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4.2.00	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.		
4.3.00	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.		
4.4.00	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.		
4.5.00	Each DC fuse board shall comprise of the following : (e.) 1 no. 63 A switch as incomer (f.) 100 A fully insulated (PVC sleeved or epoxy coated) busbars. (g.) 8 nos. 16A outgoing Fuse feeders. (h.) 1 no. auxiliary contactor for supply monitoring. (i.) 1 no. indicating lamp with resistor and blue coloured lens.		
4.6.00	Each AC fuse board shall comprise of the following : (j.) 1 no. 63A TPN switch as incomer. (k.) 100 A, 3-phase, 4-wire, fully insulated (PVC sleeved or epoxy coated) busbars. (l.) 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. (m.) 3 nos. indicating lamps with resistors and coloured lenses (R, Y, B) for incoming supply monitoring.		
4.7.00	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.		
4.8.00	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.		
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7.2.00	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.		
7.3.00	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.		
7.4.00	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.		
7.5.00	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.		
7.6.00	Each module frame shall get engaged to the vertical earth bus before the disconnecting contacts on the module are engaged to the vertical busbars.		
7.7.00	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.		
7.8.00	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.		
7.9.00	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		
8.1.00	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.		
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8.2.00	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.		
8.3.00	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" 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.		
8.4.00	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.		
8.5.00	Suitable mechanical indications shall be provided on all circuit breakers to show "OPEN", "CLOSE", "SERVICE ", "TEST" AND "SPRING CHARGED" positions.		
8.6.00	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.		
8.7.00	All circuit breakers shall be provided with the following interlocks :		
8.7.1	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.		
8.7.2	Closing of a circuit breaker shall not be possible unless it is in "SERVICE" position, "TEST" position or in "FULLY WITHDRAWN" position.		
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8.7.3	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.													
8.7.4	A breaker of particular rating shall be prevented from insertion in a cubicle of a different rating.													
8.7.5	Circuit breakers shall be provided with coded key / electrical interlocking devices, as per requirements.													
8.8.00	Circuit breaker shall be provided with anti-pumping feature (soft) and trip free feature, even if mechanical anti-pumping feature is provided.													
8.9.00	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. <table><tr><td>1.</td><td>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.</td></tr><tr><td>2.</td><td>The motor shall be such that it requires not more than 30 seconds for fully charging the closing spring at minimum available control voltage.</td></tr><tr><td>3.</td><td>Once the closing springs are discharged, after one closing operation of circuit breaker, it shall automatically initiate recharging of the spring.</td></tr><tr><td>4.</td><td>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.</td></tr><tr><td>5.</td><td>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.</td></tr></table>				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.
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8.12.00	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. Further, the racking mechanism shall be accessible only after opening the breaker panel door.		
	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.			
	TELESCOPIC TROLLEY 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.			
	AIR BREAK SWITCHES 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.			
	Continuous current rating of the switches shall be selected from the 'Module Selection tables' for various feeders.			
	The combination of switch-fuse unit would be preferred. However, if separate switch and fuses are provided, switch shall be located before fuses.			
	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			
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	padlocking facilities. However, incomer switches of switchboards shall be provided with padlocking facility in both 'ON' and 'OFF' positions.			
10.05.00	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.			
10.06.00	Switches and fuses for AC/DC control supply and heater supply wherever required, shall be mounted inside the cubicles. Toggle switch is not acceptable.			
10.07.00	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.			
10.00.00	MCCB			
10.1.00	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.			
10.2.00	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).			
10.3.00	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.			
10.4.00	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.			
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11.00.00	CONTROL AND SELECTOR SWITCHES		
11.1.00	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.		
11.2.00	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.		
11.3.00	Contacts of the switches shall be spring assisted and shall be of suitable material to give a long trouble free service.		
11.4.00	The contact ratings shall be at least the following :		
	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		
12.1.00	Motor starter contactors shall be of air break, electromagnetic type rated for uninterrupted duty as per IS/IEC 60947 Part-4 Section- 1.		
12.2.00	Contactors shall be double-break, non-gravity type and their main contacts shall be silver faced.		
12.3.00	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.		
12.4.00	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.		
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12.5.00	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.		
12.6.00	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		
13.1.00	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.		
13.2.00	Fuse shall have visible operation indicators. Insulating barriers shall be provided between individual power fuses.		
13.3.00	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.		
13.4.00	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.		
13.5.00	The Neutral links shall be mounted on fuse carriers which shall be mounted on fuse bases.		
14.00.00	INSTRUMENT TRANSFORMERS		
14.1.00	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.		
14.2.00	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.		
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14.3.00	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.		
14.4.00	Current transformers may be multi or single-core type. All voltage transformers shall be single phase type.		
14.5.00	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.		
14.6.00	All CTs shall be provided with supports independent of busbar / busbar supports.		
14.7.00	The CTs shall be located in such a way that they can be easily approached for maintenance without necessitating shut down of adjacent feeders.		
15.00.00	NUMERICAL RELAYS & NETWORKING		
15.1.00	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 Employer'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.		
15.2.00	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.		
15.3.00	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 Employer's data concentrator through LAN and Ethernet switches. Ethernet switches shall be connected through Fibre Optic cable to Numerical Relay network by Employer. The connection from the Numerical relay to Ethernet switch shall be in Contractors scope and sufficient length of cat 5e Ethernet cable shall be provided for the same.		
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15.4.00	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.		
15.5.00	The protective relays shall have at least 10 Nos programmable potential free contacts. Programmable Auxiliary relays shall have contacts as required.		
15.6.00	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.		
15.7.00	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.		
15.8.00	Relays shall be suitable for electrical measurement including voltage, current, power (active/reactive) and energy parameters.		
15.9.00	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.		
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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. 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.		
15.18.00	Numerical relays shall have two level password protections, one for read only and other for authorization for modifying the setting etc.		
15.19.00	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.		
15.20.00	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.		
16.00.00	OTHER PROTECTIONS AND CONTROL FUNCTIONS IN THE RELAYS		
16.1.00	For control from DDCMIS, 24V DC signal shall be provided from DDCMIS to the numerical relays. Preferably, no separate coupling relays shall be provided.		
16.2.00	Trip circuit supervision shall be provided for all feeders to monitor the circuit breaker trip circuit both in pre trip and post trip conditions.		
16.3.00	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.		
16.4.00	Bus no volt condition shall be configured to a output contact of the relay of all incomers for suitably interfacing with DDCMIS.		
16.5.00	Timer functions shall be programmable for on/off delays.		
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16.6.00	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.		
16.7.00	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.		
16.8.00	200 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.		
16.9.00	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 Employer's approval. Setting calculations and relay settings configured in relay software for all relays shall be submitted for Employer's approval. Approved relay configuration / settings shall be loaded in all the relays prior to dispatch to site.		
17.00.00	TRAINING The Contractor shall arrange for training on system design, engineering, operation and maintenance of Numerical relays at the principal's facility for duration of two (2) man-months.		
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	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. 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. Employer shall provide the required Infrastructure such as Training Conference room, Projection systems etc.			
18.00.00	INDICATING INSTRUMENTS			
18.1.00	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 class of 1.0 or better. The covers and cases of instruments and meters shall provide a dust and vermin proof construction.			
18.2.00	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.			
18.3.00	All instruments shall have white dials with black numerals & lettering. Black knife edge pointer shall be provided for meters.			
18.4.00	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.			
18.5.00	All motor feeders of rating $\geq 30\text{ kW}$ and $< 110\text{ kW}$ 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: 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.			
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	l) Aux supply: 90V-300V AC/DC m) Compliance: EMC/EMI n) Field programmable CT ratio o) Analog Current Output (4-20 mA)			
19.00.00	PUSH BUTTONS			
19.1.00	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.			
19.2.00	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.			
19.3.00	All push-buttons shall be provided with integral escutcheon plates marked with its function.			
19.4.00	The color of the button shall as follows : Green for motor START, breaker CLOSE , valve/ damper OPEN commands. Red for motor trip, breaker open, valve / damper close commands. Black for all annunciation functions, overload reset and miscellaneous commands including reverse for clinker grinder etc.			
19.5.00	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.			
19.6.00	All emergency push buttons shall have mushroom knobs.			
20.00.00	INDICATING LAMPS			
20.1.00	Indicating lamps shall be of CLUSTER LED type. The lamps shall have escutcheon plates marked with its function, wherever necessary.			
20.2.00	Lamps shall have translucent lamp-covers of the following colours, as warranted by the application : Red for motor ON, valve / damper OPEN, breaker CLOSE. Green for motor OFF , valve / damper CLOSE, breaker OPEN. White for motor AUTO TRIP.			
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CLAUSE NO.	TECHNICAL REQUIREMENTS			
	Blue	for all healthy conditions (e.g. control supply, and also for SPRING CHARGED").		
	Amber	for all Alarm Conditions (e.g. overload). Also for "SERVICE" and "TEST" position indications.		
20.3.00	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.			
20.4.00	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.			
20.5.00	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.			
20.6.00	All indicating lamps shall be suitable for continuous operation at 90% to 110% of their rated voltage.			
21.00.00	SPACE HEATER			
21.1.00	Space heaters shall be provided in the switchboards wherever the manufacturer considers them necessary and recommends their provision for preventing harmful moisture condensation.			
21.2.00	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 switches and fuses shall be provided.			
21.3.00	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.			
22.00.00	INTERNAL WIRING			
22.1.00	All switchboards shall be supplied completely wired internally upto the terminals, ready to receive external cables.			
22.2.00	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.			
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CLAUSE NO.	TECHNICAL REQUIREMENTS	एनटीपीसी NTPC	
22.3.00	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 mm ² (min.) for control circuit wiring and 2.5 mm ² (min) for CT and space heater circuits.		
22.4.00	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.		
22.5.00	All wiring shall be properly supported, neatly arranged, readily accessible and securely connected to equipment terminals and terminal blocks.		
22.6.00	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.		
22.7.00	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.		
22.8.00	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.		
22.9.00	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 Employer regarding cable details are to be taken. For power wiring color coded wire insulation / tapes shall be provided.		
23.00.00	CONTROL TERMINAL BLOCKS		
23.1.00	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.		
23.2.00	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,		
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CLAUSE NO.	TECHNICAL REQUIREMENTS 	
	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. LPBS shall be painted to shade no. RAL: 9002. 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.	
23.3.00	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.	
23.4.00	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 possibility of double shorting space to facilitate looping. However for DDCMIS terminals shall be suitable for 1.5 mm² cable.	
23.5.00	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.	
25.06.00	Wherever duplication of a terminal block is necessary it shall be achieved by solid bonding links.	
25.07.00	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.	
24.00.00	POWER CABLE TERMINATION	
24.1.00	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.	
24.2.00	The Local push button stations enclosure made of FRP (Fiberglass Reinforced Polymer) may also be offered. The FRP enclosure shall be of SMC Hot press Molded, Halogen free and flame retardant as per UL94, V-0. The thickness of the FRP enclosure shall be at least 4mm. The color of the FRP type LPBS shall be of RAL 7035 and the hinges, nuts & bolts shall be of Polyamide/Stainless Steel material 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.	
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25.00.00	LOCAL PUSH BUTTON STATIONS											
25.1.00	The enclosure shall be provided with a hinged guard at the front, covering full length, to avoid inadvertent operation of push buttons Support structure for mounting the LPBS shall also be supplied by Contractor.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.											
25.2.00	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 Employer's approval.											
25.3.00	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											
26.1.00	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.											
26.2.00	Each starter shall comprise of : <table><tr><td>1.</td><td>A 3-pole contactor, mechanically latched type.</td></tr><tr><td>2.</td><td>Start push button, colored green.</td></tr><tr><td>3.</td><td>Stop push button, colored red.</td></tr><tr><td>4.</td><td>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.											
26.3.00	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.											
26.4.00	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.											
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CLAUSE NO.	TECHNICAL REQUIREMENTS	
27.00.00	NAME PLATES AND LABELS	
27.1.00	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.	
27.2.00	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 Employer's approval.	
27.3.00	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 positioned so as to be clearly visible and shall have the device number, as mentioned in the module wiring drawings.	
27.4.00	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.	
28.00.00	~~METAL ENCLOSED NON SEGREGATED PHASE BUSDUCT(AIR INSULATED)~~	Not applicable
28.1.00	~~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 transformer rating is 1000KVA and above. The rating of the incoming and interconnecting bus ducts shall be same as the rating of the switchboard.~~	
28.2.00	~~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.~~	
28.3.00	~~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.~~	
28.4.00	~~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.~~	
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Not applicable

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28.5.00	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.		
28.6.00	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.		
28.7.00	Suitable Inspection covers shall be provided for periodic inspection of insulators. Handle shall be provided on each inspection cover to facilitate easy lifting.		
28.8.00	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.		
28.9.00	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 bus duct and shall be earthed at both ends. Bus duct enclosures shall be bolted type.		
28.10.00	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.		
28.11.00	All steel structures required for bus duct support shall be hot dip galvanized.		
28.12.00	Space heaters shall be provided in the bus duct wherever the manufacturer considers them necessary and recommends their provision for preventing harmful moisture condensation.		
28.13.00	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 bus duct and from junction boxes to switch boards shall be provided by the Contractor.		
29.00.00	BUS TRUNKING SYSTEM (SANDWICH TYPE BUSDUCT)		
29.1.00	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 Turbine Unit Emergency Switchgears as indicated in the BOQ.		
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CLAUSE NO.	TECHNICAL REQUIREMENTS	एनटीपीसी NTPC
29.2.00	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.	
29.3.00	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.	
29.4.00	The busduct exterior paint shade shall be RAL 5012.	
29.5.00	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.	
29.6.00	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.	
29.7.00	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.	
29.8.00	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.	
29.9.00	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	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.	
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	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 Employer. 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.			
31.00.00	GASKETS			
	The gaskets, wherever specified, shall be of good quality EPDM / Neoprene with good ageing, compression and oil resistance characteristics suitable for panel applications.			
32.00.00	TEMPERATURE –RISE			
	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.			
33.00.00	DERATING OF EQUIPMENTS			
	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. 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.			
34.00.00	PROTECTION CO-ORDINATION			
	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.			
35.00.00	TESTS AND TEST REPORTS			
	GENERAL			
	(a.) All equipments to be supplied shall be of type tested design. The Contractor shall submit for Employer's approval the reports of all the type tests as listed in this			
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	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. (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/Employer's representative and submit the reports for approval. (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. <table><tr><td>1)</td><td colspan="3">Switchgear / MCC panels of each rating</td></tr><tr><td></td><td>a)</td><td colspan="2">Short time withstand test.</td></tr><tr><td></td><td>b)</td><td colspan="2">Temperature rise test.</td></tr><tr><td></td><td>c)</td><td colspan="2">Degree of protection test</td></tr><tr><td>2)</td><td colspan="3">Circuit breaker of each rating</td></tr><tr><td></td><td>a)</td><td colspan="2">Test sequence 1</td></tr><tr><td></td><td></td><td>-</td><td>Dielectric properties.</td></tr><tr><td></td><td></td><td>-</td><td>Mechanical operation and operational performance capability</td></tr><tr><td></td><td></td><td>-</td><td>Verification of dielectric withstand.</td></tr><tr><td></td><td></td><td>-</td><td>Verification of temperature-rise</td></tr><tr><td></td><td>b)</td><td colspan="2">Combined test sequence (With Circuit breakers mounted inside the Switchgear panel)</td></tr><tr><td></td><td></td><td>-</td><td>Rated short-time withstand current</td></tr><tr><td></td><td></td><td>-</td><td>Rated service short-circuit breaking capacity</td></tr></table>				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
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35.1.00			-	Verification of dielectric withstand
			-	Verification of temperature-rise
	3)	MCC modules of any three ratings, as selected by the Employer, for class - II protection Co-ordination.		
	4)	Test for single phasing protection feature on 3 nos. bimetallic thermal overload relay selected by Employer. The relay shall be tested for compliance with manufacturer's printed / declared characteristic curve.		
	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 Employer either at third party lab or in presence of client/Employer's representative and submit the reports for approval.			
35.2.00	(a.) NUMERICAL RELAYS			
	(b.) LOCAL PUSH BUTTON STATION			
	(c.) LOCAL MOTOR STARTER			
	(g) MCCB			
	Type test reports for the following tests on the model of the Numerical relays, Ethernet switches shall be submitted for Employer's review.			
	S. No.	TEST ITEMS		Standard
	1	Dimensions of structure and visual inspection		IEC 60297-3-101
	2	Functional requirements:		Relevant
		– Steady-state simulation		IEC 60255-100
		– Dynamic simulation		series
	3	Product safety requirements		IEC 60255-27
		(including the dielectric tests and thermal short time rating)		
	4	EMC requirements:		IEC 60255-26
		– Emission		
		– Immunity		
	5	Energizing quantities:		
		– Burden		N/A
		– Change of auxiliary energizing quantity		IEC 60255-11
	6	Contact performance		N/A
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CLAUSE NO.	TECHNICAL REQUIREMENTS				
37.05.00	7	Communication requirements	Relevant IEC protocol standards		
	8	Climatic environmental requirements:	IEC 60068-2-14,		
		– Cold	IEC 60068-2-1,		
		– Dry heat	IEC 60068-2-2,		
		– Change of temperature	IEC 60068-2-78,		
		– Damp heat	IEC 60068-2-30, IEC 60255-27		
	9	Mechanical requirements: – Shock	IEC 60255-21-1,		
		– Vibration	IEC 60255-21-2,		
		– Bump	IEC 60255-21-3		
		– Seismic			
	10	Enclosure protection	IEC 60529, IEC 60255-27		
	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. All routine tests as per the specification and relevant standard IS 8623 shall be carried out. 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.				
	37.06.00	All procedures for type tests shall be approved by Employer 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 :				
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CLAUSE NO.	TECHNICAL REQUIREMENTS		एनटीपीसी NTPC	
	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.		
36.00.00	ERECTION / INSTALLATION OF SWITCHBOARDS AND OTHER EQUIPMENTS			
36.1.00	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 Employer. No equipment shall be permanently fixed down to foundations until the alignment has been checked and found acceptable by the Employer.			
36.2.00	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.			
36.3.00	Manufacturer's and Employer's instructions and recommendations shall be correctly followed in handling, setting, testing and commissioning of all equipment.			
36.4.00	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.			
36.5.00	All switchboards shall be installed in accordance with Indian Standard, IS: 3072, and Employer's instructions.			
36.6.00	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.			
36.7.00	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.			
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CLAUSE NO.	TECHNICAL REQUIREMENTS	एनटीपीसी NTPC	
36.8.00	Equipment furnished with finished coats of paint shall be touched up by Contractor if their surface is spoiled or marred during erection / commissioning.		
36.9.00	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.		
37.00.00	COMMISSIONING CHECKS / TESTS		
37.1.00	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.		
37.2.00	The Contractor shall carry out the following commissioning checks, in addition to other checks and tests recommended by the manufacturers.		
37.3.00	GENERAL (a.) Check name plate details according to the approved drawings. (b.) Check for physical damage. (c.) Check tightness of all bolted connections, by torque wrench. (d.) Check earth connections. (e.) Check cleanliness. (f.) Check all moving parts for proper lubrication.		
37.4.00	Circuit Breakers (a.) Check alignment of breaker truck for free movement. (b.) Check correct operation of shutters. (c.) Check control wiring for correctness of connections, continuity And IR values. (d.) Manual operation of breakers completely assembled. (e.) Closing /opening operation, manually and electrically. (f.) Trip free and anti-pumping operation.		
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CLAUSE NO.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
37.5.00	(g.)	I.R. values of contacts.		
	(h.)	Contact resistance.		
	(i.)	Check on spring charging motor, correct operation of limit switches and time on charging.		
	(j.)	All functional checks		
	(k.)	Breaker closing and tripping time, if required.		
37.6.00	Current Transformers			
	(a.)	Visual inspection.		
	(b.)	IR Value		
	(c.)	Ratio check.		
	(d.)	Magnetising current.		
	(e.)	Wiring connection.		
	(f.)	Spare CT cores, if any, to be shorted and earthed		
37.7.00	Voltage Transformers			
	(a.)	Visual inspection.		
	(b.)	IR Value		
	(c.)	Ratio check		
	(d.)	Magnetising current		
37.7.00	(e.)	Line connection as per connection diagram		
	Cubicle Wiring			
	(a.)	Check all switch developments		
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CLAUSE NO.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
37.8.00	(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.			
	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. 7. Check CT and VT connections with particular reference to their polarities.			
37.9.00	Meters (a.) Visual inspection. (b.) Megger all insulated partitions. (c.) Check CT and VT connections with particular reference to their polarities for power type meters. (d.) Calibration.			
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CLAUSE NO.	TECHNICAL REQUIREMENTS	एनटीपीसी NTPC	
38.00.00	AC MODULES DESCRIPTION		
38.1.00	Module type DAE (Circuit Breaker Module) (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.) Numerical relay for the following: - Short Circuit Protection - Earth Fault Protection - Over Load protection - Energy Metering - Current and Voltage metering - Trip Circuit Supervision - CB Monitoring - Synchronizing Check feature		
38.2.00	Module Type DAET (Circuit Breaker Incomer From Transformer) 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.		
38.3.00	Module Type CC (Contactor Changeover Between Two In Coming Supplies) (Note: Main and Reserve incomers shall be housed in separate drawout modules, located in different panels.) The drawout modules shall be provided with service position limit switch having 2 NO+2NC contacts.		
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CLAUSE NO.	TECHNICAL REQUIREMENTS	एनटीपीसी NTPC		
38.4.00	Main Incomer One (1) Triple pole load break isolating switch . One (1) Triple pole contactor with coil suitable for 415 V AC. Two (2) Auxiliary contactors with coil suitable for 415 V AC. One (1) Indicating lamp with resistor and coloured lens suitable for 415 V AC. Three (3) HRC control fuses. Reserve Incomer One (1) Triple pole load break isolating switch One (1) Triple pole contactor with coil suitable for 415 V AC. One (1) Indicating lamp with resistor and coloured lens suitable for 415 V AC. Two (2) HRC control fuses. Module Type CS (AC Control Supply Module) (Note: Module type CS will be of non-drawout type) Two (2) 415/110 V control transformers. Four (4) 110V auxiliary relays. Two (2) Earth links. Eight (8) HRC Control fuses. Two (2) Selector switches			
38.5.00	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			
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CLAUSE NO.	एनटीपीसी NTPC TECHNICAL REQUIREMENTS	
38.6.00 38.7.00 38.8.00	(d.) Six (6) HRC control fuses (e.) Numerical relay for the following: - Differential protection - Over Load protection - Reverse Power Protection - DG Neutral displacement - Energy Metering - Current and Voltage metering - DG Monitoring 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) 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. (c.) Three (3) HRC control fuses. Module Type H (Isolating Switch Module) (a) One (1) Triple pole load break isolating switch (b) One (1) Neutral link	
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CLAUSE NO.	TECHNICAL REQUIREMENTS			
38.9.00	Module type K1 (Non Reversible Motor Rated Below 30 kW Controlled from MCC)			
	(a)	One (1)	Triple pole fuse switch unit with three pole load break isolating switch and three HRC fuses.	
	(b)	One (1)	Triple pole contactor.	
	(c)	One (1)	Bimetallic thermal overload relay with single phasing preventer. For motor with high starting time, heavy duty overload relay shall be provided.	
	(d)	Two (2)	Push buttons.	
	(e)	Three (3)	Indicating lamps with resistors and coloured lenses.	
	(f)	One (1)	HRC control fuse.	
	(g)	One (1)	Control link.	
38.10.00	Module Type K11 (Non reversible Motor Rated 30kW to 200kW Controlled from MCC)			
	Similar to module type K1 but with the following additions:			
	One (1) Current transformer for metering.			
	One (1) Ammeter			
	One (1) Single-pole switch and fuse for motor space heater.			
38.11.00	Module type DK2 (Non Reversible Motor rated below 30kW Controlled from DDCMIS)			
	(a)	One (1)	Triple pole switch fuse unit with three pole load break Isolating switch and three HRC fuses.	
	(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.	
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CLAUSE NO.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
38.14.00	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			
38.15.00	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) Restart inhibit protection(49) Locked Rotor Protection Energy Metering Current and Voltage metering			
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CLAUSE NO.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
	Trip Circuit Supervision CB Monitoring			
39.00.00	DC MODULES DESCRIPTION			
39.1.00	Module Type -CH (Incomer)			
	(a)	One (1)	Double pole, 250 V DC fuse -switch unit	
39.2.00	Module Type - DC			
	(a.)	One (1)	Double pole 250V DC switch / circuit breaker with 2NO+2NC auxiliary contacts.	
39.3.00	Module Type - HD (DC Isolating Switch / Circuit - Breaker Module)			
	(a.)	One (1)	Double pole , 250 V DC switch isolator / circuit breaker	
39.4.00	Module Type-S (DC Metering and Protection Module)			
	(a.)	One (1)	Voltmeter, 0-300V DC	
	(b.)	One (1)	Three position voltmeter selector switch	
	(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.	
	(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	
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CLAUSE NO.	TECHNICAL REQUIREMENTS					एनटीपीसी NTPC
39.5.00	Module Type -X (DC Isolating Switch Fuse Module)					
	(a.) One (1) Double pole , 250 V DC fuse switch unit with two HRC fuses.					
40.00.00	SELECTION TABLES					
40.1.00	Feeder Module, Other than Motor Selection Table (415 V AC)					
	Sl. No.	Feeder Rating (Amp.)	Switch/MCCB Rating (Amp.)	Fuse Rating (Amp.)		
	1.	0-16	16	16		
	2.	17-32	32	32		
	3.	33-45	63	63		
	4.	46-63	63	63		
	5.	64-99	100	100		
	6.	100	100A MCCB			
	7.	101-160	160A MCCB			
	8.	161-250	250A MCCB			
	9.	251-400	400A MCCB			
	10.	401-1120 (Breaker)				
	11.	1121-1680 (Breaker)				
40.2.00	Motor Module Selection table					
	Sl. No.	Motor rating kW	Max. Motor Amp.	Switch rating Amp.	Fuse rating Amp.	Contactor rating Amp.
	1.	1.1-1.5	3.5	16	6/16	16
	2.	1.6-3.0	7	32	20	16
	3.	3.1-5.5	11	32	32	16
	4.	5.6-7.0	14.4	63	50	32
	5.	7.1-13.0	27.3	63	63	32
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6.	13.1-24.0	45	125	80/100	63
7.	24.1-37.0	70	125	125	70 (upto 30kW) 100 (above 30kW)
8.	37.1-55.0	100	250	160	100 (upto 40kW) 160 (upto 55kW)
9.	55.1-80.0	150	250	200	200
10.	80.1-100	180	As per selected fuse	Suitable for type-II	225
12.	110.0- 200.0	CIRCUIT BREAKER			

40.3.00

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.
1.	0-6	10	6
2.	6-10	16	10
3.	10-14	16	16
4.	14-19	32	32
5.	19-32	32	32
6.	32-53	63	63
7.	53-81	100	100
8.	81-114	125	125
9.	114-125	250	250
10.	215-340	400	400
11.	340-560	600	600
12.	560-1000	Circuit Breaker	
13.	1000-1400	Circuit Breaker	

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LEGEND DESCRIPTION

52	CIRCUIT BREAKER
42	CONTACTOR
S.A.	SURGE ARRESTOR
	CURRENT TRANSFORMER
	CORE BALANCE CURRENT TRANSFORMER
	VOLTAGE TRANSFORMER
50	TRIPLE POLE IDMTL/DMT O/C PROTECTION
51	TRIPLE POLE INSTANTENIOUS O/C PROTN.
50N	IDMTL / DMT SENSITIVE E/F PROTECTION
51N	INSTANTENIOUS E/F PROTECTION
49	THREE PHASE THERMAL O/L PROTN. WITH O/L ALARM & RESTART INHIBITE FUNCTION
50L/R	STALLING / LOCKED ROTOR PROTECTION
46	THREE PHASE NEGATIVE PHASE SEQUENCE PROTECTION
68	NUMBER OF START LIMITATION/REPATIVE START PROTECTION
2	TIME DELAY RELAY
60	FUSE FAILURE PROTECTION
87M	3 PHASE MOTOR DIFFERENTIAL PROTECTION

LEGEND DESCRIPTION

64R	RESTRICTED EARTH FAULT PROTECTION
51G	STAND BY EARTH FAULT PROTECTION
87T	3 PHASE BIASED TRANSFORMER DIFFERENTIAL PROTECTION
27M	3 PHASE UNDER VOLTAGE PROTECTION FOR MOTOR TRIPPING
27U	3 PHASE BUS UNDER VOLTAGE
27N	NO VOLT PROTECTION FOR BUS
50BF	CIRCUIT BREAKER FAILURE PROTECTION
86	LOCKOUT FUNCTION
3I	3 PHASE CURRENT MEASUREMENT
Io	NEUTRAL CURRENT MEASUREMENT
3U	3 PHASE VOLTAGE MEASUREMENT
Uo	RESIDUAL VOLTAGE MEASUREMENT
P	ACTIVE POWER MEASUREMENT
Q	REACTIVE POWER MEASUREMENT
E	ENERGY MEASUREMENT
PF	POWER FACTOR MEASUREMENT
HZ	FREQUENCY MEASUREMENT
HM	HOUR RUN METER

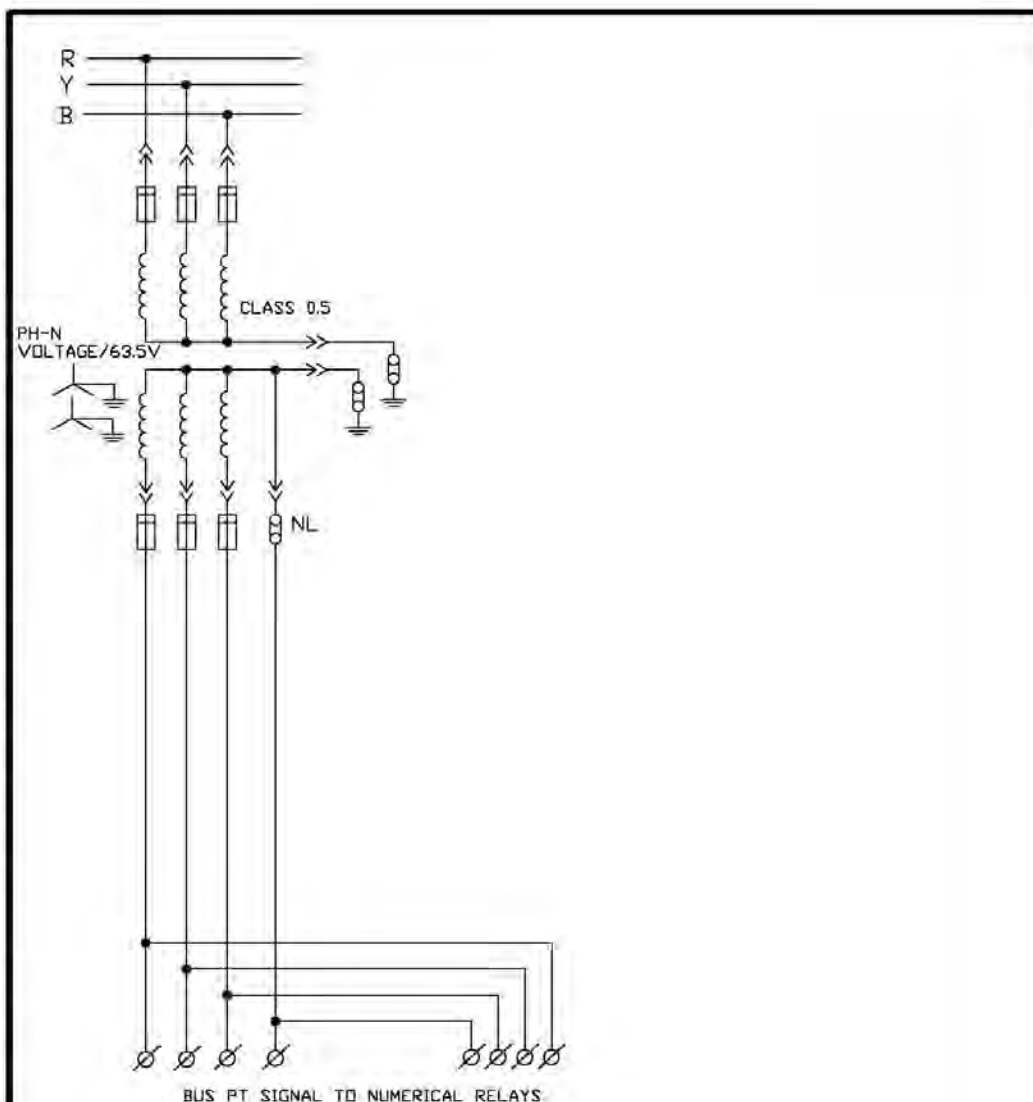
FOR TENDER PURPOSE ONLY

		एनटीपीसी लिमिटेड NTPC Limited (A GOVERNMENT OF INDIA ENTERPRISE)																																		
<table border="1"> <tr> <th colspan="5">CLEARED BY</th> <th rowspan="2">PROJECT</th> </tr> <tr> <th>C</th> <th>E</th> <th>H</th> <th>C&I</th> <th>ES</th> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td rowspan="2">STANDARD</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td colspan="5">TITLE</td> <td rowspan="2">LEGEND DETAILS</td> </tr> <tr> <td colspan="5"></td> </tr> </table>				CLEARED BY					PROJECT	C	E	H	C&I	ES						STANDARD						TITLE					LEGEND DETAILS					
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TITLE					LEGEND DETAILS																															
DRN	DGN	CHKD	APPD	DATE	SCALE	DRAWING No.	REV.																													
-				18/01/87	NA	0000-206-PDE-A-003	0																													

