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TENDER NO. IPR/TN/PUR/TPT/ET/19-20/12 DATED 03/07/2019

PROJECT INFORMATION & AUXILIARY FACILITIES

1	Purchaser	Institute For Plasma Research, Village Bhat, Gandhinagar - 382 428, Gujarat, INDIA. Phone : (079)-23962000 Fax : (079)-23969017 Web: www.ipr.res.in
2	Site elevation (avg.)	55 meters above MSL
3	Ambient temperature	Max.(annual):47 °C; Min. (annual): 4 °C; Average (annual): 35 °C Design (max): 50°C, (min): 4°C
4	Relative humidity	Max. : 95%; Min. : 10%
5	Rainfall	823 mm average (annual) June-August
6	Wind data	Max. wind speed : 130 km/h Prevailing direction : SW to W Design wind pressure : 150 kgm ⁻²
7	Seismic data	0.08 g (as per latest guidelines)
8	Accessibility	by road : Up to site(on Hansol-Gandhinagar H-way) by rail : Ahmedabad Rly. Stn. (12 km.) by sea : Bombay Harbour (525 km.) by air : Ahmedabad Airport (6 km.)
9	Auxiliary power supply (each of the voltages can be made available at one point of connection to the sources)	415VAC & 230 V AC± 10% V
10	Expected date of Delivery	3 months after the date of approval of drawings

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SPECIFICATION FOR L.T. CIRCUIT BREAKER PANELS

1.1 SCOPE:

The scope covers supply, fabrication, inspection and testing at contractor's work of **one number** of L.T. AC cubical patterns Circuit Breaker panel, with all accessories, as specified in this document and in the tender drawings.

1.2 CODES AND STANDARDS:

The design, materials, construction, manufacture, inspection, testing and performance of L.T. Breaker Panel shall comply with all currently applicable statutory regulation and safety codes in the locality where the equipment will be installed. The equipment shall also conform to the latest applicable standards and codes of practice. Some of the reference standards are mentioned in this tender document.

1.3 DESIGN FEATURES:

- a) The L.T. Breaker panels are required for distributing power to various system and utilities.
- b) The breaker panel shall be suitable for use in rated voltage of 415V earthed electrical system having maximum system voltage of 415V \pm 10%.
- c) The design and construction of the panel shall be strong enough to take the load of breaker, bus bars, cables, relays instruments etc. and withstand rated maximum fault level and rigorous adverse weather conditions. Provision shall be made for expansion and contraction of enclosure due to temperature.
- d) The breaker, bus bars, cables etc. shall be suitable for continuous operation under site conditions indicated elsewhere with conductor temperature of 105 °C maximum. Also the conductor temperature during short circuit shall not exceed 250 °C. Bus bars shall be suitable for short time overloads.
- e) The panel shall be 100% insulated, which means there shall be no access to any live part. All joints shall be shrouded with special removable PVC blocks.
- f) The hinged door shall be designed to withstand internal arcing and shall be interlocked in such a way that it cannot be opened with the breaker in closed position. Further all operations shall be possible with door closed.
- g) Special insulating barrier shall be provided where bus bar passes from place to another to restrict arc from propagating, across the full length of the board in event of bus fault.
- h) Wiring circuits fed from a supply common to a number of feeder panels shall be protected so that failure of a circuit in any one feeder does not prevent operation of other feeders.
- i) Circuit of one feeder panel should be capable of isolation for maintenance purposes without affecting other circuits.

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- j) Doors, covers and all non-current carrying metallic parts shall be earthed through flexible copper wires. This should also include instrument casing and cable armour, which should also be connected to the earth bus.
- k) For safety, a spring-loaded scraping earth shall be provided on each withdrawable tray of drawout design circuit breaker panel ensures continuous earthing when trolley is withdrawn and having direct connection to the main earth bus.

1.4 CONSTRUCTIONAL FEATURES:

1.4.1 The Basic Cubicle:

- a) The basic enclosure shall be fabricated from Cold rolled sheet steel material, of thickness not less than 2 mm in all sides. For all the load bearing application sheet steel thickness shall not be less than 2 mm. Doors and covers shall be made of cold rolled sheet steel of thickness not less than 1.6 mm. Stiffeners shall be provided wherever required. The panel frames shall be fabricated using cold rolled sheet steel of thickness not less than 2.5 mm.
- b) The cubicle shall have four distinct compartments each separately earthed – Breaker compartment, Relay & Instrument chamber, Bus bar chamber, CT & Cable chamber.
- c) The doors and removable covers shall be provided with neoprene gaskets to make the panel dust and vermin proof.
- d) Any metal to metal joint anywhere inside the panel shall be gasketed to achieve zero gap. Between two panels special T type gasket shall be provided for zero gap and aesthetics.
- e) The panel board shall be complete with all internal wiring, bus-bars, labels, accessories etc. as specified.
- f) Labels shall be provided for all identifiable like breakers, relays, indicating lamps, control switches, selector switches and accessories etc.
- g) The panel door shall be opened only by means of tools to prevent unauthorized opening.
- h) Painting: Seven-tank process treatment shall be followed for treatment of the fabrication parts of the panel. Two coats of epoxy based primer shall be applied before applying two final coats of epoxy paint which shall have good weather resistance and heat transfer properties. Electrostatic epoxy powder coating shall be applied after pre-treatment. The colour of painting shall be RAL 7032.

1.4.2 The Breaker Compartment:

- a) The CB compartment shall receive the trolley in case of ACB, which houses the CB and PT. The trolley engagement to the enclosure is of horizontal isolating horizontal draw out type.
- b) The CB trolley shall have three distinct positions – Service, test and isolated. All three positions shall have latching facility and service and test positions have locking facility. These two positions shall have limit switch with auxiliary contacts for interlocking.

