flow Test -The design flow of pumps shall be checked. The pump shall be operated after opening a number of Landing Valves at different locations. Design pressure is to be maintained in the Pump House. Water discharge is to be measured by drop in level in UG Tank for a certain period. All pumps shall be tested one by one. The flow rate shall not be less than as specified while maintaining the design pressure in pump house.

12.2 FINAL TESTING

After completion, all operation checks shall be carried for automatic operation of system including flow test. The exercise shall be repeated couple of time to ensure trouble free operation.

Commissioning: - Before commissioning, entire system be flushed properly. As soon as the work is completed the system shall be commissioned and made available for use. If required, isolate the system of under construction portion of the buildings.

For automatic operation sprinkler system by using inspection testing valve. In this case annunciation panel of that particular zone and mechanical gong valve should work.

Overhead Tanks shall be so designed so that the Pipe Inlet & Outlet Spout of Tank and the opening lid is not at the same level so as to ensure smooth filling of Tanks and subsequent overflow.

All other testing & commissioning methods to be adopted & performed as per relevant IS Codes/ CPWD Specifications & NBC 2016 norms.

xiii. **PAINTING**

Painting of the entire wet riser piping & sprinkler piping over the ground shall be done with 1 coat of anticorrosive primer and 2 or more coats of approved paint till the satisfaction of PMC/Engineer in charge ensuring that one coat of paint is done after final painting of the pump house & buildings. The color shall be post office stove enameled red with shade No. 536 of IS: 5, Paint shall also confirm to IS:2932. The pumps/ engine shall be painted after installation with a coat of approved paint to similar shade as per original supply.

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CHAPTER- J

TECHNICAL SPECIFICATIONS -WTP/STP /SOLAR HOT WATER SYSTEM

A. WATER TREATMENT PLANT GENERAL REQUIREMENTS

A.1. SCOPE OF WORK

Design, Engineering Supply, Installation, Testing & Commissioning of WTP shall be carried out by the Contractor on EPC Basis & as directed by PMC/Engineer in charge.

A.1.1. Work shall consist of furnishing all labour, materials, equipment and appliances necessary and required. The Contractor is required to completely furnish all the plumbing and other specialised services as described hereinafter and as specified in the DBR and/or shown on the plumbing drawings.

A.1.2. Without restricting to the generality of the foregoing, this section shall include the following: -

i. Hydropneumatic/Monoblock Water supply Pumps

ii. Filters (dual media/activated carbon/pressurized sand), Softeners, UV dosing etc.

iii. Pumps & Allied Equipment

iv. STP & WTP

v. Solar Hot Water System

vi. RO System (Centralized & Portable)

A.2. SPECIFICATION

A.2.1. Work under this Contract shall be carried out strictly in accordance with specifications attached with the tender.

A.2.2. Items not covered under these specifications or due to any ambiguity or misprints, or additional works, the work shall be carried out as per specifications of the latest Central Public Works Department with up to date amendments as applicable in the Contract.

A.2.3. Works not covered under Paras above shall be carried out as per relevant Codes & Bureau of Indian Standards and in case of its absence as per British Standard Code of Practice.

A.3. EXECUTION OF WORK

A.3.1. The Contractor should visit and examine the site of work and satisfy himself as to the nature of the existing roads and other means of communication and other details pertaining to the work and local conditions and facilities for obtaining his own information on all matters affecting the execution of work.

A.3.2. The work shall be carried out in confirmity with the Plumbing drawings and within the requirements of architectural and coordinated with all services drawings.

A.3.3. The Contractor shall cooperate with all trades and agencies working on the site. He shall make provision for hangers, sleeves, structural openings and other requirements well in advance to prevent hold up of progress of the construction schedule. All supports to the civil structure shall be provided with dash fasteners.

A.3.4. On award of the work, Contractor shall submit a schedule of construction in the form of a PERT chart or BAR chart for approval of the PMC/Engineer in charge/

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SBI. All dates and time schedule agreed upon shall be strictly adhered to within the stipulated time of completion/ commissioning along with the specified phasing, if any.

A.4. DRAWINGS

A.4.1. Tender drawings/Schematic of WTP/STP/Hot water system are provided to the Contractor. On the basis of these, shop drawings will be prepared & submitted to PMC/Engineer in charge/SBI for approval. The execution of work shall be done in–line with the approved shop drawings.

A.4.2. Architectural drawings shall take precedence over plumbing or other services drawings as to all dimensions.

A.4.3. Contractor shall verify all dimensions at site and bring to the notice of the SBI/PMC in charge all discrepancies or deviations noticed. Decision of the PMC/Engineer in charge shall be final.

A.4.4. Large size details and manufacturers dimensions for materials to be incorporated shall take precedence over small scale drawings.

A.4.5. Any drawings issued by the PMC/Engineer in charge/SBI for the work are the property of the PMC/Engineer in charge/ SBI and shall not be lent, reproduced or used on any works other than intended without the written permission of the PMC/Engineer in charge/SBI.

A.5. REFERENCE DRAWINGS

A.5.1. The Contractor shall maintain one set of all drawings issued to him as reference drawings. These shall not be used on site. All important drawings shall be mounted on boards and placed in racks indexed. No drawings shall be rolled.

A.5.2. All corrections, deviations and changes made on the site shall be shown on these reference drawings for final incorporation in the completion drawings to be submitted by the Contractor in fulfilment of the conditions of this contract.

A.5.3. On award of the work the Contractor shall be issued, one set of SBI's working drawings stamped "tender drawings" by the PMC/Engineer in charge. The SBI's drawings shall be the basis of Contractor's shop drawings. Upon submission of shop drawings to SBI, Final approved drawings will be stamped as "Good for Construction" drawings, based on which execution work will be done.

A.5.4. Shop drawings are detailed working drawings which incorporate the Contractor's details for execution of the work and incorporate equipment manufacturer's details and dimensions to ensure that the same can be installed in the space provided.

A.5.5. All shop drawings should detailed pipe routing and levels, showing location of other services at crossings etc., cable runs, route cable trays and all allied works and must be fully co-ordinated with other services and approved by the PMC/Engineer in charge before execution of the works. The Contractor shall submit services drawings (if required for coordination of services) from their respective contracting agencies. All drawings will valid only when stamped and issued by the PMC/Engineer in charge.

A.5.6. Shop drawings shall be furnished for detailed layout of all equipment, foundation, bolting and vibration elimination details along with information on dead and dynamic load, vibration etc.

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A.5.7. Two sets of manufacturer's equipment drawings, roughing in and wiring diagrams shall be submitted.

A.5.8. Contractor shall submit shop drawings furnishing all details of MCC panels, cable routes, wiring diagrams and connection details as required.

A.5.9. Two copies of each set of shop drawings shall be submitted for initial scrutiny, discussion and approval.

A.5.10. Each submission shall be accompanied by Contractor's certificate stating that the shop drawings meet all the contract requirements and that the piping and equipment can be satisfactorily installed without any obstructions in the space available.

A.5.11. On approval of the above the Contractor shall furnish three sets of the approved shop drawings for execution of the work.

A.6. INSPECTION AND TESTING OF MATERIALS

A.6.1. Contractor shall be required, if requested, to produce manufacturers test certificate for the particular batch of materials supplied to him. The tests carried out shall be as per the relevant Bureau of Indian Standards.

A.6.2. For examination and testing of materials and works at the site Contractor shall provide all testing and gauging equipment necessary but not limited to the following:

a) Steel tapes

b) Weighing machine

c) Plumb bobs, sprit levels, hammer

d) Micrometers

e) Hydraulic machine

A.6.3. All such equipment shall be tested for calibration at any approved laboratory, if required by the PMC/Engineer in charge. All testing equipment shall be preferably located in special room meant for the purpose.

A.6.4. Samples of all materials shall be got approved before placing order and the approved samples shall be deposited with the PMC/Engineer in charge.

A.7. METRIC CONVERSION

A.7.1. All dimensions and sizes of materials and equipment given in the tender document are commercial metric sizes.

A.7.2. Any weights, or sizes given in the tender having changed due to metric conversion, the nearest equivalent sizes accepted by Indian Standards shall be acceptable without any additional cost.

A.8. COMPLETION DRAWINGS

A.8.1. On completion of work, Contractor shall submit one complete set of original tracings and four prints of "as built" drawings to the Project Manager. These drawings shall have the following information.

a) Run of all piping, diameters on all floors, vertical stacks and location of external services.

b) Ground and invert levels of all drainage pipes together with location of

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all manholes and connections up to outfall.

c) Run of all water supply lines with diameters, locations of control valves, access panels.

d) Location of all mechanical equipment with layout and piping connections and mechanical equipment.

e) All shop drawings shall be updated from time to time for the purpose of making completion drawings.

A.8.2. Contractor shall provide four sets of catalogues, service/operation & maintenance manuals, manufacturer's drawings, performance data and list of spare parts together with the name and address of the manufacturer for all electrical and mechanical equipment provided by him.

A.8.3. All "warranty cards" of pumps & other major equipment given by the manufacturers shall be handed over to the PMC/Engineer in charge.

A.9. TESTING

A.9.1. Piping and drainage works shall be tested as specified under the relevant clauses of the specifications.

A.9.2. Tests shall be performed in presence of the PMC/Engineer in charge and test records for the tests shall be duly signed by Contractor and the PMC/Engineer in charge.

A.9.3. All materials and equipment found defective shall be replaced and whole work tested to meet the requirements of the specifications.

A.9.4. Contractor shall perform all such tests as may be necessary and required by the local authorities to meet municipal or other bye-laws in force.

A.9.5. Contractor shall provide all labour, equipment and materials for the performance of the tests.

A.10. SITE CLEARANCE AND CLEANUP

A.10.1. The Contractor shall, from time to time, clear away all debris and excess materials accumulated at the site.

A.10.2. After the fixtures, equipment and appliances have been installed and commissioned, Contractor shall clean-up the same and remove all plaster, paints, stains, stickers and other foreign matter or discolouration leaving the same in a ready to use condition.

A.10.3. On completion of all works, Contractor shall demolish all stores, remove all surplus materials and leave the site in a broom clean condition, failing which the same shall be done by the PMC/Engineer in charge at the Contractor’s risk and cost. Cost of the cleanup shall be deducted from the Contractor's bills on pro-rata basis in proportion to his contract value.

A.11. LICENCE PERMITS AND AUTHORITIES

A.11.1. Contractor must hold a valid plumbing or any other as required licence by the municipal authority or other competent authority under whose jurisdiction the work falls.

A.11.2. Contractor must keep constant liaison with the local development, municipal /statutory authority and obtain approval of all drainage, water supply, fire

suppression and other works carried out by him.

A.11.3. Contractor shall obtain, from the municipal and other authorities 'C' & 'D' & other forms as required for approval of drainage and water supply works during execution and the completion certificate with respect to his work as required for occupation of the building. Contractor shall obtain permanent water supply and drainage connections from authorities concerned. CLIENT/ SBI shall reimburse the fees paid to the authorities towards the connection charges on production of receipts for money paid.

A.11.4. Contractor shall get any materials tested from the appropriate authority if so required with no cost to the CLIENT/SBI.

A.12. CUTTING OF WATER PROOFING MEMBRANE:

A.12.1. No walls terraces shall be cut for making and opening after water proofing has been done without written approval of PMC/Engineer in charge. Cutting of water proofing membrane shall be done very carefully so as other portion of water proofing is not damaged. On completion of work at such place the water proofing membrane shall be made good and ensured that the opening/cutting is made fully water proof as per specifications and details of water proofing approved by PMC/Engineer in charges.

A.13. MATERIALS

A.13.1. Unless otherwise specified and expressly approved in writing by the SBI/PMC in charge, only materials of makes and specification as mentioned in the list of approved makes attached with the specifications shall be used.

A.13.2. If required, the Contractor shall submit samples of materials proposed to be used in the works. Approved samples shall be kept in the office of the PMC/Engineer in charge.

B. WATER SUPPLY, FLUSHING/ IRRIGATION PUMPS & EQUIPMENT

B.1. GENERAL REQUIREMENTS

B.1.1. All materials shall be new of the best quality confirming to specifications and subject to the approval of PMC/Engineer in charge.

B.1.2. All equipment shall be of the best available make manufactured by reputed firms.

B.1.3. All equipment shall be installed on suitable foundations true to level and in a neat workmanlike manner.

B.1.4. Equipment shall be so installed as to provide sufficient clearance between the end walls and between equipment to equipment.

B.1.5. Piping within the pump house shall be so done as to prevent any obstruction in the movement within the pump house.

B.1.6. Each pumping set shall be provided with a butterfly valve on the suction and delivery side and a flap type non return valve on the delivery side

B.1.7. All pump couplings and belt guards for air compressors shall be totally enclosed with 5 mm mesh.

B.2. SYSTEM OF WATER SUPPLY

B.2.1. The water supplied by the authorities will be stored in the domestic U.G. tank.

B.2.2. Water from this U.G. tank shall be pumped to O.H. Tanks at terrace of each

building by separate pumps/sump.

C. RISING MAINS & LEVEL CONTROL SYSTEM

C.1. Water from the pumps described above will fill each tank by a rising main to each tower.

C.2. To control the level in each tank and enable it to fill as the water demand so requires, each tank will be provided with a ball cock to shut off the water supply when the tank is full.

C.3. A set of electronic level sensing probes will be installed in each tank The probes installed in each pumping system will be wired to a central electronic panel which will activate the pump when any one of the tank probe signals low water conditions and top up all tanks. No excess flow will occur due to the ball cock in the tank.

D. LEVEL CONTROLLERS

D.1. Level controllers shall be electronic magnetic type using required number of stainless steel type probes, shrouded in PVC sheath or encapsulated in a stainless steel pipe. The level controller will be used for following applications: -

D.1.1. Provide a audible high water alarm when water level in the sump reaches a pre- determined high level in the sump location at MCC panel installed in wall near sump location

D.2. Overhead tank level controller cum indicators

D.2.1. Each OHT to be provided with required number of stainless steel electronically operated probes (housed in a stainless steel protective housing) and connected by a control cable to a central junction box connected to MCC panel located in the pump house at basement. A common multi-core cable from each group of buildings will be laid to the pump room in basement. The probes will function as follows:

D.2.2. To cut off the water supply pumps when all the OHT is full and to start the pump if any OHT level reaches at pre-determined low level.

D.2.3. Provision shall be made to enable the operation of the second duty pump in case the water level does not rise above a pre-determined level in the tank due to water demand which is higher than capacity of duty pump no.1 to meet.

D.2.4. Indicate the water level in each OHT in the level indicating panel installed in the pump room

D.2.5. Each OHT are also provided with motorized valve for filling of Over Head Water tank complete with high and low level control switches to control the valve. The level controllers shall be installed in overhead tanks. The level switch will close the valve when water level is high (Top Water Level) in over head tank and open the valve when over head water tank level is low (30% of storage capacity). The system should be complete in all respects with accessories, 220 V AC / 24 V DC, IP67 electrical water level control unit, copper control wiring in whether proof casing etc.

D.3. Control & Indicating Panel (For overhead and underground water tanks)

D.3.1. A centralized indicating stand–alone wall mounted panel fabricated from 14 g. with seven tank process MS sheet and painted inside and outside with stove enamelled finish with clear vertical panels for each group of buildings & tanks shall indicate water level in each tank by means of digital

display unit to indicate water level in each tank in four levels (¼th, ½, ¾ and full). The panel shall be installed on the control console panel located in the pump room or as directed by the Project Engineer. The panel shall have:

D.3.2. Digital level indicator panel meter for each water tank.

D.3.3. Etched plate identification plates.

D.3.4. Control cabling from MCC to the panel installed in the control room as directed by the PMC/Engineer in charge.

D.3.5. Cabling from PHT sensing probes to the panel

E. FILTERS-DUAL MEDIA/ACTIVATED CARBON/PRESSURIZED SAND TYPE & SOFTENER

E.1. Pressure filters for Water Supply System

E.1.1. Pressure filters shall be manufactured with factory made bobbin wound polyester fibre glass multilayer filters fitted with internal GI distribution pipe with polypropylene diffusers on top, collector pipes and arms, inlet and outlet header vertical water pressure dished ends complete with initial charge of filter media,
G.I. face piping, accessories testing and commissioning complete, Working Pressure 3.5 kg/cm2 (Test pressure 5 kg/cm2). Along with Butterfly Valve/NRV or Dual Plate Check Valve & Gauge etc.

E.1.2. Each vessel will be provided with suitable pressure tight manhole cover appropriately located for inspection and repairs.

E.1.3. The diameter and height of each vessel shall be as per the design requirement and as per site conditions.

E.2. Multi-Port Valves

E.2.1. Each vessel will be provided with multi-port valves to operate and regulate the normal flow, backwash and rinsing, rapid washing, on the face piping.

E.2.2. Provide suitable sampling cocks to draw water samples for raw water and treated water.

E.3. Face Piping

E.3.1. Each vessel shall be provided with non-corrosive face piping from the inlet to the outlet. Face piping shall be CPVC (IS 4985)/UPVC/GI 10 kg/cm2 all CPVC/UPVC/GI fittings are heavy grade to pipe and solvent weld and flanged joints

E.3.2. All valves shall be butterfly valves as specified in the piping section over 50 mm dia. And above and for pipe dia. below 50 mm dia. shall be provided with ball valves.

E.4. Water Filtration Plant (For Domestic Water)

E.4.1. Design parameters for the proposed filter shall be as follows:

i. Filter media: - Graded aggregate of required size selected coarse and fine silica sand as per latest water treatment practice. Aggregate and sand to be acid washed and having purity of 99.9%.

ii. Depth of filter media: - Approx. 750-900 mm deep (as per manufacturer's design)

iii. Back washing: - By air scouring through air blower (approx. 5.1 lpm/m^2 of filter surface area and water supply from raw water pumps by reverse flow

iv. Output Water Quality for Domestic Filters: To confirm to IS 10500 for the relevant design criteria.

E.5. Chemical Dosing Pumps

E.5.1.1. Dosing system comprising of an electronic metering pump with,

100 lit capacity uPVC/HDPE solution tank with level gauge and

lid on top.

E.5.2. Electronic driven metering pumps with mechanically actuated diaphragm with oil lubricated gear mechanism. The output of the pump should be adjustable for operation from 10-100%. Pump construction shall be corrosion resistant polypropylene or similar material. Pump electrical circuit shall be interlocked with the main raw water /pool recirculation pumps so that they operate only when the pumps are operating.

E.6. Air Blower for Back Washing

E.6.1. Low pressure air blower with TEFC electrical motor, belt driven or direct drive, all mounted on a common structural based plate with oil and water separator.

E.6.2. Air blowers will be used for back washing operations. The air blower shall be designed for operation of one filter at a time. Blowers will be designed for air flow of approx 5.1 lpm/m2 air capacity at 0.5 kg/cm2 pressure. (This may be modified to suit manufacturer's requirement for filters offered.)

E.6.3. The electrical switchgear shall be included in the respective MCC panel of the system

E.7. Softener: -

E.7.1. Specifications shall be as per requirements. As per discharge & head, HOS shall be decided, dimension of shell shall be accordingly selected, optimum Resin quantity should be selected with required OBR provisions to be considered. Softener shall be of MS with inner shell FRP lined. It should be provided with back wash, regeneration facility.

Max. Working pressure: 3.5 Kg/cm^2

Min. Working pressure: 2.0 Kg/cm^2

E.7.2. Output water parameters should be as per IGBC norms & relevant IS standards.

F. PUMPS

F.1. WATER TRANSFER PUMPS

F.1.1. Water supply pumps shall be suitable for clean filtered water. Pumps shall be single stage, monoblock vertical/horizontal, centrifugal pumps with cast iron body and bronze/gun metal impeller, stainless steel shaft and mechanical seal and coupled to a TEFC electric motor. Each pump should be operating to a curve required by the operating conditions. MOC stated in DBR for pumps will be deemed as final.

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F.1.2. All parts in contact with water shall be corrosion resistant stainless steel DIN-Nr.1.4401.

F.1.3. Each pump shall be provided with a totally enclosed fan cooled induction motor of suitable H.P. The motors shall be suitable for 410 volts, 3 phases, 50 cycles A.C. power supply and shall confirm to IS 325 operating at 1450 RPM nominal speed.

F.1.4. Each pumping set shall be provided with 100-mm dia gunmetal "Bourden" type pressure gauge with gunmetal valve and connecting piping.

F.1.5. Pump or the whole set shall be stable on rubber vibration eliminating pads appropriate for each pump as recommended by the manufacturer and accepted by the SBI/PMC in charge.

F.2. SUBMERSIBLE PUMPS

F.2.1. Submersible pumps for clear water transfer shall be single stage, submersible centrifugal Pump of closed coupled construction with C.I. casing and Gun Metal/ bronze impeller connected toa fully submersible water/ oil cooled motor.

F.2.2. Stuffing box shall be provided with mechanical seals.

F.2.3. Each pump shall be provided with water cooled Squirrel Cage Induction Motor suitable for 415 Volts, 3 phase, 50 cycles AC power supply.

F.2.4. Each pump shall be provided with liquid level controller for automatic operation of the pump between predetermined levels. Operation of level controller shall be similar to as discussed in subsequent paras below.

F.2.5. The pumping set shall be for stationary application and shall be provided with pump connector in it. The delivery pipe shall be joined to the pump through a rubber diaphragm, and bend and guide pipe for easy installation, without disturbing delivery pipe the pump unit shall have a back pull out design. A rust proof chain shall be provided for each pump.

F.2.6. Pump shall be provided with all accessories and devices necessary and required for the pump to make a complete working system.

F.2.7. The Pump shall be located at a position directly beneath the manhole to ensure proper accessibility.

G. HYDROPNEUMATIC SYSTEM

G.1. PRESSURISED WATER BOOSTING SYSTEM USING VARIABLE SPEED DRIVE

i. The booster set shall consist upto a maximum of six identical vertical multistage in - line pumps in cast iron GG20 pump head & base c/w cataphoresis coating, cartridge type mechanical seal, all internals in AISI 316 stainless steel, mounted on common galvanised steel base frame and controlled by variable frequency drives & a PFU (Pump Functional Unit) logic controller, which have features like application optimised software, regular optimization of operating conditions and read-out of operating data, Bus Communication possibility, Digital remote-control functions, pump & system monitoring functions, Display, Alarm & signal functions and clock programs. Panel to have 2x24 character LCD display, green & red LED's for operating & fault indication, potential free contacts for remote interfacing, an inbuilt lifetime battery backup for all clock functions.

ii. Booster set should include non return valves, isolating valves, pressure transmitter on discharge side, non-return valve, pressure gauge all mounted on

a factory assembled SS manifolds.

iii. Booster set should ensure constant pressure on discharge side through continuously variable adjustment of speed of one of the pumps, while the remaining pumps in operation are running on mains operating at full speed to bring about pump performance to meet consumption levels. Also provision should be made for alternate change over between pumps in operation once every 24 hours & frequency converter operation of pumps by rotation - all should be built in, cyclically, in the controls to ensure equal wear and tear of all pumps in the booster set. Means should be provided for friction loss compensation for increased consumption rate.

iv. Booster set should incorporate following “Power saving features” as standard.

- Selection of 3 basis set points for pressure relative to time.
- Pipe compensation i.e. Change of set point depending on water consumption.
- Compulsory change of staring of sequence, i.e. Equal operating time for pump, both for frequency control and ON/OFF regulation.
- Inputs and outputs for external communication.

A small sized pressure tank, (accumulator) to provide for reducing impact of water hammer and minimize short cycling of the pumps. The accumultors are piped to allow for in service maintenance.

The functions of the Controller should incorporate the following features.,

- Closed loop control.
- On / Off operation at low flow.
- Automatic cascade control of pumps
- Selection of switching sequences , automatic pump change and pump priority.
- Manual Operation.
- Analog set point influence
- Friction loss compensation
- Set point adjustment

The remote control functions should have the following features.,

- System On / Off
- Set point control
- Switching of individual pumps
- The monitoring functions should have the following features.,
  - Min / Max Levels
  - Pre pressure
  - Motor protection
  - Water shortage

monitoring Enclosure Class :

Control Box IP 54 Motors : IP

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G.2. PIPE & FITTINGS (FOR HEADERS AND CONNECTIONS)

G.2.1. Pump suction and delivery headers shall be Galvanized iron pipes/MS heavy class with matching fittings. The pipe joints shall be threaded as per manufacturer's instructions.

G.2.2. **Vibration Eliminators**

All suction and delivery lines as shown on the drawings shall be provided with double flanged reinforced neoprene flexible pipe connectors. Connectors should be suitable for a working pressure of each pump and tested to the test pressure given in the relevant head. Length of the connectors shall be as per site requirements in accordance with manufacturer details.

G.2.3. **Valves**

G.2.3.1. Sluice valves

i. Full way Sluice Valves shall be used on the suction connection to pumps and headers.

ii. Sluice valves (80 mm dia. and above) shall be C.I. double flanged sluice valves with rising stem. Each sluice valve shall be provided with wheel in exposed positions and cap top for underground valves. Contractor shall provide suitable operating keys for sluice valves with cap tops.

iii. Sluice valves shall be of approved makes confirming to I.S.780 PN1.6 class

G.2.3.2. Butterfly Valves (PN 1.6 rating)

i. Butterfly Valves shall be used in all other locations as required confirming to IS 13095.PN 1.6

ii. They shall have a cast iron body.

iii. Disc shall be Stainless Steel

iv. The shaft to be Stainless Steel

v. The seat shall be drop tight constructed by bonding resilient elastomer inside a rigid backing.

vi. Built in flanged rubber seals.

vii. Actuator to level operated for valves above ground and T Key operated for valves below Ground.

viii. Built in flanges for screwed on flanged connections. Manufacturer's details on fixing and Installation will be followed.

G.2.3.3. Non Return Valves (NRV PN 1.6 rating)

Non-return valves/ Dual plate check valve of various dia. as per requirements shall be of cast iron body. It should have Nitrile Rubber/EPDM Seal & Disc of stainless steel. They shall be swing check type/wafer type in horizontal runs and lift check type in vertical runs of piping. It should be of min. PN-16 rating. Test Pressure (Hydrostatic): Shell:
24.50 kg, Seat:16 kg/sqcm, maximum operating temperature- 80 degree C. In case of any discrepencies between manufacturer's standards & above specified values, these parameters shall be in compliance with relevant IS codes.

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7.2.3.4 Pressure gauge (Bourdon Type)

Pressure Guage shall be of suitable range with SS 316 Construction, case of 150/100mm diameter. The gauges shall have brass cocks. The accuracy range of pressure guage shall be in the range of +- 0.5 % to 1%. It shall confirm to IP 67 protection. The dial shall be Aluminium white background with black letters. The windows shall be made of plain & toughend glass. The suitability of pressure gauge shall be in the temperature range of (-) 20 degree Celsius to 60 degree celsius. The gear mechanism shall be of SS 316 & the connection material shall be of SS-316 L. Pointer shall be of black aluminium. It shall be complete with all accessories such as siphon, gauge cock, snubber & needle valve etc. Pressure range shall be between 0 to 20 Kg/Sqcm.

