

SECTION D9

**415V SWITCHGEAR/POWER
DISTRIBUTION BOARD/MCC**

SPEC. NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME IV SECTION:D9
PART B	RRVUNL, 2 x 660 MW, Super-Critical TPS Stage-V, Unit # 7 & 8 at Suratgarh, Rajasthan 415V SWITCHGEAR/ DISTRIBUTION BOARDS/MCC	SHEET 1 OF 16
1.0 415 V Switchgear, PMCCs and MCCs required for feeding the all the entire Plant Loads (except River water System) shall be supplied. These shall include as a minimum the following boards for 2 Units:- a) Turbine PCC b) Turbine MCC c) Boiler PCC d) Boiler MCC e) Soot blower MCC f) ESP MCC g) Mill MCCs h) TVDB i) BVDB j) Hydrogen Plant MCC k) AC & DC distribution boards l) AC & ventilation MCC m) Normal emergency switchgear n) DC Switchgears o) Emergency Switchboards (D.G) p) Cooling Tower MCCs. q) Intake Water MCCs. r) Ash handling Plant PMCC s) Ash water/Silo/Slurry MCC- As required. t) Fly Ash MCC- 3 Nos. u) Ash dyke MCC v) Coal Handling Plant MCCs- As required w) Wagon tippler MCCs- One MCC per Wagon tippler. x) Bunker Floor PMCCs- As required y) Water system switchgear. z) DM Plant MCC - aa) Chemical House MCC - bb) River water MCC - cc) Electro Chlorination Plant MCC.		
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dd) Clarified water MCC ee) Effluent treatment plant MCC ff) Guard Pond MCC gg) LDO MCC hh) HFO MCC ii) Fuel oil unloading PH MCC A, B jj) Switchyard PMCC A, B. kk) Station switchyard auxiliary swbd PMCC 1 , 2 ll) Fire water PH switchgear 1A,1B. mm) Site office switchgear. nn) Compressor MCC 1A,1B oo) Air washer MCC 1A, 1B. pp) C.W Pump House MCC qq) Station ACDB 1A,1B. rr) Work Shop MCC ss) Admin building PCC tt) Service building AC and Ventilation MCC uu) ESP Control Room AC and Ventilation MCC vv) Receptacle Welding DBs. ww) Space Heater DB – As required. 1.1 415 V systems shall be 3 phase, 3-wire, solidly grounded system except for those listed in cl.no.1.2 which shall be with 4-wire system. All MCC shall derive power from power source as per Key One line diagram 5750A-738-AU-3001 attached. 1.2 Following PCC/MCC/Distribution Boards shall be of 4-wire type. Incomer and bus coupler SFU/MCCB/ACB of all 4 wire PCC/MCC/DB shall be of 4 pole type: a) Welding receptacle DBs b) Space Heater DBs c) Workshop MCC d) Admin building MCC e) Site Office switchgear f) Service building and Ventilation MCCs		
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g) Station building DBs h) Switchyard DBs i) All PCCs 1.3 For codes & standards refer section D28 of this volume. 2.0 <u>FEEDER DETAILS</u> 2.1 Each of the switchgear shall be provided with two bus sections, two incomers and a bus coupler each rated for 100% of the loads connected to the switchgear. 2.2 The switchgears shall be provided with suitable number and type of outgoing feeders for the respective auxiliary loads of the system/area. Additionally following shall be provided in all Switch boards. (a) Spare feeders: 4 Nos. of 400A outgoing feeders shall be provided in station auxiliary service switchgear for Owner's use by the EPC Contractor scope. - In addition, 20% spares of each rating and type of module shall be considered with a minimum of one number. Any additional quantity required for any increase/ changes during detailed engineering stage shall also be duly considered. (b) Bus VT module – 1 per bus section. (c) Control transformer module – 1 per bus section. Where there is no bus section (only one bus) and for the N/E Switchgear bus section, 2 nos. Control Transformers are to be provided. Control transformers shall be located in Physically separate modules. Each Control transformer shall be sized for complete load of the Switchgear/MCC. i.e., Control Transformers shall be of 2 X100 % capacity with manual and auto changeover facility in case of any one Transformer supply failure. (d) 240V, 1 phase space heating. 1 per bus section. (e) Control supply (AC and DC) changeover scheme module. (f) Each bus section shall have the following feeders for Purchaser's use: 32A – 3 Nos. 63A – 2 Nos. 100A – 2 Nos. 160A – 2 Nos. (g) Essential / critical loads to receive supply from the Normal-Emergency Switchgear and 220V DCDB.		
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3.0 <u>SHORT CIRCUIT CURRENTS</u> 3.1 The fault level on the 415V buses shall be calculated based on transformer contribution and motor contribution and shall be limited to 50kA inclusive of 10 % margin. The minimum short time current rating shall be 50 kA for 1 second. 3.2 It is the responsibility of the Vendor to co-ordinate operation of all the ACBs and MCCBs for short circuit condition so that discrimination in operation is provided. Co-ordination and relay setting is in Vendor's scope. 4.0 <u>CONTINUOUS CURRENTS</u> The continuous current rating of the bus bars, the incomers, bus couplers of the switchgear, which are fed by the transformers shall be rated at the LV side full load current of the corresponding transformers with 20% margin rounded off to the next higher standard rating. 5.0 <u>SPECIFIC REQUIREMENTS</u> 5.1 All the 415V equipments/devices like bus support insulators, CBs, CTs, PTs etc mounted inside the switchgear shall be suitable for continuous operation and satisfactory performance under the following supply conditions. (a) Variation in supply voltage $\pm 10\%$ (b) Variation in supply frequency $\pm 5\%$ (c) Combined voltage and frequency variations: 10% absolute. 