

# TECHNICAL PROCUREMENT SPECIFICATION

*for*

## 415 VOLT, 3200 A, 35 MVA PMCC FOR DCDA ACID PLANT

### FACT-UC

TPS NO. : SPEC-FACT-UC-DCDA-PMCC-R2

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## 1. INTRODUCTION

- 1.1. This specification gives minimum user requirements for a new 415V, 50 Hz, 3200A, 35 MVA, TPN, Indoor, floor mounting type Power Motor Control Centre (PMCC) to be provided in the DCDA Acid plant and associated incomers bus ducting from the existing two numbers of 1250 KVA , 3.3 KV/ 415 V transformers in FACT-UC.
- 1.2. Fertilisers And Chemicals Travancore (FACT) is a Government of India Enterprise engaged in manufacture of fertilizer, chemical & petrochemical products, engineering consultancy and engineering fabrication. FACT-Udyogamandal Complex (FACT-UC) is a division of FACT located at Udyogamandal, Kochi, Kerala that manufactures intermediates and products like Sulphuric acid, Oleum, Ammonia, Ammonium phosphate, Ammonium sulphate & Caprolactum etc.
- 1.3. Vendor's scope shall include design, selection, material, manufacture, assembly, painting, testing, supply, erection and commissioning of the PMCC & design, selection, material, manufacture, assembly, painting, testing, supply, erection & commissioning of the associated incomer Bus ducts from the existing two numbers of 1250 KVA, 3.3KV/415 V transformers, as further described in sections that follow.
- 1.4. The electrics supplied shall be complete with all accessories for the safe, smooth and efficient operation of the system and shall comply with all required statutory requirements and standards with respect to 600 volt switchgear assembly.
- 1.5. Every component shall be brand new and shall be of proven design for safety, reliability and durability. Makes of components shall be as specified herein.
- 1.6. The workmanship shall be of the highest grade and the entire construction shall be in accordance with the best modern engineering practices.
- 1.7. The vendor shall provide guarantee as specified in Section 33 herein.
- 1.8. This is a two part bid. The offer shall be submitted strictly as specified in Annexure III. An unpriced copy of the price bid shall be attached with the technical bid for technical evaluation.
- 1.9. Only offers that comply with the Pre-qualification requirements as specified in the bid documents and specification shall be considered for further evaluation. If the vendor however finds some deviation unavoidable, such deviations shall be clearly mentioned in the compliance and deviation statement in the specified format with proper justification. The purchaser reserves the right to reject or accept the offer with such deviations.

## 2. PERIOD OF COMPLETION

- 2.1. The vendor shall complete the supply within a period of 24 weeks from date of final drawing approval. The drawings for approval shall be submitted within 15 days from the date of Purchase Order. Revised final drawings for final approval, after incorporating the all comments/ changes from

Purchaser, if any, shall be submitted within 10 days from the receipt of the same from the purchaser.

- 2.2. Vendor shall complete the erection and commissioning within a period of 6 weeks from date of work to proceed notice.
- 2.3. Time is of the essence of this contract. The vendor shall complete the supply within the time specified above.
- 2.4. Vendor shall submit all drawings and documents as per Section 32- Vendor Data Requirements within the time limits specified therein.

### 3. SCOPE OF SUPPLY, ERECTION & COMMISSIONING

Vendor's scope shall include:

- 3.1. Design, selection, material, manufacture, assembly, painting, testing, supply, erection & commissioning of the PMCC.
- 3.2. Design, selection, material, manufacture, assembly, painting, testing, supply, erection & commissioning of the Bus duct.
- 3.3. The erection & commissioning of the PMCC and Busduct at site are in the scope of the vendor. The Items shall be supplied at FACT Udyogamandal stores. Unloading of items at stores is under FACT's scope. Transportation of items from stores to installation site is under supplier's scope. The heavy equipment support for the transportation and lifting of the panels/busduct from stores of the purchaser to the site, will be given free of cost. Leading of the panels/busduct to the substation and transformer room, at site, are in the scope of the vendor.
- 3.4. A 3 phase, 415 volts, 50 Hz power supply will be provided by the purchaser free of charge to the vendor at one point for installation at site. Termination of switchgear however, shall be provided by the vendor. Further extension if required shall be done by the vendor. The vendor shall not use the power supply for any other purpose than that for which it is intended. The power supply will be disconnected in case of default and the vendor shall then have to arrange the required power supply at his cost.
- 3.5. Water supply shall be made available to the vendor by the purchaser free of charge at one point.
- 3.6. The persons deputed for the work by the vendor shall adhere to all the safety rules of the purchaser.
- 3.7. The persons deputed for the work by the vendor shall be covered under all the statutory laws/acts/rules of Central/State/Local Bodies.
- 3.8. In respect of all labour employed directly or indirectly on the work for the performance of the vendor's part of work, the vendor at his own expense, will arrange for the safety provisions as per the statutory requirements. The vendor shall provide necessary barriers, warning signals and other safety measures while executing the work, wherever necessary so as to avoid accident. Vendor shall also

indemnify purchaser against claims for compensation arising out of negligence in this respect. Vendor shall be liable, in accordance with the Indian Law and Regulations for any accident occurring due to any cause. The purchaser shall not be responsible for any accident occurred or damage incurred or claims arising there from during the execution of work. The vendor shall also provide all insurance including third party insurance as may be necessary to cover the risk. No extra payment would be made to the vendor due to the above provisions thereof. The persons deputed for the work by the vendor should be covered under ESI scheme or should be covered under group insurance scheme (Workmen Compensation Policy) as applicable. Police clearance certificate for the persons deputed for work shall also be submitted.

- 3.9. The purchaser will provide finished concrete floor surface inside the substation. The necessary civil work for the installation of the base frame/foundation channel for the PMCC (Including grouting, if required) are in the scope of the vendor. The cable tray / cable support above the PMCC inside the substation will be provided by the purchaser. The trenching at the site for the laying of cables (Power/Control/Earth) are in the scope of the purchaser.
- 3.10. The civil work for wall openings for the busduct and necessary support for the busduct are in the scope of the vendor. The termination of busduct at the transformer end and PMCC end are in the scope of the vendor. The laying of earth cable/strip from the PMCC & Busduct to the existing earth pits are not in the scope of the vendor.
- 3.11. Making good all damages caused to the floor/wall during installation and restoring the same to their original finish.
- 3.12. The interpanel wiring of PMCC at site is in the scope of the vendor.
- 3.13. The commissioning of PMCC & busduct is deemed to be completed by powering up of PMCC through busduct, from the existing two numbers of transformers.
- 3.14. The termination of power and control cables at PMCC for the outgoing feedes is not in the scope of the vendor.
- 3.15. The vendor shall coordinate with all other agencies involved in the work so that work of the agencies is not hampered due to delay in his work.
- 3.16. All the tools and tackles other than those mentioned in the TPS are in the scope of the vendor.
- 3.17. Vendor shall submit the documents/drawings, as per the requirements of the purchaser, required to get the Clearance/ Approval of the installation from the Central Electricity Authority (CEA). The application will be made by the purchaser and any statutory fee, as applicable shall be paid by the purchaser directly to the govt. authorities concerned.
- 3.18. Bidder's scope shall include clearing of all debris and scrap items from the site after the installation work. Scrap items shall be deposited only at the place earmarked for the same.

- 3.19. Furnishing all drawings and documents as per section 32, 'Vendor Data Requirements'.
- 3.20. Inspection and tests as per section 30.
- 3.21. Special tools and tackles required if any.
- 3.22. All necessary accessories including foundation frame, foundation bolts, Gland Plates, nuts and washers etc.
- 3.23. Mandatory spares as per Annexure VI.

#### 4. STANDARDS

Requirements laid down in the latest revisions of the following Standards and regulations shall be strictly adhered to:

- 4.1. IEC 61439 -1: Low-voltage switchgear and controlgear assemblies - Part 1: General rules
- 4.2. IEC 61439 -2: Low-voltage switchgear and controlgear assemblies - Part 2: Power switchgear and controlgear assemblies
- 4.3. IS 8623 – 2: Low-voltage Switchgear and Controlgear Assemblies - Part 2 : Particular Requirements for Busbar Trunking Systems (Busway)
- 4.4. IS/IEC 60529: Degrees of protection provided by enclosures (IP CODE).
- 4.5. IS/IEC 60947-1: Low-voltage switchgear and control gear, Part 1: General rules
- 4.6. IS/IEC 60947-2: Low-Voltage switchgear and control gear, Part 2: Circuit Breakers
- 4.7. IS/IEC 60947-3: Low voltage switchgear and control gear, Part 3: Switches, disconnectors, switch-disconnectors and fuse combination units
- 4.8. IS/IEC 60947-4-1: Low-Voltage switchgear and controlgear, Part 4: Contactors and Motor-Starters, Section 1: Electromechanical Contactors and Motors-Starters
- 4.9. IS/IEC 60947-4-2: Low-Voltage switchgear and controlgear : Part 4 - Contactors and Motor-Starters, Section 2: AC Semiconductor Motor Controllers and Starters
- 4.10. IS/IEC 60947-4-3: Low - Voltage switchgear and controlgear, Part 4 – Contactors and Motor-Starters, Section 3: AC semiconductor controllers and contactors for non-motor loads
- 4.11. IS/IEC 60947-5-1: Low-Voltage switchgear and controlgear, Part 5: Control Circuit Devices and Switching Elements, Section 1: Electromechanical Control Circuit Devices
- 4.12. IS/IEC 60947-5-2: Low-Voltage switchgear and controlgear, Part 5: Control Circuit Devices and Switching Elements, Section 2: Proximity Switches
- 4.13. IS 13703-1: LV Fuses for voltages not exceeding 1000 V ac or 1500 V dc, Part 1: General requirements.