7.2.3.5 Ball Valves

The ball valve of various dia. shall be of forged brass construction & shall have screwed female ends. It shall be lever operated with quarter turn & shall be provided with forged brass hard chrome plated ball. It shall be complete with premium quality PTFE gland packing & seating. The ball valve shall be with chrome finish wherever required. Test Pressure (Hydrostatic): Shell: 25 kg, Seat:16 kg/sqcm, maximum operating temperature- 220 degree C. In case of any discrepencies between manufacturer's standards & above specified values, these parameters shall be in compliance with relevant IS codes.

7.2.3.6 'Y' Strainers (PN 1.6 rating)

Cast iron 'Y' type strainers (with double flanged construction) with gunmetal internal strainers, CI screwed plug to be provided on all water tank suction connections to pumps. It shall have large screening areas to increase efficiency & it shall have minimum pressure drop inside the body due to streamlined body contours. The test pressure for shell shall be 15 Kg/Sqcm. The maximum working pressure shall be 16 kg/sqcm & maximum working temperature shal be 220 degree celsius.

7.3 PAINTING AND CLEANUP

a) On completion of the installation Contractor shall scrub clean all pumps, piping, filters and equipment and apply one coat of primer.

b) Apply two or more coats of synthetic enamel paint of approved make and shade on steel pipes.

c) Provide painted identification legend and direction arrows on all equipment and piping as directed by PMC/Engineer in charge.

d) On final completion of the work, Contractor should cleanup the site, filter room of all surplus materials rubbish and leave the place in a broom-clean condition.

7.4 CABLES

a. Contractor shall provide all power and control cables from the motor control centre to various motors, level controllers and other control devices.

b. Cable size shall be as per functional requirements.

c. XLPE Cables shall be provided confirming to I.S. 7098.

d. Wiring cables shall confirm to IS 694.

e. All power /control wiring & cables shall be aluminum conductor XLPE insulated armoured and PVC sheathed of 1100 volts grade.

f. All cables shall have stranded conductors. The cables shall be in drums as far as possible and bear manufacturer's name.

g. All cable joints shall be made in an approved manner as per standard practice.

7.5 EARTHING

All equipment installed by the Contractor shall be suitably earthed by making proper connection by means of G.I. Wires to the main earthing system laid by the electrical Contractors.

7.6 MOTOR CONTROL CENTRES

i. Switchboard cubicles of approved type shall be fabricated from 2 mm M.S. Sheet with dust and vermin proof construction. It shall be painted with stove enamelled paint of approved make and shape. It shall be fitted with suitable etched plastic identification plates for each motor. The cubicle shall comprise of the following: - (switchgear as given in the DBR).

a. Incoming main switch fuse unit of required capacity.

b. Isolation switch fuse unit, one for each motor.

c. Fully automatic DOL/star delta starters suitable for motor H.P. with push buttons one for each motor and on/off indicating neon lamps.

d. Single phasing preventer of appropriate rating for each motor.

e. Rotary duty selector switch.

f. Panel type ampere meters one for each motor.

g. Panel type voltmeter on incoming main with rotary selector switch to read voltage between phase to neutral and phase to phase.

h. Neon phase indicating lamps and indicating lamp for each motor.

i. Rotary switch for manual or auto operation for each pump.

j. Fully taped separate aluminium bus bars of required capacity for normal and emergency supply where specified.

k. The panel shall be prewired with colour coded wiring. All interconnecting wiring from incoming main to switch gear, meters and accessories within the switch board panel. All switch gears and accessories shall be approved make.

ii. Switchboard cubicles shall be floor or wall mounted type as recommended by manufacturers.

iii. All switch gears and accessories shall be approved make.

H. INSTALLATION, COMMISSIONING & GUARANTEES

8.1 INSTALLATION

8.1.1 Contractor shall supply required number of copies of foundation drawings giving weight, vibration and other loads required for the proper designing of the foundations.

8.1.2 All equipment shall be installed in a true workman like manner true to level and

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grade in accordance with the best current practice.

8.1.3 Contractor shall employ sufficient and proper equipment for lifting and placing of heavy equipment and in a manner which shall not strain or cause damage to the existing structures. If any damage is done, the same shall be made good to the satisfaction of the PMC/Engineer in charge without any additional cost.

8.1.4 All equipment and pipes shall be painted with one coat of red oxide before dispatch to the site.

8.2 COMMISSIONING

8.2.1 On completion of the work in all its aspects, the Contractor shall start up the equipment in a manner normally done for the continuous operation for a period of not less than 48 hours and shall rectify and adjust the equipment for leakages and balancing the system.

8.2.2 After satisfactory commissioning of the plant, the Contractor shall conduct performance tests on the equipment to satisfy the PMC/Engineer in charge that all equipment is performing to the rated outputs. Any or all equipments shall be rectified or replaced if the same is are not performing in accordance with the specifications.

8.3 GUARANTEES

8.3.1 On completion of the work Contractor shall submit a guarantee covering the quality and performance of all materials supplied and installed under the contract. This guarantee shall cover each and every material whether manufactured by the Contractor or not.

8.3.2 Contractor shall specify a suitable procedure to test the rated performance of the equipments and shall provide all necessary equipments, gauges etc. for conducting such tests.

8.3.3 The guarantee shall cover a period of one year from the date of installation and handing over.

8.4 COMPLETION

8.4.1 On completion of the job, the Contractor shall hand over to the PMC/Engineer in charge the following: -

8.4.1.1 One flow chart drawn in ink on thick paper and mounted in a glass frame showing the flow diagram of the process including legend showing valves to be normally open or closed and instructions for back washing, operation and maintenance of chlorination & other chemical feeding pumps and other equipments.

8.4.1.2 Five sets of operating and maintenance instructions with spare parts list and their manufactures and/or suppliers.

8.4.1.3 Five sets of catalogues and drawings for all equipment supplied.

I. WATER TREATMENT PARAMETERS

Expected Treated Water Characteristics after Filtration (Domestic Water Requirements for all Buildings)		
Sl. No.	**Parameters**	**Characteristics**

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1	pH	6. 5 – 8.5
2	Total Dissolved Solids	400 ppm
3	Suspended solids	< 1 mg/ litre
4	Turbidity	Nil
5	Total Hardness	Less than 150 ppm

Expected Treated Water Characteristics after Filtration and Softener (For Cooling Tower Make-up)		
Sl. No.	**Parameters**	**Characteristics**
1	pH	6. 0 – 7.0
2	Total Dissolved Solids	200 ppm
3	Suspended solids	< 1 mg/ litre
4	Turbidity	Nil
5	Total Hardness	Less than 50 ppm

Expected Treated Water parameters shall be in confirmance to relevant IS standards & IGBC Norms.

J. TECHNICAL INFORMATION

Please furnish full details separately

All information should be on the following format

PUMPS

Sr.No	Description	Domestic Water Pump	Irrigation Pump
1	Design basis		
1.1	Quantity/ No. of units offered		
1.2	Capacity lit/lpm		
1.3	Flow Range		
1.4	Pumping Head (where applicable)		
1.5	Make & Model No.		
1.6	Power		
1.7	Pump Type		
1.8	Material (body)		
1.9	Material (Impellers)		
1.10	Material (shafts)		

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2	**Accessories**		
3	**Valves**		
3.1	Type		
3.2	Material (body)		
3.3	Material (Internal parts)		
3.4	Material (Lining)		
4	**Pipes**		
4.1	Type		
4.2	Material		
4.3	Max. working pressure		
4.4	Max. test pressure		

A. PIPE COLOUR CODE

This Colour Code is as per I.S. 2379.Ground Colour , 1st Colour Band & 2nd Colour band Proportional width of band 4:1

Detail as under-

Pipe lines Ground Color , 1st Color & 2nd Color.

1. Drinking water (all cold water lines after filter) -Sea green ,French blue & Signal red
2. Treated water (soft water) -Sea green & Light orange
3. Domestic hot water-Sea green & Light grey
4. Drainage Sewer /SWD-Black
5. Fire services -Fire red - This Color Code is as per I.S. 2379

Final design for colour coding will be of CLIENT/ SBI only.

B. TECHNICAL SPECIFICATIONS OF STP

Design, Engineering Supply, Installation, Testing & Commissioning of STP shall be carried out by the Contractor on EPC Basis & as directed by PMC/Engineer in charge.

Note: IGBC norms & relevant IS standards (output water for irrigation/ flushing/ sewer/ portable) for output water parameters should be complied with.

The Sewage Treatment Plant shall be designed on MBR technology for the following raw sewage flow rate and characteristics:

1. SEWAGE GENERATION AND CHARACTERISTICS & TREATED WATER PARAMETERS: -

Flow Rate : As per DBR or meeting functional requirements.

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1.1 DESIRED QUALITY AFTER TREATMENT

a. DESIRED EFFLUENT QUALITY (AFTER TREATMENT):

Sl. No	Parameter	Unit	Treated water
1	pH	-	6.5 - 8.5
2	Suspended solids	Mg/l	< 100
3	BOD	Mg/l	< 150
4	COD	Mg/l	< 300
5	Oil &Grease	Mg/l	<5

b. DESIRED SEWAGE QUALITY (AFTER TREATMENT):

Sl. No	Parameter	Unit	Treated water
1	pH	-	6.5 - 8.5
2	Suspended solids	Mg/l	<5
3	BOD	Mg/l	< 5
4	COD	Mg/l	<10
5	Oil &Grease	Mg/l	Nil

c. EXPECTED TREATED WATER CHARACTERISTICS AFTER FILTRATION AND SOFTENER (FOR COOLING TOWER MAKE-UP)

Sl. No.	Parameters	Characteristics
1	pH	6. 0 – 7.0
2	Total Dissolved Solids	200 ppm
3	Suspended solids	< 5 mg/liter
4	Turbidity	Nil
5	Total Hardness	Less than 50 ppm

Table Given above is Indicative & Treated Discharge Effluent/Sewage Water shall meet all relevant norms including BIS standards & IGBC compliances.

2. TECHNICAL EQUIPMENT SPECIFICATIONS

i. PRIMARY TREATMENT

a. SCREENS

Quantity : 2 Nos. or As required

Dimension : Wide: 800mm X Height: 1000mm

MOC : Stainless Steel 316

Type : Perforated

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Screening Size	:	20mm & 10mm
Lifting Arrangement	:	Yes

b. MECHANICAL SCREENS

c. Quantity	:	1 Nos.
d. Dimension	:	50 m3/hr or As required
e. MOC	:	Stainless Steel
f. Type	:	Drum Type
g. Screening Size	:	≤5mm
h. Location	:	Before Anoxic Tank

ii. PUMPSET

a. RAW SEWAGE TRANSFER PUMPSET (Collection Tank to Anoxic Tank)

Quantity	:	3 Nos. (2W + 1S)
Type	:	Submersible, Vertical
MOC of Body / Impeller	:	CI / Bronze
Capacity	:	25 m3/hr or As required
Head	:	10-12 mtr
Solid Handling Capacity	:	20 mm
Motor Rating	:	As required fulfilling technical parameters
Lifting Arrangement	:	Manual Chain Pully

b. PLANT ROOM SUMP PUMPSET

Quantity	:	2 Nos. (1W + 1S)
Type	:	Submersible, Vertical
MOC of Body / Impeller	:	CI / Bronze
Capacity	:	25 m3/hr or As required
Head	:	10-12 mtr
Solid Handling Capacity	:	20 mm
Motor Rating	:	As required fulfilling technical parameters
Lifting Arrangement	:	Manual Chain Pully

c. SLUDGE TRANSFER / RECIRCULATION PUMPSET

Quantity	:	3 Nos. (2W + 1S)
Type	:	Monoblock. Centrifugal
MOC of Body / Impeller	:	CI / Bronze
Capacity	:	75 m3/hr or As required
Head	:	12 mtr
Solid Handling Capacity	:	8-10 mm
Motor Rating	:	As required fulfilling technical

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parameters

Providing, installation, testing & commissioning of screw Sludge disposal pump for the disposal of sludge to Screw Press. The pumps shall have CI casing, bronze Impeller & SS shaft & sleeve with mechanical rotary shaft seal connected by a flexible tier type coupling to TEFC induction motor mounted on a common channel base-plate with coupling guard, 150 mm dia pressure gauge with GM isolation cock, suitable vibration eliminator pads of approved design. Motor to be suitable for including all necessary piping, valves and other accessories and concrete foundation complete as required. (2Working + 1 Stand-by or as required).

d. SLUDGE DISPOSAL PUMP PUMPSET

Quantity	:	1 Set (1W+1S)
Type	:	Screw,
Horizontal MOC of Body / Impeller	:	CI / Bronze
Drive	:	V – Belt
Direction of Rotation	:	Clockwise
Capacity	:	3 m3/hr or As Required
Head	:	40 mtr
Solid Handling Capacity	:	Sludge - STP
Motor Rating	:	As required fulfilling technical parameters

e. PERMEATE/SUCTION PUMP

Quantity	:	2 Nos. (1W + 1S)
Type	:	Centrifugal Self Priming with Mech.
Seal MOC of Body / Impeller	:	CI / Bronze
Capacity	:	60 M3/Hr. or As required
Head	:	16 mtr
Operation	:	VFD operated

iii. AIR DIFUSSION SYSTEM

a. AIR BLOWER FOR EQT, SHT & AT

Quantity	:	2 Nos. (1W + 1S)
Type	:	Twin Type Rotary
MOC of Body	:	Cast Iron
Drive	:	V – Belt
Direction of Rotation	:	Clockwise
Suction Silencer with Air Filter	:	Yes
Pressure Gauge / Relief Valve Each	:	1
Capacity	:	1180 m3/hr or As Required
Discharge Pressure	:	0.45 kg/cm2

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Motor Rating	:	As required fulfilling technical parameters

b. AIR BLOWER FOR MEMBRANE SCOURING

Quantity	:	2 Nos. (1W + 1S)
Type	:	Twin Type Rotary
MOC of Body	:	Cast Iron
Drive	:	V – Belt
Direction of Rotation	:	Clockwise
Suction Silencer with Air Filter:		Yes
Pressure Gauge / Relief Valve Each	:	1
Capacity	:	200-350 m3/hr or as required
Discharge Pressure	:	0.45 kg/cm2

c. AIR DIFFUSER FOR AERATION TANK

Type	:	Fine Bubble Tube Aerator
Air Transfer Capacity	:	3 – 5 cfm / meter water
depth Length of Diffuser	:	1000 mm
Dia. of Diffuser	:	63mm or as required
Connection Size	:	20mm or as required
MOC of Membrane	:	EPDM or as required
MOC of Pipe Support	:	SS / EPDM or as required
Fitting Material	:	PVC Shaddle

d. AIR DIFFUSER FOR EQUALISATION AND SLUDGE HOLDING TANK

Type	:	Disc
Air Transfer Capacity	:	4 - 12 Nm3/hr or As Required
Dia. of Diffuser	:	75mm or as required
Connection Size	:	1” BSP or as required
MOC of Membrane	:	EPDM
MOC of Pipe Support	:	SS / EPDM or as required
Fitting Material	:	PVC Shaddle

iv. ANOXIC MIXER

Location	:	In Anoxic
Tank Type	:	Submersible
Capacity	:	As per Tank Volume
MOC	:	SS

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v. MBR MODULE

Quantity	:	Suitable for 1MLD or as per manufacture recommendation
Capacity	:	50 M3/Hr. or As
Required Type Of Membrane	:	Hollow Fibre/Flat Sheet
MOC of Membrane	:	PVDF
Pore Size	:	0.04 to 0.08 micron
Permeate MOC	:	SS-316
Air Diffuser	:	PVC/PP

vi. ULTRA VIOLET UNIT

Quantity	:	2 No. or As Required
Capacity	:	25 m3/hr or As Required
MOC Reactor	:	Stainless Steel 316L
MOC Quartz Jacket	:	High Purity Quartz (UVT >
95%) UV Dosage	:	60mJ/cm2 (65% UVT)
Voltage	:	220 – 240V / 50 – 60Hz
End Connection	:	65mm or as
required Max. Operating Pressure	:	80psig or as
required Max. Operating Temperature	:	45 Degree C
Control Panel Rating	:	IP54
Control Panel MOC	:	Sheet Steel with Electrophoretic
Dipcoat Priming and Textured Powder		
Coating Ballast Type	:	Electronic with Programmed Soft
Start Lamp Replacement Reminder	:	Yes
Lamp Running Hour Counter	:	Yes Lamp
Failure Indication	:	Yes UV
Monitoring System	:	Yes

vii. SLUDGE DEWATERING

a. SCREW PRESS

Quantity	:	1 No.
Capacity	:	3 m3/hr or As
Required Solid at Outlet	:	18-22 %
Noise Level	:	Less than 65 db
Vibration Level	:	<50 Microns

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Thickening cum compaction cylinder :

Diameter/Length	:	Dia.110mm/1000 mm long
MOC in pressure zone	:	SS 316 in thickening zone and SS-316
Filter Screen	:	SS -316
Weir Type for flow control	:	Rinsing Hollow
Pipe Screw Gear Box Type	:	Heli worm

viii. INSTRUMENTATION

a. LEVEL INDICATOR & CONTROLLER

Quantity	:	3 set or As Required
Dimension	:	As Required within EQT, MBR & TWT
Type	:	Electronic
High / Low level Alarm	:	Yes, Auxiliary NO/NC

b. AIR FLOW METER

Quantity	:	2 Nos. or As Required
Type	:	Vertical - Rotameter
MOC of Body	:	High Grade Acrylic
Capacity	:	60 &15 M3/Hr or As
Required Operating Temperature	:	Ambient
Operating Pressure	:	6PSI
MOC of Float	:	SS 316

c. WATER FLOW METER

Quantity	:	2 No. or as required
Type	:	Electromagnetic
Capacity	:	50M3/Hr or as required
Operating Temperature	:	Ambient
Operating Pressure	:	6PSI or as required
Connection Size	:	50mm or as required
MOC of Connection	:	SS

d. pH METER

Quantity	:	1 No. or as required
Type	:	Flow Through / Tank (Optional)
Sensor O/P	:	Milli Volt
Application / Fluid	:	Treated Sewage
Range	:	00.00 – 14.00 pH

e. ENERGY METER

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Quantity	:	1 No. or as required
Type	:	Electronic
Range	:	10 – 40 Amps or as required.

ix. INTERCONNECTING PIPE & FITTINGS

a. PIPING

Submerged Air Pipe Line	:	SS 316
Diffuser Line	:	Flexible
Air Line	:	MS Epoxy Painted
Effluent & Submerged Water Pipe Line:		PVC Heavy
Class Water Line	:	MS Duly
Painted		
Pipe Class	:	Medium Class
MOC of Fittings	:	As
Required		

x. ELECTRICAL WORK

a. ELECTRICAL CONTROL PANEL

Quantity	:	1 Set or as required
Fabrication Material	:	14Gauge CRCA Sheet Steel
duly Anticorrosive Paint & Powder Coated Gland Plate: Top & Bottom		
Description	:	As required
Electrical Accessories	:	ISI Approved

b. CABLE & CONDUITING

Quantity	:	1 Lot within Plant Room
Type	:	Flexible – Triple Layer ISI Marked

Note: Tank sizining as well as Electromechanical Equipment sizing calculation shall be submitted in excel with built in formula for approval before execution / installation at site with STP Drawings.

C. <u>SOLAR WATER HEATING SYSTEM</u>

Design, Engineering Supply, Installation, Testing & Commissioning of Solar Water Heating systems shall be carried out by the Contractor on EPC Basis & as directed by PMC/Engineer in charge. Solar Hot water system shall include flat plate solar collects or panels as per (BIS) OEM standards, absorber coating shall be suitably selective coating having absorptivity should be greater than 90% & emissivity should be less than 20%. Solar collector having copper fins & tubes with laser/ ultrasonic welded with brass flanges & EPDM rubber gaskets.

Solar collector absorber should be Cu-Cu type of suitable dimensions as per BIS standard. It shall be provided with rockwool or any other suitable insulation at sides & bottom of suitable thickness with proper density & K value. All the specifications of items used in solar collector should be according to BIS standard.

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Solar water heating system shall be indirect heating system with closed circulation, SS 316 heat exchanger having surface area should be 0.24 Sq. mtr/100 Liter. For closed circuit make up tank of suitable capacity shall be of PVC construction & shall be provided with soft water provision & to refill at particular interval.

For SBI Building Closed Coupled Solar Hot Water System integrated with Heat Pumps shall be used. In a "close-coupled" SWH system the storage tank is horizontally/vertically mounted on the roof. Internal solar thermal circulation shall be Thermosyphon/Force circulation depends upon the system capacity and site conditions. Solar water heating system produces hot water at a temperature of 60 Deg. C and in accordance with the IS-12976:1990 and IS-12933:1990 (Part 1 to part 5). Solar hot water system may be with recirculation pump & heat exchanger system, Hydro pneumatic pump to supply water from raw water storage tank to solar storge tank if height of hot water storage tank is higher than raw water storage tank or provide a separate tank which having height more than hot water storage tank. Hot water storage tank of suitable capacity & MOC of SS 316 of required shell & dish thickness. It shall be provided with suitable insulation of required thickness, K value & density & 24 G aluminum cladding.

In force circulation of solar water heating system, circulation pump to be controlled by differential temperature controller (DTC) which will automatically run in day time & off in night time even when required. Circulation pump to be install in 1W + 1 S arrangement which can be automatic switching from one to other.

Hot water returns or recirculation pump to be run on timer-based arrangement, when the line water will get cold on certain temperature, recirculation pump will run and when pipeline fill with hot water it will OFF automatically. Recirculation pump to be install in 1W + 1 S arrangement which can be automatic switching from one to other.

Hot water circulation pump for Heat pump should be synchronized with Heat pump, when heat pump will run then only circulation pump will run and when it will stop then circulation pump will automatically stop.

Suitable Heat exchangers with primary & secondary pumps, which shall be horizontal/ vertical centrifugal type of suitable head & discharge with motor confirming to IE3 class efficiency with brass impeller, SS 316 shaft & CI casing. Cold water tank for providing water to solar storage tank of suitable capacity made out of PVC with low- & high-level controllers. Electrical control panel for the entire system with necessary cabling, level controllers, sensors, wires & other accessories shall be provided.

System to ensure that the solar hot water generated during the sunshine hours of the day is stored in a Solar Insulated tank (Heat Bank) & then the Heat is transferred to the main storage tank, which temperature maintained by Heat Pump on desired temperature so that the **Hot Water is made available at the Controlled Temperature** for final usage.

In other buildings, conventional Solar Hot Water System shall be used with/without any recirculation pumps. It supplies the hot water by gravity as a preheated water to the electric geysers at all user points. Wherever, pumps are provided, one standby provision to be considered.

TESTING: All G.I pipes of Primary Circuit (Collector Circuits) shall be tested to hydrostatically for a period of 30 minutes to a pressure of 2 kg/Sq.cm without drop

in pressure and all other G.I pipes for a pressure of 6 Kg/Sq.cm.

HOT WATER STORAGE TANK

SS-316 horizontal/vertical hot water storage tank with the required thickness (as Required) to withstand working pressure of 5 kg/Sq cm. The hot water storage tank is provided with a manhole, cover, drain, vent, overflow, inlet and outlet connections etc. as required and as per direction of PMC/Engineer in charge.

Hot water storage tank shall be insulated with 100 mm thick Rock wool insulation of 48 Kg/cu mt. density and cladding with 26 SWG aluminum sheets.

Each hot water storage tank shall be provided with the following:

- Safety valve
- One AIR Release valve
- Pressure and temperature relief valve
- Primary flow connection
- Hot water supply connection
- Hot water return connection
- Drain connection
- Thermometer fitted (inserted) in thermo well
- Pressure gauge
- Make up tank
- Ball valve

The hot water storage tank shall be hydrostatically tested to one and half times the working pressure of a system for a period of 2 hours without any leak. Field tests are to be performed at site to satisfy the capacity and operation of the unit by the SBI/PMC/Project in-charge.

PIPING

a. HOT WATER PIPING

Supply and return pipes of the hot water system complete with necessary pipes, bends, flanges, fittings, gaskets and valves are to be provided to connect Solar water heating system, hot water storage tank.

The hot water supply and return pipes are insulated with 50mm Rock wool of 48 Kg/cu mt. density and cladding with 26 SWG aluminum sheets.

b. HOT WATER SOLAR PIPING

GI solar & Heat Pump hot water piping complete with bends, flanges, fittings, gaskets and valves to connect the solar panels to the hot water storage tank with necessary valves and fittings.

This also includes the solar circulation pumps as per requirement to circulate the hot water to the tank from the solar panels & Heat Pump.

The hot water supply and return pipes are insulated with 50mm Rock wool of 48 Kg/cu mt. density and cladding with 26 SWG aluminum sheets.

c. PIPE INSULATION

Pipe insulation shall be 50mm Rock wool of 48 Kg/cu mt. density and cladding with 26 SWG aluminum sheets.

d. INSTALLATION

Pipe installation shall be carried out with proper workmanship in accordance with approved drawings/ SBI/PMC in Charge. Pipe shall be aligned parallel to walls and ceiling and not across the room. Change of direction shall be through hydraulically formed welding fittings as specified.

Alignment shall follow the approved drawings/ Engineer in Charge and wherever necessary pipe shall be rerouted under the instructions of Engineer in Charge in order to meet the site conditions and or interference from other services.

e. **PAINTING**

Pipe supports shall be of steel with a prime coat of red oxide and two finish coats of matt black paint after installation.

f. **SUPPORTS**

Supports shall be spaced as follows:

Size	Horizontal	Vertical
Upto 15 mm	1.25 m	1.8 m
20 to 25 mm	2.00 m	2.5 m
32 to 125 mm	2.50 m	3.0 m
150mm & Over	3.00 m	3.0 m

- Additional supports shall be provided at the bends, at heavy fittings like valves, near equipment and as directed by PMC/ Authority Engineer in Charge. Pipe hangers shall be from structural steel, steel inserts in concrete, wall brackets or floor supports as decided by the Engineer in Charge depending upon the location of the support. Hangers shall not be secured to light weight roof, wall, false ceiling or any other member which is not structurally meant for such loading. Hangers from structural steel shall be from suitably designed clamps or attachments and in no case should drilling or punching of such steel members be allowed. All pipe supports shall be capable of being adjusted in height to the tune of 50 mm.
- Pipe clamps shall be specially fabricated fittings for pipes. All clamps shall be of galvanized steel and finish coated with matt black paint. Clamps shall take into account pipe movement owing to temperature variations & anchors, and in no case shall the clamping arrangement induce stresses beyond the safe load limits of the pipe under fully filled conditions. Where pipes are insulated, the clamping shall interpose a hard insulation material or shall be designed so that the insulation is not compressed for more than 60 % of its compression strength.
- Vertical pipe risers shall be supported at each floor and in addition, the riser shall have a duck-foot support.
- All pipe joints shall be welded except where flange joints are specified hereinafter. Pipes upto 40 mm NB shall use socket - weld fittings of 150

lbs rating with fillet welding and larger sizes shall have used with butt-welding type single V 35 deg weld preparation. Flange joints shall be provided at the following positions:

a. Pair of flanges for isolation of equipment

b. Mating flange for equipment flange connections

c. Mating flange for valves, strainers as the case may be

d. Pair of flanges at every 40 m continuous run of piping

e. All piping shall be laid and tack welded in position with flanges, valves etc. After inspection and approval by the Engineer in Charge as to the alignment and height, the piping shall be full welded. Piping may be presented for such approval in sections. Slip-on flanges shall be demounted for welding. Random samples of valves shall be tested for leaks and seating. Necessary hand pump and blank flange facilities with pressure gauge, valves etc. should be provided at site.

f. All pipe insulations shall be carried out in sections after duly testing.

g. TESTING

Piping shall be hydrostatically tested to 1.5 times more than the rated pressure for a minimum period of 24 hours without any leak and loss of pressure.

