







CLAUSE NO.	TECHNICAL REQUIREMENTS			
2.08.00	HRC FUSES			
	1) Voltage Class		650 Volts	
	2) Rupturing capacity		80 KA (rms) for AC ckt. 20 KA for DC ckt.	
2.09.00	CONTACTORS			
	Type		Air break electro magnetic	
	2) Utilising Category		AC3 of IS/IEC 60947 for non reversible AC4 of IS/IEC 60947 for reversible drives	
2.10.00	RELAYS			
	1) Power frequency withstand voltage		2.5KV for 1 sec. or 2.0 KV for 1 min.	
2.11.00	CONTROL TRANSFORMERS			
	1) Type		Dry / Cast Resin	
	2) Voltage Ratio		415 / 110 with taps \pm 5% in steps of 2.5%	
	3) Class of insulation		Class-B or better	
	4) One minute power frequency withstand voltage		2.5 KV	
	5) Rating		1.5 x Adequate for application.	
2.12.00	LIGHTING TRANSFORMER / WELDING TRANSFORMER			
	1) Type & Rating		Dry type / 100 KVA	
	2) Voltage Ratio		415/415V, +/- 5% taps in steps of 2.5%	
	3) Class of insulation		B or better	
NORTH KARANPURA STPP (3 X 660 MW) EPC PACKAGE		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.:CS-4410-001-2	SUB SECTION B-06 LT SWITCHGEARS & LT BUSDUCT	PAGE 9 OF 71


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2.13.00	4) One minute power frequency withstand 2.5 KV voltage 5) Enclosure protection	IP-42	
	TRANSDUCERS		
	1) Current transducers <ul style="list-style-type: none"> a) Input b) Rated frequency c) Output d) Over current e) Accuracy 	0-1 A (CT secondary) 50HZ 4-20 mA (2 Nos. decoupled) Transducer for motor current ammeters shall be capable of withstanding min. 6 times CT sec. current of 1A for a min period of 30 seconds 1.0	
2.14.00	MCCB <ul style="list-style-type: none"> 1) Rated voltage 2) Rated insulation level 3) Rated ultimate &Service S.C. breaking capacity 4) Rated making capacity 5) Utilization category 	110 V(VT secondary) ,50 HZ (for AC)/240 V DC (for DC) 4-20 mA (2 Nos. decoupled) 1.0 415V 690V 50KA 105KA A	
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CLAUSE NO.	TECHNICAL REQUIREMENTS			
3.00.00	CONSTRUCTIONAL DETAILS OF SWITCHBOARDS			
3.01.00	All Switchboards i.e., 415 V Switchgears, Motor Control Centres (MCCs), AC Distribution Boards (ACDBs), 220 V DC Distribution Boards (DCDBs) and Solenoid Valve Distribution Boards, shall be of metal enclosed, indoor, floor-mounted, free-standing type.			
3.02.00	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 2.0 mm. 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 of 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.			
3.03.00	All panel edges and cover / door edges shall be reinforced against distortion by rolling, bending or by the addition of welded reinforcement members. The top covers of the panels should be designed such that they do not permanently bulge/ bend by the weight of maintenance personnel working on it.			
3.04.00	The switchboards shall be of bolted design. The complete structures shall be rigid, self-supporting, and free from flaws, twists and bends. All cutouts shall be true in shape and devoid of sharp edges.			
3.05.00	All switchboards shall be of dust-proof and vermin-proof construction and shall be provided with a degree of protection of IP: 5X as per IS/IEC 60947. However, the busbar chambers having a degree of protection of IP: 42 are also acceptable where continuous busbar rating is 1600A and above. Provision shall be made in all compartments for providing IP: 5X degree of protection, when circuit - breaker or module trolley has been removed. All cutouts shall be provided with EPDM / Neoprene gaskets.			
3.06.00	Provision of louvers on switchboards would not be preferred. However, louvers backed with metal screen are acceptable on the busbar chambers where continuous busbar rating is 1600 A and above.			
3.07.00	The enclosure for outdoor oil filtration panels shall be constructed of stainless steel sheets in order to have protection against corrosion. The Degree of protection for outdoor panels shall be IP:65. The panels shall be mounted on a pedestal at a height of 500mm from ground level.			
3.07.00	All switchboards shall be of uniform height not exceeding 2450 mm.			
3.08.00	Switchboards shall be easily extendable on both sides by the addition of vertical sections after removing the end covers.			
3.09.00	Switchboards shall be supplied with base frames made of structural steel sections, along with all necessary mounting hardware required for welding down the base frame to the foundation			
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3.10.00	<p>/ steel insert plates. The base frame height shall be such that floor finishing (50 mm thick) to be done by Contractor after erection of the switchboards does not obstruct the movement of doors, covers, withdraw able modules etc.</p> <p>All switchboards shall be divided into distinct vertical sections (panels), each comprising of the following compartments:</p> <p>(a.) BUSBAR COMPARTMENT</p> <p>A completely enclosed bus bar compartment shall be provided for the horizontal and vertical bus bars. Bolted covers shall be provided for access to horizontal and vertical busbars and all joints for repair and maintenance, which shall be feasible without disturbing any feeder compartment. Auxiliary and power bus bars shall be in separate compartments.</p> <p>(b.) SWITCHGEAR / FEEDER COMPARTMENT</p> <p>All equipment associated with an incomer or outgoing feeder shall be housed in a separate compartment of the vertical section. Two-tier breaker arrangement in a vertical section shall be offered for outgoing breaker feeders of rating up to 1600A. The design of the vertical section for such an arrangement shall ensure ease of termination of power cables of size & quantity as specified in clause 42.00.00. The compartment shall be sheet steel enclosed on all sides with the withdraw able units in position or removed. Insulating sheet at rear of the compartment is also acceptable. The front of the compartment shall be provided with the hinged single leaf door with captive screws for positive closure.</p> <p>(c.) CABLE COMPARTMENT OR CABLE ALLEY</p> <p>A full-height vertical cable alley of minimum 250mm width shall be provided for power and control cables. Cable alley shall have no exposed live parts and shall have no communication with busbar compartment. Cable terminations located in cable alley shall be designed to meet the Form IVb Type 7 (as per IEC 60439) for safety purpose. The termination for each module shall have its own integral glanding facility. Wherever cable alleys are not provided for distribution boards, segregated cable boxes for individual feeders shall be provided at the rear for direct termination of cables. For circuit breaker external cable connections, a separately enclosed cable compartment shall also be acceptable. The contractor shall furnish suitable plugs to cover the cable openings in the partition between feeder compartment and cable alley. Cable alley door shall be hinged.</p> <p>(d.) CONTROL COMPARTMENT</p> <p>A separate compartment shall be provided for relays and other control devices associated with a circuit breaker.</p>			
3.11.00	<p>Sheet steel barriers shall be provided between two adjacent vertical panels running to the full height of the switchboard, except for the horizontal busbar compartment. EPDM / Neoprene gasket shall be provided between the panel sections to avoid ingress of dust into panels.</p>			
3.12.00	<p>After isolation of power and control circuit connections it shall be possible to safely carryout maintenance in a compartment with the busbar and adjacent circuit live. Necessary shrouding arrangement shall be provided for this purpose. Wherever two breaker compartments are provided in the same vertical section insulating barriers and shrouds shall be provided in the rear cable compartment to avoid accidental touch with the live parts of one circuit when working on the other circuit.</p>			
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3.13.00	<p>All 415V switchgear (circuit-breaker) panels shall be of single-front type. MCCs and DBs shall be of single-front / double-front construction as per the requirements. All single-front switch boards shall be provided with single-leaf, hinged or bolted covers at the rear. The bolts shall be of captive type. The covers shall be provided with "DANGER" labels. All panel doors shall open by 90 deg or more. In case of double-front MCCs, if this cannot be achieved for panels adjacent to a breaker panel, suitable dummy panel shall be provided by the Contractor wherever necessary.</p>		
4.13.01	<p>MCCs located on the Stacker reclaimers, paddle feeders, traveling trippers shall be fixed type, compartmentalized, single front and suitable for the system fault level. No spare feeders are to be provided on these MCCs, Degree of protection for the MCCs mounted on paddle feeders and traveling trippers shall be IP-65.</p>		
3.14.00	<p>All ACDBs, DCDBs and Solenoid Valve DBs shall be of fixed module type. All 415V circuit-breaker modules and contactor controlled motor modules shall be of fully draw out type having distinct 'Service' and 'Test' positions. The equipment pertaining to a draw out type incomer or feeder module shall be mounted on a fully withdrawable chassis which can be drawn out without having to unscrew any wire or cable connection. Suitable arrangement with cradle/ rollers, guides along with tool/lever operated racking in/out mechanism shall be provided for smooth and effortless movement of the chassis. For modules of size more than half the panel height, double guides shall be provided for smooth removal or insertion of module. All identical module chassis of same size shall be fully interchangeable without having to carryout any modifications. Suitable interlock shall be provided in DCDB for prevention of opening of Isolator (Incomer) when the bus coupler is open and vice-versa.</p>		
3.15.00	<p>All disconnecting contacts for power and control circuits of drawout modules shall be of robust and proven design, fully self aligning and spring-loaded. Both fixed and moving contacts shall be silver-plated and replaceable. The spring-loaded power and control drawout contacts shall be on withdrawable chassis and the same on fixed portion shall not be accepted. Detachable plug and socket type control terminals shall also be acceptable.</p>		
3.16.00	<p>Individual opening in the vertical bus enclosure shall permit the entry of moving contacts from the drawout modules into vertical droppers.</p>		
3.17.00	<p>As indicated in schematic drawings of DDCMIS controlled modules, contractor shall supply & mount two (2) coupling relays in the corresponding modules.</p>		
3.18.00	<p>All equipment and components shall be neatly arranged and shall be easily accessible for operation and maintenance. The internal layout of all modules shall be subject to owner's approval. The Contractor shall submit dimensional drawings showing complete internal details of busbars and module components, for each type and rating for approval of owner.</p>		
3.19.00	<p>Owner reserves the right to alter the cable entries, if required during detailed engineering, without any additional commercial implication.</p>		
3.20.00	<p>Each switchboard shall be provided with undrilled, removable type gland plate, which shall cover the entire cable alley. Contractor shall ensure that sufficient cable glanding space is</p>		
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	<p>available for all the cables coming in a particular section through gland plate. For all single core cables, gland plate shall be of non-magnetic material. The gland plate shall preferably be provided in two distinct parts for the easy of terminating addition cables in future. The gland plate shall be provided with gasket to ensure enclosure protection. Recommended drilling chart of gland plates for all power and control cables in the vertical panels shall be indicated by the Contractor in the respective G.A. drawings of the boards.</p>			
3.21.00	<p>The Contractor shall consider layout of panels in a switchboard consisting of various feeder modules in a straight line, unless specified otherwise. The actual composition and disposition of various modules in a switchboard shall be finalised during detailed engineering. The Contractor shall provide adopter panel / dummy panel required to meet various configuration / arrangement of busbars adopted by the Contractor. The Switchboards fed from indoor transformer will be flange connected to the same and the same shall be located as close as desirable to the transformer. The details of transformer flanges for those transformers not being supplied under this package shall be given to the contractor for matching the connections. The switchboards fed from outdoor transformers of rating 1MVA and above shall preferably be connected through busducts. Busduct connections wherever applicable shall be preferably in a straight line alignment. The centre line of the busduct will be finalized during detailed engineering. Adopter panels and dummy panels shall be provided wherever required.</p>			
3.22.00	<p>Adequate space in a separate compartment shall be identified for mounting of Ethernet Switch (19" rack mounting) in all switchgears provided with numerical relays. Further, mounting of Ethernet switch in the above compartment and inter-panel wiring of Ethernet cable for connection of numerical relays to Ethernet switch shall be in the contractor's scope. Arrangement to provide required control supply to Ethernet switch shall be made in the switchgear.</p>			
3.23.00	<p>CLEARANCES</p> <p>The minimum clearance in air between phases and between phases and earth for the entire run of horizontal and vertical busbars and bus-link connections at circuit-breaker shall be 25 mm. For all other components, the clearance between "two live parts", "a live part and an earthed part", shall be atleast ten (10) mm throughout. Wherever it is not possible to maintain these clearances, insulation shall be provided by sleeving or barriers. However, for horizontal and vertical busbars the clearances specified above should be maintained even when the busbars are sleeved or insulated. All connections from the busbars upto switch / fuses shall be fully shrouded / insulated and securely bolted to minimize the risk of phase to phase and phase to earth short circuits.</p>			
4.00.00	<p>CONSTRUCTIONAL DETAILS OF AC & DC FUSE BOARDS</p>			
4.01.00	<p>All fuse boards shall be metal enclosed, fixed type, non-compartmentalized construction, suitable for indoor/ outdoor mounting on wall or steel structure.</p>			
4.02.00	<p>The fuse board frame shall be fabricated using suitable mild steel structures or pressed and shaped cold rolled sheet steel of thickness not less than 2.0 mm. The frames shall be enclosed by cold rolled sheet steel of thickness not less than 1.6 mm.</p>			