- 4.14. IS 13703-2-1: Low-voltage fuses for voltages not exceeding 1000 V AC or 1 500 V DC, Part 2: Fuses for use by authorized persons, Section 1: Supplementary requirements.
- 4.15. IS 13703-2-2: Low-voltage fuses for voltages not exceeding 1000 V AC or 1 500 V DC, Part 2: Fuses for use by authorized persons, Section 2: Examples of standardized fuses.
- 4.16. IS:2705: Current Transformers - Part-1-General requirements.
- 4.17. IEC 61869-1: Instrument transformers – Part 1: General requirements
- 4.18. IEC 61869-2: Instrument transformers – Part 2: Additional requirements for current transformers
- 4.19. IEC 61869-3: Instrument transformers – Part 3: Additional requirements for inductive voltage transformers
- 4.20. IS:4201: Application guide for CTs.
- 4.21. IS:2551: Danger notice plates.
- 4.22. IS:3043: Code of practice for earthing.
- 4.23. Measures relating to Safety and Electrical Supply Regulations 2010 and latest amendments by Central Electricity Authority (CEA).

## 5. GENERAL REQUIREMENTS

- 5.1. The equipment shall operate satisfactorily at the rated load under the service conditions and power supply conditions specified in the data sheets.
- 5.2. The PMCC shall be Indoor, floor mounted, double/single front, free standing type fabricated preferably from CRCA sheet steel material. Thickness of sheet material, partitions, doors and gland plates shall be as per manufacturer's standards. All fasteners for assembly and fixing of components shall be of corrosion resistant / passivated MS. All doors shall be with concealed hinges and knob type locks. All components, cable connections, busbars, etc. shall be easily accessible for maintenance work.
- 5.3. The PMCC shall be fully compartmentalized dust, damp & vermin proof. Doors and openings shall be provided with neoprene gaskets. Degree of protection shall be IP 4X or better.
- 5.4. If a sectionalized construction is adopted for the PMCC for ease of transportation, the vertical units shall form a continuous line up of uniform height and front line up when assembled together. Adequate lifting eyes shall be provided on each section.
- 5.5. All barriers used shall be manufactured from non-inflammable material.
- 5.6. Busbars (horizontal) shall be housed in separate metallic compartment and shall be accessible for inspection.



- 5.7. Individual feeder modules shall be housed in independent and separate enclosed compartments, separated from each other by metallic barriers. Each vertical row of modules shall have independent vertical busbars, vertical busbar chambers, and cable alleys.
- 5.8. The design shall allow extension of the PMCC at both the ends by adding vertical panels. The ends of horizontal busbars shall be suitably drilled and the extreme end covers of the horizontal busbar chamber shall be provided with screwed removable gasketed plate for the purpose of extension.
- 5.9. All exposed live terminals in the cable alley and the incomer terminals inside modules shall be covered /shrouded to prevent accidental contact.
- 5.10. There shall be ample space for connection of incoming bus duct and outgoing power cables. Sufficient clearances shall be maintained between phases, neutral and also with the frame.
- 5.11. The terminals of the Air Circuit Breaker (ACB) shall have coating as per the manufacture standards.. Silver coating on isolating contacts is not acceptable.
- 5.12. Momentary paralleling of incomer/ bus section with other bus section/ incomer shall be possible with appropriate selector switch and check synchronizing relay.
- 5.13. Necessary foundation bolts, nuts and washers shall be supplied.
- 5.14. Painting shall be as mentioned in the data sheet and all unpainted parts shall be plated to prevent corrosion.
- 5.15. The Substation and Transformer room plan is attached Annexure- VIII (Drg No. 19E-1-84-R4).
6. **BUSBARS**
- 6.1. Bus bars shall be of electrolytic grade high conductivity aluminum / copper and of continuous rating of 3200 A. All phase and neutral bus bars shall be insulated preferably with heat shrinkable PVC sleeves with appropriate shrouds at all joints. Control bus bar shall be of copper. Earth bus bar shall be of copper or aluminum. All busbars shall be accessible for inspection and easily replaceable. If bus bar is of copper, the busbar shall be tin plated.
- 6.2. Busbar size shall be determined by taking into consideration the specified continuous current rating (3200A) & min fault level (35 MVA) for 1 sec. The temperature rise limits as per IEC 61439 shall be considered for the busbar sizing. The cross section of neutral busbar may be half the size of phase busbar.
- 6.3. Separate set of vertical busbars shall be provided for front and rear sections. The vertical busbars shall be sized to carry continuously at least the sum of rated currents of the connected feeders. Short time rating of vertical busbars shall be same as main busbars.
- 6.4. The clearance between live parts and earth shall be as per IEC.

- 6.5. It shall be possible to extend the busbars at either end of the PMCC for addition of future units. Both ends of busbars must be suitably drilled for this purpose.
- 6.6. The busbars shall be supported by insulators of non-carbonizing material and having non-hygroscopic characteristics and braced to withstand fault level of 35 MVA.
- 6.7. Busbars and connections shall be secured in such a manner that the insulators are not subjected to bending forces under short circuit conditions. Dynamic stresses shall be calculated on the basis of standrads.
- 6.8. Rigid insulating barriers / protection guards / wire meshes shall be provided between the group of live bus bars and other parts, so as to eliminate danger to personnel due to accidental contact.
- 6.9. Thermal design of the busbars shall be based on installation of the PMCC in poorly ventilated conditions. The cooling air volume shall take into account only the bus enclosure.
- 6.10. Appropriate identification shall be provided on the bus bars and tapings for distinguishing the various phase, neutral and earth buses.

## 7. FEEDER ARRANGEMENT

- 7.1. Indicating lamps, meters, relays, push buttons & selector switches shall be mounted flush with the front door/ cover.
- 7.2. The control component except those coming on doors, shall be mounted on a base plate, and fixed on the frame of the module.
- 7.3. The incoming feeders shall be arranged preferably in the middle along the PMCC in such a way that loads are distributed equally on either side.
- 7.4. The feeder details are given in Annexure VII.
- 7.5. Height of mounting of operating handle, selector switches, push buttons etc. shall be preferably, above 300mm and below 1900 mm from the floor level.

## 8. CABLE COMPARTMENTS

- 8.1. Width of cable alleys shall be sufficient to accommodate the cables and shall have free access for cable termination. In any case the width shall not be less than 200mm.
- 8.2. Cable alleys shall be provided with suitable doors. It shall be possible to carry out the maintenance work safely on cable connections to any one circuit, with the bus bars and adjacent circuits live.
- 8.3. Adequate supports and facilities for clamping of the cables shall be provided, as necessary.
- 8.4. Removable gland plates, having a minimum thickness of 3mm, shall be provided.
- 8.5. A horizontal wire-way, extending over the entire length, shall be provided at the top/ bottom for inter panel wiring.

## 9. CABLE TERMINATION

- 9.1. All terminal blocks shall have adequate current carrying capacity.
- 9.2. Terminal blocks shall be 650V grade. It shall be segregated based on the circuit voltage. Identification numbering / lettering shall be provided for each terminal. All terminals shall be mounted on DIN rails, with provision for addition of terminals. Where it is necessary to duplicate terminals, same shall be done with solid links.
- 9.3. Power terminals shall be stud type with phase separation barriers. Control terminals shall be suitable for 2.5 Sq.mm conductor.
- 9.4. Form 4b separation shall be provided by barriers/partitions as per IEC 61439. Sufficient clearances shall be available between terminals when terminal lugs are fitted to them.
- 9.5. Not more than two wires (one incoming & one outgoing) shall be connected per terminal.
- 9.6. Minimum 4 spare terminals shall be provided on each control terminal block.
- 9.7. Shorting links shall be provided for CT terminals.

## 10. INTERNAL WIRING

- 10.1. The PMCC shall be completely pre-wired (interpanel wiring to be done at site by supplier) and ready for external connections at site.
- 10.2. All control wiring shall be carried out through common wire ways. These shall not cross the bus bar chamber.
- 10.3. All control wiring shall be easily accessible for maintenance.
- 10.4. Necessary colour codes shall be adopted for power and control wiring for easy identification.
- 10.5. Power wiring shall be carried out with PVC insulated, stranded copper conductors of 1100 Volts grade having adequate current carrying capacity. Minimum size of conductor for power wiring shall be 4 sq.mm copper.
- 10.6. Control wiring shall be carried out with 650 V grade, PVC insulated, stranded copper conductor of size not less than 1.5 sq.mm. Circuits involving current transformers shall have 1100 V grade conductors.
- 10.7. Wiring shall be terminated in easily accessible terminal blocks. The wires shall be arranged neatly and the two ends of each wire and terminal block shall bear identification number /letter using unbreakable ferrules.
- 10.8. Control wiring wherever terminated shall be in single layer formation.
- 10.9. Wiring shall run in enclosed channel and shall leave space for future use.
- 10.10. Provision for motor space heater shall be provided for Motor Feeders of capacity including and

greater than 45 KW.