LEGEND.DWG

A4 210X297

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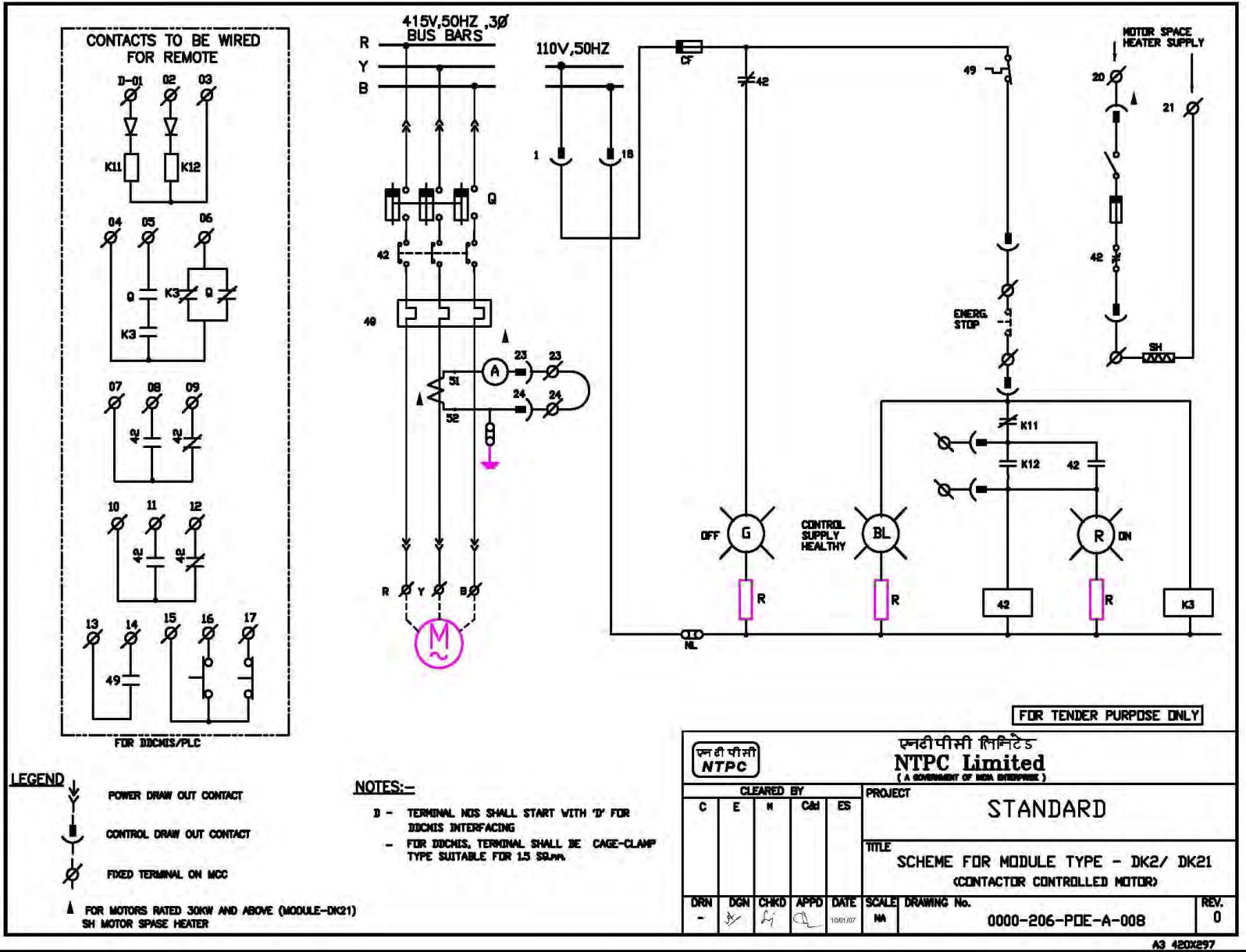


FOR TENDER PURPOSE ONLY

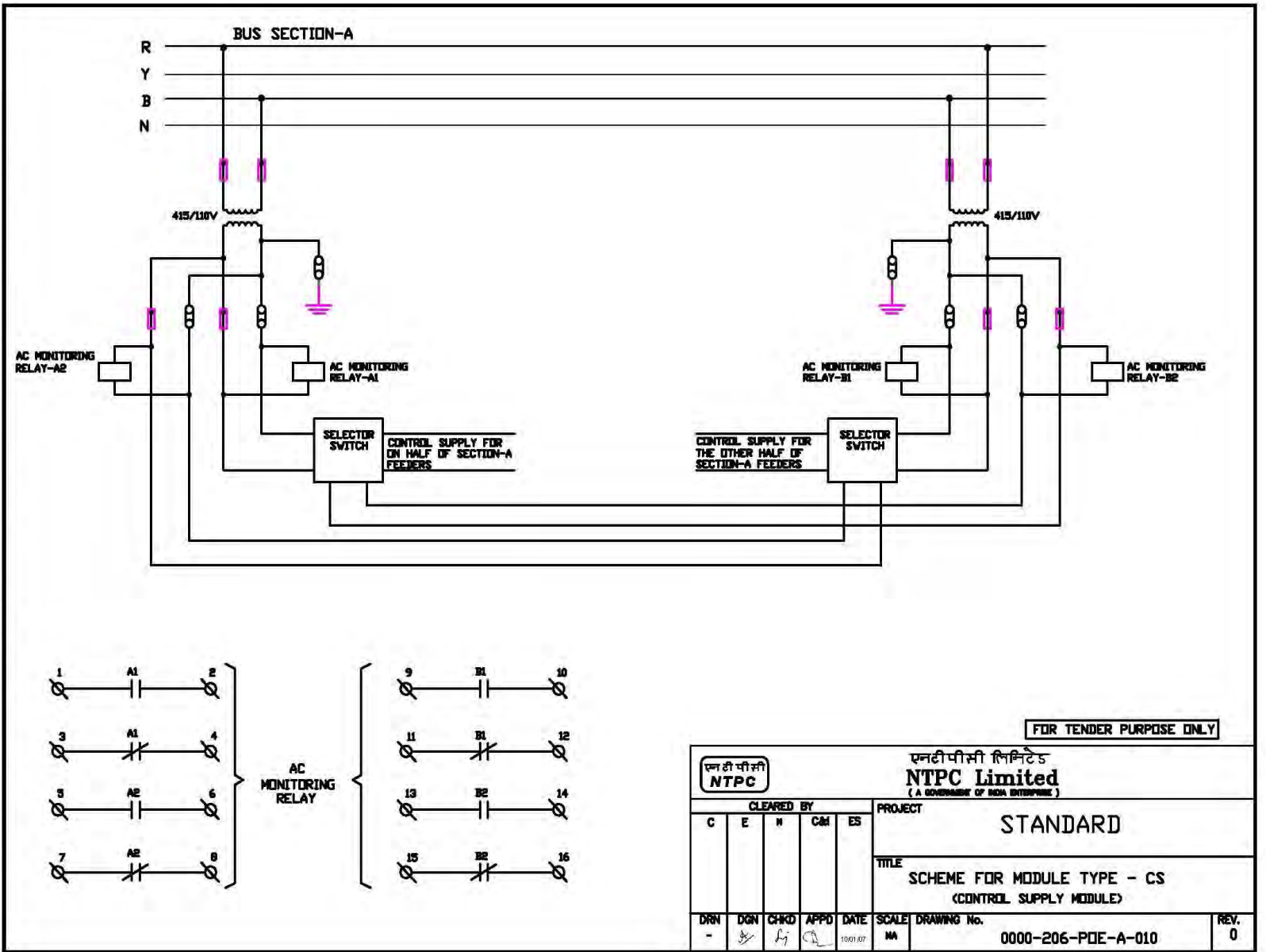
एनटीपीसी NTPC					एनटीपीसी लिमिटेड NTPC Limited (A GOVERNMENT OF INDIA ENTERPRISE)				
CLEARED BY					PROJECT				
C	E	H	C&I	ES	STANDARD				
					TITLE				
					SCHEME FOR MODULE TYPE - G1 (BUS PT)				
DRN	DGN	CHKD	APPD	DATE	SCALE	DRAWING No.			REV.
-	✓	✓	✓	10/01/07	NA	0000-206-PDE-A-007			0

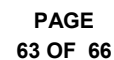
A4 210X297

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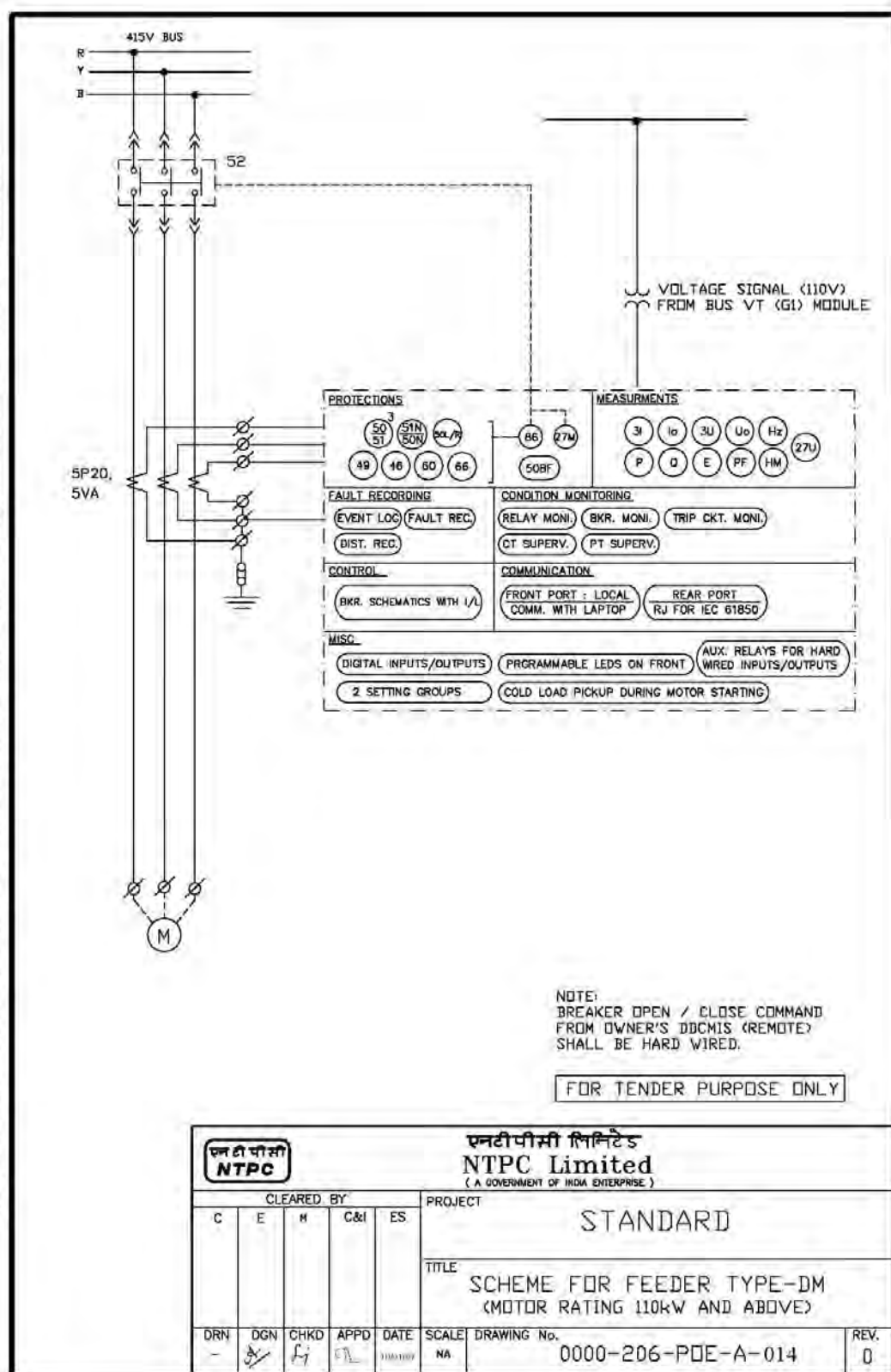


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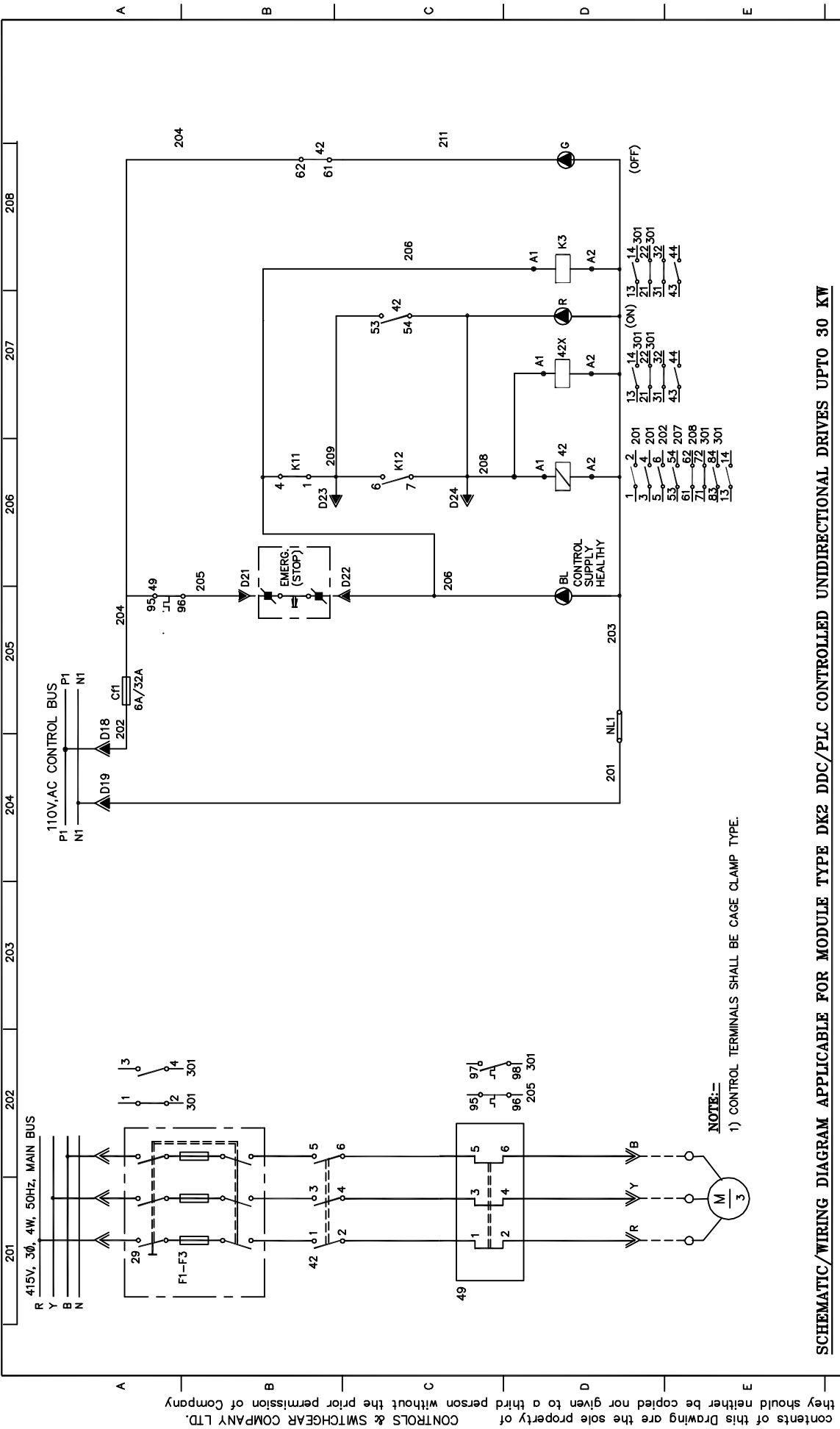


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A4 210X297

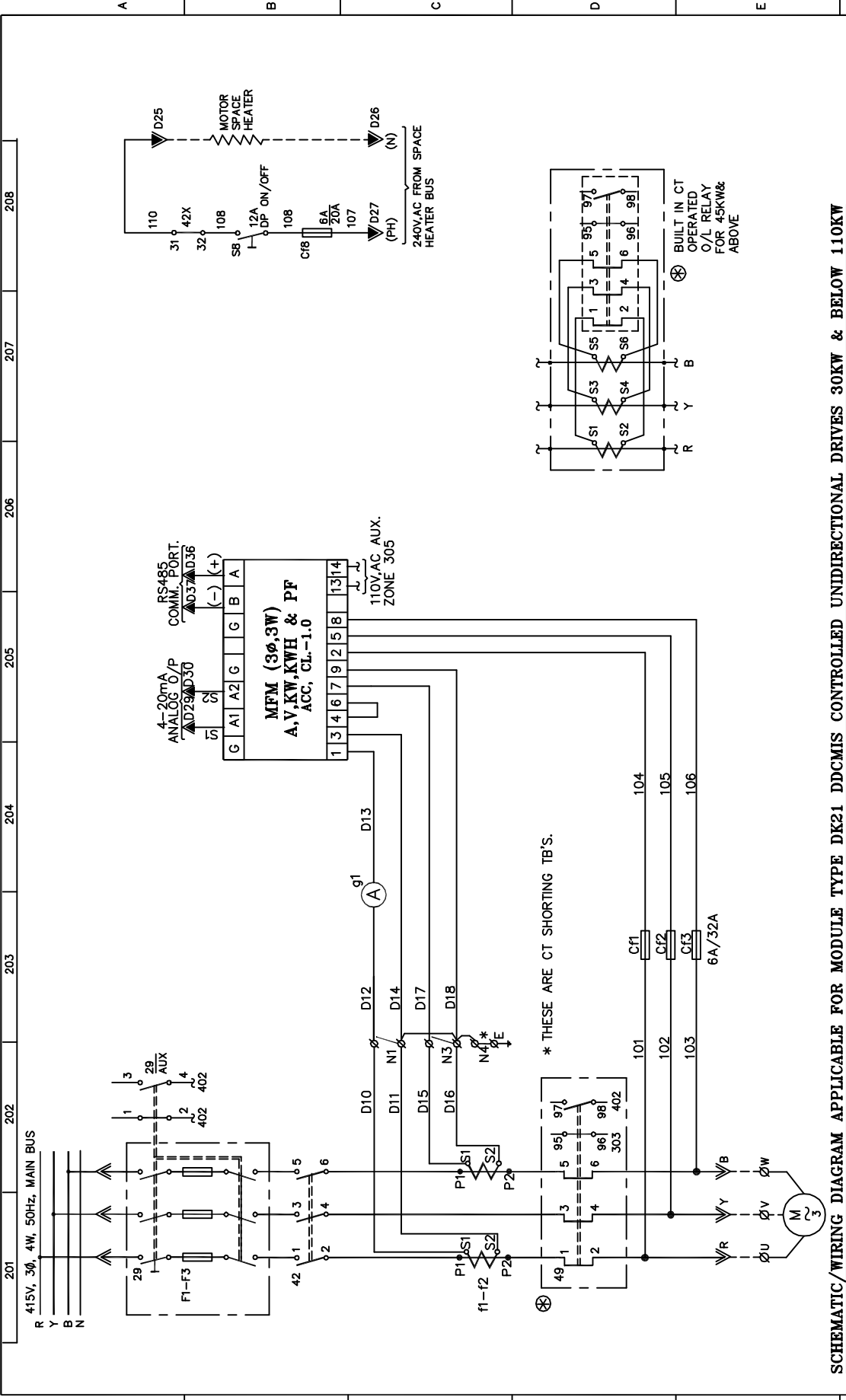
REV.										III -		IV -		C&S ELECTRIC LTD. C-59, NOIDA PHASE-II, NOIDA - 201305 DIST. GAUTAM BUDH NAGAR (U.P) FORMAT No. : CAT-Q/04									
REV.										I -		II -		C&S ELECTRIC LTD. C-59, NOIDA PHASE-II, NOIDA - 201305 DIST. GAUTAM BUDH NAGAR (U.P) FORMAT No. : CAT-Q/04									
Drawn		Date		Name		PROJECT:- TELANGANA STP PROJECT PHASE-I 2X800 MW								REV.		R0							
Checked		25.07.18		RAVINDRA										DRG. NO.		BHEL/J3314/517							
Approved		25.07.18		D.GIRI										SHEET NO.		01							
		25.07.18		D.GIRI										NO. OF SHEET		03							
														SCALE: NTS									
														Order No. 4500029919, DT-06.07.2018									
														Details		SCHEMATIC / WIRING DIAGRAM							
														Work		MODULE TYPE - DK2							
														Client		BHEL-EPD BANGALORE							
														NTPC DRG. NO.		9591-102-206-PVE-L-025							
														BHEL DRG. NO.		EP-4-CS-9591-014							
														NTPC DRG NO.		9591-102-206-PVE-L-025							
														TITLE		SCHEME FOR MODULE TYPE -DK2							
														C&S ELECTRIC LTD. C-59 NOIDA PHASE-II, NOIDA-201305 DIST. GAUTAM BUDH NAGAR (U.P)									
														BHARAT HEAVY ELECTRICALS LTD ELECTROPORCELAINS DIVISION BANGALORE-560012									
														CONSULTANT		(A Government of India enterprise)							
														NTPC Limited									
														PROJECT		TELANGANA SUPER PHASE-I (2X800MW)							
														POWER PROJECT									



SCHEMATIC/WIRING DIAGRAM APPLICABLE FOR MODULE TYPE DK2 DDC/PLC CONTROLLED UNIDIRECTIONAL DRIVES UPTO 30 KW

REV.	III -			IV -	BHEL DRG. NO.		EP-4-CS-9591-014			
	I -			II -	NTPC DRG. NO.		9591-102-206-PVE-L-025			
		Date	Name	 C&S ELECTRIC LTD. C-59 NOIDA PHASE II NOIDA - 201305 DIST. GAUTAM BUDDH NAGAR (UP) FORMAT No. : QAT-Q404	Client	BHEL-EPD BANGALORE		DRG. NO.	BHEL/J3314/J517	REV. R0
Drawn	25.07.18	RAVINDRA	PROJECT:- TELANGANA STP PROJECT PHASE-4 2X5800 MW		Work	MODULE TYPE - DK2				
Checked	25.07.18	D.GIRI	CONSULTANT		Details	SCHEMATIC / WIRING DIAGRAM				
Approved	25.07.18	D.GIRI	NTPC		Order No.	4500029919 DT-06.07.2018		SHEET NO.	NO. OF SHEET	
								SCALE: NTS	02	03

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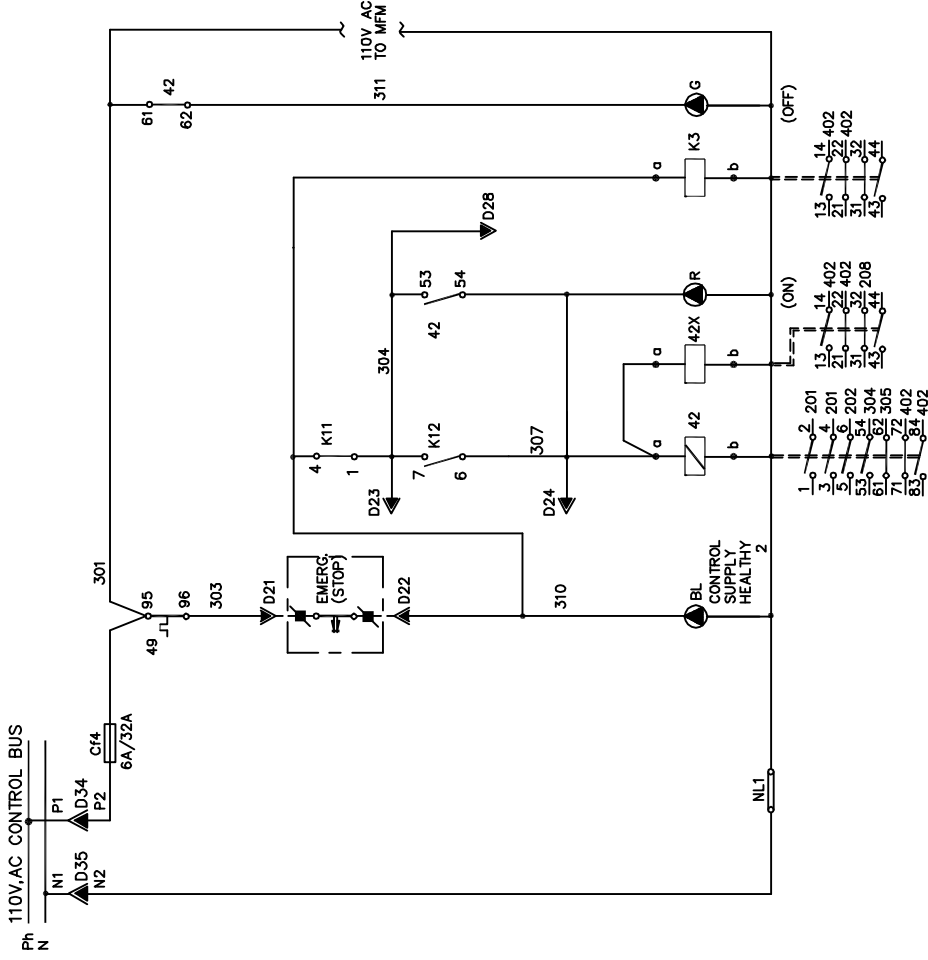


SCHEMATIC/WIRING DIAGRAM APPLICABLE FOR MODULE TYPE DK21 DDCMS CONTROLLED UNIDIRECTIONAL DRIVES 30KW & BELOW 110KW

REV.	III -	PROJECT:- TELANGANA STP PROJECT PHASE-I 2X800 MW CONSULTANT NTPC	 C&S ELECTRIC LTD. C-59, NORDA PHASE II, NORDA - 201305 DIST. GAUTAM BUDDH NAGAR (UP) FORMAT No. : QAF-0404	IV -	BHEL DRG. NO. EP-4-CS-9591-015	
	I -			NTPC DRG. NO. 9591-102-206-PVE-L-026		
Drawn	Date	Name	Client BHEL-EPD BANGALORE	DRG. NO.		REV. R0
	25.07.18	RAVINDRA		BHEL/J3314/518		
	25.07.18	D.GIRI				
Checked	25.07.18	D.GIRI	Work MODULE TYPE - DK21			
Approved	25.07.18	D.GIRI	Details SCHEMATIC / WIRING DIAGRAM			
			Order No. 4500029919,DT-06.07.2018	SCALE: NTS	SHEET NO. NO. OF SHEET	2 4

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NOTE:-
1) CONTROL TERMINALS SHALL BE CAGE CLAMP TYPE.

REV.	III -			IV -	BHEL DRG. NO.		EP-4-CS-9591-015			
	I -			II -	NTPC DRG. NO.		9591-102-206-PVE-L-026			
				 C&S ELECTRIC LTD. C-68, NIDDA PHASE II, NIDDA - 201305 DIST. GAUTAM BUDDH NAGAR (UP) FORMAT No. : QAF-0404	Client	BHEL-EPD BANGALORE		DRG. NO.	BHEL/J3314/518	REV. R0
Drawn	Date	Name	PROJECT:- TELANGANA STP PROJECT PHASE-I 2X800 MW		Work	MODULE TYPE - DK21				
Checked	25.07.18	RAVINDRA			Details	SCHEMATIC / WIRING DIAGRAM		SHEET NO.	NO. OF SHEET	
Approved	25.07.18	D.GIRI	CONSULTANT NTPC		Order No. 4500029919,DT-06.07.2018		SCALE: NTS			
	25.07.18	D.GIRI						3	4	

		401	402	403	404	405	406	407	408
NOTE -- ALL TERMINALS SHALL BE MAKE IN BOTH TEST & SERVICE POSITION.									
III -									
IV -									
REV.									
III -									
IV -									
PROJECT:- TELANGANA STP PROJECT PHASE-I 2X800 MW									
CONSULTANT: NTPC									
C&S ELECTRIC LTD. C-59, NOKIA PHASE II, NOKIA-201305 DIST. GAUTAM BUDDH NAGAR (UP) FORMAT No. : 04F-04/04									
Client BHEL-EPD BANGALORE Work MODULE TYPE - DK21 Details SCHEMATIC / WIRING DIAGRAM Order No. 4500029919.DT-06.07.2018									
DRG. NO. BHEL/J3314/518									
REV. R0									
SHEET NO. 4 NO. OF SHEET 4									

PROJECT

 एन टी पी सी NTPC	NTPC Limited (A Government of India Enterprise)
CONSULTANT	certification <deepakjind

C&S ELECTRIC LTD.
C-59 NOIDA PHASE-II, NOIDA-201305
DIST. GAUTAM BUDDH NAGAR (U.P)

COMPONENT SELECTION CHART

9591-102-206-PVE-L-043

EP-4-CS-9591-030

[illegible]

A) MOTOR MODULE

S. No.	MOTOR RATING (KW)	MAX. MOTOR FLC. (AMP)	MOTOR RATING (KW)	SWITCH RATING (AMP)	FUSE RATING (AMP)	CONTACTOR RATING (AMP)	OVERLOAD RANGE (AMP)	CURRENT TRANSFORMER	MULTIFUNCTION METER	CABLE SIZE (mm ²)	MODULE SIZE(DOL)	MODULE SIZE(RDOL)
1.	UP TO 1.0KW	0.53A	0.02-0.12	32A	6A	16A	0.4-0.63A	-	-	3CX2.5	300mm	400mm
		0.83A	0.14-0.18	32A	6A	16A	0.63-1.0A	-	-	3CX2.5		
		1.2A	0.30-0.55	32A	6A	16A	1.0-1.6A	-	-	3CX2.5		
		1.9A	0.72-0.85	32A	6A	16A	1.6-2.5A	-	-	3CX2.5		
		2.6A	0.87-0.92	32A	6A	16A	2.5-4.0A	-	-	3CX2.5		
2.	1.1-1.5KW	2.8A	1.0	32A	6A	16A	2.5-4.0A	-	-	3CX2.5		
		2.8A	1.1	32A	6A	16A	2.5-4.0A	-	-	3CX2.5		
		3.5A	1.5	32A	16A	16A	2.5-4.0A	-	-	3CX2.5		
3.	1.6-3.0KW	4.8A	1.6-2.5	32A	20A	16A	4.0-6.0A	-	-	3CX2.5		
		7.0A	2.6-3.0	32A	20A	16A	5.5-8.0A	-	-	3CX2.5		
4.	3.1-5.5KW	7.8A	3.1-3.7	32A	32A	16A	5.5-8.0A	-	-	3CX6		
		9.0A	4.0-4.6	32A	32A	16A	7-10A	-	-	3CX6		
		11.0A	5.0-5.5	32A	32A	16A	10-13A	-	-	3CX6		
5.	5.6-7.0KW	11.0A	5.6	63A	50A	32A	10-13A	-	-	3CX6		
		14.4A	6.0-7.0	63A	50A	32A	13-18A	-	-	3CX6		
6.	7.1-13KW	16A	7.1-8.5	63A	63A	32A	13-18A	-	-	3CX16		
		21A	9.3-12.0	63A	63A	32A	18-25A	-	-	3CX16		
		27.3A	13.0	63A	63A	32A	23-32A	-	-	3CX16		

REV.	III -	IV -	BHEL DRG. NO. EP-4-CS-9591-030	
		II -	NTPC DRG. NO. 9591-102-206-PVE-L043	
Drawn	Date	PROJECT:- TELANGANA STP PROJECT PHASE-I 2X600 MMW	Client	BHEL-EPD BANGALORE
Checked	24.07.18	RAVINDRA	Work	LV SWITCHGEAR
Approved	24.07.18	D.GIRI	Details	COMPONENT SELECTION CHART
	24.07.18	D.GIRI	Order No.	4500029919,DT-06.07.2018
			DRG. NO. BHEL/J3314/002	
			REV. R0	
			SHEET NO. 2	
			NO. OF SHEET 5	



C&S ELECTRIC LTD.
C-59, NOLDA PHASE II, NOLDA - 201305
DIST. GAUTAM BUDDH NAGAR (UP)
FORMAT No. : QAF-04/04

S. No.	MOTOR RATING (KW)	MAX. MOTOR FLC (AMP)	MOTOR RATING (KW)	SWITCH RATING (AMP)	FUSE RATING (AMP)	CONTACTOR RATING (AMP)	OVERLOAD RANGE (AMP)	CURRENT TRANSFORMER	MULTIFUNCTION METER	CABLE SIZE (mm2)	MODULE SIZE(DOL)	MODULE SIZE(RDOL)
7.	13.1–24KW	28A	13.1–16	125A	80A	63A	23–32A	–	–	3CX35	400mm	500mm
		34A	17.5–20	125A	80A	63A	30–40A	–	–	3CX35		
		45A	22–24	125A	100A	63A	38–50A	–	–	3CX35		
8.	24.1–37.0KW	45A	24.1–25	125A	125A	80A	38–50A	–	–	3CX70	700mm	700mm
		53A	30	125A	125A	80A	48–57A	2: 60/1A	MFM	3CX70		
		58A	33	125A	125A	115A	57–66A	2: 60/1A	MFM	3CX70		
		70A	37	125A	125A	115A	66–80A	2: 75/1A	MFM	3CX70		
9.	37.1–55KW	70A	40	250A	160A	115A	66–80A	2: 75/1A	MFM	3CX120	900mm	–
		80A	41.2–50	250A	160A	185A	65–105A	2: 100/1A	MFM	3CX120		
		100A	55	250A	160A	185A	65–105A	2: 100/1A	MFM	3CX120		
10.	55.1–80KW	120A	60–67	250A	200A	225A	80–125A	2: 150/1A	MFM	3CX150	900mm	–
		150A	70–80	250A	200A	225A	100–160A	2: 150/1A	MFM	3CX150		
11.	80.1–100KW	156A	90	400A	315A	265A	125–200A	2: 200/1A	MFM	3CX150	500+700mm	–
		180A	91–100	400A	315A	265A	125–200A	2: 200/1A	MFM	3CX240		
12.	110–132KW	–	110–132	ACB–800A				2: 300/1A	–	3(1CX300)	PCC 2TIER	
13.	150–200KW	–	150–200	ACB–800A				2: 400/1A	–	3(1CX300)	PCC 2TIER	

- 1) SELECTION CHART IS APPLICABLE FOR UNI-DIRECTIONAL MOTOR.
- 2) FOR BI-DIRECTIONAL MOTOR, COMPONENT SELECTION SHALL BE BASED ON AVERAGE FULL LOAD CURRENT OF MOTOR.
- 3) ACTUAL CABLE SIZE SHALL BE AS PER APPROVED SINGLE LINE DIAGRAM.