5.2 All bus bar, bus-taps shall be insulated with close fitting sleeve of PVC insulation with high dielectric strength. 5.3 The switchgears shall be totally enclosed, metal clad, sheet steel fabricated, indoor, floor mounted fully draw-out modular type construction, dust and vermin proof of uniform height of not more than 2450mm, easily extendable on one side having switchgear designation indicating label's on front and rear, in single/ double front execution in totally draw out. Proper gasketing shall be provided all around the perimeter of the adjacent panels, panel and base frame, removable cover and doors. The switchboard shall be fully compartmentalized. Incomers to the switchgear shall be of cable/ Non-segregated phase busbuct. The switchgear shall be capable for the suitable termination. 5.4 Operating devices shall be incorporated only in front of the switchgear. 5.5 Switchgear shall be divided in to distinct vertical section consisting of :- (a) Completely Enclosed busbar compartment running horizontally. (b) Individual feeder modules in multi tier arrangements. (c) Enclosed vertical bus bars serving all modules in vertical section.		
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(d) Vertical cable alley covering entire height and minimum 300 mm wide and shall have hinged doors. (e) A horizontal separate enclosure for all-auxiliary power and control bus as required. 5.6 All modules of identical size & type shall be fully interchangeable without any modifications. 5.7 The sheet steel to be used for the metal enclosed switchgear shall be minimum 2.5 mm thick hot rolled or 2 mm cold rolled. 5.8 The cable entry shall be bottom/top with separate gland plate for power and control cable. In case of single core cables, gland plate shall be of non magnetic material. The exact cable entry shall be finalised during detailed engineering. 5.9 All Air circuit breakers (ACBs) and Moulded case circuit breakers shall be of short circuit performance category P2 as per IS:2516 Parts I & II. 5.10 The MCCBs shall be of current limiting type. When MCCB's are used as short circuit protection devices for motor modules they shall provide type C co-ordination with associated contactor and thermal overload relay as per IS: 8544 under all operating conditions for the all currents up to the design fault current. The MCCBs on upstream and downstream shall be co-ordinated. 5.11 Test reports to prove the requirements of Type-C Co-ordination shall be furnished. 5.12 There shall be two number 220V DC control supply for each switchgear. Auto and manual changeover scheme for changeover of supply- 1 to 2 and vice versa shall be provided. Necessary voltage monitoring contactors (for remote alarm) and indication lamps shall be provided. 5.13 Minimum of one NO and one NC spare contacts of all contactors, relay devices shall be wired to terminal block. All spare contacts of all contactors relay terminals shall be wired up to the terminal block. 5.14 For CT & VT circuits disconnecting type of terminals shall be provided. 5.15 Power cable terminal arrangement and size shall be suitable to accommodate two or more number of cables based on requirements and shall facilitate easy maintenance. 5.16 Terminal arrangements shall be such that all terminals at switchgear ends, which are to be connected to remote alarms and indication at DCS, shall be separated out and shall be kept isolated from other Terminals. 240V AC, 110V AC, 24V DC, 220V DC & other voltages shall be segregated to avoid mix up of voltages. This is specifically required to avoid mixing of switchgear high voltage to C & I low voltage system.		
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5.17 Meters shall be Digital type. For MCC verticals, CT pertaining to a particular module should be mounted in the respective with drawable module it self. CT should not be mounted in cable alley. 5.18 Switchgear shall be suitable for easy extension on one side. It shall be possible at a later stage to add cubicles to the switchgear by extending the bus bars. 5.19 Secondary of CTs & VTs shall be made through disconnecting type terminals with necessary shorting and earthing facilities. All the control wiring shall be through stud type terminal. 5.20 The breaker ratings indicated in the data sheets referred to the nominal rating of the breaker. However, Breakers shall be capable of carrying continuously at least 120% of circuit breaker current at an ambient temperature of 44 deg. and with breaker mounted inside the panel. If a higher rated breaker is necessary to meet this, the same shall be used. 5.21 Dummy cubicles with horizontal bus bars, power control and annunciation cable running through the panel, if necessary, to avoid beam interfering with cable openings and to facilitate easy maintenance shall be provided. 5.22 All the bolted joints in body of the switchgear shall be earthed through flexible jumpers. 5.23 All indicating and integrating instruments, protection and alarm relays , operating and indicating devices shall be visible/ accessible without opening the instrument compartment door. All the hand reset relays shall be mounted on the panel at a conventional height for operation. 5.24 All the internal wiring shall be carried out using 1100V grade, stranded copper conductor with PVC insulation and shall be flame, vermin and rodent proof. The minimum size of the copper conductor used for panel wiring shall be as follows: ➤ All circuit except CT &PTs: 1.5 sq mm per lead. ➤ CTs/PTs : 2.5 sq mm/per lead. 5.25 The minimum number of strands per conductor shall be 07. Double flexible wire shall be used for internal wiring of devices mounted on moving parts of Cu conductor of size as mentioned at a) & b) above. 5.26 Following colour coding shall be used for internal wiring:- ➤ Red, Yellow & Blue: For respective phase /PT wires. ➤ Black : for neutral wires. ➤ Green : For Earth wires ➤ Red ferruled wires for trip circuit. ➤ All other with grey coloured wires.		