Circulation pump to be install in 1W + 1 S arrangement which can be automatic switching from one to other.

D. SOLAR THERMAL COLLECTOR

1. The scope of work covers supply, erection, testing and commissioning of the Solar Collector Panels meeting the requirements and the intent of this specifications**.**
2. Manufacturer's catalogues and guaranteed performance details to be submitted for Approvals before ordering the supply of the equipment.

a. COLLECTOR:

Solar Collector Type : copper to copper type with minimum size of 2 sq. mtr.

- Collector Frame Extruded - Aluminum 1.4 mm thick or as required
- Gasket for Glass (Beading) - EPDM "U" Type
- Glazing (Cover) - 302mm Toughened clear glass
- Collector Body - Aluminium
- Bottom Insulation - 40 mm Rockwool (Minimum)
- Side Insulation - 20 mm Rockwool (Minimum)
- Absorber Plate - Copper
- Riser Copper - Dia- 12.7 mm or as required
- Inlet Header Copper - Dia- 25.4 mm or as required
- Reflective Foil - Aluminum or as required

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- Grommet - EPDM or as required
- Collector Back sheet - Aluminum or as required
- Absorber area - 2 Sq. Mtr. or as required
- No. of Riser tubes per collector - 9 per collector
- No. of Absorber Plate per collector- 9 per collector
- Glazing transmissivity > 80%
- Coating absorptivity > 0.90
- Coating emissivity < 0.20
- Absorber riser bonding - Ultrasonic/Laser Welding
- Collector efficiency at ambient temp. > 65% or as required
- Finish - (Powder Coating)Golden yellow for frame, Black for Glass retaining angle
- Working Pressure -5 Kg./cm2 or as required
- Operating Conditions T > 50deg.C or as required

b. COLLECTOR SUPPORT FRAME/ STUCTURE

The structure should be in a position to withstand a wind velocity of 100 Kms/hr. It shall be made of angle iron 35mm x35mmx5mm and shall have vertical support at top and bottom edge of the inclined plane of the collector at a distance of 2.5 m or less. The vertical support shall be firmly grouted to the roof in the ground in case of ground mounted system. The grouting blocks shall be of minimum equal to 300 mm x 300 mm x 300 mm and finished properly. In case the grouting is carried out on roof already water proofed with asphalt the back support of the collectors may be anchored to the parapet or the size of the grouting block shall be increased to provide for a dead weight anchoring of 75 kg per leg of the vertical support. Any other alternative method of grouting/supporting shall be submitted the documents to PMC/Engineer in charge / Project In charge for their approval prior to execution.

c. ABSORBER

(1) The absorber shall consist of riser, header and sheet for absorber. The diameter of header shall be 25.4 mm and Thickness 0.71 mm. The diameter of the riser shall be 12.7 mm and thickness 0.56 mm and made of copper only. The distance between the riser from center to center shall be 120 mm. Type, Grade, Size, Workmanship and Finishes shall be as per IS: 12933. The riser and header pipes shall be of copper. The welding between Copper tube riser and Copper Sheet should be Laser-Welding or Ultrasonic-Welding

(2) The sheet shall be coated with selective coating to satisfy solar absorption of more than 0.90&solaremissivity < 0.12. or as required.

(3) The selective coating shall not get damage when the sample is raised to 1250 Degree C temperatures.

(4) All tests such as solar absorption test, emissivity test and temperature tests are to be carried out as per standard tests.

(5) Riser and header assembly designed for working pressure up to 2.5

Kg/cm2 and shall be tested for leakage at the Min. hydraulic pressure of 3.5 kg/cm2.

(6) Sheet for absorber shall be made of copper only.

d. PUMPS FOR FORCED CIRCULATION, HTC & RE_CIRCULATION OPERATIONS

All Pumps used in the solar system for Forced Circulation, HTC & Re-Circulation Systems shall be Horizontal type with Centrifugal operation & having SS Impeller & Shaft and with CI Body. All Pumps shall be suitable for 3-Phase Operation & shall be for 1Working &1Standby mode.

e. **ELECTRICAL HEATER**

Electrical Heater shall be ISI Marked immersion type. Electrical heater capacity shall same as Heat pump capacity or design to achieve Delta 40 degree of per day hot water requirement.

f. **ELECTRICAL HEATER CONTROL PANEL**

The Electrical Heaters shall operate through temperature controller with switchgear & contactor & It should be the part of main control panel.

g. CONTROL PANEL FOR PUMP OPERATION

The Operation of the Pumps in the above operations shall be DOL Starter based with adequate rating. The Main Control Panel Shall be sub-divided into sub-Zones for following operations

- Forced Circulation Zone
- Heat Transfer & Control Zone (for Primary & Secondary Pump sets)
- Hot Water Re-Circulation in Building Zone
- Heat Pump Zone

Note: Contractor shall provide Control Panel with makes as specified in the list of approved makes with digital differential temperature controller / PLC including necessary electronic parts like Contractors, Relays, Indicators, MCBs, Control fuses etc. for satisfactory working of pumps.

h. TEMPERATURE GAUGE

DIAL Type temperature gauge duly calibrated and suitable for temperature range 0-120 deg. Celsius shall be provided.

Contractor shall provide all valves, strainer, float valves and NRV etc. as per requirement.

Contractor shall provide 1:2:4 cement concrete foundation of size 300x300x250 mm (1 cement: 2 coarse sand: 4 stone aggregate of size 20 mm nominal size) for each and every footing of system. This will be scope of Civil Contractor with complete guidance from Solar Contractor.

i. PAINTING OF STANDS

Proper cleaning and degreasing of the surface should be done before painting. Two coats of zinc chromate red oxide primer shall be applied followed by one coat of epoxy paint and approved color recommended by the CLIENT/ SBI.

j. PIPING

a) Material : Medium class (B class) GI as per IS 1239 shall be used for piping.

b) Back insulation : Insulation of R value = 1.67 m2 °C/W to withstand a temperature of 100°C shall be used.

Typical insulation detail shown below and also confirming to ECBC standards.

Thin plastic sheet shall be used as covering between glass wool and aluminum cladding besides other retaining material like chicken mesh etc.

26 SWG aluminium sheet shall be used for cladding the insulated pipe.

k. VALVES / NIPPLE / TEES / BENDS

Gun metal valve as per IS 780 specifications shall be

used. Nipple / Tees and bends shall be of GI as per IS

1239 Part II.

Gun metal ball valve shall be provided in each row outlet with Air vent.

l. VALVES

Gate valves or butterfly valves for shut-off or sectionalizing service, globe or ball valves for flow modulation. For on-site control, use gate valves. Specialty valve shall be employed where appropriate, such as check valves on a pump discharge, pressure regulating valves for equipment requiring lower-than-available system pressure, solenoid valves, etc. Flanged or threaded end valves are preferred. Locate valves in accessible locations, not more than six feet above the floor, if frequently used, and with a union on the downstream side of threaded end valves.

Provide each valve with brass, aluminum or plastic disc not les than 32mm diameter engraved with numbers, piping service and normal operating position (i.e. NO, NC) corresponding to valves shown on the diagram. Fasten disc to valve with 14gauge brass wire or 16gauge jack chain.

m. GATE VALVE

The primary function of a gate valve is for starting and stopping of flow. It has a disc actuated by a stem screw and hand wheel, moves up and down at right angles to the path of flow of fluid and seats against two faces to shut of flow. As the disc of the gate valve presents a flat surface to the direction of flow, this valve is only for starting and shutting the flow in the pipe.

These valves are of Gun Metal (GM) make. Supplying, fixing and testing correspond to IS 778-1984, Specifications for Copper Alloy Gate, Globe and Check Valves for Water Works.

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

All valves should have manufacturer's test certificate indicating the date of shop test and other quality control tests with the material used for the same.

n. BALL VALVE

The ball valve shall be of high-pressure type and shall be of sizes as specified and/or shown in the drawings the normal size of a ball valve shall be that,

corresponding to the size of the pipe to which it is fixed. Ball valves shall have body of carbon steel. The ball and the shaft shall be of stainless steel. The seat shall be of PTFE.

The valve shall be complete with socket weld ends and the float of copper sheet. The minimum thickness of copper sheet used for making the float shall be 0.45mm for a float exceeding 115mm dia. The body of the high-pressure ball valve when assembled in working condition with the float immersed to not more than half of its diameter shall remain closed against a test pressure of 3.5kg/sqcm.

The ball valve shall generally confirm to IS specification No.1703: 1977. The weight of ball cock and the size of the ball cock shall be as per IS specification.

o. SYSTEM LAYOUT AND DESIGN

Maximum number of collectors in series shall be not more than Ten for Thermosyphon system and not more than 15 for force circulation system.

Maximum number of collectors in parallel in one row with header-to-header connections should not be more than six.

Air venting at appropriate places without hindrance of a spring-loaded valve to prevent air locking in the system should be provided. For this purpose, system shall have at a suitable point atmospheric pressure conditions preferably in the high temperature zone. Flow rates commensurate with optimum heat removal from collector plates.

System shall have a suitable expansion / make up tank at a high point in the system to ensure that collectors run full all the times. Capacity of this expansion make up tank should be 1% of the system capacity for all systems above the capacity of 5000 LPD and 1.5% of the system capacity for the systems of capacity ranging from 1000 LPD to 5000 LPD.

Expansion cum make-up tank is for closed loop system and make up tank is for open loop system.

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CHAPTER - K

TECHNICAL SPECIFICATIONS- RO PLANT (Portable & Centralized)

1. SCOPE OF WORK:

Work shall consist of furnishing all labour, materials, equipment,appliances necessary and required. The Contractor is required to completely furnish all the plumbing and other specialized services as described hereinafter and as specified in the DBR and/or shown on the plumbing drawings for RO Plant.

1.1. EXECUTION OF WORK

1.1.1. The Contractor should visit and examine the site of work and satisfy himself as to the nature of the existing roads and other means of communication and other details pertaining to the work and local conditions and facilities for obtaining his own information on all matters affecting the execution of work.

1.1.2. The work shall be carried out in confirmity with the Plumbing drawings and within the requirements of architectural and coordinated with all services drawings.

1.1.3. The Contractor shall cooperate with all trades and agencies working on the site. He shall make provision for hangers, sleeves, structural openings and other requirements well in advance to prevent hold up of progress of the construction schedule. All supports to the civil structure shall be provided with dash fasteners.

1.1.4. On award of the work, Contractor shall submit a schedule of construction in the form of a PERT chart or BAR chart for approval of the PMC/Engineer in charge/ CLIENT. All dates and time schedule agreed upon shall be strictly adhered to within the stipulated time of completion/ commissioning along with the specified phasing, if any.

1.1. DRAWINGS

1.1.1. Shop drawings will be prepared & submitted to PMC/Engineer in charge for approval. The execution of work shall be done in–line with the approved shop drawings.

1.1.2. Architectural drawings shall take precedence over plumbing or other services drawings as to all dimensions.

1.1.3. Contractor shall verify all dimensions at site and bring to the notice of the SBI/PMC in charge all discrepancies or deviations noticed. Decision of the PMC/Engineer in charge shall be final.

1.1.4. Large size details and manufacturers dimensions for materials to be incorporated shall take precedence over small scale drawings.

1.1.5. Any drawings issued by the PMC/Engineer in charge for the work are the property of the PMC/Engineer in charge and shall not be lent, reproduced or used on any works other than intended without the written permission of the PMC/Engineer in charge.

1.2. REFERENCE DRAWINGS

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1.2.1. The Contractor shall maintain one set of all drawings issued to him as reference drawings. These shall not be used on site. All important drawings shall be mounted on boards and placed in racks indexed. No drawings shall be rolled.

1.2.2. All corrections, deviations and changes made on the site shall be shown on these reference drawings for final incorporation in the completion drawings to be submitted by the Contractor in fulfilment of the conditions of this contract.

1.2.3. On award of the work the Contractor shall be issued, one set of CLIENT's working drawings stamped "tender drawings" by the PMC/Engineer in charge. The CLIENT's drawings shall be the basis of Contractor's shop drawings. Upon submission of shop drawings to CLIENT, Final approved drawings will be stamped as "Good for Construction" drawings, based on which execution work will be done.

1.2.4. Shop drawings are detailed working drawings which incorporate the Contractor's details for execution of the work and incorporate equipment manufacturer's details and dimensions to ensure that the same can be installed in the space provided.

1.2.5. All shop drawings should have detailed pipe routing and levels, showing location of other services at crossings etc., cable runs, route cable trays and all allied works and must be fully coordinated with other services and approved by the PMC/Engineer in charge before execution of the works.

1.2.6. Shop drawings shall be furnished for detailed layout of all equipment, foundation, bolting and vibration elimination details along with information on dead and dynamic load, vibration etc.

1.2.7. Two sets of manufacturer's equipment drawings, roughing in and wiring diagrams shall be submitted.

1.2.8. Contractor shall submit shop drawings furnishing all details of MCC panels, cable routes, wiring diagrams and connection details as required.

1.2.9. Two copies of each set of shop drawings shall be submitted for initial scrutiny, discussion and approval.

1.2.10. Each submission shall be accompanied by Contractor's certificate stating that the shop drawings meet all the contract requirements and that the piping and equipment can be satisfactorily installed without any obstructions in the space available.

1.2.11. On approval of the above the Contractor shall furnish three sets of the approved shop drawings for execution of the work.

1.3. INSPECTION AND TESTING OF MATERIALS

1.3.1. Contractor shall be required, if requested, to produce manufacturers test certificate for the particular batch of materials supplied to him. The tests carried out shall be as per the relevant Bureau of Indian Standards.

1.3.2. For examination and testing of materials and works at the site Contractor shall provide all testing and gauging equipment necessary but not limited to the following:

a. Steel tapes

b. Weighing machine

c. Plumb bobs, sprit levels, hammer

d. Micrometers

1.3.3.Hydraulic machine

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1.3.4. All such equipment shall be tested for calibration at any approved laboratory, if required by the PMC/Engineer in charge. All testing equipment shall be preferably located in special room meant for the purpose.

1.3.5. Samples of all materials shall be got approved before placing order and the approved samples shall be deposited with the PMC/Engineer in charge.

1.4. METRIC CONVERSION

1.4.1. All dimensions and sizes of materials and equipment given in the tender document are commercial metric sizes.

1.4.2. Any weights, or sizes given in the tender having changed due to metric conversion, the nearest equivalent sizes accepted by Indian Standards shall be acceptable without any additional cost.

1.5. COMPLETION DRAWINGS

1.5.1. On completion of work, Contractor shall submit one complete set of original tracings and six prints of "as built" drawings. These drawings shall have the following information.

1.6. Run of all piping, diameters on all floors, vertical stacks and location of external services.

1.7. Ground and invert levels of all drainage pipes together with location of all manholes and connections up to outfall.

1.8. Run of all water supply lines with diameters, locations of control valves, access panels.

1.9. Layout showing location of all mechanical equipment and piping connections.

1.10. All shop drawings shall be updated from time to time for the purpose of making completion drawings.

1.11. No completion certificate shall be issued unless the above drawings are submitted.

1.12. Contractor shall provide four sets of catalogues, service/operation & maintenance manuals, manufacturer's drawings, performance data and list of spare parts together with the name and address of the manufacturer for all electrical and mechanical equipment provided by him.

1.13. All "warranty cards" given by the manufacturers shall be handed over to the SBI/PMC in charge.

1.14. TESTING

1.14.1. Piping and drainage works shall be tested as specified under the relevant clauses of the specifications.

1.14.2. Tests shall be performed in presence of the PMC/Engineer in charge and test records for the tests shall be duly signed by Contractor and the PMC/Engineer in charge.

1.14.3. All materials and equipment found defective shall be replaced and whole work tested to meet the requirements of the specifications.

1.14.4. Contractor shall perform all such tests as may be necessary and required by the local authorities to meet municipal or other bye-laws in force.

1.14.5. Contractor shall provide all labour, equipment and materials for the performance

of the tests.

1.15. SITE CLEARANCE AND CLEANUP

1.15.1. The Contractor shall, from time to time, clear away all debris and excess materials accumulated at the site.

1.15.2. After the fixtures, equipment and appliances have been installed and commissioned, Contractor shall clean-up the same and remove all plaster, paints, stains, stickers and other foreign matter or discolouration leaving the same in a ready to use condition.

1.15.3. On completion of all works, Contractor shall demolish all stores, remove all surplus materials and leave the site in a broom clean condition, failing which the same shall be done by the PMC/Engineer in charge at the Contractor's risk and cost. Cost of the cleanup shall be deducted from the Contractor's bills on pro-rata basis in proportion to his contract value.

1.16. LICENCE PERMITS AND AUTHORITIES

1.16.1. Contractor must hold a valid plumbing or any other as required license by the municipal authority or other competent authority under whose jurisdiction the work falls.

1.16.2. Contractor must keep constant liaison with the local development, municipal /statutory authority and obtain approval of all drainage, water supply, fire suppression and other works carried out by him.

1.16.3. Contractor shall obtain, from the municipal and other authorities 'C' & 'D' & other forms as required for approval of drainage and water supply works during execution and the completion certificate with respect to his work as required for occupation of the building. Contractor shall obtain permanent water supply and drainage connections from authorities concerned. CLIENT shall reimburse the fees paid to the authorities towards the connection charges on production of receipts for money paid.

1.16.4. Contractor shall get any materials tested from the appropriate authority if so required with no cost to the CLIENT/CLIENT.

1.17. CUTTING OF WATER PROOFING MEMBRANE:

1.17.1. No walls terraces shall be cut for making and opening after water proofing has been done without written approval of PMC/Engineer in charge. Cutting of water proofing membrane shall be done very carefully so as other portion of water proofing is not damaged. On completion of work at such place the water proofing membrane shall be made good and ensured that the opening/cutting is made fully water proof as per specifications and details of water proofing approved by SBI/PMC in charge.

1.18. MATERIALS

1.18.1. Unless otherwise specified and expressly approved in writing by the PMC/Engineer in charge, only materials of makes and specification as mentioned in the list of approved makes attached with the specifications shall be used.

1.18.2. If required, the Contractor shall submit samples of materials proposed to be used in the works. Approved samples shall be kept in the office of the PMC/Engineer in charge.

2. DESIGN BASIS: -

The central RO Capacity shall be as per DBR. Portable RO Water System with SS water cooler shall be installed as per DBR & meeting functional requirements.

2.1. TREATED WATER QUALITY

Physical Quality

Normally the RO water turbidity shall be less than 1 NTU.

The colour of the filtered water shall be restricted to 2 Hazen units on platinum

cobalt There shall be nothing objectionable as regards taste and odor

Chemical Quality

The pH value of filtered water shall be within 6.5 – 7.0

Other chemical quality parameters such as total dissolved solids should be less than 50 ppm

Biological Quality

Throughout the year, 100% of samples shall not contain any coliform organism in 100 ml.

Coliform organisms shall not be detectable in 100 ml of any two consecutive samples. No sample shall contain E – Coli in 100 ml.

EXPECTED TREATED WATER CHARACTERISTICS AFTER RO (REVERSE OSMOSIS PLANT)

Expected Treated Water Characteristics after RO (Reverse Osmosis Plant)	
Parameters	**Characteristics**
PH	6. 0 – 7.0
Total Dissolved Solids	<50 ppm
Suspended solids	Nil
Turbidity	Nil
Iron as Fe	Nil
Total Hardness	Less than 5 ppm

The Output of RO Water should comply with the BIS 10500 for Drinking Water.

The RO membranes are embedded within the pressure vessel. One side of the membrane is enclosed within the brine seal to avoid the mixing of filtered water and inlet water. Each membrane is connected to the other by means of interconnect or, and has a common permeate end. The filtered water is collected from the permeate end is sent to drinking and cafeteria usage.

3. Components & specification of Centralized RO Plant are mentioned hereunder: -

3.1. **RO High Pressure Feed Pumps (HPP)** of Vertical multistage centrifugal type and suitable head to generate permeate flow. The pump casing construction shall be of SS-316 & impeller shall be also SS 316. The motor shall be TEFC with IE-3 efficiency suitable for a

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supply of 415V / 3 Phase at 50 Hz. Supply. The pump shall be supplied complete with base channel, coupling foundation bolts, pressure gauge, valves at inlet and outlet of each pump. (1 working + 1 Standby). RO high pressure pump is water feeding from treated water tank to RO module at high pressure flow.

3.2. R**O Raw Water Pumps (RWP)** of Vertical multistage centrifugal type and suitable head to generate permeate flow as Required. The pump casing construction shall be of SS-316 & impeller shall be also SS 316. The motor shall be TEFC with IE -3 efficiency suitable for a supply of 415 V / 3 Phase / 50 Hz. Supply. The pump shall be supplied complete with base channel, coupling foundation bolts, pressure gauge, valves at inlet and outlet of each pump. (Contractor to confirm duty for suitability). (1 working + 1 Standby).

3.3. **Package type RO module** capable of giving a net treated water output as required. The Reverse osmosis module shall be made out of Sprial Wound Thin Film Composite suitable BSPT/NPT connections shall be used for connecting feed and reject ends. The modules shall be supplied complete with all necessary instrumentation, valves for sampling, drain, reject and permeate.

3.4. **Special Antiscalant dosing system** consisting of one HDPE tank of capacity as Required with a positive displacement diaphragm dosing pump having variable flow rate. The motor shall be suitable for operation at 240 V / single phase / 50 Hz supply. The pump shall be supplied complete with necessary polypropylene piping, valves, strainers and injection fittings.

3.5. **Micron cartridge filter (**shall be made of FDA compliant high quality poly propylene material) suitable for a flow rate as Required to achieve particle filtration of less than 5 microns. The unit shall be supplied complete with inlet and outlet branches, removal caps for replacement of elements, inlet and outlet pressure indicator, valves etc. complete in all respect.

3.6. **CIP system (Cleaning in Place)** consisting of HDPE tank with agitator complete with inlet/outlet, drain overflow etc. along with SS pump of capacity as required and cartridge filter of 10 microns. The cartridge filter shall be made of FDA compliant high quality poly propylene material to achieve particle filtration of less than 10 microns.

3.7. **PH correction dosing system** consisting of one HDPE tank with a positive displacement diaphragm dosing pump having variable flow rate as required. The motor shall be suitable for operation at 240 V / single phase / 50 Hz supply. The pump shall be supplied complete with necessary polypropylene piping, valves, strainers and injection fittings.

3.8. **Centralized control panel** made out of CRCA sheet min. 2mm thick having main contactors for all pumps (listed above) including SPP, 3 phase thermal overload relay. The control panel for monitoring and control of RO system shall include all required signal lamps, HRC fuses, and Annunciation box with hooter. All control and power cabling along with double earthing between the panel shall be included in the scope of the Contractor. An emergency stop push button shall be provided in the panel.

3.9. **High pressure side piping** from the RO high pressure pumps to the rejects stream control valves shall be of SS 316 using all SS fittings ball valves of suitable pressure rating shall be used till 50 MM size, above 50 MM, flanged globe / water butterfly valves in SS construction shall be used. Rejects pressure control valves shall be globe valve and feed flow control valve shall be of SS 316.

3.10. **SS 316 RO Water storage** tank (Capacity as Required) of minimum 3mm thickness. Tank shall be provided with water flow meter at inlet & outlet, inlet / outlet valves, overflow / drain connection with MH cover (550 mm I.D.) Tank shall be mounted on 450

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mm high steel structural supports with access ladder painted with 2 coats of red oxide paint.

3.11. ELECTRICAL AND INSTRUMENTATIONS

Control Panel: Fixed cubical type with weather proof DOL/Star Delta Starters (as per requirements) consisting of incoming feeder with outgoing feeder feeders, Voltmeters, Ammeter, push button with indicator lamp, overload relays, Contactors, Bus bar of required size, control cablings etc.

Type of panel:

Compartment for individual feeder

MOC:

MS (1.6mm thick sheet) fabricated with powder coating.

Earthing Consist of Copper flats/copper wire of required size for earthing motors, MCC Etc. Required compression glands, ferrules, ties, aluminum etc.

Instrumentation

Like level controllers, pressure switches, pressure gauges as required.

3.12 Instruments List including but not limited to (Provision to be considered in the Centralized R.O Plant)

Sr. No.	INSTRUMENT
1	Flow Indicator
2	Pressure Gauge
3	Pressure Switch (Low & High)
4	Conductivity Indicator
5	PH Meter etc.

4. PORTABLE RO WITH SS BODY WATER COOLER

Design, Supply, installation, testing & commissioning of Portable RO + UV with water cooler of 80 LIT (approx.) storage capacity & water flow rate 50 LPH through faucets including RO membrane, pumps, motors, cartridge filters, interconnecting pipes, valves, cable etc. along with water cooler facility. It shall be provided with adjustable cold water thermostat, seam welded food grade stainless steel tank, pre coated outer body, mechanically expanded condenser, overload compressor protection, sturdy compressor & trouble free operation, in situ power saving PUF insulation, no. of faucets (min. 2), 7 stages of filtration (approx.) with speedy drainage facility. The refrigerant shall be ecofriendly & the unit shall be silent operation type. The operating temperature shall be between 15 to 45-degree C. It shall be provided with auto flush feature.

MATERIALS: The Portable Water Purifier shall have PP meltdown sediment filter, activated carbon block, thin film composite spiral wound type reverse osmosis membrane, ultra violet membranes, diaphragm type pump, suitable for maximum 500 ppm hardness,

10 NTU turbidity, TDS of max 2000 ppm inlet water quality& a reduction upto 75% in TDS & Hardness parameters. The system shall be suitable for a supply of 100-240 V AC / 50 Hz. The Purifier shall be supplied with all equipment membranes, filters and pumps, motors, interconnecting pipes, adaptor and cable of minimum 1.8m length & complete in all respect.

Testing, Commissioning & Operation: After satisfactory installation of the centralized R.O system, entire system shall be tested, commissioned & operated for continuous 15 days as directed by E-I-C.