REV.	III -		IV -		BHEL DRG. NO.		EP-4-CS-9591-030	
	II -		I -		NTPC DRG. NO.		9591-102-206-PVE-L-043	
F	PROJECT:-		C&S ELECTRIC LTD.		Client		BHEL-EPD BANGALORE	
	TELANGANA STP PROJECT PHASE-I		C-59, NIDDA PHASE II, NIDDA - 201305		Work		LV SWITCHGEAR	
	DRAWN		CONSULTANT:-		Details		COMPONENT SELECTION CHART	
	DATE		FORMAT No. : QAF-04/04		Order No. 4500029919,DT-06.07.2018		SCALE: NTS	
F	Name		DRG. NO.		REV.		BHEL/J3314/002	
	RAVINDRA		R0		SHEET NO.		3	
	D.GIRI		NO. OF SHEET		5			

B) FEEDER MODULE (415V AC)

SELECTION CHART FOR SFU FEEDER					MODULE SIZE		CABLE SIZE
SL. NO.	FEEDER RATING (AMP)	SWITCH/MCCB RATING (AMP)	FUSE RATING (AMP)	FOR DRAWOUT TYPE MODULE	FOR FIXED TYPE MODULE		
1	0-16A	32A	16A	200mm	200mm	4CX6	
2	17-32A	32A	32A	200mm	200mm	4CX16	
3	33-45A	63A	63A	200mm	200mm	3.5CX35	
4	46-63A	63A	63A	300mm	300mm	3.5CX70	
5	64-99A	100A	100A	300mm	300mm	3.5CX70	
6	100A	100A, MCCB	-	300mm	300mm	3.5CX70	
7	101-125A	160A, MCCB	-	400mm	400mm	3CX150+1CX150	
8	126-160A	160A, MCCB	-	500mm	400mm	3CX150+1CX150	
9	161-250A	250A, MCCB	-	500mm	500mm	3(1CX300)+1CX150	
10	251-400A	400A, MCCB	-	600mm	600mm	3(1CX630)+1CX300	
11	401-630A	630A, MCCB	-	700mm	700mm	3(1CX630)+1CX300	
12	631-1120A BREAKER			700mm		7(1CX630)	
13	1121-1680A BREAKER			700mm		10(1CX630)	

NOTES: -
ACTUAL CABLES SIZES SHALL BE AS PER
APPROVED SINGLE LINE DIAGRAM.

REV.	III -	IV -	BHEL DRG. NO.	EP-4-CS-9591-030
		II -	NTPC DRG. NO.	9591-102-206-PVE-L-043
			C&S ELECTRIC LTD. C-59, NOLDA PHASE II, NOLDA - 201305 DIST. GAUTAM BUDDH NAGAR (UP) FORMAT No. : QAF-04/04	
				
			PROJECT:- TELANGANA STP PROJECT PHASE-I 2X800 MW	
Drawn	Date	Name		
	24.07.18	RAVINDRA		
Checked	24.07.18	D.GIRI		
Approved	24.07.18	D.GIRI		
			CONSULTANT:- NTPC	
			C&S ELECTRIC LTD. C-59, NOLDA PHASE II, NOLDA - 201305 DIST. GAUTAM BUDDH NAGAR (UP) FORMAT No. : QAF-04/04	
			Client BHEL-EPD BANGALORE	
			Work LV SWITCHGEAR	
			Details COMPONENT SELECTION CHART	
			Order No. 4500029919,DT-06.07.2018	
			DRG. NO. BHEL/J3314/002	
			REV. R0	
			SCALE: NTS	
			SHEET NO. NO. OF SHEET	
			4	
			5	

C) FEEDER MODULE (240V DC)

SELECTION CHART FOR DC FEEDER					MODULE SIZE		CABLE SIZE (mm ²)
SL. NO.	FEEDER RATING (AMP)	SWITCH RATING (AMP)	FUSE RATING (AMP)		FOR DRAWOUT TYPE MODULE	FOR FIXED TYPE MODULE	
1.	0-6A	10A	6A		200mm	200mm	2CX2.5
2	7-10A	16A	10A				2CX2.5
3	11-14A	16A	16A				2CX2.5
4	15-19A	32A	32A				2CX6
5.	20-32A	32A	32A				2CX16
6	33-53A	63A	63A		200mm	200mm	2CX35
7	54-81A	100A	100A		400mm	400mm	2CX70
8	82-114A	125A	125A		400mm	400mm	2CX120
9	115-214A	250A	250A		700mm	700mm	2(1CX150)
10	215-340A	400A	400A		700mm	700mm	2(1CX300)
11	341-560A	600A	600A		700mm	700mm	2(1CX630)
12	561-1000A BREAKER				700mm		4(1CX630)
13	1001-1400A BREAKER				700mm		6(1CX630)

NOTES: -
ACTUAL CABLES SIZES SHALL BE AS PER
APPROVED SINGLE LINE DIAGRAM.

REV.	III -			IV -	BHEL DRG. NO. EP-4-CS-9591-030		REV.
				II -	NTPC DRG. NO. 9591-102-206-PVE-L-043		
	PROJECT:- TELANGANA STP PROJECT PHASE-I 2X800 MW		 C&S ELECTRIC LTD. C-59, NOLDA PHASE II, NOLDA - 201305 DIST. GAUTAM BUDDH NAGAR (UP) FORMAT No. : QAF-Q4/04				DRG. NO. BHEL/J3314/002
Drawn	Date 24.07.18	Name RAVINDRA					
Checked	24.07.18	D.GIRI	COMPONENT SELECTION CHART				
Approved	24.07.18	D.GIRI	Order No. 4500029919,DT-06.07.2018				
			SCALE: NTS		SHEET NO. 5 NO. OF SHEET 5		

[illegible]

FORM 66-271 A4

MANUFACTURER'S NAME & ADDRESS:		MANUFACTURING QUALITY PLAN				PROJECT : 2X800 MW TELANGANA SUPER THERMAL POWER PROJECT PHASE-I PACKAGE: STEAM GENERATOR ISLAND PACKAGE CONTRACT NO. : CS-9591-101-2-FC-COA-6462, Dtd. 05.02.2018 MAIN SUPPLIER: M/S BHEL - EPD (BANGLORE)			
C & S ELECTRIC LTD. C-59, PHASE-II, Noida 201 301 (U.P.)		ITEM : PCC, MCC, ACDB AND DCDB (UP TO 4000 A)	Q.P. NO. C&S/J-3314/801 REV. NO. 02 DATE : 01.11.2018 Page 1 of 11	Reference Document	Acceptance Norms	Format of Records	Agency 10	Remarks	
Sl. No.	Component & Operations	Characteristics	Classification	Type of Check	Quantum of check, 5	As per NTPC spec.	QC record	P	
1	2	3	4	5	6	7	8	9	
1	2	3	4	5	6	7	8	9	
Note: Prototype inspection to be offered for witness on each rating / type of panel by NTPC & BHEL before bulk manufacturing clearance by NTPC 1) Makes of bought out items as per Attached Annexure - I 2) Relay Fat procedure to be submitted as a separate document for review 3) Documents identified in the QP for NTPC verification will be maintained. However, other documents i.e. all QC records & supplier's TCs mentioned in the QP will also be maintained by the Manufacturer, which NTPC may verify on surveillance basis at the time of final inspection. 4) Outsourcing / subcontracting of panel fabrication, assembly, pretreatment, painting, wiring, final assembly and testing activity in Switchgear manufacturing process shall be done, only with prior approval of NTPC									
A Raw material									
1.	Angles, channels & Sheet Steel for fabrication (CRCA / HR)	1) Dimensions 2) Surface finish check for waviness / flatness 3) Tensile / Bending Test	Major	Meas	1 sample of each type & size per lot -do-	IS-513 (94), IS-1079 (94), IS 2062 (99) IS-513 (94), IS-1079 (94), IS 2062 (99) IS-513 (94), IS-1079 (94), IS 2062 (99)	QC record	P	
2.	Bus bars - Aluminum & Copper	1) Dimensions 2) Surface finish check for waviness / flatness 3) Tensile / Bending Test	Major	Meas	1 sample of each type & size per lot -do-	IS-513 (94), IS-1079 (94), IS 2062 (99) IS-513 (94), IS-1079 (94), IS 2062 (99) IS-513 (94), IS-1079 (94), IS 2062 (99)	QC record	P	
3.	CTs	1) Dimensions 2) Surface finish check for waviness / flatness 3) Tensile / Bending Test	Major	Meas	1 sample of each type & size per lot -do-	IS-513 (94), IS-1079 (94), IS 2062 (99) IS-513 (94), IS-1079 (94), IS 2062 (99) IS-513 (94), IS-1079 (94), IS 2062 (99)	QC record	P	
B Bought out items:									
1.	Air Circuit Breaker	1) Dimensions 2) Surface finish check for waviness / flatness 3) Tensile / Bending Test	Major	Meas	1 sample of each type & size per lot -do-	IS-513 (94), IS-1079 (94), IS 2062 (99) IS-513 (94), IS-1079 (94), IS 2062 (99) IS-513 (94), IS-1079 (94), IS 2062 (99)	QC record	P	
2.	CTs	1) Dimensions 2) Surface finish check for waviness / flatness 3) Tensile / Bending Test	Major	Meas	1 sample of each type & size per lot -do-	IS-513 (94), IS-1079 (94), IS 2062 (99) IS-513 (94), IS-1079 (94), IS 2062 (99) IS-513 (94), IS-1079 (94), IS 2062 (99)	QC record	P	
Certification signature by Designation <deepakindal@ntpc.com> 11/08/2018									
MODEL OF ACB SHALL BE - AH-8D, AH-10D, AH-16D, - AH-25D, AH-30D, AH-40D AH-8D- 800A AH-10D- 1000A AH-12D- 1200A AH-16D- 1600A AH-25D- 2500A AH-30D- 3000A AH-32D- 3200A AH-40D- 4000A									
GEND: * RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN DOCUMENTATION. ** M: MANUFACTURER/SUB-CONTRACTOR, C: CONTRACTOR /NOMINATED INSPECTION AGENCY, N: NTPC INDICATED "W" PERFORM "W" WITNESS AND "V" VERIFICATION ALL "W" INDICATED IN COLUMN "N" SHALL BE "CRP" OF NTPC.									
DOC. NO. 9591-102-206-PVE-Q-001, RE									
FOR NTPC USE									
REVIEWED BY APPROVED BY APPROVAL SEAL									
MANUFACTURER/SUB / SUPPLIER SIGNATURE RAJESH RAGH									
Dy Manager, CPBG / QUALITY BHEL-EPD, BENGALURU-560 012									

MANUFACTURER'S NAME & ADDRESS:			MANUFACTURING QUALITY PLAN					PROJECT : 2X800 MW TELANGANA SUPER THERMAL POWER PROJECT PHASE-I PACKAGE: STEAM GENERATOR ISLAND PACKAGE CONTRACT NO. : CS-9591-101-2-FC-COA-6462, Dtd. 05.02.2016 MAIN SUPPLIER: M/S BHEL – EPD (BANGLORE)					
C & S ELECTRIC LTD. C-59, PHASE-II, NOIDA 201 301 (U.P.)			ITEM : PCC ,MCC , ACDB AND DCDB (UP TO 4000 A) REV. NO. 02 DATE : 01.11.2018. Page 2 of 11					Format of Records					
Sl. No.	Component & Operations	Characteristics	Classification	Type of Check	Quantum of check, &	Reference Document	Acceptance Norms	9	D*	M**	C	N	Remarks
1	2	3	4	5	M	C/N	7	8					11
		2) Make, type & rating	Major	Visual	-do-	-	NTPC App. Drg. & data sheet, IS 2705 (92)	NTPC App. Drg. & data sheet, IS 2705 (92)	QC Record	P	-	-	
		3)IR,HV,Ratio& Polarity check	Critical	elect	10%	-	NTPC App. Drg. & data sheet, IS 2705 (92)	NTPC App. Drg. & data sheet, IS 2705 (92)	QC Record	P	-	-	
		4) All routine tests as per IS 2705 (92)	Critical	elect	10%	-	-do-	-do-	Supplier's TC	V	-	-	
3.	PT's	1 Overall dimensions & mounting arrangement	Major	Meas	10% of each type & rating per lot	-	Mnfr std.	Mnfr std.	QC Record	P	-	-	
		2) Make, type & railing	Major	Visual	-do-	-	NTPC App. Drg. & data sheet, IS 3156 (92)	NTPC App. Drg. & data sheet, IS 3156 (92)	QC Record	P	-	-	
		3)IR,HV,Ratio& Polarity check	Critical	elect	10%	-	-do-	-do-	QC Record	P	-	-	
		4) All routine tests as per IS 3156 (92)	Critical	elect	-do-	-	-do-	-do-	Supplier's TC	V	-	-	
4.	AC / DC Power & aux. Contactors	1) Make, type & rating	Major	Visual	5 sample of each type, make & railing per lot	-	IS-13947 Part 4 sec 1 (93), NTPC appd. drag & data sheet	IS-13947 Part 4 sec 1 (93), NTPC appd. drag & data sheet	QC Records	P	-	-	
		2) Operation checks	Major	elect	-do-	-	Mnfr Std.	Mnfr Std.	QC Records	P	-	-	
5.	Air Break switches / Fuse Switch units	1) Make, type & rating	Major	Visual	5 sample of each type & railing per lot	-	IS-13947 Part 3 (93), NTPC appd. drag & data sheet	IS-13947 Part 3 (93), NTPC appd. drag & data sheet	QC Records	P	-	-	
6	Protection Relays (Electromagnetic & Static)	1) Make ,Type & rating	Major	Visual	10% sample of each type, make & railing per lot	-	NTPC App. Drag. & data sheet	NTPC App. Drag. & data sheet	QC Records	P	-	-	
		2) Routine test certificate	major	Elect	100%	-	IS-3231 (83) / IS 8686 (77) Relay Mfr's Specifications	IS-3231 (83) / IS 8686 (77) Relay Mfr's Specifications	Supplier's TC	✓	V	V	
		2) Operational Checks	Major	elect	-do-	-	Mnfr std.	Mnfr std.	QC Records	P	-	-	
6A	Protection Relays (Numerical Relays)	1) Make, type & rating	Major	Elect	10% each type, Per lot	-	NTPC App. Drag. & data sheet	NTPC App. Drag. & data sheet	QC Records	✓	P	V	Fat Procedure to be submitted separately for NTPC review &

 MANUFACTURER/SUB / SUPPLIER		FOR NTPC USE		DOC. NO. 9591-102-206-PVE-Q-001, REV. 01
SIGNATURE RAJESH R. GUPTA Dy. Manager, BHEL-EPD, BANGLORE		REVIEWED BY APPROVED BY		APPROVAL SEAL

MANUFACTURER'S NAME & ADDRESS:		MANUFACTURING QUALITY PLAN					PROJECT : 2X800 MW TELANGANA SUPER THERMAL POWER PROJECT PHASE-I PACKAGE: STEAM GENERATOR ISLAND PACKAGE CONTRACT NO. : CS-9591-101-2-FC-COA-6462, Dtd. 05.02.2016 MAIN SUPPLIER: M/S BHEL - EPD (BANGLORE)							
C & S ELECTRIC LTD. C-59, PHASE-II, NOIDA 201 301 (U.P.)		ITEM : PCC MCC, ACDB AND DCDB (UP TO 4000 A)	QIP NO. C&S/J-3314/801 REV. NO. 02 DATE : 01.11.2018 Page 3 of 11	Acceptance Norms		Reference Document		Agency 10		Remarks				
Sl. No.	Component & Operations	Characteristics	Classification	Type of Check	Quantum of check, 6	C/N	7	8	9	D*	W	C	N	11
1	2	3	4	5	M	100% each type, Per lot	NTPC App. Fat procedure	NTPC App. Fat procedure	Test report	✓	W			11
7	Timers	2) Numerical relay fat tests. 1) Make, Type & rating	Major	Elect	10% of each type, & rating per lot	-	NTPC App. Drag. & data sheet	NTPC App. Drag. & data sheet	QC Records	P				
		2) Contact configuration	Major	Elect	10% of each type, & rating per lot	-	NTPC App. Drag. & data sheet	NTPC App. Drag. & data sheet	QC Records	P				
		3) Functional Check	Major	Elect	-do-	-	Mnfr Std	Mnfr Std	QC Records	P				
8	HRC Fuses	1) Make, type & rating	Major	Visual	10% of each rating per lot	-	IS-13703 / (93) NTPC App. Drgs.	IS-13703 / (93) NTPC App. Drgs.	QC Records	P				
9	Indicating Instruments	1) Make, type & ratings	Major	Visual	10% of each type & rating per lot	-do-	NTPC Appr. drag / data sheet	NTPC Appr. drag / data sheet	QC Records	P	V			
		3) Routine tests including calibration & accuracy test reports	Major	elect	10% of each type & rating per lot	-do-	IS 1248 (93), NTPC Appr. drag / data sheet	IS 1248 (93), NTPC Appr. drag / data sheet	Supplier's test report	V	V			
10	KWH meters	1) Make, type & ratings	Major	Visual	10% of each type & rating per lot	-do-	NTPC Appr. drag / data sheet	NTPC Appr. drag / data sheet	QC Records	P	V			
		3) Routine tests including calibration & accuracy test reports	Major	elect	100%	-do-	IS 722 (85) & IS 13779 (99) & NTPC Appr. drag / data sheet	IS 722 (85) & IS 13779 (99) & NTPC Appr. drag / data sheet	Supplier's test report	V	V	V		
11	Transducers	1) Make, type & ratings	Major	Visual	10% of each type & rating per lot	-do-	NTPC Appr. drag / data sheet	NTPC Appr. drag / data sheet	QC Records	P	V			
		3) Routine tests including calibration & accuracy test reports	Major	elect	100%	-do-	IEC 60688 & NTPC Appr. drag / data sheet	IEC 60688 & NTPC Appr. drag / data sheet	Supplier's test report	V	V			
12	Push Button & Indicating Lamp	1) Make, Type, colour & rating	Major	Visual	5 samples of each type & rating per lot	-	IS 13947 Part 5 sec1 (93) NTPC App. Drag. & data sheet	IS 13947 Part 5 sec1 (93) NTPC App. Drag. & data sheet	QC record	P				
13	Control & Selector Switches	1) Make, Type & rating	Major	Visual	5 samples of each type & rating per lot	-	IS 13947 Part 5 sec1 (93) NTPC App. Drag. & data sheet	IS 13947 Part 5 sec1 (93) NTPC App. Drag. & data sheet	QC record	P				
		2) Contact configuration check	Major	Visual	-do-	-	-do-	-do-	QC record	P				

DOC. NO. 9591-102-206-PVE-Q-001, REV. 01

FOR NTPC USE

GEND: * RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN DOCUMENTATION.
** M. MANUFACTURER/SUB-CONTRACTOR, C. CONTRACTOR/NOMINATED INSPECTION AGENCY, N. NTPC INDICATED "P" PERFORM "W" WITNESS AND VERIFICATION ALL "W" INDICATED IN COLUMN "N" SHALL BE "CIP" OF NTPC.

 MANUFACTURER/SUB-SUPPLIER SIGNATURE	 MAIN SUPPLIER	REVIEWED BY	APPROVED BY	APPROVAL SEAL

MANUFACTURER'S NAME & ADDRESS:			MANUFACTURING QUALITY PLAN					PROJECT : 2X800 MW TELANGANA SUPER THERMAL POWER PROJECT PHASE-I						
 C & S ELECTRIC LTD. C-59, PHASE-II, NOIDA 201 301 (U.P.)			ITEM : PCC, MCC, ACDB AND DCDB (UP TO 4000 A) REV. NO. 02 DATE : 01.11.2018 Page 4 of 11					PACKAGE: STEAM GENERATOR ISLAND PACKAGE CONTRACT NO. : CS-9591-101-2-FC-COA-6462, Dtd. 05.02.2016 MAIN SUPPLIER: M/S BHEL – EPD (BANGLORE)						
			Characteristics					Classification	Type of Check	Quantum of check, %	Reference Document	Acceptance Norms	Format of Records	Agency 10
Sl. No.	Component & Operations	3	4	5	M	C/N	7	8	9	D*	M**	C	N	11
1	2	3)	Major	Mech.	-do-	-	-do-	-do-	QC Records	P				11
14	Overload relay with SPDR facility & Heavy duty starting overload relay	1) Make, type & rating	Major	Visual	10% of each type & rating per lot	-	IS-13947 (Part-4) NTPC appd. drag & data sheet	IS-13947 (Part-4) NTPC appd. drag & data sheet	QC Records	P				
15	Coupling Relays	2) Function Tests	Major	elect	5% of each type & rating per lot	-	Mnfr Std.	Mnfr Std.	Supplier's TC	V				
16	MCB	1) Make, type & rating	Major	Visual	10% of each type & rating per lot	-	IS-3231 (87) NTPC appd. drag & data sheet	IS-3231 (87) NTPC appd. drag & data sheet	QC Records	P	-	-		
17	Control Transformer	1) Make, Type & Rating	Major	Visual	100%	-	IS-8828 (96) & NTPC appd. drag	IS-8828 (96) & NTPC appd. drag	QC Records	P	-	-		
		2) Voltage Ratio	Major	elec	-do-	-	NTPC Appr. drag / data sheet	NTPC Appr. drag / data sheet	QC Record	P	-	-		
		3) All Routine tests as per IS 12021 (87)	Major	elec	100%	100 %	-do-	-do-	Supplier's TC	V				
18	PVC Insulating barriers & shrouds – (Fire retardant type)	1) HV test	Major	Elect	One sample of each type per lot	-	2.5 KV for 1 min.	2.5 KV for 1 min.	QC Record	P	V	-		
		2) Flame Resistance	Major	Flame Test	Sampling as per Mnfr. Std.	-	-do-	-do-	Suppliers TC	P	-	-		
19	Bus bar Support insulator	1) Dimensions	Major	Measure ment	5 sample of each type per lot	5 Sample per lot	Mnfr Std. / Mnfr drag.	Mnfr Std. / Mnfr drag	QC Record	P	V	V		Nos. of Bus bar support shall be same as type tested panel & of same dimensions
		2) Finish	Major	Visual	-do-	-do-	No visual defects.	No visual defects.	QC Record	P	V	V		
		3) Comparative Tracking Index check	Major	Elect	-do-	-do-	Mnfr Std. / Mnfr drag. & IS-2824	Mnfr Std. / Mnfr drag.	Supplier's TC	V	V	V		
		4) HV Test	Major	Elect	-do-	-do-	IS-2824	IS-2824	QC Record	P	V	V		
		5) IR Test	Major	Elect	-do-	-do-	IS-2824	IS-2824	QC Record	P	V	V		
		6) Flexural strength test	Critical	Mach	As per supplier's std.	-do-	Mnfr Std. / Mnfr drag.	Mnfr Std. / Mnfr drag.	Supplier's TC	V	V	V		
		7) Impact strength of raw material	Major	Mech.	-do-	-	-do- / IS-2824	-do- / IS-2824	-do-	V	V	V		

MANUFACTURER/SUPPLIER	SIGNATURE	FOR NTPC USE	DOC. NO. 9591-102-206-PVE-Q-001, REV. 01

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C & S ELECTRIC LTD. C-59, PHASE-II, NOIDA 201 301 (U.P.)			ITEM : PCC ,MCC , ACDB AND DCDB (UP TO 4000 A) Q.P NO. C&S/J-3314/801 REV. NO. 02 DATE : 01.11.2018 Page 5 of 11					Format of Records						
Sl. No.	Component & Operations	Characteristics	Classification	Type of Check	Quantum of check, 6	Reference Document	Acceptance Norms	8	9	D*	M**	C	N	Remarks
1	2	3	4	5	M	C/N	7	8	9	D*	M**	C	N	Remarks
20	Synthetic rubber Gasket	1) Material Type	Major	Visual	1 sample of each type & size per lot	1 sample per lot	NTPC spec & IS 11149	NTPC spec & IS 11149	QC Record		P	V	V	Type, Dimensions & profile of the gaskets should be same as type tested panel gaskets
		2) Dimensions, profile & Visual Inspection	Major	Meas	-do-	-do-	Mnfr Std	Mnfr Std	QC Record		P			
		3) Shore Hardness	Critical	Test	Mnfr Std	-do-	-do-	-do-	Supplier's TC		V			
		4) Elongation at break & ageing	Major	Test	-do-	-do-	-do-	-do-	Supplier's TC		V			
		5) Compression set	Critical	Test	-do-	-do-	-do-	-do-	Supplier's TC		V			
		6) Ozone Resistance	Major	Test	-do-	-do-	-do-	-do-	Supplier's TC		V			
21	PVC wires (ISI marked)	1) Verify size, colour and BIS marking	Major	Visual	1 sample of each type & rating per lot	-	IS-694	IS-694	QC Records		P	-	-	
22	Space Heater, Thermostat, pin socket, hooter	1) Dimension/ Mounting arrangement	Major	Measurement	-do-	-	Mnfr std.	Mnfr std.	QC record		P	-	-	
		2) Functional test	Major	By Test	-do-	-	Mnfr std.	Mnfr std.	QC record		P	-	-	
23	ACB Handling trolley	Overall dimensions & functional Checks	Major	test	-do-	-	Mnfr std	Mnfr std	QC Record		P			
24	Bus bar fish plates	Dimensions	Major	Visual	5 sample of each type & rating per lot	-	Mnfr Std.	Mnfr Std.	QC Records		P	-	-	
25	Bus bar Joint shrouds	Dimensions	Major	Visual	- do -	-	Mnfr Std.	Mnfr Std.	QC Records		P	-	-	
26.	Spring loaded power & control contacts	Silver plating thickness, adhesion check	Major	Mach	-do-	-	-do-	-do-	QC Records		P	-	-	
27	Terminal Block	1) Make, type & rating	Major	Visual	-do-	-	NTPC Approved Drgs.	NTPC Approved Drgs.	QC Records		P	-	-	
28	Paint	1) Make, type & shelf life	Major	Visual	100 %	-	Mnfr Std	Mnfr Std.	QC Records		P	-	-	
In – Process:														
1.	Fabrication	1) Cutting, punching, shearing & bending	Major	Meas	Mnfr Practice	-	Mnfr std. / drag.	Mnfr std. / drag.	QC Records		P	-	-	
		2) panel front door cut-outs punching	Major	Meas	-do-	-	Mnfr std. /NTPC Approved (GA Drgs.)	Mnfr std. / NTPC Approved (GA Drgs.)	QC Records		P	-	-	

 MANUFACTURER/SUB / SUPPLIER		SIGNATURE:  RAJESH RAGINI Dy. Manager: CPBG/OUNDA BHEL-EPD/ BENGALURU-560 012		GEND: * RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN DOCUMENTATION. ** M. MANUFACTURER/SUB-CONTRACTOR, C. CONTRACTOR / NOMINATED INSPECTION AGENCY, N. NTPC INDICATED "P" PERFORM "W" WITNESS "W" VERIFICATION ALL "W" INDICATED IN COLUMN "N" SHALL BE "CHP" OF NTPC.		FOR NTPC USE		DOC. NO. 9591-102-206-PVE-Q-001, REV. 01	
						REVIEWED BY		APPROVED BY	
								APPROVAL SEAL	

MANUFACTURER'S NAME & ADDRESS:		MANUFACTURING QUALITY PLAN					PROJECT : 2X800 MW TELANGANA SUPER THERMAL POWER PROJECT PHASE-I				
C & S ELECTRIC LTD. C-59, PHASE-II, Noida 201 301 (U.P.)		ITEM : PGC, MCC, ACDB AND DCDB (UP TO 4000 A) REV. NO. 02 DATE : 01.11.2018 Page 6 of 11					PACKAGE: STEAM GENERATOR ISLAND PACKAGE CONTRACT NO. : CS-9591-101-2-FC-COA-6462, Dtd. 05.02.2016 MAIN SUPPLIER: M/S BHEL - EPD (BANGLORE)				
Sl. No.	Component & Operations	Characteristics	Classification	Type of Check	Quantum of check, 6	Reference Document	Acceptance Norms	Format of Records	Agency	Remarks	
1	2	3	4	5	6	7	8	9	10	11	
2.	Pretreatment & Painting (powder coating)	1) Chemical concentration checks of all tanks for pre treatment of sheet steel 2) Paint Shade	Major	Chemical	-do-	Mnfr std practice, NTPC spec. IS-6005	Mnfr std practice, NTPC spec. IS-6005	QC Records	V	Process parameters records per Mnfr. plant std. to be maintained for verification by NTPC on surveillance basis	
		3) Paint Thickness & Adhesion	Major	Visual	1 sample per lot	NTPC spec., Approved Drgs.	NTPC spec., Approved card -do-	QC Records	P	Paint adhesion check by Cross hatch method using Packing tape at final inspection	
3.	Panel Assembly	1) Panel shell assembly, Top & back cover assembly, Panel door assembly, hinge fitting & door knob fitting etc.	Major	Measure ment & test	Mnfr Practice	Mnfr std.	Mnfr std.	QC Records	P	Typical internal view for 30 KW & above. Trolley shall be as per share in GA drawing of the Unit Service PMCC (9591-102-PVE-B-003 NTPC Drawing number	
		2) Form 4B, 7 Type design in cable alley	Major	Process	100%	Mnfr std.	Mnfr std.	QC Records	P		
		3) Size of bus bar & bus bar finish	Major	Process	100%	Mnfr std.	Mnfr std.	QC Records	P		
		4) Colour coding of bus bar	Major	Process	100%	Mnfr std.	Mnfr std.	QC Records	P		
		5) Insulator type & mounting	Major	Process	100%	Mnfr std.	Mnfr std.	QC Records	P		
		6) Bus bar joints	Major	Process	100%	Mnfr std.	Mnfr std.	QC - Records	P		
		7) Bus bar support distance, tightness of bolts for Main, Control & Auxiliary bus bars and bus bar joints	Major	Process	100%	Mnfr std. NTPC Spec. / QP Manual/ NTPC Approved test report	Mnfr. std. NTPC Approved drg. / Type test report	QC Records	P	1) Busbar support Insulator type & distance between two supports should be in line with the Type test report	
		8) Main, control & Auxiliary Bus bar Clearances	Major	Process	100%	Mnfr std.	Mnfr std.	QC Records	P		

DOC. NO. 9591-102-206-PVE-Q-001, REV. 01

MANUFACTURER/SUB / SUPPLIER	SIGNATURE	GEN'D: * RECORDS, IDENTIFIED WITH "TICK" (/) SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN DOCUMENTATION. ** THE MANUFACTURER/SUB-CONTRACTOR, C. CONTRACTOR /NOMINATED INSPECTION AGENCY, N. NTPC INDICATED -P" PERFORM "W" WITNESS AND *** VERIFICATION ALL "W" INDICATED IN COLUMN "N" SHALL BE "CHP" OF NTPC	FOR NTPC USE	APPROVED BY	APPROVAL SEAL
			REVIEWED BY		

MANUFACTURER'S NAME & ADDRESS:			MANUFACTURING QUALITY PLAN					PROJECT : 2X800 MW TELANGANA SUPER THERMAL POWER PROJECT PHASE-I PACKAGE: STEAM GENERATOR ISLAND PACKAGE CONTRACT NO. : CS-9591-101-2-FC-COA-6462, Did. 05.02.2016 MAIN SUPPLIER: M/S BHEL - EPD (BANGLORE)				
C & S ELECTRIC LTD. C-59, PHASE-II, Noida 201 301 (U.P.)			ITEM : PCC, MCC, ACDB AND DCDB (UP TO 4000 A)			QP NO. C&S/J-3314/801 REV. NO. 02 DATE : 01.11.2018 Page 7 of 11			Format of Records			Remarks
Sl. No.	Component & Operations	Characteristics	Classification	Type of Check	Quantum of check, %	Reference Document	Acceptance Norms	9	D*	M**	C	N
1	2	3	4	5	M	C/N	8	9	D*	M**	C	N
		9) CT / PT mounting arrangement & tightness	Major	Process	100%	Mnfr std.	Mnfr std.	QC Records		P	-	-
		10) CT secondary shorting	Major	Process	100%	Mnfr std.	Mnfr std.	QC - Records		P	-	-
		11) Termination for power & control circuits	Major	Process	100%	Mnfr std.	Mnfr std.	QC - Records		P	-	-
		12) Lug size & crimping quality	Major	Process	100%	Mnfr std.	Mnfr std.	QC - Records		P	-	-
		13) Earthing bus bar size & continuity ; earthings of panel & doors	Major	Process	100%	Mnfr std.	Mnfr std.	QC - Records		P	-	-
		14) Breaker safety shutter operation	Major	Process	100%	Mnfr std.	Mnfr std.	QC - Records		P	-	-
		15) Spring loaded power & control contacts alignment	Major	Process	100%	Mnfr std.	Mnfr std.	QC - Records		P	-	-
4.	Module assembly	1) Component identification	Major	Process	100%	Mnfr std.	Mnfr std.	QC - Records		P	-	-
		2) Component layout, mounting & dimensions	Major	Process	100%	Mnfr std.	Mnfr std.	QC - Records		P	-	-
		3) Incoming & outgoing power & control contacts assembly & alignment	Major	Process	100%	Mnfr std.	Mnfr std.	QC - Records		P	-	-
		4) Power circuit wire / strip termination & clearances	Major	Process	100%	Mnfr std.	Mnfr std.	QC - Records		P	-	-
		5) Functional Checks	Major	Process	100%	Mnfr std.	Mnfr std.	QC - Records		P	-	-
		6) Alignment of module with master gauge	Major	Process	100%	Mnfr std.	Mnfr std.	QC - Records		P	-	-
5.	Control Wiring	1) Wire Size & lug size, Colour of wire	Minor	Visual	100%	Wiring diagram	Wiring diagram	QC - Records		P	-	-
		2) Proper wire Clamping & Ferruling	Minor	Visual	100%	As per shop practice	As per shop practice	QC - Records		P	-	-
		3) Continuity as per wiring drag.	Critical	Test	100%	NTPC Appr. Drag.	NTPC Appr. Drag.	QC - Records		P	-	-
		4) Tightness of termination & crimping check	Major	Test	100%	Mnfr std	Mnfr std	QC - Records		P	-	-
D	Final inspection: Note: 1) Type test clearance from NTPC-Engg to be verified 2) Before start of inspection , manufacturer's internal inspection (QC) records of the offered panels/ equipments & main contractor's inspection report to be submitted											

 MANUFACTURER/SUB / SUPPLIER		 MAIN SUPPLIER		GEND: * RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN DOCUMENTATION. ** M. MANUFACTURER/SUB-CONTRACTOR, C. CONTRACTOR /NOMINATED INSPECTION AGENCY, N. NTPC INDICATED "P" PERFORM "W" WITNESS AND "N" VERIFICATION ALL "W" INDICATED IN COLUMN "N" SHALL BE "CHP" OF NTPC.		FOR NTPC USE		DOC. NO. 9591-102-206-PVE-Q-001, REV. 01	
						REVIEWED BY		APPROVED BY	
								APPROVAL SEAL	