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4.03.00	The fuse boards shall be provided with doors on the front. The doors shall preferably be in two halves with hinges at the extreme ends and locking facility at the centre.			
4.04.00	Suitable EPDM/Neoprene gaskets shall be provided to make fuse boards completely dust and vermin-proof with a degree of protection of IP-52 for indoor and IP-54 for outdoor application, as per IS/IEC 60947.			
4.05.00	<p>Each DC fuse board shall comprise of the following :</p> <p>(a.) 1 no. 63 A switch as incomer</p> <p>(b.) 100 A fully insulated (PVC sleeved or epoxy coated) busbars.</p> <p>(c.) 8 nos. 16A outgoing Fuse feeders.</p> <p>(d.) 1 no. auxiliary contactor for supply monitoring.</p> <p>(e.) 1 no. indicating lamp with resistor and blue coloured lens.</p>			
4.06.00	<p>Each AC fuse board shall comprise of the following :</p> <p>(a.) 1 no. 63A TPN switch as incomer.</p> <p>(b.) 100 A, 3-phase, 4-wire, fully insulated (PVC sleeved or epoxy coated) busbars.</p> <p>(c.) 9 nos. 16 A single phase switch fuse units and 3 nos. 16 A TPN switch fuse units as outgoing feeders or alternatively 16 amps MCCB can be provided.</p> <p>(d.) 3 nos. indicating lamps with resistors and coloured lenses (R, Y, B) for incoming supply monitoring.</p>			
4.07.00	The fuses shall be mounted in an insulating fuse carrier and it shall be possible to replace the outgoing feeder fuses without disturbing the other feeders. The handle of incoming switch shall be mounted on the door of the fuse board, with padlocking facility in both 'ON' and 'OFF' positions. The outgoing feeder switches shall preferably be of rotary type.			
4.08.00	Cable entry facilities shall be provided at top / bottom with removable gland plates of suitable thickness. All incoming and outgoing cables shall be terminated on suitable terminal blocks.			
5.00.00	<p>POWER BUSBARS AND INSULATORS</p> <p>All 415 V Switchboards, MCCs and ACDBs shall be provided with three phase and neutral busbars as specified in BOM. Two separate sets of vertical busbars shall be provided in each panel of double front MCCs. Interleaving arrangement for busbars shall be adopted for switchboards with a rating of more than 1600A. DCDBs shall be provided with two (2)</p>			
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	<p>busbars. Entire busbar system shall be insulated with PVC sleeves. Busbar sleeves shall be compliant to UL224 (Extruded insulating tubing),CE/UL certified, having fire retardant properties and working temperature of 105°C.</p> <p>5.01.00 All busbars and jumper connections shall be of high conductivity aluminum alloy / copper of adequate size.</p> <p>5.02.00 The cross-section of the busbars shall be uniform throughout the length of switchboard section and shall be adequately supported and braced to withstand the stresses due to the specified short circuit currents. Neutral busbar short circuit strength shall be same as main busbars.</p> <p>5.03.00 All busbars shall be adequately supported by non-hygroscopic, non-combustible, track-resistant and high strength sheet molded compound or equivalent type polyester fiber glass molded insulator. Separate supports shall be provided for each phase and neutral busbar. If a common support is provided, anti-tracking barriers shall be provided between the supports. Insulator and barriers of inflammable material such as Hylam shall not be accepted. The busbar insulators shall be supported on the main structure.</p> <p>5.04.00 All busbar joints shall be provided with high tensile steel bolts, belleville / spring washers and nuts, so as to ensure good contacts at the joints. Non-silver plated busbar joints shall be thoroughly cleaned at the jointed locations and suitable contact grease shall be applied just before making a joint. All bolts shall be tightened by torque spanner to the recommended value. The overlap of the busbars at each joint surface shall be such that the length of overlap shall be equal to or greater than the width of the busbar. All copper to aluminum joints shall be provided with suitable bimetallic washers.</p> <p>5.05.00 All busbars shall be color coded as per IS: 375.</p> <p>5.06.00 Wherever the busbars are painted with black Matt paint, the same should be suitable for temperature encountered in the switchboard under normal operating conditions.</p> <p>5.07.00 The Contractor shall furnish calculations establishing the adequacy of bus bar sizes for specified current ratings.</p> <p>6.00.00 AUXILIARY BUSBARS AND CONTROL TRANSFORMERS</p> <p>6.01.00 AC CONTROL SUPPLY BUSBAR</p> <p>Each bus-section of all Switchgears and MCCs shall be provided with two (2) nos. 415V / 110V control transformers. The 110V AC control supply from the control transformers shall be run through the MCC by means of two sets of control supply busbars of electrolytic copper. In case of one transformer failure, whole bus section can be fed through single transformer. The control supply to different modules shall be tapped individually from the control supply busbars.</p>		
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6.02.00	<p>DC CONTROL SUPPLY BUSBARS</p> <p>Electrically controlled circuit breaker boards shall be provided with DC control supply busbars. The manually controlled breakers shall also be provided with such busbars in case relays are provided. Each section of the switchboard shall be provided with a DC supply by the Contractor. The Contractor shall provide suitable terminals, switch-fuse etc. to receive the DC supply and distribute the same through above mentioned control busbars to the required modules of the respective section. The DC control supply bus of one section shall be coupled to the control supply of other section through a switch located in the bus-coupler breaker panel. The DC supply to the bus-coupler breaker may be given from any of the control buses. For emergency switchgear, Contractor shall provide two DC supplies. The contractor shall provide suitable diodes to derive the control supply through diode auctioneering from the above two supplies. Power Supply to Numerical Relay and Ethernet switch shall be an independent circuit with switch and fuse tapped from the panel DC supply. Exact scheme for segregation of switchgear & numerical relay DC supplies shall be finalized during detailed engineering.</p>			
6.03.00	<p>SPACE HEATER BUSBARS</p> <p>Panel and motor space heaters shall be fed from separate AC auxiliary busbars running throughout the switchboard. The supply for these busbars shall be tapped from incomer, before the isolating switch/circuit breaker. Incoming circuit to space-heater bus shall have an isolating switch, HRC fuse and neutral link of suitable rating. Suitable terminals shall also be provided to facilitate energisation of space-heater bus from outside during long shutdowns of unit / switch-board.</p>			
6.04.00	<p>CONTROL TRANSFORMERS</p> <p>The control transformers shall be 415 V/110 V with neutral point-earthed, of insulation class 'B' or better. The sizing of Control transformers shall be carried out by Contractor considering the actual load of power contactors, auxiliary contactors, indicating lamps and other equipment in the module circuit. An additional load of 15 watts should also be considered for each module, for remote auxiliary relays and lamps to be connected in the control circuit of modules. Contractor shall also ensure that control transformers are adequately designed for meeting the momentary loading requirements & the voltage drop during this condition shall not be more than 5%.</p>			
7.00.00	<p>EARTH BUS AND EARTHING</p>			
7.01.00	<p>A galvanized steel / Copper / Aluminum earth bus shall be provided at the bottom of each panel and shall extend throughout the length of each switchboard. It shall be welded / bolted to the framework of each panel and breaker earthing contact bar. Vertical earth bus shall be provided in each vertical section which shall in turn be bolted / welded to main horizontal earth bus.</p>			
7.02.00	<p>The earth bus shall have sufficient cross section to carry the momentary short circuit and short time fault current to earth, as indicated in "Technical Parameters", without exceeding the allowable temperature rise.</p>			
7.03.00	<p>Suitable arrangements shall be provided at each end of the horizontal earth bus for bolting to Contractor's earthing conductors. The horizontal earth bus shall project out of the switchboard ends and shall have predrilled holes for this connection. All joint splices to earth bus shall be made through at least two bolts, and taps by proper lug and bolt connection.</p>			
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7.04.00	All non-current carrying metal work of the switchboard shall be effectively bonded to the earth bus. Electrical conductivity of the whole switchgear enclosure framework and truck shall be maintained even after painting.			
7.05.00	The carriage and breaker frame shall get earthed while being inserted in the panel and positive earthing of the breaker frame shall be maintained in all positions, i.e. SERVICE & ISOLATED, as well as throughout the intermediate travel.			
7.06.00	Each module frame shall get engaged to the vertical earth bus before the disconnecting contacts on the module are engaged to the vertical busbars.			
7.07.00	All metallic cases of relays, instruments and other panel-mounted equipment shall be connected to earth by independent stranded copper wires of size not less than 2.5 sq. mm. All the equipment mounted on the door shall be earthed through flexible wire/braids. Insulation color code of earthing wires shall be green. Earthing wires shall be connected to terminals with suitable clamp connectors, soldering is not acceptable. Looping of earth connections, which would result in loss of earth connections to other devices, when a device is removed, is not acceptable. However, looping of earth connections between equipment to provide alternative paths to earth bus is acceptable.			
7.08.00	VT and CT secondary neutral point earthing shall be at one place only, i.e. on the terminal block. Such earthing shall be made through links so that earthing of one secondary circuit shall be removed without disturbing the earthing of other circuit.			
7.09.00	All hinged doors having potential carrying equipment mounted on it shall be earthed by flexible wire/ braid. For doors not having potential carrying equipment mounted on it, earth continuity through scraping hinges/ hinge pins of proven design may also acceptable. The Contractor shall establish earth continuity at site also.			
8.00.00	CIRCUIT BREAKERS			
8.01.00	Circuit breakers shall be three pole, air break, horizontal draw out type, and shall have fault making and breaking capacities as specified in "Technical Parameters". The circuit breakers which meet specified parameters of continuous current rating and fault making / breaking capacity only after provision of cooling fans or special device shall not be acceptable.			
8.02.00	Circuit breakers along with its operating mechanism shall be provided with suitable arrangement for easy withdrawal. Suitable guides shall be provided to minimize misalignment of the breaker.			
8.03.00	There shall be "SERVICE", "TEST" and "FULLY WITHDRAWN" positions for the breakers. In "Test" position the circuit breaker shall be capable of being tested for operation without energizing the power circuits i.e. the power contacts shall be disconnected, while the control circuits shall remain undisturbed. Locking facilities shall be provided so as to prevent movement of the circuit breaker from the "SERVICE", "TEST" or "FULLLY WITHDRAWN"			
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<p>8.04.00</p> <p>8.05.00</p> <p>8.06.00</p> <p>8.07.00</p> <p>8.07.01</p> <p>8.07.02</p> <p>8.07.03</p> <p>8.07.04</p> <p>8.07.05</p>	<p>position. It shall be possible to close the door in "Test" position. The circuit breaker rack in and rack out from Service to Test, Test to Isolated position or vice-versa shall be possible only in the door closed position.</p> <p>All circuit breakers shall be provided with "6 NO" and "6NC" potential free auxiliary contacts. These contacts shall be in addition to those required, for internal mechanism of the breaker and should be directly operated from breaker operating mechanism. In case the manufacturer does not have a proven arrangement for providing the required number of circuit breaker auxiliary contacts on the fixed portion of the cubicle, necessary electrically reset latched relays shall be provided complete with all wiring in series with service position limit switch contacts, for multiplying the circuit breaker mounted auxiliary contacts and provide 4 NO and 4 NC contacts. Separate limit switches, each having required numbers of contacts shall be provided in both "SERVICE" and "TEST" position of the breaker. All contacts shall be rated for making, continuously carrying and breaking 10 Amp at 240 V AC and 1 Amp (Inductive) at 240 V DC respectively.</p> <p>Suitable mechanical indications shall be provided on all circuit breakers to show "OPEN", "CLOSE", "SERVICE ", "TEST" AND "SPRING CHARGED" positions.</p> <p>Main poles of the circuit breakers shall operate simultaneously in such a way that the maximum difference between the instants of contacts touching during closing shall not exceed half a cycle of rated frequency.</p> <p>All circuit breakers shall be provided with the following interlocks :</p> <p>Movement of a circuit breaker between "SERVICE" and "TEST" position shall not be possible unless it is in open position. Attempted withdrawal of a closed circuit breaker shall preferably not trip the circuit breaker. In case the offered circuit breaker trips on attempted withdrawal as a standard interlock, it shall be ensured that sufficient contact exists between the fixed and draw out contact at the time of breaker trip so that no arcing takes place even with the breaker carrying its full rated current.</p> <p>Closing of a circuit breaker shall not be possible unless it is in "SERVICE" position, "TEST" position or in "FULLY WITHDRAWN" position.</p> <p>Circuit-breaker cubicles shall be provided with safety shutters operated automatically by the movement of the circuit breaker carriage, to cover the stationary isolated contacts when the breaker is withdrawn. It shall however be possible to open the shutters intentionally against pressure for testing purposes.</p> <p>A breaker of particular rating shall be prevented from insertion in a cubicle of a different rating.</p> <p>Circuit breakers shall be provided with coded key / electrical interlocking devices, as per requirements.</p>	<p>NORTH KARANPURA STPP (3 X 660 MW) EPC PACKAGE</p>	<p>TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.:CS-4410-001-2</p>	<p>SUB SECTION B-06 LT SWITCHGEARS & LT BUSDUCT</p>	<p>PAGE 19 OF 71</p>


