

CONTENTS

CLAUSE NO.	DESCRIPTION
1.00.00	SCOPE OF SUPPLY
2.00.00	CODES AND STANDARDS
3.00.00	DESIGN CRITERIA
4.00.00	SPECIFIC REQUIREMENTS
5.00.00	TESTS
6.00.00	DRAWINGS, DATA AND MANUALS

ATTACHMENTS

ANNEXURE-A	RATINGS AND REQUIREMENTS
ANNEXURE-B	PROTECTIONS
ANNEXURE-C	FITTINGS & ACCESSORIES
ANNEXURE-D	BUS TRANSFER SCHEME FOR PMCC

DRAWINGS

TYPICAL SINGLE LINE DIAGRAM
TYPICAL CONTROL SCHEMATIC

VOLUME :V-A

SECTION-VII

**TECHNICAL SPECIFICATION
FOR
415V PMCC/MCC, 415V ACDB AND 220V DCDB**

1.00.00 SCOPE OF SUPPLY

1.01.01 Requisite nos. of following equipment shall be furnished with all accessories :-

- a. Power cum Motor Control Centre (PMCC)
- b. Motor Control Centres (MCC)
- b. A.C. Distribution Board (DB)
- c. D.C. Distribution Board (DB)
- d. D.C. Starters
- e. Lockout Switches
- f. A.C./D.C. fuse boards

1.01.02 The base channel frame with hardware and lifting angles.

1.01.03 One set of special tools and tackles.

1.01.04 Set of accessories as listed below :

- a) Breaker lifting and handling trolley.
- b) Test cabinet with coupling cables for testing the breaker in drawout position.
- c) Racking in/out handle for breakers.

1.01.05 12kV rubber mats shall be provided both at front and rear of LT Switchgear.

1.01.06 Mandatory Spare parts.

1.01.07 All relevant drawings, data and instruction manuals.

2.00.00 CODES AND STANDARDS

2.01.01 All equipment and materials shall be designed, manufactured and tested in accordance with the latest applicable Indian Standards (IS) and IEC except where modified and/or supplemented by this specification.

2.01.02 Equipment and material conforming to any other international standard which ensures equal or better quality, may be accepted. In such case, copies of the English version of the standard adopted shall be submitted along with the bid.

2.01.03 The electrical installation shall meet the requirements of Indian Electricity Rules as amended upto date and relevant IS Code of Practice. In addition, other rules and regulations applicable to the work shall be followed.

3.00.00 DESIGN CRITERIA

- 3.01.00 The PMCCs/MCCs/DBs will be used to provide power, control and protection for 415/240V A.C. and 220V D.C. auxiliary services (Motors & Feeders) of generating units.
- 3.02.00 Duty involves direct-on-line starting of large squirrel cage motors below 175kW. The starting current varies from 6 to 8 times rated current at very low power factor.
- 3.03.00 The equipment will be located in a hot, humid and tropical atmosphere, highly polluted at places with coal dust and/or fly ash.
- 3.04.00 For continuous operation at specified ratings, the temperature rise of various equipment/components shall be limited to the permissible values stipulated in relevant standards and/or this specification.
- 3.05.00 Equipment ratings and quantities are detailed in the enclosed drawings and annexure. Equipment shall be furnished in strict compliance with the same.
- 3.06.00 All equipment and components thereof shall be capable of withstanding the mechanical forces and thermal stresses of the short-circuit currents without any damage or deterioration of the materials.
- 3.07.00 The PMCCs/ MCCs / DBs shall have two incomers and one bus-coupler. In addition to electrical interlocks, mechanical castle key interlock shall be provided between the two incomers and the bus-coupler so that any two of the three may be closed at a time.
- 3.08.00 Busbars of PMCCs shall be sized to carry continuously the associated transformer secondary current plus a 20% margin.
- Busbars of MCC/DBs shall be sized to carry continuously the total running load of MCC/DB plus a 20% margin.
- 3.09.00 In cubicle of incomers & bus section breakers/MCCBs shall be identical to the associated busbar rating.
- 3.10.00 For continuous operation at specified ratings, the temperature rise of various equipment/components shall be limited to the permissible values specified in relevant standards and/or this specification.
- 3.11.00 Circuit breakers shall not produce any harmful over voltage during switching off of induction motors. If required, surge protective devices shall be included in the scope of supply to limit over voltages.
- 3.12.00 Incomers, Bus-couplers & outgoing feeders rated upto & including 630A shall be MCCB controlled. Above 630A all incomers, Bus-couplers & outgoing Feeders shall be ACB controlled. For critical loads ACB controlled feeders shall be provided which will be decided during detail engineering.
- 3.13.00 All motor rated 110kW & above, below 175kW shall be ACB controlled. Motor rated upto 110kW shall be contactor operated.