- 10.11. Bidder shall provide adequate terminals/ potential free contacts as required, for the following as minimum for each motor feeder and the same shall be duly wired to dedicated terminal blocks in respective module/feeder.
- A). Contactor 'ON' (Motor Running) status to DCS/PLC
  - C). Process/DCS/PLC start command
  - D). Local/Field start command (Manual)
  - E). Local/Field stop Command (Manual)
  - F). Process/DCS/PLC Stop command
  - G). Process/DCS/PLC Trip indication
  - H). Ready to start status in DCS/PLC
  - I). Local/Remote selector from DCS Control Room

- 10.12. All inter panel control wiring shall be done by the manufacturer with the identification of wires and terminals for interconnection.

## 11. INSULATION

- 11.1. All insulating materials shall be non-hygroscopic. Hylam shall not be used.

## 12. LOAD BREAK SWITCHES

- 12.1. The switches shall be of air break type, AC23 utilization category.
- 12.2. The switches shall have a quick-make, quick-break, fault-make, load-break mechanism operated by an external insulated handle, complete with ON-OFF position indicator / dial plates.
- 12.3. Load break switches of motor starter feeders shall have AC23 rating corresponding to full load current of the motor connected for Direct-on-line starting. Also the AC23 rating of the switches used shall not be less than the rating of the HRC fuses in the feeder.
- 12.4. The switch fuse feeders shall be provided with load break switches of AC23 utilization category.
- 12.5. Bolted type removable copper links of adequate size shall be provided for neutral.
- 12.6. The cubicle door shall be interlocked with the switch mechanism so that the door cannot be opened unless the switch is in the OFF position.
- 12.7. Padlocking facility in OFF position shall be provided for feeder switches.

## 13. FUSES

- 13.1. All fuses shall be HRC link type, suitable for industrial application.

- 13.2. All power and control fuses shall have distinct operation indicators.
- 13.3. Fuse holders and fuse bases shall be of non-inflammable and non-hygroscopic material, preferably phenolic mouldings.
- 13.4. Fuse pullers of different sizes required for inserting and removing HRC fuses shall be supplied.

#### 14. STARTERS-CONTACTORS

- 14.1. The Starter- contactors shall be electromechanical, air break type, suitable for uninterrupted duty and of AC3 utilization category. However for motors in inching or reverse rotating service, utilization category AC4 shall be used , conforming to relevant standards.
- 14.2. The contactor coil shall be suitable for the specified control voltage.
- 14.3. The coils have suitable insulation and shall be suitable for use in ambient temperature specified.
- 14.4. The motor feeders shall be provided with re-acceleration logic. The scheme shall be realized using off delay timer (selectable up to 5 seconds).
- 14.5. Contactors shall preferably have switching position operation indicator.
- 14.6. A minimum of 1 N/O and 1 N/C spare auxiliary contacts, in addition to those required for control circuits, shall be available for each contactor (If necessary, auxiliary contactor can be provided) and wired up to the terminal block.
- 14.7. Type of co-ordination between contactor, over load protective device and short circuit protective device shall conform to Type-2 co-ordination as per IEC for IE1 category Motors.

#### 15. MOTOR PROTECTION RELAYS

- 15.1. CT operated Numerical motor protection relay with the following minimum motor protection features shall be provided for each motor feeder of capacity equal to or greater than 45 kW
- Thermal Protection.
  - Stalling Protection.
  - Negative Phase Sequence Protection.
  - Earth Fault Protection.
  - Protection to prevent Single Phasing.
- 15.2. Bi-metallic thermal type CT operated / microprocessor based thermal overload relay with single phasing prevention feature shall be provided for each motor feeder of capacity from 15 kW to 37.0 kW.
- 15.3. Bi-metallic thermal type thermal overload relay with single phasing prevention feature shall be provided for each motor feeder of capacity below 15 kW.

- 15.4. Overload protection shall be available for all the phases.
- 15.5. The thermal overload relay shall have manual & auto reset options. Manual reset knob / push button shall be provided on the cubicle door.
- 15.6. In the case of CT operated relays, cast resin insulated CTs shall be included.
- 15.7. Motor protection relays for motor feeders of blowers, fans, agitators, crushers, compressors and mills shall be of heavy duty, delayed action type to allow for more starting time. If required heavy duty overload relays are not available, necessary by-pass contactor & timer arrangement/ saturable reactors shall be provided.
- 15.8. Contactor and motor protection relay shall be selected so as to withstand the let-through energy of the connected HRC fuse in the feeder, and consequent thermal and dynamic effects.

## 16. FEEDER PROTECTIVE RELAYS

- 16.1. Protective relays shall be flush mounted draw out type or Fixed type as per manufacture standard.
- 16.2. Protective relays shall be suitable for the CT secondary current.
- 16.3. Circuit breaker feeders with protective relays shall be provided with high speed master tripping relay of the lock out type with hand reset feature and coil cut off contact.
- 16.4. CT parameters shall be verified by vendor, based on connected relay make & relay manufacturers recommendation.
- 16.5. Vendor shall furnish complete relay co-ordination details applicable. This is required to check the adequacy of CT ratios, VA ratings, relay types and characteristics, etc. and to determine the optimum settings to be adopted for ensuring selectivity and back-up protection. While selecting the settings, manufacturing tolerances of devices shall be considered. Settings for all adjustable devices shall be tabulated.

## 17. CURRENT TRANSFORMERS

- 17.1. Current Transformers (CTs) shall be of cast resin insulated type.
- 17.2. Ratings of CTs provided shall match the specific requirements of the meters and protective relays involved.
- 17.3. The CTs shall be capable to withstand dynamic and thermal stresses originated by the fault current. Separate CTs / cores shall be used for metering and protection. Dual purpose CTs are not acceptable.
- 17.4. CTs for metering purposes shall have adequate capacity to cater full load conditions.
- 17.5. Metering CTs shall have adequate accuracy limit factor and an accuracy class not more than 1.
- 17.6. CTs for protection purposes shall have sufficient accuracy, burden and accuracy limit factor for

necessary co-ordination / discrimination for clearing faults. Accuracy limit factor for protection CT shall not be less than 10 and accuracy class shall be 5 P. CTs for differential / REF protection shall be of class 'PS'.

- 17.7. The CTs shall be suitably insulated and mounting of CTs shall facilitate easy maintenance.
- 17.8. All CT terminals and terminals to remote meters shall be provided with links to facilitate shorting as and when required.
- 17.9. CTs shall be provided with polarity markings adjacent to terminals, both for primary and secondary. These shall be legible even after years of service.
- 17.10. One number of current transformer with 1 Amp secondary rating with suitable VA rating and of suitable accuracy class shall be provided in Y Phase for each motor feeder for remote analog ammeter at local control station and digital ammeter at DCS control room through current transducer. The current transducer for digital ammeter shall have dual output of 4-20 milli Amps and input current shall be 0-1 Amps. The accuracy class and VA rating of the current transducer shall be suitable for the application. The auxiliary supply for current transducer, if required shall be 110 Volt AC. Burden of the Current Transformer shall be sufficient to compensate for the lead burden and for the burden of current transducer and remote ammeter.

## 18. CONTROL TRANSFORMERS

- 18.1. All motor feeders shall have 415/ 55-0-55 Volt, control transformer of appropriate VA rating on each motor module. Control transformer shall have adequate capacity to feed the control loads of the motor feeder as well as the inrush VA of the contactors & relays of the feeder.
- 18.2. Control transformer shall be cast resin insulated type.
- 18.3. Control transformer shall have  $\pm 5\%$  voltage tapings on the primary side and with centre tap of secondary winding earthed.
- 18.4. All control transformers on motor modules shall have HRC fuse protection on primary side and double pole MCB on secondary side.
- 18.5. Each bus section shall have 415/ 55-0-55 Volt common control transformer of appropriate VA rating in a separate module. Each unit shall have adequate capacity to feed all control loads (including incomer panel, bus coupler panel or spare panels) of particular bus section and any one of the adjacent bus sections as well as the inrush VA of contactors & relays applicable. In the event of failure of the control transformer of one bus section, control transformer feeding any one of its adjacent bus sections shall be capable of feeding the same also, in addition to its own loads, by temporary interconnection.
- 18.6. For all motor feeders test control supply shall also be provided from common control transformer of respective bus section through associated control wiring and accessories. The test control supply to

motor module shall get automatically isolated when the feeder switch is switched ON.

- 18.7. Common control transformer shall be provided additional tapings of  $\pm 2.5\%$  on primary side.
- 18.8. The compartment housing of the common control transformer shall preferably be located towards the bottom of the PMCC, to facilitate maintenance and replacement.
- 18.9. All common control transformers on bus section shall have SDF/MPCB/MCCB of appropriate rating on primary side and double pole MCB on secondary side.
- 18.10. All motor modules shall be provided with control supply selector switch having 'SERVICE', 'TEST' & 'OFF' position. The test control supply shall be available in motor module only when feeder isolator in in OFF position.
- 18.11. The test control supply to motor module from common control transformer shall get automatically isolated when the control supply selector switch is in 'SERVICE' & 'OFF' position.
- 18.12. The control supply to motor feeder from respective module control transformer shall get automatically isolated when the control supply selector switch is in 'TEST' & 'OFF' position.