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CHAPTER- L

Technical Specifications - Organic Waste Converter

All the Equipment comprising of Composting machine, double curing system & shredder shall be designed to operate 10-12 hrs a day. Accordingly, suitable capacity & no. of OWC shall be provided to process approx. capacity as per DBR biodegradable waste generate per day.

I. Composting Machine

- Capacity : As Per requirement
- Power Connection : As Per requirement
- Brim Capacity : As Per requirement
- Waste Batch size : As Per requirement
- Batch Duration : As Per requirement
- MOC : All contact parts of SS-316
- Trolley MoC : MS Powder Coated /SS-316

II. Double Curing System

- HDPE crates of adequate size, laminated with aerating net.
- Four shelf folding storage rack of adequate size.
- Collection tray of G.I. of adequate size.
- Double Fogger, Disc Filter, Ball Valve, Pump, Time Control unit for spray and frequency control, pressure gauge, and other accessories like piping, valves etc.

III. Portable Shredder

- Capacity : As Per requirement
- Motor : As Per requirement
- Phase : Single Phase.
- Weight : As Per requirement
- Dimension : As Per requirement

Other requirements:

- Space requirement: It should include segregation, Treatment & storage area.
- 3 Phase Power supply with suitable electrical panel
- 4 Pole MCB – No. as required.
- Single Phase – 5 Amp –3 Pin Switch Socket - No. as required.
- Single Phase connection – No. as required.
- 1/2" Dia. Tap for water connection.

Testing , Commissioning & Operation: After satisfactory installation of Organic Waste Converter, entire system shall be tested, commissioned & operated for continuous 15 days as directed by Engineer – in – charge.

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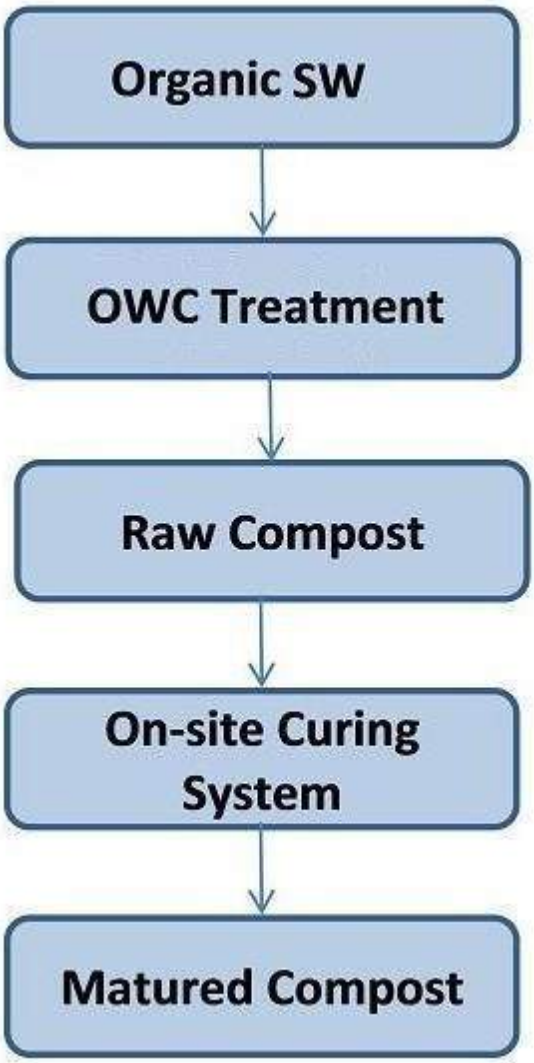
FLOWCHART OF ORGANIC WASTE CONVERTER



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CHAPTER – L
Detailed Technical Specifications
(Civil and Plumbing Works)

S.No	Specifications
	Preamble
	Rate shall be inclusive of following;
i	The serviceable and unserviceable materials shall be stacked separately and properly in the designated place and to be Stacked/Stored at designated till the disposal / reuse of the same. The debris, excess materials is to be carted outside the premises and disposed off at the Municipal Corporation / APCRDA City designated place up to any lead, lift and level by the Contractor at his own cost.
ii	For all the civil work 53 grade OPC cement of approved make to be used. For Plastering & waterproofing works PPC cement of approved make can be used. (Approved Make: Ambuja, Birla, Ultratech, ACC and L&T or as approved by SBI)
iii	River sand / Crush Sand to be used shall be VSI quality.
iv	All the civil work , whether new or repair, must be cured for at least 7 days preferable by ponding, using gunny bags etc.
v	For all work, water to be used must be fresh, potable and pure without any salinity and turbidity.
vi	The rates quoted for all the items of the BOQ shall include the following specifications: -
a	All the works are to be carried out at all heights and locations i.e. from foundation level, Ground Floor of the building up to the Over Head Water Tank roof slab or Mumty roof slab, as applicable.
b	Providing and fixing double scaffolding system (cup lock type) on the exterior side, up to any height (entire height) of the building structure made out of 40 mm dia. M.S. tubes, 1.5 m centre to centre, horizontal & vertical tubes joining with cup & lock system with M.S. tubes, M.S. tube challies, M.S. clamps and M.S. staircase system in the scaffolding including the working platform etc. and maintaining it in a serviceable condition for the entire required duration as approved and directed by the SBI/PMC & removing it thereafter.
c	The scaffolding system shall be stiffened with bracing, runners, connection with the building fascia etc. wherever required & including providing vertical supports which shall be sound and strong, tied together with horizontal steel / metal support pieces over which scaffolding planks shall be fixed properly & secured at required locations including the essential safety features for the workmen etc. complete as per directions and approval of SBI/PMC. Note: - The scaffolding shall not be removed without prior approval of SBI/PMC .
d.	Providing & fixing temporary support arrangements such as Steel Props (Up to any number whenever and wherever as directed by the SBI/PMC) to support the structure provisionally during the project duration for all trades of work, etc. and maintaining the props in position till required & as directed by the consultant including other safety elements such as bracing, steel angles, working platforms, plates etc., which shall be provided & considered in the quoted rates for the areas in the vicinity in adequate

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	numbers as directed. All trades of works indicated herein under shall include all leads & lifts & working up to any heights, depths & levels.
e.	Providing & fixing safety net around the work so that loose plaster/ concrete does not cause damage to the property or any human being, if necessary and removing the same after completion of work.
f.	Providing and covering entire external surface with Hessian cloth curtains through out the duration of project and carefully removing the same after completion of work.
g.	Providing all type of PEE (Personal protective Equipment) to the workforce such as safety shoes, safety helmets, reflective safety jacket, full body safety harness, goggles, gloves, etc. complete for all types of workforce engaged on site for execution of the work.
h	The quoted rate should include cost of necessary scaffolding, staging, centring, shuttering etc. as required for execution of the job at any height and location including removal of same. The scaffolding should be erected and anchored into the concrete members with help of expandable bolts, which are to be cut as the scaffolding is removed, no wall is to be punctured, at no extra cost to the Bank.
i	Rates shall be inclusive of all enabling works like tower cranes all safety measures, aerial lift, man & material lift, Temporary lift, scaffolding, Cup lock system, labour camp, storages, godowns, all required permissions from local governing respective authorities to carry out the works, all insurances, all licenses, administration, all S.H.E. (Safety, Health, Environment) related measures, security , watch and ward measures, barricades other than specified, traffic management, tree protection, property damage repairs, water, electricity, DG as per requirement, all tools, machineries, vehicles, etc. Complete.
j	Before starting of Excavation NGL levels shall be got verified and approved by SBI/PMC and RL levels to be at the top of different layer and based on the difference levels excavation qty shall be calculated. Area for excavation shall be arrived . Excavation measurement must be only P.C.C. area around Foundation/Raft as per direction from SBI/PMC .
k.	All rates should be inclusive all loading, unloading, shifting,all leads, lifts, sorting, transportation, labours, tools, plants, machinery etc. complete
l	All the above-mentioned points including the requisite elements & items as mentioned shall be considered included within the quoted rates of the line items of the BOQ and nothing extra would be paid on this account.
m	Though Locations of execution are mentioned for specific items, Contractor have to execute those all items at all required/necessary locations at no extra cost as per direction from SBI /PMC
n	Contractors to be fully equipped with APCRDA CITY regulations/guidelines available at their site and APCRDA CITY guidelines/rules are to be followed by contractor till the completion of the project.
o	Water test is mandatory before using for construction purposes and test results shall be submitted to Consultants / Bank. Test shall be carried out at Contractor's cost.
p	The said plot shall be covered all around by MS pre coated sheet over Steel structural frame up to desired height, min. 6m, or as per APCRDA City guidelines till the total tenure (Start to Completion) of project.
1.	Excavation in all kinds of soil, including soft murum, hard murum, Soft & hard rock.
	Excavation in all kinds of soil, including soft, hard murum, soft & hard rock, wet or dry, in loose and slushy condition including clearing the site removing

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	shrubs, tree roots, rank vegetation etc., to the required level for foundations, trenches, pits, rafts, plinths, plinth area levelling, etc.; to required depth from existing ground level including carting away / disposing of unwanted excavated material, stacking suitable earth for backfilling and disposing off surplus excavated material off the site as per direction of the SBI/PMC at no extra cost; using mechanical/ electrical means such as poclain, JCB, rock breaker, chisel tools, compressor, dumper, dozers etc., bailing/pumping out water with required capacities with dewatering pump of required numbers to keep the site dry at all times at location as directed by PMC/ SBI , including making temporary stepping / sloping, sectioning, trimming, dressing of sides, levelling or grading including sprinkling of water cleaning, removing and excavating loose pockets and consolidating them by backfilling all as directed by SBI / PMC.
2.	Close timbering over areas including strutting, shoring and packing cavities
	Close timbering over areas including strutting, shoring and packing cavities (wherever required) etc. complete.
3.	Providing , Filling and banking with outside Murum in foundations, trenches, plinths, area levelling
	Providing , Filling and banking in foundations, trenches, plinths, area levelling etc. in layers not exceeding 200mm in depth, breaking clods, watering, compacting each layer with vibrator/ compactor and at inaccessible places with wooden/steel rammers at optimum moisture content; dressing up embankments; if required, bailing/pumping out of water to keep site dry while back filling; cost includes conveyance of all materials, labour, machinery, mechanical mean such as dumpers, dozers, poclain/JCB for lifting from any height etc. taking permission of local authorities and paying royalty including density tests etc. Complete as per direction of the SBI/ PMC complete.
3 a	Excavating, supplying and filling of good quality Murum (including royalty) by mechanical transport up to any lead including ramming and watering of the earth in layers not exceeding 20 cm in trenches, plinth, sides of foundation ; Item also include proctor density test etc. complete.
3 b	Providing , Filling and banking with approved quality excavated earth available on site in foundations, trenches, plinths, area levelling
	Providing , Filling and banking in foundations, trenches, plinths, area levelling etc. in layers not exceeding 200mm in depth, breaking clods, watering, compacting each layer with vibrator/ compactor and at inaccessible places with wooden/steel rammers at optimum moisture content; dressing up embankments; if required, bailing/pumping out of water to keep site dry while back filling; cost includes conveyance of all materials, labour, machinery, mechanical mean such as dumpers, dozers, poclain/JCB for lifting from any height etc. taking permission of local authorities if required including density tests etc. Complete as per direction of the SBI/ PMC complete.
4.	Providing & Laying Dry Rubble Stone Soling of 23 to 30 cm thickness
	Providing & Laying Dry Rubble Stone Soling of 23 to 30 cm thickness using locally available stones 80mm to 150mm size, hand-packed and set on ends with interstices, voids filled tight with stone chips and screened with murrum/sand including sprinkling of water, compaction with mechanical vibratory roller compactor complete to satisfaction of SBI/ PMC & as per design , drawing including hand packing, watering, compacting etc. Complete.
5.	Pre-constructional Anti termite Treatment
	Providing pre-constructional anti-termite treatment by treating the bottom surface & sides of excavation in soil with plinth beams, plinth filling and

	periphery confirming as per IS : 8944 & IS : 6313 Part-II 1981 or any latest revision and furnishing 10 years guarantee in required proforma all complete. (Reference Specification- IS-6313 Part-II of 1981 and IS-IS-8944- 1978) Chemical used- Chemical name Trade Name Manufacturer Indian Standard Concentrations Chlorpyriphos 20% EC Cologuard Gharda Chemicals IS-8944- year-1978 1% Imidacloprid 30.5% SC Premise Bayer CIB 0.075% Treatment for Buildings with basement- The treatment will start after site survey, when the excavation is completed and before doing soling and PCC. The agency shall submit guarantee for Anti-termite treatment carried out by them for a period of 10 years on non-judicial stamp paper of required value as per format approved by the Bank. 1. Treatment to Soil below the RAFT :- The excavated area will be treated with chemical emulsion @ 5liter/ Sq mtr, before soling and PCC, the side wall of the pit up to height of raft will also treated with chemical emulsion. Roding will have carried out if required to facilitate chemical absorption. 2. Treatment to Soil along the Diaphragm / retaining wall :- The soil in immediate contact with retaining wall will be treated with chemical emulsion @ 5 litre /Sq mtr. The treatment will be done to back filling to facilitate continuity of chemical barrier. Roding will have carried out if required to facilitate chemical absorption. 3. Treatment of soil Along the External Perimeter of Building :- The External perimeter is treated by making holes with Iron bar @ 5 litre/running. The iron rod moved backward & forward to break up the earth and chemical emulsion is poured into the holes to establish continuity of chemical barrier. 4. Treatment to the Expansion Joints- The expansion joints are also treated to avoid termite entry from these expansion joints which are treated with the chemical emulsion @ 5 litre/running. 5. Treatment of the soil surrounding pipes and conduits :- This is also one of the important area from where the termite get easily entry, this area is treated @ 5liter/Sq mtr or linear mt. of chemical emulsion thoroughly, the total surrounding area is covered by pouring the chemical emulsion. Make : PCI/ Godrej/ Hi-care or equivalent as approved. 6. Treatment to internal Basement area's columns, footings horizontal & vertical surfaces, Below Trimix / parking floor horintal surfaces, vertical & horizontal surfaces of in contact with soil/ murum filling. (Internal basement Area's below ground floor)
6.	Steel Reinforcement
	Providing & laying including straightening, cutting, bending and binding in position of steel reinforcement bars (Make :- SAIL, TISCON, RINL, JINDAL, JSW or as aprroved make) confirming to BIS, to correct shape and size as per detailed drawings, specifications and approved bar-bending schedules, Including preparing & Maintaining bar bending schedules in substructure / superstructure walls, columns, Shear Wall, slabs, beams, Diaphragm wall, retaining Wall, sloping slab & steps for staircase, chajja, lintel, patali, Fins, all types of Paradi, pergola, Including water tanks, Septic tank etc.; with correct size with Super fine micro concrete cover blocks and annealed binding wire (G.I.) of 18 gauge including dewatering to keep site dry etc. complete at all heights and leads to the satisfaction of the PMC/SBI. Measurement of steel is strictly as per I.S. Code. No extra for bending will be permitted. Weights shall be calculated by taking Average weight of 3 no. samples of steel rods and paid with lowest of average weight or theoretical weight . Rate includes Chairs, hooks, pins as well. Laps will be paid extra.
	With TMT / Fe 500 bars conforming to IS : 1786/1139 High yield strength corrosion resistant bars with respect to physical properties and of approved chemical properties in all RCC work.

7.	Reinforcement Couplers
	Providing and fixing parallel threaded couplers conforming to IS code on “Reinforcement Couplers as per required diameter of bar for Mechanical Splices of Bars for Concrete Reinforcement - Specification”, to reinforcement bars of DEXTRA/ Unitech/ J. K. Industries/ Lokpal industries or as approved make by SBI/ PMC including threading, enlargement at connection by forging, protecting the prepared reinforcement bars and related operations as required to complete the works per direction of SBI / PMC.
7 a	Coupler for 20 mm diameter reinforcement bar
7 b	Coupler for 25 mm diameter reinforcement bar
7 c	Coupler for 32 mm diameter reinforcement bar
7 d	16 to 20 mm dia reducer coupler
7 e	20 to 25 mm dia reducer coupler
7 f	25 to 32 mm dia reducer coupler
	PCC / RCC WORKS
	PREAMBLE :
a.	All shuttering material used for concreting / RCC Work should be of good quality using waterproof plywood of minimum 12 mm thickness to ensure smooth finish.
b.	The scope of work under the items includes execution of work at all heights and location including all shapes, curved walls etc. Complete.
c.	In case there is bulging / minor honey combing is noticed after removal of shuttering, the contractor will have to rectify the work at his own cost. If in case Major Bulging/ Honey combing noticed on site, contractor has to do the rectification as per decision given by structural consultant at his own cost. The decision as to what constitute minor & major honey combing/ bulging is left to the SBI/PMC.
d.	The Contractor will be responsible or arranging "design of concrete mix" through approved Institute at their own cost within the quoted rates only and will submit the report to SBI/PMC for approval. No extra payment shall be eligible on this account.
e.	The flooring. raft & slab curing is to be done for minimum 7 days by ponding method only .
f.	Checking of top level of slab & all structural components should be done at every floor & it should be within IS tolerance limit / SBI or PMC requirement.
g.	Frequency of testing for all materials like sand, aggregates, cement, steel. Concrete should be as per IS standard. Testing should be done with material on site & from 3rd party agencies as per mentioned frequency. Refer Tender document for details.
h.	The use of admixture, fly ash & crush sand should be as per concrete mix design.
i.	Concrete mix design to be prepare by contractor & shall submit it to PMC/ SBI for approval. Upon approval of concrete mix design from SBI/ PMC contractor permitted to use the same for execution on site.
8.	Providing and laying design mix (RMC) cement concrete for plain cement concrete
	Providing and laying in position design mix (RMC) cement concrete for plain cement concrete work; using coarse aggregate and fine aggregate derived

	from natural sources, Ordinary Portland cement, admixtures in foundations, for bases of foundations, walls, plinths, rafts, plinth beams, floor slabs, pits to make up level etc.; coping, sill concrete, including cost of Centering and shuttering, compacting, curing, dewatering, cleaning, preparing surfaces, junctions, etc.; complete at all leads, levels, lift and depths (Sub structure & Super structure.) as per the drawing and to the satisfaction of the PMC/SBI in recommended proportions as per IS: 9103 to accelerate / retard setting of concrete, to improve durability and workability without impairing strength; pumping of concrete at any heights to site of laying, curing, Ponding at horizontal area's & Gunny bags/ hessian cloth for vertical surfaces, carriage for all leads, lifts, at any floors & heights; centring, shuttering and finishing as per direction of the SBI / PMC.
	All concrete should be Ready Mixed Concrete & all raw material used for concrete like Sand, Cement, Metal Plasticizer, Fly Ash etc. Should comply with the norms of Green Building & should be approved by PMC/ SBI . Only RMC should use for any concreting works.
	Concrete mix design to be prepare by contractor & shall submit it to PMC/ SBI for approval. Upon approval of concrete mix design from SBI/ PMC contractor permitted to use the same for execution on site.
9.	Providing and laying in position design mix (RMC) cement concrete for reinforced cement concrete work
	Providing and laying in position design mix (RMC) cement concrete for reinforced cement concrete work; using coarse aggregate and fine aggregate derived from natural sources, Ordinary Portland cement, including admixtures in recommended proportions as per IS: 9103 to accelerate / retard setting of concrete, to improve durability and workability without impairing strength and durability; including pumping of concrete to site of laying, curing, carriage for all leads, levels and heights/depths manufactured as per mix design for reinforced cement concrete work at all leads, levels and heights/depths, including pumping of R.M.C. from transit mixer to site of laying, Including Centering and shuttering with plywood shuttering , strutting, scaffolding staging, Bracing, finishing the exposed surfaces properly, de shuttering and hacking the surfaces as desired curing etc. complete And with including making Cut outs, Holes, Core cut, Providing Sleeves Rungs, Etc. including strutting, propping, staging, scaffolding at any heights, all leads, lifts etc. Complete as per direction of the PMC/SBI. All supporting, scaffolding & bracing material shall be of MS as per direction of the PMC/SBI. Only RMC should use for any concreting works.
	MASONRY WORK
10.	Autoclaved Aerated Cement blocks (Grade1) masonry 100mm thick
	Providing and constructing 100 mm thick AAC block masonry in structure at all floor level, Having rough surface to receive the plaster effectively, blocks conforming to IS 2185 (Part-III) masonry with approved block laying polymer modified adhesive mortar per manufacturer's instructions, including providing RCC patli beam(Lintel) of 100mm thick at every 1.00m c/c with 2 nos. 8 mm dia Tor bars and 6 mm dia links at 300 c/c in cement concrete of mix M 20, required form work complete with raking out joints, curing, independent double legged scaffolding as per specifications etc. at heights, depths and leads as directed by PM to his entire satisfaction.
11.	Autoclaved Aerated Cement blocks (Grade1) masonry 150mm and above thick
	Providing and laying autoclaved aerated cement blocks masonry with 150mm thick & above AAC blocks in sub structure Below plinth level with M20 RCC band at sill level and lintel level with Having rough surface to receive the

	plaster effectively, blocks conforming to IS 2185 (Part-III) masonry with approved block laying polymer modified adhesive mortar required form work complete with raking out joints, curing, independent double legged scaffolding as per specifications etc. at heights, depths and leads all complete as per direction of PMC/SBI his entire satisfaction.
	PLASTER WORK
12.	Providing External Double coat plaster about 20 to 25 mm average thickness cement plaster in two coats using approved sand in all positions, Heights/Depths & leads under layer 12 to 15mm thick (average) cement plaster 1:4 (1 cement : 4 sand) mixing waterproofing compound with Adhesive approved by PMC / SBI in the proportion approved by the manufacturer of the said waterproofing compound and Polypropylene Fiber in appropriate proportion and curing the same for not less than 2 days including and keeping the surface of base coat rough to receive sand faced treatment including Providing fibre-mesh at joints of brickwork and concrete and also while making good the chase cut for the purpose of electrification / Plumbing and a top layer 8 to 10 mm mm thick cement plaster 1:4 (1 cement : 4 sand) and finishing the surface by taking out grains in desired finish making grooves, Kani, Dhar, Drip Mould, strips, bands, finishing top of chajja in Slope etc. and curing for 14 days including preparing the surface and strictly double legged MS scaffolding including fiber mesh at all junctions of RCC & brickwork etc. Complete as directed by the PMC/SBI.
13.	Single Coat 15mm thick plaster without Neeru in single coat
	Providing Single Coat Plaster with 15 mm average thick in single coat in cement plaster 1:4 (1 cement : 4 sand) with screen and washed River sand / P-sand to concrete or brick/Block surface in all positions, heights & leads including scaffolding curing, etc. complete. Including Providing fibre-mesh at joints of brickwork and concrete and also while making good the chase cut for the purpose of electrification / Plumbing , Filling all gapes along the wooden door frames, Making moist the surface before plastering & Curing the plaster surface for 15 Days. Including polypropylene fibre as per proportion specified in the manufacturers specifications, fiber mesh at all junctions of RCC & brickwork, making grooves, Kani, Dhar, Drip Mould, strips, bands, finishing top of chajja in Slope etc. etc. complete as directed by the PMC/SBI.
14.	Internal cement plaster 12 mm avg. thickness in a single coat without neeru
	Providing internal cement plaster about 12 mm avg. thickness in a single coat in cement mortar 1:4 (1 cement : 4 sand) making the surface rough / finished without neeru finish with screen and washed River sand / P-Sand to concrete or brick/Block surface in all positions, heights & leads including scaffolding(Single/ Double.), curing, etc. complete. Including Providing fibre-mesh at joints of brickwork and concrete and also while making good the chase cut for the purpose of electrification / Plumbing , Filling all gapes along the door frames, Making moist the surface before plastering & Curing the plaster surface for 15 Days. Including polypropylene fibre as per proportion specified in the manufacturers specifications, fiber mesh at all junctions of RCC & brickwork etc. complete as directed by the PMC/SBI.
15.	Internal smooth finish cement plaster in a single coat
	Providing internal smooth finish cement plaster about 12 mm avg. thickness in a single coat in cement mortar 1:4 with cement with screen and washed River sand / P-Sand to concrete or brick/Block surface in all positions, heights & leads including scaffolding (Single/ Double.), curing, with making the surface smooth finish with neat cement punning etc. complete. Including