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8.08.00	Circuit breaker shall be provided with anti-pumping feature (soft) and trip free feature, even if mechanical anti-pumping feature is provided.			
8.09.00	Mechanical tripping shall be possible by means of front mounted Red "trip" push-button. In case of electrically operated breakers these push buttons shall be shrouded to prevent accidental operation.			
8.10.00	Complete shrouding / segregation shall be provided between incoming and outgoing bus links of breakers. In case of bus coupler breaker panels the busbar connection to and from the breaker terminals shall be segregated such that each connection can be approached and maintained independently with the other bus section live. Dummy panels if required to achieve the above feature shall be included in the Contractor's scope of supply.			
8.11.00	Circuit breaker shall be provided with Power operated mechanism as follows.			
1.	Power operated mechanism shall be provided with a universal motor suitable for operation on 240 V DC / 240 AC Control supply, with voltage variation from 198 V to DC to 242 V DC . Motor insulation shall be class "E" or better.			
2.	The motor shall be such that it requires not more than 30 seconds for fully charging the closing spring at minimum available control voltage.			
3.	Once the closing springs are discharged, after one closing operation of circuit breaker, it shall automatically initiate recharging of the spring.			
4.	The mechanism shall be such that as long as power is available to the motor, a continuous sequence of closing and opening operations shall be possible. After failure of power supply at least one open-close-open operation shall be possible.			
5.	Provision shall be made for emergency manual charging and as soon as this manual charging handle is coupled, the motor shall automatically get mechanically decoupled.			
6.	All circuit breakers shall be provided with closing and trip coils. The closing coil shall operate correctly at all values of voltage from 187-242 V DC. The trip coil shall operate satisfactorily at all values of voltage from 154-242V DC /77 V-121 V DC			
7.	Provision for mechanical closing of the breaker only in "Test" and "WITHDRAWN" positions shall be made. Alternately, the mechanical closing facility shall be normally made inaccessible; accessibility being rendered only after deliberate removal of shrouds.			
8.	It shall not be possible to open the ACB panel door in breaker closed condition.			
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CLAUSE NO.	TECHNICAL REQUIREMENTS			
<p>8.12.00</p> <p>9.00.00</p> <p>9.01.00</p> <p>9.02.00</p> <p>10.03.00</p> <p>10.04.00</p> <p>10.05.00</p> <p>10.06.00</p> <p>10.07.00</p>		<p>Further, the racking mechanism shall be accessible only after opening the breaker panel door.</p>		
	<p>Note: The circuit breakers for DC applications shall have manually operated mechanism of spring charged, stored energy type. The closing operation of the circuit breaker shall charge the tripping spring. Necessary interlocks shall be provided to inhibit closing of the circuit breaker unless the closing spring is fully charged.</p>			
	<p>TELESCOPIC TROLLEY</p>	<p>Telescopic trolley or suitable arrangement shall be provided for maintenance of circuit-breaker module in a cubicle. The trolley shall be such that the top most breaker module can be withdrawn on the trolley and can be lowered for maintenance purpose. The telescopic trolley shall be such that all type, size and rating of breaker can be withdrawn /inserted of particular switchgear. The quantity of telescopic trolleys to be supplied shall be adequate for the number of switchgears / switchgear rooms.</p>		
	<p>AIR BREAK SWITCHES</p>			
	<p>Air break switches shall be of heavy duty, single throw, group operated, load break, fault make type when associated with fuses. All switches for motor circuits shall be of utilization category AC-23A with 1NO +1NC auxiliary contact, which shall be wired to the control circuit as shown in the schematic drawings. All switches for other outgoing feeders shall be of utilization category AC-22A. All switches for DC circuits shall be suitable for 240 V DC and shall be of DC-22 utilization category.</p>			
	<p>Continuous current rating of the switches shall be selected from the 'Module Selection tables' for various feeders.</p>			
	<p>The combination of switch-fuse unit would be preferred. However, if separate switch and fuses are provided, switch shall be located before fuses.</p>			
	<p>The main switches shall be operable from outside the module door. The switch handle shall clearly indicate the position of switch. Switch operating handles shall be provided with padlocking facilities. However, incomer switches of switchboards shall be provided with padlocking facility in both 'ON' and 'OFF' positions.</p>			
	<p>Interlocks shall be provided such that the cubicle door will not open when the switch is in closed position and the switch will close only when the door is closed.</p>			
	<p>Switches and fuses for AC/DC control supply and heater supply wherever required, shall be mounted inside the cubicles. Toggle switch is not acceptable.</p>			
<p>Even if a single phase feeder is required for certain applications, Contractor shall provide TPN switch, fuse-bases and cable/ link connections between switch/fuse and vertical busbars for all the three phases, so that changing from single phase feeder to three phase feeder is possible without any modification other than inserting fuses at site.</p>				
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CLAUSE NO.	TECHNICAL REQUIREMENTS 		
10.00.00	MCCB		
10.01.00	MCCB shall be fixed type/part of withdraw able feeder module as per specification, three pole, air break type having trip free mechanism with quick make and quick break type contacts. MCCB shall have current limiting feature. MCCB of identical ratings shall be physically and electrically interchangeable. MCCB shall be provided with 1 NO and 1NC auxiliary contacts.		
10.02.00	MCCB shall be provided with Microprocessor based inbuilt front adjustable releases (overload & short circuit) and shall have adjustable earth fault protection unit also. The protection settings shall have suitable range to achieve the required time & current settings. LED indications shall also be provided for faults, MCCB status(on/off etc).		
10.03.00	MCCB terminals shall be shrouded and designed to receive cable lugs for cable sizes relevant to circuit rating. Extended cable terminal arrangement for higher size cable may also be offered. ON and OFF position of the operating handle of MCCB shall be displayed and the rotary operating handle shall be mounted on the door of the compartment housing MCCB. The compartment door shall be interlocked mechanically with the MCCB, such that the door can not be opened unless the MCCB is in OFF position. MCCB shall be provided with padlocking facility to enable the operating mechanism to be padlocked. The MCCBs being offered shall have common/interchangeable accessories for all ratings like aux. switch ,shunt trip, alarm switch etc. The MCCBs shall have the current discrimination up to full short circuit capacity and shall be selected as per manufacturers discrimination table.		
10.04.00	The auxiliary contacts of the MCCB shall be fed to the digital inputs available in the numerical relays of Incomer/bus coupler/motor circuit breaker feeders , for integration in to the numerical relay network.		
11.00.00	CONTROL AND SELECTOR SWITCHES		
11.01.00	Control and selector switches shall be of heavy duty, rotary type with escutcheon plates clearly marked to show the positions. The control & selector switches should be as per IS/IEC 60947 Part V section 1. The switches shall be of sturdy construction suitable for mounting on panel front. Switches with shrouding of live parts and sealing of contacts against dust ingress shall be preferred.		
11.02.00	Ammeter and voltmeter selector switches shall have four stay put positions with adequate number of contacts for 3-phase 4-wire system. These shall have oval handles. Ammeter selector switches shall have make before break type contacts to prevent open circuiting of CT secondary.		
11.03.00	Contacts of the switches shall be spring assisted and shall be of suitable material to give a long trouble free service.		
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CLAUSE NO.	TECHNICAL REQUIREMENTS									
11.04.00	<p>The contact ratings shall be at least the following :</p> <table border="1" data-bbox="347 286 1442 533"> <tr> <td data-bbox="347 286 504 367">1.</td> <td data-bbox="504 286 1442 367">Make and carry, continuously, 10 A at 240 V DC and 110 V AC</td> </tr> <tr> <td data-bbox="347 367 504 448">2.</td> <td data-bbox="504 367 1442 448">Breaking current at 240 V DC, 1 A (inductive)</td> </tr> <tr> <td data-bbox="347 448 504 533">3.</td> <td data-bbox="504 448 1442 533">Breaking current at 110 V AC and 0.3 lagging p.f., 5A</td> </tr> </table>				1.	Make and carry, continuously, 10 A at 240 V DC and 110 V AC	2.	Breaking current at 240 V DC, 1 A (inductive)	3.	Breaking current at 110 V AC and 0.3 lagging p.f., 5A
1.	Make and carry, continuously, 10 A at 240 V DC and 110 V AC									
2.	Breaking current at 240 V DC, 1 A (inductive)									
3.	Breaking current at 110 V AC and 0.3 lagging p.f., 5A									
12.00.00	CONTACTORS									
12.01.00	Motor starter contactors shall be of air break, electromagnetic type rated for uninterrupted duty as per IS/IEC 60947 Part-4 Section- 1.									
12.02.00	Contactors shall be double-break, non-gravity type and their main contacts shall be silver faced.									
12.03.00	Direct-on-line contactors shall be of utilization category AC3. Reversing starters shall comprise of Forward and Reverse contactors mechanically and electrically interlocked with each other. These contactors shall be of utilization category AC4. DC contactors shall be of DC3 utilization category. For CHP conveyor motors, minimum rating of power contactors shall be 240% of full load current of the motors. For other CHP drives, minimum rating of power contactors shall be 160% of full load current of motor.									
12.04.00	The number of normally open (NO) and normally closed (NC) auxiliary contacts of a contactor shall be as per requirement shown in the respective module drawings. It shall, however, be not less than 2NO+2NC.									
12.05.00	Operating coil of contactors shall be of 110 V AC unless otherwise specified elsewhere. The contactor shall operate satisfactorily between 85% and 110% of the rated voltage. The contactor shall not drop out at 70% of the rated voltage but shall definitely drop out at 20% of the rated voltage.									
12.06.00	Contactors for DC drives shall have a coil voltage of 240 V DC. DC operated contactor coil shall have an economy resistor and shall be suitable for satisfactory continuous operation at 187-242 V DC/ 93.5-121 V									
13.00.00	FUSES									
13.01.00	All fuses shall be of HRC cartridge fuse link type. Screw type fuses shall not be accepted. Fuses for AC circuits shall be rated for 80kA rms (prospective) breaking capacity at 415V AC and for DC circuits, 20kA rms breaking capacity at 240V DC.									
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CLAUSE NO.	TECHNICAL REQUIREMENTS 		
13.02.00	Fuse shall have visible operation indicators. Insulating barriers shall be provided between individual power fuses.		
13.03.00	Fuse 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 bases. In such cases one set of insulated fuse pulling handles shall be supplied with each switchboard.		
13.04.00	Fuse ratings shall be selected by the Contractor from the 'Module Selection Tables' for various feeder ratings. However, the fuse ratings for motor feeders given in the 'Motor Module Selection Table' are indicative only, and the same shall be coordinated by the Contractor to achieve class-II protection coordination and also to match the motor characteristics. Switch rating shall in no case be less than the fuse rating.		
13.05.00	The Neutral links shall be mounted on fuse carriers which shall be mounted on fuse bases.		
14.00.00	INSTRUMENT TRANSFORMERS		
14.01.00	All current and voltage transformers shall be completely encapsulated, cast resin insulated type suitable for continuous operation at the temperature prevailing inside the switchgear enclosure, when the switchboard is operating at its rated condition and the specified ambient temperature. The class of insulation shall be 'E' or better.		
14.02.00	All instrument transformers shall be able to withstand the thermal and mechanical stresses resulting from the maximum RMS short circuit breaking and peak making current ratings of the associated switchgear.		
14.03.00	All instrument transformers shall have clear indelible polarity markings. All secondary terminals shall be wired to separate terminals on an accessible terminal block where star point formation and earthing shall be done.		
14.04.00	Current transformers may be multi or single-core type. All voltage transformers shall be single phase type.		
14.05.00	The bus VTs shall be housed in a separate compartment. All VTs shall have readily accessible HRC current limiting fuses on both primary and secondary sides.		
14.06.00	All CTs shall be provided with supports independent of busbar / busbar supports.		
14.07.00	The CTs shall be located in such a way that they can be easily approached for maintenance without necessitating shut down of adjacent feeders.		
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CLAUSE NO.	TECHNICAL REQUIREMENTS 		
15.00.00 15.01.00 15.02.00 15.03.00 15.04.00 15.05.00 15.06.00	NUMERICAL RELAYS & NETWORKING All relays in protective circuits shall be flush mounted on panel front with connections from the inside. The protective relays shall be communicable numerical relays. These numerical relays shall be of types as proven for the application and shall be subject to owner's approval. Numerical relays shall have appropriate setting ranges, accuracy, resetting ratio and other characteristics to provide required sensitivity. All equipments shall have necessary protections as detailed in the standard scheme drawings. The circuit breaker will normally be controlled from remote control panels (DDCMIS) through closing and shunt trip coils. Additionally, control shall be carried out from the Switchgear SCADA System through the Numerical relay. The Local control console of the relay flush mounted on the switchgear would normally be used only for testing of circuit breaker in isolated position, and for tripping it in an emergency. Provision for closing & tripping of the circuit breaker locally from laptop through serial port shall be possible to facilitate commissioning activities. The basic control scheme of breaker feeders shall be developed as per the schematic logics in the relay. The schematics shall be developed in soft inside the relay. Numerical relays shall be interfaced with DDCMIS through 24V DC signal for closing / opening operations. The numerical relay shall be capable of measuring and storing values of a wide range of quantities, events, faults and disturbance recordings. The alarm / status of each of protection function and trip operation shall be communicated to DDCMIS. The numerical relays shall have built in feature / hardware interface to provide such inputs to DDCMIS for analog / digital values. All the numerical relays shall have communications on three ports; local front port communication to laptop and a dual port on IEC 61850 to communicate with the data concentrator through LAN and Ethernet switches. Ethernet switches shall be connected through Fibre Optic cable to Numerical Relay network as specified elsewhere. Preferably, the numerical relays shall be capable of communicating simultaneously on both the redundant ring networks for seamless switchover. All relays and timers shall be rated for control supply voltage as mentioned elsewhere under parameters and shall be capable of satisfactory continuous operation between 80-120% of the rated voltage. Making, carrying and breaking current ratings of their contacts shall be adequate for the circuits in which they are used. The protective relays shall have at least 10 Nos programmable potential free contacts. Programmable Auxiliary relays shall have contacts as required. Failure of a control or auxiliary supply and deenergisation of a relay shall not initiate any circuit breaker /contactor operation. All relay digital output contacts shall withstand a minimum test voltage of 2kV AC rms for one minute.		