## 19. EARTHING

- 19.1. A continuous earth bus shall be provided for the entire length of the PMCC. At least two terminals shall be provided on the earth bus for external connection to earth grid.
- 19.2. Earthing shall confirm to IS 3043.
- 19.3. All non-current carrying metallic parts of the equipment shall be earthed.
- 19.4. All hinged doors and covers shall be provided with suitable flexible earthing connections.

## 20. PUSH BUTTONS

- 20.1. 'EMERGENECY STOP SWITCH' shall be stay-put type and shall be provided on front door of all motor feeders.
- 20.2. Colour of push buttons/ switch/ knobs shall be as per relevant IEC/IS.
- 20.3. All push buttons shall have at least 1 N/O + 1 N/C spare contacts.
- 20.4. All push buttons shall be provided with legend plates to identify the function or operation.
- 20.5. Local / Remote change over switch shall be provided, if specified in the data sheet, when starting is envisaged from more than one location.
- 20.6. Trip-Neutral-Close switch shall be provided, if specified in data sheet.
- 20.7. Based on operation philosophy, Auto/manual Switch shall be provided.
- 20.8. All Control switches shall be preferably of rotary type with operating knob. They shall have proper designation plates.



## 21. INDICATING LAMPS

- 21.1. Panel Indication lamps shall be provided on each feeder for indications as per the schematics. Indicating lamps shall be cluster LED type. The voltage rating shall be as per the data sheet
- 21.2. Motor feeders shall be provided minimum, lamps for 'ON', 'OFF', 'TRIP', 'READY TO START' & "MOTOR SPACE HEATER ON". The Motor Space Heater ON indication is not required for motor feeders of capacity less than 45 KW.
- 21.3. All Incomer feeders shall be provided with control switch fuse / MCB for the aux. supply for indication lamps.

## 22. INDICATING INSTRUMENTS

- 22.1. All incomer feeders shall be provided with Voltmeters, Ammeters & Energy meters.
- 22.2. All ammeters and energy meters shall be operated through current transformers only. All ammeters, voltmeters shall be either analog or digital. Voltmeters & ammeters shall be mounted at suitable height for easy reading from front. Cushion stoppers and zero correction screws shall be provided for analog meters. Display of digital ammeters & voltmeters shall be LCD/LED type.
- 22.3. Analog voltmeters shall have selector switches (3 way and OFF) and control fuses. Analog Voltmeters shall be of accuracy class 1 and shall have suppressed scale for the lower values in the range.
- 22.4. Digital voltmeters shall have facility to display voltage in all three phases.
- 22.5. Analog ammeters shall be of suitable range and with ammeter selector switches (3 way and OFF) to read line currents. The scales shall be approximately uniform up to 100% (full load current) and suppressed end scale from 100% to at least for 600%. Analog Ammeters shall be of accuracy Class 1.
- 22.6. Digital ammeters shall have facility to display current in all three phases.
- 22.7. Energy meters shall be digital type suitable to measure unbalanced loads on a 3 phase 4 wire system.
- 22.8. Energy meters shall be capable of integrating with Energy Management System (EMS) through RS 485/Ethernet Port.

## 23. PANEL SPACE HEATERS

- 23.1. Panel space heaters of adequate capacity, rated for 240 V AC, shall be provided in every vertical panel or in cable alley or an easily accessible position.
- 23.2. Two pole MCBs as necessary and earth leakage protection (30 milli Amps Double Pole ELCB) shall be provided for each panel space heater circuit along with suitable thermostat for automatic temperature control.

- 23.3. Wiring of panel space heater shall be isolated or separately bundled from other internal wiring, preferably using a different colour.
- 23.4. 240V AC for panel space heaters should be taken from the LT incomer itself before incomer switch. To receive this, 2 terminals, 1 ON-OFF switch, 1 Fuse, and 1 Neutral link should be provided in the cable alley of Incomer Panels.
- 23.5. There shall be provision to feed the motor space heater (anti-condensation heater) through an MCB / ON-OFF switch with HRC fuse & neutral link and NC contact of main contactor of associated module.
- 23.6. Warning inscription should be provided, as follows: "ISOLATE PANEL SPACE HEATER BEFORE MAINTENANCE".

#### 24. NAME PLATE

- 24.1. A nameplate with the PMCC designation shall be fixed at the top of the central panel. Separate nameplates, giving feeder designation shall be provided on each compartment. Functional name plates shall be provided for each component such as meters, relays, lamps, switches & push buttons, etc. mounted on the panel front.
- 24.2. Permanent non-corrosive name plate with engraved white letters in black back ground, indicating the designation shall be fixed at the top of the central panel.
- 24.3. The component numbers shall be painted/ suitably identified inside the panel at appropriate points to give a permanent marking.
- 24.4. Each panel of PMCC shall be marked with the panel number on both front and rear side.
- 24.5. In addition, Special Warning plates shall be provided on all removable doors and covers giving access to high voltage cables/busbars and inside the PMCC wherever considered necessary. Danger plates shall be provided as per relevant IEC/IS and Central Electricity Authority (CEA) regulation.

#### 25. REQUIRMENTS OF DRAW OUT TYPE ACB (Air Circuit Breaker) FEEDERS

- 25.1. The incomers & Bus coupler modules shall be fully draw out type.
- 25.2. All draw out modules shall have distinct TEST position, SERVICE position & ISOLATED (WITH DRAWN) position.
- 25.3. All power contacts (both on incomer side and busbar side) shall be of fully draw out, self-aligning, plug-in design, which get automatically disconnected when the draw out module is withdrawn from the connected (SERVICE) position.
- 25.4. Wiring for neutral may be in the fixed portion of the compartment. Where neutral connection is required for control purposes within the module, they shall be through draw out contacts providing full

draw out facility.

- 25.5. All control contacts also shall be fully draw out self-aligning type which get automatically connected / disconnected depending on the circuit requirements, when draw out module is withdrawn to TEST / ISOLATED positions.
- 25.6. Necessary separation barriers shall be envisaged between pairs of power contacts to prevent flash-overs.
- 25.7. Draw out arrangement shall be designed in such a way that withdrawing and plugging-in of the trolley are achieved with smooth and reliable operation and without causing any damage or thrust to the plug in type contacts.
- 25.8. Withdrawable trolley/ chassis shall be preferably with screw cranking arrangement and/ or guide vanes, such that trolley movement is positively guided and self-aligning type. The trolley must move on low friction rolling mounts.
- 25.9. Trolley pad locking switch and latch /trolley clamping captive screw shall be provided for the fully inserted position.
- 25.10. There shall be positive indication for the various positions of the trolley.
- 25.11. For same rating and type of feeders, wiring for components within the draw out module shall be identical in layout, ferrule numbering, sequencing of secondary isolating contacts, colouring etc. to achieve maximum inter changeability.
- 25.12. In the case of double front panels, the module trolleys shall be interchangeable from one front to another front in such a manner that phase sequences are kept unaltered. Such interchanging shall not require re-arranging / connecting cables.
- 25.13. All modules shall carry, on the door as well as on the module itself, labels identifying the module, rating and type of control wiring.
- 25.14. Necessary earthing arrangements shall be provided for the truck in the 'TEST' and 'SERVICE' positions. The earth connection shall make before the main power and control contacts make and break after the power and control contacts are disconnected. Earthing connection through manual plug & socket connection will not be acceptable.
- 25.15. Provision of control supply in the test position of draw out modules (feeders which require control supply) shall be available.

## 26. REQUIRMENTS OF CIRCUIT BREAKERS

- 26.1. All CBs shall be suitable for uninterrupted duty.
- 26.2. All circuit breakers used in the PMCC shall be interchangeable, irrespective of Incomer/ Buscoupler.

- 26.3. Circuit breaker shall be of forward draw out construction. The cradle shall be so designed and constructed as to permit the smooth withdrawal and insertion of the breaker into it. The movement shall be free of jerks, easy to operate and shall preferably be on steel balls / rollers and not on flat surfaces. Horizontal draw out type truck is preferred.
- 26.4. Each CB shall be housed in a separate compartment and shall be enclosed on all sides. Adequate provision shall be made for escape of hot gases.
- 26.5. Sheet steel barriers shall be fitted between two vertical sections in the breaker compartment.
- 26.6. The hinged lockable door of the draw out type of CB shall not form an integral part of the draw out portion, so that entry of foreign materials / things into the cubicle is not possible when the CB is drawn out.
- 26.7. The door shall be of such a design that it shall allow the breaker to be kept withdrawn up to the 'TEST' and 'ISOLATED' positions with the CB door closed.
- 26.8. The CB door shall be interlocked with the breaker positions such that:
- A) The door cannot be opened unless the breaker is in ISOLATED position and
  - B) The breaker cannot be racked into the SERVICE position unless the door is closed.
- 26.9. The following four positions of the CB shall be distinctly marked and locking arrangements shall be made:
- a) Service position: The main disconnecting contacts shall be fully gripped on both sides, namely the bus bar and bus duct side and vice versa (both main and secondary isolating contacts in service).
  - b) Test position: The truck shall be perfectly isolated from the live bus bars in order to test for proper performance (main isolating contacts separated and secondary isolating contacts in service / test position).
  - c) Isolated position: It shall be able to withdraw the truck from the cubicle for inspection and maintenance (both main and secondary isolating contacts isolated).
- 26.10. The above positions of the CB shall be positive, achieved only through the turning / racking motion of the draw out mechanism and not by trial and error. There shall be an indicator clearly showing the positions listed above, and the same shall be visible from the front without opening the front door.
- 26.11. It shall not be possible to close the CB unless it is positively in one of the following positions:
- a) Truck in 'SERVICE' position
  - b) Truck in 'TEST' position
  - c) When the truck is in completely 'ISOLATED' position.
- 26.12. The interlocks mentioned above are the minimum requirement. Manufacturers shall include any other

safety interlocks which may be required by the particular design feature of the switchgear offered.