TESTED BY: RAJESH RAGHAI
 TESTED DATE: 01.11.2018
 BY: Manager: CPBG QUALITY
 BHEL-EPD, BENGALURU-560 017

MANUFACTURER'S NAME & ADDRESS:		MANUFACTURING QUALITY PLAN					PROJECT : 2X800 MW TELANGANA SUPER THERMAL POWER PROJECT PHASE-I						
 C & S ELECTRIC LTD. C-59, PHASE-II, NOIDA 201 301 (U.P.)		ITEM : PCC MCC, ACDB AND DCDB (UP TO 4000 A)					PACKAGE: STEAM GENERATOR ISLAND PACKAGE						
		Q.P. NO. C&SJ-3314/801					CONTRACT NO. : CS-9591-101-2-FC-COA-6482, Dtd. 05.02.2016						
		REV. NO. 02					MAIN SUPPLIER: M/S BHEL – EPD (BANGLORE)						
		DATE : 01.11.2018					Format of Records					Remarks	
		Page 8 of 11					Agency						
Sl. No.	Component & Operations	Characteristics	Classification	Type of Check	Quantum of check, 6	Reference Document	Acceptance Norms	9	D*	M**	C	N	11
1	2	3	4	5	M	C/N	7	8					
		1. Overall visual check for aesthetics, verticality of panels and alignment between two transport sections	Major	Visual	100%	10%	As per approved GA Drgs	As per approved GA Drgs	QC Records	✓	P	W	W
		2. Verification of overall dimensions including sheet steel thickness	Major	Meas.	100%	1 sample / lot	As per approved GA Drgs	As per approved GA Drgs	QC Records	✓	P	W	W
		3. Bus duct interface, phase sequence, flange dimensions & clearances	Major	Visual	100%	100%	NTPC appd Drag / NTPC spec	NTPC appd Drag / NTPC spec	QC Records	✓	P	W	W
		4. Bus bar (Main, control & Aux.) – clearances, colour coding, phase sequence identification	Critical	Measurement & visual	100%	10%	NTPC Appr. Drgs / NTPC spec	NTPC Appr. Drgs / NTPC spec	QC Records	✓	P	W	W
		5. Bus bar support arrangement centre – centre distance between supports	Major	Measurement	100%	Random sample s	NTPC accepted Type test reports	NTPC accepted Type test reports	QC Records	✓	P	W	W
		6. Overlapping of bus bar joints	Major	Elect	100%	10%	NTPC appd Drg / NTPC spec	NTPC appd Drag / NTPC spec	QC Records	✓	P	W	W
		7. Measurement of tightness of bus bar joints by torque wrench	Critical	Mach	100%	10%	M60.300.70KGFM, M8-1.25-2.5KGFM, M10-2.52.5KGFM, M12-4.3-2.54KGFM, 7.1KGFM, IS-13947-13947.1993	M60.300.70KGFM, M8-1.252.5KGFM, M10-2.54KGFM, M12-4.3-2.54KGFM, IS-13947-13947.1993	QC Records	✓	P	W	W
		8. CT /PT fixing & mounting arrangement	Major	Mech.	100%	10%	Mnfr std.	Mnfr std.	QC Records	✓	P	W	W
		9. Check shrouding of accessible live parts , Cable supports and tool falling shroud in cable alley	Major	Visual	100%	10%	NTPC spec	NTPC spec	QC Records	✓	P	W	W
		10. For modules more than 30KW, minimum 4 no of support guide arrangement required.	Major	Visual	100%	10% of each type/	NTPC approved GA / scheme drag	NTPC approved GA / scheme drag	QC Records	✓	P	W	W
													Same to be witnessed at random during final inspection

 MANUFACTURER/SUB-SUPPLIER		GEND. * RECORDS IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN DOCUMENTATION. **MANUFACTURER/SUB-CONTRACTOR, C: CONTRACTOR/NOMINATED INSPECTION AGENCY, N: NTPC INDICATED "P" PERFORM "W" WITNESS AND "V" VERIFICATION ALL "W" INDICATED IN COLUMN "N" SHALL BE "CHP" OF NTPC		FOR NTPC USE		DOC. NO. 9591-102-206-PVE-Q-001, REV. 01	
		REVIEWED BY		APPROVED BY		APPROVAL SEAL	

MANUFACTURER'S NAME & ADDRESS:		MANUFACTURING QUALITY PLAN					PROJECT : 2X800 MW TELANGANA SUPER THERMAL POWER PROJECT PHASE-I PACKAGE: STEAM GENERATOR ISLAND PACKAGE CONTRACT NO. : CS-9591-101-2-FC-COA-6462, Dtd, 05.02.2018 MAIN SUPPLIER: M/S BHEL – EPD (BANGLORE)				
C & S ELECTRIC LTD. C-59, PHASE-II, NOIDA 201 301 (U.P.)		ITEM : PCC ,MCC , ACDB AND DCDB (UP TO 4000 A) REV. NO. 02 DATE : 01.11.2018 Page 9 of 11					QP NO. C&S/J-3314/801 REV. NO. 02 DATE : 01.11.2018 Page 9 of 11				
Sl. No.	Component & Operations	Characteristics	Classification	Type of Check	Quantum of check, %	Reference Document	Acceptance Norms	Format of Records	Agency	Remarks	
1	2	3	4	5	6	7	8	9	10	11	
		11. Mounting arrangement of components shall be verified such that there would be no hindrance for accessibility	Major	Visual	100%	NTPC approved GA / scheme drag	NTPC approved GA / scheme drag	QC Records	P	W	
		12. Check control wiring / terminal arrangement & ferruling	Major	Visual	100%	As per NTPC approved drag.	As per NTPC approved drag.	QC Records	P	W	
		13. Safety Shutters operation check & padlocking arrangement	Critical	Mech.	100%	NTPC spec	NTPC spec	QC Records	P	W	
		14. Check door interlock & defeat interlock	Major	Mech.	100%	NTPC spec	NTPC spec	QC Records	P	W	
		15. Mach operation test for ACB as per IS	Critical	Elect	100%	IS 13947	IS 13947	QC Records	P	W	
		16. Breaker operation at service , test & isolate position	Critical	Elect	100%	NTPC spec	NTPC spec	QC Records	P	W	
		17. Power & control draw out contacts alignment check	Major	Elect	100%	NTPC spec	NTPC spec	QC Records	P	W	
		18. Check for Breaker antidumping & trip free feature	Major	Elect	100%	NTPC spec	NTPC spec	QC Records	P	W	
		19. Interlocks & operation check- elect. / Machopen, close under test & service.	Critical	Elect	100%	Approved drgs & NTPC Spec.	Approved drgs & NTPC Spec.	QC Records	P	W	
		20. FRP sheets material used as barriers shall be Flame retardant material	Major	Flame Test	Sampling as per Mfr. Std. 5 sample of each type per lot	As per IS 6746, table - 4 grade - I	As per IS 6746, table - 4 grade - I	Suppliers TC	P	W	
		21. Bus bar Sleeves material shall be as per NTPC Spec. and marking UL on sleeve. Material Certification for the sleeve material complying to UL 224	Major	Measurement	5 sample of each type per lot	Mnfr Std. / Mnfr drg.	Mnfr Std. / Mnfr drg.	Suppliers TC	P	W	
		22 Interchangeability check for draw out modules	Major	Mech	100%	NTPC spec	NTPC spec	QC Records	P	W	
										10% random sample by NTPC	
										10% random sample by NTPC	
										UL-94, V0 GRADE PREFERABLY	
										Marking of UL on sleeve and relevant UL certification for the sleeve material complying to UL 224 shall be verified by NTPC at time of final inspection	

MANUFACTURER'S SIGNATURE / SUPPLIER 		MAIN SUPPLIER 		FOR NTPC USE GRND: * RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN DOCUMENTATION. ** M: MANUFACTURER/SUB-CONTRACTOR, C: CONTRACTOR /NOMINATED INSPECTION AGENCY, N: NTPC INDICATED "N" SHALL BE "CHP" OF NTPC. *** VERIFICATION ALL "W" INDICATED IN COLUMN "N" SHALL BE "CHP" OF NTPC.		DOC. NO. 9591-102-206-PVE-Q-001, REV. 01	
REVIEWED BY 		APPROVED BY 		APPROVAL SEAL 			

MANUFACTURER'S NAME & ADDRESS:			MANUFACTURING QUALITY PLAN					PROJECT : 2X800 MW TELANGANA SUPER THERMAL POWER PROJECT PHASE-I PACKAGE: STEAM GENERATOR ISLAND PACKAGE CONTRACT NO. : CS-9591-101-2-FC-COA-8482, Dtd. 05.02.2016 MAIN SUPPLIER: M/S BHEL – EPD (BANGLORE)										
C & S ELECTRIC LTD. C-59, PHASE-II, NOIDA 201 301 (U.P.)			ITEM : PCC /MCC , ACDB AND DCDB (UP TO 4000 A) QIP NO. C&S/J-3314/801 REV. NO. 02 DATE : 01.11.2018 Page 10 of 11															
Sl. No.	Component & Operations	Characteristics	Classification	Type of Check	Quantum of check, 6	Reference Document	Acceptance Norms	Format of Records										Remarks
1	2	3	4	5	M	C/N	7	8	9	D*	M**	C	N	11				
		23.Earth bus dimensions , earthing of draw out modules, door etc.	Major	Elec	100%	10% of each type f	NTPC spec	QC Records	✓	P	W	W	W	Paint Thickness to be checked as per NTPC spec./ app. drag/ Mnfr std. Paint adhesion check by cross hatch method using packing tape				
		24.Check Paint shade, thickness, Adhesion & finish	Major	Visual/ Test	100% for shade & finish; 2 – 3 samples / board	As per NTPC approved drg. For shade	As per NTPC approved drg. For shade	QC Records	✓	P	W	W	W					
		25.Degree of protection check, check fixing of gaskets	Major	Visual	2-5 samples at casketed joints per board	NTPC approved drags / NTPC spec	No insertion possible from openings & casketed joints	QC Records	✓	P	W	W	W	Paper insertion method for IP 5X compartment & 1 mm wire insertion method for IP 4X compartment.				
		26.No. of support insulator which shall be same as that of type tested panel.	Major	Visual	100%	As per Type Test	As per Type Test	QC Records	✓	P	V	V	V					
		27.IR Test before & after the HV Test	Major	Elect.	100%	IS-8623	IS-8623	QC Records	✓	P	W	W	W					
		28.HV test on Power & control ckt.	Critical	Elect.	100%	IS-8623	IS-8623	QC Records	✓	P	W	W	W					
		29. Fitting of sheet steel covers at one ends of transport units	Major	Visual	100%	NTPC spec	NTPC spec	QC Records	✓	P	V	V	V	1) Generally, verification of compliance report of Manufacturer				
6	Packing & transportation	Panels cleared by NTPC for dispatch to be packed suitably & transported to site after proper packing & crating	Major	Visual	100%	Mnfr std	Mnfr std	QC Records		P				Panels cleared by NTPC for dispatch to be packed suitably & transported to site after proper packing and crating				

Make of Components - Annexure-I

Sr. No.	Item	Make
1.	Air Circuit Breaker	C&S ELECTRIC LTD. (AH TYPE)
2.	Switch/Switch Fuse Unit	Any make's Model with VDE, CE, UL, CSA OR BIS Approved with CML No.
3.	HRC Fuse Link & fuse base	Any make's Model with VDE, CE, UL, CSA OR BIS Approved with CML No.
4.	Contactor & Over Load Relays	Any make's Model with VDE, CE, UL, CSA OR BIS Approved with CML No.
5.	Current Transformer	AE - MUMBAI / KAPPA - BANGALORE / PRAGATI - THANE / PRAYOG - PUNE / INDCOIL - MUMBAI / PRECISE - MUMBAI / SOUTHERN ELECTRIC - CHENNAI, NEWTEK Electrical - Aurangabad

MANUFACTURER'S SIGNATURE / SUPPLIER		FOR NTPC USE		DOC. NO. 9591-102-206-PVE-Q-001, REV. 01	
SIGNATURE		REVIEWED BY		APPROVED BY	
				APPROVAL SEAL	

MANUFACTURER'S NAME & ADDRESS:			MANUFACTURING QUALITY PLAN					PROJECT : 2X800 MW TELANGANA SUPER THERMAL POWER PROJECT PHASE-I PACKAGE: STEAM GENERATOR ISLAND PACKAGE CONTRACT NO. : CS-9591-101-2-FC-COA-6462, Dtd. 05.02.2016 MAIN SUPPLIER: M/S BHEL – EPD (BANGLORE)						
C & S ELECTRIC LTD. C-59, PHASE-II, NOIDA 201 301 (U.P.)			ITEM : PCC /MCC, ACDB AND DCDB (UP TO 4000 A) REV. NO. 02 DATE : 01.11.2018 Page 11 of 11		QP NO. C&SJ-3314/801		Acceptance Norms		Format of Records		Agency 10		Remarks	
Sl. No.	Component & Operations	Characteristics	Classification	Type of Check	Quantum of check, %	Reference Document	8	9	D*	M**	C	N	11	
6.	Potential Transformer	AE – MUMBAI / KAPPA – BANGALORE / PRAGATI – THANE / PRAYOG – PUNE / INDCOIL – MUMBAI / SOUTHERN ELECTRIC – CHENNAI	4	5	M	CIN	7	8	9	D*	M**	C	N	11
7.	Control Transformer	AE – MUMBAI , KAPPA – BANGALORE , SOUTHERN ELECTRIC – CHENNAI , PRAGATI – THANE , PRAYOG – PUNE , INDCOIL – MUMBAI , PRECISE – MUMBAI/G&M – BARODA, LOGICSTATE – DELHI, NEWTEK Electrical – Aurangabad	4	5	M	CIN	7	8	9	D*	M**	C	N	11
8.	Lighting Transformer	AE – MUMBAI , PRAGATI – THANE , INDCOIL – MUMBAI , PRECISE – MUMBAI, LOGICSTATE – DELHI	4	5	M	CIN	7	8	9	D*	M**	C	N	11
9.	Protection relays (Numerical)	ABB – BARODA / ALSTOM T&D – CHENNAI / GE – CANADA / SIEMENS – FINLAND (EUROPE)	4	5	M	CIN	7	8	9	D*	M**	C	N	11
10	Protection relays (Electromechanical)	ABB / AREVA (ALSTOM) / SIEMENS/ SCHNIEDER	4	5	M	CIN	7	8	9	D*	M**	C	N	11
11.	Indicating lamp	Any make's Model with VDE, CE, UL , CSA OR BIS Approved with CML No.	4	5	M	CIN	7	8	9	D*	M**	C	N	11
12.	Push Button	Any make's Model with VDE, CE, UL , CSA OR BIS Approved with CML No.	4	5	M	CIN	7	8	9	D*	M**	C	N	11
13.	Indicating/Measuring Instrument	Any make's Model with VDE, CE, UL , CSA OR BIS Approved with CML No.	4	5	M	CIN	7	8	9	D*	M**	C	N	11
14.	Plug in Terminal & Terminals Block	Any make's Model with VDE, CE, UL , CSA OR BIS Approved with CML No.	4	5	M	CIN	7	8	9	D*	M**	C	N	11
15	Space Heater	MANUFACTURER ACCEPTENCE SOURCE	4	5	M	CIN	7	8	9	D*	M**	C	N	11
16.	Thermostat	MANUFACTURER ACCEPTENCE SOURCE	4	5	M	CIN	7	8	9	D*	M**	C	N	11
17.	BKR control switch	Any make's Model with VDE, CE, UL , CSA OR BIS Approved with CML No.	4	5	M	CIN	7	8	9	D*	M**	C	N	11
18.	Selector Switch	Any make's Model with VDE, CE, UL , CSA OR BIS Approved with CML No.	4	5	M	CIN	7	8	9	D*	M**	C	N	11
19.	Coupling relay	Any make's Model with VDE, CE, UL , CSA OR BIS Approved with CML No.	4	5	M	CIN	7	8	9	D*	M**	C	N	11
20.	Transducer	Any make's Model with VDE, CE, UL , CSA OR BIS Approved with CML No.	4	5	M	CIN	7	8	9	D*	M**	C	N	11
21.	TIMER	L&T / SIEMENS/Any make's Model with VDE, CE, UL , CSA OR BIS Approved with CML No.	4	5	M	CIN	7	8	9	D*	M**	C	N	11
22.	Neutral link	C&S ELECTRIC LTD./ MANUFACTURER ACCEPTENCE SOURCE	4	5	M	CIN	7	8	9	D*	M**	C	N	11
23.	Cable Lugs	DOWELLS/3D/CHETNA	4	5	M	CIN	7	8	9	D*	M**	C	N	11
24	Cable Gland	MANUFACTURER APPROVED SOURCE	4	5	M	CIN	7	8	9	D*	M**	C	N	11
25.	3 PIN POWER SOCKET	Any make's Model with VDE, CE, UL , CSA OR BIS Approved with CML No.	4	5	M	CIN	7	8	9	D*	M**	C	N	11
26.	MCB	Any make's Model with VDE, CE, UL , CSA OR BIS Approved with CML No.	4	5	M	CIN	7	8	9	D*	M**	C	N	11
27.	WIRE	BIS APPROVED with valid CML no	4	5	M	CIN	7	8	9	D*	M**	C	N	11
28.	KWH METER	Any make's Model with VDE, CE, UL , CSA OR BIS Approved with CML No.)	4	5	M	CIN	7	8	9	D*	M**	C	N	11
29.	AL BUSBAR (RAW MATERIAL)	HINDALCO / BALCO / INDALCO	4	5	M	CIN	7	8	9	D*	M**	C	N	11
30.	SHEET STEEL	TATA/SAIL/BHUSHANSTEEL/JINDAL/ESSAR/TISCO.	4	5	M	CIN	7	8	9	D*	M**	C	N	11
31..	Copper Bubar (RAW MATERIAL)	HINDUSTAN COPPER LTD./ STERLITE	4	5	M	CIN	7	8	9	D*	M**	C	N	11
32.	Paint.	MANUFACTURER ACCEPTENCE SOURCE	4	5	M	CIN	7	8	9	D*	M**	C	N	11

MANUFACTURER/SUB / SUPPLIER	SIGNATURE	MAN SUPPLIER	FOR NTPC USE	DOC. NO. 9591-102-206-PVE-Q-001, REV. 01
				REVIEWED BY



TITLE :
ELECTRICAL EQUIPMENT SPECIFICATION
FOR ETP
2X800MW TELANGANA KARIMNAGAR STPP
(SG ISLAND)

SPECIFICATION NO.

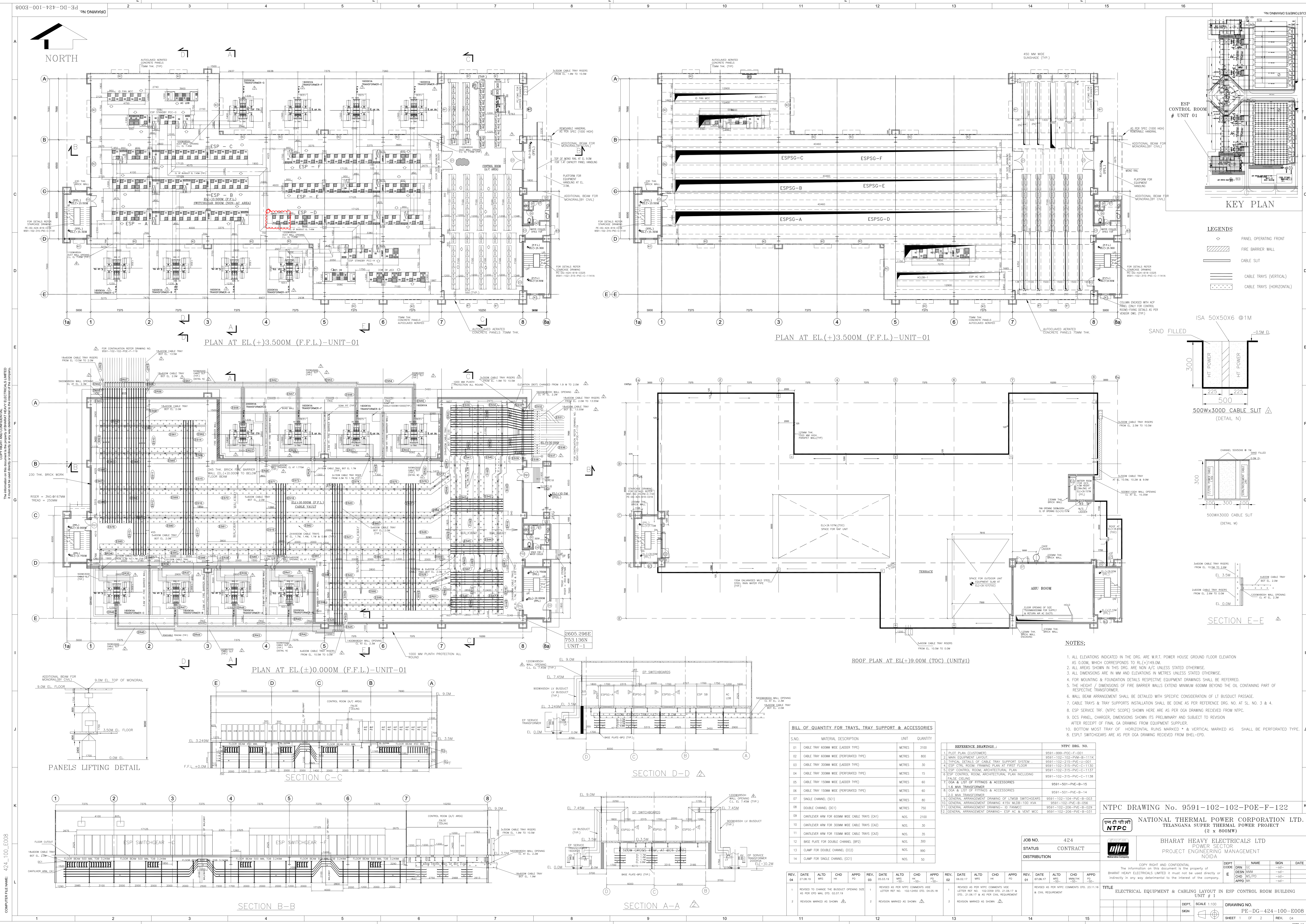
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SECTION :

REV NO. : DATE :

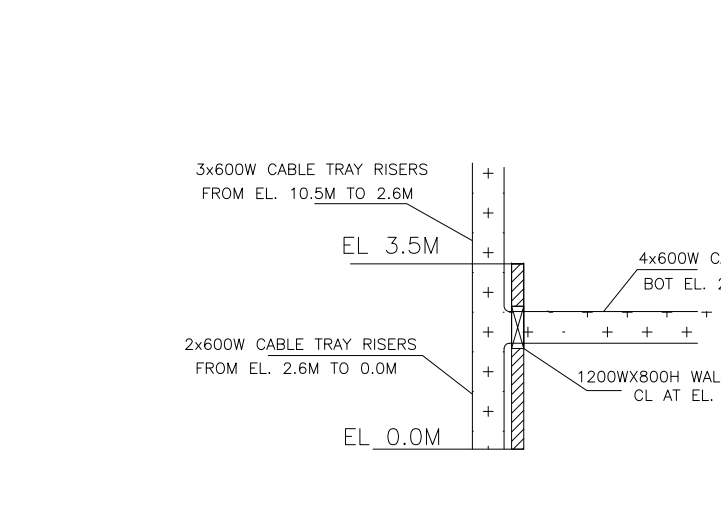
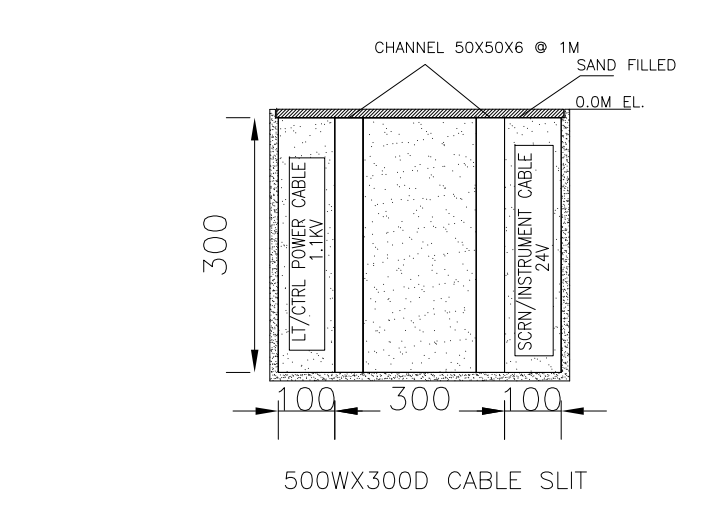
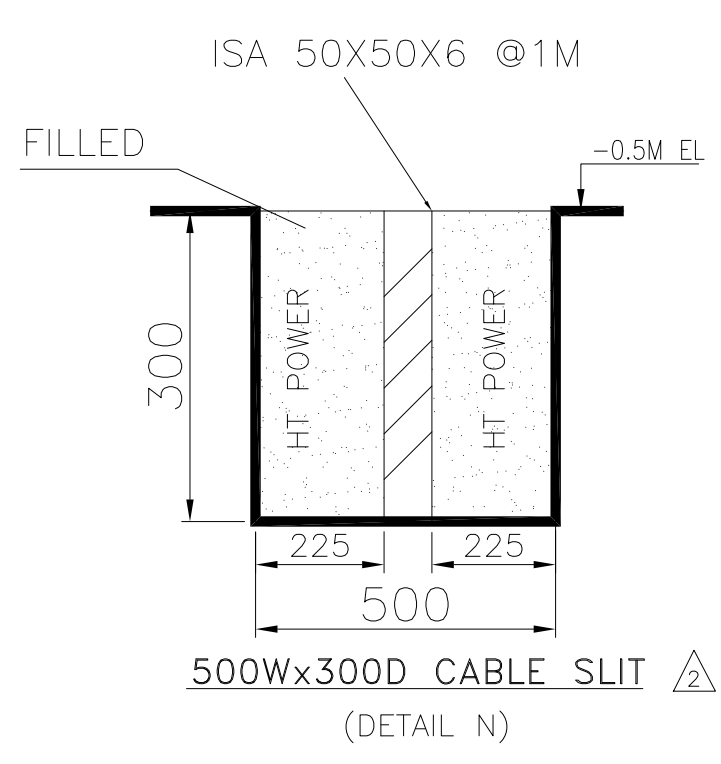
SHEET : 1 OF

LAY OUT DRAWING
(ANNEXURE-VI)



KEY PLAN

- LEGENDS
- PANEL OPERATING FRONT
 - FIRE BARRIER WALL
 - CABLE SUT
 - CABLE TRAYS (VERTICAL)
 - CABLE TRAYS (HORIZONTAL)



- NOTES:
- ALL ELEVATIONS INDICATED IN THE DRG. ARE W.R.T. POWER HOUSE GROUND FLOOR ELEVATION AS 0.00M, WHICH CORRESPONDS TO RL(+149.00M).
 - ALL AREAS SHOWN IN THIS DRG. ARE NON A/C UNLESS STATED OTHERWISE.
 - ALL DIMENSIONS ARE IN MM AND ELEVATIONS IN METRES UNLESS STATED OTHERWISE.
 - FOR MOUNTING & FOUNDATION DETAILS RESPECTIVE EQUIPMENT DRAWINGS SHALL BE REFERRED.
 - THE HEIGHT / DIMENSIONS OF FIRE BARRIER WALLS EXTEND MINIMUM 600MM BEYOND THE OIL CONTAINING PART OF RESPECTIVE TRANSFORMER.
 - WALL BEAM ARRANGEMENT SHALL BE DETAILED WITH SPECIFIC CONSIDERATION OF LT BUDDUCT PASSAGE.
 - CABLE TRAYS & TRAY SUPPORTS INSTALLATION SHALL BE DONE AS PER REFERENCE DRG. NO. AT SL. NO. 3 & 4.
 - ESP SERVICE TRF. (NTPC SCOPE) SHOWN HERE ARE AS PER OGA DRAWING RECEIVED FROM NTPC.
 - OGA & LIST OF FITTINGS & ACCESSORIES
 - OGA & LIST OF FITTINGS & ACCESSORIES
 - GENERAL ARRANGEMENT DRAWING OF LTWEE SWITCHGEARS
 - GENERAL ARRANGEMENT DRAWING 415V MCB-100 KVA
 - GENERAL ARRANGEMENT DRAWING- (D) FANMCC
 - GENERAL ARRANGEMENT DRAWING- ESP AC & VENT MCC

NTPC DRAWING No. 9591-102-102-POE-F-122

NATIONAL THERMAL POWER CORPORATION LTD.
TELANGANA SUPER THERMAL POWER PROJECT
(2 x 800MW)

BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
Noida

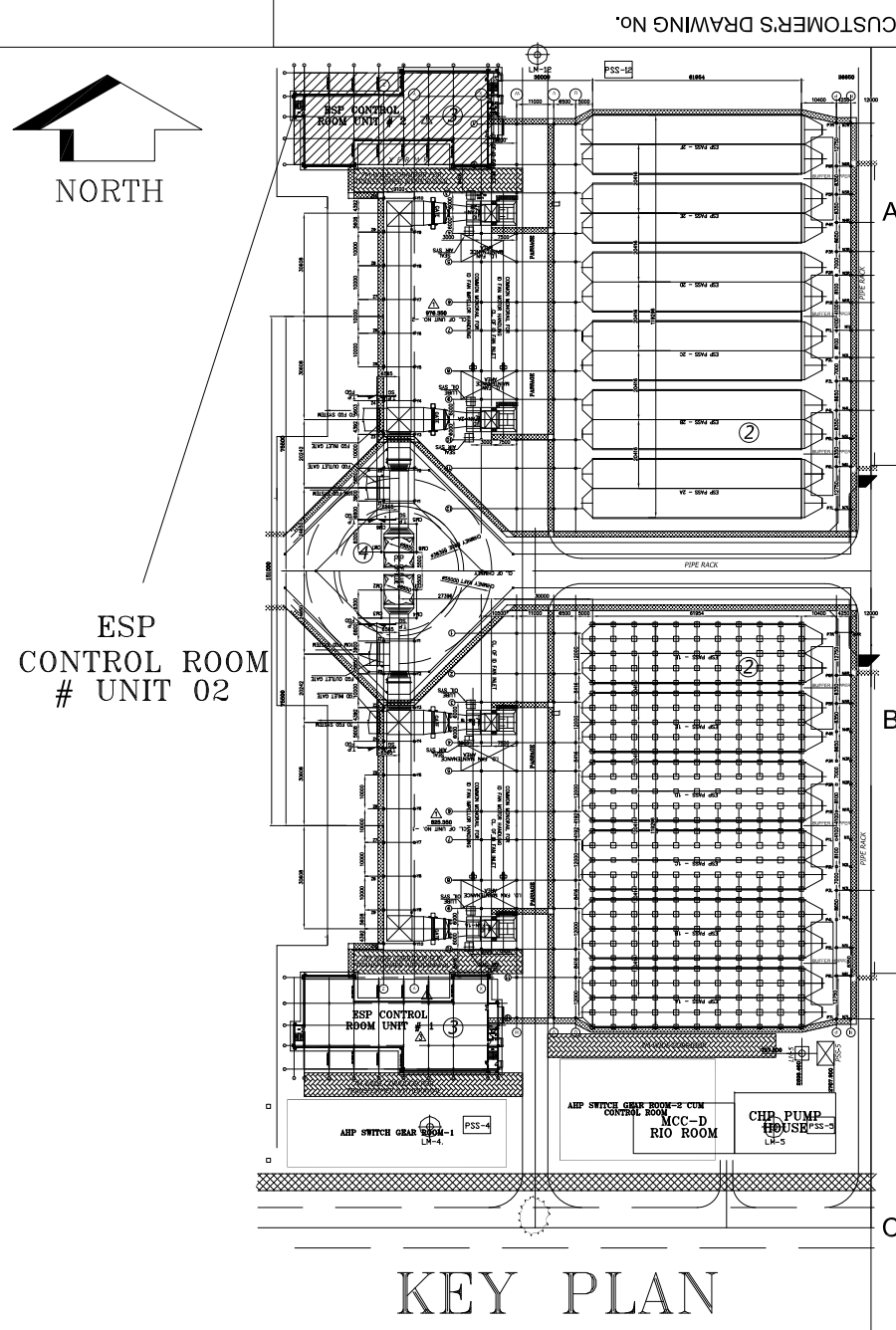
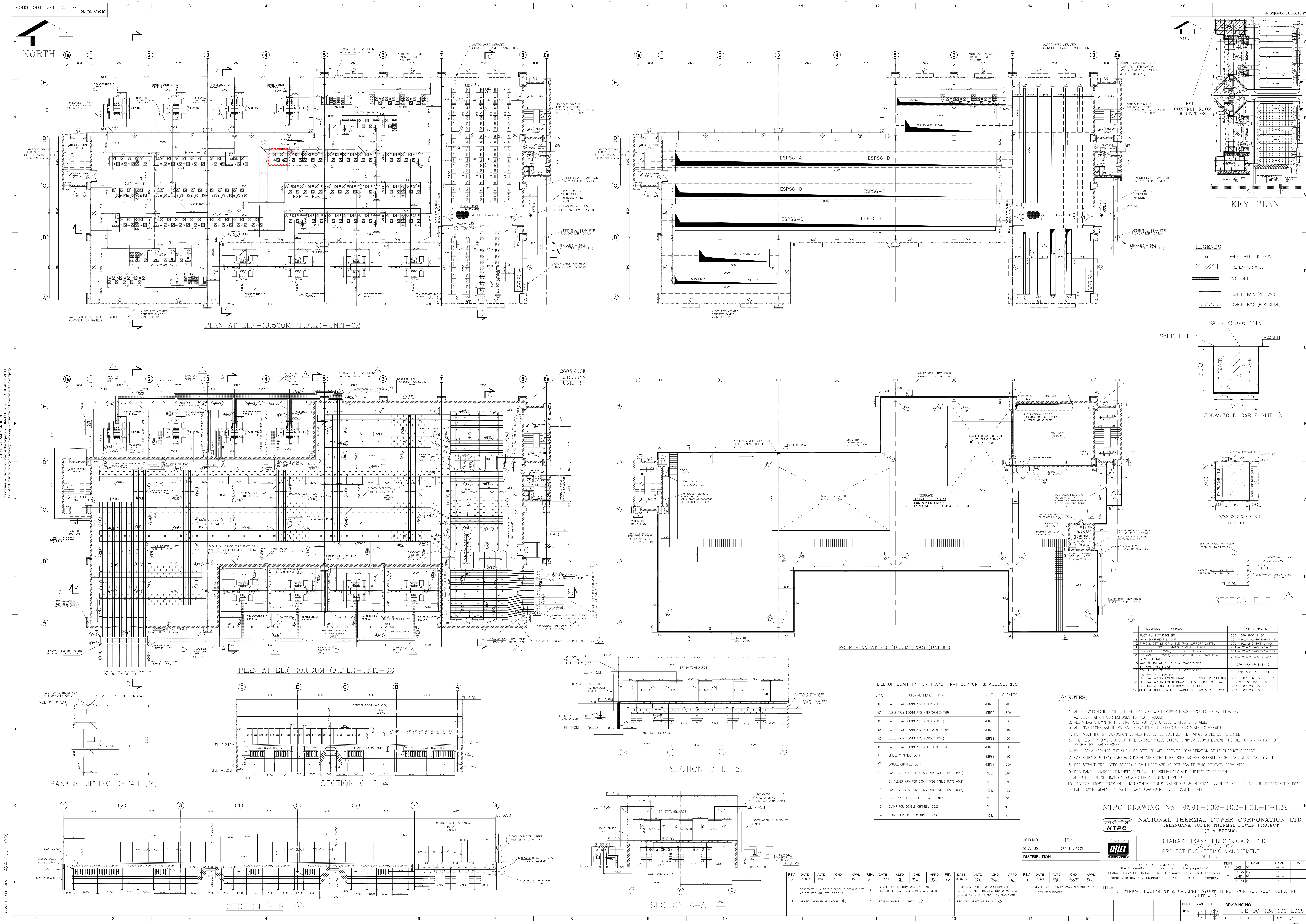
JOB NO. 424
STATUS CONTRACT
DISTRIBUTION