- 3.14.00 MCC & PMCC shall have sufficient number of spare modules (at least 20% of various sizes used with a minimum of 1 no. for each rating and type).
- 3.15.00 Outgoing feeders of PMCC shall be limited to minimum number of different sizes so that max. standardization is achieved from MCCB & contactor size point of view.
- 3.16.00 Incomers & bus section breakers of PMCCs/MCCs shall have provisions for remote operation from control room.
- 3.17.00 All breaker operated motor feeder shall be supplied from PMCC.
- 3.18.00 One no. Normal/Emergency switchgear to cater power supply to important emergency load / motors for safe shut-down of unit including 220V battery chargers shall be provided for each unit. The main incoming supply shall be from 415V unit service switchgear. When main incoming supply fails, reserve incoming supply shall be switched ON automatically from 415V station service switchgear. In case of total failure of AC supply of the power station, the supply from DG shall be switched ON automatically.
- 3.19.00 Each switchgear shall be provided with two bus sections, two incomer and a bus coupler rated for 100% of the loads connected to the switchgear.
- 3.20.00 For each auxiliary or load, one feeder shall be provided except for the following cases:
- One feeder for a maximum 2 nos. isolator motor operating mechanism.
- 3.21.00 The switchgears shall be provided with suitable number and type of outgoing feeders for the respective auxiliary loads of the system/area, power supply feeders to various panels, lighting transformer, space heating panels, control cabinets and all other loads encountered in the plant. In addition, following feeders shall be provided in each bus section of each switchgear.
- a) Bus VT module: One (1) no.
 - b) Switchgear test supply module: One (1) no.
 - c) 240V, 1 phase essential supply module with five nos. 1 phase outlets: One (1) no.
Necessary 415V/240V dry type transformer shall be provided.
 - d) Alarm module for common alarm for outgoing feeder fault: One (1) no.
 - e) DC supply alarm module for incomer, bus coupler fault: One (1) no.
- 3.22.00 Each feeder shall be provided with two nos. interposing relays for start & stop. These interposing relays shall be located in separate IPR panel described under C&I specification.

4.00.00 **SPECIFIC REQUIREMENTS**

4.01.00 **Construction**

4.01.01 PMCC / MCC / DB shall be indoor, metal-clad, air insulated and floor mounting type. All MCCs shall be fully draw out type and DBs shall be fixed type. ACB modules of PMCCs/MCCs shall be fully drawout type. MCCB / Switch Fuse modules shall also be fully drawout type. The design and construction shall be such as to allow extension at either end.

4.01.02 All PMCC/MCC shall be of double front construction.

4.01.03 PMCC /MCC/DB enclosure shall be dust and splash proof, conforming to a degree of protection IP-54. All switchboard frames and load bearing members shall be fabricated using suitable mild steel structural sections or pressed and shaped cold rolled sheet steel of thickness 2.0mm. Frames shall be enclosed in cold rolled sheet steel of thickness 1.6 mm. Doors and covers shall also be of cold rolled sheet steel thickness 1.6 mm. Stiffeners shall be provided wherever necessary. The gland plate thickness shall be 3.0 mm for hot/cold rolled sheet steel and 4.0 mm for non-magnetic material.

4.01.04 PMCC / MCC / DB assembly shall comprise a continuous line up of dead front, free-standing vertical sections, housing the control modules in multi tier formation.

4.01.05 The design shall be fully compartmentalized with metal/insulating partitions between compartments. The working height shall be limited within 750 mm to 1800 mm from floor level.

4.01.06 Each control module shall be housed in a separate compartment, complete with an individual front access door having sufficient opening with concealed type hinges. Each vertical section shall have a removal back cover. All doors and covers shall be gasketed.

4.01.07 All push buttons, lamps, indicating instruments shall be flush / semi-flush mounted on respective module compartment.

4.01.08 A full height vertical cable chamber with cable supports shall be provided in each section to facilitate unit wiring. The chamber shall be liberally sized to accommodate all cables and shall have removable cover at the front for access.

4.01.09 A horizontal wireway, extending the entire length, shall be provided at the top of each PMCC / MCC / DB for inter panel wiring.