26.13. Necessary earthing arrangements shall be provided for the truck in the 'TEST' and 'SERVICE' positions. The earth connection shall make before the main power and control contacts make and break after the power and control contacts are disconnected. Earthing connection through manual plug & socket connection will not be acceptable.

26.14. Separate and adequate accommodation shall be provided for instruments / meters, indicating lamps, auxiliary contactors, timers, control fuses, CTs, protective and auxiliary relays, auxiliary switches, control transformers if any, etc. These shall be easily accessible for testing and maintenance, without any danger of accidental contact with live parts of the CB. All the above accessories, busbar connections, wire ways, cable space, painting and other general requirements of CB shall conform to relevant clauses mentioned in this specification.

## 27. CIRCUIT BREAKER CONTACTS

27.1. CB contact assemblies shall include easily replaceable arcing contacts. Main current carrying contacts shall be of low resistance, arc resistant and adjustable to compensate wear.

27.2. Contact fingers shall be spring loaded to reduce contact bounce.

27.3. The isolating contacts shall be self-aligning and able to carry rated short circuit current, without any tendency for the contacts to 'blow-off'.

27.4. The arc chutes of air circuit breakers shall be removable for routine inspection of the contacts.

27.5. The arcing contacts of air circuit breaker shall have anti-sticking and burn-resistant properties.

27.6. Wiring and termination of secondary isolating contacts shall be interchangeable in all identical breakers.

## 28. OPERATING MECHANISM

28.1. The CB shall be electrically operated with remote close/ trip facility. The operating mechanism of the CB shall be either with direct motor or solenoid with motor charged spring. Whatever be the mode of operation of the breaker, it shall have hand closing and hand tripping provision to be operated in emergencies and during testing. The design of the hand closing and hand tripping mechanism shall be such as not to require large open slots in the front door. The voltage of the operating mechanism shall be 110 Volt DC.

28.2. It shall be possible to close and trip the circuit breaker without opening the CB compartment door. The operating handle and the mechanical trip push button shall be at the front of the breaker and integral with it. Arrangements with operating handle fitted on the door independently of the breaker, and connected through a set of links to the breaker, are not acceptable.

28.3. Operating mechanism shall be mechanically and electrically trip-free in all positions of CB.

- 28.4. It shall be possible to mechanically trip the CB by a distinctively marked push button.
- 28.5. The breaker shall be provided with suitable anti pumping feature to ensure that it does not reclose automatically after a tripping, even if the closing impulse is maintained.
- 28.6. When the breaker is in the closed position, a closing operation of an initiating control device shall not result in further operation of the breaker closing mechanism or discharging of the closing spring.
- 28.7. Closing of CB shall be prevented, unless the spring is fully charged.

## 29. OTHER REQUIRMENTS OF CIRCUIT BREAKERS

- 29.1. The auxiliary wiring between the switchgear receptacle and the truck unit shall be established by means of a plugging / sliding unit, consisting of adequate number of contacts rated with suitable rating, which get automatically disconnected when the drawn out module is withdrawn from the test position.
- 29.2. A mechanical ON-OFF indicator, appropriately marked, shall be provided at the front of the CB.
- 29.3. The control voltage for closing coils, trip coils other auxiliary devices shall be as per data sheet.
- 29.4. Auxiliary power supply for control, indication shall be as indicated in the data sheet. For control supply necessary control fuse, switch/ MCB of required ratings shall be provided.
- 29.5. Releases: Releases shall be provided. Type of releases provided and their characteristics shall be furnished by the vendor. The releases shall have the following features:
- a) The overload release
  - b) The short circuit release
  - c) Earth fault release

## 30. INSPECTION AND TESTS

- 30.1. Comprehensive Inspection and Testing Plan in the form of Quality Assurance Manual for PMCC and Bus Duct shall be submitted by the bidder including testing, inspection & witnessing required by the Purchaser. The Comprehensive Inspection and Testing Plan shall be approved by the Purchaser.
- 30.2. Bidder's quality assurance manual shall include all details of type tests & routine tests as per IEC 61439.
- 30.3. Bidder shall submit type test certificates of Power Switchgear and Control gear assemblies as per IEC 61439-1/2.
- 30.4. Bidder shall submit type test certificates of Busduct as per latest IS/IEC.
- 30.5. Bidder shall bear the cost of all tests. The purchaser will witness inspection & testing at mutually agreed date. The cost of the purchaser's visit to the factory for inspection and testing will be borne by the Purchaser.
- 30.6. Bidder shall give 15 days advance intimation to Purchaser for inspection and witnessing of routine tests on completely assembled PMCC.

31. DATA SHEET

<b>1</b>	<b>Service conditions</b>	
1.1	Location	Udyogamandal, Cochin
1.2	Humidity Min.	Data related to location shall be adopted
1.3	Humidity Max.	Data related to location shall be adopted.
1.4	Humidity Design	100 % At 20 ° C
1.5	Ambient Temperature °C - Min.	Data related to location shall be adopted.
1.6	Ambient Temperature °C - Max.	Data related to location shall be adopted.
1.7	Ambient Temperature °C - Design	40
1.8	Rainfall - Max. recorded in an hour	Data related to location shall be adopted
1.9	Rainfall - Max. recorded in 24 hours	Data related to location shall be adopted
1.10	Environment	Tropical atmosphere + Corrosive Chemical Plant atmosphere with fumes of Sulphuric Acid and SO <sub>2</sub> .
1.11	Indoor/Outdoor	Indoor
<b>2</b>	<b>Power System Details</b>	
2.1	Voltage (V) & Variation (± %)	415±10%
2.2	Frequency (Hz)	50
2.3	No. of phases	3
2.4	No. of wires	4
2.5	Fault Level (MVA)	35
2.6	Method of neutral earthing	SOLIDLY EARTHED
<b>3</b>	<b>GENERAL DATA</b>	
3.1	Degree of protection	IP 4X
3.2	Execution – ACB Panels	Drawout
3.3	Execution – Motor feeders	Non Drawout
3.4	Bus trunking Entry	Top
3.5	Cable entry- Whether Top or Bottom	Top entry
3.6	Cable lugs	Not Required with switchboard
3.7	Compression type cable glands for	
	a) Power Cables	Not Required with switchboard
	b) Control cables	Not Required with switchboard
3.8	Control /Aux. voltages	
	a) Panel space heater	230 V AC
	b) Spring Charging Motor	230 V AC
	c) Closing Coil	110 V DC
	d) Shunt Trip Coil	110 V DC
	e) Motor Space Heater	230 V AC
	f) Indication lamps	110 V DC Cluster LED for Breaker Panels/110 V AC Cluster LED for Other Outgoing Feeders + DC Failure Indication
	g) Motor Control Supply	110 V AC
3.9	Metering CT- Accuracy Class	Accuracy Class 1
3.10	Ammeter- Accuracy Class	1
3.11	Painting	Epoxy Painting, Powder Coating , RAL 7032/ RAL 7035
3.12	Busbar Details	Busbars Ground

	a) Continuous rating	Refer feeder details	Refer feeder details
	b) Short time rating	>/=50kA/ 1s	>/=50kA/ 1s
	c) Material and Insulation	Cu/Al, Sleeved, Joints Shrouded	Cu/Al, Bare Conductor
4	<b>COMPONENT DETAILS</b>		
4.1	SDF Outgoing Feeders		
4.2	SDF category (TPN)		
4.3	SDF rating	Refer feeder details	
4.4	Fuses (HRC)	Reqd.	
4.5	Neutral link- removable	Reqd.	
5	<b>INCOMER / BUS COUPLER PANELS</b>		
		Incomer	Bus coupler
5.1	No of feeders	2	1
5.2	ACB with O/C , S/C, E/F Release	Reqd.	Reqd.
5.3	Current transformers		
	a) For metering- Class 1	Reqd.	
	b) For REF protection - Class PS	Reqd.	
	c) Ground CT for REF with covering -Class PS.	Reqd.	
	d) CT for stand by E/F (Earth leakage) protection with covering - CLASS 5P10.	Reqd.	
5.4	Lamps		
	a) Breaker ON	Reqd.	Reqd.
	b) Breaker OFF	Reqd.	Reqd.
	c) Breaker auto trip	Reqd.	Reqd.
	d) Breaker ready for ON	Reqd.	Reqd.
	e) Trip circuit healthy	Reqd.	Reqd.
	f) DC control supply failure	Reqd.	Reqd.
	g) Spring charged	Reqd.	Reqd.
5.5	Meters		
	a) Ammeter	Reqd.	
	b) Voltmeter	Reqd.	
	c) KWH meter 3 Ph 4 wire- Digital	Reqd.	
	Protective Relays		
	a) REF (Restricted Earth Fault)	Reqd.	
	b) SEF (Standby Earth Fault)	Reqd.	
	c) Master Trip Relay	Reqd.	Reqd.
	d) Inter trip relay	Reqd.	
	e) Circuit Supervision Relay	Reqd.	Reqd.
	f) Check Synchronizing Relay		Reqd.
	g) Bus/Line U/V Relay	Reqd.	Reqd.
	h) Aux Relay for DC fail		Reqd.
	i) Aux Relays as per design requirements	Reqd.	Reqd.
	Control Switches and PBs	Reqd.	Reqd.
5.6	a) Trip-Neutral-Close Switch	Reqd.	Reqd.
	b) Ammeter Select Switch	Reqd.	
	c) Voltmeter Select Switch	Reqd.	
	d) Local/Remote Selector Switch	Reqd.	Reqd.
	e) Auto On/Off Switch	Reqd.	Reqd.