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- c) In draw-out air circuit breaker, components of a feeder shall be mounted on withdrawable trolley. The trolley shall be provided with guides and low friction sliding devices. The trolley shall be provided with simple insertion and withdrawal device, which also locks the tray in fully inserted position.
- d) ACB's and MCCB's shall be arranged in multi-tier form if design permits looking at its size and thermal properties for better optimization of overall size of enclosure and of available space.

1.4.3 The Bus bar Chamber:

- a) The bus bar chamber on the top shall house the bus bars, which shall be accessed only by special tools.
- b) Bus bars shall be of Electrolytic Copper material and shall comply the requirements of IS: 8130. The bus bars should have rectangular section. The size of the bus bar should be clearly indicated in the quotation and the current density while calculating the size of the bus bars should be 1.6 A/sq.mm.
- c) The bus bars shall be supported by non-hygroscopic, anti-tracking high impact epoxy cast resin insulator. The support shall be rigid and suitable for all thermal and electro dynamic stresses arising out of short circuit current for 3 sec.
- d) Bus bars shall be designed for rated normal continuous current and fault level for one second **as specified in BOM**, without injurious heating.
- e) Bus bars in the switchgear may be provided with insulating sleeves OR insulating coatings. The sleeves or coating material shall comply with the following requirements:
 - 1. The insulating material shall safely withstand the hot-spot temperatures of the bus bars.
 - 2. The material shall be flame retardant in accordance with ANSI-C37.20.
 - 3. Thermal cycling tests should have been carried out (on representative samples of insulated bus bars) to prove that insulation will not flake off or deteriorate during the expected life of the switchgear which is 30 years. One cycle is from full – load temperature to no-load temperature. Expected numbers of cycles are 20,000.
 - 4. The thickness of insulation on the bus bars shall be sufficient to withstand 1.5 kV rms for one minute.
 - 5. Minimum phase to phase and phase to earth clearance shall be 25 mm.
 - 6. The material shall have low dielectric loss.
 - 7. It shall have good thermal conductivity to dissipate heat.
 - 8. If there is any de-rating of bus bars due to the above, the same shall be furnished.
- f) The bus bars and every tap off joints shall be colour coded.
- g) Silver plating of all bus bar joints shall be provided so that temperature rise of 55°C over 50 °C ambient temperature can be allowed as per ANSI C37.20

1.4.4 The CT and Cable Chamber:

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- a) A spacious cable chamber at the rear of the panel shall be provided. It shall be suitable for receiving number of cables of different size. The cable Chamber shall be accessed through removable rear cover.
- b) The cable Chamber shall be designed for cable entry from top or bottom as mentioned in BOM.
- c) Sufficient distance between cable gland plate and terminal lug shall be provided for cable termination.
- d) For cable entry, a removable 2 mm MS gland plate shall be provided.
- e) Various Clearances shall be as per the standards and practices.

1.4.5 The Relay and Instrument Chamber:

- a) Protective relays and indicating instruments shall be mounted on the door. Auxiliary relays should be projection mounted inside the cubicle.
- b) Control wiring shall be done using 650 V grade grey PVC stranded wire 1.5 sq.mm for control and 2.5 sq.mm for CT circuit.
- c) As a standard practice, all control cables shall be neatly bunched together with ferrules at either end of each wire. As per application colour ferrules shall be provided.
- d) The wire bunch shall be passed through PVC ducts.
- e) For safety and reliability, cable bunch shall be routed through flexible metallic conduit wherever it passes through HV compartments like breaker, PT chamber etc.
- f) Bus wiring shall be through grommets. Separate terminal stack shall be provided for inter-panel wiring.
- g) All wiring practices shall be as per IS-375.

1.5 AIR CIRCUIT BREAKER (ACB):

- a) Air Circuit Breakers shall fully conform to latest IS: 13947.
- b) ACBs shall be designed for circuit protection of 415 V, three phase four wire AC distribution system. They shall be designed for use in panel boards as main breakers and for protection of feeder circuits and connecting equipment.
- c) The ACB's shall be suitable for installation on multi-tier panel box.
- d) The terminals of the ACBs shall be designed to maintain adequate clearances and to accept Aluminium cables and busbars.
- e) ACBs shall be of draw-out type, electrically/motor operated and of ratings as per BOM. The fully draw out type compartments shall be provided.
- f) All ACBs shall be provided with integrated Microprocessor based trip releases for overload, short circuit and earth fault with multiple characteristic curves and adjustable setting for each characteristic to ensure proper co-ordination with upstream and downstream breakers.
- g) For all air circuit breakers, monitoring of close and trip circuit voltages, trip coil shall be provided.
- h) Each circuit breaker shall be provided with distinct SERVICE/TEST/ISOLATED positions.
- i) Potential free auxiliary contacts shall be provided for ACB's status indication (ON, OFF & TRIP) and remote operation (closing and opening).

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- j) Motor for ACBs shall be rated at 230V AC.

1.6 MOLDED CASE CIRCUIT BREAKER (MCCB) :

- a) Molded Case Circuit Breakers shall fully conform to IS: 13947 part II.
- b) MCCB's shall be designed for circuit protection of 415 V, three phase four wire AC distribution system. They shall be designed for use in panel boards as main breakers and for protection of feeder circuits and connecting equipment.
- c) The terminals of the MCCB's shall be designed to maintain adequate clearances and to accept Aluminium cables.
- d) The insulating case and cover shall be made of high strength, heat resistant, flame retardant thermosetting material, providing a very high dielectric strength, high withstand capability against thermal and mechanical stresses, protection against secondary fire hazards and enhanced safety of operating personnel.
- e) All MCCB's shall be provided with integrated static trip releases for overload, short circuit and earth fault with multiple characteristic curves and adjustable setting for each characteristic to ensure proper co-ordination with overload, short circuit and earth fault protection provided on upstream and downstream (a) air circuit breakers and (b) MCCB shall be provided.