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5.27 The inter panel wiring shall be brought out to a separate set of terminal blocks located near the slots meant for inter panel connecting wires. 5.28 At least 20% spare spare terminations of CT, PT & others shall be provided on each panel'. and these spare terminals shall be uniformly distributed on all rows of terminal blocks. A clearance of 250 mm shall be maintained between terminal blocks and gland plate and 150 mm between two rows of terminal blocks. at least 20% 5.29 All the electrical equipment shall be fed from main MCC only and if any specific arrangement is needed, separate panel for that shall be provided in switchgear room. 5.30 All LT panels shall be mounted at least on ISMC (Indian Standard Medium Channel) or other applicable 100 channels to prevent ingress of water. 5.31 All hardware required for meeting the functional requirements stated above, whether specifically listed out in the specification or not, shall be included in the scope of supply. 5.32 Current transducers, power transducers and Voltage transducers shall be provided. 5.33 The cable terminations inside the cable alley shall be completely shrouded so that it shall be possible to work on any one of the terminations by switching OFF the corresponding feeder switch only. 5.34 All bezels, handles, screws, bolts, washers, hinges, etc. shall be of the best quality electro galvanized or passivated to withstand attach from corrosive atmosphere. 5.35 Horizontal busbar chambers shall be at the top of the board for bottom cable entry. Busbars shall be completely shrouded to prevent metal pieces falling on the busbar during maintenance. 5.36 In case of copper to aluminium connections, proper treatment shall be given to minimise the bimetallic effect. That is, all joint surfaces at aluminium to copper joints shall be silver / tin plates, alternatively Cu-Al washers (bimetallic washers) can be used.. 5.37 On- line energy monitoring system shall be provided on all drives above 80kW rating which will help in preventive maintenance. 5.38 All MCC feeders of 80kW and above rating shall have Ampere,kVA, kW transducers for communicating the data to PLC system for auxiliary consumption analysis. 5.39 Outgoing feeders of rating 200A and above upto 630A (other than motor feeders) shall have MCCBs only with Short-circuit and Earth fault protection. Feeders of rating less than 200A shall be SFU. This is not applicable for feeders feeding other MCCs and switchboards.		
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5.40 Welding Distribution Boards shall be provided with the following: a) It shall be with isolating transformer on the incomer with ACB with Over current and Earth fault protections. b) It shall be provided with maximum 12 nos. Of outgoing feeders. c) Quantity of Welding receptacles: (i) One (1) no. in each ESP and Boiler Platform. (ii) One (1) no. every 50m in each floor of TG building. (iii) Two (2) nos. each in every building in the power plant other than Admin Building. (iv) One (1) no. for every 60M in Switchyard and Main Transformer yard. (v) Looping of welding receptacles not allowed. 6.0 <u>INCOMERS & BUS COUPLERS.</u> 6.1 Incoming/ Bus coupler/ Outgoing feeders of rating 200A and above up to 630A (other than motor feeders) shall have MCCBs only with Short-circuit and Earth fault protection. Feeders of rating less than 200A shall be SFU. Feeders rated above 630A shall have ACBs. 6.2 The following minimum protections shall be provided for incomers and bus coupler for switchgears. ➤ phase inverse time over current relays ➤ Earth fault relay (for incomer only) ➤ Numerical relays shall be provided for all protection. 6.3 The incomer modules & bus coupler modules of PMCC as well as important MCC's as mentioned in clause 6.5 irrespective of loads shall be equipped with fully draw out air circuit breaker protected with relays. 6.4 All incomers and outgoing feeders of various loads shall have digital energy meter for energy accounting. The energy Meters of Incomers shall be of the Tri Vector Meter type (TVM) with recording and download facility. 6.5 Important MCCs shall be controlled from remote DCS & ECP. They shall be with ACBs, closing coil, shunt trip coil and relays irrespective of the current ratings. 6.6 The incomer modules shall be interlocked with their upstream breaker such that they can be closed only when upstream breaker is closed and trip automatically when upstream breaker is tripped. 6.7 Each circuit breaker cubicle shall be complete with following minimum accessories:-		