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	Providing fibre-mesh at joints of brickwork and concrete and also while making good the chase cut for the purpose of electrification / Plumbing , Filling all gapes along the door frames, Making moist the surface before plastering & Curing the plaster surface for 15 Days. Including polypropylene fibre of approved quality as per proportion specified in the manufacturers specifications, fiber mesh at all junctions of RCC & brickwork etc. complete as directed by the PMC/SBI.
	MARBLE & GRANITE WORK
16.	Granite Stone Vanity counters, window sills, facias
	Providing and fixing 18mm thick (with deviation of +/-2 mm thickness) thick gang saw cut, mirror polished, premoulded and prepolished, machine cut for Vanity counters, window sills in single / double layer strips, facias and similar locations of required size, approved shade, colour and texture laid over 30 mm average thick base cement mortar 1:4 (1 cement : 4 coarse sand), joints treated with white cement, mixed with matching pigment, epoxy touch ups,, uniformly in line and level including rubbing, curing, moulding and polishing to edges to give high gloss finish , cleaning etc. complete at all levels as per as per design, drawing & direction of PMC/SBI his entire satisfaction. Jet Black, Cherry Red, Elite Brown, Cat Eye or approved equivalent shade & colour only.(Basic Rate= Rs 2200/Sqm)
17.	Granite Stone of work for wall lining up to any height
	Granite Stone of 18mm thick (+/-2 mm thickness) tile work for wall lining up to any height with approved special adhesive over 20 mm thick (Average) bed of cement mortar 1:3 (1 cement : 3 coarse sand), including High gloss polishing, pointing in white cement with an admixture of pigment to match the stone shade, epoxy touch ups, including , groves, rubbing, curing, moulding / chamfering and polishing to edges to give high gloss finish, cleaning etc. complete at all levels as per design, drawing & as per direction of PMC/SBI his entire satisfaction. Jet Black, Cherry Red, Elite Brown, Cat Eye or approved equivalent shade & colour as approved only. (Basic Rate= Rs 1850 / Sqm)
18.	Polished/Leather/Flamed Granite stone flooring
	Providing and laying Polished Granite stone flooring, tread of 18mm thick (+/- 2 mm thickness) in required design and patterns, in linear as well as curvilinear portions of the building all complete as per the design, drawings with 18 mm (+/- 2 mm thickness) thick stone slab over cement mortar 1:4 (1 cement : 4 coarse sand) laid and jointed with cement slurry and pointing with white cement slurry admixed with pigment of matching shade including mirror polishing, groves, rubbing , curing, cleaning etc. complete at all levels as per design, drawing from & as per direction of PMC/SBI his entire satisfaction. Jet Black, Cherry Red, Elite Brown, Cat Eye or approved equivalent shade & colour or equivalent as approved only. (Staircase Area etc.) (Basic Rate= Rs. 1850 / Sqm)
	Polished Granite stone slab colour of Black, Cherry/Ruby Red or equivalent
19.	Kota stone slab flooring, skirting
	Kota stone slab flooring, skirting over 2 5 mm (+/-2 mm thickness) thick base laid over and jointed with grey cement slurry mixed with pigment to match the shade of the slab, including rubbing, nosing, grooving and mirror polishing, curing, cleaning complete with base of cement mortar 1 : 4 (1 cement : 4 coarse sand)) laid and jointed with cement slurry and pointing with cement slurry admixed with pigment of matching shade etc. complete at all levels as

	per design, drawing & as per direction of PMC/SBI his entire satisfaction. (Basic Rate= Rs. 500 / Sqm)
20.	Kota stone slab over 25 mm thick
	Kota stone slab over 25 mm thick in single length on base laid over and jointed with grey cement slurry mixed with pigment to match the shade of the slab, including groving, rubbing , polishing, nosing with base of cement mortar 1 : 4 (1 cement : 4 coarse sand) etc. complete at all levels as per design, drawings & as per direction of PMC/SBI his entire satisfaction. (Basic Rate= Rs 700 / Sqm)
21.	Kota stone slabs 25 mm thick
	Kota stone slabs 25 mm thick in single length laid on 20 mm (average) thick cement mortar 1:3 (1 cement: 3 coarse sand) and jointed with grey cement slurry mixed with pigment to match the shade of the slabs, including rubbing and polishing etc. complete at all levels as per design, drawing & as per direction of PMC/SBI his entire satisfaction. (Basic Rate= Rs 700 / Sqm)
22.	Granite Kitchen Platform
	Providing and fixing in position Granite Kitchen Platform with max. 750 mm made out of average 18mm thick (+/-2 mm thickness) approved quality Granite stone. The top of the platform shall be provided with MS angle framework with BWP grade plywood 18mm thick. The edges of the granite slab should be full round moulded edges complete as per sample approved by the SBI/PMC. Including providing 50 to 60 mm Granite band with full rounded moulded edges, making cut outs for SS Kitchen sink, Tapes, Gas pipe, joints treated with Epoxy based joint filling compound mixed with matching pigment, including curing, necessary scaffolding etc. complete as per detailed drawing and site instructions of the PMC/ SBI (Basic Rate= Rs 2200 / Sqm)
	WOOD WORKS
	Note:- Before fixing Door frame back side of door frame shall be treated with anti termite/black japan paint in 2 coats. Also Frame shall be fixed with minimum 3 Holdfast on each side and shall be fixed in concrete which is to be done in wall to take hold fast
23.	Door Shutter with Veneer Finish including necessary polishing
	Providing and fixing in position 35 mm thick FSC certified BWP grade ply with 4mm thick Veneer finish (both side) Flush Door Shutters Rates to include necessary SS hard wares like 4 nos. heavy duty 125 mm Butt Hinges, 200x10mm Tower bolt, 2 nos. 200mm long 12mm dia door handle, 300 x 15 mm Al Drop with Locking Arrangement with 2 nos of Lock Hole Bracket, 7 leavers mortise lock with computerised key, magic eye, Rim night latch, door buffers with magnetic catcher, hanging type door stopper etc. Complete. Approved by the SBI/PMC. Basic Rate for Veneer: Rs. 2500/Sq.m.
24.	Door Shutter with Laminate
	Providing and fixing in position 32-35 mm thick FSC certified BWP grade ply with 1mm thick Laminated (both sides) Flush Door Shutters. Rates to include necessary SS hardwares like 4 nos. heavy duty 125 mm Butt Hinges, 300x8mm Tower bolt, 2 nos. 200mm long 10mm dia door handle, 7 leavers mortise lock with computerised key, 300 X 12 mm Door Latch without Lock Hole Bracket, door buffers with magnetic catcher, hanging type door stopper etc. Complete. approved by the SBI/PMC. All the hardware items included. Basic Rate for Laminate: Rs. 800/Sq.m.
25.	Teak Wood Door frame

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	Providing and fixing in position P/F approved quality second class seasoned Teak wood door frame in design, shape and profile size as per drawing with black japan paint to the surface in contact with plaster/ masonry/ RCC. The over all sectional size as required including fixing in position with 6 nos. M.S. hold fasts anchored in 1:2:4 cement concrete of approximate size 200 x 200 x 150mm, making arrangements for fixing aldrop, tower bolts, slip way (tadi) in the frame. The frame is finished with two or more coat of melamine polish/enamel paint after preparing surface complete. Rates to include necessary hardware, screws, etc. Complete.
26.	Aluminium doors for shaft
	Providing & Fixing powder coated Aluminium doors for shaft with with 50 x50x 2 mm thick square pipe for frame fixed into wall with 10 mm dia double threaded Carbon Steel galvanized (min 5 micron) dash fastener of 120mm depth, shutter consists of 50 x 25 x2 mm aluminium pipe for outer side with horizontal pipe welded to outer frame of shutter at both sides with 25 x 25 x2 mm thk. Hollow pipe with 50 mm clear opening. Item includes Powder coating to all members from all sides, 100x75x4 mm Aluminium butt hinges 6 no.s, Nickled Chromium Brass cupboard lock 40 mm size, Handles, all welding & finishing of complete as per detailed drawing and site instructions of the PMC/ SBI
	List of Hardware for Doors
	Hardware Brass CP (Godrej, DORSET, Ozone, Kich, Haffle, Hettitch or equivalent make)
a.	Mortise Lock set with Lever at both side of 240 mm
a1	Handle 200 mm wide 10 mm dia C/ D type- Both Side
b.	Rim Night Latch
c.	Magic eye (Minimum 1 " Dia)
d.	250 x 16 mm Al Drop with Locking Arrangement (Bedroom, toilet)
e.	250 X 16 mm Door Latch without Lock Hole Bracket (Bedroom,Toilet)
f.	150 x 10 mm Tower Bolt
g.	150 x 10 mm Tower Bolt
h.	Door buffers with magnetic catcher
i.	Hanging type door stopper
j.	Door Safety Chain
	STEELWORK
	All structural steel items are including fabrication, welding, riveting, bolting, scaffolding, finishing, with all accessories, anchor fasteners of Hilty, Fischer or equivalent make including all lead, lifts, heights etc. Complete ; all as per design, drawings , as per manufacturer’s specification & instructions given by SBI/ PMC
27.	structural steel work in rolled sections like joists, channels, angles, tees, Sections trusses
	Providing and fabricating structural steel work in rolled sections like joists, channels, angles, tees, sections,trusses and framed works etc. as per detailed design and drawings or as directed including cutting, fabricating, hoisting, erecting, fixing in position making riveted / bolted /welded connections without connecting plates, braces etc. and including ready mixed red oxide zinc chromate primer with 2 coats of synthetic enamel paint

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	of approved brand and manufacture on steel galvanised iron/ steel works up to satisfaction of PMC/SBI inclusive all heights, Sub structure, Superstructure & leads, etc. Complete.
28.	Galvanized Steel Deck Sheet
	Providing and fixing roofing consist of 1.00 mm thick galvanized steel deck sheet confirming to IS 277:1992 used as permanent shuttering over which MS wire mesh 3mm laid at 100x100 mm grid including edge trim covered with concrete. This metal deck will be supported on structural steel beam with shear studs. complete as per detailed drawing and site instructions of the PMC/ SBI (Structural steel like Beam, column, joists etc. & concrete of different grade as per design will be paid separately). Make: Jindal/ JSW/ TATA/ RINL/as approved.
29.	MS tube/Square hand rail
	Providing and fixing MS tube/square hand rail of approved size by welding etc. to steel ladder railing, balcony railing, and similar works at all heights including fabricating ,fixtures, erecting , necessary welding , grinding , finishing, applying priming coat of approved steel primer with synthetic enamel paint of 2 or more coats of approved shade , complete as per detailed drawing and site instructions of the PMC/ SBI.
30.	Glossy/mat finish stainless steel (Grade 316) railing
	Providing & fixing Stainless Steel 316 Grade Railing over stair case steps / landings at 1050 mm height from FFL (in landing height will be around 750 mm from sill level) comprising of 50 mm dia and 16 gauge SS top glossy finish pipe supported by 40 mm dia, 16 gauge SS glossy finish at 600 mm c/c (in alternative treads in stairs), 2 - 4 nos 25mm dia horizontal SS pipe in between with proper fixing arrangements including providing SS round cover at a junction of each support and hand rails, rate also includes of all necessary Patch fittings of Dorma/ Enox Ozone/ Haffle /As approved etc all complete as per specification and the pattern as provided in the drawing and as per direction of the SBI/PMC. (For Staircase etc.)
31.	12 mm thick Toughened glass S S railing
	Providing and fixing 12 mm thick toughened glass S S railing of height up to 1.2m in combination of Glossy/mat stainless steel (Grade 316) pipe of 50 mm dia and 16 gauge SS top glossy finish pipe supported by 40 mm dia, 16 gauge SS glossy finish of Hollow tubes, channels, plates etc., including welding, grinding, buffing, polishing and making curvature (wherever required) and fitting the same with necessary stainless steel nuts and bolts complete, including fixing the railing with necessary accessories & stainless steel dash fasteners , stainless steel bolts etc., of required size, on the top of the floor or the side of waist slab with suitable arrangement rate also includes of all necessary Patch fittings of Dorma/ Enox/ Ozone/ Haffle /As approved etc all complete as per specification and the pattern as provided in the drawing and as per direction of the SBI/PMC. (for payment purpose only length of surface shall be considered and no extra for fixing accessories such as nuts, bolts, fasteners, drills etc.). (Balcony Etc.)
32.	Multicell polycarbonate panel
	Supply and Installation of translucent roof with DPI Flux standing seam multicell polycarbonate panel system. The system with complete assembly of co extruded UV protected multicell panels incorporated into a complete system. Co-extruded UV protected polycarbonate panel system of min 8 mm thick of 900 mm (min.) width with angular daylighting concept. Panels with all fixing accessories to ensure best performance for wind uplift, vibration, oil

	canning and visual appearance. Panels shall be manufactured with vertical standing seam at both sides of the panel. Panels shall be fixed on Purlin with snap on connectors with double tooth grip lock locking mechanism and will be secured on MS structure (will be paid Separately) with 3 numbers self-drilling screws & trapezoid SS fasteners holding the base of the standing seam offering best stability as per IS codes. Panel shall be with additional End cap/Aluminium U/F profile/ Glazing Bar for ends as required as per approved drawings. Trained and factory authorized labour with supervision to complete the entire panel installation as per drawing & direction of the PMC/SBI. Colour: As per Approval . (Excluding the MS structural framing Works). Make :- FLUX, Lexan, Sunlite, Sunpal or equivalent as approved . (Duct Covering at terrace etc.)
33.	Rolling shutters with partly grill
	Supplying and fixing rolling shutters with partly grill of approved make, made of required size M.S. laths, interlocked together through their entire length and jointed together at the end by end locks, mounted on specially designed pipe shaft with brackets, side guides and arrangements for inside and outside locking with push and pull operation complete, including the cost of providing and fixing necessary 27.5 cm long wire springs manufactured from high tensile steel wire of adequate strength conforming to IS: 4454 – part 1 and M.S. top cover of required thickness for rolling shutters with ball bearing, mechanical device chain and crank operation etc. and including ready mixed red oxide zinc chromate primer with 2 coats of synthetic enamel paint of approved brand and manufacture up to satisfaction of PMC/ SBI .Complete as per detailed drawing and site instructions of the PMC/ SBI
34.	M.S. grills of required pattern in frames of windows
	Providing and fixing M.S. grills of required pattern in frames of windows etc. with M.S. flats, square or round bars etc. With cutting, fabricating, welding, hoisting, erecting, fitting, finishing, cleaning including priming coat with approved steel primer & two or more coats of enamel paint & as per approved design/drawing all complete as directed by the PMC/SBI
	FLOORING
35.	Vitrified glazed wall tiles of 300 x 600 mm
	Providing and fixing 1st quality ceramic glazed wall tiles of 300 x 600 mm / approved size in dado / walls of conforming to IS: 15622 (thickness to be specified by the manufacturer), of approved make & colours, shades of any size including digital print as per sample approved by the SBI. Skirting, risers of steps and dados, and fixing the same on plastered surface with cement based high polymer modified quick set tile adhesive of approved make (water based) conforming to IS: 15477, including pointing in white cement mixed with pigment of matching shade Cleaning, curing etc. Complete as per approved design/drawing all complete as directed by the PMC/SBI. Make: Kajaria/Somany/Nitco/H.R Johnson/Simpolo/ as approved. (Basic rate of Tile Rs 510 / Sqm)
36.	Vitrified glazed wall tiles of 300 x 600 mm
	Providing and fixing 1st quality ceramic glazed wall tiles of 300 x 600 mm / approved size in dado / walls of conforming to IS: 15622 (thickness to be specified by the manufacturer), of approved make & colours, shades of any size including digital print as per sample approved by the SBI / PMC. Skirting, risers of steps and dados, and fixing the same on plastered surface with cement based high polymer modified quick set tile adhesive of approved make (water based) conforming to IS: 15477, including pointing in white cement mixed with pigment of matching shade Cleaning, curing, scaffolding

	etc. Complete as per approved design/drawing & all complete as directed by the PMC/SBI. (Dry balcony, Toilet Wall, Basin dado/ wall Tile, inside water tanks etc.) Make: Kajaria/Somany/Nitco/H.R Johnson/ Simpolo/ as approved. (Basic rate of Tile Rs 510 / Sqm)
37.	Vitrified floor tiles of size 300x300 mm
	Providing and laying Vitrified Anti-skid floor tiles of size 300x300 mm / approved size (thickness to be specified by the manufacturer) of 1st quality conforming to IS : 15622 of approved quality & make in any colours such laid on 20 mm thick cement mortar 1:4 (1 Cement : 4 Coarse sand), Jointing with grey / white cement slurry @ 3.3 kg/sqm including pointing the joints with white cement and matching pigment, cleaning, curing etc., complete as per approved design/drawing & all complete as directed by the PMC/SBI. Make: Kajaria/Somany/ Nitco /H.R Johnson/Simpolo/ as approved (Basic rate of Tile Rs 510 / Sqm)
38.	Providing and laying vitrified floor tiles, skirting of 100mm height / as per design, drawing, in different sizes (thickness to be specified by the manufacturer) with water absorption less than 0.08% and conforming to IS: 15622, of approved make, in all colours and shades, fixing uniformly in line and level in approved design laid on 20mm thick (average) cement mortar 1:4 (1 cement : 4 coarse sand), jointing with grey cement slurry @ 3.3 kg/ sqm including grouting the joints with white cement and matching pigments cleaning, curing etc., complete as per approved design/drawing & all complete as directed by the PMC/SBI. The tiles must be cut with the zero chipping diamond cutter only . Laying of tiles will be done with the notch trowel, plier, wedge, clips of required thickness, levelling system and rubber mallet for placing the tiles gently and easily . Make: Kajaria/Somany/Nitco/H.R Johnson/Simpolo or as approved
39.	Double Charged Vitrified tiles of size 600 x 600
	Gloss/ matt finished Double Charged Vitrified tiles of size 600 x 600 mm / as approved by the PMC/SBI (Basic rate of Tile Rs 650 / Sqm
40.	Double Charged Vitrified tiles of size 800 x 800 mm
	Gloss/ matt finished Double Charged Vitrified tiles of size 800 x 800 mm / as approved by the PMC/SBI (Common Lobby etc.) (Basic rate of Tile Rs 760 / Sqm)
41.	Vitrified Wooden textured tiles of 150 x 1200 mm
	Double charged vitrified Wooden textured tiles of 150 x 1200 mm/ as approved by the PMC/SBI (Master Bed etc.) (Basic rate of Tile Rs 1500 / Sqm)
42.	Double charged Vitrified Tiles of Size 800 x 1600mm Providing and laying Double charged Vitrified Tiles of Size 800 x 1600mm for Flooring, skirting of 100mm height / as per design, drawing, in different sizes (thickness to be specified by the manufacturer) with water absorption less than 0.08% and conforming to IS: 15622, of approved make, in all colours and shades, fixing uniformly in line and level in approved design laid on 50mm thick (average) M15 grade cement Concrete Floor (IPS) with sandwiched layer of High quality modified polymer adhesive of 5mm thick (Average) between tile & Concrete floor, including grouting the joints with epoxy grout of matching colour & cleaning, curing etc., complete as per approved design/drawing & all complete as directed by the PMC/SBI. The tiles must be cut with the zero chipping diamond cutter only . Laying of tiles will be done with the notch trowel, plier, wedge, clips of required thickness, levelling system and rubber mallet for placing the tiles gently and easily . Make: Kajaria/Somany/Nitco/H.R Johnson/Simpolo or as approved

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	Gloss/ matt finished Double charged Vitrified Tiles of Size 800 x 1600mm/ as approved by the PMC/SBI (Basic rate of Tile Rs 865 / Sqm)
43.	Providing and laying Vitrified tiles in floor with skirting of 100mm height / as per design, drawing, (thickness to be specified by the manufacturer) with water absorption less than 0.08% and conforming to IS:15622, of approved brand & manufacturer, in all colours and shade, fixing uniformly in line and level laid on 20 mm (average) thick cement mortar 1:4 (1 cement: 4 coarse sand) jointing with grey cement slurry @3.3 kg/sqm including grouting the joints with white cement and matching pigments, cleaning, curing etc complete as per approved design/drawing & all complete as directed by the PMC/SBI. The tiles must be cut with the zero chipping diamond cutter only . Laying of tiles will be done with the notch trowel, plier, wedge, clips of required thickness, levelling system and rubber mallet for placing the tiles gently and easily Make: Kajaria/Somany/Nitco/H.R Johnson/Simpolo or as approved. (Basic rate of Tile Rs 650 / Sqm)
44.	600 x 600 mm Anti Skid Vitrified
	600 x 600 mm / as approved Anti Skid Vitrified
45.	600 x 600 mm Rustic Vitrified Flooring
	600 x 600 mm/ as approved Rustic Vitrified Flooring
46.	Italian Marble stone flooring , skirting
	Providing and laying machine cut, mirror polished Italian Marble stone flooring of not less than 1m x1m (Minimum Size) with skirting 100 mm high in single length laid in required design & pattern in linear as well as curvilinear portion of the building all complete as per drawings, with 18 mm thick (variation of +/- 2mm) stone slab laid over 40 mm (average) thick base of cement mortar 1:4 (1 cement : 4 coarse sand) laid and jointed with white cement slurry @ 4.4 kg/sqm including pointing with white cement slurry admixed with pigment to match the marble shade including Mirror Polishing, groves, rubbing, curing and polishing, curing, cleaning etc. Complete at all levels as per design, drawing & as per direction of PMC/SBI his entire satisfaction. (Basic rate of Rs 5400 / Sqm)
	18mm thick Italian Marble stone slab as approved by PMC/ SBI
47.	Italian Marble Tread
	Providing and laying machine cut, mirror polished Italian Marble Tread with nosing in single length laid in required design & pattern in linear as well as curvilinear portion of the building all complete as per drawings, with 18 mm thick (variation of +/- 2mm) stone slab laid over 50 mm (average) thick base of cement mortar 1:4 (1 cement : 4 coarse sand) laid and jointed with white cement slurry @ 4.4 kg/sqm including pointing with white cement slurry admixed with pigment to match the marble shade including Mirror Polishing, groves, rubbing, curing and polishing, curing, cleaning etc. Complete at all levels as per design, drawing & as per direction of PMC/SBI his entire satisfaction. (Basic rate of Rs 5400 / Sqm)
48.	Italian Marble Stone work for Riser
	Providing and fixing machine cut, mirror/ eggshell polished , Italian Marble stone work for Riser 18 mm thick (variation of +/- 2mm) in single length (veneer work) including dado, skirting etc., in required design and pattern wherever required, stones of different finished surface texture, on 20 mm (average) thick cement mortar 1:3 (1 cement : 3 coarse sand) laid and jointed with white cement slurry @ 3.3 kg/sqm including pointing with white cement slurry admixed with pigment of matching shade, including polishing , rubbing,

	curing, cleaning etc. Complete at all levels as per design, drawing & as per direction of PMC/SBI his entire satisfaction. (Basic rate of Rs 5400 / Sqm)
49.	Cement concrete Flooring of M-30 grade with vaccum dewatering
	Providing and laying design mix cement concrete Flooring of M-30 grade with vaccum dewatering, in roads/ taxi tracks/ runways, using cement content as per design mix, using coarse sand and graded stone aggregate of 40 mm nominal size in appropriate proportions as per approved & specified design criteria, providing dowel bars with sleeve/ tie bars wherever required, laying at site, spreading and compacting mechanically by using needle and surface vibrators, levelling to required slope/ camber, finishing with required texture, including steel form work with sturdy M.S. channel sections, curing, making provision for contraction/ expansion, construction & longitudinal joints (10 mm wide x 50 mm deep) by groove cutting machine, providing and filling joints with approved joint filler and sealants. Rate shall include joint fillers, sealants, dowel bars with sleeve/ tie bars, treatment of Expansion joint, construction joint by using silicon sealant/bitumen and Baker rod of approved make complete all as per manufacturer's specification & direction of SBI/ PMC, curing, cleaning at all the locations and height with necessary scaffolding, shuttering etc. Complete. Cement concrete manufactured in automatic batching plant (RMC plant) including transportation to site in transit mixer.
50.	80 mm thick C.C. paver block of M-30 grade
	Providing and laying factory made chamfered edge Cement Concrete paver blocks of 80 mm thick C.C. paver block of M-30 grade with approved colour design and pattern in footpath, parks, lawns, drive ways or light traffic parking etc, of required strength, thickness & size/ shape, made by table vibratory method using PU mould, laid in required colour & pattern over 50mm thick compacted bed of 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 sand and cutting of paver blocks as per required size and pattern, finishing and sweeping extra sand. complete at all locations and height all as per direction of SBI/ PMC & as per manufacturer's specifications. Make :- Basant Betons / Paveit/ or equivalent as approved.
51.	35 mm thick Rubberised Flooring
	Providing & Fixing 35 mm thick Rubberised Flooring (+ / - 2mm) of approved make & as per Design & Drawing of any colour, shape with adhesive if required soft and porous two layer system rubber flooring consisting of base layer of Black SBR rubber of 30mm thick and 6 mm thick EPDM top layer colored granules both mixed with full polyurethane binder to be installed at site on the levelled and finished good quality concrete surface to a total thickness of either 36 mm over PCC/Concrete surface as per manufacturer specification with 5 years manufacturer's warranty. Item includes making pattern of various colours like Red/Green/Gray/Blue as per design, cutting tiles as per design, wastage, Non hazardous, hygienic and as per ASTM standards etc. Complete & as per direction of SBI/ PMC & as per manufacturer's specifications.. Item also includes all Taxes, leads, lifts, transport, labour Cess etc. Complete. Make :- Asian, Sunflex, Ecoflex, Aditya or equivalent as approved
	WATERPROOFING WORK
52.	Waterproofing
	Make :- BASF, MYK, Dr. Fixit, Fosroc, cico or Equivalent as approved

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	All the waterproofing items shall be carried out by the reputed approved agency as mentioned in the tender and duly approved by the SBI/ PMC. Items includes ponding test, sealing of pipes/sleeve at no extra cost. The treatments shall be tested for water tightness and shall be guaranteed for water tightness in bone dry conditions for at least 10 years period during which period if any leakage is observed, the same shall be rectified to the satisfaction of the Owners. Such undertakings shall be furnished on Rs. 500/- stamp to cover all the above conditions.
	1.Drain pipes and Core Cut treatment: Cleaning and preparation of surface with the help of wire brush or grinder. Clean the surface with water to remove the dust. Insert the pipe with Bathseal tape (Non reinforced twin sided self adhesive bituminous membrane) of approved make wrapped over the pipe into the core and support with form work. Pack the core cut junction with non-shrink free flow cementitious grout of Micro Concrete of approved make. Mix ready to use grout with water @ ratio of w/p as per manufacturer's specification(depending upon the flowability required) with paddle mixer and pour by providing necessary shuttering and support. Allow the grout to set for 24 hrs. And do the moist curing for 5 days. The area around the pipes shall be dressed in the 40-60 GSM geotextile in wet-on wet condition by applying high performance elastomeric 1K waterproof coating Bathseal tape (Non reinforced twin sided self adhesive bituminous membrane of approved make. 2.Angle Fillet treatment Roughen and clean the junction of wall and floor with air blower and water to remove the dust particles. Moisten the surface with water & apply a bond coat of URP of approved make and cement (1:1) by volume with brush. Providing & Laying angle fillet (gola) of size 50 x 50 mm in width over the bond coat when it's in wet condition. Preparing PMM by taking 1 kg URP/ equivalent, 5 kg fresh cement, and 15 kg graded quartz sand. (i.e., in the ratio of 1:5:15) on RCC surface (slab and wall junction) finishing in smooth finish. Including water curing for 3-4 days, etc complete. (Continued .....)
	3.Waterproof Coating: The concrete surface must be brought into surface saturated dry condition (SSD). Providing and applying a self-priming coat of Bathseal tape (Non reinforced twin sided self adhesive bituminous membrane) of approved make with 50% water dilution at of floor & walls extending 1 m height coverage at the rate 8-10 Sq.mt/ litre. Allow the primer to cure for 6 hrs. All joints / corners / angle fillet and penetrations shall be sealed with liberal amount of the waterproofing coating Bathseal tape (Non reinforced twin sided self adhesive bituminous membrane) of approved make followed by reinforcing specialized tape or 40 to 60 Gsm geo textile fabric and min 100 mm width in between 2 coats. Apply two top coats of Bathseal tape (Non reinforced twin sided self adhesive bituminous membrane) of approved make by brush or roller without dilution at the rate 1.1 -1.2 litre/ Sq.mt in the interval of 6 hrs. to achieve DFT of 500 – 600 microns. While the first coat is still wet fix 45 Gsm geo textile fabric on the angle fillets extending about 10 - 20 mm on wall and floor, also warp it around PVC, joint fittings ensuring the perimeter of the pipe/substrate abutment is sealed. Over the splash zone / shower wall taking the coating up the full height and up to 1 meter height on vertical surface and on other walls and 0.3 metre on horizontal surface below threshold for complete bathroom waterproofing.
	4.Horizontal Protection – Brick Bat Coba for protection and slope: Providing & laying brickbat Coba of minimum 120 mm thick laid over a bed of cement mortar (1:4), including integral waterproofing admixture, of approved make conforming to IS 2645:2003 & as per manufacturer's specification. The surface should be

	neatly finished with the help of wooden / steel hand trowel. The vertical surfaces of the adjoining walls are to be treated up to a height of 300mm including rounding of junction. The curing should be done for 2 weeks. 5.Vertical wall Protection plaster: Apply 1 coat of spatter dash bond coat mixed in the ratio of 1 part URP of approved make Cement and 2 parts of clean fine coarse sand and 1 part water to make thick slurry coat over the waterproof coating on the vertical walls. Apply 12mm thick plaster over the prepared surface of cement sand mortar admixed with integral waterproofing compound conforming to IS 2645:2003, of approved make as per manufacturer's specification, Including finishing & water curing of plaster for minimum 7 days..“All above operations to be done in order and as directed and specified by the PMC/SBI.
	All Waterproofing Work Should be Done by only Authorized Skilled Applicator of Company.
53.	Attached Terrace + Dry balcony
	1. Surface preparation Cleaning and preparation of surface with the help of wire brush or grinder. Wash the roof with clean water pressure jet. Remove all loose concrete, grease, oil using wire brush, and scrubber. Undulation in RCC roof slab surface, honeycombs, pin hones, imperfections should be chiselled shall be repaired with Polymer Modified Mortar mixed by adding 1 kg URP of approved make, 5 kg fresh cement, and 15 kg graded quartz sand. (i.e., in the ratio of 1:5:15) or with dual shrinkage compensated of approved make as approved Polymer Modified Mortar HB. Etc., complete. All pipes to be placed / inserted in the core cut areas, apply a coat of URP of approved make Epoxy bonding agent over this, sprinkling fine sand / quartz sand and fill the gap with shrinkage compensating water proofing compound of approved make Polymer modified mortar HB / non-shrink grout. 2. Angel Fillet treatment Roughen and clean the junction of wall and floor with air blower and water to remove the dust particles. Moisten the surface with water & apply a bond coat of URP of approved make and cement (1:1) by volume with brush. Providing & Laying angle fillet (gola) of size 75 x 75 mm in width over the bond coat when it’s in wet condition. Preparing PMM by taking 1 kg URP of approved make, 5 kg fresh cement, and 15 kg graded quartz sand. (i.e., in the ratio of 1:5:15) on RCC surface (slab and wall junction) finishing in smooth finish. Including water curing for 3-4 days, etc complete. 3. Waterproof Coating: The concrete surface must be brought into surface saturated dry condition (SSD). Providing & Applying 2 coats of high performance two component high performance cementitious waterproof coating two component acrylic cementitious system of approved make, with a mix ratio of (liquid: Powder), parts by wt. - 1:2 at the rate 0.42 - 0.50 Sq.mt / Kg for 2 coats to achieve the DFT on 1.2mm in a span of 4 - 6 hours with a roller / brush on the prepared concrete substrate . The floor surface & wall surface up to 450 mm in height, as per the manufacturers’ specification of approved make waterproofing. All the coats to be applied in perpendicular direction to each other. Allow the coating to air cure for 3-5 days before conducting water ponding test for 24 Hrs.
	4. Horizontal Protection: A - Brick Bat Coba for protection and slope Option – 1 Brick Bat Coba for protection and slope: Providing & laying brickbat coba of minimum 120 mm thick laid over a bed of cement mortar (1:4), including integral waterproofing admixture of approved make conforming to IS 2645:2003@ 200 ml per bag of cement. The surface should be neatly finished with the help of wooden / steel hand trowel. The vertical surfaces of the adjoining walls are to be treated up to a height of 300mm including rounding of junction. The curing should be done for 2 weeks.