1.7 CURRENT TRANSFORMERS:

- a) Current transformers shall comply with IS: 2705.
- b) Construction of CT's shall be bar type, separately mounted type.
- c) CT's shall be provided with two (2) nos. of cores, one for metering and another one for protection. Each core shall carry its own secondary winding.
- d) Protection CT core are intended for Over load, Short circuit current and Earth fault protection.

1.8 POTENTIAL TRANSFORMERS:

- a) Potential transformers shall comply with IS:3156.
- b) PT's shall be of Magnetic type.
- c) PT's shall be single of core and should be used for both metering and protection.
- d) Protection is intended for under voltage protection.

1.9 PROTECTION, METERING AND INDICATION:

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1.9.1 Protection & Control:

- a) Each Air circuit breaker (ACB) shall be provided with Microprocessor based releases for overload, short circuit and earth fault (LSIG Protection).
- b) Under-voltage release should be provided in all incoming feeders to monitor the availability of power supply in each bus of LT panels. When loss of supply is detected, designated feeders should be automatically disconnected using multiplied contacts of the Under-voltage release.
- c) Each downstream MCCB shall be provided with Static trip releases for overload, short circuit and earth fault protection (LSIG Protection).
- d) The relays should feature inherent high accuracy, high reliability and stable characteristics for both current and time setting functions.
- e) The relays should provide guaranteed performance in the specified operating conditions at specified ambient conditions without any need for specific ventilation or air conditioning.
- f) Adequate number of relay auxiliary contacts should be available for direct interface with breaker, monitoring and interlocking.
- g) Auxiliary contacts associated with ACBs/ MCCBs /Relays for all above fault conditions or combined fault signal suitable for integrating with computer based supervisory control and data acquisition system (SCADA) shall be provided.
- h) All ACB incoming and outgoing feeder control signals ON, OFF and TRIP shall be available for remote operation.
- i) For all downstream MCCB outgoing feeders control switch shall be provided for local operation in panel itself.
- j) Flexible settings on protection relays and releases shall be provided as follows :
 - i) Over load setting: 0.4 to 1.0 times the rated current.
 - ii) Over load time delay: 3 to 40 sec.
 - iii) Short circuit pick up level setting: 1.5 to 14 times the rated current.
 - iiii) Short circuit time delay: Inst., 30 to 300 msec.
 - iv) Earth fault settings: 0.2 to 0.8 times the rated current
 - v) Earth fault time delay: Inst., 100 to 300 msec.
 - vi) Under voltage settings: 0.35 to 1.1 of rated voltage.
 - vii) Under voltage time delay: Inst., to 0.5 sec.

1.9.2 Metering:

- a) As per BOM Incoming/Outgoing feeders shall be provided with Digital Multifunction Meter/Voltmeter/Ammeter. Ammeter range will be same as CT primary rating.
- b) All above meter shall be Panel mounting type and digital, 96 mm² size for all feeders.
- c) Protective fuses/MCBs of 4 A rating associated with voltage measurement and protection shall be provided.

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1.9.3 Indication:

- A set of indicating lamps of reputed make like Siemens or Teknic showing breaker status (ON, OFF & TRIP) shall be provided with auxiliary contacts for remote monitoring.
- Visual indication within breaker panel for breaker Service/Test/Isolated position shall be provided for draw out ACBs.
- Protective fuses/MCBs of 4 A rating associated with all indicating lamps shall be provided.

1.10 ACCESSORIES:

All breaker panels shall be provided with following accessories -

- Motor-wound spring charged closing mechanism with motor suitable for 230V AC for ACB's
- Earth fault relay for all downstream MCCB outgoing feeders.
- U/V trip release suitable for 380V-400V AC for all incoming feeders.
- Closing release/coil suitable for 230 V AC for all ACBs.
- CTs of rating specified in BOM for all the feeders.
- PTs of rating specified in BOM for all incoming feeders.
- Auxiliary contacts - 4 NO + 4 NC for ACB and 2 NO + 2 NC for MCCB.
- Door Operating Mechanism with handle for MCCBs

1.11 EARTHING:

- A copper earth bus of size not less than 35 x 6 mm² continuously runs at the bottom of the panel shall be provided.
- The earth bus shall be robust and capable of carrying full short circuit current for 1 sec.
- Doors, covers and all non-current carrying metallic parts shall be earthed through flexible copper wires. This should also include instrument casing and cable armour, which should also be connected to the earth bus.
- The earth bus shall have provisions for terminals at each end for connecting to grid earthing.

1.12 BILL OF MATERIAL

LTP#22

Panel	Load	Circuit Breaker	CT Ratio (A/A)	PT Ratio (V/V)	Meters (Digital)	Protection
<u>LT Panel#22</u>	Incomer	4 Pole ACB, 4000A, 65 kA Isc.	4000/5	415/110	MFM: 0 - 4000 A, 0 - 500 V, f, kW, KVA,	50, 51, 50N, 51N