4.01.10 The width of the cable alley shall not be less than 250 mm.

4.02.00 **Bus and Bus Taps**

4.02.01 All PMCCs/MCCs/DBs shall be provided with three phase & neutral bus bars . All DCDBs shall be provided with two busbars. All busbar compartments shall be completely enclosed.

- 4.02.02 The main buses and connections shall be of high conductivity Aluminium / Aluminium alloy, sized for specified current ratings with maximum temperature limited to 85°C (i.e., 35°C rise over 50°C ambient).
- 4.02.03 Vertical busbars shall be designed for minimum current rating of 200A. Separate vertical busbars shall be provided for each vertical panel.
- 4.02.04 All bus connections shall be silver plated. Adequate contact pressure shall be ensured by means of two-bolt connection with plain and spring washers and locknuts.
- Bimetallic connector shall be furnished for connection between dissimilar metals.
- 4.02.05 Busbars and connections shall be fully insulated for working voltage with adequate phase/ground clearances. Insulating sleeves for busbars and shrouds for joints and tap-off points shall be provided.
- Bus insulators shall be flame retardant, non-hygroscopic track-resistant type with high creepage surface.
- 4.02.06 Busbars shall be supported and braced to withstand the stresses due to maximum short circuit current and also to take care of any thermal expansion.
- 4.02.07 Busbars shall be colour coded for easy identification and so located that the sequence R-Y-B shall be from left to right, top to bottom or front to rear when viewed from the front of the assembly.
- 4.03.00 **Control Modules**
- 4.03.01 Draw-out type control module shall have self-aligning power/control disconnects. All disconnects shall be silver plated to ensure good contacts.
- 4.03.02 The design shall be such as to permit easy withdrawal/reinsertion of the unit with guide rails to ensure correct alignment.
- 4.03.03 Control Module shall house the control components for a circuit such as switch fuse / MCCB, contactors, relays, push buttons, lamps etc. as per requirement of the control circuit.
- 4.03.04 The equipment layout shall provide sufficient working space in between the components and subject to Owner's approval.
- 4.03.05 Various module/compartments sizes shall be multiple of one basic unit to facilitate modifications at site. Suitable provision for this purpose should also be incorporated in the vertical bus bars.
- 4.03.06 Draw-out type control modules of same size and type shall be electrically and physically interchangeable.
- 4.04.00 **Air Circuit Breaker**
- 4.04.01 Circuit breaker shall be provided on the incomer having minimum interrupting capacity equal to the 50kA(r.m.s) fault level.

- 4.04.02 Circuit breaker shall be three pole, single throw, air-break type with independent manual spring closing, trip-free mechanism and shunt trip. However Incomer breaker shall be four pole type.
- 4.04.03 Circuit breaker shall be draw-out type, having service, test & isolated position with positive indication for each position.
- 4.04.04 Circuit breakers of identical rating shall be physically and electrically interchangeable.
- 4.04.05 Each breaker shall be provided with microprocessor based protection unit having three overload protection with adjustable current and time, three short circuit protection with adjustable current and time and three instantaneous short circuit protection. The operating characteristic shall be suitable for co-ordination with down-stream fuses.
- 4.04.06 Circuit breakers shall be provided with motor wound spring charging mechanism. Spring charging shall take place automatically after each breaker closing operation. One open-close-open operation of the circuit breaker shall be possible after failure of power supply to the motor. In addition, facility for manual charging of spring shall be provided.
- 4.04.07 Mechanical safety interlock shall be provided to prevent the circuit breaker from being racked in or out of the service position when the breaker is closed. It shall not be possible to open the circuit breaker door cubicle unless the breaker is in 'OFF' position.
- 4.04.08 Automatic safety shutters shall be provided to cover up the stationary disconnects when the breaker is withdrawn.
- 4.04.09 Each breaker shall be provided with an emergency manual trip, mechanical ON-OFF indicator, an operation counter and spring mechanism charge/discharge indicator, and electrical anti-pumping feature.
- 4.04.10 In addition to the auxiliary contacts required for normal breaker operation and indication, each breaker shall be provided with the following for interlocking purpose :-
- a. Position/Cell switch with 4 NO + 4 NC contacts.
 - b. Auxiliary switch, with minimum 6NO + 6NC contacts,
- 4.04.11 Spring charge limit switch shall be provided for breakers with motor wound spring charging mechanism. These limit switches shall be provided with minimum 2NO + 2NC contact.
- 4.04.12 Limit/auxiliary switches shall be convertible type, that is, suitable for changing N.O. contact to N.C. and vice-versa.
- 4.04.13 Each breakers operated feeder shall be provided with protective devices as specified in Annexure–B.