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	5. Vertical wall Protection plaster: Apply 1 coat of spatter dash bond coat mixed in the ratio of URP of approved make as per manufacturer's specification with fine coarse sand and water to make thick slurry coat over the waterproof coating on the vertical walls. Apply 12mm thick plaster over the prepared surface of cement sand mortar admixed with integral waterproofing compound conforming to IS 2645:2003 of approved make @ 220ml per bag of cement. Including finishing & water curing of plaster for minimum 7 days.
	All Waterproofing Work Should be Done by only Authorized Skilled Applicator of Company.
54.	Water tank waterproofing
54 a	Providing and laying water proofing treatment to horizontal and vertical surfaces of RCC water tanks, including cleaning the surface with wire brush, treating all surface cracks, construction joints and honeycombs by grouting with specialised non shrink grout, chamfer preparation at wall - slab joint and preparation of surface in all aspects to receive the waterproofing, which consists of :
54 b	Preparation of chamfer or vatta at wall & raft junction: The junction between RCC raft & Pardi / retaining wall should be treated by preparation of vatta of size min. 50mm X 50mm with Polymer Modified Mortar prepared using URP of approved make as per manufacturer's specification fixing with cement and sand. Preparation of construction joints: The tie rod holes should be filled with Non Shrink Free Flow Grout Like of approved make @ 10 liter per 50 kg bag of cement & 150 kg zone II sand. Only plan area will be measured for payment. Make :- BASF, MYK, Dr. Fixit, Fosroc, cico or Equivalent as approved
54 c	Waterproofing application on positive side: Providing & Applying 2 coats of high performance two component high performance cementitious waterproof coating of approved make, with a mix ratio of (liquid: Powder), parts by wt. - 1:1.4 at the rate 0.42 - 0.50 Sq.mt / Kg for 2 coats to achieve the DFT on 1.2mm in a span of 4 - 6 hours with a roller/ brush on the prepared concrete substrate. Make :- BASF, MYK, Dr. Fixit, Fosroc, cico or Equivalent as approved
54 d	Protective Plaster :- providing and laying avg. 15 mm thick, Cement Mortar 1:3 plaster admixed with Integral Waterproofing Compound of approved make as per manufacturer's specification mixed with cement, items also including curing cleaning etc. Complete as per instruction by PMC/ SBI.
54 e	Application of food grade epoxy (Anti-microbial Coating)Inner side of tank: Providing & applying 2 coats of Damp proof coating – two component, water-based epoxy resin having anti-algae, antifungal,Nontoxic, hygiene cum damp-proof coating Certified by CFTRI as per 21 CFR 175 – 300 of US – FDA, having mixing Ratio (Base: Hardener: Water) – 1:1:1 to be applied @ 4 sqm / Kg, as per manufacturer's specification of approved make. The coating shall have Specific Gravity: 1.2, Water vapour permeance: 244.48 g/m2/24 hrs, as per IS 7809/Pt 2/1977, Adhesion strength: 2 N/mm2 as per ASTM D4541: 02, all as per manufacturers' specification, etc, complete. Make :- BASF, MYK, Dr. Fixit, Fosroc, cico or Equivalent as approved.
	Item also include ponding, curing, scaffolding. The whole Water tank so finished shall be flooded with water for a minimum period of two weeks for curing and for final test."All above operations to be done in order and as directed and specified by the PMC/SBI. All Waterproofing Work Should be Done by only Authorized Skilled Applicator of Company. Make :- BASF, MYK, Dr. Fixit, Fosroc, cico or Equivalent as approved
55.	Top Terrace brick bat waterproofing with China mosaic tiles

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	Providing and laying integral cement based water proofing treatment including preparation of surface as required for treatment of top terraces etc consisting of following operations: (a) Applying a slurry coat of neat cement using 2.75 kg/sqm of cement admixed with water proofing compound conforming to IS. 2645 and approved by PMC/SBI over the RCC slab including adjoining walls up to 300 mm height including cleaning the surface before treatment. (b) Laying brick bats with mortar using broken bricks/brick bats 25 mm to 115 mm thick with 50% of cement mortar 1:5 (1 cement : 5 coarse sand) admixed with water proofing compound conforming to IS : 2645 and approved by PMC/ SBI over 20 mm thick layer of cement mortar of mix 1:5 (1 cement :5 coarse sand) admixed with water proofing compound conforming to IS : 2645 and approved by SBI / PMC to required slope and treating similarly the adjoining walls up to 300 mm height including rounding of junctions of walls and slabs. (c) After two days of proper curing applying a second coat of cement slurry using 2.75 kg/ sqm of cement admixed with water proofing compound conforming to IS : 2645 and approved by PMC/SBI (d) Finishing the surface with 20 mm thick cement mortar of mix 1:4 (1cement :4 coarse sand) admixed with water proofing compound (conforming to IS : 2645) at the rate of 1 Kg per bag, Including laying in required position flooring of broken China Mosaic (broken pieces of China Chips) of approved colour and pattern including neat cement float, giving proper slops, compaction, curing, finishing preparing bell mouth etc. approved by SBI/PMC. along with Kani plaster over Round portion.(i.e. Vatta) (e) The whole terrace so finished shall be flooded with water for a minimum period of two weeks for curing and for final test.“All above operations to be done in order and as directed and specified by the PMC/SBI.
56.	Terrace garden Waterproofing (Area 1700 sqm)
	Ground floor Area of Lawn & Shrub (Area 500 sqm)
56 a	Surface preparation: Clean the surface by using vacuum and ensure the surface is free from laitance, loose or friable materials, debris etc. Ensure the substrate has properly cured and the concrete is profile free, no ridges or troughs. Surface profile shall be prepared to take all above coating . If concrete surface found to be defective with pinholes, bug roles, honeycombs etc., it must be repaired using scratch coat prepare by mixing 16D primer or equivalent and 4 mm down silica sand at ratio of 1:1 by weight. Apply the scratch coat by using suitable spatula/squeeze to get level surface for the upcoming primer. Make :- BASF, MYK, Dr. Fixit, Fosroc, cico or Equivalent as approved.
56 b	Angle Fillet treatment: Angle Fillets/Vata/Coving must provide at size of 50 x 50 mm on all vertical up-stands & junctions /corners with cement sand Polymer modified mortar all around the periphery. Alternatively, all vertical upstands and junctions, wall floor joints, mechanical installation shall be treated with Joint Tape of approved manufacturer & as recommend in technical data sheet and Mechanical installations. All above process shall be done as per manufacture’s specification & as per instruction from SBI/ PMC. Make :- BASF, MYK, Dr. Fixit, Fosroc, cico or Equivalent as approved.
56 c	Crack Treatment: Non leaking cracks :- <30mm expansion joints and Visible surface cracks which are more than 1 mm should be cut open in square or V -groove manner up to 10 mm width by using mechanical cutter and treat with PU Sealant/Hybrid Sealant and allow it to cure as per datasheet(manufacturer’s specification)

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	The sealant with shore A hardness of 25, have elongation at break, 400 %, movement accommodation factor 25 % for butt joints and 50 % for lap joints. Allow sealant to cure for minimum 7 days before carrying out any testing. Prevent the joints from water after application at least for 24 hrs (best for 7 days). Primed surfaces apply 1 coat of Dr Fixit Flexi PU 270(I) or Equivalent then apply 100 mm width geo textile strip of 60 GSM and saturate the fleece with Dr Fixit Flexi PU 270(I) or equivalent. >30mm expansion joints must be treated waterproofing Tape of approved brand with Adhesive with two part epoxy based adhesive 1-2mm thickness on each side of the joint where at least 50mm stays beyond the edge are sealed with recommended epoxy adhesive. Providing and carry out expansion joint treatment after proper surface preparation to remove loose mortars, dust, foreign particles from joints, fixing of tightly packed closed cell polyethylene based back up rod or filler board to ensure no gaps or voids exists, mask face edge of the joint using masking tape for neat finish, mixing of waterproofing Tape adhesive of approved brand Adhesive– Two part Epoxy Adhesive using slow speed drill till get homogeneous mix, apply it to prepared joint 1-2mm thick with notched trowel or putty blade, tooled to a smooth finish and finally fixing of waterproofing Tape of approved brand– Flexible expansion joint membrane available in 1mm thickness exhibiting superior mechanical properties like, Elongation >500%, Tensile Strength >12N/mm2, Tear Strength >200N above joint followed by another layer of epoxy adhesives waterproofing Tape adhesive of approved brand as complete as per manufacturer's specification. (To be Continued...)
	For joint over end laps, the overlaps surfaces must be clean, wiped and heat welded with at hot air welding gun with 100 mm overlap. After application the system should be allowed to cure for 7 days. In case of exposed condition/ Trafficable joint/higher water pressure joints > 1.5 bar up to 3 bars, protect the joint with a metal plate screwed at one end. The Adhesive area can be painted by any acrylic coating as a protective top coat. Leaking cracks on RCC slab :- Clean the identified crack and remove drilling dust before placing the nozzle. Seal and pack the nozzle with fast setting approve brand of waterproofing Instant Leak Plug compound. Injection of cement slurry admixed with admixture Pidicrete AM (225gms/ bag of cement) or equivalent by using 40PSI grout pump. Plasticizing grout additive Dr. Fixit Pidicrete AM or equivalent of approved brand; the product is to be dispensed in water & added to 50 kg of cement at a water cement ratio of 0.4-0 – 0.45. The mixture thus batched is to be used for injection grouting.
56 d	Waterproof Coating :- Providing & applying of High Solid Content, Cold Liquid- Applied Elastomeric Water Proofing Membrane using Brush/ roller / airless spray to form a minimum system thickness of 1.5mm in three coats with a total consumption is 2.5Kg/m² to achieve 1.5mm DFTor as per manufacturer's specification. 2.5 kg/m² is minimum recommended consumption when applied in three layers to achieve a DFT of 1.5 mm to comply with ASTM C 898 Standard Guide for use of High Solid Content, Cold Liquid- Applied Elastomeric Water Proofing Membrane. Allow the membrane to air cure for 7 days before any activity over it. The PU membrane shall be terminated 300mm above FFL, self-curing for 7 days. The Waterproofing material shall have Solids > 85%, Tensile strength > 2 MPa as per ASTM D 412, Elongation > 400% as per ASTM C 1305, crack bridging up to 3.2mm, Shore A Hardness > 50 as per ASTM D 2240, Adhesion to concrete > 1.5Mpa as per ASTM D 903, Water vapor permeability > 14gm / m2 / day.

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56 e	Separation Layer :- Providing & Laying more than 100 GSM Geotextile (non-woven polyester) membrane with a min of 100mm wide overlap loosely laid over PU membrane, etc., complete.
56 f	Horizontal Protection - Mortar screed for protection & Slope:- Providing & laying of average 100 mm thick protective screed of M20 grade by keeping minimum 50mm thickness at drainage point with slope 1:100 containing 12 mm, 100% virgin polypropylene fibres @ 0.9 Kg/Cu.m with a broom finish, well compacted, curing for 7 days etc. complete. The screed shall be raised to the wall in the form of vatta to achieve a smooth corner. The screed shall be divided into panels of 4 mtr X 4 mtr with 6 mm wide x10mm deep construction joint and filling the same with PU sealant, confirms to ASTM C-920-S, NS, 25 & BS EN ISO—11600: 2003 Type F & G as per manufacturer specification, etc, complete.
56 g	**Vertical wall Protection plaster :-** Providing & laying 15mm THK protective plaster of C:M – 1:4 admixed with integral waterproof compound conforming to IS 2645:2003,of approved brand as per manufacturer's specification per bag of cement, over the waterproofing membrane for vertical protection after application of Epoxy Bonding agent / 16D primer and sprinkling of quartz sand to create key for the plaster. Including finishing & water curing of plaster for minimum 7 days.
56 h	**Anti-Root Barrier Membrane :-** Providing & laying 1.5mm THK SBS modified self-adhesive, cross laminated HDPE Valero lining waterproofing membrane, Dr. Fixit Samshield XL 1500 / 2100 or equivalent, conforming to IS 16471:2017 Type A, over the solvent based bituminous Dr. Fixit Torchshield primer @ 4 sq.mt/litre or equivalent as per manufacturer's specification. The lap with HDPE membrane shall be 100mm treated with double sided tape. The SBS membrane shall have Roll Size: 1 Mtr X 10 Mtr, Mass per Unit Area > 1.8 Kg/m2 as per ASTM D 5147, Puncture resistance > 200 N as per ASTM E 154, Elongation > 180% as per ASTM D 412-06, Crack bridging (10 cycles) > 1.5mm as per ASTM C 836, Tensile Strength > 4 Mpa as per ASTM D 412- 06, Tear resistance > 20 N/mm as per ASTM D 4073, Softening Point (ºC) ≥ 105º as per IS 1205/1978, Low temperature Flexibility – 10º C as per ASTM 2 | P a g e D 5147, Chemical Resistance (pH) as per ASTM D 543, Hydrostatic pressure > 50M as per DIN 1048. Make :- BASF, MYK, Dr. Fixit, Fosroc, cico or Equivalent as approved.
56 i	**Drain board with filter media :-** Installation of Rolled Matrix Soil Filter cum surface drainage System as per manufacturers' specifications consist of dimple raised, moulded polypropylene sheet bonded to a high strength polypropylene geotextile fabric having compressive strength of 600 Kg / Sq.mt. and thickness of 10 – 12 mm. System as specified by Landscape architect / engineer shall be laid over the Sloped screed before soil filling. Make :- BASF, MYK, Dr. Fixit, Fosroc, cico or Equivalent as approved.
56 f	Rate includes The entire treatment will be taken up to 300mm/450mm on parapet wall or up to parapet projection as per architectural drawing. For the purpose of measurement the entire treated surface will be measured. Item also include ponding, curing for two weeks, scaffolding, The whole Water tank so finished shall be flooded with water for a minimum period of two weeks for curing and for final test. All above operations to be done in order and as directed and specified by the PMC/SBI. Make :- BASF, MYK, Dr. Fixit, Fosroc, cico or Equivalent as approved.
	All Waterproofing Work Should be Done by only Authorized Skilled Applicator of Company.
57.	40mm thick Cement concrete flooring 1:2:4 Grade

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	Providing & placing 40 mm thick with 20 mm nominal size stone aggregate Cement concrete flooring 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate) finished with a floating coat of neat cement, including cement slurry, but excluding the cost of nosing of steps with curing, scaffolding etc. Complete as per instruction by PMC/ SBI. (Lift pit etc.)
58.	Water Proofing of Basement
	HDPE Membrane Waterproofing System
58 a	Horizontal Surface (Below Raft) - Supplying and laying composite 1.5mm thick, pre-applied, fully bonded HDPE weldable membrane of approved make over P.C.C. conforming to BS 8102 & IS 16471:2017, requirements of UG waterproofing structures. The system should be fully bonded to the Raft and consists of highly resilient HDPE film, pressure sensitive layer and weather protective layer. Typical application includes surface preparation by removing loose aggregates from PCC, foreign material, cleaning the surface etc., cutting membrane to convenient length, carefully aligning the membrane over blind concrete and rolling it out with sand coated side facing up, laying adjacent sheets by keeping side B25overlap of 75 mm, carry out hot air fusion welding by using suitable machine, end overlaps to be welded in 75 mm width after removing sand and adhesive. The membrane shall be continued over the vertical surface leaving 50 mm from top of the Raft and fixed to shutter using double side adhesive tape. Item rate is inclusive of all material, labour, tools & tackles, scaffolding & transportation etc. complete as per specification & as directed by SBI/ PMC. Make :- MYK, Dr. Fixit, Fosroc, cico, BASF or Equivalent as approved .
58 b	Retaining wall waterproofing with SBS Membrane (after de shuttering & curing) - Providing & laying 1.6mm THK SBS modified self-adhesive, cross laminated HDPE valeron lining waterproofing membrane, of approved make, conforming to IS 16471:2017 Type A, requirements of UG waterproofing structures, over the solvent based bituminous of approved make primer @ 4 sq.mt/litre. The lap with HDPE membrane shall be 100mm treated with double sided tape. This shall include surface preparation by cleaning work, removal of loose concrete and filling cracks with polymer modified mortar & treatment of tie rod holes, bracing angle etc with plugging mortar dual shrinkage cementitious flow able grout, which are anchored in shuttering for holding the same and other projections as per manufacturers' recommendation, followed by the installation of 8-10mm THK polyethylene dimpled drain board having compressive strength > 400kN/m2 (as per ISO 25619-2) and puncture resistance of 1250N as per ISO 12236 over the waterproofing membrane for vertical surface stuck to the membrane by spot bonding method, using synthetic adhesive with butt joints to protect the membrane from damages from back-filling materials, all followed by termination of the membrane minimum 200mm above FGL with aluminium termination bar shall be fixed with non-corrosive fastener @ 4 no's per RM, sealing of termination bar with PU Sealant / epoxy mortar / putty, as per manufacturer specification, etc. complete. Item rate is inclusive of all material, labour, tools & tackles, scaffolding & transportation etc. complete as per specification & as directed by SBI/ PMC. Make :- MYK, Dr. Fixit, Fosroc, cico, BASF or Equivalent as approved.
	Crystalline waterproofing system
58 c	Concrete admixture for Diaphragm / retaining wall & raft concrete (During casting) : Supplying and mixing integral full section crystallization based waterproofing treatment of approved make having to be added into the concrete of Base slab up to 300mm Raft thickness, at a dosage rate of 1% by weight of the

	cement contents of the concrete. Integral concrete waterproofing system of approved make shall be added to the concrete in the form of thin slurry by mixing Integral concrete waterproofing system of approved make with water as per manufacturer's specification. Slurry formed shall be added to the concrete directly into the RMC transit mixer at site prior to pumping of the concrete. After adding Integral concrete waterproofing system of approved make slurry into the concrete, the transit mixer shall be rotated at a full speed for around 5 minutes to ensure the uniform mixing of the Integral concrete waterproofing of approved make into the concrete.
58 d	Construction joint treatment (During casting) - Providing and applying water re-swellable-bar SealArm Waterbar of approved make at starter & all construction joints, it shall have unrestrained volumetric expansion > 800% after 14 days. It shall be fixed to the concrete using a gun grade hydrophilic adhesive / or mechanically fixed by non corrosive nailing as recommended by manufacturer. It shall be fixed at centre of concrete element using cross nailing in alternate manner so that it shall not be displaced from its original position. Before fixing of Waterbar, surface of concrete element on which waterbar to be fixed shall be levelled. Make :- MYK, Dr. Fixit, Fosroc, cico, BASF or Equivalent as approved.
	All Waterproofing Work Should be done & certified by only Authorized Skilled Applicator of Company.
	PAINTING WORKS
	Note:- All plaster works Measurements shall be considered only as Surface Areas of application and no extra/separate payment for dhar, kani, groove, strips, bands etc.
	Only MS Scaffolds shall be used for the all Plastering , painting Works.
	Rate shall inclusive of all heights, Sub structure, Superstructure, lift & leads, levelling, finishing curing etc. Complete up to the satisfaction of SBI / PMC.
	Painting works to be done by authorised applicator only. Certificate / registration of the same to be submit to SBI / PMC before starting of the work.
	All painting works to be done with LOW VOC paints as approved by IGBC/ GRIHA/ Green building norms or required for any other certification.
59.	**Synthetic Enamel Paint**
	Providing and applying synthetic enamel paint with low VOC content of approved brand or equivalent of approved colour shade & quality to new surfaces with one coat of primer & two or more coats / up satisfaction of PMC/SBI with uniform shade including scaffolding all complete at podiums and all floors, height , leads & lifts , cleaning etc. Complete as directed by the PMC/SBI. Make:- Asian / Nerolac/ Berger/ Dulux or approved equivalent make.
60.	**White Cement Base Putty**
	Providing and applying 2 mm thick (average) White cement base Putty on hacked / uneven background such as bare RCC work/ plastered surface on walls & ceiling at all floors , heights and locations, finished in smooth line and level with necessary scaffolding , Rubbing the surface with sand paper to give smooth surface & cleaning as per the instruction of the PMC / SBI complete. Make :- Birla, Asian, Nerolac, Berger, JK or approved equivalent make.
61.	**Acrylic emulsion paint with low VOC content to internal walls/ceiling**

	providing & applying of one coat of approve make Primer & two or more coats of Acrylic emulsion paint with low VOC content to internal walls/ceiling with uniform shade of flats, common lobby, staircase, passages, common areas etc. Of approved brand, colour & shade at all heights, levels including necessary scaffolding, cleaning as per the instruction of the PMC / SBI complete. Make:- Asian / Nerolac/ Berger/ Dulux or approved equivalent make.
62.	**Exterior Grade Acrylic Emulsion Paint with low VOC content**
	Providing and applying **Acrylic Emulsion with low VOC content / ACE** with uniform shade of make of approved , colour, shade & quality to new surfaces in two or more coats over a coat of primer, filling up the services and over sand face plaster including scaffolding all complete. Make : (Asian, Berger, Nerolac, Jotun) or approved equivalent make.
63.	EXTERNAL PAINTING WITH TEXTURE PLASTER & HIGHER GRADED ELASTOMERIC PAINT WITH LOW VOC
	a) Preparing the existing surface by scrapping and rubbing with sandpaper to remove all loose adhered particles followed by washing with water using wire brush to ensure thorough cleaning.
	b) Providing and applying **Texture plaster** with finishing with texture material of approved make in 3 to 4 millimetre thickness on previously plastered surface, including Plaster Groove 6mm thickness or Tape Grooves 35 to 45 mm Width or as required, in all position including preparing the surface, scaffolding etc. complete.
	c) Providing and applying one coat of water based acrylic anti fungal Primer of approved quality and make as per sample approved.
	d) Providing and applying one coat of fibre reinforced membrane paint water proofing Coat of "Protek Basecoat" of Asian/ "Weather coat Roof Guard" of Berger / "Aqua Touch" of dulux or equivalent approved by the PMC / SBI having crack bridging ability up to 2.00 mm, superior anti-carbonation & water proofing property.
	e) Providing and applying 2 or more coats of approved quality low VOC Higher graded External Acrylic Emulsion paint, Exterior grade having anti fungal property, resistance to dust & dirt accumulation, resistance to fading of colours etc. of approved colour and shade Apex Ultima (Asian) / Weathercoat All Guard (Berger) / Weather Shield Max (Dulux) or equivalent approved by the SBI / PMC.
	Note: Rates to include cleaning afterwards, necessary scaffolding/Cradle, debris safety netting, labour etc complete.
	Make: Asian Paints Ultima Protek / Berger Weathercoat Long Life or approved equivalent.
	Note:- All Painting Works shall be Measured as per application surface area no extra/separate payment for Band, grooves, strips painting. For Grills /Jali MS Gates if not mentioned specifically /separately. Payment area shall be calculated as per Mode of Measurement given in Technical Bid Document/ BIS/As per Standards