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Panel	Load	Circuit Breaker	CT Ratio (A/A)	PT Ratio (V/V)	Meters (Digital)	Protection
					PF	
	OG_F1:	3 Pole ACB, 1600A, 65 kA Isc.	1600/5		0 - 1600 A,	Overload, Short-Circuit and Earth Fault Protection
	O/G_F2:	3 Pole ACB, 800A, 65 kA Isc.	800/5		0 - 800 A	Overload, Short-Circuit and Earth Fault Protection
	O/G_F3:	3 Pole ACB, 800A, 65 kA Isc.	800/5		0 - 800 A	Overload, Short-Circuit and Earth Fault Protection
	O/G_F4:	3 Pole MCCB, 400A, 65 kA Isc.	400/5		0 - 400 A	Overload, Short-Circuit and Earth Fault Protection
	O/G_F5:	3 Pole MCCB, 400A, 65 kA Isc.	400/5		0 - 400 A	Overload, Short-Circuit and Earth Fault Protection
	O/G_F6:	3 Pole MCCB, 400A, 65 kA Isc.	400/5		0 - 400 A	Overload, Short-Circuit and Earth Fault Protection

General Description: Indoor, Floor mounted, draw-out type 415 V circuit breaker panel suitable for use on 415V $\pm 10\%$ 3 \emptyset 4 wire, 50 Hz System, fully conforming to the specifications and SLD, complete with main horizontal bus-bars of **4000 A, 65kA rating** and neutral of half the main bus rating with incoming feeder. Provision for top/bottom cable entry to be provided for incoming and outgoing feeders.

Accessories: 1 set of Lamps (Red, Green, Yellow) for CB ON/OFF/TRIP indication for each I/C and O/G Feeder; Shunt Trip Coil, Closing Coil for ACB; Auxiliary s/w 4 NO + 4 NC for ACB; Mechanical ON/OFF indicator and spring charge indicator; 1 no. space heater with s/w and thermostat for each vertical section; 1 no. cubicle lamp with s/w and fuse; independent DP s/w with HRC fuse/MCB for close and trip control supplies and DP s/w with HRC fuse/MCB for AC control Supply.

1.13 DRAWING:

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Detailed Power and Control circuit drawing along with fabrication drawings showing breaker arrangement and the overall size of bus bars, enclosure, fixing details, support, joints, etc. shall be submitted for approval of purchaser. The purchaser's comments/modification suggested shall be incorporated. Actual fabrication of the Panels shall be carried out only after the approval of the purchaser.

1.14 TESTS:

All routine tests shall be conducted, as per relevant IS standard specified.

1.15 UNLOADING AND STORAGE:

VENDOR has to take the complete responsibility of the unloading of the L.T. Circuit Breaker Panel at proper location at the site. The accessories shall be unloaded and store at vendor's responsibility at the site. Vendor will be fully responsible for timely unloading of equipment and accessories. IPR will not bear any expenses for the delay in unloading the equipment in the scope of this specification.

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	Rated peak short circuit current	2.5 times short ckt. Current
	Max. rise in temperature above ambient	55 °C
	Insulation	Heat shrinkable PVC sleeves
5	Terminal Connections :	as per BOM
	Incoming Feeders	By XLPE Cables
	Outgoing Feeders	By XLPE Cables
6	CT :	
	Type	Cast resin
	Ratio	as per BOM
	Accuracy Class :	
	a) Measuring core	1
	b) Protective core	5P
	Rated Burden :	
	a) Measuring core	10 VA
	b) Protective core	15 VA
	Accuracy limit factor :	
	a) Measuring core	1
	b) Protective core	10
	Short time current rating	of breaker rating with which it is associated as per BOM
	Rated insulation test voltage	2.5 kV
7	PT :	
	Type	Cast Resin
	Number of secondary	1 (One)
	Ratio	415 V / 110 V
	Accuracy class :	
	a) Measuring core	3
	Rated burden :	
	a) Measuring core	50 VA
	Voltage factor and rated time	1.2 continuous
	Rated insulation test voltage	2.5 kV
8	Accessories :	
	Under voltage relay	1) with Trip contacts required 2) Local /Remote
	Earth fault relay	1) with Trip contacts required 2) Local/Remote
	Shunt trip	1) with contacts required 2) Local/Remote
	Closing coil	1) with contacts required 2) Local/Remote
	Auxiliary contacts	4 NO + 4 NC – for ACB 2 NO + 2 NC – for MCCB

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	Visual indicating lamp	ON, OFF & TRIP -230V 1ph AC
	Ammeters and Voltmeter	as per BOQ digital type
	Current Transducer and Voltage Transducer	4-20 mA
	Door lock	1) with contacts required 2) Local/Remote
	Safety Shutter	1 no. for each ACB
	Space heater with s/w & thermostat	1 no. for each vertical section
9	Enclosure :	Cubical pattern, sheet steel, dust and vermin proof suitable for indoor installation with IP-52 degree of protection.
10	Clearances :	Various electrical clearances like phase to phase & phase to earth on poles, busbars, cable & busduct terminating boxes etc. shall be in accordance with applicable standards and Indian Electricity Rules.

2. SPECIFICATION FOR L. T. BUS DUCTS

2.1 SCOPE

This specification scope covers design, manufacture, inspection and testing at contractor's/his sub-contractor's works and installation and commissioning of one number of seven meter length of L.T. Bus Ducts as specified in this document for interconnection between indoor L.T. Switchgear & outdoor transformer.

2.2 CODES AND STANDARDS:

The design, material, construction, manufacture, inspection and testing of Bus Duct shall comply with all currently applicable statutes, regulations and safety codes in the locality where the equipment shall be installed. Indian Standard for L.T. Bus duct is IS-8623.

2.3 BILL OF MATERIAL:

Sr. No.	System	From	To	Rated Bus Duct Current	Approx. Length
no.				Amps	Meter
1.	Bus Duct	DT-13, Sec.	I/C-1, LTP- 21	4000	1 x 7

Bus Duct shall be designed in such a way to enable connection at the transformer end.