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CLAUSE NO.	TECHNICAL REQUIREMENTS 		
15.07.00	All the numerical relays shall have adequate processor memory for implementing the programmable scheme logic required for the realization of the protection / control schemes, in addition to the built in protection algorithms.		
15.08.00	Relays shall be suitable for electrical measurement including voltage, current, power (active/reactive) and energy parameters.		
15.09.00	Relays shall have separate output for individual functionality and the master trip shall be software configurable in case of multi output relays. Relays shall have event recording feature, recording of abnormalities and operating parameters with time stamping		
15.10.00	Preferably comprehensive single numerical relay shall have provision of both current and voltage inputs. The current operated relay shall have provision for 4 sets of CT inputs, 3 nos. for phase fault & 1 CT input for earth fault. Relay shall be suitable for both residually connected CT input as well as CBCT input. The voltage-operated relay shall have provision for 3 PT inputs. Relays shall be suitable for CT secondary current of 1A / 5A selectable at site. Relays used in incomers and bus couplers shall have provision of two sets of voltage signal inputs for the purpose of synchronization.		
15.11.00	All CT & PT terminals shall be provided as fixed type terminals on the relay to avoid any hazard due to loose connection leading to CT opening or any other loose connection. In no circumstances Plug In type connectors shall be used for CT / PT connections. Contractor to ensure the same for all protective relay models offered.		
15.12.00	All numerical relay shall have key pad / keys to allow relay settings from relay front. All hand reset relays shall have reset button on the relay front. Relay to be self or hand reset shall be software selectable. Manual resetting shall be possible from remote.		
15.13.00	Relays shall have suitable output contact for breaker failure protection.		
15.14.00	Relays shall have self diagnostic feature with self check for power failure, programmable routines, memory and main CPU failures.		
15.15.00	Relays shall have at least two sets or groups of two different sets of adaptable settings. Relays shall have multiple IEC / ANSI programmable characteristics. Relays shall have self reset auxiliary contacts of programmable type.		
15.16.00	Design of the relay must be immune to any kind of electromagnetic interference. Contractor to submit all related type test reports for the offered model along with the offer.		
15.17.00	Relay shall be immune to capacitance effect due to long length of connected control cables. Any external hardware, if required for avoiding mal operation of the relay due to cable capacitance shall be included as a standard feature.		
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CLAUSE NO.	TECHNICAL REQUIREMENTS 		
	<p>All I/Os shall have galvanic isolation. Analog inputs shall be protected against switching surges, harmonics etc. Relays shall be provided with suitable harsh environment coating for protection against failure due to high temperature, humidity and dust.</p>		
15.18.00	<p>Numerical relays shall have two level password protections, one for read only and other for authorization for modifying the setting etc.</p>		
15.19.00	<p>Time clock synchronization feature shall be provided for synchronization of clocks of numerical relay and metering LAN with data concentrator time clock. Required hardware and software interface to receive GPS/Time signal to achieve time synchronization shall be supplied by the contractor. The resolution of time synchronization shall be +/- 1.0 millisecond or better throughout the entire system.</p>		
15.20.00	<p>Relays shall be suitable to accept both AC & DC supplies with range 110V or 240V with tolerance of 70 % to 120 % of rated voltage & shall be finalized during detailed engineering.</p>		
16.00.00	OTHER PROTECTIONS AND CONTROL FUNCTIONS IN THE RELAYS		
16.01.00	<p>For control from DDCMIS, 24V DC signal shall be provided from DDCMIS to the numerical relays. Preferably, no separate coupling relays shall be provided.</p>		
16.02.00	<p>Trip circuit supervision shall be provided for all feeders to monitor the circuit breaker trip circuit both in pre trip and post trip conditions.</p>		
16.03.00	<p>Schematics requiring auxiliary relays /timers for protection function shall be a part of numerical relay. The number of auxiliary relay and timer function for protection function shall be as required. Auxiliary relays for interlocking purpose shall be of self reset type.</p>		
16.04.00	<p>Bus no volt condition shall be configured to a output contact of the relay of all incomers for suitably interfacing with DDCMIS.</p>		
16.05.00	<p>Timer functions shall be programmable for on/off delays.</p>		
16.06.00	<p>The numerical relay shall be able to provide supervisory functions such as trip circuit monitoring, circuit breaker state monitoring, PT and CT supervisions and recording facilities with Post fault analysis.</p>		
16.07.00	<p>The numerical processor shall be capable of measuring and storing values of a wide range of quantities, all events, faults and disturbance recordings with a time stamping using the internal real time clock. Battery back up for real time clock in the event of power supply failure shall be provided.</p>		
16.08.00	<p>250 time tagged events /records should be able to store with time stamping Last 5 faults storage including the indication, protection operated , fault location relay and operating time, currents, voltage and time.</p>		
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CLAUSE NO.	TECHNICAL REQUIREMENTS 		
16.09.00	Diagnostics Automatic testing, power on diagnostics with continuous monitoring to ensure high degree of reliability shall be shall be provided. The results of the self reset functions shall be stored in battery back memory. Test features such as examination of input quantities, status of digital inputs and relay outputs shall be shall be available on the user interface.		
16.10.00	The alarm/status of each individual protection function and trip operation shall be communicated to DDCMIS.		
16.11.00	Sequence of events shall have 1 ms resolution at device level.		
16.12.00	Measurement accuracy shall be 1 % for RMS Current and voltage (20-120% of rated value).		
16.13.00	It shall be possible to carryout open / close operation of breakers from a laptop by interfacing from the relay front port during initial commissioning.		
16.14.00	Required no. of extra digital inputs shall be provided in the numerical relay for digital inputs from various outgoing MCCB feeders on that switchgear section.		
16.15.00	At least two licensed copies of necessary software for numerical relay configuration / setting / disturbance analysis and other utilities shall be supplied. Numerical relay configuration for all relays being supplied under the package shall be carried out in line with the approved schematics and shall be submitted for owner's approval. Setting calculations and relay settings configured in relay software for all relays shall be submitted for owner's approval. Approved relay configuration / settings shall be loaded in all the relays prior to dispatch to site.		
17.00.00	<p>TRAINING</p> <p>The contractor shall arrange for training on system design, engineering, operation and maintenance of Numerical relays and Switchgear networking system at the principal's facility for duration of two (2) man-months.</p> <p>Workshop Training at site shall aim for familiarization of Site Engineers for commissioning and day to day O & M of Numerical Relays and trouble shooting.</p> <p>The scope shall include Two No's of Numerical Relay and Training for a batch of 20 Engineers at Project Site. One such Workshop shall be organized before the commissioning of First LV Switchboard and the Second workshop shall be conducted before Unit Commissioning. Owner shall provide the required Infrastructure such as Training Conference room, Projection systems etc.</p>		
18.00.00	<p>INDICATING INSTRUMENTS</p>		
18.01.00	All indicating and integrating meters shall be flush mounted on panel front. The instruments shall be of at least 96mm square size with 90 degree linear scale and shall have an accuracy		
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CLAUSE NO.	TECHNICAL REQUIREMENTS			
<p>18.02.00</p> <p>18.03.00</p> <p>18.04.00</p> <p>18.05.00</p> <p>19.00.00</p> <p>19.01.00</p>	<p>class of 1.0 or better. The covers and cases of instruments and meters shall provide a dust and vermin proof construction.</p> <p>All instruments shall be compensated for temperature errors and factory calibrated to directly read the primary quantities. Means shall be provided for zero adjustment without removing or dismantling the instruments.</p> <p>All instruments shall have white dials with black numerals & lettering. Black knife edge pointer shall be provided for meters.</p> <p>Ammeters provided for motor feeders (for motors of rating $\geq 30\text{kW}$ & $< 100\text{kW}$) shall have a compressed scale at the upper current region to cover the starting current upto 6.0 times the CT primary current.</p> <p>All motor feeders of rating $\geq 30\text{ kW}$ and $< 110\text{ kW}$ and all motors of Dust Suppression System shall be provided with Multifunction Digital Energy Meter with communication facility to display the current, voltage, power factor, power energy related data locally as well as communicate these for remote metering/audit/analysis purposes. These meters shall The technical specification for Digital indicating energy meter shall be as follows:</p> <ul style="list-style-type: none"> a) Input Voltage:110VAC / 240VDC b) Input Current:1A c) Size:96X96 SQ.MM d) Power & Energy Accuracy: 1.0 e) Mounting: Flush mounting f) Type: True RMS 3-PHASE V,I, kW,PF & kWh indication g) 4 Digit, seven segment LED display/LCD display, with floating decimal h) Communication: In built RS 485 bus port i) Operating Frequency: 45 HZ-65HZ j) Dielectric Test: 2KV RMS for 1 minute k) Over Current: 10 times for 3 sec. l) Aux supply: 90V-300V AC/DC m) Compliance: EMC/EMI n) Field programmable CT ratio o) Analog Current Output (4-20 mA) <p>PUSH BUTTONS</p> <p>Push-buttons shall be of spring return, push-to-actuate type. Their contacts shall be rated to make, continuously carry and break 10 A at 110 V AC and 1 A (inductive) at 240 V DC.</p>			
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CLAUSE NO.	TECHNICAL REQUIREMENTS			
19.02.00	All push buttons shall have two (2) normally open and two (2) normally closed contact, unless specified otherwise. The contact faces shall be of silver alloy.			
19.03.00	All push-buttons shall be provided with integral escutcheon plates marked with its function.			
19.04.00	<p>The color of the button shall as follows :</p> <p>Green for motor START, breaker CLOSE , valve/ damper OPEN commands.</p> <p>Red for motor trip, breaker open, valve / damper close commands.</p> <p>Black for all annunciation functions, overload reset and miscellaneous commands including reverse for clinker grinder etc.</p>			
19.05.00	All push buttons on panels shall be located in such a way that Red push button shall always be to the left of Green push button. In case of clinker grinder etc. the push buttons would be black - red-green from left to right.			
19.06.00	All emergency push buttons shall have mushroom knobs.			
20.00.00	INDICATING LAMPS			
20.01.00	Indicating lamps shall be of CLUSTER LED type. The lamps shall have escutcheon plates marked with its function, wherever necessary.			
20.02.00	<p>Lamps shall have translucent lamp-covers of the following colours, as warranted by the application :</p> <p>Red for motor ON, valve / damper OPEN, breaker CLOSE.</p> <p>Green for motor OFF , valve / damper CLOSE, breaker OPEN.</p> <p>White for motor AUTO TRIP.</p> <p>Blue for all healthy conditions (e.g. control supply, and also for SPRING CHARGED").</p> <p>Amber for all Alarm Conditions (e.g. overload). Also for "SERVICE" and "TEST" position indications.</p>			
20.03.00	Bulbs and lamp covers shall be easily replaceable from the front of the cubicle. The method of mounting indicating lamp fittings on panels shall prevent their rotation under the action of lamp removal or replacements, reliance upon the tightness of ring nut for the purpose is not sufficient.			
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CLAUSE NO.	TECHNICAL REQUIREMENTS			
20.04.00	<p>Indicating lamps should be located just above the associated push-button / control switches. Red lamps shall invariably be located to the right of green lamps. In case a white lamp is also provided, it shall be placed between the red and green lamps along the centre line of control switch / push button pair. Blue and Amber should normally be located above the Red and Green lamps.</p>			
20.05.00	<p>When associated with push-buttons, red lamps shall be directly above the green push-button and green lamp shall be directly above the red push button.</p>			
20.06.00	<p>All indicating lamps shall be suitable for continuous operation at 90% to 110% of their rated voltage.</p>			
21.00.00	SPACE HEATER			
21.01.00	<p>Space heaters shall be provided in the switchboards wherever the manufacturer considers them necessary and recommends their provision for preventing harmful moisture condensation.</p>			
21.02.00	<p>The space heaters shall be suitable for continuous operation on 240 V AC, 50 Hz, single phase supply, and shall be automatically controlled by thermostats. Necessary switches and fuses shall be provided.</p>			
21.03.00	<p>The circuit for each panel and motor space heater should have an isolating switch, HRC fuse and isolating link. In addition, the space heater circuit of each panel shall also have a thermostat of suitable rating.</p>			
22.00.00	INTERNAL WIRING			
22.01.00	<p>All switchboards shall be supplied completely wired internally upto the terminals, ready to receive external cables.</p>			
22.02.00	<p>All intercubicle and interpanel wiring and connections between panels of same switchboard including all bus wiring for AC and DC supplies shall be provided by the Contractor.</p>			
22.03.00	<p>All auxiliary wiring shall be carried out with 650V grade, single core stranded copper conductor, color coded, PVC insulated wires. Conductor size shall be 1.5 mm² (min.) for control circuit wiring and 2.5 mm² (min) for CT and space heater circuits.</p>			
22.04.00	<p>Extra flexible wires shall be used for wiring to devices mounted on moving parts such as hinged doors. The wire bunches from the panel inside to the doors shall be properly sleeved or taped.</p>			
22.05.00	<p>All wiring shall be properly supported, neatly arranged, readily accessible and securely connected to equipment terminals and terminal blocks.</p>			
<p align="center">NORTH KARANPURA STPP (3 X 660 MW) EPC PACKAGE</p>	<p align="center">TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.:CS-4410-001-2</p>	<p align="center">SUB SECTION B-06 LT SWITCHGEARS & LT BUSDUCT</p>	<p align="center">PAGE 31 OF 71</p>	