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64.	Oil Bound Distemper
	Providing & Applying of Oil Bound Distemper to new work with acrylic distemper in 2 or more coats over and including water thinnable priming coat, to give even shade of approved colour, shade & quality to new surfaces in two or more coats / up satisfaction PMC/SBI including putty for filling holes, rubbing of surface to make it even and smooth, scaffolding all complete at basements, ground and all floors, height , leads & lifts cleaning etc. Complete as directed by the PMC/SBI. (inside of Lift Shafts Etc.) Make : Nerolac/ Asian/ Berger or approved equivalent make.
65.	Cement paint
	Providing & Applying of Cement paint to new work with 2 or more coats to give even shade of approved colour, shade & quality to new surfaces in two or more coats / up satisfaction PMC/SBI including scaffolding all complete at podiums and all floors, height , leads , lifts cleaning, rubbing of surface to make it even and smooth etc. Complete as directed by the PMC/SBI. (Diaphragm / Retaining wall from inside etc.) make : Asian paints, Shalimar/ Nerolac / Indigo/Jotun / snowcem Topecem, Nitcocem approved equivalent make
	WINDOWS, VENTILATORS, SLIDING DOORS ETC.
66.	UPVC Windows
	Providing & fixing in position factory made uPVC white colour casement /Sliding /casement cum fixed fully glazed Doors/ sliding window/ ventilator comprising of 6mm thick Toughened glass for all window & 5mm thick frosted glass for ventilator, uPVC multi-chambered frame with in-built roller track and sash extruded profiles duly reinforced with with 1.5 to 2.52 mm thick depending upon the window glavanised mild steel section made from roll formaing process of required length (shape & size according to uPVS profile), appropriate dimensions of uPVC extruded glazing beads and uPVC extruded interlocks, EPDM gaskets, stainless steel (SS 314 grade) friction hinges, zinc alloy (white powder coated) casement handles, wool pile, touch locks with hooks, with single nylon rollers (weight bearing capacity to be 80/ 150 Kg), SS fasteners 100 x 8 mm size for fixing frame to finished wall and 5 degree gradient slope in track (drainage track) comes with threshold, low threshold without threshold option & necessary stainless steel screws etc 12 mm thick toughened glass panes (ST 136), fixed in shutters, flush handle, C handle, D handle with locking arrangements as per manufacturers specifications etc. Complete. Profile of frame & sash shall be mitred cut and fusion welded at all corners, mullion (if required) shall be also fusion welded including drilling of holes for fixing hardware's and drainage of water etc. After fixing frame the gap between frame and adjacent finished wall shall be filled with weather proof silicon sealant of approved quality, including Mosquito net all complete as per approved drawing & direction of SBI/PMC. Variation in profile dimension in higher side shall be accepted but no extra payment on this account shall be mad. Make: Fenesta, deceunick, Saint Gobain, Tostem, Koemmerling, prominance or approved equivalent. (Refer detailed windows/ door schedule provided by the SBI/PMC.)
66 a.	**3 track 3 panels UPVC sliding window with fly proof S.S wire mesh**

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	Three track three panels sliding window with fly proof S.S wire mesh (Two nos. glazed & one no. wire mesh panels) made of (big series) frame 116 x 45 mm & sash 46 x 62 mm both having wall thickness of 2.3 ± 0.2 mm and single glazing bead / double glazing bead of appropriate dimension. (Area of window above 1.75 sqm).
66 b	**2 track 2 panels UPVC sliding window**
	Two track two panels sliding window made of (big series) frame 67 x 50 mm & sash 46 x 62 mm both having wall thickness of 2.3 ± 0.2 mm and single glazing bead / double glazing bead of appropriate dimension . (Area of window above 1.75 sqm up to 2.50 sqm).
66 C.	**UPVC ventilators**
	UPVC ventilator as per design & drawing with 8mm thick toughened glass in casement shutter having wall thickness 2.3 ± 0.2 mm and single glazing bead / double glazing bead of appropriate dimension & partly fixed with provision for exhaust fan. (Area of window above 0.5 sqm up to 1 sqm)
67.	Providing and fixing factory made UPVC white colour sliding glazed door with 6mm Toughened thick glass in single glss unit comprising of uPVC multichambered frame with in-built roller track and sash extruded profiles duly reinforced with 1.60 ± 0.2 mm thick galvanized mild steel section made from roll forming process of required length (shape & size according to uPVC profile), appropriate dimension uPVC extruded glazing beads, uPVC extruded interlock, stainless steel (SS 316) friction hinges and uPVC extruded Inline sash adaptor (if required), EPDM gasket, wool pile, zinc alloy (white powder coated) handle with key on one side of extreme panels along with zinc plated mild steel multi point locking having transmission gear with keeps, zinc alloy (white powder coated) cament handles, wool pile, touch locks with hooks, Single nylon roller, cresent lock (if required), stainless steel (SS 316 grade) body with adjustable double nylon rollers (weight bearing capacity to be 120 kg), S.S. fasteners 100 x 8 mm size for fixing frame to finished wall and necessary stainless steel screws etc. Profile of frame & sash shall be mitred cut and fusion welded at all corners, including drilling of holes for fixing hardware's and drainage of water etc. After fixing frame the gap between frame and adjacent finished wall shall be filled with weather proof silicon sealent over backer rod of required size and of approved quality, all complete as per approved drawing & direction of SBI/ PMC. Variation in profile dimension in higher side shall be accepted but no extra payment on this account shall be made. Note: For uPVC frame and sash extruded profiles minus 5% tolerance in dimension i.e. in depth & width of profile shall be acceptable Make: Fenesta, deceuninck, Saint Gobain, Tostem, Encraft, Koemmeling or approved equivalent. (Refer detailed windows/ door schedule provided by the SBI/PMC.)
67a	**3 track 3 panels UPVC sliding door with fly proof S.S wire mesh**
	Three track three panels sliding door with fly proof S.S wire mesh (Two nos. glazed & one no. wire mesh panels) made of (big series) frame 116 x 45 mm & sash 46 x 82 mm both having wall thickness of 2.3 ± 0.2 mm and single glazing bead / double glazing bead of appropriate dimension. **(**Area of door above 2.00 sqm upto 5.00 sqm)

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68.	**Powder Coated Aluminium vertical fins**
	Providing & fixing in position Powder Coated Aluminium vertical fins to Duct with openable door outer frame of 75x40x1.5 mm box section, inner frame of 75 x40x1.5mm thick box section & vertical fins of 75x40x1.5 mm box section with 75mm clear opening with fixing of frame in to wall with fasteners, Aluminium butt hinges locking arrangement , welding of all corners, joints properly & rubbing of all welding joints, Powder coating to each member, sections to all sides properly as per design , drawing & as per instruction by SBI / PMC.
69.	**Toughened glass door**
	Providing and fixing 12 mm thick frameless toughened glass door shutter of approved brand and manufacture, including providing and fixing top & bottom pivot , hydraulic floor spring 120kg capacity of approved brand and manufacture conforming to IS : 6315, having brand logo embossed on the body / plate with double spring mechanism and door weight upto 125 kg, for doors, including cost of cutting floors, embedding in floors as required and making good the same matching to the existing floor finishing and cover plates with brass pivot and single piece M.S. sheet outer box with slide plate and making necessary holes, CP Door handle, lock, all patch fittings, stopper etc. , door fittings, all complete as per manufacture's specification, design, drawings, as per instructions by SBI/ PMC. All fittings & fixtures of Dorma/ Hettich/ dorset/ approved equivalent brands.
	MISCELLANEOUS WORKS
70.	**Providing, Fixing and maintaining Nylon Safety Nets**
	Providing, Fixing and maintaining, Nylon safety Nets (35mm X 35mm square with 5 mm thick nylon rope.) having width of 4.5 mts. horizontal to the periphery of the Building with supporting structure of 50 mm dia MS hollow (40 nb) pipe duly anchored on slab with 10 mm thick base plate and anchor fastener (hilti) 4 No at all corners, and free end of pipe to be tied up with upper floor column with the help of nylon rope 16 mm dia. same supporting system is to be followed for every 4.5 Mtrs. in such a way to have a proper slope during Construction, and removing and re fixing part of the same as and when required/ necessary for smooth progress of the work for 4 individual layers & same should be maintained with cleanliness. All complete as approved by the SBI/ PMC.
71.	**M.S. Rungs**
	Providing & Fixing **MS Rungs in Over Head Water Tank & Under Ground Water tank** to be fitted at the time of casting RCC walls for Tanks without any extra cost for fixing & necessary changes in shuttering of size 600 X 300 mm , with 25 mm thk. Bars with Epoxy Paint all complete. Weight to consider for 1 rungs is 2.5 kgs.
72.	**Rebaring reinforcement bar dowel**
	Providing and rebaring reinforcement bar dowel in RCC including drilling hole at required or specified , placing the dowel in position and effectively grouting

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	the hole with specified hilti / Equivalent make epoxy/chemical grout material (as per manufacturer specification) at all levels including scaffolding etc. complete as directed by the PMC/SBI . Make :- Hilti, Fischer, Fosroc / approved Equivalent make
72 a	8 mm dia bars
72 b	10 mm dia bars
72 c	12 mm dia bars
72 d	16 mm dia bars
72 e	20 mm dia bars
72 f	25 mm dia bars
72 g	32 mm dia bars
73.	M.S. Sleeves
	Providing and fixing, **M.S Sleeves** as per IS :1239 (Class C) to be placed on the RCC wall, Brick wall, beams or any other RCC members for pipes to pass through including filling of the gap with glass wool and sealing both end with water and fire proof sealant complete in all respects as directed & up to satisfaction of Project Manager. Note: Any displacement of sleeves shall be rectified by the Contractor at his own cost no claim in this regards will be entertained against this work.
73 a.	50 mm dia ranging from 100 to 500mm length
73 b.	75 mm dia ranging from 100 to 500mm length
73 c.	110 mm dia ranging from 100 to 500mm length
73 d.	150 mm dia ranging from 100 to 500mm length
74.	**PVC Sleeves**
	Providing and fixing **PVC sleeves** (6kg / Sq m) properly fixed in wall, column, beams, floor and top slab of following diameters , sealing both faces by plastic tape as directed & up to satisfaction of Project Manager. Note: Any displacement of sleeves shall be rectified by the Contractor at his own cost no claim in this regards will be entertained against this work.
74 a	50 mm dia ranging from 100 to 500mm length
74 b	75 mm dia ranging from 100 to 500mm length
74 c	110 mm dia ranging from 100 to 500mm length
74 d	150 mm dia ranging from 100 to 500mm length
75.	**Corner guards**

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	Providing & Fixing 1m height and 75 mm X 75 mm X 10 mm thk **Corner Guards** of approved make made up of flexible and high strength, tamper proof rubber with international standard bright colours with Black Base and with attractive & reflective Yellow colour strips as per approved design & drawing etc. Complete. (Parking Area etc.)
76.	**Thermoplastic paint**
	Providing and applying 2.5 mm thick road marking strips (retro- reflective) of specified shade/ colour using hot thermoplastic material by fully/ semi automatic thermoplastic paint applicator machine fitted with profile shoe, glass beads dispenser, propane tank heater and profile shoe heater, driven by experienced operator on road surface including cost of material, labour, T&P, cleaning the road surface of all dirt, seals, oil, grease and foreign material etc. complete as per direction of SBI/ PMC and accordance with applicable specifications.
77.	**Rubberised Speed Breakers**
	Providing and fixing water resistant, weather resistant Rubber Speed Breakers humps which are made up of EPDM as per ASTM standards , ASTM D2240, D412, D412, D395, D573, D624 etc. in 500 X 350 X 50 mm Size and in combination of Black and Yellow colour. laying to be done as per width of the road and wherever instructed by PMC/SBI on roadways/ driveways with necessary anchors/bolts, hardware etc. Item includes all transport, handling, wastage, cutting fixing, laying as per profile and as per instructions form PMC/SBI. Approved makes – Deesawala Rubber Industries/ Acutel Solutions/ Axnoy Industries/ Realtek / Equivalent / As approved by PMC/SBI
78.	**Glow studs of size 100x20 mm made of heavy duty**
	Providing and fixing Glow studs of size 100x20 mm made of heavy duty body shall be moulded ASA (Acrylic styrene Acryloretrite) or HIP (High impact polystyrene) or ABS having electronically welded micro- prismatic lens with abrasion resistant coating as approved by SBI /PMC. The glow stud shall support a load of 13635 kg tested in accordance with ASTM D4280. The slope of retro- reflective surface shall be 35 (+/-5) degress to base .The reflective panels on both sides with at least 12 cm of reflective area up each side. The luminance intensity should be as per the specification and shall be tested as described in ASTM I: 809 as recommended in BS: 873 part 4 : 1973. The studs shall be fixed to the Road surface using the adhesive conforming to IS, as per procedure recommended by the manufacturer complete and as per direction of SBI/ PMC.
79.	**Expansion joint system related with floor location**
	Providing and fixing of expansion joint system related with floor location as per design, drawings and direction of PMC / SBI. The joints system will be of extruded aluminum base members, self aligning / self centering arrangement and support plates etc. as per ASTM B221-02. The system shall be such that it provides floor to floor /floor to wall expansion control system for various vertical location in load application areas that accommodates multi directional seismic movement without stress to it's components. System shall consist of metal profiles with a universal aluminum base member designed to

	accommodate various project conditions and finish floor treatments. The cover plate shall be designed of width and thickness required to satisfy projects movement and loading requirements and secured to base members by utilizing manufacturer's pre-engineered self- centering arrangement that freely rotates / moves in all directions. The Self - centering arrangement shall exhibit circular sphere ends that lock and slide inside the corresponding aluminum extrusion cavity to allow freedom of movement and flexure in all directions including vertical displacement. Provision of Moisture Barrier Membrane in the Joint System to have watertight joint is mandatory requirement all as per the manufactures design and as approved by PMC / SBI. (Material shall confirm to ASTM 6063).
	Floor Joint of 50 mm gap
80.	Expansion joint system related with wall joint
	Providing and fixing of expansion joint system related with wall joint (internal/external) location as per drawings and direction of SBI / PMC. The joints shall be of extruded aluminum base members, self aligning / centering arrangement and support plates as per ASTM B221- 02. The material shall be such that it provides an Expansion Joints System suitable for vertical wall to wall/ wall to corner application, both new and existing construction in office Buildings & complexes with no slipping down tendency amongst the components of the Joint System. The Joint System shall utilize light weight aluminum profiles exhibiting minimal exposed aluminum surfaces mechanically snap locking the multicellular to facilitate movement. (Material shall confirm to ASTM 6063).
	Wall Joint of 50 mm gap
81.	**Expansion joint system related with roof location**
	Providing and fixing of expansion joint system of approved make and manufactures for various roof locations as per approved drawings and direction of PMC / SBI. The joints shall be of extruded aluminium base members with, self aligning and self centering arrangement support plates as per ASTM B221-02. The system shall be such that it provides watertight roof to roof/roof to corner joint cover expansion control system that is capable of accommodating multidirectional seismic movement without stress to its components. System shall consist of metal profile that incorporates a universal aluminium base member designed to accommodate various project conditions and roof treatments. The cover plate shall be designed of width and thickness required to satisfy movement and loading requirements and secured to base members by utilizing manufacturer's pre-engineered self-centering arrangement that freely rotates / moves in all directions. The Self centering arrangement shall exhibit circular sphere ends that lock and slide inside the corresponding aluminum extrusion cavity to allow freedom of movement and flexure in all directions including vertical displacement. The Joint System shall resist damage or deterioration from the impact of falling ice, exposure to UV, airborne contaminants and occasional foot traffic from maintenance personnel. Provision of Moisture Barrier Membrane in the Joint System to have water tight joint is mandatory requirement. (Material shall confirm to ASTM 6063).
	Wall Joint of 50 mm gap

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82.	**Artificial Lawn**
	Providing & fixing of 35mm thick Artificial lawn made of polyethylene with high UV protection with PP Woven fabric primary & secondary backing , applied on concrete / finished surface with adhesive of approved quality, make, colour as per design , drawing & Manufacturer's specification having with 5years of warranty & as per instructions from PMC/ SBI
83.	**kerb stone**
	Providing and laying at or near ground level factory made kerb stone of M-25 grade cement concrete in position to the required line, level and curvature, jointed with cement mortar 1:3 (1 cement: 3 coarse sand), including making joints with or without grooves (thickness of joints except at sharp curve shall not to more than 5mm), including making drainage opening wherever required complete etc. as per direction SBI / PMC. (length of finished kerb edging shall be measured for payment). (Precast C.C. kerb stone shall be approved by SBI / PMC).
84.	**Coloured Thermoplastic road marking paints**
	Providing and applying blue and white/As Instructed coloured thermoplastic road marking paints for marking a 3ft x 3 ft universal accessibility symbol within the parking bay as per the drawings and up to the satisfaction of the PMC/SBI.
85.	**M. S. Gates Sliding/ Openable**
	Providing fabricating and fixing in position M. S. Gates Sliding/ Openable as per design & drawings with ms angles including framing, M.S box sections , hold fast to be embedded in adjacent RCC Columns, hinges, Sliding Channel, guiding plate, MS Wheel, ball bearings, Rollers, Stopper, locking arrangement,with all welding cutting, fitting, finishing, etc. with one coat of Red Oxide Primer two coats of synthetic enamel paint of approved shade and colours , all the joints, surfaces shall be well finished etc. Complete to satisfaction of the PMC/SBI.
86.	**G.I. chain link fabric fencing**
	Providing and fixing G.I. chain link fabric fencing of 1.8m height is fixed in frame by welding / Riveting from top , bottom , side & in cross length of frame & supported with vertical support welded to vertical sides of frame & those vertical supports are embedded in to M15 grade concrete of 450 mm in length & 650mm in depth or as per design drawings & instruction from PMC/ PMC. GI Chain link fencing of width in mesh size 50x50 mm including strengthening with 4 mm dia wire or nuts, bolts and washers,, with all fabrication, welding / bolting / Riveting, rubbing , cutting, fitting, finishing, with one coat of red oxide primer & two or more coats of synthetic enamel paint of approved make & shade, , all the joints, surfaces shall be well finished etc. Complete to satisfaction of the PMC/SBI.
87.	**false ceiling**
	Providing and fixing false ceiling at all height including providing and fixing of frame work made of special sections, power pressed from M.S. sheets and

	galvanized with zinc coating of 120 gms/sqm (both side inclusive) as per IS : 277 and consisting of angle cleats of size 25 mm wide x 1.6 mm thick with flanges of 27 mm and 37mm, at 1200 mm centre to centre, one flange fixed to the ceiling with dash fastener 12.5 mm dia x 50mm long with 6mm dia bolts, other flange of cleat fixed to the angle hangers of 25x10x0.50 mm of required length with nuts & bolts of required size and other end of angle hanger fixed with intermediate G.I. channels 45x15x0.9 mm running at the spacing of 1200 mm centre to centre, to which the ceiling section 0.5 mm thick bottom wedge of 80 mm with tapered flanges of 26 mm each having lips of 10.5 mm, at 450 mm centre to centre, shall be fixed in a direction perpendicular to G.I. intermediate channel with connecting clips made out of 2.64 mm dia x 230 mm long G.I. wire at every junction, including fixing perimeter channels 0.5 mm thick 27 mm high having flanges of 20 mm and 30 mm long, the perimeter of ceiling fixed to wall/partition with the help of rawl plugs at 450 mm centre, with 25mm long dry wall screws @ 230 mm interval, including fixing of gypsum board to ceiling section and perimeter channel with the help of dry wall screws of size 3.5 x 25 mm at 230 mm c/c, including jointing and finishing to a flush finish of tapered and square edges of the board with recommended jointing compound , jointing tapes , finishing with jointing compound in 3 layers covering up to 150 mm on both sides of joint and two coats of primer suitable for board, all as per manufacturer's specification and also including the cost of trap door as per drawings, making openings for light fittings, grills, diffusers, cutouts made with frame of perimeter channels suitably fixed, all complete as per design, drawings, specification and direction of the SBI / PMC but excluding the cost of painting with :
	12.5 mm thick tapered edge gypsum plain board conforming to IS: 2095- (Part I) :2011 (Board with BIS certification marks) (all flats & common area to cover fire line etc.)
88.	**chromium plated brass curtain rod**
	Providing and fixing **chromium plated brass curtain rod of 25mm dia** having wall thickness of 1.25mm with two chromium plated brass brackets fixed with C.P. brass screws and PVC sleeves etc., wherever necessary complete.
89.	**Aluminium Composite Panel Cladding**
	Designing, fabricating, testing, installing and fixing in position Curtain Wall with Aluminium Composite Panel Cladding, with open grooves for linear as well as curvilinear portions of the building, for all heights and all levels etc. Including: (a) Structural analysis & design and preparation of shop drawings for pressure equalisation or rain screen principle as required, proper drainage of water to make it watertight including checking of all the structural and functional design. (b) Providing, fabricating and supplying and fixing panels of aluminium composite panel cladding in pan shape in metallic colour of approved shades made out of 4mm thick aluminium composite panel material consisting of 3mm thick FR grade mineral core sandwiched between two Aluminium sheets (each 0.5mm thick). The aluminium composite panel cladding sheet shall be coil coated, with Kynar 500 based PVDF / Lumiflon based fluoropolymer resin coating of approved colour and shade on face # 1 and polymer (Service) coating on face # 2 as specified using stainless steel

	screws, nuts, bolts, washers, cleats, weather silicone sealant, backer rods etc. (c) The fastening brackets of Aluminium alloy 6005 T5 / MS with Hot Dip Galvanised with serrations and serrated washers to arrest the wind load movement, fasteners, SS 316 Pins and anchor bolts of approved make in SS 316, Nylon separators to prevent bi-metallic contacts all complete required to perform as per specification and drawing & instructions from SBI / PMC. The item includes cost of all material & labour component, the cost of all mock ups at site, cost of all samples of the individual components for testing in an approved laboratory, field tests on the assembled working curtain wall with aluminium composite panel cladding, cleaning and protection of the curtain wall with aluminium composite panel cladding till the handing over of the building for occupation. The Contractor shall provide curtain wall with aluminium composite panel cladding of any shade, having all the performance characteristics all complete, as per the Architectural drawings, as per item description, as specified, as per the approved shop drawings and as directed by SBI / PMC. However, for the purpose of payment, only the actual area on the external face of the curtain wall with Aluminium Composite Panel Cladding (including width of groove) shall be measured in sqm. up to two decimal places.
90.	**S S Bird Spikes**
	Providing & fixing of Stainless-Steel Bird Spikes of moulded virgin grade polycarbonate base with UV stabilizer width minimum 20 CM diameter hole 4mm diameter of center projection 3.4 mm center spread 200mm of BIRD EDGE or equivalent make for bird control at given locations including all fittings, fixture, Hardwares, scafolding of approved quality, make as per design, drawing & Manufacturer's specification & as per instructions from PMC/ SBI-as per site conditions.
	LANDSCAPING WORKS
91.	**Plum Concrete**
	Providing & Laying Plum concrete consisting of 80% P.C.C. mix (M15) and 20% Rubble stone of maximum size of 150 mm laid in layers with ramming consolidating, watering including dewatering cost & conveyance of all materials, labour charges, machine mixing, finishing the surface etc. Complete
92.	**Supplying, stacking, spreading of good quality red Earth**
	Supplying & stacking of good quality red earth at site including royalty mixed with bio-organic manure from approved source for spreading at the require depth for making dome shape and levelling, filling of pits, filling of flower beds at the surrounding wall (20% of stack volume will be reduced for payment)
93.	**Supplying & Planting of Shrubs** Supplying of Shrubs of various colour with ornamental plants for covering of edges and boundary of lawn area and at the bottom of tall trees area in the R.G. like Nerium Dwarf, Tagar Green Variegated Acalypha with all colour, Green Lily, Hibiscus, Himalaya Pattern, Syngonium, Maranta Variegata, Rhoeo Compacta, Durantta Golden, Lump sum 1500 Plants, approx. height 1 to 1 $^{1}/_{2}$ feet with bag laying and survival value up to 6 month period with free of cost Maintenance.
94.	**Carpet natural grass with lush green colour**

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95.	Supplying and laying of carpet natural grass with lush green colour having size of 1 x 2 ft. slab in Podium area as well as ground level including watering and maintenance of the lawn for 30 days or more till the grass forms a thick lawn, free from weeds and fit for mowing including, poyta / Red soil filling, manure, preparing bed, supplying good earth, if needed.

In case the make or brand of any item, fitting, fixture, finish, equipment or material is not specifically mentioned in the tender documents, the Contractor shall propose makes of only premium, reputed, and ISI/ASTM/BS/EN certified brands, subject to prior approval of the SBI/ Engineer-in-Charge/PMC. Under no circumstances shall substandard, unbranded, or locally fabricated items be used. The cost for such premium items shall be deemed included in the quoted contract price and no extra claim shall be entertained on this account. In case of discrepancies in specifications of any items within this document, the premium specification shall prevail.

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CHAPTER - M

LIST OF APPROVED MANUFACTURERS / SPECIALISED AGENCIES:

1. The Contractor shall obtain prior approval from the SBI/PMC before placing order for any specific material or engaging any of the specialized agencies. The Contractor shall make a detailed submittal with catalogues and highlighted proposed specifications / as well as full details of the works proposed to be executed by the specialized agency / as specified.

2. Unless otherwise specified / only the brand / make of the material as specified in the item nomenclature / in the particular specifications and in the list of approved materials attached in the tender / shall be used in the work.

3. Under exceptional circumstances / Engineer-in-charge at his discretion that shall be final and binding / may permit any other equivalent brand or any brand that is already adopted by SBI for its works or by CPWD in last three years subject to proof being offered by the contractor for the equivalence.

