

**Design, Build and Commissioning of 7 MLD
Common Effluent Treatment Plant (CETP) and
0.5 MLD Package Sewage Treatment Plant (STP)
at DPIA on EPC basis with 4 years Operation and
Maintenance -Package B**

VOLUME 2

PART 3 PARTICULAR ELECTRICAL SPECIFICATION

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1.1 Particular Specification

1.1.1 General

- The scope of electrical works shall include design, manufacture, supply, delivery to site, inspection and testing at the manufacturer's works, erection/installation, testing and commissioning of all the electrical equipment/systems required for the STP/CETP on turnkey basis so as to make the system complete in all respects.
- This is a performance specification and covers the project particular requirements for the electrical works, plant and equipment.
- The Contractor shall be responsible for providing the full detailed design, construction and installation drawings.
- Any drawings issued with this Specification are for tender purposes only and shall be read in conjunction with this specification. Any discrepancy between the drawings, the specification and any matter which requires clarification shall be referred to the Engineer prior to the submission of tender.
- Acceptance of such drawings by the Engineer shall not relieve the Contractor of his responsibility to provide an installation suitable in dimension, construction, function and finish for the purpose intended.
- Contractor will follow the electrical norms/standards for smooth execution of complete plant.
- It is responsibility of the electrical contractor to take approval/electrical clearance from electrical Inspector/State Electricity Board/MSEB/MSEDCL or other authorities.
- Electrical supply for construction purpose shall be in contractor scope.

1.2 Design Philosophy

1.2.1 The brief description of design philosophy is given below-

- Two numbers of incoming power supply up to electrical substation for CETP and STP plant of current phase of package B shall be fed from the nearest 11kV RMUs (RMUs are in scope of EPC package A contractor). Further space provision shall be provided in plant layout for electrical substations for CETP/STP plant for future expansion.
- The location of RMU shall be near the electrical substation.
- Successful bidder shall follow up with MSEDCL for sanction of scheme for obtaining the power supply from the suggested location by MSEDCL.
- There will be a separate metering room and Tariff metering panel will be kept in the metering room.
- Mainly two levels of distribution voltages are used at STP/CETP site i.e. 11KV and 415V.
- Two 11KV incoming supplies will terminate up to 11KV switchboard located in STP/CETP substation, for STP and CETP.
- The power distribution will be at 415V level for supplying power to electrical equipment.

- The 11KV switchboard shall consist of two numbers incoming feeder along with two outgoing feeders and bus coupler.
- The two numbers transformer, one working and one standby each will size for full working load for STP & CETP. Separate electrical system shall be designed for future phase.
- DG shall be sized only for current phase load of STP & CETP which needs to be run during 24hrs as per process requirement. For future phase, separate DG sets shall be designed.
- PMCC/PCC shall be designed to cater current phase load of STP and CETP. Each incomer shall consist of energy meter along with all necessary metering and protection.
- Each drive has selector switch so that at a time drive can operate either from panel, LPB or from PLC.
- MCC shall consist of current phase load of STP & CETP and space provision shall be given in the MCC for future load. Each mcc incomer shall consist of energy meter and all necessary metering and protection and biological equipment drives (anoxic tank mixer, internal recirculation pumps, aeration blower, permeate pumps, RAS pumps) shall have separate energy meter for each one.
- PMCC/PCC will include all the MCC feeders/power feeders as per preliminary single line diagram.
- The design provided in preliminary single line diagram is tentative and minimum requirement and for bidding purpose only. It shall be the bidder responsibility to create detailed SLD for optimize, cost effective and efficient design as per the requirements.
- MCC will include all the motor feeders and lighting DB feeders.
- Rooftop Off Grid Solar system to be considered for catering HVAC & Lighting loads.
- All switchgear, auxiliary equipment and relays will be interfaced to the SCADA system.