CLAUSE NO.	TECHNICAL REQUIREMENTS 		
22.06.00	<p>All internal wiring terminations shall be made with solderless crimping type tinned copper lugs which shall firmly grip the conductor or an equally secure method. Similar lugs shall also be provided at both ends of component to component wiring. Insulating sleeves shall be provided over the exposed parts of lugs to the extent possible. Screw-less (spring loaded) / cage clamp type terminal shall also be provided with lugs.</p>		
22.07.00	<p>Printed single tube ferrules marked to correspond with panel wiring diagram shall be fitted at both ends of each wire. The wire identification marking shall be in accordance with IS: 375. Red Ferrules should be provided on trip circuit wiring.</p>		
22.08.00	<p>Wiring for equipment, which are to be supplied by the Contractor and for which the Contractor has to provide mounting arrangement in his panels, shall also be provided by the Contractor, upto the terminal blocks.</p>		
22.09.00	<p>All connections from vertical busbars for individual modules above 100 A shall be by Copper / Aluminum links only. The cable connections for modules less than 100 A shall be selected in such a way that there will not be any melting / shorting in case of a short circuit inside the module and the cable shall have current rating to carry the let through energy of the corresponding fuses in case of a fault. The insulation of the cable and its cross section shall be decided considering the high ambient temperature within the module. For all modules where use of cable is envisaged by the Contractor specific approval from the Contractor regarding cable details are to be taken. For power wiring color coded wire insulation / tapes shall be provided.</p>		
23.00.00	CONTROL TERMINAL BLOCKS		
23.01.00	<p>Terminal blocks shall be 650V grade, 10Amps rated, made up of unbreakable polyamide 6.6 grade. The terminals shall be either screw type or screw-less (spring loaded) / cage clamp type with lugs. Marking on terminal strips shall correspond to the terminal numbering in wiring diagrams. All metal parts shall be of non-ferrous material. In case of screw type terminals the screw shall be captive, preferably with screw locking design.</p>		
23.02.00	<p>Terminal blocks for CT and VT secondary leads shall be of stud type, made up of unbreakable polyamide 6.6 grade. They shall be provided with links to facilitate testing, isolation star / delta formation and earthing. Terminal blocks for CT secondary shall have the short circuiting facility. The terminals for remote ammeter connection etc. shall also be disconnecting type only. All metal parts shall be of non-ferrous material. Screws shall be captive.</p>		
23.03.00	<p>In all circuit breaker panels MCC modules at least 10% spare terminals for external connections shall be provided and these spare terminals shall be uniformly distributed on all terminal blocks.</p>		
23.04.00	<p>All terminal blocks shall be suitable for terminating on each side two (2) nos. stranded copper conductors of size upto 2.5 sq. mm each, or alternatively, the terminal blocks shall have the</p>		
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CLAUSE NO.	TECHNICAL REQUIREMENTS 		
	<p>possibility of double shorting space to facilitate looping. However for DDCMIS terminals shall be suitable for 1.5 mm² cable.</p>		
23.05.00	<p>All terminals shall be numbered for identification and grouped according to the function. Engraved white-in-black labels shall be provided on the terminal blocks.</p>		
25.06.00	<p>Wherever duplication of a terminal block is necessary it shall be achieved by solid bonding links.</p>		
25.07.00	<p>Terminal blocks shall be arranged with at least 100mm clearance between two sets of terminal blocks. The minimum clearance between the first row of terminal blocks and the associated cable gland plate shall be 250 mm.</p>		
24.00.00	POWER CABLE TERMINATION		
24.01.00	<p>Cable termination compartment and arrangement for power cables shall be suitable for heavy duty, 1.1 kV grade, stranded aluminum conductor, PVC/ XLPE insulated, armored / unarmored and PVC sheathed cables. The size and type of cable for individual modules shall, preferably, be as indicated in the 'Module Selection Tables'. All necessary cable terminating accessories such as supporting clamps and brackets, hardware etc. for cables shall be provided by the contractor to suit the final cable sizes.</p>		
24.02.00	<p>All power cable terminals shall be of stud type and the power cable lugs shall be of tinned copper solderless crimping ring type conforming to IS: 8309. All lugs shall be insulated/ sleeved.</p>		
25.00.00	LOCAL PUSH BUTTON STATIONS		
25.01.00	<p>The local push button stations shall be metal enclosed, suitable for outdoor / indoor mounting on wall or steel structures. The enclosure shall be die-cast aluminum or cold-rolled sheet steel of at least 1.6 mm thickness. The enclosure shall be provided with a hinged guard at the front, covering full length, to avoid inadvertent operation of push buttons. LPBS shall be painted to shade no. RAL: 9002. Support structure for mounting the LPBS shall also be supplied by Contractor.</p>		
25.02.00	<p>The local push button stations shall be dust and vermin proof and shall have a degree of protection of IP -55 as per IS/IEC 60947. The DOP shall be IP-65 in case the same are located in dusty areas.</p>		
25.03.00	<p>The push button stations shall be suitable for bottom cable entry and shall be provided with removable undrilled gland plates or knockouts. Adequate space shall be available inside the push button station enclosure for terminating external cables directly on pushbutton terminals. Overall size of push button stations shall be subject to owner's approval.</p>		
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CLAUSE NO.	TECHNICAL REQUIREMENTS											
25.04.00	The push button station shall comprise of a latched type EMERGENCY STOP push button with two (2) NO and two (2) NC contacts.											
26.00.00	LOCAL MOTOR STARTERS											
26.01.00	Local motor starters shall be suitable for manual switching of 415 V, 3-phase, squirrel cage motors rated upto 5.5 KW. They shall have constructional features similar to those specified for local push button stations.											
26.02.00	Each starter shall comprise of : <table border="1" data-bbox="347 640 1442 1077"> <tr> <td data-bbox="347 640 491 719">1.</td> <td data-bbox="491 640 1442 719">A 3-pole contactor, mechanically latched type.</td> </tr> <tr> <td data-bbox="347 719 491 797">2.</td> <td data-bbox="491 719 1442 797">Start push button, colored green.</td> </tr> <tr> <td data-bbox="347 797 491 875">3.</td> <td data-bbox="491 797 1442 875">Stop push button, colored red.</td> </tr> <tr> <td data-bbox="347 875 491 1077">4.</td> <td data-bbox="491 875 1442 1077">Ambient temperature compensated, thermal over load relay with single phasing protection. The continuously variable relay setting range shall be suitable for the motor rating which shall be advised to the Contractor in due course. The relay shall trip the contactor.</td> </tr> </table>			1.	A 3-pole contactor, mechanically latched type.	2.	Start push button, colored green.	3.	Stop push button, colored red.	4.	Ambient temperature compensated, thermal over load relay with single phasing protection. The continuously variable relay setting range shall be suitable for the motor rating which shall be advised to the Contractor in due course. The relay shall trip the contactor.	
1.	A 3-pole contactor, mechanically latched type.											
2.	Start push button, colored green.											
3.	Stop push button, colored red.											
4.	Ambient temperature compensated, thermal over load relay with single phasing protection. The continuously variable relay setting range shall be suitable for the motor rating which shall be advised to the Contractor in due course. The relay shall trip the contactor.											
26.03.00	The start push button, when pressed, shall preferably remain in depressed position and shall be released along with the contactor when the stop push button is pressed or when thermal overload relay operates.											
26.04.00	Local starters shall be suitable for loop-in and loop-out of incoming cable and for one outgoing cable to motor. Final cable sizes and number of lugs required will be intimated to the contractor. Support structure for mounting in local motor starters shall be supplied by the Contractor.											
27.00.00	NAME PLATES AND LABELS											
27.01.00	All Switchgears, MCCs, Distribution Boards, Fuse boards, all feeders, local push-button stations and local motor starters shall be provided with prominent, engraved identification plates. The module identification plate shall clearly give the feeder number and feeder designation. For single front switchboards, similar panel and board identification labels shall be provided at the rear switchgear also.											
27.02.00	All name plates shall be of non-rusting metal or 3-ply Lamicoid, with white engraved lettering on black background. Inscription & lettering sizes shall be subject to owner's approval.											
27.03.00	Suitable stenciled paint mark shall be provided inside the panel/module for identification of all equipment in addition to the plastic sticker labels, if provided. These labels shall be											
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CLAUSE NO.	TECHNICAL REQUIREMENTS 		
	<p>positioned so as to be clearly visible and shall have the device number, as mentioned in the module wiring drawings.</p>		
27.04.00	<p>Caution name plate "Caution Live Terminals" shall be provided at all points where the terminals are likely to remain live and isolation is possible only at remote end.</p>		
28.00.00	<p>METAL ENCLOSED NON SEGREGATED PHASE BUSDUCT(AIR INSULATED)</p>		
28.01.00	<p>Three phase and neutral metal enclosed non segregated phase bus duct assemblies shall be supplied for incoming connections from the transformers to the switch boards and inter connecting sections between switch boards, wherever called for.</p>		
28.02.00	<p>The enclosure shall be made of minimum 3 mm thick aluminum alloy. The section of the bus duct shall be rectangular. The design of the bus duct enclosures shall be of sturdy construction such that it will withstand the internal or external forces resulting from the various operating conditions.</p>		
28.03.00	<p>The entire bus duct shall be designed for dust, vermin and weather proof construction. A suitable aluminum sheet flange-protection hood shall be provided to cover all outdoor bus duct enclosure joints to facilitate additional protection against rain water ingress. All horizontal runs of bus ducts shall have a suitable sloped enclosure top to prevent retention of water for both indoor and out door portion of bus ducts. Bus duct enclosure shall have a degree of protection of IP-55.</p>		
28.04.00	<p>The inside of the bus enclosure may be treated with black paint to enable efficient heat dissipation. The matt paint used shall be suitable for temperature experienced during continuous loading of the bus conductor. The bus duct exterior paint shade shall be RAL 5012.</p>		
28.05.00	<p>Flexible expansion joints for the enclosure shall be provided wherever deemed necessary by the Contractor. Necessary bonding shall be provided at the expansion joints if made of insulating materials.</p>		
28.06.00	<p>Enclosures shall be provided with flanged ends with drilling dimensions to suit the flanges at the switchgear and transformer terminals. Any adapter boxes required for this purpose are in the Contractor's scope of supply. The flanges shall be provided with gaskets, nuts, bolts, etc. Details of the flanges provided on transformer ends will be furnished to the successful Contractor.</p>		
28.07.00	<p>Suitable Inspection covers shall be provided for periodic inspection of insulators. Handle shall be provided on each inspection cover to facilitate easy lifting.</p>		
28.08.00	<p>The EPDM / Neoprene gaskets shall be provided so as to satisfy the operating conditions imposed by temperature, weathering, durability etc. Flange gaskets shall be provided at the equipment terminal connections.</p>		
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CLAUSE NO.	TECHNICAL REQUIREMENTS 		
28.09.00	<p>Necessary earthing arrangement as applicable shall be provided with clamps to receive station earthing bus. All accessories and hardware required for the earthing arrangement shall be provided by the Contractor. This shall be a GI strip of adequate size, continuously running along the bus duct and shall be earthed at both ends. Bus duct enclosures shall be bolted type.</p>		
28.10.00	<p>The material of the conductor shall be aluminum. The minimum clearance in air between phase to phase, phase to neutral and phase to earth for the entire run of bus duct shall be 25 mm The bus bars shall be rated in accordance with the service conditions and the rated continuous and short time current ratings calculated for specific application / specified elsewhere.</p>		
28.11.00	<p>All steel structures required for bus duct support shall be hot dip galvanized.</p>		
28.12.00	<p>Space heaters shall be provided in the bus duct wherever the manufacturer considers them necessary and recommends their provision for preventing harmful moisture condensation.</p>		
28.13.00	<p>The space heaters shall be suitable for continuous operation on 240 V AC, 50 Hz single phase supply and shall be automatically controlled by thermostats. Necessary wiring upto junction boxes mounted on bus duct and from junction boxes to switch boards shall be provided by the Contractor.</p>		
29.00.00	BUS TRUNKING SYSTEM (SANDWICH TYPE BUSDUCT)		
29.01.00	<p>Three phase Bus trunking system conforming to IEC 60439 (Parts 1 & 2) / IS 8623 (Parts 1 & 2) shall be provided for connecting the Main and Standby DG sets to Unit Emergency Switchgears as indicated in the BOQ.</p>		
29.02.00	<p>The enclosure shall be made of CRCA (1.6mm thick) / GI (1.6mm thick) / Aluminium (2.5mm thick) sheet. The design of the bus duct enclosure shall be of sturdy construction such that it will withstand the internal or external forces resulting from the various operating conditions.</p>		
29.03.00	<p>The entire bus duct shall be designed for dust, vermin and weather proof construction. A suitable aluminium sheet flange-protection hood shall be provided to cover all outdoor bus duct enclosure joints to facilitate additional protection against rain water ingress. All horizontal runs of bus ducts shall have a suitable sloped enclosure top to prevent retention of water for both indoor and out door portion of busducts. Busduct enclosure shall have a degree of protection of IP-55.</p>		
29.04.00	<p>The busduct exterior paint shade shall be RAL 5012.</p>		
29.05.00	<p>Enclosures shall be provided with flanged ends with drilling dimensions to suit the flanges at the switchgear and DG terminals. Any adapter boxes required for this purpose are in the contractor's scope of supply. The flanges shall be provided with gaskets, nuts, bolts, etc.</p>		
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CLAUSE NO.	TECHNICAL REQUIREMENTS 		
29.06.00	EPDM / Neoprene gaskets shall be provided so as to satisfy the operating conditions imposed by temperature, weathering, durability etc. Flange gaskets shall be provided at the equipment terminal connections.		
29.07.00	Necessary earthing arrangement as applicable shall be provided with clamps to receive station earthing bus. All accessories and hardware required for the earthing arrangement shall be provided by the contractor. This shall be a GI strip of adequate size, continuously running along the busduct and shall be earthed at both ends. busduct enclosures shall be bolted type.		
29.08.00	The material of the conductor shall be high conductivity aluminum / copper. The busbars shall be rated in accordance with the service conditions and the rated continuous and short time current ratings specified elsewhere.		
29.09.00	All steel structures required for busduct support shall be hot dip galvanized.		
29.10.00	Space heaters shall be provided in the busduct wherever the manufacturer considers them necessary and recommends their provision for preventing harmful moisture condensation.		
29.11.00	The space heaters shall be suitable for continuous operation on 240 V AC, 50 Hz single phase supply and shall be automatically controlled by thermostats. Necessary wiring upto junction boxes mounted on busduct and from junction boxes to switch boards shall be provided by the contractor.		
30.00.00	LIGHTING / WELDING TRANSFORMERS Each AC Lighting Distribution Board (LDB) / Welding DB shall be fed from 415V / 415V, 100kVA isolating transformer. The lighting / welding transformer may, preferably, be located inside the LDB / Welding DB panel itself. Otherwise, the same shall be located by the side of respective LDB / Welding DB. Lighting / Welding transformers shall be dry type, natural air cooled with class B insulation or better. Impedance of lighting / Welding transformer shall be so selected that the fault level of lighting /Welding system shall be reduced to 3 to 5 KA. Lighting / Welding transformers shall be tested as per IS: 2026. Off-circuit tap changer with $\pm 2.5\%$ and $\pm 5\%$ tapping shall be provided. In case the transformers are not mounted inside the LDB panels, the same shall be housed in a separate 2 mm thick CR sheet steel enclosure with IP-42 degree of protection as per IS/IEC 60947. However, the transformer terminal box shall have IP-52 degree of protection.		
31.00.00	PAINTING All sheet steel work shall be pretreated, in tanks, in accordance with IS: 6005. Degreasing shall be done by alkaline cleaning. Rust and scales shall be removed by pickling with acid. After pickling, the parts shall be washed in running water. Then these shall be rinsed in slightly alkaline hot water and dried. The phosphate coating shall be "Class-C" as specified in IS: 6005. The phosphated surfaces shall be rinsed and passivated. After passivation, Electrostatic Powder Coating shall be used. Powder should meet requirements of IS 13871 (Powder costing specification). Finishing paint shade for complete panels excluding end covers shall be RAL9002 & RAL5012 for extreme end covers of all boards, unless required otherwise by the owner. The paint thickness shall not be less than 50 microns. Finished parts shall be suitably packed and wrapped with protective covering to protect the finished surfaces from scratches, grease, dirt and oil spots during testing, transportation, handling and erection.		
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CLAUSE NO.	TECHNICAL REQUIREMENTS			
32.00.00	<p>GASKETS</p> <p>The gaskets, wherever specified, shall be of good quality EPDM / Neoprene with good ageing, compression and oil resistance characteristics suitable for panel applications.</p>			
33.00.00	<p>TEMPERATURE –RISE</p> <p>The temperature rise of the horizontal and vertical busbars and main bus links including all power drawout contacts when carrying 90% of the rated current along the full run shall in no case exceed 55 deg C with silver plated joints and 40 deg C with all other types of joints over an outside ambient temperature of 50 deg C. The temperature rise of the accessible parts/external enclosures expected to be touched in normal operation shall not exceed 20deg. C. The temperature rise of manual operating means shall not exceed 10deg. C for metallic & 15 deg. C for insulating material. Temperature rise for the busbars shall be carried out at 90% of the rated current. The above temperature rise limits are applicable for busducts also without any current derating.</p>			
34.00.00	<p>DERATING OF EQUIPMENTS</p> <p>The Contractor shall ensure that the equipment offered will carry the required load current at site ambient conditions specified and perform the operating duties without exceeding the permissible temperature as per Indian Standards / Specification. Continuous current rating at 50 deg C ambient in no case shall be less than 90% of the normal rating specified.</p> <p>The Contractor shall indicate clearly the derating factors if any employed for each component and furnish the basis for arriving at these derating factors duly considering the specified current ratings and ambient temperature of 50 deg C.</p>			
35.00.00	<p>PROTECTION CO-ORDINATION</p> <p>It shall be the responsibility of the Contractor to fully coordinate the overload and short circuit tripping of the circuit breakers with the upstream and downstream circuit breakers / fuses / motor starters, to provide satisfactory discrimination. Further the various equipment supplied shall meet the requirements of Type II class of Co-ordination as per IS: 8544.</p>			
36.00.00	<p>TESTS AND TEST REPORTS</p> <p>GENERAL</p> <p>(a.) All equipments to be supplied shall be of type tested design. The Contractor shall submit for owner's approval the reports of all the type tests as listed in this specification and carried out within last ten years from the date of bid opening. These reports should be for the tests conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client.</p> <p>(b.) In case the Contractor is not able to submit report of the type test(s) conducted within last ten years from the date of bid opening, or in case the type test report(s) are not found to be meeting the specification requirements, the Contractor shall conduct all such tests under this contract at no additional cost either at third party lab or in presence of client/owner's representative and submit the reports for approval.</p>			
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(c.) All routine tests as per the specification and relevant standards shall be carried out..