4.05.00 **Switches**

4.05.01 Switches shall be triple pole, air break, AC23 motor duty for motor feeders and AC22 heavy duty for other feeders.

Motors duty switches shall be capable of safely making and breaking the locked rotor current of the associated motor circuit.

4.05.02 The switch shall have a quick-make, quick-break mechanism operated by a suitable external handle, complete with position indicator. This handle shall have provision for padlocking in ON and OFF position.

4.05.03 The compartment door shall be interlocked mechanically with the switch such that the door cannot be opened unless the switch is in OFF position. Means shall be provided for releasing this interlock at any time.

4.05.04 Switches shall be capable of withstanding the let-through fault current of back-up fuses or circuit breakers.

4.05.05 Wherever two incoming switches and one bus-section switch are provided for an assembly, these shall be mechanically/key interlocked to ensure that only two out of the three can be closed at time.

Wherever two incoming switches are provided for an assembly, these shall be mechanically/key interlocked to ensure that one of the two can be closed at time.

4.05.06 All incoming and outgoing feeders shall be provided with bolted disconnect link for isolation of neutral if necessary.

4.06.00 **Fuses**

4.06.01 Fuses shall be HRC, preferably link type, with a minimum interrupting capacity equal to the short circuit current of the LT system. Fuses shall be mounted on insulated fuse carriers, which are mounted on fuse bases. Wherever it is not possible to mount fuses on carriers, fuses shall be directly mounted on plug-in type of base. In such cases, one set of insulated fuse pulling handles shall be supplied with each board.

4.06.02 Fuses shall be furnished complete with fuse bases and fittings of such design as to permit easy and safe replacement of fuse element.

Visible indication shall be provided on blowing of the fuse.

4.06.03 Motor fuse characteristics and ratings shall be chosen to ride over starting period without blowing. The fuse on incoming feeder wherever provided, shall be chosen to provide discrimination with motor/feeder fuses.

4.07.00 **Moulded Case Circuit Breaker (MCCB)**

4.07.01 The MCCBs shall be of drawout type with trip-free operating mechanism of quick make & quick break type. Each MCCB shall be equipped with thermal release for thermal overload and magnetic release for short circuit protection on each pole.

- 4.07.02 MCCBs / MPCBs shall be suitable for manual closing and opening and also automatic trip on overload and short circuit. MCCB shall have intermediate position to indicate trip condition.
- 4.07.03 The MCCBs shall be provided with mechanical ON-OFF indicator at the front panel. The MCCB handles, after the breaker tripped due to faults, shall occupy a mean position indicating trip condition.
- 4.07.04 The compartment door shall be interlocked mechanically with the MCCB such that the door cannot be opened unless the MCCB is in OFF position. Means shall be provided for releasing this interlock at any time.
- 4.07.05 All feeders of PMCC / MCC rated up to & including 630 Amp shall be provided with MCCB. Air circuit breaker shall be provided for feeders rated above 630 Amp. For critical loads ACB controlled feeders shall be provided which will be decided during detailed engineering.
- 4.07.06 Motors rating above 110 KW will be operated by Air circuit breaker and protected by consolidated numerical motor protection relay.
- 4.08.00 **A.C. Starter**
- 4.08.01 Contactors
- a. The contactors shall be three pole, air break type designed for duty class III - Category AC3 (for unidirectional motor) with non-bouncing silver/ silver alloy contacts. Contacts for reversible motors will be of AC4 duty.
 - b. Each contactor shall be provided with minimum two (2) normally open and two (2) normally closed auxiliary contacts rated 10 A at 240V A.C.
 - c. Reversing contacts shall be electrically and mechanically interlocked.
 - d. Contactors with delayed dropout feature shall be provided for some essential auxiliaries. These contactors shall not dropout on power failure if the voltage is restored within 3 seconds.
- 4.08.02 **Protection**
- a. Thermal overload relays shall be three element, positive acting, ambient temperature compensated with adjustable settings.
 - b. Single phase preventor relay shall be provided, preferably as an inbuilt feature of thermal overload relay.
 - c. Relays shall be manual reset type with two changeover potential-free contacts. Resetting of relays shall be possible with compartment door closed. Colour of the resetting button shall be BLACK.
 - d. Relays may be direct acting or C.T. operated, depending on current rating. C.T.s shall be included in the scope of supply.
 - e. Motor starters shall have type '2' co-ordination according to IEC 947-4.