A. CIVIL:

S. NO	DESCRIPTION OF WORK	MANUFACTURERS
	Structural & Architectural	
1	Cement	ACC / Ultra Tech / Ambuja Cement
2	White Cement	J.K. / Birla
3	Ready Mix Concrete	RMC: Inhouse (EPC)/ Birla, Ultratech/ACC. Ordinary Portland cement (Ultratech/ ACC/ Birla), admixtures (SIKA, Pidilite, FOSROC)
4	Waterproofing Compound	Pidilite / BASF / Fosroc / Sika
5	Reinforcement Steel	SAIL / Tata Steel / Jindal/JSW
6	Mechanical Splicing System with Coupler	Splicetek India Pvt. Ltd. Dextra India Pvt. Ltd. Ishita Enterprises
7	Structural Steel	Tata Steel / Jindal / JSW
8	Concrete Blocks	Conwood / Hindustan / Lokgroup / Sai Block / Ved Pmc Ltd.
9	AAC Blocks	Aerocon / Siporex / Ultra Tech / Ecolite / Godrej
10	Sand	Local River Sand

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S. NO	DESCRIPTION OF WORK	MANUFACTURERS
11	Anti-Termite Treatment	PCI / Godrej /Hi-Care
12	Factory Made Concrete Blocks	Astra Concrete / Raj Cover Blocks
13	Ready Mixed Cement Plaster	Walplast / Ultra Tech / Madras Cement Ltd / Sound Build Care Ltd. / Ferrouscrete / Precise Conchem Pvt Ltd.
14	External Texture Paint	Berger / Dulux / Asian
15	Waterproofing Cement Paint	Berger / Dulux / Asian
16	Paints Elastomeric Paint	Berger / Dulux / Asian Ultima Protek / Equivalent from Berger/Dulux
17	Gypsum Light Weight Plaster	Gyproc / Ultratech / Saint Gobain
18	White Cement Based Putty For Concrete / Plastered Surfaces	Birla White / Plasto Shine / Walplast Products Pvt. Ltd./Asian/Birla
19	Polymer Modified Cementitious Grout / Cement Adhesive / Epoxy Grout	Pidilite / BASF / CICO / Fosroc / Roff / Laticrete / Ardex Endura / Kerakoll / Ferrouscrete / Bal Endura
20	Polymer Modified Adhesive Mortar for AAC Blocks	Walplast / Ultra Tech / Pidilite / Ecolite
21	Integral Water Proofing Compound	Pidilite / Roff / Fosroc / Sika
22	Membrane Water Proofing	Pidilite / Roff / Fosroc / Sika
23	Calcium Silicate Boards / Tiles	Hilux / Promat / Visaka / Starpan / Aerolite
24	Friction Hinges & Locks	Cotswold / Geze / Alualpha / Securistyle / Sotralu / Master
25	Spacer tape / Backer Rod	Norton / Bow / Tremco
26	All Types of Silicon	Dow Corning / GE / Wacker India
27	EPDM	Amee Rubber Industries / Okaska / Bohra Rubber
28	Nuts / Bolts / Screws	Kundan / Puja / Atul
29	Welding Rods	Ador / Cosmos / ESAB / Super Bond (S)
30	Stainless Steel Anchor Fasteners	Hilti / Fischer / Klimas / Index

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S. NO	DESCRIPTION OF WORK	MANUFACTURERS
31	Aluminium Extrusion Sections	Jindal / Hindalco / Nalco / Indian Aluminium Co / Vedanta
32	Intumescent Strips	Promat / Pemko / Intumex / Astroflame
33	Float Glass Clear	Saint Gobain / Asahi / Modiguard / Guardian
34	DGU / SGU / Fire Rated Glass	
35	Toughened Glass	
36	Fire Resistant Wooden Door Frame & Shutters	Ardor / Signature / Sukriti / Promat / Kutty / Signum / Kenwood / Shreeji / Tufwood / Navair / Sukri
37	Fire Resistant Metal Door Frame & Shutters	Ardor / Signature Sukriti / Promat / Kutty / Signum / Kenwood / Shreeji / Tufwood / Navair / Shaktimate Horman / Iclean /Sukri/Anand/Century
38	Fire Rated Glass	Saint Gobain / Asahi / Guardian / Modi
39	Hardware For Fire Rated Doors	Dorma / Geze / Assa Abloy
40	SS Door Hardware	Dorma / Geze / Hafele / Hettich
41	Floor Springs / Door Closures / Panic Bar / Patch Fittings	Dorma / Geze / Hafele
42	Locks	Godrej / Yale / Hettich
43	Wooden Flush Doors	Century / Greenply /Archidply
44	Marine Plywood	Century / Greenply /Archidply
45	Commercial Plywood	
46	Blockboard	
47	Laminates	Greenlam / Century/ Merino
48	UPVC Window	Fenesta/ Veka/ Saint Gobain
49	WPC Door	Alstone/ Century / Greenply
50	Screws	Nettlefold / Brass Oxide/Kundan
51	High Pressure Compact Laminate Doors	Merino / Greenlam / Citadel
52	Stainless Steel	Jindal / Tata Steel / JSW
53	Polycarbonate Sheets	Palaram / Danpalon / Lexon / Alcox
54	Paver Blocks / Grass Pavers / Kerbstone	Paveit/Basant Betons
55	Granite	NA
S. NO	**DESCRIPTION OF WORK**	**MANUFACTURERS**

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56	Vitrified Tiles - Glazed / Soluble Salt / Double Charge / Full Body	Somany / Kajaria /Nitco
57	Ceramic Tiles	Somany / Kajaria /Nitco
58	Non-Shrink Cementitious Grout	Sika / Fosroc / BASF/Berger
59	Hydrophilic Swellable Water Bar Profile Sealants	Sika / BASF / Adeka India
60	Adhesive For Granite / Marble / Stone	Araldite / Hunstman
61	Adhesive For Wood / Laminate / Veneer	Fevicol-Pidilite / Euro-Jyoti Resins/sJivanjor
62	Galvanised Steel Sheets (precoated)	Tata / Jindal / SAIL/ JSW
63	High Pressure Laminates	Greenlam / Merino / Renoarc / Fundermax
64	Veneers	Greenlam / Century / Merino
65	Screws	Nettlefold / Brass Oxide/Kundan
66	High Pressure Compact Laminate Cubicles	Merino / Greenlam / Stylam
67	Architectural Fabric	Ferrari / Nehlek / Hiraoka
68	Polyester Pu Coating on Venner / Wood	MRF Corp / ICA / Asian Paints
69	Plaster Of Paris	Mk / Saint Gobain/JK
70	PVC Bird Nets	Balaji Safety Nets / Nets'n'screens
71	GFRC Fins / Chajja / Cornices / Designer Panels	Birla White Cement / Asian GRC / Ultratech RDC Concrete/ Facilini Labs
72	Expanded Polyurethane Board	Saint Gobain / Macoy / 3M
73	Anti-Vibration Pads / Isolators	Sylomere
74	Visco Elastic Synthetic Sound Proofing Membrane	Tecsound / Tranquil
75	Glass Wool	U.P. Twiga / Rock Wool / Mikron
76	Extruder System	Jindal / Gujrat Alum / Sapa / Global
77	Coated Glass	Saint Gobain / Asahi Glass / Guardian
78	Float Glass Mirror	Modiguard / Saint Gobain / Asahi
79	Rock wool	Rockwool India/ Twiga Fiberglass/ Polybond Insulations
80	Softscape maintenance materials	7Petals / Greenland
81	Metal False ceiling	Dexune / Armstrong / Bollard Durlum
82	Open cell Metal ceiling	Armstrong / Durlum / Hunter-Douglas / Bollard
83	Baffle ceiling	Armstrong / Durlum / Hunter-Douglas / Bollard
84	Clay Tile Louvers / Terracota slats and louvers	Clayton / Wienberger India. NBK Terracotta

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85	GRC Jali	Unistone / Pioneer
86	Aluminium Ventilated Facade	Hunter Douglas / Eurobond / Viva. Alstone
87	Intumescent paint	Jotun / Hempel /AkzoNobel /
88	Vermiculite fire protection	White Night / UGAM Chemicals
89	Profiled deck sheet (readymade / custom fabricated)	JSW / Arcelor Mittal / Tata

B. ELECTRICAL AND MECHANICAL (E&M) WORKS

SR. NO.	EQUIPMENT / MATERIALS	RECOMMENDED MANUFACTURERS
A	**Electrical Works**	
1	LT Panels	Legrand / LK / Schneider Electric / ABB / Siemens
		LT Panels shall be manufactured as per IEC 61439-1,2. Panel shall be inclusive of IOT/BMS based system.
2	Sandwich Construction Bus Duct and Rising Mains	Schneider Electric / Legrand / LK / Siemens/C&S
3	Distribution Board	Legrand (Ekinox)/ Siemens (Betaguard) / LK (Exora) / ABB (ITUS) / Schneider (Acti9)
4	Motor Starter	LK / Schneider / Siemens / ABB / Legrand
5	Air Circuit Breaker	LK (U-Power) / Schneider Electric (Master Pact NW) / Siemens (3WT / 3WA) / Legrand (DMX SP) / ABB (Emax)
6	Moulded Case Circuit Breaker (MCCB)	Schneider Electric (NSX) / LK (D-Sine) / Siemens (3VM / 3VA) / Legrand (DPX3 / DRX) / ABB (Tmax)
7	LT Switchgears: Miniature Circuit Breakers (MCB) Residual Current Circuit Breaker (RCCB) Residual Current Circuit Breaker with Overcurrent (RCBO) Motor Protection Circuit Breakers (MPCB) Isolators	Legrand (DX3)/ Siemens (Betaguard) / ABB (SB200M)/ Schneider Electric (Acti9) / LK (Exora) Note : All MCB shall be integrated inbuilt common Trip bar
8	Power / Auxiliary Contactor	Legrand / Schneider Electric / Siemens / LK / ABB
9	Energy Monitoring System	Legrand / Socomec / Schneider / LK / ABB / Siemens

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10	Change Over Switch/ACCL	Socomec / LK / Legrand / ABB
11	ATS – Auto Transfer Switch	Vitzrotek / ASCO / Socomec / Schneider Electric / Legrand / LK / ABB / Siemens
12	Current Transformers / Potential Transformers	Automatic Electric / Kappa / LK / Precise / Elmex/ Kalpa
13	Relays	LK / Siemens / Enercon / Legrand / Schneider Electric/EPCOS / ABB
14	Indicating Lamps (LED type)	LK / Salzer / Schneider Electric / ABB / Siemens / GE / Technik / Vaishno / as per OEM Standards
15	Push Buttons and Bush Button Set	LK / Salzer / Schneider Electric / ABB / Siemens / GE / C&S / Teknic / Vaishno as per OEM Standards
16	Selector Switch	LK / Salzer / Kaycee / Schneider Electric / ABB / Siemens / MECO / as per OEM Standards
17	Terminal Blocks	Connect Well / Elmex / WAGO
18	Connectors (Colours as per Phases and Neutral)	WAGO / Phoenix Contact / Connect Well
19	Meters / Energy Meters & Load Managers (Digital)	LK / Siemens / Schneider Electric / Legrand / ABB / Secure / Rishab/HPL
20	Meters (Analog)	LK / Siemens / Schneider Electric / Legrand / ABB / Secure / Rishab/HPL
21	Electric Timers	LK / Legrand / Siemens / Schneider Electric / ABB / MECO / BCH
22	Rotary Switches	Siemens / Kaycee / Salzer / LK / Legrand / Schneider Electric / As per OEM Standards
23	Low Voltage Cables	KEI / Finolex / Havells / Polycab
24	Cable Glands (Double / Single Compression type)	Comet / Cosmos / 3D / HMI / Hex / Jainsons / Dowells / Braco / Polycab
25	Cable Lugs / Cable Terminations	Comet / Cosmos / 3D / HMI / Hex / Jainsons / Dowells / Braco / Polycab
26	Cu. Conductor Wires (FRLSH)	KEI / Finolex / Havells / Polycab
27	PVC Conduits and related accessories	Precision / AKG / Polycab / Anchor / Asian/sudhakar

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28	MS / GI Conduit (ISI approved)	AKG / BEC / Vimco / Supreme / Precision / Steelcraft / Anchor
29	HDMI Cables / USB Cables / Audio Cables	Legrand / AMP / Molex/ D-Link
30	TV Co-Axial Cables	KEI / Finolex / Havells / Polycab
31	Modular Switches & Sockets / Modular Base Frames with Plate and GI Switch Boxes	Legrand (Lyncus) / MK (Blenze Plus & Orna) / Crabtree (Murano) / Schneider (Miluz) / Norisys / Panasonic (Europa) / LK (Englaze) Model shall be as approved by Architect & Client. GI Switch boxes shall be of Switch sockets brand
32	Occupancy Sensor / Motion Sensor	Legrand / Schneider / Wipro / Phillips / Siemens
33	Industrial type Sockets (Metal Clad / Splash Proof / Waterproof / Weatherproof)	Legrand / Schneider Electric / LK / ABB / Siemens / Hager / Hensel / SCAME
34	Ceiling Fan – BLDC with regulator and remote	Atomberg (Efficio) / Usha (Aero Edge Plus) / Bajaj (Energos)/ Crompton /Havells
35	Exhaust Fans	Atomberg / Crompton / Bajaj / Havells / Usha
36	Lighting Fixtures	
	A) External	Signify-Philips / Panasonic / Wipro / K-Lite
	B) Poles for External Light	Bajaj / K LITE / Crompton
37	Junction Boxes	Hensel / Sintex / Clipsal / Spelsberg / SCAME
38	Aviation Light	Bajaj / Insta Power / Spectrum
39	Cable Trays (Ladder Type / Perforated-Hot dip)	OBO Bettermann / Legrand / Neidax/ Profab/ MK
40	Floor Raceways / Floor Trunking	MK / Legrand / OBO Bettermann / Schneider
41	Floor Junction Boxes	MK / Legrand / OBO Bettermann / Schneider
42	uPVC Trunking	MK / Legrand / OBO Bettermann / Precision
43	Fire Sealant & Fire-Retardant Paint	3M / HILTI / OBO / PROMAT
44	Lightning Protection System / Surge Arrester	Axis / LPI / OBO / Dehn / Indelec / ABB Furse / Purcel / Eltech / Tercel / JEF / CIKIT IEC 62561 shall be mandatorily complied

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45	Earthing System	OBO Bettermann / JEF / JMV / Axis / Dehn / Eltech / Indelec / ABB Furse / Ashlok IEC 62561 shall be mandatorily complied
46	UPS	Eaton / APC-Schneider / Legrand (Numeric) / Vertiv (Emerson) / Delta / ABB
47	SMF Batteries for UPS	Exide / Amara Raja / Rocket / Amaron / Tata Green / HBL Life
48	Inverter/Solar Inverter	Microtek / Luminous /Amaron/ Legrand (Numeric)/Delta/Power one
49	RCC Hume Pipes	Dhere / KK / Indian Hume Pipe / Pranali
50	DWC Pipes / HDPE Pipes	Rex / Natni / Polymer / Gemini
51	Anchor Fasteners	HILTI / Fischer
52	Solar Power	Vikram / Adani/Waaree / Tata Power Solar / Reliance- Qinso
53	Battery Chargers	HBL Life / Exide / Universal Instruments / Automatic Electric ltd. / Mass.Tech controls (p) ltd. / Chabbi Electricals Pvt ltd
54	Insulating Mats	Premier Polyfilm Ltd. / RMG Polyvinyl India / Commercial Enterprises / Dl miller & co. Ltd.
55	Transformers	Crompton Greaves / Voltamp / Schneider Electric / Kirloskar/ ABB
56	33 KV VCB HT Panels (OEM or their Authorized partner only)	Schneider Electric / ABB /Siemens/ Crompton Greaves
57	H.T. Termination & Joining Kit	Raychem / M-Seal / Birla – 3M
58	HT Cables	Finolex / KEI / Havells / Polycab
C	**ELV Works**	
1	Fire Alarm System and all accessories	Edwards / Honeywell-Notifier / Bosch / Siemens-Fire finder
2	Cables for Fire Alarm System	Finolex / Havells / Polycab / Tyco
3	Cables for Public Address System	Finolex / KEI / Havells / Polycab
4	24 X 7 LED Displays	Samsung / Sony / LG / Dell / Lenovo / HP / Delta
5	Servers / Workstations / Display	Dell / HP / Lenovo
6	Switches and Accessories (PoE / Non PoE / Network / Core)	Cisco / HP-Aruba / Juniper / D-Link

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7	Cat 6 Cables / Wire / Fiber Optic Cables and Patch Cords / Patch Panels and related accessories	R&M / Legrand / Systimax / Molex / AMP / Siemens / Panduit/ D-Link
8	LIU and related accessories	R&M / Legrand / Molex / AMP / Siemens / Panduit / Cisco
9	Hard Disk	Seagate / Toshiba / WD-Purple
10	Racks	Valrack / Rittal / APC / Cisco / Wipro / Vertiv
11	Network Video Recorder / Digital Video Recorder / Software and related accessories	Prama / Samsung / Honeywell / Bosch
12	Telephone Tag Box	ADC-Krone / Legrand / Cisco
13	Telephone Junction Boxes and Modules	ITL / Krone / MALSON
14	RJ-45 Information Outlets	Legrand (Lyncus) R&M / Systimax / Molex / AMP / Siemens / Panduit Model shall be as approved by Architect & Client. Contractor to provide minimum 03 Nos. samples of different makes for approval of Client & Architect
15	Door Access Control System	Siemens / Honeywell / Bosch / HID / Matrix / ESSL
16	Cables for Door Access Control System	Finolex / KEI / Havells / Polycab
17	Gas leak detection System	Ambetronics / Oldham / Honeywell / Uniphos
D	**ELEVATORS**	
1	Elevators	Kone Elevators India Pvt. Ltd. Otis Elevator Company (I) Ltd, Schindler India Pvt. Ltd, Thysunkrupp
F	**FIREFIGHTING**	
1	Fire / Sprinkler / Hydrant Main / Jockey Pumps	Kirloskar / Mather & Platt-WILO / Crompton / Siemens
2	Terrace Pumps	Kirloskar / Mather & Platt-WILO / Crompton / KSB / Grundfoss
3	Diesel Engine	Cummins / KOEL / Greaves / Perkins / Cooper / Kirloskar
4	Battery	Exide / Amara Raja / Rocket / Amaron / Tata Green / HBL Life
5	Battery Chargers	Servilink / HBL / Numeric / Robin Teper

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6	Motors	KEC / Siemens / ABB / Crompton / Kirloskar
7	Starters	L K / Schneider / Siemens / ABB / Legrand
8	Anti-Vibration Mounting / Expansion Joints	Dunlop / Resistoflex / Easy Flex / Flexionics / Vimpa / IMRA
9	Motors	KEC / Siemens / ABB / Crompton / Kirloskar / Crompton / Grundfoss
10	Starters	Legrand/ Schneider Electric / ABB / Siemens/LK
11	GI Pipes/M.S pipes	TATA / Jindal / SAIL
12	Pipe Fittings	Jainsons / Unik / VR
13	Non-Return Valves	Leader / Zoloto / Sant / Kirloskar / Advance / Audco / Hawa / Lehry
14	Gate Valves	Leader / Zoloto / Sant / Kirloskar / Advance / Audco / Hawa / Lehry
15	Sluice Valves	Leader / Zoloto / Sant / Kirloskar / Advance / Audco / Hawa / Lehry
16	Butterfly Valves	Leader / Zoloto / Sant / Kirloskar / Advance / Audco / Hawa / Lehry
17	Ball Valves	Leader / Zoloto / Sant / Kirloskar / Advance / Audco / Hawa / Lehry
18	Air Release Valves	Leader / Zoloto / Sant / Kirloskar / Lehry / Shah Bhogilal / Claval
19	Solenoid Valves	Danfoss / Honeywell / Lehry / Rotex / Avcon
20	Y-Strainer	Leader / Zoloto / Sant / Kirloskar / Advance /Audco / Hawa
21	Pressure Switches	Indfos / Danfoss / Honeywell / Stefa / Switzer / NICO / Viking
22	Pressure Gauges	HD Fire / H Guru / Fiebig / Waree
23	Air Vessel	Nema / Golden Deer / Zenith
24	Anti-Corrosive Materials / Wrapping & Coating	IWL / Rustech / Pypkote
25	Pipe Clamp & Supports	Chilly / Euroclamp / Easyflex / Gripple
26	Hydrant Valves	Padmini / New Age / Omex / Minimax / Superex
27	Fire Hydrants	Padmini / New Age / Omex / Minimax / Superex
28	RRL Hose Reel	Padmini / New Age / Omex / Minimax / Superex
29	Fire Hose Reel	Padmini / New Age / Omex / Minimax / Superex

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30	Fire Hose / First -Aid Hose Reel / Branch Pipe / Siamese Connections / Hose Coupling / Nozzle / Fire Brigade Connection / etc.	Padmini / New Age / Omex / Minimax / Superex
31	Stand Post Hydrant	New Age / AAG / Padmini
32	Sprinklers / QBD	HD Fire / Tyco / Viking / Grinnell / Spray Safe / Newage
33	Flexible Drop Connection	Flexhead / Newage / Tyco / Newage
34	Flow Switch	Danfoss / Switzer / Honeywell / System Sensor / HD Fire / Tyco / Johnson control / Siemens
35	Test Drain Assembly	New Age / Tyco / HD Fire / Viking / Spray Safe / Grinnell
36	Alarm Control Valve / Installation Control Valve	New Age / Tyco / HD Fire / Viking / Spray Safe / Grinnell
37	Fire Extinguisher	Kanex / Minimax / Safex / New Age / Cease Fire / Safeguard
38	Toggle Switch	Jay / Equi
39	Fireman Axe	New Age / Safeguard
40	Paints / Primer	Asian Paints / Berger / Nerolac
41	Welding Electrodes	Advani / Maruti / ESAB
42	Fire suppression System / Clean Agent	Ansul / Siemens / 3M / minimax / Honeywell
43	Hose Cabinet / Hose Box	New Age / Minimax / Safex
44	Water Curtain pumps	Kirloskar / Mather & Platt-WILO / Crompton / KSB /Xylem
45	Deluge Valve	HD Fire / Safex
46	Water Curtain Nozzles	HD Fire / Safex
G	**Plumbing Works**	
SR NO	**DESCRIPTION FOR WORK**	**MANUFACTURERS & APPLICATOR**
1	Sanitary Wares	Jaquar / Kohler / Grohe / TOTO
2	C. P. Fittings	Jaquar / Kohler / Grohe / CERA / Roca / Euromics/Plumber
3	S. S. Sink	Nirali / Deepali / Futura / Prestige / Hefle/Jaquar
4	C. I. Pipes & Fittings	Neco / Kapilansh / SKF/ Hepco
5	G.I. Pipes	Tata / Jindal / Prakash Surya /
6	G. I. Fittings	Unik / R-Brand / Zoloto

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7	NP2 Class / R.C.C. Pipes	Jain Spun Pipe / K. K. Spun Pipe / The Indian Hume Pipe Co. Ltd. / Patel Hume Pipes
8	S. S. Gratings	Chilly / Camry
9	Glass / Mirror	Modi Guard / Saint Gobin/Gold Plus/Asahi India
10	Stainless steel Sink	Nirali / Franke / Prestige / Hefle/ Deepali / Futura
11	Floor Drain Fixture / Rainwater	Supreme / Prince Piping Systems / Ajay / Aco / Neer
12	G.I / M.S Pipes	TATA / Zenith / Jindal-Hissar / SAIL
13	G.I Malleable fittings	Unik / Jain Sons / Kirti
14	C.P. Grating for Floor Trap	Chilly / GMGR / Neer
15	GM or copper alloy Gate / Peet / Globe / Check valve	Sant / Leader / Zoloto
16	Ball Valve	Sant / Zoloto / Itap / Hawa / Lehry
17	GM / Forged Brass Ball Valves	Itap / Zoloto / RB / Hawa / Lehry
18	Air Valve / Kinetic Air Valve	Zoloto / ITAP / RB / Watts
19	Water meter	Capston / Keycee / Paramount / Deshmesh / Rockwin To be BMC approved./kranti
20	Sluice valve / Foot valve (ball type)	Kirloskar / IVC / Danfoss / Normex / Sant / Zoloto
21	C.I Water quality pipes	Electrosteel / Kapilansh / Keshospun / Kartar
22	C.I Soil quality pipes	Neco / Saint Gobain / Kapilansh / kartar
23	C.I Frame & Cover	Neco / Saint Gobain / RIF
24	S.W Pipe & Gully Trap	Kashmira / Rajura / Girco / Perfect / C.I.or
		approved eq. / Tacel
25	RCC Hume pipe	IHP / Pranali / Premier / Shreeji / Pragati / Usha / JSP or app. Eq
26	SFRC frame & cover / gratings	Bharat / Shreeji / SS / KK or approved eq.
27	HDPE Pipe	Supreme / Mahavir / Reliance / Duraline
28	PVC flushing Cistern	Parryware / Hindware/cera/RAK
29	Pressure Gauge	Fiebig / H. Guru Guru / Emerald / Waaree
30	Foot Valve (Ball type)	Normex / Zoloto / Itap
31	SBR / EPDM Gaskets	Prabhat / Orient / Paul / Durable or approved eq.
32	C.I fittings / Specials	Electrosteel / Kapilansh / NECO
33	Flush Valves	Jaquar / Grohe / Kohler/cera
34	Check Valve WaferType	Advance/Danfoss/Kirloskar/SKS/Leader/RB/Sant/TBS/Zoloto/Intervale/Itap/C&R/Audco/sant/Lehry/VARIE/Honeywell/Watts
35	Check Valve Dual Plate	
36	Check Valve Forged Screwed	

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37	Check Valves (slim type)	
38	Butterfly Valve	
39	Ball Valve (15 to 40 mm)	
40	Pressure Reducing Valve	
41	Cockroach trap	Chilly / ACO / Neer
42	CI double flanged non-return valve	Kirloskar / IVC / Leader /
43	Cast Iron Pipes & Fittings Manhole covers and frames	
a.	As per IS:3989 (Pipes & Fittings)	Kapilash
b.	As per IS:1729 (Manhole covers and frames)	Raj Iron Foundry Agra
c.	As per IS:1536 (CIClass LA Pipes)	IISCO / NECO / Electrosteel
44	D.I. Manhole Covers & Frames	Neco / Kapilansh
45	CILA fittings	Kartar valves & fittings / Electrosteel / Neco
46	Drip Seal	ACQUA Bond / Vinod Cement Co.
47	GI pipe sealant	Henkel - LOCTITE 55
48	Pipe clamp & supports	Chilly / Euroclamp / Easyflex / Gripple
49	CPVC pipes	Finolex/ Astral/ Supreme/ Prince /Ashirvad
50	UPVC pipes	Finolex/ Astral/ Supreme/ Prince/ Ashirvad
51	SWR pipes	Finolex/ Astral/ Supreme/ Prince /Ashirvad
52	D. I. Pipes	Electro Steel / Jindal / Lanco Kalahasthi
53	Copper Pipes & Fitting	Flowflex Rajco / Viega Max flow
54	Solenoid Valve	Danfoss / Honeywell / Lehry / Rotex / Avcon
55	FRP frames / covers and gratings	Everlast / Thermodrain / Fibro cast
56	Enamel Panting of pipes etc. (low VOC)	Asian (ADCOLITE ONLY) / Goodlas Nerolac / ICI
57	Ball Float Valve	Esseti / HBD / Zoloto
58	NRV Ball type Sewage application	Danfoss / Silverspark
59	Y Strainer CI	Emerald / Sant / SKS / Zoloto
60	Water Pumps	Grundfos / DP / Wilo / KSB / Kirloskar / Ebara
61	Anti-Vibration Mounting & Flexible Connections	Flexionics / Kanwal Industrial Corporation / Resistoflex /
62	Pressure Switch	Indfoss / Danfoss
63	HDPE corrugated underground	D-Rex / reliance
64	Electronic Flow Meter	Krohne (Forbes Marshall) / Rockwin

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65	Level Controller & Indicator (Water)	Auto Pump / Cirrus Engineering / Elegent Controls / Technika / Techtrol
66	MH / Water Tank Plastic Steps	KGM / Patel / Pranali Industries
67	Fastner	Fisher / Hilti / Diamond / Hitech
68	Fire Sealant	Birla 3 M / Hilti / Promat / STI (USA)
69	Manhole (Prefabricated)	OK Play / Supreme
70	Temperature Sensor / Gauge	Forbes Marshall / Danfoss / Wika
71	Pressure Vessel	ELBI / Wellmate / Aventura
72	Grey Water Treatment Plant (GWTP)	Ideal System / Blue Drop / Aqua Environment Co.
73	Plumbing Pumps and Pump Sets	Kirloskar / Mather & Platt-WILO / Crompton / KSB / Grundfos / Ebara
74	Kitchen Equipment	Ambika Sales / Apollo / International Equipment Company (IEC)

In case the make or brand of any item, fitting, fixture, finish, equipment or material is not specifically mentioned in the tender documents, the Contractor shall propose makes of only premium, reputed, and ISI/ASTM/BS/EN certified brands, subject to prior approval of the SBI/ Engineer-in-Charge/PMC. Under no circumstances shall substandard, unbranded, or locally fabricated items be used. The cost for such premium items shall be deemed included in the quoted contract price and no extra claim shall be entertained on this account. In case of discrepancies in specifications of any items within this document, the premium specification shall prevail.

Signature of the bidder with seal