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a) One spring return Trip normal close (TNC) switch. b) Large size cluster LEDs for following condition of breaker/contactors:- (i) "ON"(Red) (ii) "OFF" (Green) (iii) Trip relay supervision (White). (iv) Spring charged (Blue) (v) DC supply supervision (Violet) (vi) Trip on fault (Amber) c) Limit switches for test and service position interlocking. d) Double pole switch for DC control supply and spring charging motor with HRC fuses or MCB will be provided (Fuse or MCB shall be provided for DC control supply which shall be decided during detailed engineering). e) Anti pumping relay. f) Sufficient terminal blocks. g) Auxiliary relays as required for contact multiplication. h) Breaker operation counter. i) Numerical Protective relays along with trip circuit supervision relay and master trip relay. j) Meters as indicated elsewhere. k) Required CTs/PTs. l) Space heaters. m) One Local/Remote Switch. n) Required number of 24 V DC DC Interposing Relays. o) 4-20 mA output Transducers for current, power and voltage. p) Other associated equipment. 6.8 All the circuit breakers shall be of fully draw out execution with "Test", "Service " & " Fully withdrawn " positions. 6.9 Double tier arrangement shall not be provided for incomers and bus coupler. In case of motor feeders, double tier arrangement may be provided but two breakers of same application motor shall not be provided in one vertical. 6.10 Breakers shall be with motor wound spring operating mechanism, 220 V DC operated Closing and tripping coils. 6.11 Closing action of the CB shall compress the opening spring ready for tripping.		
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6.12 Proper mechanical indication shall be provided to locate these three positions without opening of the compartment door. 6.13 It shall be possible to bring the circuit breaker to isolated position with the help of external lever without opening the compartment door. 6.14 A stop block shall be provided on the slide rails to prevent the movement of the circuit breaker out of the compartment when it reaches the isolated position so that any accidental fall can be avoided. 6.15 No control & metering equipments should be mounted on breaker compartment door (i.e access to control & metering equipments should be available at all time without opening Breaker Compartment door). 6.16 It shall not be possible to close the Breaker if stored energy mechanism is not charged. 6.17 In case of MCCBs, it shall not be possible to close the Breaker if under-voltage relays release is not energised (if present). 6.18 Movement of the circuit breaker truck from service to test or test to isolated position OR in reverse order shall be possible only when circuit breaker is off. 6.19 It shall not be possible to withdraw the breaker when it is in closed position. 6.20 Opening of compartment door with breaker / isolating switch in Service & Intermediate and ON position and vice versa shall not be possible. 6.21 It shall not be possible to close the Breaker if closing coil is energized. 6.22 It shall not be possible to close the Breaker if OFF – Push Button is locked in off position. 6.23 It shall not be possible to close the Breaker if crank hole is open. 6.24 The Circuit Breaker shall be provided with mechanical ON/OFF, TRIP and SPRING CHARGED, DISCHARGED READY TO CLOSE AND BREAKER POSITION indication, mechanical trip push button. 6.25 The circuit breaker shall be provided with automatic safety shutters, so that before the breaker reaches 'isolated' position the main isolating contacts are completely shrouded. In the draw-out condition, it shall be possible to inspect the Breaker fixed contacts condition by lifting the shutters. 6.26 The protective relays and instruments shall be mounted in separate compartment. This compartment shall be along side and immediately next to the controlled breaker 6.27 Contact erosion indicator shall be provided on Moving contacts of Breaker for visual indication of contact life. 6.28 All the non conducting metal parts of the circuit breaker trolley shall be bonded together and shall make perfect electrical connection to earth through substantial sliding contacts, at service and test positions. Such sliding		
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contacts shall be arranged to make before power plug in and interrupt after power draw out. 7.0 <u>BUS AND LINE PTs</u> Bus PT over voltage factor shall be 1.9 for 08 hours. 3 Nos. single phase PTs shall be connected up to form a 3 phase unit. Each PT cubicle shall be complete with following minimum accessories (a) PTs shall be fully draw out type with required no of cores and ratios as specified elsewhere. (b) Voltmeter with selector switch. (c) Separate Under voltage (2 nos.) and No voltage relays (2 nos.) with timers and fuse fail relays. (d) Required auxiliary relays. (e) LEDs for voltage indication. (f) Auxiliary PTs, as required. (g) DC and AC control supply and changeover switches with Short Circuit protection. 8.0 <u>MOTOR MODULES</u> 8.1 All LT motors shall be controlled as follows: a) Up to 50kW: - MPCB + Contactor (MPCB shall be with adjustable S/C and O/L protection). b) 50kW to 90kW shall have MCCB+ contactor+ bimetallic relay. c) 90Kw to 160kW shall have ACB +motor protection relay (MPR). 8.2 All motor feeder shall be complete with following minimum accessories. (a) Interlocking schemes for Space heating arrangements (space heating for motors above 30KW). (b) 3 position selector switch-Local (switchgear)/Field/Remote (DCS/PLC) (c) Test services position switches and associated contactors for interlocking. (d) Power contactors and MPCB or breaker. (e) Bi-metal relay or Motor Protection relay. (f) CTs as specified elsewhere. (g) Local indication lamp for ON, OFF & TRIP/Fault indication. ISSUE R1		