	f) Momentary Paralleling Switch			Reqd.
6.0	Other Items			
	a) Space Heater	Reqd. for every vertical panel/Cable alley		
	b) MCB (Double Pole) for space heater	Reqd. for every vertical panel/Cable alley.		
7.0	<b>MOTOR FEEDERS (DOL)</b>			
		45 Kw to 125 kW	15 kW to 37 kW	Upto 15 kW
7.1	Switch Disconnecter Fuse	Reqd.	Reqd.	Reqd.
7.2	Current Transformers - Class 5P10	Reqd.	Reqd.	
7.3	Current Transformers - Class 1	Reqd.	Reqd.	Reqd.
7.4	Current Transducer	Reqd.	Reqd.	Reqd.
7.5	Control Transformers	Reqd.	Reqd.	Reqd.
7.6	Ammeter - Class 1	Reqd.	Reqd.	Reqd.
7.7	Power Contactor	Reqd.	Reqd.	Reqd.
7.8	Auxiliary Contactors	Reqd.	Reqd.	Reqd.
7.9	Motor Protection Relay	Reqd.	Reqd.	Reqd.
7.10	Trip Relay – Hand Reset	Reqd.		
7.11	Selector Switches as per design requirements	Reqd.	Reqd.	Reqd.
7.12	Push Buttons	Reqd.	Reqd.	Reqd.
7.13	Indication Lamps	Reqd.	Reqd.	Reqd.
7.14	MCB/FUSES/Fuse Link/Fuse Holder/Neutral Link	Reqd.	Reqd.	Reqd.

32. VENDOR DATA REQUIREMENTS

Sl. No.	Description	With offer		After LOI/PO		Final	
		No.of copies	Date	No.of copies	Date	No.of copies	Date
1	Duly filled in Technical Particulars of PMCC, as per format attached along with signed copy of TPS	1S	With tech bid				
2	Dimensioned general arrangement drawing - internal & external, including busbar disposition.	1S	With tech bid	1S	As per Clause 2.1	1S	As per Clause 2.1
3	Foundation plan, showing cutouts/floor openings, foundation pockets etc. along with outline dimensions and static & dynamic loading.			1S	As per Clause 2.1	1S	As per Clause 2.1
4	Sectional View of PMCC and showing fixing details			1S	As per Clause 2.1	1S	As per Clause 2.1
5	Single line diagram of PMCC with metering and protection.			1S	As per Clause 2.1	1S	As per Clause 2.1
6	Schematic Diagram and Wiring Diagrams (including inter panel wiring diagrams) with ferrule nos, terminal nos, arrangement of terminals etc			1S	As Per Clause 2.1	1S	As per Clause 2.1
7	Dimensioned drawings of bus trunking, flange with complete dimensions including bolt hole locations & sizes showing busbar arrangement.			1S	As per Clause 2.1	1S	As per Clause 2.1
8	Schedule of materials / components, with quantity, rating, type, make, etc.	1S	With tech bid	1S	As per Clause 2.1	1S	As per Clause 2.1
9	Calculation sheet proving busbar capacity	1S	With tech bid				
10	Type test certificates as per Section 30	1S	With tech bid			1P/1S	Before dispatch
11	Routine test certificates as per Section 30					1P/1S	Before dispatch
12	Quality assurance Plan	1S	With tech bid				
13	Technical literature, pamphlets and brochures and Data Sheets relating to the various equipment used.	1S	With tech bid				
14	Erection, Operation and Maintenance manuals					2P/1S	Before dispatch
15	Spare parts list	1S	With tech bid	1S	As per Clause 2.1	1S	As per Clause 2.1
16	Duly filled and signed Compliance statement as per format attached	1S	With tech bid				
17	Unpriced copy of price bid	1S	With tech bid				

## Notes:

- S : Soft copy
- P: Print copy
- Vendor shall fill in proposed lead time if different from the required lead time.
- Two numbers of printed copy of each documents, in standard drawing sheet mentioned in Sl. Nos. 2, 3, 4, 5, 6 and 7 shall be submitted in standard drawing sheet shall be submitted before the dispatch of the switch board.
- One number of print copy of document mentioned in Sl. Nos. 8 shall be submitted before the dispatch of switch board.

### 33. GUARANTEE

- 33.1. The vendor shall provide guarantee for the entire PMCC, bus duct and all accessories for a period of 12 months from the date of commissioning or 18 months from date of dispatch, whichever is earlier
- 33.2. Vendor shall be fully responsible for proper design, selection, material, manufacture, assembly, painting, testing, supply, erection and commissioning of complete PMCC, busduct and all accessories.
- 33.3. Equipment and its components shall be guaranteed against faulty design, defective / improper materials poor workmanship or failure from normal use during the guarantee period. The guarantee shall also cover all bought-out items by the vendor, for the same period as mentioned in clause 33.1.
- 33.4. Vendor shall have full defect liability during the guarantee period. It shall be obligatory on the part of vendor to modify and/ or replace any hardware completely at vendor's cost, in case any malfunction is revealed during the guarantee period.

### 34. BUSDUCT

- 34.1. The section describes the minimum requirements for the design, material, manufacture, assembly, painting, inspection, erection and commissioning of non-segregated metal enclosed three phase neutral bus duct.
- 34.2. Bus duct shall be designed, manufactured, assembled and supplied in accordance with this specification as per latest IS/IEC. Busduct shall be either OEM or bought-out item. The Guarantee, as per Section 33 of TPS is applicable for Busduct.
- 34.3. The bus duct shall be rated for 415 V, 3200 Amps. The bidder shall manufacture bus duct as per final approved drawings from the purchaser.
- 34.4. Erection and commissioning of bus duct at site is in the scope of the bidder.
- 34.5. The Bus duct shall be of box frame construction of Sheet Steel enclosure. The Bus duct enclosure shall be fabricated from 2 mm thick Sheet Steel. Eddy current heating, if applicable, shall be taken into account.
- 34.6. The section of the Bus duct shall be rectangle & non-phase segregated. The degree of protection shall be IP-5X. The Bus duct shall have fire barriers inside.
- 34.7. The Bus duct shall be provided with removable top covers fitted with gaskets secured by sufficient number of nuts, bolts to ensure that these covers are dustproof. All joints and covers shall be provided with non-deteriorating type gaskets of neoprene between joints. These covers shall be of suitable length for ease of removal and shall be arranged to give complete accessibility to the bus bars, joints, bends and supports, etc. The entire bus duct shall be dust and vermin proof. Louvers shall not be provided.

- 34.8. The design of Bus duct enclosure shall be such that it will withstand the operating conditions arising out of the following (a) Normal operating conditions,(b) Momentary short circuit currents and Combinations of above.
- 34.9. The bus duct shall be provided with flanged ends to connect the bus duct to transformer at one end and switchgear at other end. These flanges shall match with corresponding flanges in the equipment to which these are connected. Bidder shall provide suitable termination arrangement at 415V switchgear and transformer ends.
- 34.10. Proper alignment and co-ordination between the bus duct and power transformer / switchgear terminations shall be the responsibility of the Bidder. The bus duct shall be supplied complete with all the hardware necessary for making the terminations.
- 34.11. All fasteners shall be hot dip galvanized/Cadmium Plated. The bolts shall be full threaded and high tensile quality. Belleville washers for all current carrying conducting parts of the bus bars and plain washers for enclosure and covers shall be provided for every bolt.
- 34.12. Filter type drain holes shall be provided for draining out condensed moisture. The filter element shall be such that it will allow escape of moisture but prevent ingress of dust. This shall be removable type for cleaning purposes.
- 34.13. Bolted inspection cover shall be provided throughout length of Bus duct. At the wall crossing of the bus duct, there should not be removable type inspection cover.
- 34.14. Proper wall sealing arrangements shall be provided at the wall where bus duct enters the substation building. Bus duct with wall mounting flange will be acceptable for the sealing arrangement.
- 34.15. Top covers of the bus duct shall be so located that they will not fall within the wall crossing section.
- 34.16. Bidder shall design and indicate the supporting arrangement for bus duct. The design of the supporting arrangements shall be as per standards.
- 34.17. The Bus duct shall be designed for temperature rise limits as per latest IS/IEC.
- 34.18. The bus bars shall be of electrolytic grade Aluminum/Copper adequately sized to carry maximum specified continuous current & short circuit current for 1sec, at maximum site temperature specified. The final temperature of bus bars and connectors at joints between connector and bus bar should not exceed the values as per IS when carrying rated currents. Also the final bus bar temperature shall not exceed the values specified in IS, when specified short circuit current for 1sec duration flows through.
- 34.19. All bus bars shall be insulated with heat shrinkable PVC sleeves. All bus bars shall be colour coded such that on removal of any inspection cover the phases shall be identifiable.
- 34.20. Suitable Bus bar clamps shall be provided to maintain the bus bars in position. The clamp design

shall be such that it holds the bus bar firmly and also allow sliding movement of bus bars without generating internal stresses to accommodate expansion during operation at rated current. For fixing the bus bars to the bus bar supports, suitable bolts, nuts and washers shall be employed.