2.4 DESIGN FEATURES:

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1. The bus ducts are required for supplying power from the distribution transformers to the breaker panels.
2. The bus ducts shall be suitable for use in 415V earthed electrical system having maximum system voltage of 415 V +10%.
3. The construction of the bus duct shall be strong enough to take the load of busbars and withstand rated maximum fault level and rigorous adverse weather condition. Provision shall be made for expansion and contraction of enclosure due to temperature.
4. The bus bars shall fully insulated for 1-min. power frequency withstands voltage and heat shrinkable sleeves shall be used for protection and insulation.
5. The bus duct shall be suitable for continuous operation under site conditions indicated elsewhere with conductor temperature of 105 °C maximum. Also the conductor temperature during short time rating shall not exceed 250 °C. Bus duct shall be suitable for short time overloads.
6. The bus bar support shall be rigid for all thermal and electrodynamic stresses arising out of short circuit current for 3 sec.

2.5 CONSTRUCTION FEATURES:

2.5.1 Enclosure:

1. The bus duct enclosure shall be fabricated from (Cold Rolled Close Annealed) CRCA sheet steel material of gauge 14 SWG or better on a suitable angle iron framework.
2. The enclosure shall generally be of rectangular cross section. The size of the enclosure should be indicated clearly in the quotation.
3. The construction shall be dust and vermin proof and provision must be there to open any portion of the bus duct for inspection without disturbing the bus bars.
4. There should not be any through bolt in any section of the enclosure. Any joint of busbar enclosure should be provided with flange.
5. Where ever bus ducts pass through walls, the following provisions shall be made -
 - a) An opening shall be made for the required dimension in the **existing walls**, using an approved procedure.
 - b) A wall frame assembly should be provided together with all hardware required for fixing the bus duct to the wall.
 - c) A fire barrier should be provided to prevent the spread of fire/smoke through the bus duct enclosure.
 - d) The annular space between the bus duct enclosure & the wall opening should be properly sealed.
6. In order to take care of misalignments & tolerances in dimensions, Neoprene rubber bellows in the enclosure and flexible terminal interconnections should be provided at

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- (a) the termination of the bus duct on the switchgear as well as (b) at the termination of the bus duct on the transformer.
7. Filter type drain plug shall be provided at low point along with run of bus duct to drain out automatically any moisture condensing within the enclosure.
 8. Suitable Hot dip galvanized structural steel support shall be provided for the bus duct from ground level / wall bracket. The bidder should indicate clearly the details of support recommended by them.
 9. Outdoor bus duct between Distribution transformer and associated switchgear up to the partition wall should have a degree of protection of at least IP 56. All other indoor bus ducts can have degree of protection of at least IP 52.
 10. Painting : Painting of bus enclosure and supports shall be painted with 2 coats of epoxy base primer on which 2 coats of final epoxy paint of air craft grey shade as per IS:5 shade No. 631. Electrostatic epoxy powder coating is preferable.
 11. Earth bus of 50 x 10 mm copper should be provided for entire length of the bus duct. The same should be painted with bituminous paints and shall be fixed on the outside of duct. Suitable copper links shall be provided at the joints of bus duct. Earth bus at the point of wall entry should have suitable arrangement as approved by the purchaser.

2.5.2 Bus Bars:

1. The conductor shall be Electrolytic Copper bus bar with the current density of 1.6A/sq.mm. It shall comply the requirement of IS: 8130.
2. The bus bar should have rectangular section. The size of bus bar should be clearly indicated in the quotation.
3. Bus bar insulation as in case of L.T. Circuit Breaker Panel shall also be applicable for Bus ducts.
4. The bus bar should be supported on non-hygroscopic, anti-tracking high impact epoxy cast resin insulator on every 500-mm interval. The support should be supported on single iron structure provided for enclosure.
5. Bus bars shall be thoroughly cleaned before carrying out any straight through joints, expansion joint or flexible joint. The joints shall be bolted such that the initial contact pressure remains substantially undiminished at all temperature up to rated full load temperature. Sprint washer shall be provided at every bolted joint. The joints shall have very low resistance.
6. All flexible joints shall be of copper only. The bidder should indicate clearly the contact pressure of the joints. Bidder along with tender shall furnish the details of joints.
7. Silver plating of all bus bar joints shall be provided so that temperature rise of 55 °C over 50 °C ambient temperature can be allowed as per ANSI C37.20.
8. All bends required for the complete run of the bus bars or bus duct shall be included in the length of the bus duct.

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9. The following minimum clearance should be maintained throughout the length of the bus duct including joints and flexible expansion joints.
- i) Phase to Phase : 25 mm
 - ii) Phase to Neutral : 25 mm
 - iii) Bus bar to enclosure : 35mm

2.6 DRAWING:

Detailed layout and fabrication drawings showing the sizes of bus bars, enclosure, fixing details, supports, bends, joints, wall entry assembly etc. shall be submitted by the successful bidder for approval of Purchaser. The bidder shall incorporate purchaser's comments/modification suggested. Actual fabrication of the bus duct shall be carried out only after the approval of the purchaser.

2.7 TESTS:

1. Routine tests shall be conducted as per relevant IS standard specified.

TECHNICAL SPECIFICATION FOR BUS DUCTS

Sr. No.	Param	Data
1.	Application	Power Distribution
2.	Quantity	1 (one) no.
3.	Installation	Indoor
4.	Cooling	Air Natural
5.	Ambient conditions	As per Section - I
6.	No. of Phases	3 phase + neutral
7.	Method of grounding	Effective
8.	<u>Ratings :</u>	
	Rated normal continuous current	4000 A
	Rated Voltage & Frequency	415 V, 50 Hz
	Rated Insulation test voltage	2.5 kV (for 5 min.)
	Rated short circuit current	50 kA (for 1 sec.)
	Rated peak short circuit current	110 kA
9.	Max. conductor operating temperature at full rated current	105 °C
	Max. ambient temperature	50 °C

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11.	Clearances	Various electrical clearances like phase to earth and phase to phase etc. shall be in accordance with applicable standards and Indian Electricity Rules.
12.	Enclosure :	Cubical pattern, sheet steel, dust and vermin proof suitable for indoor installation with IP-52 & 56 for outdoor installation degree of protection.