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(h) Relays as required. (i) ON & OFF PBs, for testing in Test Position. (j) 24 V DC Interposing relays to accept remote start and stop signals . 8.3 All the motors rated 30 kW and above shall be provided with a CT, ammeter and a current transducer with remote metering in DCS. Further important motor like ID/FD/PA fan, LOP motors, HP/LP bypass motor, mill feeders motor, APH motor, air conditioning motor etc shall also be provided with CT, ammeter and a current transducer with remote metering in DCS irrespective of kW. 8.4 The incomer/bus coupler, module, MPCB/MCCB feeder etc shall confirm to the attached M2 series of schematic drawings. 9.0 <u>ACTUATORS.</u> All actuators to be supplied with non integral starters. 10.0 <u>METERING.</u> 10.1 Each incomer feeder to all PMCC/PCC/MCCs shall have Voltage, Ampere, kVA, kW, transducers for communicating the data to DCS/PLC system for auxiliary consumption analysis and these parameters voltage, current, kW and kVA of each incomer also shall be available on respective ECP. 10.2 Meters shall be Digital type. All CT s/ PT s, transducers and meters (Energy accounting and audit meters) on 415 V system shall be class 1.0. Metres for motor feeders shall be with suppressed scale. 10.3 All MCC feeders (except motor feeders) of 80kW and above rating shall have Ampere, kVA, kW transducers for communicating the data to DCS/PLC system for auxiliary consumption analysis. 10.4 All the motors rated 30 kW and above shall be provided with a CT, ammeter and a current transducer with remote metering in DCS. Further important motor like ID/FD/PA fan, LOP motors, HP/LP bypass motor, mill feeders motor, APH motor, air conditioning motor etc shall also be provided with CT, ammeter and a current transducer with remote metering in DCS irrespective of kW. 10.5 The Energy accounting and audit meters as required by CEA shall be on a separate core and shall be installed at following locations to facilitate the accounting of the energy generated, transmitted, distributed and consumed in various segments of the power system and the energy loss, namely • Low voltage side of each incoming transformer feeder of low voltage (415V) buses, and This CT core and the meters shall have an accuracy of 0.2S for this purpose and PT cores shall have an accuracy class of 0.2 for this purpose.		
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11.0 **ALARMS/INDICATION/SER POINTS**