S.NO.	MATERIAL DESCRIPTION	UNIT	QUANTITY
01	CABLE TRAY 600MM WIDE (LADDER TYPE)	METRES	3100
02	CABLE TRAY 600MM WIDE (PERFORATED TYPE)	METRES	800
03	CABLE TRAY 300MM WIDE (LADDER TYPE)	METRES	30
04	CABLE TRAY 300MM WIDE (PERFORATED TYPE)	METRES	15
05	CABLE TRAY 150MM WIDE (LADDER TYPE)	METRES	60
06	CABLE TRAY 150MM WIDE (PERFORATED TYPE)	METRES	60
07	SINGLE CHANNEL (SC1)	METRES	80
08	DOUBLE CHANNEL (DC1)	METRES	750
09	CANTILEVER ARM FOR 600MM WIDE CABLE TRAYS (CA1)	NOS.	2100
10	CANTILEVER ARM FOR 300MM WIDE CABLE TRAYS (CA2)	NOS.	30
11	CANTILEVER ARM FOR 150MM WIDE CABLE TRAYS (CA3)	NOS.	35
12	BASE PLATE FOR DOUBLE CHANNEL (BP2)	NOS.	300
13	CLAMP FOR DOUBLE CHANNEL (CC2)	NOS.	990
14	CLAMP FOR SINGLE CHANNEL (CC1)	NOS.	50

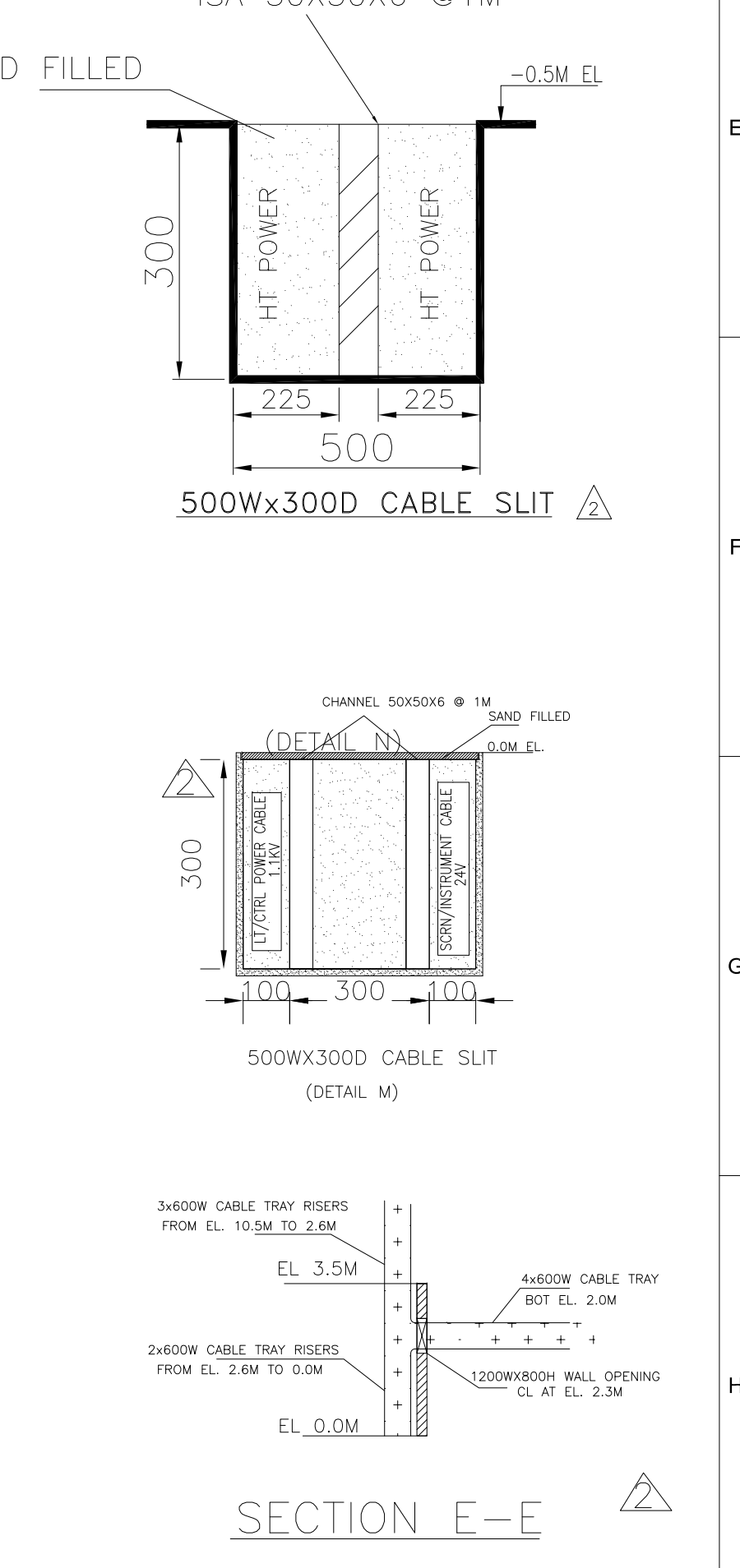
REFERENCE DRAWINGS:	NTPC DRG. NO.
1. PLOT PLAN (CUSTOMER)	9591-999-POE-F-001
2. MAIN EQUIPMENT LAYOUT	9591-102-102-POE-B-1116
3. TYPICAL DETAILS OF CABLE TRAY SUPPORT SYSTEM	9591-102-215-PVE-U-001
4. ESP CTRL ROOM FRAMING PLAN AT FIRST FLOOR	9591-102-315-PVC-C-1300
5. ESP CONTROL ROOM ARCHITECTURAL PLAN INCLUDING FALSE CEILING	9591-102-315-PVC-C-1137
6. ESP CONTROL ROOM ARCHITECTURAL PLAN INCLUDING FALSE CEILING	9591-102-315-PVC-C-1138
7. OGA & LIST OF FITTINGS & ACCESSORIES	9591-501-PVE-B-15
8. OGA & LIST OF FITTINGS & ACCESSORIES	9591-501-PVE-B-14
9. GENERAL ARRANGEMENT DRAWING OF LTWEE SWITCHGEARS	9591-102-104-PVE-B-003
10. GENERAL ARRANGEMENT DRAWING 415V MCB-100 KVA	9591-102-PVE-B-056
11. GENERAL ARRANGEMENT DRAWING- (D) FANMCC	9591-102-208-PVE-B-029
12. GENERAL ARRANGEMENT DRAWING- ESP AC & VENT MCC	9591-102-206-PVE-B-031

REV.	DATE	ALTD	CHD	APPD	REV.	DATE	ALTD	CHD	APPD	REV.	DATE	ALTD	CHD	APPD	REV.	DATE	ALTD	CHD	APPD
1	27.08.19				1	27.08.19				1	27.08.19				1	27.08.19			
2	27.08.19				2	27.08.19				2	27.08.19				2	27.08.19			

COMPUTER FILE NAME: 424_100_E008



- LEGENDS
- PANEL OPERATING FRONT
 - FIRE BARRIER WALL
 - CABLE SLIT
 - CABLE TRAYS (VERTICAL)
 - CABLE TRAYS (HORIZONTAL)



REFERENCE DRAWINGS

S.NO.	MATERIAL DESCRIPTION	UNIT	QUANTITY
01	CABLE TRAY 600MM WIDE (LOADER TYPE)	METRES	3100
02	CABLE TRAY 300MM WIDE (PERFORATED TYPE)	METRES	800
03	CABLE TRAY 300MM WIDE (LOADER TYPE)	METRES	30
04	CABLE TRAY 300MM WIDE (PERFORATED TYPE)	METRES	15
05	CABLE TRAY 150MM WIDE (LOADER TYPE)	METRES	60
06	CABLE TRAY 150MM WIDE (PERFORATED TYPE)	METRES	60
07	SINGLE CHANNEL (SC1)	METRES	80
08	DOUBLE CHANNEL (DC1)	METRES	750
09	CANTILEVER ARM FOR 600MM WIDE CABLE TRAYS (CA1)	NOS.	2100
10	CANTILEVER ARM FOR 300MM WIDE CABLE TRAYS (CA2)	NOS.	30
11	CANTILEVER ARM FOR 150MM WIDE CABLE TRAYS (CA3)	NOS.	35
12	BASE PLATE FOR DOUBLE CHANNEL (BP2)	NOS.	300
13	CLAMP FOR DOUBLE CHANNEL (CC2)	NOS.	990
14	CLAMP FOR SINGLE CHANNEL (CC1)	NOS.	50

- NOTES:
- ALL ELEVATIONS INDICATED IN THE DRG. ARE W.R.T. POWER HOUSE GROUND FLOOR ELEVATION AS 0.00M, WHICH CORRESPONDS TO RL(+149.0M).
 - ALL AREAS SHOWN IN THIS DRG. ARE NON A/C UNLESS STATED OTHERWISE.
 - ALL DIMENSIONS ARE IN MM AND ELEVATIONS IN METRES UNLESS STATED OTHERWISE.
 - FOR MOUNTING & FOUNDATION DETAILS RESPECTIVE EQUIPMENT DRAWINGS SHALL BE REFERRED.
 - THE HEIGHT / DIMENSIONS OF FIRE BARRIER WALLS EXTEND MINIMUM 600MM BEYOND THE OIL CONTAINING PART OF RESPECTIVE TRANSFORMER.
 - WALL BEAM TRANSFORMER SHALL BE DETAILED WITH SPECIFIC CONSIDERATION OF LT BUSDUCT PASSAGE.
 - CABLE TRAYS & TRAY SUPPORTS INSTALLATION SHALL BE DONE AS PER REFERENCE DRG. NO. AT SL. NO. 3 & 4.
 - ESP SERVICE TRF. (NTPC SCORE) SHOWN HERE ARE AS PER OGA DRAWING RECEIVED FROM NTPC.
 - DOS PANEL, CHARGER, DIMENSIONS SHOWN ITS PRELIMINARY AND SUBJECT TO REVISION AFTER RECEIPT OF FINAL GA DRAWING FROM EQUIPMENT SUPPLIER.
 - BOTTOM MOST TRAY OF HORIZONTAL RUNS MARKED * & VERTICAL MARKED AS SHALL BE PERFORATED TYPE.
 - ESPTL SWITCHGEARS ARE AS PER OGA DRAWING RECEIVED FROM BHEL-EPO.

NTPC DRAWING No. 9591-102-102-POE-F-122

NATIONAL THERMAL POWER CORPORATION LTD.
TELANGANA SUPER THERMAL POWER PROJECT
(2 x 800MW)

BHARAT HEAVY ELECTRICALS LTD.
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
Noida

JOB NO. 424
STATUS CONTRACT
DISTRIBUTION

DEPT. CODE
DESIGN NAME
EHD
SHEET 2 OF 2

DRAWING NO.
PE-DG-424-100-E008
SHEET 2 OF 2



TITLE:

**TECHNICAL SPECIFICATION FOR
EFFLUENT COLLECTION AND DISPOSAL
2X800 MW TELAGANA STPP PHASE-I (SG
PACKAGE)**

BHEL DOCUMENTS NO.: PE-TS-424-673-A001

VOLUME II-B

SECTION-

REV. NO. 00

DATE: 10.06.2024

SECTION-IC

SPECIFIC TECHNICAL REQUIREMENT OF EFFLUENT TRANSFER SYSTEM (C&I)

SPECIFIC TECHNICAL REQUIREMENT	
Sl.No.	Items / Requirements
1	Total 4 nos. Local control panel at different locations as indicated tender P&ID shall be in bidder's scope.
2	Local Control with start, stop push buttons from Local Control Panel shall be provided by bidder.
3	On, off, disturbed, sump level, pump disch hdr pressure indication on Local Control Panel shall be provided by bidder.
4	Complete Field Instrumentation for monitoring and operation of Effluent collection and disposal system shall be provided by bidder.
5	Root valves, impulse piping, drain cocks, gauge-zeroing cocks, valve manifold, and all other accessories required for erection of local / remote instruments shall be provided by bidder.
6	All necessary hardware for deriving other power supply from given feeder shall be in bidder's scope.
7	The make/model of various instruments/items/systems shall be subject to approval of owner/purchaser during detailed engineering stage. No commercial implication in this regard shall be acceptable.
8	Bidder to comply with codes and standards as mentioned in the specification.
9	Scope of Instrumentation cables (Screened Control Cables), Fibre Optic cable & Control cables shall be as per Electrical Cable scope matrix in Electrical portion of specification. Any cable in Bidder's scope shall be as per specification.

DATASHEET OF PRESSURE TRANSMITTER		
SI.NO.	ITEM	DETAILS
1	Fluid Handled	Effluent water
2	Transmitter Type	Microprocessor based 2 Wire Loop powered,Hart protocol compatible
3	Output	4-20 mA DC along with superimposed digital signal (based on HART protocol)
4	Turndown Ratio	30:1
5	Accuracy	± 0.1% of calibrated span (minimum)
6	Stability (% of Calibrated Range)	± 0.1% of calibrated span for six months
7	Diaphragm Seal material, fill fluid	SS316L, Inert Liquid
8	Wetted parts	All wetted parts upto diaphragm seal shall be suitable for corrosive, viscous, solid bearing or slurry type media.
9	Housing	Metallic housing with durable corrosion resistant coating
10	Protection	Weather Proof IP-65
11	Display	Integral digital display
12	Diagonstic feature	Required
13	Electrical Connection	1/2" NPT (F)
14	Manifold	2 Valve manifold, non integral type
15	Power supply	24V DC ± 10%.
16	Over Pressure	150% of max. Operating pressure
17	Zero and span drift	+/- 0.015% per deg.C at max span, +/-0.11% per deg.C at min. Span.

DATASHEET OF ULTRASONIC LEVEL TRANSMITTER		
SI.NO.	ITEM	Details
1	Fluid Handled	Effluent water
2	TransmitterType	Non Contact Microprocessor based 2 wire type loop powered, HART protocol compatible
3	Output Signal	4-20 mA DC (analog signal) alongwith superimposed digital signal based on HART Protocol
4	Accuracy	±0.5 of calibrated span or minimum 5mm
5	Power Supply	24 VDC +/- 10%
6	Temperature Compensation	To be provided within Transducer
7	Housing Material	Metallic housing with durable corrosion resistance coating
8	Protection	Weather proof as per IP-65
9	Sensor Material	Corrosion resistant material to suit individual application requirement
10	False Signal Tolerance	Transmitter shall be capable of ignoring false echoes from internal tank/sumped obstructions such as pipes, heating coils or agitator blades. Also transmitter shall have adjustable damping circuitry.
11	Display	Integral digital display
12	Diagnostics	Loss of echo alarm etc.
13	Electrical Connection	Plug and socket
15	Zero and Span adjustment	Continuous, tamper proof, remote as well as manual adjustability from instrument. It should be possible to calibrate the instrument without any level in the tank/sump etc.
16	Range	Range of transmitter shall be capable of covering the complete level span of tank taking care of blocking distance, frequency attenuation due to surface, obstructions, vapors etc.
17	Mounting	Top mounting
18	Accessories	1. All weather canopy shall be provided for protection from direct sunlight and direct rain for open locations.
		2. All mounting accessories required for erection and commissioning shall be provided.

DATASHEET OF PRESSURE GAUGE		
Sl. No	FEATURES	ESSENTIAL/MINIMUM REQUIREMENTS
		Pr. Gauge/ DP Gauge
1	Sensing Element and material	Bourdon for high pressure, Diaphragm/Bellow for low pressure of SS316, movement material SS316
2	Body material	Die-cast aluminium
3	Dial size	150mm
4	End connection	1/2 inch NPT (M)
5	Accuracy	±1% of span
6	Scale	Linear, 270° arc graduated in metric units
7	Range selection	Cover 125% of max. of scale
9	Diaphragm seal material, fill fluid	SS316L, Inert Liquid suitable for application
10	Wetted parts	All wetted parts upto diaphragm seal shall be suitable for corrosive media.
11	Housing	Weather and dust proof as per IP-55
12	Zero/span adjustment	External
13	Accessories	Blow out disc, siphon, snubber, pulsation, dampener, chemical seal, gauge isolation valve

DATASHEET OF LEVEL GAUGE		
Sl. No	FEATURES	
		Level Gauge
1	Sensing Element and material	Tempered toughened Borosilicate gauge glass steel armoured reflex or transparent type, Bicolour type
2	End connection	Process connection as per ASME PTC , 3/4" and drain/vent 15 NB
3	Accuracy	± 2%
4	Diaphragm seal material, fill fluid	SS316L, Inert Liquid suitable for application
5	Wetted parts	All wetted parts upto diaphragm seal shall be suitable for corrosive meadia.
6	Accessories	Gasket for all KEL-F shield for transparent type vent and drain valves of Steel/SS as per CS/Alloy process Requirement.
7	Housing	CS/304 SS leak proof.

Notes:

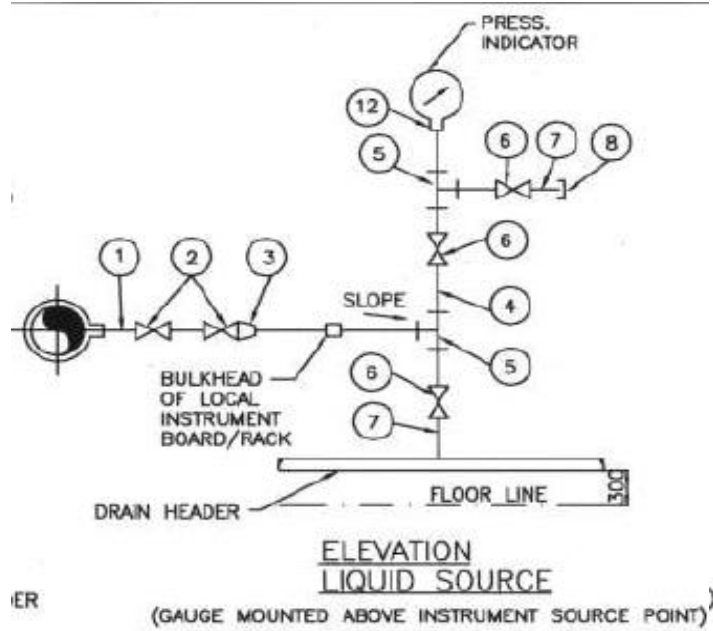
1. Length of gauge glass shall not be more than 1400 mm. If the vessel is higher, multiple gauge glasses with 50 mm overlapping shall be provided.

PROCESS CONNECTION PIPING	
The rating of material of impulse pipes, tubes, fittings, valves and their installation thereof shall conform to the latest edition of standards as per following table:	
Impulse Pipes, Tubes (Material, Rating)	ANSI B31.1, ANSI B31.1a, ANSI/ISA 77.70
Valves (Material, Pr. Class, Size)	ASTM A182/ASTM A105 as per ASME 16.34
Fittings (Size, Rating, Material)	ANSI B31.1, ANSI B31.1a, ASME B16.11
Installation Schemes	BS 6739-2009, ANSI/ISA 77.70

	SPECIFICATION & DATA SHEET FOR LOCAL PANELS	
S.No.	PARAMETERS	REQUIREMENT
1	CONSTRUCTION	
	TYPE	FREE STANDING TYPE
	CONSTRUCTION	FOLDED
	DEVICES & EQUIPMENTS	PANEL ENCLOSURE, SECONDARY INSTRUMENTS, ANNUNCIATION SYSTEM, SINGLE LOOP CONTROLLER, SELECTOR SWITCH, PUSH BUTTONS, INDICATING LAMPS/ LED CLUSTER, RELAYS, MCBs, AMMETER, VOLTMETER, CLAMP ON TERMINALS, PLUG SOCKET, PANEL LIGHT.
	ENCLOSURE SHEET MATERIAL	COLD ROLLED SHEET STEEL
	ENCLOSURE SHEET THICKNESS	MINIMUM 3.0 mm FOR LOAD BEARING SECTIONS (MOUNTED WITH INSTRUMENTS)
		2.0 mm FOR DOORS
		MINIMUM 2.0 mm FOR OTHER SECTIONS
	HEIGHT	MINIMUM 1100 mm
	FRAME THICKNESS	MINIMUM 3.0 mm
	INTERNAL PLATE THICKNESS	2.5 mm
	GLAND PLATE THICKNESS	3.0 mm
	CABLE GLAND	DOUBLE COMPRESSION
	BASE CHANNEL	ISMC 100 WITH ANTI-VIBRATION MOUNTING & FOUNDATION BOLTS
	CLASS OF PROTECTION	IP-55
2	POWER & CONTROL SUPPLY	
	INPUT POWER SUPPLY	415V 3 PHASE AC
	NO. OF FEEDERS	TWO
	CONTROL SUPPLY	230V AC
	ADDITIONAL REQUIREMENT FOR CONTROL SUPPLY	MCBs
		SUPERVISORY RELAY ALONG WITH A PILOT LAMP TO INDICATE CONTROL SUPPLY 'ON'
		AUTO CHANGEOVER UNIT MOUNTED ON PANEL
3	INTERNAL WIRING	
	VOLTAGE	1100 V
	MATERIAL & SIZE	PVC INSULATED COPPER MULTI STRAND WIRE /FLEXIBLE OF 1.5MM2, POWER CABLE 2.5SQMM
	ROUTING AND RUNS	THROUGH PVC TROUGHS, AC & DC WIRES SHALL BE KEPT SEPARATELY
	COLOUR	SEPARATE COLOURS FOR AC & DC WIRES
	FERRULING	CROSS FERRULING
4	PAINTING DETAILS*	
	PAINTING SHADE & THICKNESS - EXTERIOR / INTERIOR	RAL 5012 & MINIMUM 85 MICRONS / GLOSSY WHITE & MINIMUM 70 MICRONS
	*THESE DETAILS SHALL BE DECIDED DURING DETAILED ENGINEERING	
5	GASKET	
	AT DOOR & REMOVABLE COVER	NEOPRENE
6	VENTILATION SYSTEM ALONG WITH LOUVERS	
	COOLING FAN	2 X 100%, COVERED WITH REMOVABLE WIRE MESH
7	TERMINAL BLOCK	
	TYPE	CLIP ON , SEPARATE FOR AC & DC CIRCUITS
	VOLTAGE	1100 V
	TB POINTS	CAGE CLAMP
	MOUNTING HEIGHT FROM FINISHED FLOOR	>=250 mm
	SPARE	20%
	IDENTIFICATION STRIP	TO BE PROVIDED

S.No.	PARAMETERS	REQUIREMENT
8	ILLUMINATION	
	LIGHT	LED TUBELIGHT
	SHROUDED COVER	15W MINIMUM
	OPERATING POWER SUPPLY	240V 50 Hz AC
	OPERABLE THROUGH	PANEL DOOR SWITCH
	POWER RECEPTACLE	15 Amp, 3-PIN
9	SPACE HEATER	
	OPERATING POWER SUPPLY	240V 50 Hz AC
	PANEL TEMPERATURE TO BE MAINTAINED	5 DEG. C ABOVE THE AMBIENT TEMPERATURE DURING MAINTENANCE SHUTDOWN
	ISOLATING AND CONTROL DEVICES	MCB, THERMOSTAT ETC.
10	EATHING BUS AND STUDS	
	EARTH BUS	25X 6 MM SIZE RUNNING THROUGHT THE WIDTH OF THE PANEL
	TERMINATION TO MAIN STATION EARTH	INTERNALLY WITH 10 MM BOLTS AT EXTREME ENDS FOR CONNECTION
11	ALARM ANNUNCIATOR SYSTEM	
	NO. OF WINDOWS	MINIMUM 2
	FACIA	SOLID STATE DISCRETE
	HOOTER	10W
	ANNUNCIATOR SPARE (WITH ELECTRONICS)	10% SPARE WINDOW OR MINIMUM 1NOS. WHICHEVER IS MORE
	LAMP TEST PROVISION	REQUIRED
12	NOTES FOR LOCAL CONTROL PANEL	
1	The panel shall be provided with rear doors with integral lockable handle. The door when locked shall be held at minimum three places. The doors shall be provided with suitable stiffeners to prevent buckling. The door shall be removable type with concealed hinges to facilitate maintenance work. Suitable pocket inside the door shall be provided for keeping the drawings / documents. Double door shall be provided with suitable glass windows, as per the requirement.	
2	All operable and indicating devices shall be mounted on the front of the panel while aux. Relays, terminal, PVC trough, MCBs etc. required shall be mounted on a mounting plate inside the panel. The devices shall be located in such a way so as to ensure easy access for operation / maintenance.	
3	Panel shall be provided with main name plate of 150 mm x 40 mm size having inscription of 20mm height. The individual devices on the panels shall be as provided with separate name plate with inscription of 3 mm height. The instrument / devices shall be provided with stick on label plates inside the panel. The material of the main and individual labels shall be three (3) ply 3 mm thick Traffolyte Sheet / 2 mm Anodised Aluminium Plate. The inscription shall be with white letters on black background on traffolyte sheet. The labels shall be fixed by self tapping non-rusting screws.	

Pressure Gauge



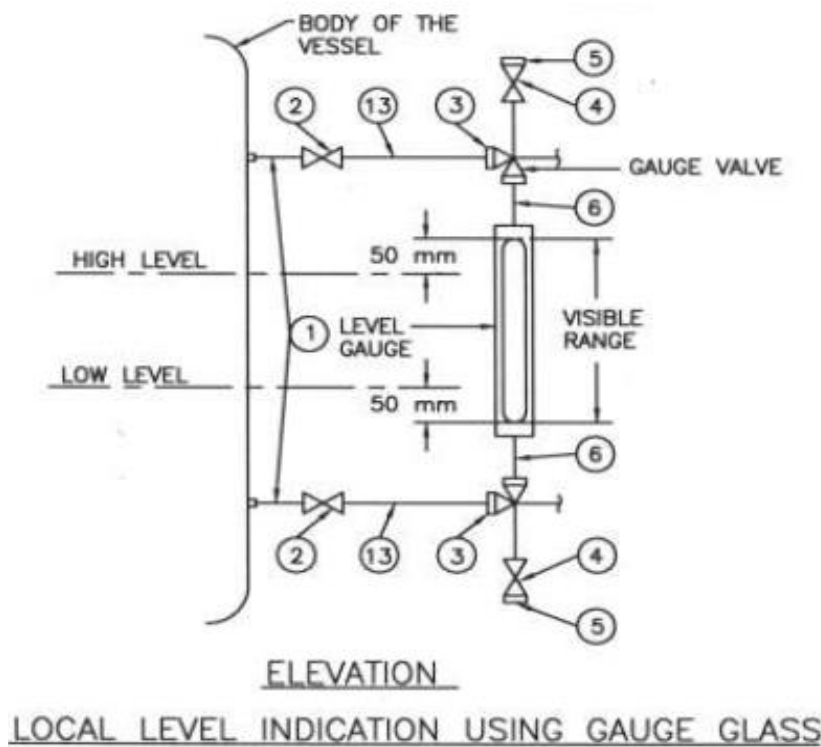
LIST OF MATERIALS

ITEM NO.	DESCRIPTION
1.	1/2", 3/4", 1" NPS SCH 40/80/160/XXS/P91 (AS PER PROCESS REQUIREMENT) NIPPLE OF MATERIAL SAME AS THAT OF MAIN PIPE.
2.	1/2"/3/4"/1" SW GLOBE VALVE/GATE VALVE
3.	3/4" / 1" x 1/2" SW REDUCING INSERT
4.	1/2" / 3/4" PIPE
5.	1/2" / 3/4" SW EQUAL TEE
6.	1/2" / 3/4" SW GLOBE VALVE.
7.	1/2" / 3/4" NPS SW x 1/2" / 3/4" NPT(M) CARBON/ALLOY STEEL NIPPLE.
8.	1/2" / 3/4" NPT(F) CAP.
9.	1/2" / 3/4" PIPE UNION.
10.	6" SS SYPHON
11.	1/2" BLIND 300lbs RF ANSI FLANGE DRILLED AND TAPED FOR 1" NPT PIPE.
12.	SUITABLE ADAPTER.
13.	1/4" CHROME MOLY STEEL TUBE.
14.	
15.	1"/3/4" SW EQUAL TEE.
16.	DIAPHRAGM(WAFER ELEMENT)
17.	ISOLATION VALVE 316 SS,1/4"SW

NOTES:-

1. THE MATERIAL SPECIFICATION AND SCHEDULE NO. OF IMPULSE PIPE & NIPPLE AS LISTED HEREIN SHALL BE AS PER TECHNICAL SPECIFICATIONS.
2. THE MATERIAL SPECIFICATION AND RATING OF FITTINGS AS LISTED SHALL BE AS PER SPECIFICATIONS. WELDED/THREADED FITTINGS SHALL CONFIRM TO ANSI-B.16-11.
3. INSTRUMENTS VALVES BODY STEM MATERIAL AND PRESSURE CLASS SHALL BE AS PER TECHNICAL SPECIFICATIONS.

Level Gauge

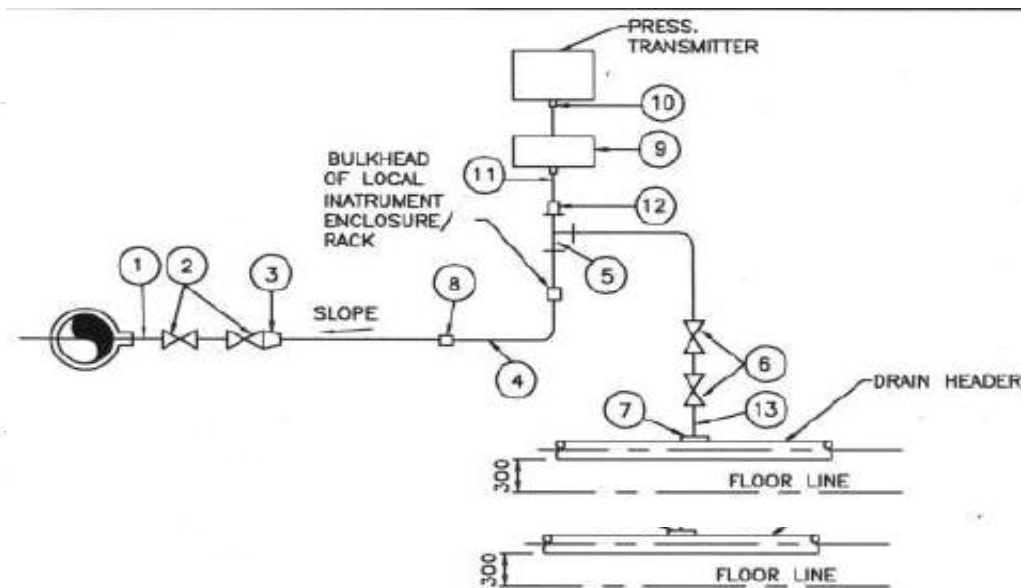


LIST OF MATERIALS

ITEM NO.	DESCRIPTION
1.	3/4"/1" NPS SCH.40/80/160/P91 (AS PER PROCESS REQUIREMENT) CARBON /ALLOY STEEL PIPE.
2.	3/4" SW GLOBE VALVE.
3.	3/4" SW UNION.
4.	3/4" NPT GLOBE VALVE.
5.	3/4" NPT (M) CAP.
6.	3/4" NPT (F) UNION CONNECTION.
7.	1" SW EQUAL UNION.
8.	1" x 1/2" SW REDUCING INSERT.
9.	1" SW EQUAL TEE.
10.	1/2" SW GLOBE VALVE.
11.	1/2" NPS SWx1/2" NPT(M) CS/AS NIPPLE.
12.	1/2" NPT (F) CAP
13.	3/4"x1/2" NPS SCH.40/80 CS/AS PIPE.
14.	1/2" NPS SCH.80/160 CS/AS NIPPLE.
15.	1" SW GLOBE VALVE.