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2.8 INSPECTION/TESTING

The vendor shall arrange all the testing facilities for below mentioned factory acceptance tests and inspection in presence of purchaser's representatives, at factory on his own cost.

The factory acceptance test reports shall be furnished to the purchaser for prior approval before dispatch of any equipment from the works and the approval in writing from the purchaser to affect the dispatch of the equipment.

The test reports shall be submitted completed with identification data including serial number of equipment.

The vendor should give at least two weeks advance notice of the date when the tests are to be carried out.

On L. T. Panels (on each panel):

Following Factory Acceptance Tests shall be carried out on the complete panel at factory:

- Physical inspection of LT Panel.
- Verification of BOM
- High Voltage Test at 2500 V for one minute.
- Insulation Resistance Test at 1000 V Megger.
- Continuity Test.

On Bus Ducts:

- High Voltage Test at 5000 V for one minute.
- Insulation Resistance Test at 1000 V Megger.

REFERENCE STANDARDS:

Sr. No.	Description	Standard No.
1.	L.T. Panels	IS - 8623
2.	ACB	IS - 13947 part 1 & 3
3.	MCCB	IS - 13947 part 2
4.	Current Transformer	IS - 2705
5.	Potential Transformer	IS - 3156
6.	Distribution Board	IS - 13032 / 8623
9.	Bus bars and bus bars connection	IS - 159
10.	Bus bar supporting insulators	IS - 2544

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2.9 INSTALLATION AND COMMISSIONING

The vendor shall be responsible for the site mobilization to install and commissioning of the L.T Circuit Breaker Panel and bus duct.

Fixing the panel at the desired location in the IPR is in the scope of the Vendor. This includes grouting, fixing bolts; foundation bolts etc. along with supply of required hardware for fixing of L.T. Panels. The Vendor shall take the approval of the Engineer-in-charge before the commencement of the work.

All the installation tools and commissioning spares are to be provided by Vendor. This includes crane of suitable capacity, trailer, megger (5 kV) and any other instruments or tools required during the erection and commissioning.

The installation work should be carried out immediately after receipt of intimation from IPR in that regard.

During commissioning the successful Vendor has to perform all the required operational tests mentioned in the scope.

Following acceptance tests should be carried out at site:

- Physical inspection of LT Panel.
- Insulation Resistance Test at 1000 V Megger.
- Phase Sequence Test.
- Continuity Test.
- Interlocks and Operation test

2.10 DRAWINGS, OPERATION/INSTRUCTION MANUALS:

1. Drawing shall be submitted to IPR for approval within one month after placement of the purchase order and before commencing the manufacture and construction. The drawing and data to be submitted after Purchase Order should include the following:
 - a) Assembly drawing of the switchgear showing plan, elevation and typical sectional views and locations of breaker compartment, cable terminations, busbar chamber, metering and relay compartment and terminal blocks for external wiring connections. Marshalling panel GA drawing showing the layout of the terminal block and cabling etc.
 - b) Schematic diagrams for control and protection of circuit breakers.
 - c) Foundation plan showing location of foundation channels, anchor bolts and anchors, floor plans and openings for cables/bus ducts etc.
Foundation plan showing location of foundation channels, anchor bolts and anchors, floor plans etc.
2. Along with the delivery of L.T. Circuit Breaker Panels and the Vendor shall supply operation/instruction manuals/catalogs for all the equipment, drawings of accessories and circuit diagram.
3. Three sets of final drawings shall be provided along with the delivery of the Panels.

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2.11 SCHEDULE OF DELIVERY

The following schedule has to be followed.

Sr.No.	Description	IPR Scope	Vendor's Scope	Time Schedule
1.	Issue of PO	✓		T_0 (in months)
2.	Submission of GA drawing, and QAP		✓	$T_1 = T_0 + 1$ months
3.	Approval of GA drawing, and QAP	✓		$T_2 = T_1 + 0.5$ month
4.	Manufacturing of LT Panel and Bus bar		✓	$T_3 = T_2 + 3$ months
5.	Factory Acceptance Test(FAT)		✓	$T_4 = T_3 + 0.5$ month
6.	Dispatch Clearance	✓		$T_5 = T_4 + 1$ month
7.	Delivery of LT Panel and Bus bar at site.		✓	$T_6 = T_5 + 1$ month
8.	Erection, Testing & commissioning of the above mentioned L.T. AC cubical pattern Circuit Breaker panel and LT Bus Duct at site		✓	$T_7 = T_6 + 3$ month