The following type test certificates on each type & rating of L.T. Switchgear and MCC panel shall be submitted.


1)	Switchgear / MCC panels of each rating		
	a)	Short time withstand test.	
	b)	Temperature rise test.	
	c)	Degree of protection test	
2)	Circuit breaker of each rating		
	a)	Test sequence 1	
		-	Dielectric properties.
		-	Mechanical operation and operational performance capability
		-	Verification of dielectric withstand.
		-	Verification of temperature-rise
	b)	Combined test sequence (With Circuit breakers mounted inside the Switchgear panel)	
		-	Rated short-time withstand current
		-	Rated service short-circuit breaking capacity
		-	Verification of dielectric withstand
		-	Verification of temperature-rise
3)	MCC modules of any three ratings, as selected by the owner, for class - II protection Co-ordination.		
4)	Test for single phasing protection feature on 3 nos. bimetallic thermal overload relay selected by owner. The relay shall be tested for compliance with manufacturer's printed / declared characteristic curve.		


CLAUSE NO.	TECHNICAL REQUIREMENTS																			
36.01.00	<p>For the following equipment the contractor shall submit the reports of all the type tests as per applicable standards and carried out within last ten years from the date of bid opening. These reports should be for the tests conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client. In case the Contractor is not able to submit report of the type test(s) conducted within last ten years from the date of bid opening, or in case the type test report(s) are not found to be meeting the specification requirements, the Contractor shall conduct all such tests under this contract at no additional cost to the owner either at third party lab or in presence of client/owner's representative and submit the reports for approval.</p> <p>(a.) NUMERICAL RELAYS</p> <p>(b.) ETHERNET SWITCHES</p> <p>(c.) FIBRE OPTIC CABLE</p> <p>(d.) LOCAL PUSH BUTTON STATION</p> <p>(e.) LOCAL MOTOR STARTER</p> <p>(f.) LIGHTING / WELDING TRANSFORMER</p> <p>(g) MCCB</p>																			
36.02.00	<p>Type test reports for the following tests on the model of the Numerical relays, Ethernet switches shall be submitted for owner's review.</p> <table border="1" data-bbox="347 1317 1289 1921"> <thead> <tr> <th data-bbox="421 1328 480 1350">Test</th> <th data-bbox="1082 1328 1251 1350">Specification</th> </tr> </thead> <tbody> <tr> <td colspan="2" data-bbox="368 1402 735 1424">1 Functional requirements</td> </tr> <tr> <td data-bbox="437 1473 727 1496">1 Features and logics</td> <td data-bbox="1082 1473 1203 1496">IEC61850</td> </tr> <tr> <td data-bbox="437 1552 1054 1608">2 Checking of compatibility with co-operating devices</td> <td data-bbox="1082 1552 1203 1574">IEC61850</td> </tr> <tr> <td data-bbox="437 1664 679 1686">3 Communication</td> <td data-bbox="1082 1664 1203 1686">IEC61850</td> </tr> <tr> <td colspan="2" data-bbox="368 1738 911 1760">2 Mechanical construction requirements</td> </tr> <tr> <td data-bbox="437 1809 715 1832">1 General inspection</td> <td data-bbox="1082 1809 1390 1832">Manufacturer's document</td> </tr> <tr> <td data-bbox="437 1888 858 1910">2 Inspection of marking and data</td> <td data-bbox="1082 1888 1235 1910">IEC 60255-6</td> </tr> </tbody> </table>			Test	Specification	1 Functional requirements		1 Features and logics	IEC61850	2 Checking of compatibility with co-operating devices	IEC61850	3 Communication	IEC61850	2 Mechanical construction requirements		1 General inspection	Manufacturer's document	2 Inspection of marking and data	IEC 60255-6	
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CLAUSE NO.	TECHNICAL REQUIREMENTS		
	3	Clearances and creepage distances	IEC 60255-5
	4	Degree of protection by enclosure	IEC 60529
	3 Insulation requirements		
	1	Dielectric test	IEC 60255-5
	2	Impulse voltage test	IEC 60255-5
	3	Insulation resistance measurements	IEC 60255-5
	4 Accuracy requirements		
	1	Measurement accuracy of characteristic quantity and specified time	IEC 60255-6
	2	Limits of frequency range and frequency dependence	IEC 60255-6
	3	Limits of ambient temperature and ambient temperature dependence	IEC 60255-6
	4	Limits of operative range of auxiliary energizing inputs and auxiliary voltage dependence	IEC 60255-6
	5 Rated burden requirements		
	1	Measuring circuits	IEC 60255-6
	2	Auxiliary circuits	IEC 60255-6
	3	Signalling inputs	IEC 60255-6
	6 Thermal requirements		
	1	Temperature rise	IEC 60255-6
	2	Limiting continuous thermal withstand values	IEC 60255-6
	3	Limiting short-time thermal withstand values	IEC 60255-6
<p align="center">NORTH KARANPURA STPP (3 X 660 MW) EPC PACKAGE</p>	<p align="center">TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.:CS-4410-001-2</p>	<p align="center">SUB SECTION B-06 LT SWITCHGEARS & LT BUSDUCT</p>	<p align="center">PAGE 41 OF 71</p>


CLAUSE NO.	TECHNICAL REQUIREMENTS		
	7 Limiting dynamic value requirements	IEC 60255-6	
	8 Power supply requirements		
	1 Limiting duration of interruptions to dc auxiliary voltage	IEC 60255-11	
	2 Limiting value of ripple in dc auxiliary voltage	IEC 60255-11	
	3 Limiting value of voltage dips to ac auxiliary voltage	IEC 61000-4-11	
	4 Limiting duration of interruptions to ac auxiliary voltage	IEC 61000-4-11	
	5 Limiting variations of ac auxiliary voltage	IEC 61000-4-11	
	9 Electromagnetic compatibility requirements		
	1 High frequency disturbance test	IEC 60255-22-1	
	2 Electrostatic discharge test	IEC 60255-22-2, 61000-4-2	
	3 Radiated, radio-frequency, electromagnetic field immunity test	IEC 60255-22-3, 61000-4-3	
	4 Fast transient disturbance test	IEC 60255-22-4, 61000-4-4	
	5 Surge immunity test	IEC 60255-22-5, 61000-4-5	
	6 Immunity to conducted disturbances, induced by radio-frequency fields	IEC 60255-22-6, 61000-4-6	
	7 Power frequency immunity test	IEC 60255-22-7	
	8 Conducted and Radiated radio-frequency emission tests	IEC 60255-25, EN55011-CISPR 11	
	9 Power frequency magnetic field immunity test	IEC 61000-4-8	
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CLAUSE NO.	TECHNICAL REQUIREMENTS			
37.05.00	10 Environmental requirements			
	1	Dry cold test	IEC 60068-2-1	
	2	Dry heat test	IEC 60068-2-2	
	3	Storage temperature test	IEC 60068-2-8	
	4	Damp heat test, cyclic (12 + 12 hour cycle)	IEC 60068-2-30	
	11 Contact performance requirements			
	1	Make and carry for dc	IEC 60255-23	
	2	Breaking capacity for dc	IEC 60255-23	
	3	Make and break ac	IEC 60255-23	
	12 Mechanical performance requirements			
	1	Durability of relay operation	IEC 60255-6	
	2	Durability of plug-in relays	IEC 60255-6	
	3	Durability of relay setting controls	IEC 60255-6	
	4	Vibration response and endurance test	IEC 60255-21-1	
	5	Shock response and withstand test	IEC 60255-21-2	
	6	Bump test	IEC 60255-21-2	
	<p>The type test reports once approved for any projects shall be treated as reference. For subsequent projects of NTPC, an endorsement sheet will be furnished by the manufacturer confirming similarity and “No design Change”. Minor changes if any shall be highlighted on the endorsement sheet.</p>			
	<p>All routine tests as per the specification and relevant standard IS 8623 shall be carried out.</p>			
	<p>An indicative lists of tests / checks is mentioned as QA chapter . However, the manufacturer is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents.</p>			
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CLAUSE NO.	TECHNICAL REQUIREMENTS			
37.06.00	All procedures for type tests shall be approved by owner before commencement of type tests. However, the following points may be specifically noted.			
	1)	For temperature rise tests, the connection arrangement between the source and the test equipment shall be such that the temperature gradient in the connection piece of cable at a distance of one meter away from the test equipment shall be restricted to 5 deg C.		
	2)	Milli Volt drop test shall be done on switching devices before and after the type tests.		
	3)	Bolt tightness of busbar joints shall be checked with torque wrench before and after short time rating tests on the circuit breaker and MCC panels.		
37.07.00	Routine checking to observe compliance to degree of protection, first numeral , on switchboard enclosures and busbar chambers shall be as under :			
	1) IP -4 X	It shall not be possible to insert a one mm dia. Steel wire into the enclosure from any direction, without using force.		
	2) IP-5X	It shall not be possible to insert a thin sheet of paper under gaskets and through enclosure joints.		
37.00.00	ERECTION / INSTALLATION OF SWITCHBOARDS AND OTHER EQUIPMENTS			
37.01.00	Each equipment shall be installed in a neat, workman-like manner so that it is leveled, plumbed, squared and properly aligned and oriented. Tolerances shall be as established in Contractor's drawings or as stipulated by owner. No equipment shall be permanently fixed down to foundations until the alignment has been checked and found acceptable by the owner.			
37.02.00	Contractor shall furnish all supervision, labour, tools, equipment, rigging materials, bolts, wedges, anchors, etc., in proper time, required to completely install, test and commission the equipment.			
37.03.00	Manufacturer's and owner's instructions and recommendations shall be correctly followed in handling, setting, testing and commissioning of all equipment.			
37.04.00	Contractor shall move all equipment into the respective rooms through the regular door or openings specifically provided for this purpose. No part of the structure shall be utilised to lift or erect any equipment without prior permission of Engineer.			
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CLAUSE NO.	TECHNICAL REQUIREMENTS 		
37.05.00	All switchboards shall be installed in accordance with Indian Standard, IS: 3072, and owner's instructions.		
37.06.00	Switchboard panels shall be installed on concrete floor or supported on steel channel / edge angle in concrete trenches. The Contractor shall provide steel insert plates in the concrete floor and / or steel channels / edge angle on the trenches as applicable. The base frame of switchboards shall be welded to the insert plates by the Contractor. The Contractor shall be required to install and align the panels using suitable metallic shims before welding the base frame. In joining shipping sections of switchboards together, adjacent housing of panel sections or flanged throat sections shall be bolted together after alignment has been completed.		
37.07.00	Contractor shall take utmost care in handling instruments, relays and other delicate mechanisms. Wherever the instruments and relays are supplied separately they shall be mounted only after the associated panels have been erected and aligned. the blocking materials employed for safe transit of instruments and relays shall be removed after ensuring that panels have been completely installed and no further movement of the same would be necessary. Any damage shall be immediately reported to Engineer.		
37.08.00	Equipment furnished with finished coats of paint shall be touched up by Contractor if their surface is spoiled or marred during erection / commissioning.		
37.09.00	The room and floor finishing work would be done after erection of the panels and the Contractor shall suitably cover up the panels to protect them from injury and marring of finish.		
38.00.00	COMMISSIONING CHECKS / TESTS		
38.01.00	After installation of panels, power and control wiring and connections, Contractor shall perform operational tests on all switchboards, to verify proper operation of switchboards / panels and correctness of all equipment in each and every respect.		
38.02.00	The Contractor shall carry out the following commissioning checks, in addition to other checks and tests recommended by the manufacturers.		
38.03.00	<p>GENERAL</p> <p>(a.) Check name plate details according to the approved drawings.</p> <p>(b.) Check for physical damage.</p> <p>(c.) Check tightness of all bolted connections, by torque wrench.</p> <p>(d.) Check earth connections.</p>		
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CLAUSE NO.	TECHNICAL REQUIREMENTS			
<p>38.04.00</p> <p>38.05.00</p>	<p>(e.) Check cleanliness.</p> <p>(f.) Check all moving parts for proper lubrication.</p> <p>Circuit Breakers</p> <p>(a.) Check alignment of breaker truck for free movement.</p> <p>(b.) Check correct operation of shutters.</p> <p>(c.) Check control wiring for correctness of connections, continuity And IR values.</p> <p>(d.) Manual operation of breakers completely assembled.</p> <p>(e.) Closing /opening operation, manually and electrically.</p> <p>(f.) Trip free and anti-pumping operation.</p> <p>(g.) I.R. values of contacts.</p> <p>(h.) Contact resistance.</p> <p>(i.) Check on spring charging motor, correct operation of limit switches and time or charging.</p> <p>(j.) All functional checks</p> <p>(k.) Breaker closing and tripping time, if required.</p> <p>Current Transformers</p> <p>(a.) Visual inspection.</p> <p>(b.) IR Value</p> <p>(c.) Ratio check.</p> <p>(d.) Magnetising current.</p> <p>(e.) Wiring connection.</p> <p>(f.) Spare CT cores, if any, to be shorted and earthed</p>			
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CLAUSE NO.	TECHNICAL REQUIREMENTS			
38.06.00	Voltage Transformers (a.) Visual inspection. (b.) IR Value (c.) Ratio check (d.) Magnetising current (e.) Line connection as per connection diagram			
38.07.00	Cubicle Wiring (a.) Check all switch developments (b.) Each wire shall be traced by continuity tests and it shall be ensured that the wiring is as per relevant drawing. All inter-connections between panels / equipment shall be similarly checked. (c.) All the wires shall be meggered to earth. (d.) Functional checking of all control circuit e.g., closing, tripping, control, interlock, supervision and alarm circuit.			
38.08.00	Relays 1. Check connections and wiring. 2. Megger a) Megger all terminals to body. b) Megger AC to DC terminals. 3. Check operating characteristics by secondary injection. 4. Check minimum pick up voltage of DC coils. 5. Check operation of electrical / mechanical targets. 6. Relay settings.			
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CLAUSE NO.	TECHNICAL REQUIREMENTS			
38.09.00	<p>7. Check CT and VT connections with particular reference to their polarities.</p> <p>Meters</p> <p>(a.) Visual inspection.</p> <p>(b.) Megger all insulated partitions.</p> <p>(c.) Check CT and VT connections with particular reference to their polarities for power type meters.</p> <p>(d.) Calibration.</p>			
39.00.00	AC MODULES DESCRIPTION			
39.01.00	<p>Module type DAE (Circuit Breaker Module)</p> <p>(a.) One (1) Triple-pole circuit breaker, complete with all accessories and power operated mechanism, as specified.</p> <p>(b.) Three (3) Current transformers for Protection and metering.</p> <p>(c.) One (1) DC isolating Switch</p> <p>(d.) Six (6) HRC Control fuses.</p> <p>(e.) Numerical relay for the following:</p> <ul style="list-style-type: none"> • Short Circuit Protection • Earth Fault Protection • Over Load protection • Energy Metering • Current and Voltage metering • Trip Circuit Supervision • CB Monitoring • Synchronizing Check feature 			
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CLAUSE NO.	TECHNICAL REQUIREMENTS			
39.02.00	<p>Module Type DAET (Circuit Breaker Incomer From Transformer)</p> <p>Similar to module type DAE; but with additional PS Class Current transformers for Restricted Earth Fault Protection. The Numerical relay shall have provision for REF protection in addition to the features listed against module type DAE.</p>			
39.03.00	<p>Module Type CC (Contactor Changeover Between Two In Coming Supplies)</p> <p>(Note: Main and Reserve incomers shall be housed in separate drawout modules, located in different panels.)</p> <p>The drawout modules shall be provided with service position limit switch having 2 NO+2NC contacts.</p> <p>Main Incomer</p> <p>One (1) Triple pole load break isolating switch .</p> <p>One (1) Triple pole contactor with coil suitable for 415 V AC.</p> <p>Two (2) Auxiliary contactors with coil suitable for 415 V AC.</p> <p>One (1) Indicating lamp with resistor and coloured lens suitable for 415 V AC.</p> <p>Three (3) HRC control fuses.</p> <p>Reserve Incomer</p> <p>One (1) Triple pole load break isolating switch</p> <p>One (1) Triple pole contactor with coil suitable for 415 V AC.</p> <p>One (1) Indicating lamp with resistor and coloured lens suitable for 415 V AC.</p> <p>Two (2) HRC control fuses.</p>			
39.04.00	<p>Module Type CS (AC Control Supply Module)</p> <p>(Note: Module type CS will be of non-drawout type)</p> <p>Two (2) 415/110 V control transformers.</p> <p>Four (4) 110V auxiliary relays.</p> <p>Two (2) Earth links.</p> <p>Eight (8) HRC Control fuses.</p>			
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CLAUSE NO.	TECHNICAL REQUIREMENTS			
39.05.00	Two (2)	Selector switches		
	Module Type DG (Circuit Breaker Incomer From DG Set)			
	(a.) One (1)	Triple-pole circuit breaker, complete with all accessories and power operated mechanism, as specified.		
	(b.) Three (3)	Current transformers for protection & metering.		
	(c.) One (1)	DC isolating Switch		
	(d.) Six (6)	HRC control fuses		
	(e.)	Numerical relay for the following:		
		<ul style="list-style-type: none"> • Differential protection 		
		<ul style="list-style-type: none"> • Over Load protection 		
		<ul style="list-style-type: none"> • Reverse Power Protection 		
		<ul style="list-style-type: none"> • DG Neutral displacement 		
		<ul style="list-style-type: none"> • Energy Metering 		
		<ul style="list-style-type: none"> • Current and Voltage metering 		
		<ul style="list-style-type: none"> • DG Monitoring 		
39.06.00	Module Type E/E1/E2 (Switch Fuse Module/MCCB)			
	(a.) One (1)	Triple pole switch-fuse unit with three pole isolating switch and three / one / two HRC fuses for E/E1/E2 modules, respectively.		
	(b.) One (1)	Neutral link.		
	(c.) One (1)	3 pole MCCB (for rating 100A and above)		
39.07.00	Module Type G1 (VT Module with Under Voltage / No Volt Relay)			
	(a.) Three (3)	415/ $\sqrt{3}$ / 110/ $\sqrt{3}$ V single phase voltage transformers, mounted on a common draw-out chassis		
	(b.) Three (3)	HRC fuses for VT primary.		
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CLAUSE NO.	TECHNICAL REQUIREMENTS											
39.08.00	(c.) Three (3)	HRC control fuses.	<p>Module Type H (Isolating Switch Module)</p>									
39.09.00	(a) One (1)	Triple pole load break isolating switch			<p>Module type K1 (Non Reversible Motor Rated Below 30 kW Controlled from MCC)</p>							
39.10.00	(b) One (1)	Neutral link					<p>Module Type K11 (Non reversible Motor Rated 30kW to 200kW Controlled from MCC)</p> <p>Similar to module type K1 but with the following additions:</p> <p>One (1) Current transformer for metering.</p> <p>One (1) Ammeter</p> <p>One (1) Single-pole switch and fuse for motor space heater.</p>					
39.11.00	(a.) (c) One (1)	Bimetallic thermal overload relay with single phasing preventer. For motor with high starting time, heavy duty overload relay shall be provided.	<p>Module type DK2 (Non Reversible Motor rated below 30kW Controlled from DDCMIS)</p>									
	(d) Two (2)	Push buttons.			<p>(a) One (1) Triple pole switch fuse unit with three pole load break Isolating switch and three HRC fuses.</p>							
	(e) Three (3)	Indicating lamps with resistors and coloured lenses.										
	(f) One (1)	HRC control fuse.										
	(g) One (1)	Control link.										