1.3 Environmental

Site Conditions:	
Maximum ambient temperature	50 degree C
Minimum ambient temperature	3.5 degree C
Average relative humidity	100.6% max, 40% min
Altitude	Less than 1000 meters
Environment	Tropical

1.4 Installation Requirements

Voltage variation	+/-10%
Frequency variation	+/-5%
Combined voltage and frequency variation	+/-10%(absolute sum)
Phases	Three phase and neutral with the neutral solidly connected to earth.
Control voltage	24V DC
Instrument voltage	230V AC
Systems Fault Level	25kA for 11kV System 50kA for 415V System

	10kA for 230V System
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The Contractor shall make his own arrangements for electrical power for use during the construction period. The PMCC/MCC rooms shall have proper ventilation.

1.5 Scope of Work

The general scope of electrical work includes, but is not necessary limited to:

- Building all associated civil works necessary for housing all electrical equipment to ensure fitness for the purpose of the works.
- Contractor is fully responsible for interfacing, connection & termination of the 11kV HT Cabling system from the nearest RMUs (RMUs are in scope EPC Package A) to STP & CETP metering unit/Substation building., and eventually all hardware required including the desired civil works for the said 11kV cabling system is in the scope of Contractor.
- Contractor to make proper provision /Coordination with upstream breaker.
- Termination, cabling between electricity authority supply MV switchgear, transformers and MCCs.
- Building services including lighting, small power, fire alarm, firefighting systems, low current systems, AC and ventilation as required in the specification of this Contract.
- To supply and install PMCCs/MCCs comprising of starters and feeders.
- Provision of main PMCCs, MCCs, standalone VFDs, sub MCC's, sub main distribution boards, final distribution boards, power factor correction equipment, harmonic filters, isolators and other ancillary components as necessary, complete with associated cabling;
- It shall be the responsibility of the Contractor to ensure that the electrical equipment offered are completely satisfactory to use with the mechanical equipment offered and vice versa. The MCCs for the various mechanical plants shall also be fully coordinated with the respective specialist equipment supplier/installer.
- Design, supply and install interior and exterior lighting systems, including emergency and escape lighting, for all Plant areas detailed in this Specification. Also to include a street lighting system around the roads.
- Design, supply and install Small Power and Lighting Distribution Boards in all the plant room.
- Design, supply and install building services in all the plant buildings;
- Design, supply and install power, control and instrumentation cables and associated supports and containment.
- Supply and install cable and local motor isolators and control stations as per system requirements.
- Design, supply and install fire alarm, fighting and suppression systems as per latest Civil Defense Requirements.
- Design, supply and install cabling on cable trays and in trenches, cable trays, trunking, supports and conduit systems, trenching and backfilling, necessary to adequately support the cabling supplied and installed under this Specification.

- Design, supply and install earthing, equipotential site bonding and lightning protection systems for all items of Plant as per latest MSEDCL standards/IS/IEC.
- All electrical materials shall be new and to the best quality as well as to the latest technology and shall be designed to withstand the stresses imposed by working and ambient conditions without distortion or deterioration affecting the efficiency and reliability of the plant.
- All of the electrical works shall be designed to the modern best practices including all health and safety features.
- Master drawing list and calculation and calculation shall be developed as per client/consultant agreement.
- All areas within the battery limit shall be classified for the degree and extent of hazard from flammable materials as applicable.
- All the electrical equipment installed in the hazards areas shall be meet the requirements of IS or IEC.

1.6 Substation

The main electrical substation for STP/CETP is to be sited at the ground level of the plant. This location provides easy access for the installation of equipment such as switchgear and transformers.

1.7 MV Switchgear

11KV distribution is used for power intake to the facility -

The 11KV switchgear is typically specified as detailed below -

Bus bar current - 630 Amps.

Short time withstand current (main and earth) -25kA for 1 sec.

Normal current rating CB - 630A

1.8 Power Transformer

Two transformers one working and one standby each of 100% of required capacity with minimum 10% overload capacity. The transformer will cater to The complete load of current phase of STP, CETP. All transformers shall be provided with necessary protective equipment as recommended by Indian Electricity rules, Indian and International standards and statutory norms. The transformers are typically specified as detailed below-

Rating – 2000 kVA, ONAN (rating may vary with the change/variation of Electro-mechanical load)

HV rated voltage - 11 KV

LV rated voltage - 433 V

Frequency - 50 Hz

Vector group - Dyn 11

1.9 Power Factor Correction

The power factor improvement of the power supply system is an essential requirement of the local supply authority. Equipment shall be provided such that when any numbers of motors are running the power factor at the incoming terminals of the power distribution/motor control centre is automatically maintained at 0.98 lagging at full load.