Level Gauge

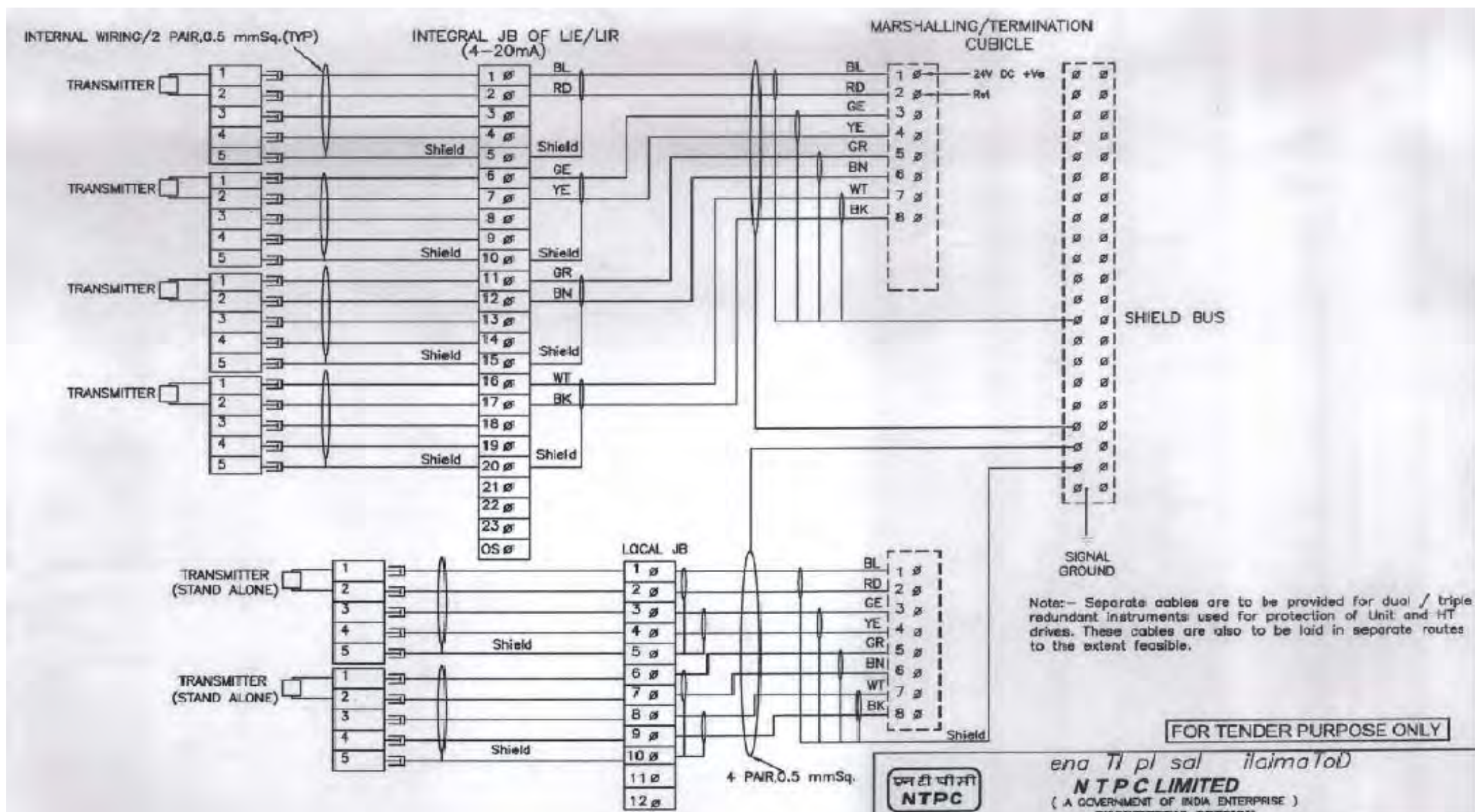
Pressure Transmitter



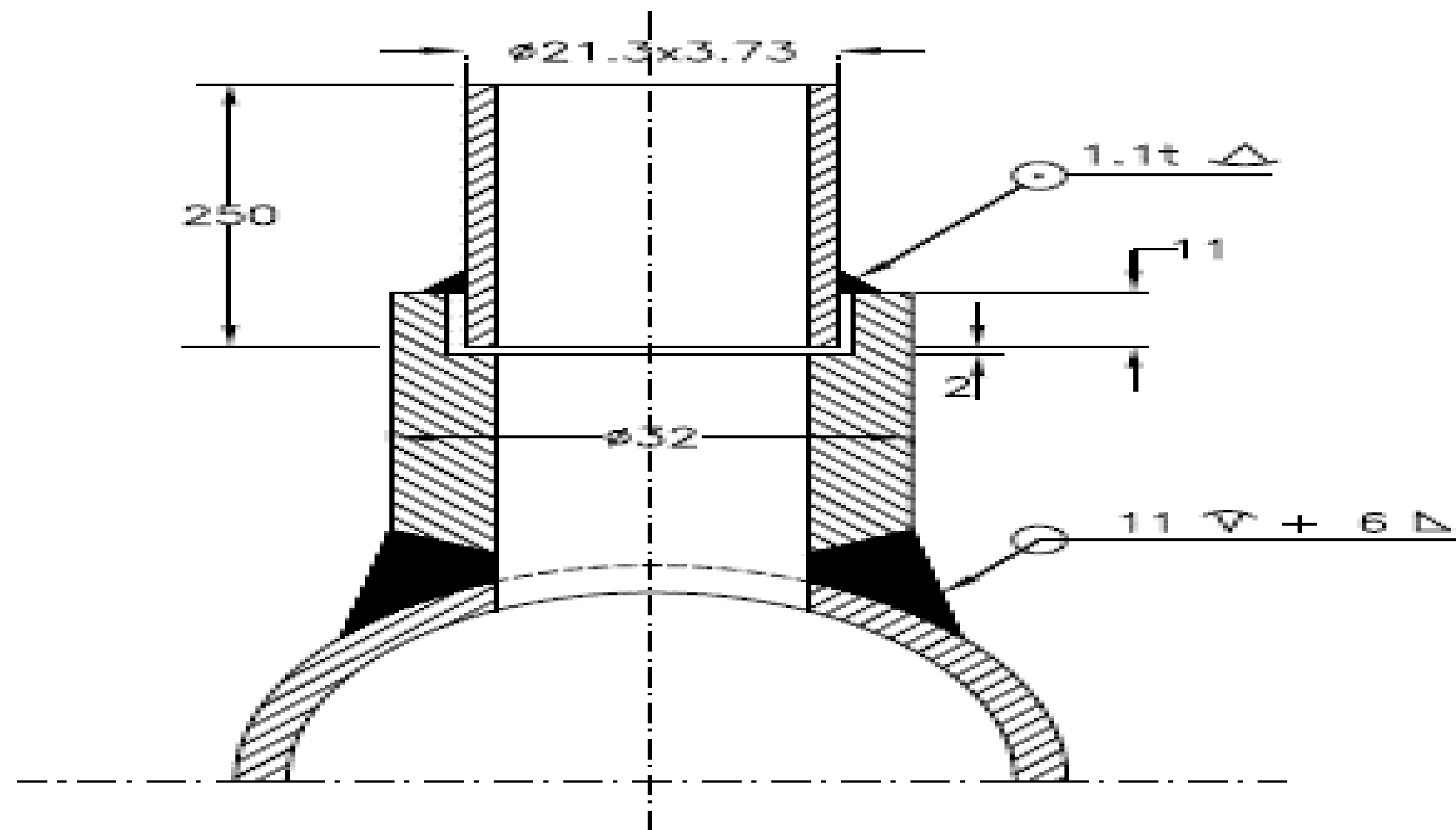
- 2. IMPULSE LINE DRAIN CONNECTIONS SHALL BE DONE AS PER TECHNICAL SPECIFICATIONS
- 3. THE SLOPE IN THE HORIZONTAL OF THE IMPULSE PIPE SHALL BE APPROX. 50 mm/mtr.
- 4. THE EXACT ORIENTATION OF THE TRANSMITTERS WITH RESPECT TO VALVE MANIFOLDS ETC. WILL BE FINALISED DURING DETAILED ENGINEERING KEEPING IN VIEW THE MANUFACTURER'S RECOMMENDATIONS.

LIST OF MATERIALS

ITEM NO.	DESCRIPTION
1.	1/2" / 3/4" / 1" NPS SCH. 80/160/XXS/P91 NIPPLE OF MATERIAL SAME AS THAT OF MAIN PIPE.
2.	3/4" / 1" SW GLOBE VALVE.
3.	3/4" / 1" TO 1/2" REDUCING INSERT
4.	1/2" NPS PIPE
5.	1/2" SW EQUAL TEE
6.	1/2" SW GLOBE VALVE
7.	1/2" NPS SCH. 80/160 SWx1/2" CS/AS COUPLER
8.	1/2" PIPE UNION
9.	2/3 VALVE MANIFOLD (FOR DETAIL SEE DRAWING NO.0000-102-POI-A-023.
10.	SUITABLE ADAPTER
11.	SS TUBE
12.	1/2" PIPE x 1/2" TUBE UNION
13.	1/2" NPS SCH. 80/160 SWx1/2" NPT(M) CS/AS NIPPLE



Pressure Measurement



NOTE :

1. MATERIAL OF THE BOSS AND NIPPLE SHALL BE THE SAME AS THE PIPE INTO WHICH IT IS WELDED AND CONFORM TO ANSI B16.11.
2. THE LENGTH OF NIPPLE SHALL BE 250 MM.
3. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE INDICATED
4. EDGE HOLE MUST BE CLEAN AND SQUARE OR ROUNDED SLIGHTLY ($1/64"$ RADIUS) FREE FROM BURRS, WIRE EDGES OR OTHER IRREGULARITIES
5. STUB LENGTH SHALL BE 64mm UPTO 200Nb PIPE, 45mm ABOVE 200Nb PIPE SIZE.

MEASURING INSTRUMENTS										
Item Components	Sub System Assembly	Dimensions (R)	Make, Model, Type, Rating (R)	Process / Electrical connection (R)	Calibration (R)	Test as per standard(R)	Insulation Resistance (R)	IBR Certification (As applicable)(R)	Hydro Test(R)	Material Test certificate (R)
Pressure Gauge (IS-3624)		Y	Y	Y	Y	Y				
Pressure /Differential Pressure Switch(BS-6134)		Y	Y	Y	Y	Y	Y			
Electronic Transmitter(IEC-60770)		Y	Y	Y	Y	Y	Y			
Electrical Metering Instrument (IS-1248)		Y	Y	Y	Y	Y	Y			
Transducer (IS-14570)		Y	Y	Y	Y	Y	Y			
R-Routine Test A- Acceptance Test Y – Test applicable										
Note: This is an indicative list of tests/checks. The manufacturer is to furnish a detailed quality plan indicating the Practices and Procedure adopted along with relevant supporting documents.										

[illegible]

PROCESS CONNECTION AND PIPING															
Tests	Items	Visual & Dimensions ®	GA, BOW, Layout of component & construction	Flattening, Flaring, Hydrotest, hardness check as per ASTM standard (A)	Component Ratings ®	Wiring ®	Make, Model, Type, Rating®	IR & HV ®	Review of TC for instrument/devices (R)	Accessibility of TBs/Devices Illumination, grounding ®	Tubing ®	Leak/Hydro test(A)	Chemical/physical properties of material (A)	Proof pressure test,Dismantling & reassembly test	Hydraulic tests as per standards & specification
	Local Instrument enclosure	Y	Y		Y	Y	Y	Y		Y	Y	Y			
	Local instruments racks	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y			
	Junction Box	Y	Y*		Y		Y	Y							
	Gauge Board	Y	Y		Y		Y		Y		Y	Y			
	Impulse pipes and tubes	Y		Y			Y						Y		
	Socket weld fittings ANSI B-16.11	Y					Y						Y		Y
	Compression fittings	Y					Y					Y	Y	Y	
	Instrument valves & Valve manifolds	Y					Y					Y	Y		
	Copper tubings ASTM B75	Y					Y								Y
*-applicable for painted junction boxes.															
®-Routine Test A-Acceptance Test Y – Test applicable															
Note: This is an indicative list of tests/checks. The manufacturer is to furnish a detailed quality plan indicating the Practices and Procedure adopted alongwith relevant supporting documents.															

LOCAL CONTROL PANEL										
Tests		Pre Power on Check (#) (R)	Post Power on Check (%) (R)	Internal cabling / Wiring checking(R)	Door Alignment, waviness, and Locking (R)	Louvers, Fans, wire mesh, Lifting arrangement (R)	HV / IR on wired panels (R)	Paint Shade, Thickness and Illumination (R)	Hardware/Make as per BOM (R)	Dimensions, GA, layout (R)
Items										
Local Control Panel		Y	Y	Y	Y	Y	Y	Y	Y	Y
R-Routine Test , A- Acceptance Test, Y – Test applicable										
Note:										
1) These test are minimum requirement.										
2) Pre power on check: - Wire dressing, looseness, Availability of Fuses and MCB, Modules are inserted properly, Earthing connection, Input Voltage checking.										
3) Manufacturer also needs to include their practices and procedure in MQP along with relevant supporting documents.										

REFERENCE CODES AND STANDARDS FOR CONTROL AND INSTRUMENTATION

	Pressure Measurements	
1.a	Instruments and apparatus for pressure measurement	ASME PTC19.2 (1964)
1.b	Electronic transmitters	BS-6447
2	Bourdon tube pressure and vacuum gauges	IS-3624 : 1966
	Enclosures	
1	Type of Enclosures	NEMA ICS Part - 6 - 1978 (with Rev. 1 4/80) through 110.22 (Type 4 to 13)
2	Racks, panels and associated equipment	EIA : RS - 310 C- 1983 (ANSI C83.9 - 1972)
3	Protection class for Enclosures, cabinets, control panels & desks	IS:2147 -1962
	Process Connection, Piping & Instrument tubing	
1	Codes for pressure piping "power piping"	ANSI B 31.1
2	Seamless carbon steel pipe	ASTM - A - 106
3	Forged & Rolled Alloy steel pipe flanges, forged fittings and valves and parts	ASTM - A - 182
4	Material for socket welded fittings	ASTM - A - 105
5	Seamless ferritic alloy steep pipe	ASTM - A - 335
6	Pipe fittings of wrought carbon steel and alloy steel	ASTM - A - 234
7	Composition bronze of ounce metal castings	ASTM - B - 62
8	Seamless Copper tube, bright annealed	ASTM - B - 168
9	Seamless copper tube	ASTM - B - 75
10	Dimension of fittings	ANSI - B - 16.11
11	Valves flanged and butt welding ends	ANSI - B - 16.34
12	Code of practice for instrumentation in process control systems: installation design and practice	BS 6739:2009
13	Fossil Fuel Power Plant Instrument Piping Installation	ISA 77.70
	Electronic Measuring Instrument & Control Hardware/ Software	
1	Automatic null balancing electrical measuring instruments	ANSI C 39.4 (Rev. 1973): IS:9319
2	Safety requirements for electrical and electronic measuring and controlling instrument	ANSI C 39.5 - 1974
3	Compatability of analog signals for electronic industrial process instruments	ISA - S 50.1 (1982) ANSI MC 12.1 - 1975
4	Dynamic response testing of process control instrumentation	ISA - S 26 (1968)
5	Surge Withstand Capability (SWC) tests	ANSI C 37.90 a/IEEE-472 or suitable class of IEC-255-4 equivalent to ANSI C37.90a/IEEE-472.
6	Printed circuit boards	IPC TM - 650, IEC 326 C
7	General requirement and tests for printed wiring boards	IS 7405 (Part-I) 1973
8	Edge socket connectors	IEC 130-11.
9	Requirements and methods of testing of wire wrap terminations	DIN 41611 Part-2
10	Direct acting electrical indicating instrument	IS:1248 - 1968 ®
11	Standard Digital Interface for Programmable Instrumentation	IEEE-488.2 -1990
12	Electromagnetic Susceptibility of Process Control Instrumentation	SAMA PMC 33.1 - 1978
13	Electromagnetic Compatibility for Industrial Process Measurement and Control Equipment	Part 3 : Radiated Electromagnetic Field Requirements - IEC 801-3-1984
	LOCAL CONTROL PANEL	
1	Code of practice for phosphating of iron and steel.	IS-6005 : 1998
2	Colors for ready mixed paints and enamels.	IS-5 : 2007
3	Direct Acting Indicating Analog Elec Measuring Instruments.	IS-1248:2003
4	Low Voltage switchgear & control gear: Part-I (General Rules)	IS/IEC 60947:Part 1:2004
5	Circuit breaker for household and similar installations.	IS-8828:1996
6	Low Voltage switchgear & control gear : Part-I (General Rules)	IS-13947 (Part-I):1993
7	Annunciator Sequences and Specification	ISA-18.1:1979
8	Purged & Pressurised Enclosure for Electrical Equipment in Hazardous Locations	NFPA-496:2003

General Requirement	
1	Out of the tests listed, the Bidder/ sub-vendor/ manufacturer is required to conduct certain type tests specifically for this contract (and witnessed by Employer or his authorized representative) even if the same had been conducted earlier, as clearly indicated subsequently against such tests.
2	For the rest, submission of type test results and certificate shall be acceptable provided:
2.1	The same has been carried out by the Bidder/ sub-vendor on exactly the same model /rating of equipment.
2.2	There has been no change in the components from the offered equipment & tested equipment.
2.3	The test has been carried out as per the latest standards alongwith amendments as on the date of Bid opening.
3	In case the approved equipment is different from the one on which the type test had been conducted earlier or any of the above grounds, then the tests have to be repeated and the cost of such tests shall be borne by the Bidder/ sub-vendor within the quoted price and no extra cost will be payable by the Employer on this account.
4	The schedule of conduction of type tests/ submission of reports shall be submitted and finalized during pre-award discussion.
5	For the type tests to be conducted, Contractor shall submit detailed test procedure for approval by Employer. This shall clearly specify test setup, instruments to be used, procedure, acceptance norms (wherever applicable), recording of different parameters, interval of recording precautions to be taken etc. for the tests to be carried out.

Type Test Requirement for C&I					
Sl.No	Item	Test Requirement	Standard	Test To Be Specifically Conducted	NTPC's Approval Req. on Test Certificate
1	Electronic transmitter	As per standard	BS-6447 / IEC-60770	No	Yes

	TITLE: TECHNICAL SPECIFICATION FOR EFFLUENT TRANSFER SYSTEM 2X800 MW TELAGANA STPP PHASE-I (SG PACKAGE)	BHEL DOCUMENTS NO.: PE-TS-424-673-A001	
		VOLUME II-B	
		SECTION-	
		REV. NO. 00	DATE: 10.06.2024

**SUB-SECTION II
GENERAL TECHNICAL REQUIREMENTS**

SECTION-II

GENERAL TECHNICAL REQUIREMENT OF

LOW PRESSURE PIPING

CLAUSE NO.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC																																											
	<u>LOW PRESSURE PIPING</u>																																														
1.00.00	EQUIPMENT SIZING CRITERIA																																														
1.01.00	All the piping systems and equipment supplied under this package shall be designed to operate without replacement and with normal maintenance for a plant service life of 30 years, and shall withstand the operating parameter fluctuations and cycling which can be normally expected during this period.																																														
1.02.00	For all Low Pressure piping systems covered under this specification, sizing and system design shall be to the requirements of relevant codes and standard indicated . In addition to this, requirements of any statutory code as applicable shall also be taken into consideration.																																														
1.03.00	Inside diameters of piping shall be calculated for the flow requirements of various systems. The velocities for calculating the inside diameters shall be limited to the following: a) Water Application <table><tr><th colspan="2"></th><th colspan="3">Water Velocity in m/sec</th></tr><tr><th></th><th>Pipe Size</th><th>Below 50 mm</th><th>50-150 mm</th><th>200 mm & above</th></tr><tr><td>(a)</td><td>Pump suction</td><td>-----</td><td>1.2-1.5</td><td>1.2-1.8</td></tr><tr><td>(b)</td><td>Pump discharge and recirculation</td><td>1.2-1.8</td><td>1.8-2.4</td><td>2.1-2.5</td></tr><tr><td>(c)</td><td>Header</td><td>-----</td><td>1.5-2.4</td><td>2.1-2.4</td></tr></table> Pipe line under gravity flow shall be restricted to a flow velocity of 1 m/sec generally. Channels under gravity flow shall be sized for a maximum flow velocity of 0.6 m/sec. WILLIAM & HAZEN formula shall be used for calculating the friction loss in piping systems with the following "C" value: <table><tr><td>(i)</td><td>Carbon steel pipe</td><td>100</td></tr><tr><td>(ii)</td><td>C.I Pipe</td><td>100</td></tr><tr><td>(iii)</td><td>Rubber lined steel pipe</td><td>120</td></tr><tr><td>(iv)</td><td>Stainless steel pipe</td><td>100</td></tr><tr><td>(v)</td><td>GRP</td><td>150</td></tr><tr><td>(vi)</td><td>Ductile Iron</td><td>140</td></tr></table> For calculating the required pump head for pump selection, at least 10% margin shall be taken over the pipe friction losses and static head shall be calculated from the minimum water level of the tank/ sump/ reservoir from which the pumps draw water.						Water Velocity in m/sec				Pipe Size	Below 50 mm	50-150 mm	200 mm & above	(a)	Pump suction	-----	1.2-1.5	1.2-1.8	(b)	Pump discharge and recirculation	1.2-1.8	1.8-2.4	2.1-2.5	(c)	Header	-----	1.5-2.4	2.1-2.4	(i)	Carbon steel pipe	100	(ii)	C.I Pipe	100	(iii)	Rubber lined steel pipe	120	(iv)	Stainless steel pipe	100	(v)	GRP	150	(vi)	Ductile Iron	140
		Water Velocity in m/sec																																													
	Pipe Size	Below 50 mm	50-150 mm	200 mm & above																																											
(a)	Pump suction	-----	1.2-1.5	1.2-1.8																																											
(b)	Pump discharge and recirculation	1.2-1.8	1.8-2.4	2.1-2.5																																											
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(i)	Carbon steel pipe	100																																													
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(v)	GRP	150																																													
(vi)	Ductile Iron	140																																													
TELANGNA STPP PHASE-1 (2X800 MW) BALANCE OF PLANT (BOP) TURNKEY PACKAGE		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC.NO.:CS-9591-001C-2		SUB-SECTION-A-03 LOW PRESSURE PIPING																																											
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CLAUSE NO.	TECHNICAL REQUIREMENTS						
	(b) Compressed Air Application						
	Compressed air 15.0 m/sec.(under Average Pressure & Temp. conditions)						
1.04.00	The pipes shall be sized for the worst (i.e. maximum flow, temp. and pressure values) operating conditions.						
1.05.00	Based on the inside dia. so established, thickness calculation shall be made as per ANSI B 31.1 OD and thickness of pipes shall than be selected as per ANSI B 36.10/IS-1239 Heavy grade/IS-3589/ASTM-A-53/API-5L/ANSI B 36.19 as the case may be.						
1.06.00	Corrosion allowance of 1.6 mm will be added to the calculated thickness being considered (except stainless steel piping).						
1.07.00	Bend thinning allowance/manufacturing allowance etc. shall be as per the requirement of the design code provision.						
1.08.00	High points in piping system shall be provided with vents along with valves as per the system requirement. Low points shall be provided with drains along with drain valves as per the system requirement. Drain lines shall be adequately sized so as to clear condensate in the lines. Material for drain and vent lines shall be compatible with that of the parent pipe material.						
1.09.00	Material of construction for pipes carrying various fluids shall be as specified elsewhere.						
1.10.00	Compressed air pipe work shall be adequately drained to prevent internal moisture accumulation and moisture traps shall be provided at strategic locations in the piping systems.						
1.11.00	Depending upon the size and system pressure, joints in compressed air pipe work shall be screwed or flanged. The flange shall be welded with the parent pipe at shop and shall be hot dip galvanized before dispatch to site. Alternatively, the flanges on GI pipes may be screwed-on flanges also.						
1.12.00	Threaded joints shall be provided with Teflon sealant tapes.						
1.13.00	Following types of valves shall be used for the system/service indicated.						
	SYSTEM		TYPES OF VALVES				
		Butterfly	Gate	Globe	Check	Ball	Plug
	Water	x	x	x	x	x	
	Air		x	x	x	x	
	Drains & vents		x	x	x		
1.14.0	Recirculation pipes along with valves, breakdown orifices etc. shall be provided for important pumping systems as indicated in respective process and instrumentation diagrams (P&IDs). The recirculation pipe shall be sized for minimum 30%design flow of single pump operation						
TELANGNA STPP PHASE-1 (2X800 MW) BALANCE OF PLANT (BOP) TURNKEY PACKAGE		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC.NO.:CS-9591-001C-2		SUB-SECTION-A-03 LOW PRESSURE PIPING		PAGE 2 OF 26	

CLAUSE NO.	TECHNICAL REQUIREMENTS			
	or the recommended flow of the pump manufacturer whichever is higher.			
1.15.0	For Design criteria of GRP pipes refer cl. No 2.12.00 (A).			
1.16.0	For Design Criteria of DI pipes refer cl No. 2.12.00 (B)			
2.00.00	TECHNICAL SPECIFICATION			
2.01.00	GENERAL			
	Specific technical requirements of low-pressure piping, fittings, supports, valves, specialties and tanks etc. have been covered under this Sub-section. It includes details pertaining to design and material of construction for piping, fittings, valves, equipment, etc.. It also includes detailed technical requirement of laying underground/buried piping including water proofing/anti corrosive protection. It also covers design, engineering, manufacturing, fabrication, technical details of piping, valves, specialties, piping hangers / supports, tanks etc.			
2.02.00	Pipes and fittings			
2.02.01	All low pressure piping systems shall be capable of withstanding the maximum pressure in the corresponding lines at the relevant temperatures. However, the minimum thickness as specified in the following clauses and or respective codes for pipes and fittings shall be adhered to. The bidder shall furnish the pipe sizing/ thickness calculation as per the criteria mentioned above under LP piping equipment sizing criteria of this Technical Specification.			
2.02.02	Piping and fittings coming under the purview of IBR shall be designed satisfying the requirements of IBR as a minimum.			
2.02.03	Supporting arrangement of piping systems shall be properly designed for systems where hydraulic shocks and pressure surges may arise in the system during operation. Bidder should provide necessary protective arrangement like anchor blocks/anchor bolt etc. for the safeguard of the piping systems under above mentioned conditions. The requirement will be, however, worked out by the contractor and he will submit the detailed drawings for thrust/anchor block to the Employer. External, and internal, attachments to piping shall be designed so as not to cause flattening of pipes and excessive localized bending stresses.			
2.02.04	Bends, loops, off sets, expansion or flexible joints shall be used as required in order to prevent overstressing the piping system and to provide adequate flexibility. Flexibility analysis (using software packages such as Caesar-II etc.) shall be carried out for sufficiently long piping (straight run more than 300M).			
2.02.05	Wherever Bidder's piping coming under this specification, terminates at an equipments or terminal point not included in this specification, the reaction and the thermal movement imposed by bidder's piping on equipment terminal point shall be within limits to be approved by the Employer.			
2.02.06	The hot lines shall be supported with flexible connections to permit axial and lateral movements. Flexibility analysis shall be carried out for pipelines which have considerable straight run as indicated above and necessary loops/ expansion joint etc. shall be provided as may be necessary depending on layout.			
TELANGNA STPP PHASE-1 (2X800 MW) BALANCE OF PLANT (BOP) TURNKEY PACKAGE	TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC.NO.:CS-9591-001C-2	SUB-SECTION-A-03 LOW PRESSURE PIPING	PAGE 3 OF 26	

CLAUSE NO.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
2.02.07	Piping and fittings shall be manufactured by an approved manufacturer of repute. They should be truly cylindrical of clear internal diameter, of uniform thickness, smooth and strong, free from dents, cracks and holes and other defects.			
2.02.08	For rubber lined ERW pipes, beads shall be removed.			
2.02.09	Inspection holes shall be provided at suitable locations for pipes 800 Nb and above as required for periodic observations and inspection purposes.			
2.02.10	At all intersection joints, it is Contractor's responsibility to design and provide suitable reinforcements as per the applicable codes and standards.			
2.02.11	For large size pipes/ducts, at high point and bends/change of direction of flow, air release valves shall be provided as dictated by the system requirement and operation philosophy & tripping conditions of pumping system. Sizing criteria for air release valves shall be generally on the basis of valve size to pipe diameter ratio of 1:8. Requirement shall be decided as per relevant code.			
	Transient analysis /surge analysis where ever specified and required shall be conducted in order to determine the location , number and size of the Air-Release valve on certain long distance/high volume piping systems, if applicable within the scope of work of the package.			
2.03.00	Material			
2.03.01	Alternate materials offered by Bidder against those specified. shall either be equal to or superior to those specified, The responsibility for establishing equality or superiority of the alternate materials offered rests entirely with the Bidder and any standard code required for establishing the same shall be in English language.			
2.03.02	No extra credit would be given to offers containing materials superior to those specified. Likewise no extra credit would be given to offers containing pipe thickness more than specified.			
2.03.03	All materials shall be new and procured directly from the manufacturers. Materials procured from traders or stockists are not acceptable.			
2.03.04	All materials shall be certified by proper material test certificates. All material test certificates shall carry proper heat number or other acceptable references to enable identification of the certificate that certifies the material.			
2.03.05	Material of construction for pipes carrying various fluids shall be as follows:			
	SI No.	Type of Fluid	Material	
	1.	i) Ordinary Water (Raw Water, Clarified Water, CW blow down water, *Final Effluent disposal etc.)	IS-2062 Gr.-E-250B/ASTM A-36/ASTM A-53 type 'E'Gr.B/IS-3589 Gr. 410 /IS-1239 Gr-Heavy.	
	2.	i) Demineralized water, DM N. Pit effluents	Stainless Steel to ASTM A312, Gr. 304 welded for sizes 65 mm NB and above. Stainless steel to ASTM A312, Gr. 304 sch.40s seamless for sizes 50mm and below	
	3.	i) *Drinking (potable) water ii)Compressed air (Instrument & service air)	ASTM A-53 type E Gr. B galvanized/ IS 1239 Gr heavy galvanized/IS 3589 Gr 410 galvanized. Galvanized shall be to IS- 4736 or equivalent.	
	4.	Condensate excess return(spill)	ASTM 106 Gr B	
TELANGNA STPP PHASE-1 (2X800 MW) BALANCE OF PLANT (BOP) TURNKEY PACKAGE TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC.NO.:CS-9591-001C-2 SUB-SECTION-A-03 LOW PRESSURE PIPING PAGE 4 OF 26				

CLAUSE NO.	TECHNICAL REQUIREMENTS	एनटीपीसी NTPC		
	NOTE: Bidder to note that for Final Effluent disposal system and potable water system for colony (* marked), Glass Fibre Reinforced plastic (GRP) pipes conforming to ASTM-D-3517 / AWWA-C-950 / IS-12709 / IS-14402 or Ductile Iron (DI) pipes conforming to IS 8329 and for fittings IS 9523 can be offered as an alternate to the mild steel/ galvanized mild steel pipes as specified above for standalone or outside plant boundary stretches. Various design aspects of GRP and DI piping have been discussed at Clause no 2.12.00 (A) and 2.12.00 (B) respectively.			
2.03.06	In water lines, pipes upto 150mm Nb shall conform to ANSI B36.10/ASTM-A-53, Type-E Gr.B /IS:1239 Gr. Heavy and minimum selected thickness shall not be less than IS:1239 Grade Heavy except for demineralised water, drinking water and condensate spill lines.			
2.03.07	Pipes of above 150mm Nb shall be to AWWA-C200/ANSI B 36.10/ASTM A-53/IS 3589 Gr.410. Pipe to be fabricated by the bidder shall be rolled and butt welded from plates conforming to ASTM A-53 type 'E' Gr. B/IS 2062 Gr.E-250B/ASTM-A-36. However, larger pipes, i.e. 1000mm Nb and above shall be made from plates conforming to ASTM A 36/IS 2062 Gr.E-250B and shall meet the requirements of AWWA-M-11 (for deflection & buckling criteria considering water filled pipe as well as vacuum condition that may prevail during transient/surge conditions, truck-load, rail-load and weight density for compacted soil or any other load as the case may be).			
2.03.08	In demineralised water service, the pipes upto 50 Nb shall be of stainless steel ASTM A 312, Gr. 304 sch. 40 Seamless. The size for these pipes shall be to ANSI B 36.19. These shall be socket welded. The material for pipe from 65mm NB upto and including 400 NB shall be to ASTM A 312, Gr. 304 (welded). In no case the thickness of fittings shall be less than parent pipe thickness. Bidder/Contractor shall note that pipes offered as per a particular code shall conform to that code in all respects i.e. Dimension, tolerances, manufacturing methods, material, heat treatment, testing requirements, etc. unless otherwise mentioned elsewhere in the specification.			
2.03.09	Instrument air, Plant (service) air lines and Drinking water lines shall be to ASTM A 53 type E grade B/ANSI B 36. 10/IS 3589, Gr. 410 / IS: 1239 Heavy (in case thickness calculated is more than gr. Heavy, ANSI B 36.10 Schedule numbers shall be followed) and galvanized to IS 4736 or any equivalent internationally reputed standard. The material of the pipes shall be to ASTM A 53 type 'E' Gr. B / IS: 3589, Gr. 410 / IS: 1239 Gr. Heavy. The fittings shall be of either same as parent material or malleable iron to IS-1879 (galvanized).			
2.03.10	Spiral welded pipes as per API-5L/IS-3589 are also acceptable for pipe of size above 150 NB. However minimum thickness of the pipes shall be as elaborated in above clauses.			
2.03.11	Condensate lines shall be to ASTM A 106 Gr. B and dimension to ANSI B 36.10 schedule "standard" as minimum to be maintained.			
2.03.12	If carbon steel plates of thickness more than 12 mm are used for manufacture of pipes, fittings and other appurtenances, then the same shall be control-cooled or normalized as the case may be following the guidelines of the governing code.			
2.04.00	Field routed pipes:			
2.04.01	Pipe lines of NB 50 size and below are regarded as field run piping. It is Bidder's responsibility to plan suitable layouts for these system insitu. Bidder shall prepare drawings indicating the layout of field run pipe work. These drawings shall be approved by Project			
TELANGNA STPP PHASE-1 (2X800 MW) BALANCE OF PLANT (BOP) TURNKEY PACKAGE		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC.NO.:CS-9591-001C-2	SUB-SECTION-A-03 LOW PRESSURE PIPING	PAGE 5 OF 26