CLAUSE NO.	TECHNICAL REQUIREMENTS			
39.12.00	(b)	One (1)	Triple pole contactor.	
	(c)	One (1)	Bimetallic thermal overload relay with single phasing preventor. Modules marked with * (DK2* / PK2*) shall not have this relay. For motor with high starting time, heavy duty overload relay shall be provided.	
	(d)	Three (3)	Indicating lamps with resistors and coloured lenses.	
	(e)	One (1)	HRC control fuse.	
	(f)	One (1)	Control link	
	(g)	One (1)	Auxiliary contactor	
	(h)	Two (2)	Coupling relays suitable for 24V DC.	
	(i)	One (1)	digital energymeter with analog output of current (4-20 mA) for CHP dust suppression motors.	
39.12.00	Module Type DK21 (Non Reversible Motor rated 30kW to up to 110KW (* See Remark) controlled from DDCMIS).			
	(* Remark : For CHP Motors –upto 160 KW			
	(a)		Similar to module type DK2 but with the following additions :	
	(b)	One (1)	Current transformer for metering.	
	(c)	One (1)	Ammeter (for motors of rating $\geq 30\text{kW}$ & $< 110\text{kW}$)	
	(d)	One (1)	Single-pole switch and fuse for motor space heater.	
	(e)	One (1)	Digital Energy Meter with Analog output of Current (4-20 mA) (for motors of rating $\geq 30\text{kW}$ & $< 110\text{kW}$ and all dust suppression motors)	
39.13.00	Module Type DN1 (Reversible Motor Controlled from DDCMIS)			
	(a.)	One (1)	Triple pole fuse switch unit with three pole load break solating switch and three HRC fuses.	
	(b.)	Two (2)	Triple pole mechanically interlocked, forward / reverse contactors.	
	(c.)	One (1)	Bimetallic thermal overload relay with single phasing preventor.	
	(d.)	One (1)	Indicating lamp with resistor and coloured lens.	
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CLAUSE NO.	TECHNICAL REQUIREMENTS			
39.14.00	(e.)	One (1)	HRC control fuse	
	(f.)	One (1)	Control link	
	(g.)	One (1)	Auxiliary contactor	
	(h.)	Two (2)	Coupling relays suitable for 240V DC.	
	Module Type VM (Voltmeter Module)			
	(a.)	Three (3)	HRC fuses.	
	(b.)	One (1)	Voltmeter (0-500 V.)	
	(c.)	One (1)	Four position voltmeter selector switch	
	(d.)	One (1)	415 V auxiliary contactor with 2 NO + 2 NC contacts.	
	(e.)	One (1)	Voltage transducer with output of 4-20mA between R & Y phases	
39.15.00	Module Type DM (Circuit Breaker (DDC /PLC Controlled) Motor Feeder for motor rated 110 KW & above (except for CHP motors).			
	(a.)	One (1)	Triple-pole circuit breaker, complete with all accessories and power operated mechanism, as specified.	
	(b.)	Three (3)	Current transformers for Protection and metering.	
	(c.)	One (1)	DC isolating Switch	
	(d.)	Six (6)	HRC Control fuses.	
	(e.)	One (1)	Single-pole switch and fuse for motor space heater	
	(f.)	Numerical relay for the following:		
		Short Circuit Protection (50)		
		Thermal Over Load protection(51I)		
		Earth fault Protection(50N)		
		Negative sequence Protection(46)		
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CLAUSE NO.	TECHNICAL REQUIREMENTS			
	<p>Restart inhibit protection(49)</p> <p>Locked Rotor Protection</p> <p>Energy Metering</p> <p>Current and Voltage metering</p> <p>Trip Circuit Supervision</p> <p>CB Monitoring</p>			<p>40.00.00 DC MODULES DESCRIPTION</p> <p>40.01.00 Module Type -CH (Incomer from Charger)</p> <p>(a) One (1) Double pole, 250 V DC fuse -switch unit</p> <p>40.02.00 Module Type -DB (Incomer from Battery)</p> <p>(a) Two (2) HRC fuses with striker pins and Fuse monitoring relays with contacts for alarm. These fuses shall be mounted in a separate fiber glass / plastic enclosure and located in the battery room.</p> <p>(b) One (1) DC ammeter with shunt and centre zero. This shall be mounted in the DCDB.</p> <p>40.03.00 Module Type - DC</p> <p>(a) One (1) Double pole 250V DC switch / circuit breaker with 2NO+2NC auxiliary contacts.</p> <p>40.04.00 Module Type - HD (DC Isolating Switch / Circuit - Breaker Module)</p> <p>(a) One (1) Double pole , 250 V DC switch isolator / circuit breaker</p> <p>40.05.00 Module Type-S (DC Metering and Protection Module)</p> <p>(a) One (1) Voltmeter, 0-300V DC</p> <p>(b) One (1) Three position voltmeter selector switch</p>
<p>NORTH KARANPURA STPP (3 X 660 MW) EPC PACKAGE</p>	<p>TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.:CS-4410-001-2</p>	<p>SUB SECTION B-06 LT SWITCHGEARS & LT BUSDUCT</p>	<p>PAGE 54 OF 71</p>	

CLAUSE NO.	TECHNICAL REQUIREMENTS			
	(c) One (1)	Instantaneous under voltage relay (27) with a setting of 95% of 240V DC. The resetting ratio of relay should not be more than 1.05.		
	(d) One (1)	Instantaneous over voltage relay (59) which shall operate at 110% of 240 V DC. The resetting ratio of relay should not be less than 0.95.		
	(e) One (1)	Earth leakage relay having adjustable pick up range between 3 to 7mA. The relay shall be suitable for 240V / 50V DC and 240V AC auxiliary supply. The relay shall be Alstom type CAEM-21 or equivalent.		
	(f) Two (2)	Indicating lamps with resistors & coloured lenses, one each for 'Earth fault' and 'DC supply failure ' indications.		
	(g) Three (3)	HRC control fuses.		
	(h) One (1)	Neutral link		
40.06.00	Module Type -X (DC Isolating Switch Fuse Module)			
	(a) One (1)	Double pole , 250 V DC fuse switch unit with two HRC fuses.		
40.07.00	Module Type DW1 (DC Solenoid Valve Controlled from DDC)			
	(a) One (1)	Double pole 250 V DC isolating switch		
	(b) Two (2)	HRC fuses		
	(c) One (1)	Contactor with coil suitable for 240 V DC.		
	(d) One (1)	Auxiliary contactor with coil suitable for 240 V DC		
	(e) One (1)	Coupling relay		
	(f) One (1)	Diode with peak inverse voltage of 440 V.		
40.08.00	Module Type Q (Incomer to DC Lighting DB)			
	(a) One (1)	Double pole , 250 V DC switch isolator		
	(b) One (1)	Power Contactor		
NORTH KARANPURA STPP (3 X 660 MW) EPC PACKAGE	TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.:CS-4410-001-2	SUB SECTION B-06 LT SWITCHGEARS & LT BUSDUCT	PAGE 55 OF 71	



- (c) Two (2) Instantaneous under voltage relays (27) with a setting of 60% of 110V AC.
- (d) One (1) Timer having a delay of 0.5 to 3 sec. on pick-up with 2 self reset NO contacts, suitable for 240 Volts DC.
- (e) Two (2) Indicating lamps with resistors & coloured lenses, one each for 'On' and 'Off' indications.
- (f) Four (4) HRC control fuses
- (g) Two (2) Neutral links

41.00.00

SELECTION TABLES

41.01.00

Feeder Module, Other than Motor Selection Table (415 V AC)

Sl. No.	Feeder Rating (Amp.)	Switch/MCCB Rating (Amp.)	Fuse Rating (Amp.)	Cable Size (sq. mm)
1.	0-16	16	16	4CX6
2.	17-32	32	32	4CX16
3.	33-45	63	63	3 ¹ / ₂ CX35
4.	46-63	63	63	3 ¹ / ₂ CX70
5.	64-99	100	100	3 ¹ / ₂ CX70
6.	100	125A MCCB		3 ¹ / ₂ CX70
7.	101-160	250A MCCB		3CX150+1-1CX150
8.	161-250	400A MCCB		**
9.	251-400	400A MCCB		**
10.	630-1120 (Breaker)			7-1CX630
11.	1121-1680 (Breaker)			10-1CX630



- Note**
- i) The cables of size below 150 sq. mm shall be PVC insulated and those of size 150 sq. mm and above shall be XLPE insulated**
 - ii) All cables shall be of aluminium conductor except for 2.5 sq. mm size which shall be copper conductor.**
 - iii) ** - Shall be finalized based on actual requirement during detailed engineering.**
 - iv) Termination arrangement suitable for the above cable sizes shall be provided in the switchgear / MCC panels.**

41.02.00

Motor Module Selection table (Except CHP motors)

Sl. No.	Motor rating kW	Max. Motor Amp.	Switch rating Amp.	Fuse rating Amp.	Contactor rating Amp.	Cable size Sq. mm
1.	1.1-1.5	3.5	16	6/16	16	3CX2.5
2.	1.6-3.0	7	32	20	16	3CX2.5
3.	3.1-5.5	11	32	32	16	3CX6
4.	5.6-7.0	14.4	63	50	32	3CX6
5.	7.1-13.0	27.3	63	63	32	3CX16
6.	13.1-24.0	45	125	80/100	63	3CX35
7.	24.1-37.0	70	125	125	70 (upto 30kW) 100 (above 30kW)	3CX70
8.	37.1-55.0	100	250	160	100(upto 40kW) 160 (upto 55kW)	3CX120
9.	55.1-80.0	150	250	200	200	3CX150

10.	80.1-100	180	As per selected fuse	Suitable for type-II	225	3CX150 (upto 90kW) 3CX240 (above 90kW)
12.	110.0-200.0	CIRCUIT BREAKER				3-1CX300

- Note**
- i) *The cables of size below 150 sq. mm shall be PVC insulated and those of size 150 sq. mm and above shall be XLPE insulated.*
 - ii) *All cables shall be of aluminum conductor except for 2.5 sq. mm size which shall be copper conductor.*

41.03.00

Switch Fuse Module Selection Table (220 V DC)

For all 220 V DC modules other than for motors, the ratings of switches fuses and cable termination shall be selected from the following table :

Sl. No.	Feeder rating Amp.	Switch rating Amp.	Fuse rating Amp.	Cable Size Sq.mm
1.	0-6	10	6	2CX2.5
2.	6-10	16	10	2CX2.5
3.	10-14	16	16	2CX2.5
4.	14-19	32	32	2CX6
5.	19-32	32	32	2CX16
6.	32-53	63	63	2CX35
7.	53-81	100	100	2CX70
8.	81-114	125	125	2CX120
9.	114-125	250	250	2-1CX150



10.	215-340	400	400	2-1CX300
11.	340-560	600	600	2-1CX630
12.	560-1000	Circuit Breaker		4-1CX630
13.	1000-1400	Circuit Breaker		6-1CX630

Note i) The cables of size below 150 sq. mm shall be PVC insulated and those of size 150 sq. mm and above shall be XLPE insulated

ii) All cables shall be of aluminum conductor except for 2.5 sq. mm size which shall be copper conductor.