11.1 **INCOMERS AND BUSCOUPLER CONTROL.**

11.1.1 Incomers/Bus couplers/Ties from/to the various Switchboards (with ACB and MCCB as incomers) listed in Clause 1.0 shall be controlled from DCS/PLC (as applicable) and ECP as explained in clause no. 2.1.1 of section D2.

11.1.2 Interconnecting cables to DCS and required interposing relays (24 V DC) are in Vendor's scope. Interposing relays are to be located in the Switchgear.

11.1.3 Each ECP shall have all the instruments as explained in clause no. 2.1.2 of section D2.

11.1.4 It shall be possible to control every breaker in the test position both from Switchgear as well as remote (DCS) for testing purpose.

11.1.5 **ALL OTHER SERVICES.**

All the motors / Valves and other equipment shall be controlled from respective process control panels/DCS to be supplied by Vendor.

Emergency stop pushbutton shall be provided near all drives except emergency drives and shall be wired directly to MCC. In case of emergency drives, emergency start PB only shall be provided.

11.1.6 The control room shall provide indication & alarms for the 415V auxiliary supply as given below. Any additional indications/alarms considered necessary during detailed engineering also shall be provided. Some of these shall be selected for sequential event recording. For each breaker and bus, grouped alarm for any abnormal conditions shall be provided in the control desk. For all breaker (ACB/MCCB) fed switchgear, status indications shall be available on CRT in form of SLD.