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	Manager to the installation of the field run pipe work. Based on these approved layouts the Bidder shall prepare the BOQ of field run-pipes and submit to Employer for approval.			
2.05.00	Slope/Drains and Vents			
2.05.01	Suitable slope shall be provided for all pipelines towards drain points. It is Bidder responsibility to identify the requirements of drains and vents, and supply the necessary pipe work, valves, fittings, hangers and supports etc. As per the system requirement low points in the pipelines shall be provided with suitable draining arrangement and high points shall be provided with vent connections where air or gas pockets may occur. Vent for use during hydrostatic test shall be plugged after the completion of the test. Vent shall not be less than 15mm size. Drains shall be provided at low points and at pockets in piping such that complete drainage of all systems is possible. Drain shall not be less than 15mm for line size up to 150mm, not less than 20mm up to 300mm and not less than 25mm for 350mm to 600mm pipes and not less than 50mm for 600mm and above pipes.			
2.05.02	Air piping shall be sloped so that any part of the system can be drained through the shut-off drain valve or drain plugs.			
2.06.00	Pipe Joints In general all water lines 65mm NB and above, are to be joined generally by butt welding except the locations where valves/fittings are to be installed with flanged connections and 50mm and below by socket welding unless mentioned otherwise specifically. All air lines shall be of screwed connection and rubber lined pipes of flanged connections.			
2.06.01	Screwed Joints (a) Threading of pipes shall be carried out after bending, heat treatment etc. If not possible, threading may be done prior to these operations but proper care should be taken to protect them from damage. Threads shall be to ANSI B 2.1 (taper) NPT/IS: 554 unless specified otherwise. (b) Galvanized pipe shall generally be joined by screwing into sockets. The exposed threaded portion on the outside of the pipes shall be given a zinc silicate coating. Galvanized pipes shall not be field joined by welding for protection of Galvanising Zinc layer. Screwed ends of GI pipes shall be thoroughly cleaned and painted with a mixture of red and white lead before jointing. For galvanized pipes (sizes up to 300 mm NB), screw & socket jointing as per IS 1239 part-II / IS 1879/ASTM-A-865 shall be employed for both pipe-to-pipe and pipe-to-fitting jointing.. For pipe to fitting connection since no direct threading can be done on the fittings (supplied as per ASTM-A-234 Gr. WPB and ANSI B-16.9) necessary straight pipe lengths acting as match pieces shall be welded to the fitting at both ends and subsequently the free ends of the straight lengths shall be threaded as per ASTM A-865 for jointing with main pipe. Once welding of fittings with match pieces and threading of free ends of match pieces are over, the entire fabricated piece shall be galvanized, or in case match pipes and fittings are already galvanized before the above mentioned fabrication then suitable application of Zinc-Silicate paste adequately at the welded surface (both in side & out side) after welding with zinc rich electrode, along with the nascent threaded metal portions at both free ends given the same application of Zinc Silicate paste. Alternatively flanged jointing may be employed for pipe sizes 100 NB and above. However, the bidder shall ensure the galvanized pipe joints do not fail during hydro test. (c) Teflon tapes shall be used to seal out screwed joints and shall be applied to the male threads only. Threaded parts shall be wiped clean of oil or grease with appropriate solvent if necessary and allowing proper time for drying before applying the sealant. Pipe ends shall be reamed and all chips shall be removed. Screwed flanges shall be			
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	attached by screwing the pipe through the flange and the pipe and flange shall be refaced accurately. (d) For pipe sizes from 350 mm NB to 550 mm NB (including 350 NB & 550 NB) the GI pipes shall be of flanged connection. However, the pipes after welding of flanges shall be completely galvanized. Any site welding done on galvanized pipes shall be done with zinc-rich special electrodes and the welded surfaces whether inside or outside shall be coated with zinc-silicate paste. Seal welding of flanges with zinc-rich electrode will be permitted only when any flange is leak-prone during hydro testing. (e) For pipe sizes 600 mm NB and above, the GI pipes shall be of welded connection (with zinc-rich special electrodes) followed by application of zinc silicate coating at welded surfaces both inside and outside the pipe, except for the last blank/blind flange, or, equipment connection where application of zinc-silicate paste after welding cannot be done due to inaccessibility of the inside welded surface and where galvanic protection has been impaired due to welding of pipe-to-pipe joint. Thus the last erection joint shall be flanged joint.			
2.06.02	Welded Joints			
	(a) For making up welded joints (butt weld or socket weld) the welding shall be performed by manual shielded metal arc process in accordance with the requirements specified elsewhere in the spec. Any welder employed for carrying butt welding shall be qualified as per ASME section IX for the type of joints he is going to weld. Jointing by butt weld, or socket weld shall depend upon the respective piping material specifications.			
2.06.03	Flanged Joints			
	(a) Flanged connections for pipes are to be kept to the minimum and used only for connections to vessel, equipments, flanged valves and other fittings like strainer/traps/orifices etc. for ease of connection and maintenance etc. Rubber lined pipes shall be flange joined only. (b) All flanged valves intended for installation on steel piping system, shall have their flanges drilled to ANSI B 16.5 (or equivalent) and according to the pressure class stated in their respective piping material specification. (c) Drilling on flanges of flanged valves must correspond to the drilling of flanges on the piping system on which the valves are installed.			
2.07.00	Bends/elbows/mitre bends/ Tees/ Reducers & other fittings			
2.07.01	For pipe fittings such as elbows (long radius), reducers, tees, etc. the material shall be to ASTM-A-234 Gr. WPB/ASTM-105 up to 300 NB. For pipe fittings above 300 NB, the fittings may be fabricated conforming to parent pipe material. Provision of compensation pads shall be kept as per ANSI B 31.1. The fitting shall conform to the dimensional standard of ANSI B-16.9/ 16.11. Further branching in pipes for sizes 65nb and above is also acceptable (ANSI B 31.1). However, for pipes up to 150 NB, pipe fittings may be supplied with material and dimension conforming to IS 1239 in case parent pipes also conform to IS 1239.			
2.07.02	For pipe size 350Nb and above mitre bends may be used for all pipes except rubber lined pipes. The bend radius shall be 1½ times the nominal pipe diameter. 90 deg. bends (mitre) shall be in 4 pieces (3 cuts) and 45 deg. mitre bends shall be in 3 pieces 22½ deg. Fabrication of mitre bends shall be as detailed in BS 2633/BS534.			
2.07.03	For pipes, above 1200 NB, reducer and tees shall be to dimensional standard of AWWA-C-208.			
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2.07.04	Stainless steel fittings shall conform to either ASTM-A-182 Gr. 304 or ASTM-A-403 Grade WP. 304 Class-S, for sizes upto and including 50 mm NB, i.e. the fittings shall be of seamless construction. However, for stainless fittings above 50 mm NB, the same shall conform to ASTM-A-403 Gr. WP 304 Class W i.e. the fittings shall be of welded construction strictly in accordance with ASTM-A-403.			
2.07.07	In no case, the thickness of fittings shall be less than the thickness of parent pipe, irrespective of material of construction.			
2.08.00	Flanges			
2.08.01	Flanges shall be slip on type. Welding of flanges in tension is not permitted.,			
2.08.02	All flanges and-flanged drilling shall be to ANSI B 16.5/BS EN-1092 of relevant pressure/temperature class. Flanges shall be fabricated from steel plates conforming to ASTM A 105/IS 2062 Gr. E-250B. However stainless steel flanges shall be fabricated from SS plates to ASTM-A-240, Gr. 304 or equivalent.			
2.09.00	Specific technical requirement of laying buried pipe with anti corrosive treatment			
	The pipe in general shall be laid with the top of the pipe minimum 1.0 (one) meter below finished general ground level.			
2.09.01	Trenching			
	(a) The trench shall be cut true to the line and level and shall follow the gradient of the pipeline. The width of the trench shall be sufficient to give free working space on each side of the pipe. Trenches shall conform to IS 5822 or any international standard.			
2.09.02	Preparation and cleaning of piping			
	(a) The pipeline shall be thoroughly cleaned of all rust, grease, dirt, weld scales and weld burrs etc. moisture or other foreign matter by power cleaning method such as sand or grit blasting, power tool cleaning, etc. Grease or heavy oil shall be removed by washing with a volatile solvent such as gasoline. Certain inaccessible portions of the pipeline (which otherwise not possible to be cleaned by power cleaning methods) may be scrubbed manually with a stiff wire brush and scrapped where necessary with specific permission of the Project Manager.			
	(b) On the internal surface for pipes 1000 NB and above, a coat of primer followed by a hot coal-tar enamel or coal tar epoxy painting (cold) shall be applied.			
2.09.03	Coating and wrapping/ Anti corrosive Protection Coal tar tape			
	a. Buried piping shall be coated and wrapped, as per specification, after completion of welded and/or flanged connections, and after completion and approval of Hydro testing. Materials to be used for coating and wrapping of underground pipelines are:			
	(1) Coating primer (coal tar primer)			
	(2) Coating enamel (coal tar enamel)			
	(3) Wrapping materials.			
	All primer/coating/wrapping materials and methods of application shall conform to IS: 10221 except asphalt/bitumen material. Materials (primer/coating/wrapping) as per AWWA-C-203 are also acceptable.			
TELANGNA STPP PHASE-1 (2X800 MW) BALANCE OF PLANT (BOP) TURNKEY PACKAGE		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC.NO.:CS-9591-001C-2	SUB-SECTION-A-03 LOW PRESSURE PIPING	PAGE 8 OF 26

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	Protective coating shall consist of coal tar primer, coal tar enamel coating, glass fiber, tissue inner wrap followed by glass fiber or coal tar impregnated Kraft outer wrap or finish coat. Number of coats and wraps, minimum thickness for each layer of application shall be as per IS-10221. Number of Coats and wraps shall be decided based on soil corrosivity /resistivity as indicated in IS-10221. Soil data-for this purpose shall be made available. Total thickness of completed coating and wrapping shall not be less than 4.0 mm. b. Alternatively, the anti-corrosive protection for buried pipes can consist of anti-corrosive protection Coal-tar tapes. Material and application of tapes shall conform to IS 15337 or equivalent. These-tapes shall be applied hot over the cold coal tar primer in steps of 2mm thickness so as to cover the spiral edges of the first tape by the application of second tape. The total thickness of the finished protective coating shall be 4.0 mm min.			
2.09.04	Trench bed preparation and back filling Prior to lowering and laying pipe in any excavated trench, the bottom of the trench may require to be back filled and compacted (or as the case may be) to provide an acceptable bed for placing the pipe. Bed preparation in general shall be as per IS: 5822.			
2.09.05	Laying of galvanized steel (GI) pipes All the joints shall be screwed with socket or flanged. Screwed ends of GI pipes shall be thoroughly cleaned and painted with a mixture of red and white lead before jointing Threaded portion on either side of the socket joint shall be applied with Zinc silicate paste. All the provisions for trenching' bed preparation' laying the pipe application of primer' coating' wrapping with tapes and back filling etc. as indicated for "laying of buried piping" and " anti corrosive protection for buried piping" are applicable for buried galv.steel (GI) pipes also.			
2.10.00	Cleaning and flushing			
2.10.01	All piping shall be cleaned by the Bidder before and after erection to remove grease, dirt, dust, scale and welding slag.			
2.10.02	Before erection all pipe work, assemblies, sub-assemblies, fittings, and components, etc. shall be thoroughly cleaned internally and externally by blast cleaning or by power driven wire brushes and followed by air-blowing . However for pipe sizes below 100nb the pipes may be cleaned internally by compressed air blowing as an alternative to internal blast cleaning. The brushes shall be of the same or similar material as the metal being cleaned. Cleaning of Galvanized pipes shall be done by air blowing only.			
2.10.03	After erection, all water lines shall be mass flushed with water. The cleaning velocities in water lines shall be 1.2-1.5 times the operating velocities in the pipelines.			
2.10.04	All compressed air pipe work shall be cleaned by blowing compressed air.			
2.11.00	Specification for hangers and supports			
2.11.01	All supports and parts shall conform to the requirement of power piping code ANSI B 31.1 or approved equivalent.			
2.11.02	The maximum spans of the supports of straight length shall not exceed the recommended values indicated in ANSI B 31.1.			
2.11.03	At all sliding surfaces of supports suitable arrangement is to be provided to minimize sliding friction.			
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2.12.00 (A)	Design Basis For GRP Piping			
	i) The GRP pipes shall be designed as per the applicable codes AWWA-M-45/ ASTM-D-3517 / AWWA-C-950 / IS-12709 / IS-14402 . Design calculations for selection of pressure class and stiffness class of GRP pipes against the applicable piping systems, considering the requirements of above mentioned standards shall be furnished for employer/owner's approval. The GRP pipes shall be manufactured by either CFW (Continuous Filament Winding process) or HFW (Helical filament winding process)			
	ii) Pipeline shall be sized considering C value as 150 and velocity 2-4m/sec(as per guidelines of AWWA)			
	iii) GRP pipes shall not be used on land with expansive soil, high water table sections/marshy land/perennially water logged area or flooded area. GRP pipes should be laid always in dry soil as underground pipes, In water logged area MS pipes duly protected externally shall be used as usual. Water table should be well below (at least 500 mm below) trench bed.			
	iv) Bidder to ensure correct installation & proper quality trench bed as per IS Code 13916 before installation so as to make only one contracting agency responsible for any possible defect (like leakage through joints, excessive ovality or dislocation of joints & pipe spools) found in GRP piping during hydro testing / commissioning/ charging of system after erection. Improper installation methodology like poor trench bed, un compacted soil, sub standard fill material, inadequate sand cushion/ earth cover etc. are not acceptable. Additional 2 years AMC contracts for the GRP piping system after installation/commissioning is also required to be given to the same agency to facilitate smooth operation of the relevant pumping systems without any repair and maintenance hassles suffered by the owner/Employer .			
	v) RCC thrust blocks are required to be constructed (common thrust blocks for all pipes) at the places of bends, tees & reducer. It is recommended to wrap a band of rubber around the pipe prior to placement of any concrete. Rubber should protrude (25 mm) from the pipe. It is always recommended to cast thrust blocks as laying progresses. Before the hydro test all thrust blocks should be completed. It is always recommended to have coupling on two edges when pipe comes out of thrust block. It is necessary that all joints before & after bend, including the pipe-to-bend AND bend-to-pipe also are unrestrained,			
	vi) GRP pipes should cross minor road/nallah through Hume pipes when buried GRP pipes are crossing roads & nallahs. Sand bags shall be put around GRP pipes within Hume pipe.			
	vii) For railway crossing and/or high way crossings of underground GRP pipes culverts or MS encased pipe with pushing technology should be adopted.			
	viii) All GRP pipes generally shall be joined with unrestrained sleeve couplings (Double REKA joint) or un-restrained double 'O' ring bell-Spigot joints and thrust blocks are to be provided at each bends. For over ground piping, anchors are to be provided at reducers, branch offs, Tee-offs, expanders and terminal points of other suppliers apart from at points in straight run separated by an interval of 90 meters approx as per codes.			
	ix) Support span for above ground application is to be as per AWWA-M-45.			
	x) GRP pipes specified should have at least STIFFNESS CLASS OF 5000 N/m² i.e. 248KPA to take care of uncertainties in various loading conditions in different terrains. However the actual stiffness class offered for the pipeline shall be based on design calculations as per AWWA-M-45 keeping the 248kpa stiffness class as minimum.			
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	xi) Proper erection sequence is to be followed during installation of GRP pipes in underground trenches where multiple agencies are to work, else ground bed preparation is disturbed or compromised having adverse impact on GRP pipe performance. It is further advised that for future construction of any structure in the area, safe distance is to be kept from the pipe line, to avoid any collapsing / damage to trench or laid pipeline. xii) Over ground installation , as discussed before, will be dictated by mid span deflection criterion/Axial stress criterion of AWWA and from practical experience varies from 2m to 6m support span depending on pipe size. Pipes are to be wrapped with elastomer sheets/rubber sheets before clamping on supports. xiii) Minimum sand bed cushion of 300mm all around trench-laid underground GRP pipes (i.e. 300mm below invert level of trench, 300mm or more in trench profile on both sides and 300mm of top cover of sand over pipe crown). Excavated soil can be backfilled provided it conforms to IS, ASTM & AWWA specifications from 300 mm above pipe crown to the finished ground level. Before providing sand cushion in trench bed, the raw earth bed in trench shall be maintained truly horizontal and finally sand filled bed should be compacted to achieve atleast 85% relative density. Minimum earth cover required above pipe crown to avoid uplift of empty pipes is 1 meter or 1 time the diameter of pipe whichever is more. Flooded trench condition shall be avoided as far as possible during erection of GRP Pipes. Suitable mitigation measures to prevent floatation of pipes like a) dewatering b) erection only after water level goes below trench bed by minimum 200mm. c) backfilling with sand & soil above GRP pipe once pipe is jointed piece by piece d) Tack weld type lapping spot joints along the circumference between pipe pieces to be joined and laid in sequence thus making the empty piping heavier. xiv) All joints shall be hydro-tested at site during erection or alternatively one can do hydro testing in stretches of suitable GRP piping length after joining a few no. of pipes/ fittings. Finally entire system shall be hydro tested at 1.5 times design pressure when erection is complete and pump charging has been done. xv) Site lapping (butt jointing) of last joint during erection or repair butt-joint lapping shall be done at a de-humidified condition by skilled worker to ensure correct curing. xvi) Fittings are to be generally made at works for proper curing and dimensional correctness. xvii) Type test: GRP pipe supplier shall carry out the following long term qualification tests (type tests): a) Hydrostatic Design Basis (HDB) for 1000 Hrs b) Long Term Ring Bending Test However, in case pipe suppliers have already obtained the above long term qualification tests certificates duly approved by accredited third party agency (s) , the same are also acceptable For other routine tests, relevant QA chapters may be referred as given elsewhere in specification.			
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2.12.00 (B)	SPECIFICATION FOR DUCTILE IRON (DI) PIPES, FITTINGS & SPECIALS																																																																																
	i)DI GENERAL This specification covers the specific requirement of design, material, manufacture / fabrication, constructional features, inspection & testing, transportation, handling, laying, site testing and annual maintenance contract of Ductile Iron (DI) Pipes, Joints, fittings and specials. ii)CODES AND STANDARDS The material, design, manufacture, dimensions, tolerances, mechanical properties, internal cement mortar lining, external zinc coating along with bituminous finished layer, inspection and testing of DI water pipes shall comply with the latest Indian Standard, “IS 8329 (Centrifugally cast (spun) ductile iron pressure pipes for water, gas and sewage – specification)” or equivalent international standard unless otherwise specified elsewhere in this Technical Specification. <table><tr><th>S. No.</th><th>Code No.</th><th>Code Title</th></tr><tr><td>1</td><td>IS 8329</td><td>Centrifugally cast(spun) ductile iron pressure pipes for water, gas and sewage - specification</td></tr><tr><td>2</td><td>IS 9523</td><td>Ductile iron fittings for pressure pipes for water, gas and sewage - specification</td></tr><tr><td>3</td><td>IS 5382</td><td>Rubber sealing rings for gas mains, water mains and sewers</td></tr><tr><td>4</td><td>IS 638</td><td>Specification for Sheet Rubber Jointing and Rubber Insertion Jointing</td></tr><tr><td>5</td><td>IS 12288</td><td>Code of practice for use and laying of Ductile Iron pipes</td></tr><tr><td>6</td><td>IS 11606</td><td>Methods for sampling of Cast Iron pipes and fittings</td></tr><tr><td>7</td><td>IS 455</td><td>Portland slag cement</td></tr><tr><td>8</td><td>IS 12330</td><td>Sulphate resisting Portland cement</td></tr><tr><td>9</td><td>IS 6452</td><td>Specification for high alumina cement for structural use</td></tr><tr><td>10</td><td>IS 6909</td><td>Specification for supersulphated cement</td></tr><tr><td>11</td><td>IS 8112</td><td>43 grade ordinary Portland cement</td></tr><tr><td>12</td><td>IS 1387</td><td>General requirements for supply of metallurgical materials</td></tr><tr><td>13</td><td>IS 1500</td><td>Methods for Brinell hardness test for metallic materials</td></tr><tr><td>14</td><td>IS 1608</td><td>Mechanical testing of metals – tensile testing</td></tr><tr><td>15</td><td>ISO 2531</td><td>Ductile iron pipes, fittings, accessories and their joints for water applications</td></tr><tr><td>16</td><td>ISO 4179</td><td>Ductile iron pipes and fittings for pressure and non-pressure pipelines -- Cement mortar lining</td></tr><tr><td>17</td><td>ISO 4633</td><td>Rubber seals -- Joint rings for water supply, drainage and sewerage pipelines -- Specification for materials</td></tr><tr><td>18</td><td>ISO 8179</td><td>Ductile iron pipes -- External zinc-based coating -- Part 1: Metallic zinc with finishing layer</td></tr><tr><td>19</td><td>ISO 8179</td><td>Ductile iron pipes -- External zinc coating -- Part 2: Zinc rich paint with finishing layer</td></tr><tr><td>20</td><td>ISO 8180</td><td>Ductile iron pipelines -- Polyethylene sleeving for site application</td></tr><tr><td>21</td><td>ISO 10802</td><td>Ductile iron pipelines -- Hydrostatic testing after installation</td></tr><tr><td>22</td><td>ISO 10803</td><td>Design method for ductile iron pipes</td></tr><tr><td>23</td><td>ISO 16132</td><td>Ductile iron pipes and fittings -- Seal coats for cement mortar linings</td></tr><tr><td>24</td><td>AWWA M 41</td><td>Ductile – Iron pipe and fittings (guideline code for design, manufacturing, testing, jointing, laying & installation etc.)</td></tr><tr><td>25</td><td>BS EN 545</td><td>Ductile iron pipes, fittings, accessories and their joints for water pipelines - Requirements and test methods</td></tr></table>				S. 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	iii) DUCTILE IRON (DI) PRESSURE PIPES: a) DESIGN REQUIREMENTS Pipeline shall be sized considering C value as 140 and velocity 2-3m/sec. b) Classification: The class of DI pipes to be provided shall be as specified in the data sheet attached with this sub-section. The external diameter and wall thickness of socket and spigot pipes for the specified Class shall be as per IS 8329 or equivalent international standard. iv) Joints : a) Generally push-on flexible joints shall be provided for pipe to pipe connection as per IS 8329 or equivalent international standard. However mechanical joints, flange joints and restrained joints can also be used. b) Rubber gaskets Rubber gasket used with push-on flexible joints shall conform to the requirements of IS: 5382 or equivalent international standard. Rubber gaskets for use with flanged joints shall conform to IS 638 or approved equivalent international standard. v) DI FITTINGS & SPECIALS Design Requirements: a) Classification The DI fittings shall be as per IS 9523 or equivalent international standard. b) External layer: The DI fittings supplied shall be provided with external protection of metallic zinc coating or zinc rich paint coating with finishing layer of bituminous paint as per IS 9523 or equivalent international standard. c) Internal lining: The fittings shall be provided with suitable cement mortar internal lining as per IS 9523 or equivalent international standard. d) Joints between pipe and fittings: Generally , Push-on flexible joints shall be provided for pipe to fitting connection as per IS 9523 or equivalent international standard. Flange joints, wherever required, shall conform to the requirements of IS 9523 or equivalent international standard. e) Rubber gaskets All the DI fittings shall be provided with rubber gaskets for each socket. Rubber gasket used with push-on flexible joints shall conform to the requirements of IS: 5382/ IS 9523 or equivalent international standard. Rubber gaskets for use with flanged joints shall conform to IS 638 or equivalent international standard .			
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	vi) TYPE TESTS 1) The contractor / manufacturer shall carry out the type tests as listed in this specification on the pipes to be supplied under this contract. 2) The type tests shall be carried out in presence of the Employer's representative, for which minimum 15 days notice shall be given by the contractor. The contractor shall obtain the Employer's approval for the type test procedure before conducting the type test. The type test procedure shall clearly specify the test set-up, instruments to be used, procedure, acceptance norms, recording of different parameters, interval of recording, precautions to be taken etc. for the type test(s) to be carried out. 3) In case the contractor / manufacturer has already conducted such specified type test(s), he may submit the type test reports to the Employer during detailed engineering for consideration of waiver of conductance of such type test(s) or otherwise as deemed fit by Employer. Such test(s) should have been either conducted at an independent laboratory or duly approved by accredited third party agency. The Employer reserves the right to waive conducting of any or all the specified type test(s) under this contract. 4) The type test shall be performed whenever a significant change is made in the design, material or process of manufacture or a new size or size range of the product is being supplied by the manufacturer. vii) THE FOLLOWING TYPE TESTS SHALL BE CARRIED OUT: 1) Joint Leak Tightness Test: a) Tests for joints (push-on flexible joints) shall be conducted as per the guidelines of ISO 2531 to establish adequate joint performance with respect to internal pressure, external pressure and vacuum pressure under both normal alignment of joints and deflected alignment of joints as dictated in ISO 2531. b) Tests for Leak tightness and mechanical resistance of flanged joints shall be conducted as per ISO 2531. 2) Cement Lining Smoothness Type Test: The contractor / manufacturer should have carried out Cement Lining Smoothness test to establish C value (Hazen & William's constant) of the offered DI pipe as 140. Necessary certificate for the same shall be furnished to the employer. In case the contractor / manufacturer has not carried out the test, the same shall be carried out by the contractor / manufacturer within the scope of this contract. 3) Ring bend test: Ring bend test for 3% deflection with respect to external diameter of DI pipe offered shall be conducted by contractor / manufacturer to prove that internal cement mortar lining does not come off the substrate surface of Ductile Iron on random basis for each manufacturing lot. If the contractor / manufacturer of pipes do not have the facility for this type test at his own works, the same can be arranged by him to conduct and demonstrate the test. viii) LAYING AND JOINTING OF DI PIPES: 1) Laying, erection and jointing of DI pipelines at field / site shall be under the direct supervision of Manufacturer (Supplier) from whom pipe is sourced / procured.			
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	For underground laying, Special provisions in trench shall be made for accommodating socket (Bell) of each pipe, as applicable so that barrel is uniformly rested on even trench bed surface, which is well compacted as recommended in codes / standards. 2) Pipeline anchorage Pipeline shall be securely anchored at dead ends, tees, bends, tapers and valves to resist thrust arising from internal pressure. Suitable thrust blocks made of concrete shall be designed and cast-in-situ. ix) Hydraulic Testing Of Pipelines After laying and jointing, the pipeline shall be tested for soundness and leak tightness of pipes, fittings and joints, and soundness of any construction work. The pipeline may be tested in sections. Water and other facilities as required for such hydro testing shall be arranged by the Contractor x) Hydraulic Testing of Sections The section under test shall be filled with water, taking care that all the air is displaced either through vents at the high points or by using a pig or a sphere. After filling, the pipeline shall be slightly pressurized for a period of time to achieve stable conditions. The pipeline is then pressurized up to the full test pressure as per the relevant standard. The test pressure shall be maintained for a period of not less than 10 minutes to reveal any defects in the pipes, joints or anchorages. The test pressure shall be measured such as to ensure that the required test pressure is not exceeded at any point in the entire pipeline. If the test is not satisfactory, the fault shall be found and rectified. Methods employed for finding faults shall be as per IS 12288. xi) Hydraulic Testing of Complete Pipeline After all the sections have been joined together on completion of section testing, a test on the complete pipeline shall be carried out. This test shall be carried out at a pressure as specified in the data sheet attached with this sub-section. During the test, the pressure at any point in the pipeline shall not exceed the pressure as specified in the data sheet attached with this subsection. xii) DATA SHEET FOR DI PIPES, FITTINGS & SPECIALS <table><tr><th>Sl.no</th><th>Description</th><th>Units</th><th>Parameters</th></tr><tr><td>1</td><td>Pipe Material</td><td></td><td>Ductile Iron (DI) pipe internally cement mortar lined and externally coated with metallic zinc & finishing layer of bituminous paint</td></tr><tr><td>2</td><td>Applicable standards</td><td></td><td>IS/ISO/AWWA/BS as listed in technical specification</td></tr><tr><td>3</td><td>Hazen& William's constant</td><td></td><td>140</td></tr><tr><td>4</td><td>Pipe Class</td><td></td><td>K7 / K9 as per IS 8329 or equivalent international standard. Compatible with system pressure requirement.</td></tr></table>				Sl.no	Description	Units	Parameters	1	Pipe Material		Ductile Iron (DI) pipe internally cement mortar lined and externally coated with metallic zinc & finishing layer of bituminous paint	2	Applicable standards		IS/ISO/AWWA/BS as listed in technical specification	3	Hazen& William's constant		140	4	Pipe Class		K7 / K9 as per IS 8329 or equivalent international standard. Compatible with system pressure requirement.
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CLAUSE NO.	एनडीपीसी NTPC TECHNICAL REQUIREMENTS			
				<div> <div>5</div> <div>Pipe Joint type</div> <div></div> <div>Push-on flexible joints as per IS 8329 / Flanged / Restraint.</div> </div> <div> <div>6</div> <div>Pipe Joint type at valves, pumps and other piping</div> <div></div> <div>Flange Joints as per IS 8329 & IS 9523</div> </div> <div> <div>7</div> <div>Welded-on Flange (as applicable)Pressure Class</div> <div></div> <div>Compatible with system pressure requirement.</div> </div> <div> <div>8</div> <div>DI fittings class</div> <div></div> <div>Compatible with system pressure requirement.</div> </div> <div> <div>9</div> <div>DI fittings flange (as applicable) class</div> <div></div> <div>PN 25</div> </div> <div> <div>10</div> <div>Restrain mechanism at bends, specials etc.</div> <div></div> <div>Thrust Blocks</div> </div> <div> <div>11</div> <div>Maximum field hydrostatic test pressure</div> <div data-kind="parent" data-rs="3">N/mm2</div> <div>Shut-off pressure or (operating pressure + surge pressure) whichever is higher for not less than 10 Minutes .</div> </div> <div> <div></div> <div>a) At each section (not exceeding 1000m)</div> <div data-kind="ghost"></div> <div>As per IS:12288 Table -1</div> </div> <div> <div></div> <div>b) Complete Pipeline</div> <div data-kind="ghost"></div> <div>As per IS:12288 Table -1</div> </div> <div> <div>12</div> <div>Other Requirements</div> <div></div> <div>As per technical specification .</div> </div>
2.13.00	Design/ Construction/ Material Particulars of Gate/ Globe / Check /Butterfly / Ball / Air release / Float valves / Moisture Traps.			
2.13.01	GENERAL (a) All valves shall have indicators or direction clearly marked on the hand-wheel so that the valves opening/closing can be readily determined. (b) Special attention shall be given to operating mechanism for large size valves with a view to obtaining quick and easy operation ensuring that a minimum of maintenance is required. (c) The valves coming in vacuum lines shall be of extended gland type and/or water sealed. (d) The actuator-operated valves shall be designed on the basis of the following: (1) The internal parts shall be suitable to support the pressure caused by the actuators; (2) The valve-actuator unit shall be suitably stiff so as not to cause vibrations, misalignments, etc. (3) All actuator-operated valves shall be provided with hand operated gearing mechanism also. (4) All actuators operated valves shall open/ close fully within time required by the process. (e) Valves coming under the purview of IBR shall meet IBR requirements. (f) All valves shall be provided with embossed name plate giving details such as tag number, type, size etc. (g) Wherever required valves shall be provided with chain operator, extension spindles and floor stands or any other arrangement approved by employer so that they can be			
TELANGNA STPP PHASE-1 (2X800 MW) BALANCE OF PLANT (BOP) TURNKEY PACKAGE		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC.NO.:CS-9591-001C-2	SUB-SECTION-A-03 LOW PRESSURE PIPING	PAGE 16 OF 26

CLAUSE NO.	TECHNICAL REQUIREMENTS																													
2.13.02	operated with ease from the nearest operating floor. Wherever necessary for safety purpose locking device shall be provided. Further, necessary small platforms for facilitating easy valve operation shall be provided by the contractor wherever necessary in consultation with project manager within the bid price at no extra cost to employer																													
	VALVE BODY MATERIAL Valve body material for various services shall be as follows: Valve body material for water application like Raw water, Ash water make-up, service water, clarified water, & drinking water shall be cast iron for sizes 65NB and above; gun-metal for sizes 50 Nb and below. For compressed air application, valve body material shall be cast carbon steel or forged carbon steel for sizes 65 mm NB & above and Gun metal for sizes 50 NB and below. DM water: SS body and disc along with SS internals. However for butterfly valves, Cast Iron /Ductile Iron/SG iron/carbon steel body and disc with elastomer lining are also acceptable.																													
2.13.03	The design, material, construction, manufacture, inspection, testing and performance of valves shall comply with all currently applicable statutes, regulations and safety codes in the locality where the valves will be installed. The valves shall conform to the latest editions of applicable codes and standards as mentioned elsewhere. Nothing in this specification shall be construed to relieve the Bidder of his responsibility. Valves in general shall conform to the requirements of the following standards. Standards and Codes <table><tr><td>AWWA-C-504</td><td>Rubber seated butterfly valves.</td></tr><tr><td>BS-5155/EN-593</td><td>Cast iron and steel body butterfly valves for general purpose.</td></tr><tr><td>IS-778</td><td>Gun-metal gate, globe and check valves for general purpose.</td></tr><tr><td>BS-5154</td><td>Copper alloy globe/globe stop and check and gate valves for general purpose.</td></tr><tr><td>IS-780</td><td>Sluice valves for water works purpose (50-300 mm size)</td></tr><tr><td>IS-2906</td><td>Sluice valves for water works purpose (350-1200 mm size)</td></tr><tr><td>IS-5150</td><td>Cast iron wedge and double disc gate for general purpose.</td></tr><tr><td>BS-5152</td><td>Specification for cast iron globe valves.</td></tr><tr><td>BS-5153</td><td>Cast iron check valves for general purpose.</td></tr><tr><td>IS-5312</td><td>Swing check type reflux (non-return) valves.</td></tr><tr><td>ANSI B 16.34</td><td>Standard for valves.</td></tr><tr><td>API-594</td><td>Standard for Dual-check valves.</td></tr><tr><td>API-600</td><td>Steel gate valves.</td></tr></table>				AWWA-C-504	Rubber seated butterfly valves.	BS-5155/EN-593	Cast iron and steel body butterfly valves for general purpose.	IS-778	Gun-metal gate, globe and check valves for general purpose.	BS-5154	Copper alloy globe/globe stop and check and gate valves for general purpose.	IS-780	Sluice valves for water works purpose (50-300 mm size)	IS-2906	Sluice valves for water works purpose (350-1200 mm size)	IS-5150	Cast iron wedge and double disc gate for general purpose.	BS-5152	Specification for cast iron globe valves.	BS-5153	Cast iron check valves for general purpose.	IS-5312	Swing check type reflux (non-return) valves.	ANSI B 16.34	Standard for valves.	API-594	Standard for Dual-check valves.	API-600	Steel gate valves.
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2.14.01	(g) Check valves shall be used for non-return service. They shall be swing. check type or double door (Dual plate)check type with a permanent arrow inscription on the valve body indicating the fluid flow direction. In long distance pipes lines with possibility of surge-occurrence, dual plate check valves are preferable for its spring controlled opening /closing of flaps/doors against flow reversals. However, dual plate check valves shall not be used for sizes more than 600mm NB.			
	(h) For bore greater than 2" the valves must be swing check type or dual plate check type suitable for installation in all positions (vertical and horizontal);			
	(i) For bore smaller than or equal to 2" the valves must be of the piston type to be installed, in horizontal position.			
	(j) All gate and globe valves shall be provided with back seating arrangement to enable on line changing of gland packing. The valves shall be preferably outside screw & yoke type.			
	(k) All gate and globe valves shall be rising stem type and shall have limit switches for full OPEN and full CLOSED indication wherever required. This will include motor-operated valves also wherever required. In such cases the limit switches shall form an integral part of the valve. Stop-gap arrangement in this respect is not acceptable.			
	(l) All valves except those with rising stems shall be provided with continuous mechanical position indicators; rising stem valves shall have only visual indication through plastic/metallic stem cover for sizes above 50 mm nominal bore.			
	(m) For CI gate, globe and check valves wherever thickness of body/bonnet is not mentioned in the valves standards, thickness mentioned in IS- 1538 for fitting shall be applicable.			
	MATERIAL OF CONSTRUCTION (GATE/GLOBE/CHECK VALVE)			
	(a) The materials shall generally comply with the following:			
	(1) Cast Steel Valves			
	Body & bonnet	ASTM A 216 Gr. WCB/ ASTM A 105		
	Disc for non-return Valves	ASTM A 216 Gr. WCB/ ASTM A 105		
	Trim.	ASTM A 182 Gr. F6 or Equivalent		
	(2) Stainless steel valves			
	Body & Bonnet	ASTM A 351 Gr. CF 8M/ ASTM A 182 Gr. 304		
	Disc	-do-		
	Trim.	ASTM 182 Gr. F. 316 /ASTM-A-479Gr.316 / ASTM A 351 Gr. CF 8M		
	(3) Cast iron valves			
	Body & bonnet	BS 1452 Gr. 14/ IS-210 Gr. FG 260		
TELANGNA STPP PHASE-1 (2X800 MW) BALANCE OF PLANT (BOP) TURNKEY PACKAGE		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC.NO.:CS-9591-001C-2	SUB-SECTION-A-03 LOW PRESSURE PIPING	PAGE 19 OF 26