**TITLE : TECHNICAL SPECIFICATION
FOR
SELF CLEANING STRAINERS (SCS)**

SPEC. NO. PE-TS-405-165-N003

VOLUME : IIB

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**SECTION C3
SELF CLEANING STRAINERS
C&I DETAILS**

		3x660MW North karanpura STPP
1.00	SYSTEM	SCS
2.00	COMMON / PER UNIT	PER UNIT
3.00	CONTROL SYSTEM	DCS
3.10	PROCESSOR CONFIGURATION FOR PLC SYSTEM	NA
4.00	LOCATION OF CONTROL SYSTEM	CCR
4.10	CONTROL SYSTEM SCOPE (BIDDER/ BHEL/ CUSTOMER)	BHEL
5.00	HARDWIRED INTERFACE WITH DCS (Y/N)	NA
5.10	PURPOSE OF HARDWIRED INTERFACE WITH DCS	
5.11	a) <i>COMMAND FROM DCS (Y/N)</i>	NA
5.12	b) <i>STATUS FEEDBACK TO DCS (Y/N)</i>	NA
5.13	c) <i>GROUP FAULT ALARM TO DCS (Y/N)</i>	NA
6.00	SOFTLINK TO DCS (Y/N)	NA
6.10	PURPOSE OF SOFTLINK TO DCS	
6.11	a) <i>COMMAND INTERFACE WITH DCS (Y/N)</i>	NA
6.12	b) <i>STATUS MONITORING IN DCS (Y/N)</i>	NA
7.00	PROTECTION CLASS FOR PLC / RIO PANEL	NA

8.00	CONTROL FROM PB's ON LCP/OWS ON LCP	NA
9.00	ANNUNCIATION ON LCP (Y/N) -- IF Y, MIN NO. OF HARDWIRED ALARMS / INDICATIONS	NA
9.10	MIMIC ON LCP (Y/N)	NA
10.00	CONTROL FROM DCS IN CCR (Y/N)	Y
11.00	TYPE OF SOFTLINK (TP/OFC)	NA
11.10	COMMUNICATION CABLE SCOPE (BIDDER/ PEM/ EDN/ CUSTOMER)	NA
11.20	REDUNDANT CABLE (Y/N)	NA
11.30	PROTOCOL	NA
12.00	RIO / RPU (Y/N)	NA
13.00	## NO. OF OWS / LAPTOP	NA
13.10	SIZE OF OWS/ CRT OR LCD	NA
14.00	NO. OF PRINTER	NA
14.10	PRINTER SIZE AND TYPE	NA
15.00	\$\$ POWER SUPPLY AVAILABLE FOR BALL MONITOR (24V DC / 110 V AC UPS / 230 V AC UPS)	24V DC
15.10	&& POWER SUPPLY AVAILABLE FOR PLC PANEL (3PHASE, 415 V AC/ 1PHASE, 110 V UPS/ 1PHASE, 230 V UPS)	NA
15.20	REDUNDANT FEEDERS (R) / NON-REDUNDANT (NR) FEEDERS FOR POWER SUPPLY	NA
15.30	UPS BATTERY CONFIGURATION (1X100% / 2X100%)	NA

15.40	BATTERY TYPE (LEAD ACID/ Ni-Cd)	NA
15.50	BATTERY BACK-UP TIME (in minutes)	NA
16.00	ACTUATOR WITH INTEGRAL STARTER (Y/N)	Y
17.00	PG/ DPG/ PS/ DPS/ PT/ DPT per Self Cleaning Strainer	DPT = 2 no. DPG = 1 no.
18.00	REMARKS	
19.00	PROJECT SPECIFIC INFO	

19.00 NOTES:

1. **\$\$ THIS IS APPLICABLE FOR DCS CONTROLLED SYSTEMS ONLY.**
2. **\$\$\$ THIS IS APPLICABLE FOR PLC CONTROLLED SYSTEMS. ALL POWER SUPPLY REQUIREMENTS FOR INDIVIDUAL SUB-SYSTEMS/ COMPONENTS EG. BALL MONITOR, SOL VALVES ETC SHALL BE DERIVED BY THE VENDOR FROM THIS POWER SUPPLY.**
3. **** THE UPS FOR PLC SHALL BE IN BIDDER'S SCOPE. ITS CONFIGURATION SHALL BE 2X100% CHARGERS / INVERTERS.**
4. **IN CASE OF DCS CONTROLLED SYSTEMS, BIDDER TO TERMINATE ALL INSTRUMENTATION AND CONTROL ELEMENTS IN JUNCTION BOXES FOR FURTHER CABLING TO DCS BY BHEL/CUSTOMER. BIDDER TO PROVIDE INPUT/OUTPUT LIST, DRIVES LIST, JUNCTION BOX SCHEDULE AND TERMINATION DETAILS, RECOMMENDED CONTROL LOGICS / WRITE-UP ETC. DURING DETAILED ENGINEERING**
5. **IN CASE OF PLC CONTROLLED SYSTEMS, ALL CABLES & CABLE ENGINEERING SHALL BE IN BIDDER'S SCOPE.**
6. **## FOR PLC BASED CONTROL SYSTEM WHERE OWS IS PROVIDED, THE OWS SHALL HAVE PROGRAMMING & CONFIGURATION FACILITY.**
7. **OWS SHALL BE MOUNTED ON THE FRONT OF LCP.**
8. **COLOUR OF PLC PANEL SHALL BE AS PER IS-5 SHADE 631 OR EQUIVALENT.**
9. **INSTRUMENT RACK AND JUNCTION BOXES SHALL BE IN BIDDER'S SCOPE OF SUPPLY. NECESSARY STRUCTURAL STEEL FOR MOUNTING THE INSTRUMENTS(DPG,DPT,DPS),JUNCTION BOX, INSTRUMENT RACK,SWGR PANEL, ETC. SHALL BE IN BIDDER'S SCOPE.**
10. **BIDDER TO FURNISH ELECTRICAL LOAD DATA DURING DETAILED ENGINEERING.**
11. **ALARM FACIA SHALL BE UNDER BIDDER'S SCOPE. NO. OF FACIA SHALL BE DECIDED DURING DETAILED ENGINEERING.**

LEGEND:

DCS- DISTRIBUTED CONTROL SYSTEM

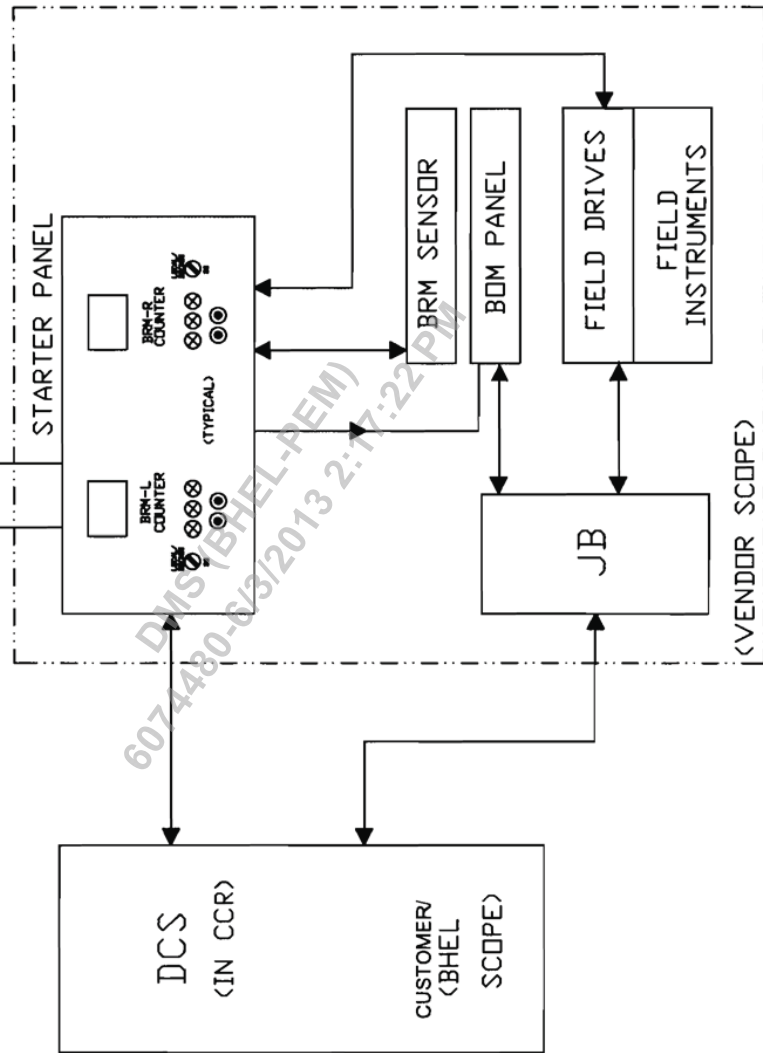
PLC- PROGRAMMABLE LOGIC CONTROLLER

RPU - REMOTE PROCESSING UNIT

STANDARD BLOCK DIAGRAM FOR SCS PACKAGE WITH DCS CONTROL

415V AC, 3P, 4WIRE
 REDUNDANT FEEDER (BY CUSTOMER/BHEL)

CONFIGURATION A:
 WITH STARTER PANEL IN VENDOR SCOPE



PE-DG-999-145-I274A(a)



**TITLE : TECHNICAL SPECIFICATION
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SECTION – D

STANDARD TECHNICAL SPECIFICATION

SECTION D1 : SELF CLEANING STRAINERS

SECTION D2 : ELECTRICAL SYSTEMS

SECTION D3 : C&I SYSTEM



**TITLE : TECHNICAL SPECIFICATION
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SELF CLEANING STRAINERS (SCS)**

SPEC. NO. PE-TS-405-165-N003

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SECTION D1

**STANDARD TECHNICAL SPECIFICATION
FOR
SELF CLEANING STRAINERS**



**TITLE : TECHNICAL SPECIFICATION
FOR MOU
SELF CLEANIGN STRAINER (SCS)**

SPEC. NO. PE-TS-XXX-165-N001

VOLUME : III

SECTION :

REV. NO. 0


DATE : 12.06.2012

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SECTION D1

**STANDARD TECHNICAL SPECIFICATION
FOR
SELF CLEANING STRAINER**

DMS (BHEL-P&M)
6078516-2014/07/19

	TITLE :	SPEC. NO. PE-TS- 999-165-N002
	STANDARD TECHNICAL SPECIFICATION	VOLUME : II B
	SELF - CLEANING FILTERS	SECTION : D
		REV. NO. 0 DATE : 02.12.2009
		SHEET 1 OF 10

1.00.00 **GENERAL**

This specification covers the Design, Performance and Operational Requirements, Constructional Features, Manufacture, Assembly. Inspection and Testing at the Manufacturer's and/or his Sub-contractor's works and Painting for delivery of Self-cleaning filter (Backwash Type) complete with all accessories as specified hereinafter.

2.00.00 **CODES AND STANDARDS**

2.01.00 The design, materials manufacture, inspection and testing of the self-cleaning filter complete with all accessories, shall comply with the requirements of the latest revisions of the following appropriate codes and standards :

2.01.01 IS / BS / DIN / US Standards regarding pressure vessels, pipes, flanges and others as necessary.

2.01.02 IS / BS / DIN / ASTM Standards for materials specification and testing procedures.

2.01.03 IS / BS / DIN / AWWA Standards for valves and their testing.

2.02.00 In case of any conflict between the above codes / standards and this specification, the later shall prevail and in case of any further conflict in the matter, the interpretation of the specification by the Engineer shall be final and binding.

3.00.00 **DESIGN AND CONSTRUCTION**

3.01.00 **General Requirements**

3.01.01 Unless otherwise necessary manufacturer's standard and proven models of the self cleaning filter shall be supplied.

3.01.02 The self-cleaning filter shall be capable of safe, proper and continuous operation. Vibration, noise, mechanical stresses shall be kept within allowable limits specified by relevant codes / standards, In design due attention shall be given to ease of maintenance, repair and cleaning.

3.01.03 Suitable corrosion allowance shall be provided wherever necessary.

3.01.04 Unless otherwise specified in Data Sheet-A, the inlet and outlets of the filter shall be co-axial without any off set between the centre lines of inlet and outlet pipes.

3.02.00 **Performance Requirements**

The self-cleaning filter with all accessories shall be designed and guaranteed to meet the following requirements :-

3.02.01 The self - cleaning filter shall perform satisfactorily under the flow and pressure conditions specified in Data Sheet -A and shall be capable of housing the various forms of debris / sludge i.e., suspended particles / matter, mussels, grass, leaves,