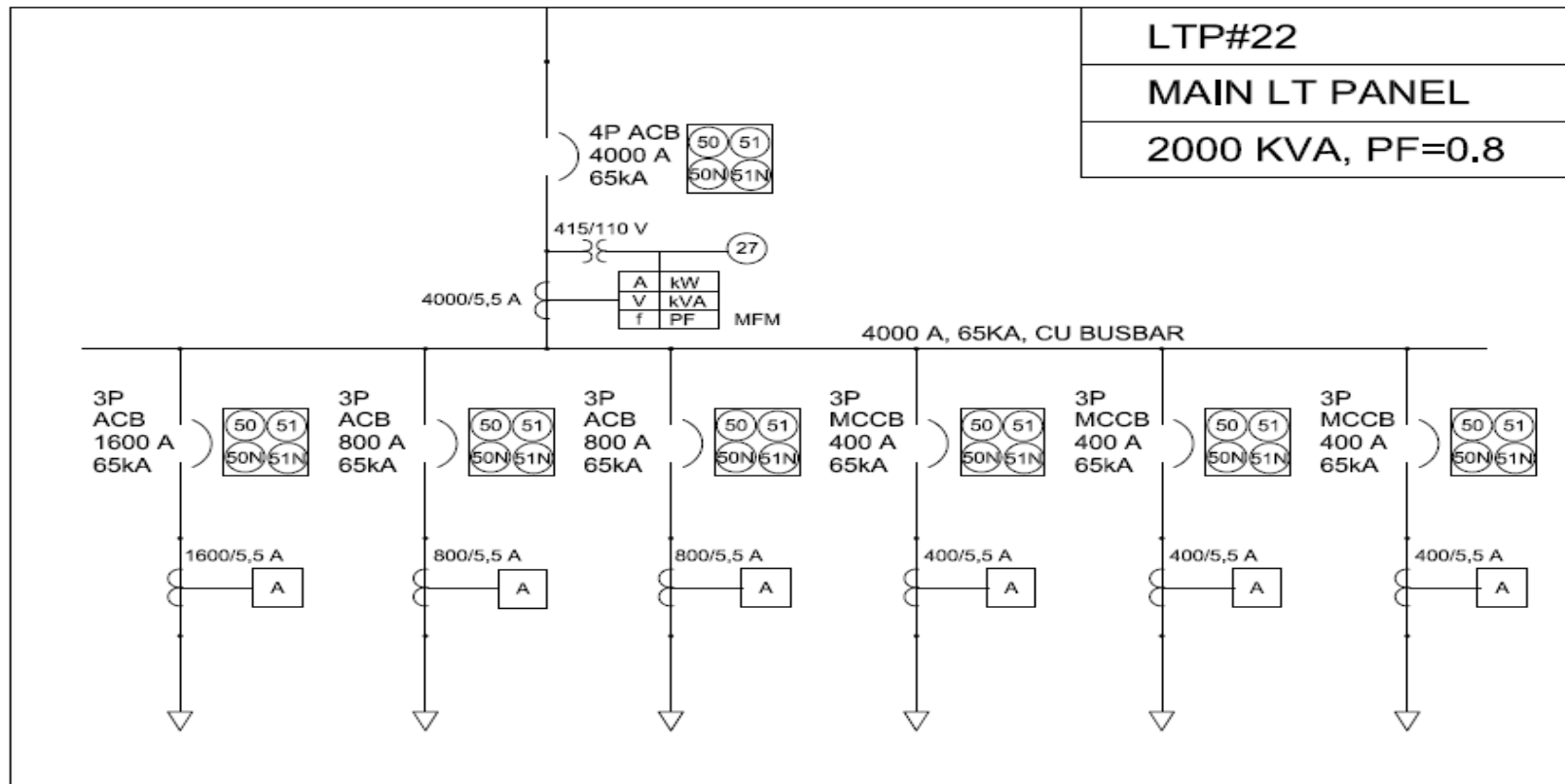
Important Notes :

1. Bidders are requested to complete the technical particulars in the data sheets enclosed and submit them with their offer.

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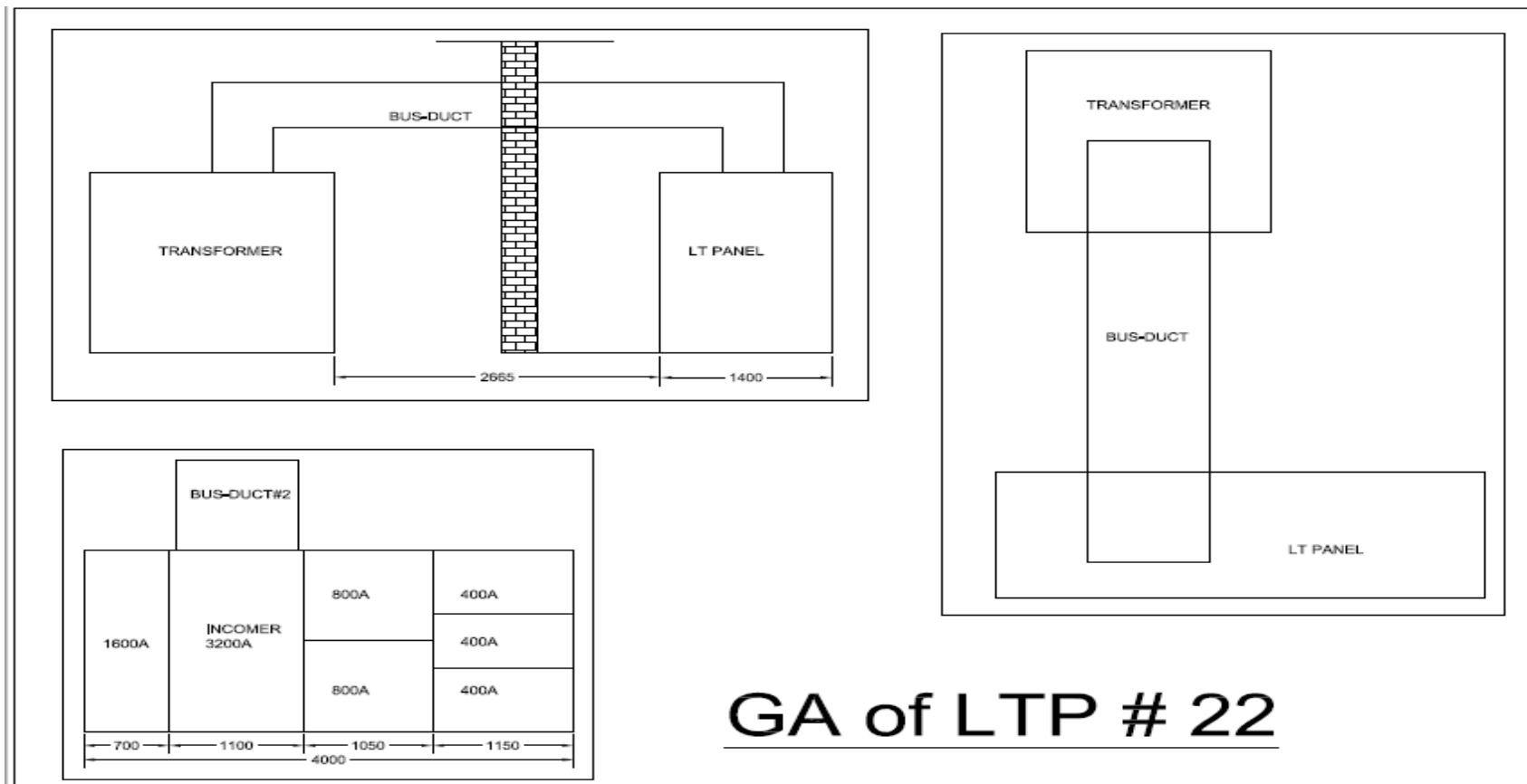
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SINGLE LINE DIAGRAM