		MCC	DCS / PLC	ECP
STATUS INDICATION				
(a)	Incomer & Bus coupler breaker (ACB/MCCB) feeders			
	➤ Breaker ON	✓	✓	✓
	➤ Breaker OFF	✓	✓	✓
	➤ Breaker in local	✓	✓	✓
	➤ Breaker in remote	✓	✓	✓
	➤ Breaker in service	✓	✓	✓
	➤ Breaker in test	✓	✓	✓
	➤ DC supply healthy	✓	✓	✓

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		MCC	DCS / PLC	ECP
	➤ Breaker spring charged	✓	✓	✓
	➤ Trip Relay supervision	✓	✓	✓
(b)	Incomer & Bus coupler breaker (SFU) feeders			
	➤ Incomer /Bus coupler ON	✓	✓	✓
(c)	Motor Feeders			
	➤ Motor ON	✓	✓	✗
	➤ Motor OFF	✓	✓	✗
	➤ Motor Auto trip.	✓	✓	✗
	➤ Motor Local Emergency PB pressed	✗	✓	✗
	➤ Feeder Fault	✗	✓	✗
	➤ Breaker in Remote	✗	✓	✗
	➤ Breaker in Field	✗	✓	✗
	➤ Breaker in Local	✓	✓	✗
	➤ Breaker in service	✓	✓	✗
	➤ Breaker in test	✓	✓	✗
	➤ Breaker spring charged	✓	✓	✗
	➤ Trip Relay supervision	✓	✓	✗
	ALARM SIGNALS			
(d)	Incomer & Bus coupler breaker (ACB/MCCB) feeders			
	➤ Breaker auto tripped/L/O Relay operated	✗	✓	✓
	➤ Sources paralld beyond pre-set time	✗	✓	✓
	➤ Common outgoing feeder fault	✗	✓	✓
	➤ Incoming 220 V DC control supply failed	✗	✓	✓
(e)	Incomer & Bus coupler breaker (SFU)			

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PART B	RRVUNL, 2 x 660 MW, Super-Critical TPS Stage-V, Unit # 7 & 8 at Suratgarh, Rajasthan 415V SWITCHGEAR/ DISTRIBUTION BOARDS/MCC	SHEET 15 OF 16

		MCC	DCS / PLC	ECP
	feeders			
	➤ Incomer/Bus coupler Fuse blown	✓	✓	✓
(f)	BUS/Line PT			
	➤ Bus under voltage	✓	✓	✓
	➤ Bus PT fuse failed	✓	✓	✓
	➤ BUS PT not in service	✓	✓	✓
(g)	Motor Feeders			
	➤ Overload alarm	x	✓	x
	➤ Feeder fault / closing permissive not available	x	✓	x
	➤ Breaker trip circuit trouble	x	✓	x
	➤ Trip through process interlock.	x	✓	x
	➤ Local push button pressed	x	✓	x
	➤ Breaker spring not charged alarm	x	✓	x

11.1.7 The current, voltage, Power measurements for each bus shall be available both on control room as indicated in this section and elsewhere in the specification. Also for specific motors where the current transducers are indicated, the measurement shall be available at the DCS.

11.1.8 Each remote controlled feeder including spare feeders shall be provided with 2nos interposing relays for start & stop.

11.1.9 The operation, indications and fault alarms for the motors of the auxiliaries shall be displayed as covered in the specification as part of C&I requirements.

12.0 **TESTS**

12.1 Switchgear shall be subjected to all routine tests as per relevant standards along with following tests:

- Mechanical operation test
- Insulation resistance and 500V DC Megger before/ after 1 minute HV test
- Electrical control, interlock and sequential operation tests

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(d) Verification of wiring as per approved schematic.

12.2 Temperature rise test on each type and rating of Breaker and associated panels shall be carried out by the Vendor on breaker/Panel to be supplied for this project.

12.3 For all other type tests BIDDER shall submit valid type test reports for similar switchgear and ratings of breakers included in the offer. If these tests are not done or test results are not found satisfactory by the PURCHASER then such tests shall be carried out by Vendor without any cost implication.

12.4 Routine tests shall be carried out on all associated equipment supplied with switchgear as per relevant standards. Type test certificates of all associated equipment shall be furnished.

12.5 Valid type and routine test certificates shall be submitted by the VENDOR before despatch of the switchgear.

13.0 For technical particulars refer datasheet-A.

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