- 34.21. Wherever required for long run of bus duct, expansion joints with flexible strips shall be provided to allow for expansion and contraction due to temperature variations arising out of normal continuous current flow and short circuit current flow for specified duration.
- 34.22. Suitable Bimetallic strips shall be provided wherever copper to aluminum connections are envisaged.(For flexible jumpers at expansion joint & end terminations).
- 34.23. All the hardware for connections both at transformer end & the PMCC end shall be in scope of supply.
- 34.24. The bus bars shall be supported by non-deteriorating type (non-hygrosopic, non-carbonising, corrosion resistance) resin cast epoxy insulators of requisite electrical / mechanical strength.
- 34.25. Adequate Creepage distance shall be available on insulator to operate under high humid conditions and effects of condensed moisture due to variations in temperature within bus duct due to different conditions of loading.
- 34.26. The spacing of the insulating supports shall be decided on the basis of the fault withstand capacity.
- 34.27. Bus duct shall be provided with anti-condensation space heaters with controlling thermostats of adequate capacity to maintain internal temperature above dew point to prevent moisture condensation in bus duct. Space heaters shall be rated for 240V, single phase, 50 Hz AC supply. Space heater shall be provided on both sides of the fire barrier.
- 34.28. Earth bus of aluminum/copper shall run on the external side of the bus duct through the whole length of the bus duct and shall be positively connected to the body of the bus duct enclosure. At both ends of the earth bus provision shall be made to connect it to main earthing system. The earth bus shall be rated for short time rating of 50KA (min) for 1 Sec.
- 34.29. The bus duct shall be provided with flexible at both ends for connecting it with transformer at one end and 415V switchgear at other end.
- 34.30. The Flexibles shall be made of thin copper strips. The ends of the flexible shall be clamped by copper plate. The ends of flexible shall be tin plated.
- 34.31. To match the phase sequence of the two equipments connected by bus duct, a suitable phase cross over chamber shall be provided; if required, at suitable location.
- 34.32. All bus duct parts like enclosure, adaptor box, enclosure covers, supports and bus bar shall be identified distinctly by clear numbers. These shall be indicated in drawing.
- 34.33. Painting shall be as mentioned in the data sheet. All unpainted parts shall be plated to prevent

corrosion.

**ANNEXURE I**  
**ACCEPTABLE MAKES FOR COMPONENTS**

1	Air Circuit Breakers	ABB/ L&T/ Schneider/Siemens/GE-Alstom
2	Protective Relays	ABB / L&T/ Schneider/ Siemens/GE-Alstom
3	LT Power Contactors	ABB/ L&T/ Schneider/ Siemens/GE-Alstom
4	Switch Disconnecter Fuse (SDF)	ABB/ L&T/ Schneider/ Siemens/GE-Alstom
5	Aux Contactors	ABB/ L&T/ Schneider/ Siemens/GE-Alstom

**ANNEXURE II**  
**TECHNICAL PARTICULARS (TO BE FILLED BY VENDOR)**

1.0	Maker's name	
2.0	Switch board type designation	
3.0	Rated voltage	
4.0	Rated insulation voltage	
5.0	Maximum permissible operating voltage	
6.0	Nominal current rating of switchboard	
7.0	Maximum temperature rise over ambient	
8.0	Cable Entry	
9.0	<b>Bus bar details</b>	
a)	Horizontal Phase Busbars	
	Location of bus bar W.R.T board	
	Material & grade	
	Size, shape and number of bars per phase	
	Rated current in amps	
	Short circuit withstand current in KA for 1 sec	
	Peak dynamic withstand capacity	
	Clearance of bus bar in air-Phase to phase	
	Clearance of bus bar in air-Phase to neutral	
	Clearance of bus bar in air-Phase to earth	
	Details of Bus bar insulation	
	Details of insulation at joints and tap-offs	
	Type of bus bar support	
	Colour coding for Phase Bus bars	
b)	Horizontal Neutral Bus bars	
	Location of bus bar W.R.T board	
	Material & grade	
	Size, shape and number of bars	
	Rated current in amps	
	Short circuit withstand current in KA for 1 sec	
	Peak dynamic withstand capacity	
	Clearance of bus bar in air	
	Details of Bus bar insulation	

	Details of insulation at joints and tap-offs	
	Type of bus bar support	
	Colour coding for Neutral Bus bar	
c)	Vertical Phase Bus bars	
	Material & grade	
	Size, shape and number of bars per phase	
	Rated current in amps	
	Short circuit withstand current in KA for 1 sec	
	Peak dynamic withstand capacity	
	Clearance of bus bar in air-Phase to phase	
	Clearance of bus bar in air-Phase to neutral	
	Clearance of bus bar in air-Phase to earth	
	Details of Bus bar insulation	
	Type of bus bar support	
	Colour coding	
d)	Vertical Neutral Bus bars	
	Material & grade	
	Size, shape and number of bars	
	Rated current in amps	
	Short circuit withstand current in KA for 1 sec	
	Peak dynamic withstand capacity	
	Clearance of bus bar in air	
	Details of Bus bar insulation	
	Type of bus bar support	
	Colour coding	
	Provision for future extension	
e)	<b>Details of Busbars - Bus duct</b>	
	Material & grade	
	Size & Shape	
	Rated current in amps	
	Short circuit withstand current in KA for 1 sec	
	Peak dynamic withstand capacity	
	Clearance of bus bar in air-Phase to phase	
	Clearance of bus bar in air-Phase to neutral	
	Clearance of bus bar in air-Phase to earth	
	Details of Bus bar insulation	
	Type of bus bar support	
	Colour coding	
<b>10.0</b>	<b>Constructional details</b>	
10.1	Sheet steel type	
10.2	Thickness of door in mm	
10.3	Thickness of load bearing members in mm	
10.4	Thickness of base frame in mm	
10.5	Thickness of gland plate in mm	
10.6	Weight of each section in KG	
10.7	Overall dimensions in mm of the entire switchboard (Length X Depth X Height)	
<b>11.0</b>	<b>Air Circuit Breaker (ACB) Details</b>	
11.1	Rating in amps.	



11.2	Make & type	
11.3	Short time (1sec.) rating in KA	
11.4	Operating voltage for opening	
11.5	Operating voltage for closing	
11.6	Operating voltage for spring charging	
<b>12.0</b>	<b>Power circuit – Air Circuit Breaker (ACB) Feeders <i>Details Shall be Submitted During Detailed Engineering for Purchaser's Approval</i></b>	
12.1	Material, Voltage Class and size of outgoing conductor from ACB to BUS (Incomers)	
12.2	Material, Voltage Class and size of incoming conductor conductor from BUS to ACB (Bus Coupler) and outgoing conductor from ACB (Bus Coupler) to	
<b>13.0</b>	<b>Power circuit – SFU Feeders</b>	
	Material, voltage class and size of incoming conductor from Bus to SFU and outgoing conductor from SFU to Terminals <i>(Details Shall be Submitted During Detailed Engineering for Purchaser's Approval)</i>	
	For 63A Feeder	
	For 250A Feeder	
	For 400A Feeder	
	For 630A Feeder	
<b>14.0</b>	<b>Power circuit -Motor Feeders</b>	
	Material, voltage class and size of incoming conductor from Bus to SFU/ Outgoing conductor from SFU to Contactor/Outgoing conductor from contactor to terminals <i>(Details Shall be Submitted During Detailed Engineering for Purchaser's Approval)</i>	
	For 0.75 Kw Motor Feeder	
	For 1.5 Kw Motor Feeder	
	For 5.5 Kw Motor Feeder	
	For 9.3 Kw Motor Feeder	
	For 11 Kw Motor Feeder	
	For 15 Kw Motor Feeder	
	For 18.5 Kw Motor Feeder	
	For 22 Kw Motor Feeder	
	For 37.0 Kw Motor Feeder	
	For 45 Kw Motor Feeder	
	For 75 Kw Motor Feeder	
	For 110 Kw Motor Feeder	
	For 125 Kw Motor Feeder	
<b>15.0</b>	<b>Painting for Switchboard</b>	
	Inside – Type and Shade	
	Outside – Type and Shade	
	Painting for Base frame (Type and Shade)	
<b>16.0</b>	Whether Catalogues/ Leaflets/ Technical details for the following items attached?	
	Load Break Switches	

	Circuit Breakers	
	Motor Protection Relays	
	Current Transducers	
	Power Contactors	
	Energy Meter	

**ANNEXURE III**  
**INSTRUCTIONS TO THE BIDDER**

- 1.0 Sealed bids under 'Two Part Bid' system (Part 1 – Unpriced technical bid and Part 2 – Priced commercial bid) are to be submitted by the vendor.
- 2.0 Bids complete in all respect shall be submitted as per this detailed format. Bids submitted not in the manner detailed are liable to be rejected at the sole discretion of the purchaser.
- 3.0 Bids shall be kept valid for a minimum period of 4 (four) months from bid due date or extended bid due date.

4.0 The Part 1 termed as Un-priced Bid shall contain the following sections: -

SECTION -1 : COMPANY PROFILE

- a) Organisation.
- b) Quality assurance manual.