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2.15.00	Seating surfaces and rings	13% chromium steel/ 13% Chrome overlay		
	Disc for non-return valves	BS 1452 Gr. 14/IS-210 Gr FG 260		
	Hinge pin for non-return valves	AISI 316		
	Stem for gate globe valves	13% chromium steel or Equivalent		
	Back seat	13 % chromium steel / 13% Chrome overlay		
	(4) Gun Metal valves			
	Body and bonnet	IS 318 Gr. 2/ Equivalent Standard		
	Trim.	-do-		
	(b) Cast iron body valves shall have high alloy steel stem and seat.			
	(c) Material for counter flanges shall be the same as for the piping.			
(d) Forged carbon steel valves are also acceptable in place of Gun metal valves.				
2.15.00	Air Release Valve			
	(a) The air release valves shall be of automatic double air valve with two orifices and two floats. The float shall not close the valve at higher air velocities. The orifice contact joint with the float shall be leak tight joint.			
	(b) The valve shall efficiently discharge the displaced air automatically from ducts/pipes while filling them and admit air automatically into the ducts/pipes while they are being emptied. The valve shall also automatically release trapped air from ducts/pipes during operation at the normal working pressure.			
	(c) Body material of automatic air release valves shall comply generally with BS 1452 Gr. 14/IS: 210 Gr. FG 260. and spindle shall conform to high tensile brass.			
	(d) Air release valves shall not have any integral isolation device within them. Each Air release valve shall be mounted, preceded by a separate isolation gate/ butterfly valve.			
2.16.00	Butterfly valves			
2.16.01	Design/Construction			
	(a) The valves shall be designed for the design pressure/temperature of the system on which it is installed and in accordance with AWWA-C-504/AWWA-C-516, EN-593 or any other approved equivalent standard latest edition. Fabricated steel (IS: 2062 GR. E-250B) butterfly valves instead of cast iron body valves are also acceptable for size above 300 mm nb diameter.			
	(b) The valves shall be suitable for installation in any position (horizontal/vertical etc.) and shall be generally of double-flanged construction. However for sizes 600 NB and below the valves of Wafer construction are also acceptable			
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2.16.02	(c) Valves-350Nb and above shall have pressure equalizing bypass valves, wherever system parameters warrant the same.			
	(d) Valves-200Nb and above shall also be provided with gear operator arrangement as a standard practice suitable for manual operation. Manual operation of valve shall be through gear arrangement having totally enclosed gearing with hand wheel diameter and gear ratio designed to meet the required operating torque It shall be designed to hold the valve disc in intermediate position between full open and full closed position without creeping or fluttering. Adjustable stops shall be provided to prevent over travel in either direction.			
	Limit and torque switches (if applicable) shall be enclosed in water tight enclosures along with suitable space heaters for motor actuated valves, which may be either for On-Off operation or inching operation with position transmitter.			
	Material of Construction (Butterfly Valves)			
	Materials and other design details shall be as indicated below :			
	(a) Cast Iron Butterfly Valves			
	Body & Disc ASTM A48, Gr. 40 with 2% Ni / IS: 210. Gr. FG-260, with 2% Ni / SG iron BSEN 1563, Gr EN GJS-400-15 with 2%Ni and epoxy coated			
	Shaft BS 970 431 S: 291 / EN 57, or AISI-410 or AWWA-permitted shaft material equivalent to EN-57/AISI-410 or better.			
	Seat ring 18-8 Stainless steel			
	Seal Nitrile Rubber			
2.16.03	(b) Stainless Steel Butterfly Valves			
	Body & Disc ASTM A 351, Gr. CF8M / ASTM-A-182-Gr.304			
	Shaft ASTM A 182, Gr. 316 / ASTM-A-479 Gr.316/Equivalent			
	Seat Rings EPT/BUNA-N/Neoprene			
	(c) Carbon steel Butterfly Valves			
	Body & Disc ASTM A 216, Gr. WCB			
	Shaft ASTM A 182, Gr. 304 / ASTM-A-479 Gr.304/Equivalent			
	Disc & Seat Rings EPT/BUNA-N/Neoprene			
	(d) Elastomer lined Butterfly Valves			
	Body & Disc ASTM A48, Gr. 40 / IS: 210. Gr. FG-260 / SG Iron (ductile iron) IS 1865 Gr 400-15 or BSEN 1563, Gr EN GJS-400-15 / ASTM A 216, Gr. WCB with elastomer lining.			
Shaft ASTM A 182, Gr. 316 / ASTM-A-479 Gr.316/Equivalent				
Proof of Design Test (Type Test) for Butterfly Valves				
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CLAUSE NO.	TECHNICAL REQUIREMENTS			
	Proof of Design (P.O.D.) test certificates shall be furnished by the bidder for all applicable size-ranges and classes of Butterfly valves supplied by him, in the absence of which actual P.O.D. test shall be conducted by the bidder. All valves that are designed and manufactured as per AWWA-C-504 / AWWA-C-516 shall be governed by the relevant clauses of P.O.D test in AWWA-C-504/AWWA-C-516. For Butterfly valves, designed and manufactured to EN-593 or equivalent, the P.O.D. test methods and procedures shall generally follow the guidelines of AWWA-C-504 in all respect except that Body & seat hydro test and disc-strength test shall be conducted at the pressures specified in EN-593 or the applicable code. Actuators shall also meet requirements of P.O.D. test of AWWA-C-504/AWWA-C-516.			
2.17.00	Float operated valves (a) Valve shall automatically control the rate of filling and will shut off when a predetermined level is reached and close to prevent over flow on pre-set maximum water level. Valve shall also open and close in direct proportion to rise or fall of water level. (b) DESIGN AND CONSTRUCTION FEATURES The following design and construction feature of the valve shall be the minimum acceptable. (c) Valves shall be right-angled or globe pattern. (d) Valves shall be balance piston type with float ball. (e) Leather liner shall not be provided. (f) The body and cover material shall be cast iron conforming to ASTM-A 126 Grade 'B' or IS: 210 Grade 200 or equivalent, and Float shall be of copper with epoxy painting of two (2) coats. (g) Valves shall be suitable for flow velocities of 2 to 2.5m/sec. (h) The valves shall have flanged connections.			
2.18.00	Tanks and Accessories			
2.18.01	The designer and manufacturer of storage tanks shall comply with and obtain approval of all currently applicable statutory regulations and safety codes in the locality where the equipment will be installed. The tanks shall conform to IS 803/IS804/IS 805/ IS 2825/ API 650/ IS 4049/ IS 4682 (part-I) and IS 4864 to 4870/ ASME B & PV code Sec.-VIII as the case may be.			
2.18.02	DESIGN AND CONSTRUCTION (a) Design of all vertical atmospheric storage tanks containing water, acid, alkali and other chemical shall conform to IS:803 & API 650. (b) Design of all horizontal atmospheric storage tanks containing water, acid, alkali and other chemicals shall generally conform to IS:2825 as regards to fabrication and general construction taking care of combined bending, shear & hoop stresses developed due to supporting arrangement. (c) Tank shall be made from mild steel plates to BS 4360/IS-2062 Gr.E-250B (or equivalent) for ordinary wafer application when it is not corrosive in nature.			
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CLAUSE NO.	TECHNICAL REQUIREMENTS			एनडीपीसी NTPC																											
2.18.03	(f)	Tank shall be provided with suitable supporting joints. All vessels shall be provided with lifting lugs, eye bolts etc. for effective handling during erection.																													
	(j)	Tanks shall be provided with float operated level indicators/level gauges/level transmitters and level switches, as required, with complete assembly. Suitable flanged pads for level switches mounting shall also be provided. The level indicator can be top or side mounted as the case may be.																													
	(k)	In addition to inlet and outlet nozzles, the tanks shall be provided with vents, overflow, drain nozzles complete for various connections on tanks. Overflow lines from storage tanks is to be routed to the nearest surface drains. For tanks containing dm water, alkaline water or power cycle water the vent to atmosphere shall be through carbon-di-oxide absorber vessel suitably mounted on the tank. CO2 absorber vessel shall be provided with the initial fill of chemicals.																													
	(l)	Tanks shall have suitable stairs/ladders on inside and outside of the tanks, manholes/inspection covers as required and also platform suitably located.																													
	(m)	Tank supporting arrangement as approved by Employer shall be provided with all plates/angles/joints/flats and supporting attachment including lugs, saddles, legs etc.																													
	(o)	Tank fabrication drg. and design calculations shall be approved by the Project Manager.																													
	Corrosion protection																														
	(a)	A corrosion allowance, applicable to surface in contact with corrosive media, when required after thorough cleaning by blast cleaning preceded by wire brushing shall be taken into consideration.																													
	(b)	Manholes shall be provided for easy access into the vessels. The size shall be minimum 500 mm and will be with cover plate, nuts bolts, etc. to ensure leak tightness at the test pressure.																													
	(c)	Each tank shall be provided with drilled cleats welded to the tank for electrical grounding. Material of cleats shall be same as that of the shell.																													
----- <table><tr><th>Sl. No.</th><th>Description</th><th colspan="2">Tech. Particulars</th></tr><tr><td colspan="4">-----</td></tr><tr><td>1.00</td><td colspan="3">CONDENSATE STORAGE TANKS</td></tr><tr><td>1.01</td><td>Number required</td><td colspan="2">one for each unit</td></tr><tr><td>1.02</td><td>Capacity of each tank (Effective)</td><td colspan="2">450 Cu.m (for 800MW units),</td></tr><tr><td>1.03</td><td>Size (Dia & Height)/Plate Thickness</td><td colspan="2">9mx8.2m minimum), Shell & Roof plate Thickness 8mm and Base plate thickness 10mm</td></tr><tr><td>1.04</td><td>Type and pressure class</td><td colspan="2">Vertical, cylindrical, atmospheric</td></tr></table> -----				Sl. No.	Description	Tech. Particulars		-----				1.00	CONDENSATE STORAGE TANKS			1.01	Number required	one for each unit		1.02	Capacity of each tank (Effective)	450 Cu.m (for 800MW units),		1.03	Size (Dia & Height)/Plate Thickness	9mx8.2m minimum), Shell & Roof plate Thickness 8mm and Base plate thickness 10mm		1.04	Type and pressure class	Vertical, cylindrical, atmospheric	
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CLAUSE NO.	एनटीपीसी NTPC TECHNICAL REQUIREMENTS			
2.19.00 2.19.01	1.05 Material of construction MS- (IS-2062 Gr.B or equivalent) as per specified code, 8mm thickness (minimum) 1.06 Location Outdoor 1.07 Overflow, drain, vent and Sample connection(piping &valve) required 1.08 Level Indicator a) Number One for each tank b) Type Mechanical float type with dial type indicator (Guide wire, Float and Housing of Stainless steel - 316 Gr. construction) 1.09 Manhole (minimum 500mm size) Two (2)-one on shell and the other on roof 1.10 Special Fittings a) Hydraulic Seal of Overflow/Drain Required b) Additional nozzle Connection number and size to be indicated to successful Bidder c) Nozzle connection for Instrument/spare Three (3) nos. for each tank d) CO2 Absorber for vent (not to be kept on roof of tank, but to be kept on ground level) required e) Outside stair case (spiral) required f) Inside Ladder Required g) Draw off sump required h) Root valve for level Transmitter Root valves for two (2) nos. level transmitter for each tank Required			
	2.19.00 RUBBER EXPANSION JOINTS (If Applicable)			
	2.19.01 All parts of expansion joints shall be suitably designed for all stresses that may occur during continuous operation and for any additional stresses that may occur during installation and also during transient condition.			
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2.19.02	The expansion joints shall be single bellow rubber expansion joints. The arches of the expansion joints shall be filled with soft rubber.			
2.19.03	The tube (i.e. inner cover) and the cover (outer) shall be made of natural or synthetic rubber of adequate hardness. The shore hardness shall not be less than 60 deg. A for outer and 50 deg. A for inner cover.			
2.19.04	The carcass between the tube and the cover shall be made of high quality cotton duck, preferably, square woven to provide equal strength in both directions of the weave. The fabric plies shall be impregnated with age resistant rubber or synthetic compound and laminated into a unit.			
2.19.05	Reinforcement, consisting of solid metal rings embedded in carcass shall be provided.			
2.19.06	Expansion joints shall be complete with stretcher bolt assembly. The expansion joints shall be suitable to absorb piping movements and accommodate mismatch between pipe lines.			
2.19.07	The expansion joints shall be of heavy duty construction made of high grade abrasion-resistant natural or synthetic rubber compound. The basic fabric for the ' duck' shall be either a superior quality braided cotton or synthetic fibre having maximum flexibility and non-set characteristic.			
2.19.08	The expansion joints shall be adequately reinforced, with solid steel rings, to meet the service conditions under which they are to operate.			
2.19.09	All expansion joints shall be provided with stainless steel retaining rings for DM water application and IS 2062 Gr E-250B galvanized steel retaining rings for ordinary water for use on the inner face of the rubber flanges, to prevent any possibility of damage to the rubber when the bolts are tightened. These rings shall be split and beveled type for easy installation and replacement and shall be drilled to match the drilling on the end rubber flanges and shall be in two or more pieces.			
2.19.10	The expansion joints shall have integral fabric reinforced full-face rubber flanges. The bolt on one flange shall have no eccentricity in relation to the corresponding bolt hole on the flange on the other face. The end rubber flanges shall be drilled to suit the companion pipe flanges. The end flanges shall be as per ANSI B 16.25. For higher sizes, not covered under ANSI B 16.25, the same shall be as per AWWA.			
2.19.11	All exposed surfaces of the expansion joint shall be given a 3 mm thick coating of neoprene. This surface shall be reasonably uniform and free from any blisters, porosity and other surface defects.			
2.19.12	Each control unit shall consist of two (2) numbers of triangular stretcher bolt plates, a stretcher bolt with washers, nuts, and lock nuts. Each plate shall be drilled with three holes, two for fixing the plate on to the companion steel flange and the third for fixing the stretcher bolt.			
2.19.13	Each joint shall have a permanently attached brass or stainless steel metal tag indicating the tag numbers and other salient design features.			
2.19.14	Bidder to note that any metallic part which comes in contact with DM /corrosive water shall be of Stainless Steel material.			
2.20.00	STRAINERS (If Applicable)			
2.20.01	Simplex type			
	The strainers shall be basket type and of simplex construction. The strainer shall be provided with plugged drain/blow off and vent connections. The free area of the strainer element shall be at least four (4) times the internal area of the connecting pipe lines. The strainer element			
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2.20.02	shall be 20 mesh. Pressure drop across the strainers in new condition shall not exceed 1.5 MCW at full flow. Wire mesh of the strainers shall be suitably reinforced, to avoid buckling under operation. Strainer shall have screwed blow off connection fitted with a removable plug. The material of construction of various parts shall be as follows:			
	(a)	Body	IS: 318, Gr. 2 up to 50 mm Nb, and IS: 210 Gr. FG 260 above 50 mm Nb. (For DM water/ -Body: AISI 316 or equivalent)	
	(b)	Strainer Element	Stainless steel (AISI 316)	
	(c)	End connection	Screwed upto 50 mm Nb, and Flanged above 50 mm Nb	
	Duplex type			
	(a)	The strainers shall be basket type and of duplex construction. The strainer shall be provided with plugged drain/blow off and vent connections. The free area of the strainer element shall be at least four (4) times the internal area of the connecting pipe. The mesh of strainer element shall be commensurate with the actual service required. Pressure drop across the strainer in new condition shall not exceed 4.0 MWC at full flow.		
	(b)	Wire mesh (if applicable) of the strainers shall be suitably reinforced. The material of construction of various parts shall be as follows.		
		Body	IS: 318, Gr. 2 up to 50 mm Nb, and IS:210, Gr. FG 260 or ASTM-A-515 Gr. 75/IS-2062 Gr. E-250B and internally epoxy-painted above 50 mm NB.	
		Strainer element	Stainless steel (AISI 316)	
		End connection	Screwed up to 50mm Nb, and Flanged above 50 mm Nb. Gasket shall be of full face type	
(c)	The strainer will have a permanent stainless steel tag fixed on the strainer body indicating the strainer tag number and service and other salient data.			
(d)	The size of the strainer and the flow direction will be indicated on the strainer body casting.			
(e)	Thickness of the strainer element should be designed to withstand the pressure developed within the strainer due to 100% clogged condition exerting shut-off pressure on the element.			
TELANGNA STPP PHASE-1 (2X800 MW) BALANCE OF PLANT (BOP) TURNKEY PACKAGE		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC.NO.:CS-9591-001C-2	SUB-SECTION-A-03 LOW PRESSURE PIPING	PAGE 26 OF 26

CLAUSE NO.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
	GENERAL TECHNICAL REQUIREMENT PUMPS SUBMERSIBLE PUMPS(other than raw water pumps) 1.00.00 SCOPE 1.01.00 This specification covers general requirements in respect of design, material, manufacture, construction, testing & inspection at Vendor's / sub-vendor's delivery to side, of submersible pumps. 2.00.00 CODES AND STANDARD 2.01.00 List of Applicable Indian Standards IS: 8034 - Submersible pumps for clear cold fresh water IS: 5120 - Technical requirement of Rotodynamic Special Purpose pumps. In case of any contradiction with aforesaid standards and the technical specification requirements, the stipulation of the technical specification shall prevail. 3.00.00 DESIGN AND PERFORMANCE REQUIREMENTS a) The pump shall be of single stage mono - block type with non-clog design. b) Components of Identical pumps shall be interchangeable. c) Pumps shall have continuously rising head characteristics. 4.00.00 MOTOR RATING Continuous motor rating (at 50 deg. C ambient) for pumps shall be at least ten percent (10%) above the maximum load demand of the driven equipment in the complete operating range to take care of the system frequency variations. 5.00.00 FEATURES OF CONSTRUCTION a) Pumps shall be of Submersible, wet pit type. b) Pumps shall be able to pass through solids upto 100 mm and capable of handling waste water which may contain, sludge, plastic solids etc. c) Coupling device shall ensure leak proof joint between the pump and discharge elbow. This shall also enable pump to be removed from the sumps without the necessity of dismantling any nuts, bolts etc. d) Pumps shall be portable type and capable of using in any sump as and when required. Pump shall be provided with required stool, flexible, hose chain connection etc. for easy installation, removal and maintenance. Adequate length of chain required for lowering the pump into the sump and flexible type discharge pipe shall be provided. e) Impeller			
TELANGANA STPP PHASE – I (2 X800 MW) BALANCE OF PLANT (BOP) TURNKEY PACKAGE		TECHNICAL SPECIFICATIONS SECTION-VI, PART-B BID DOC. NO.: CS-9591-001C-2	SUB SECTION-A-07 CW SYSTEM	Page 60 of 61

CLAUSE NO.	TECHNICAL REQUIREMENTS			
	The Impeller shall be as indicated in Data Sheets in this Sub-section. Enclosed impellers shall be equipped with seal rings on their hubs. In case of open impeller, the pump shall be design to take care of the additional thrust produced.			
TELANGANA STPP PHASE – I (2 X800 MW) BALANCE OF PLANT (BOP) TURNKEY PACKAGE		TECHNICAL SPECIFICATIONS SECTION-VI, PART-B BID DOC. NO.: CS-9591-001C-2	SUB SECTION-A-07 CW SYSTEM	Page 61 of 61

GENERAL TECHNICAL REQUIREMENT OF MANDATORY SPARE

**TELANGANA STPP
PHASE-I (2X800 MW)
BALANCE OF PLANT (BOP) TURNKEY PACKAGE**

**TECHNICAL SPECIFICATION
SECTION-VI, PART-F
BID DOC NO: CS-9591-001C-2**

CLAUSE NO.	LIST OF MANDATORY SPARES FOR COOLING WATER			
Sl.No.	Description	Quantity		
1.00.00	CW pumps and Auxiliary water System			
A)	Mechanical Items			
1) i)	Spares for CW pump (Vertical Wet pit or Volute type)			
	Shaft sleeves	2 Sets		
	Bearing of pumps (all bearings) including thrust bearing as applicable.	1 Set		
	Bearing of motor (all bearings including thrust bearing as applicable)	1 Set		
	Wearing rings or equivalent for impeller (if applicable)	1 Set		
	Wearing rings or equivalent for Casing/ Bowl (if applicable)	1 Set		
	Impeller Shaft and Line shafts with fasteners (as applicable)	1 Set		
	All shaft Couplings with fasteners (as applicable)	1 Set		
	Coupling between pump and motor & coupling Guards	1 Set		
	Bushes for the all Couplings as applicable	1 Set		
	Mechanical seal or gland packing as applicable for the pumps	1 Set		
	Thrust bearings Pads	2 Sets		
	All Gaskets	1 Set		
	Impeller with impeller nut	1 Set		
	Oil Seal Ring (if applicable)	2 Sets		
	Deflectors (if applicable)	2 Sets		
ii)	Spares for electro hydraulic actuators			
	Complete actuator excluding the oil tank, accumulator cylinders, counterweight and powerpack.	1 no		
	Complete power pack	1 set		
2)	Spares for horizontal pumps (for each type and size)			
	Impeller with nuts	1 no		
TELANGANA STPP PHASE-I (2 X800 MW) BALANCE OF PLANT (BOP) TURNKEY PACKAGE		TECHNICAL SPECIFICATION SECTION-VI, PART-F BID DOC. NO. CS-9591-001C-2	MANDATORY SPARES CHAPTER - 4 WS-COOLING WATER	PAGE 1 OF 3

CLAUSE NO.	LIST OF MANDATORY SPARES FOR COOLING WATER			
	Shafts with fasteners		1 set	
	Shaft Sleeves		2 Sets	
	All Gaskets		1 Set	
	Wearing rings – Impeller as applicable		1 Set	
	Wearing Rings – Casing as applicable		1 Set	
	Bearings for the pump and Drives		2 Sets	
	Thrust bearings if applicable		1 Set	
	Pump & Drive Coupling with all fasteners & coupling Guards		1 Set	
	All shaft Couplings with fasteners (as applicable)		1 Set	
	Pin and Bushes for the all Couplings as applicable		1 Set	
	Gland Packing		1 Set	
3)	Submersible pumps)			
	Impeller		1 set	
	Pump shaft		1 Set	
(B)	CONTROL & INSTRUMENTATION ITEMS FOR CW PUMPS			
S. NO.	ITEM.	QUANTITY		
I.	MEASURING INSTRUMENTS			
1	Transmitters			
(i)	Transmitters of all types and model no. (for the measurement of Pressure, differential pressure flow, level, etc.) including local indication (if applicable)	10 % or 1 no. of each type and model whichever is more.		
2	Temperature Elements			
i)	Temperature Transmitter	10 % or 1 no. of each type and model whichever is more.		
ii)	RTD's	1 no. of each type		
TELANGANA STPP PHASE-I (2 X800 MW) BALANCE OF PLANT (BOP) TURNKEY PACKAGE		TECHNICAL SPECIFICATION SECTION-VI, PART-F BID DOC. NO. CS-9591-001C-2	MANDATORY SPARES CHAPTER - 4 WS-COOLING WATER	PAGE 2 OF 3

CLAUSE NO.	LIST OF MANDATORY SPARES FOR COOLING WATER		एनडीपीसी NTPC
iii)	Thermo well	1 no. of each type	
	* (with head assembly, terminal block and nipple)	** (to be divided into various lengths in proportion to main population).	
3	All types of Local Gauges	1 no. of each make, model and type (to be divided to various ranges in proportion to main of all make, model, type population)	
4	Flow Switch	1 no. of each type and model	
5	Reverse Rotation Indicators including proximity sensors	1 no.	
6	Position Transmitters for Butterfly valves	1 no.	
7	Solenoid Valves for Hydraulic Actuators of Butterfly Valves	1 no.	
8	Limit switches	1 no. of each type	
9	Electronic Flow Meter	20% Or 2 nos min of each make and type, whichever is more	
II.	Process Connection Piping (For Impulse Piping/Tubing and Air Supply Piping as Applicable)		
1)	Valves	10% or 1 no. of each type, class, size and model whichever is more.	
2)	2 way, 3way, 5way valve manifolds.	10% or 1 no. of each type, class, size and model whichever is more.	
3)	Fittings	10% or 1 no. of each type, class, size and model whichever is more.	
III.	INSTRUMENTATION CABLE		
(i)	Prefab cable	1 No of each type and length	
TELANGANA STPP PHASE-I (2 X800 MW) BALANCE OF PLANT (BOP) TURNKEY PACKAGE		TECHNICAL SPECIFICATION SECTION-VI, PART-F BID DOC. NO. CS-9591-001C-2	MANDATORY SPARES CHAPTER - 4 WS-COOLING WATER
			PAGE 3 OF 3

CLAUSE NO.	LIST OF MANDATORY SPARES FOR PIPING एनटीपीसी NTPC		
1.00.00	Low Pressure Piping (Mandatory Spares) (1) Valves 5% of the total population of each type, size and class OR minimum 2 Nos. of each type, size and class. NOTE 1. If there is one no valve only of particular type , class and size then only one no is required 2. Wherever valves are specified as mandatory spare, complete valve along with actuator and all other accessories which are the part of original supply shall also be supplied		
TELANGANASTPP PHASE-I (2 X 800 MW) BALANCE OF PLANT (BOP) TURNKEY PACKAGE	TECHNICAL SPECIFICATION SECTION-VI, PART-F BID DOC. NO. CS-9591-001C-2	MANDATORY SPARES CHAPTER - 6 PIPING	PAGE 1 OF 1



TITLE:

**TECHNICAL SPECIFICATION FOR
EFFLUENT TRANSFER SYSTEM
2X800 MW TELAGANA STPP PHASE-I (SG
PACKAGE)**

BHEL DOCUMENTS NO.: PE-TS-424-158-A001

SECTION – III

SUB SECTION –

REV. NO. 00

DATE: 10.06.2024

SECTION-III



TITLE:
**TECHNICAL SPECIFICATION FOR
EFFLUENT TRANSFER SYSTEM
2X800 MW TELAGANA STPP PHASE-I (SG
PACKAGE)**

BHEL DOCUMENTS NO.: PE-TS-424-158-A001

SECTION – III

SUB SECTION –

REV. NO. 00

DATE: 10.06.2024

LIST OF DOCUMENTS TO BE SUBMITTED ALONG WITH BID

1.0 Bidder to furnish following documents/information along with the bid (For Electrical And C&I Please Refer The Respective Section Of The Specification).

- Deviation if any strictly in the enclosed Schedule of deviation with cost of withdrawal only with mention of specification clause for which deviation is being asked. (Stamped & Signed). In case of No Technical Deviation, bidder to furnish the same format stating “No Deviation” duly Stamped & Signed.
- Compliance certificate. (Stamped & Signed)
- Schedule of Declaration. (Stamped & Signed)
- Un Price Schedule duly filled in. (Stamped & Signed)
- List of Start-up & commissioning spares if any. (Stamped & Signed)

Any other documents submitted by bidder except as asked in the bid's specification shall not be evaluated & considered as null & void.

NOTES:

- 1) Any item/work either supply of equipment or erection material which have not been specifically mentioned but are necessary to complete the works for trouble free and efficient operation of the plant shall be deemed to be included within the scope of this specification. The bidder without any extra charge shall provide the same.
- 2) All drawings/documents shall be approved by BHEL/Customer during detailed engineering stage. Successful Bidder shall comply with the comment of the customer/BHEL without any price & delivery implication.



TITLE:
**TECHNICAL SPECIFICATION FOR
EFFLUENT TRANSFER SYSTEM
2X800 MW TELAGANA STPP PHASE-I (SG
PACKAGE)**

BHEL DOCUMENTS NO.: PE-TS-424-158-A001

SECTION – III

SUB SECTION –

REV. NO. 00

DATE: 10.06.2024

COMPLIANCE CUM CONFIRMATION CERTIFICATE

The bidder shall confirm compliance with following by signing/ stamping this compliance certificate and furnishing same with the offer:

1. The scope of supply, technical details, construction features, design parameters etc. shall be as per technical specification & there are no exclusions/ deviations with regard to same.
2. QP/ test procedures shall be submitted in the event of order based on the guidelines given in the specification & QP enclosed therein.
3. QP will be subject to BHEL/Customer approval in the event of order & customer hold points for inspection/ testing shall be marked in the QP at the contract stage. Inspection/ testing shall be witnessed as per same apart from review of various test certificates/ Inspection records etc. The charges for 3rd party inspection (Lloyds, TUV or equivalent) for imported components shall be included in the base price of the equipment by the bidder.
4. All drawings/data – sheets etc. to be submitted during contract shall be subject to BHEL/Customer review/ approval. GA drawings, as submitted with offer at tender stage are for reference purpose only and shall be subject to approval during contract stage.
5. There are no other deviations with respect to specification other than those furnished in the 'Schedule of Deviations'.
6. The offered materials shall be either equivalent or superior to those specified. Also for components where material is not specified it shall be suitable for intended duty, materials shall be subject to approval in the event of order.
7. The commissioning spares (if any) are supplied on 'As Required Basis' & prices for same included in the base price (If bidders reply to this is "No commissioning spares are required" and if some spares are actually required during commissioning same shall be supplied by bidder without any cost to BHEL and Customer).
8. All sub vendors shall be subject to BHEL/CUSTOMER approval.
9. Any special tools & tackles, if required, shall be in bidder's scope.
10. Performance guarantee test parameters shall stand valid till the satisfactory completion of Performance guarantee test and its acceptance by BHEL and Customer.



TITLE:
**TECHNICAL SPECIFICATION FOR
EFFLUENT TRANSFER SYSTEM
2X800 MW TELAGANA STPP PHASE-I (SG
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SECTION – III
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REV. NO. 00 DATE: 10.06.2024

PRE BID CLARIFICATION SCHEDULE

All clarification from the Technical Specification shall be filled in by the BIDDER clause by clause in this format only.

VOLUME	SECTION	CLAUSE NO.	PAGE NO.	SPECIFICATION REQUIREMENT	CLARIFICATION	REASONS FOR CLARIFICATION

PARTICULARS OF BIDDER / AUTHORISED REPRESENTATIVE				
NAME	DESIGNATION	SIGNATURE	DATE	COMPANY SEAL



TITLE:
**TECHNICAL SPECIFICATION FOR
EFFLUENT TRANSFER SYSTEM
2X800 MW TELAGANA STPP PHASE-I (SG
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SCHEDULE OF DECLARATION

I certify that all the technical data and information pertaining to this specification are correct and are true representation of the equipment/system covered by our format proposal number Dated and there is no deviation to the specification.

I hereby certify that I am duly authorized representative of the Bidder's company whose name appears above my signature.

Bidders Company Name

Authorized Representative's
Signature

Name

Bidder's Name

The bidder hereby agrees to fully comply with the requirements and intent of this specification for the price indicated.

**THIS IS A PART OF TENDER TECHNICAL SPECIFICATION PE-TS-424-158-A001 R00****SCHEDULE OF DEVIATIONS WITH COST OF WITHDRAWAL****PROJECT:- 2X800 MW TELAGANA STPP PHASE-I (SG PACKAGE)****EFFLUENT TRANSFER SYSTEM****TENDER ENQUIRY REFERENCE:-****NAME OF VENDOR:-**

SL NO	VOULME/ SECTION	PAGE NO.	CLAUSE NO.	TECHNICAL SPECIFICATION/ TENDER DOCUMENT	COMPLETE DESCRIPTION OF DEVIATION	COST OF withdrawal OF DEVIATION	REFERENCE OF PRICE SCHEDULE ON WHICH COST OF withdrawal OF DEVIATION IS APPLICABLE	NATURE OF COST OF withdrawal OF DEVIATION (POSITIVE/ NEGATIVE)	REASON FOR QUOTING DEVIATION
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TECHNICAL DEVIATIONS

COMMERCIAL DEVIATIONS

PARTICULARS OF BIDDERS/ AUTHORISED REPRESENTATIVE

NAME	DESIGNATIONS	SIGN & DATE	

NOTES:

1. For self manufactured items of bidder, cost of withdrawal of deviation will be applicable on the basic price (i.e. excluding taxes, duties & freight) only.
2. For directly dispatchable items, cost of withdrawal of deviation will be applicable on the basic price including taxes, duties & freight.
3. All the bidders have to list out all their Technical & Commercial Deviations (if any) in detail in the above format.
4. Any deviation not mentioned above and shown separately or found hidden in offer, will not be taken cognizance of.
5. Bidder shall submit duly filled unpriced copy of above format indicating "quoted" in "cost of withdrawal of deviation" column of the schedule above along with their Techno-commercial offer, wherever applicable.
6. Bidder shall furnish price copy of above format along with price bid.
7. The final decision of acceptance/ rejection of the deviations quoted by the bidder shall be at discretion of the Purchaser.
8. Bidders to note that any deviation (technical/commercial) not listed in above and asked after Part-I opening shall not be considered.
9. For deviations w.r.t. Payment terms, Liquidated damages, Firm prices and submission of E1/ E2 forms before claiming 10% payment, if a bidder chooses not to give any cost of withdrawal of deviation loading as per Annexure-VIII of GCC, Rev-06 will apply. For any other deviation mentioned in un-priced copy of this format submitted with Part-I bid but not mentioned in priced copy of this format submitted with Priced bid, the cost of withdrawal of deviation shall be taken as NIL.
10. Any deviation mentioned in priced copy of this format, but not mentioned in the un-priced copy, shall not be accepted.
11. All techno-commercial terms and conditions of NIT shall be deemed to have been accepted by the bidder, other than those listed in unpriced copy of this format.
12. Cost of withdrawal is to be given seperately for each deviation. In no event bidder should club cost of withdrawal of more than one deviation else cost of withdrawal of such deviations which have been clubbed together shall be considered as NIL.
13. In case nature of cost of withdrawal (positive/negative) is not specified it shall be assumed as positive.
14. In case of discrepancy in the nature of impact (positive/ negative), positive will be considered for evaluation and negative for ordering.