1.10 Motor Control Centre (MCC) / Main Distribution Boards (MDB)

1.10.1 Starters and Feeders

The contractor shall install MCCs which sections shall include as a minimum but not be limited to the equipment's as required by the process and mechanical requirements and as per the approved Process and Instrumentation Diagrams (P&IDs).

PMCC/MCC outgoing feeders shall be as per the limitations dictated in the General Electrical specification.

All Power panels should be compliant with IEC 61439, 1& 2 and Arc fault compliances as per IEC 61641 for 70kA/300ms.

1.10.2 Assembly

The MCC shall be constructed in sections consisting of tiers to provide flexibility for transportation and handling.

The MCC panel sections shall be suitable for floor mounting with bottom or side entry cabling. Access to the panel for operations and routine maintenance shall be from the front. The need for rear access shall be limited to installation and major overhauls.

Motor starters shall be suitable for either fixed speed drives or variable speed in accordance with the requirements of process requirements. The type of starter for the fixed speed motor shall be determined by the motor rating in accordance with the General Electrical Specification. The MCC bus bar shall be extendable at both ends.

Rubber mat shall be provided in front of the MCC as per safety rules/guidelines.

1.10.3 Bus-bars

MCCs shall have bus-bars rated as per the Drawings, nominal with a short circuit rating of 50kA for one second. They shall be type tested to this standard and type test certificates shall be provided for each bus bar rating.

They shall be rated to suit the load and include starter, controls and distribution equipment necessary to make the operational requirements detailed for the MCC.

1.10.4 SCADA

Provision is to be made for providing signals and controls to a SCADA control system (as required by the ICA Specifications).

1.11 Earthing and Lightning Protection

The Contractor shall design, supply, install and test, a plant earthing system, in the form of a main earth ring and branch instrumentation to equipment including bonding of structures and lightning protection system and earth electrodes.

The earthing and bonding system shall include all Plant installed under this Contract.

The earthing and bonding installation shall comply with Indian standard - Code of Practice for Earthing, and with the General Electrical Specification, of this document.

The earthing system shall meet the requirements of IS, whose requirements will take precedence over the specific details given in this Specification.

1.12 Lighting

1.12.1 General

In general, all lighting system used will be LED based or energy efficient lighting system including flood lights and street lights except for hazardous area classification.

Emergency lighting with twin lamps shall be installed to illuminate entrances, exits, access ways, plant rooms, and areas where regular operational presence or inspections are required.

1.12.2 Lighting Levels

Area	Lux
Office and Labs	300
Switchgear Room	250
Control Room	300
Pump House	200
DG Area	50
Other Indoor Areas	150
Outdoor Walkways	50
Building Entrance	100
Outdoor Area	50
Transformer Area	100
Roads	15-20

1.13 Induction Motor

Motors shall be capable of satisfactory operation for the application and continuous duty as required by the driven equipment. Motors shall be capable of giving rated output without reduction in the expected life span when operated continuous. Motor shall be designed as per IS 12615 and will be IE2/IE3 type.

Motor shall be suitable for the method of starting specified. All electric motors are to be operated through suitable starters complete with single phase protection device. For motors up to 3.7 KW starters should be D.O.L and for all other motors above 3.7 KW to up to 75 KW starters should be star/ delta air break type with protective devices suitable for 400/415 Volts, 50 c/s, AC supply. For motors above 75 KW suitable soft start type starters should be quoted. The starters should be complete with suitable cable end box and glands for cable entry. VFD shall be used as per process requirement.

All submersible motors up to 250 kW ratings shall be suitable for operation on 415 V supply. Contractor to consider motor design maximum ambient temperature as 50°C.

1.14 Variable Frequency Drive (VFD) Starters

Each VFD motor starter section shall comply with IEEE519.