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GA of LTP # 22



GA of LTP # 22

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A - TECHNICAL PARTICULARS TO BE SUBMITTED ALONGWITH THE TENDER

(Bidders are requested to complete the data sheets and submit the same with their bids)

L. T. CIRCUIT BREAKER PANELS

(Please fill the Data separately for individual type and size of breaker offered)

Sr. No.	Parameter Description	IPR Specifications	Data	
1.	<u>General :</u>			
	Name of the manufacturer	-		
	Manufacturer's type	-		
	Type of construction	Floor Mounted / Fixed Mounted		
	Suitable for indoor/outdoor application	Indoor		
	Design ambient temperature	max 47°C, average 35°C	°C	
	Meters (Voltmeter, Ammeter, MFM)	96x96 mm, Digital (Schneider/LT)	____ x ____mm	
	Indicating Lamps	LED type , 230 V AC Siemens, Teknic	Siemens/ Teknic / _____	
	Control wire size and make	1.5 sq. mm Cu; Finolex, Havells, Polycab etc	____sq. mm Cu / ____ Finolex/ Havells/ Polycab/ ____	
	Auxiliary Contactors/Push Buttons/TNC/Selector Switch	230 VAC L&T, Siemens, Schneider, ABB		
2.	<u>Breaker :</u>		<u>ACB</u>	<u>MCCB</u>
	Name of the Manufacturer	Schneider, L&T, ABB,		
	Number of Poles	As Per BOM		
	Rated Current	As Per BOM	A	A
	Rated Voltage	415 V		
	Frequency	50 Hz	Hz	Hz
	Rated insulation Voltage	1.0 kV(ACB) ≥690 V (MCCB)	V	V
	Rated impulse withstand Voltage	8 kV	kV	kV

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Sr. No.	Parameter Description	IPR Specifications		Data	
	Power frequency withstand Voltage	2.5 kV		kV	kV
	Rated short time withstand current for 1 sec.	50 kA (ACB) / 35kA (MCCB)		kA	kA
	Releases : Microprocessor / Static	Microprocessor (ACB) Static/Microprocessor (MCCB)			
	Operating Mechanism	Electrical Drawout type (ACB) Manual fixed type (MCCB) with Door Operating Mechanism			
	External protection relay provided If yes, List out indicating type, quantity, make, rating, settings etc.			YES / NO	YES / NO
	Protection available for			Enclose separate sheet	
	<ul style="list-style-type: none"> • Overload • Short circuit • Earth Fault 	YES YES YES	YES YES YES		
	Whether following contacts for remote monitoring of breaker provided -			YES / NO	YES / NO
	<ul style="list-style-type: none"> • Breaker Status Indication and No. Of Contacts • Contacts for Breaker Releases Operation No. of Contacts • Breaker Remote Operation and No. of Contacts 	Yes Yes Yes	Yes Yes No	YES / NO YES / NO YES / NO	YES / NO YES / NO YES / NO
3.	<u>Bus bar :</u>				
	Material& Size	Copper, size as per current density 1.6A/ sq. mm			
	Rated continuous current	As per BOM			A
	Rated short circuit withstand current	As per BOM			kA
	Rated peak short circuit	105 kA			kA

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Sr. No.	Parameter Description	IPR Specifications	Data
	withstand current		
	Temperature rise at rated current over design ambient temperature	55 °C	°C
	Insulation	Heat Shrinkable PVC Sleeves	
	Earth Bus: Material & size	35 x 6 sq. mm Copper	
4.	<u>Current Transformer :</u>		
	Make and type	AE / Kappa	
	Current ratio	As per BoM	A/A
	Insulation withstand level	2.5 kV	kV
	CT wiring	2.5 sq. mm Cu	
	CT terminals	Short link type	
5.	<u>Potential Transformer :</u>		
	Make and type	AE / Kappa	
	Voltage ratio	As per BoM	V/V
	Insulation withstand level	2.5 kV	kV
7.	<u>Enclosure :</u>		
	Suitable for indoor/outdoor application	Indoor	
	Thickness of sheet steel	2mm	mm
	Sheet metal cold rolled/hot rolled	CRCA	
	Degree of protection (as per IS:2147)	IP 52	
	Colour of finish paint : a) Outside b) Inside	RAL 7032	