SECTION – 2 : SYSTEM DETAILS

- a) Filled Technical Particulars as per Annexure-II.
- b) Busbar Capacity Calculation.
- c) Dimensioned General Arrangement drawing of switch Board
- d) Single Line Diagram of Switch Board.
- e) Data sheet of Circuit Breakers, Load Break Switches, Motor Protection Relays, Power Contactors, Current Transducers and Energy Meter.
- f) Documents as per SI Nos. 8, 10 & 15 in Vendor Data Requirements (Section 32 Page No. 26 of 43 in TPS).

SECTION – 3 : CONFORMITY TO TECHNICAL SPECIFICATION

- a) Signed copy of Technical Procurement Specification for 415 V, 50 Hz, 3200 A, 35 MVA PMCC.
- b) Compliance Statement/ Deviation List indicating the relevant Section No. / Cl. No. of purchaser's TPS, for each deviation.
- c) Engineering, Design, Testing, Inspection, Supply, Erection and Commissioning Schedule.
- d) Duly filled in bidder's checklist as per Annexure IV.

## SECTION - 4 : UNPRICED COPY OF PRICE BID

a) Unpriced copy of Price Bid for Supply, Mandatory Spares, Erection & Commissioning.

- 5.0 Part 2 termed as Priced bid shall be submitted online as bill of quantity (BOQ) available in CPP Portal.
- 6.0 Bids and all correspondence, including but not limited to drawings, bill of materials, spare parts lists, instruction booklets, etc, shall be in the English language only.
- 7.0 Bidders are required to state in their bid the names of proposed manufacturers for every item or equipment which is not of bidder's own manufacture.
- 8.0 All weights and dimensions shall be in metric system only. All dimensions shall be shown in millimeters.

ANNEXURE– IV  
BIDDER'S CHECK LIST

Bidder shall fill up the bidder's response column using "✓" mark to indicate that the document /detail is attached with the offer and shall submit the check list along with the bid.

Sl.No.	Description	Bidders response
1	Details of Organisation	
2	Quality Assurance Manual	
3	Signed copy of Technical Procurement specification for 415V, 50 Hz, 3200 A, 35 MVA, PMCC	
4	Compliance statement (point by point confirmation) with list of deviation, if any	
5	Unpriced copy of price bid	
6	Engineering, Design, Testing, Inspection, Supply, Erection and Commissioning Schedule.	
7	Filled Technical Particulars as per Annexure II	
8	Busbar capacity calculation	
9	Dimensioned General Arrangement drawing of switch Board	
10	Single Line Diagram of Switch Board	
11	Documents as per SI Nos. 8, 10 & 15 in Vendor Data Requirements (Section 32 Page No. 26 of 43 in TPS)	
12	Data sheet of Circuit Breakers, Load Break Switches, Motor Protection relays, Power Contactors, Current Transducers & Energy Meter	

**ANNEXURE V**  
**COMPLIANCE STATEMENT**

ENQUIRY No : \_\_\_\_\_

We state that our Quotation No.....is in full compliance with the documents issued against the Enquiry No: -----except for the deviations listed below.

**LIST OF DEVIATIONS**

Sl. No	Description	Reason for deviation

Name of Vendor:

We have read, understood and accepted the terms and conditions of the enquiry as given in the Technical procurement Specification, Instructions to Bidders, Annexures, Terms and Conditions for Purchase attached with the tender documents, except for the deviations distinctively listed above.

Date:

Name & Designation

Seal & Signature



**ANNEXURE VI**  
**MANDATORY SPARES**

SI.No.	Item	Quantity
1	3200 A incomer ACB with all primary and secondary isolating contacts(Fixed and movable)	1 No.
2	Overload Relay of motor feeders	1 No of each rating
3	Numerical Motor Protection Relay	1 No
4	MCB for control supply	2 Nos. of each rating
5	Control/Auxiliary contactor	2 Nos of each rating
6	Indication lamp assembly and lamps	6 Nos. of each type/colour
7	Power contactor of motor feeder	2 Nos. of each rating
8	Control Transformer	1 No of each rating
9	Control Fuses	10 Nos of each rating
10	Base for control fuses	2 Nos of each rating
11	Push buttons Switches	6 Nos each
12	Selector Switches	2 Nos Each
13	SDF with Fuse	2 Nos. of each for all rating, except for 630 Amps, 400 Amps & 250 Amps
14	SDF with Fuse	1 Nos. of each for rating 630 Amps, 400 Amps & 250 Amps
15	Current Transducers	1 No of each type

**ANNEXURE VII  
FEEDER DETAILS**

Sl. No.	Feeder / Equipment name	Equipment Number	Feeder Rating	Feeder Type
1	INCOMER 1		3200A	ACB
2	INCOMER 2		3200A	ACB
3	BUSCOUPLER		3200A	ACB
4	SPARE FEEDER		110KW	MOTOR
5	SPARE FEEDER		75KW	MOTOR
6	Oleum Cooling Tower Pump- B	MP6638B	37.5KW	MOTOR
7	COLD WELL PUMP – C	MP6693C	125KW	MOTOR
8	HOT WELL PUMP – B	MP6637B	75KW	MOTOR
9	CT FAN-B	MK6690B	45KW	MOTOR
10	BOILER FEED WATER PUMP – B	MP6654B	75KW	MOTOR
11	SPARE FEEDER		0.75KW	MOTOR
12	COLD WELL PUMP – B	MP6693B	125KW	MOTOR
13	MAIN CT FAN-A	MK6690A	45KW	MOTOR
14	ADT CIRCULATION PUMP	MP6609	110KW	MOTOR
15	FAT CIRCULATION PUMP	MP6628	110KW	MOTOR
16	BOILER FEED WATER PUMP- A	MP6654A	75KW	MOTOR
17	IAT CIRCULATION PUMP	MP6617	110KW	MOTOR
18	SPARE FEEDER		250 A	SFU
19	DCDA ESSENTIAL PANEL		630 A	SFU
20	OLEUM CIRCULATION PUMP	MP6634	75KW	MOTOR
21	SPARE FEEDER		45KW	MOTOR
22	SPARE FEEDER		400A	SFU
23	SPARE FEEDER		630A	SFU
24	SPARE FEEDER		5.5KW	MOTOR
25	COLD WELL PUMP – A	MP6693A	125KW	MOTOR
26	HOT WELL PUMP – A	MP6637A	75KW	MOTOR
27	SPARE FEEDER		125KW	MOTOR
28	BFW TURBINE OIL PUMP- A		0.75KW	MOTOR
29	OLEUM COOLING TOWER PUMP-A	MP6638A	37.5KW	MOTOR
30	DRY AIR MOV		5.5KW	MOTOR/MOV
31	SPARE FEEDER		15KW	MOTOR
32	SPARE FEEDER		1.5KW	MOTOR
33	CAUSTIC TRANSFER PUMP	MP6513	15KW	MOTOR
34	KERSOENE OIL PUMP – B	MP6510B	1.5KW	MOTOR
35	LP DOSING PUMP	MP6657	0.75KW	MOTOR



36	HP DOSING PUMP-B	MP6656B	0.75KW	MOTOR
37	DEAERATOR WATER PUMP-C	MP6659C	5.5KW	MOTOR
38	OLEUM COOLING TOWER FAN- B	MK6638B	15KW	MOTOR
39	SPARE FEEDER		15KW	MOTOR
40	DM WATER BOOSTER PUMP – B	MP6666B	15KW	MOTOR
41	DEAERATOR WATER PUMP-B	MP6659B	5.5KW	MOTOR
42	BOILER FEED WATER PUMP – C	MP6654C	18.5KW	MOTOR
43	DM WATER PUMP – B	MP6674B	15KW	MOTOR
44	CLEAN SULPHUR PUMP – B	MP6600B	15KW	MOTOR
45	HP DOSING PUMP –A	MP6656A	0.75KW	MOTOR
46	DILUTION WATER BOOSTER PUMP-B	MP6691B	22KW	MOTOR
47	SPARE FEEDER		63A	SFU
48	SPARE FEEDER		5.5KW	MOTOR
49	FAT COOLER DRAIN PUMP	MP6688	15KW	MOTOR
50	SPARE FEEDER		22KW	MOTOR
51	KERSOENE OIL PUMP – A	MP6510A	1.5KW	MOTOR
52	DM WATER BOOSTER PUMP – A	MP6666A	15KW	MOTOR
53	DILUTION WATER BOOSTER PUMP-A	MP6691A	22KW	MOTOR
54	IAT TANK DRAIN PUMP		9.3KW	MOTOR
55	SPARE FEEDER		15KW	MOTOR
56	OLEUM COOLING TOWER FAN-A	MK6638A	15KW	MOTOR
57	DEAERATOR WATER PUMP-A	MP6659A	5.5KW	MOTOR
58	CLEAN SULPHUR PUMP – A	MP6600A	15KW	MOTOR
59	OLEUM COOLER DRAIN PUMP	MP6687	11KW	MOTOR
60	IAT COOLER DRAIN PUMP	MP6686	15KW	MOTOR
61	OIL PUMP OF MAB	MK6607	0.75KW	MOTOR
62	DM WATER PUMP – A	MP6674A	15KW	MOTOR
63	SPARE FEEDER		63A	SFU
64	SPARE FEEDER		0.75KW	MOTOR

ANNEXURE VIII

The Substation and Transformer room Plan (Drg No. 19E-1-84 - R4)