TPS No.	**CDNPELEC2022-2**
STATUS	**ENQUIRY**
ORIGINATOR	**FACT CD ELECTRICAL**
PROJECT	**REPLACING OF 3.3 KV SWITCH BOARD IN CENTRAL SUBSTATION**
ITEM	**3.3KV SWITCHBOARD**
LOCATION	**CENTRAL SUBSTATION – FACT-CD**

CONTENTS

1. EQUIPMENT/ ITEMS TO BE SUPPLIED

Sl.No.	Description	Qty.
1	Design, manufacture, testing ,supply of 3.3kV 1500A 31.5KA LSC2B, PM, IAC AFLR Indoor Vacuum Circuit Breaker switchboard for central substation conforming to attached specifications/documents.	1 No
2	Supply of spares as per "Spares List".	1 set

2 SCOPE

2.1 This specification covers the requirements for design, manufacture, testing ,supply, Installation supervision and commissioning support of 3.3kV 1500A 31.5KA LSC2B, PM, IAC AFLR Indoor Switchgear and control gear fully type tested according to IS/IEC 62271-200 standards for industrial applications comprising of circuit breaker, isolators, bus bars, operating mechanism, CTs, VTs, meters, protective relays, auxiliary relays, pushbuttons, indicating lamps, wiring etc. designed to give reliable and continuous operation at the load rating specified in the data sheet/ single line diagram.

2.2 Arranging inspection and tests as per "Scope of Inspection & Tests" attached.

2.3 Supply of spares as per "Spares List"(as per clause 17.1).

2.4 Furnishing all data/documents as specified in TPS

2.5 Commissioning assistance for 3 Days(8 hour working time per day).

2.6 Installation supervision for 3 Days(8 hour working time per day).

3 STANDARDS

3.1 The switchgear shall be designed, manufactured, assembled and tested in accordance with the following standards:

Description	Reference Standards
High voltage switchgear	IS/IEC: 62271
Electrical relays	IS: 3231/IEC: 60255
Current transformer	IS: 2705/IEC: 60044
Potential transformer	IS: 3156/IEC: 60044
Degree of protection	IS: 3427 IEC: 60529

3.2 The design of the switchgear shall be exclusive and specific responsibility of supplier and shall comply with current good engineering practice and relevant codes.

4 GENERAL

4.1 The switchgear and control gear panels shall be fully arc proof LSC 2B, PM, IAC AFLR for 31.5kA for 1sec, free standing, floor mounting, flush fronted, withdraw able type, consisting of separate panels assembled into one or more sections to form a single structure with a common bus bar assembly.

4.2 The panels shall be constructed from prime quality folded and riveted Aluminium Zinc coated steel sheet or pre-galvanised sheets of 2 mm thickness. Only doors and end covers shall be painted/powder coated with shade as specified. All non-painted steel parts shall be zinc-plated or galvanized.

4.3 Loads needs to be feed from three different transformers simultaneously. Switch board shall have 2 separate sections as per SLD given in ANNEXURE IV.

4.4 Front access with hinged doors shall be available to all components in the cubicle which require adjustment, maintenance or replacement.

4.5 The functional unit outer enclosure shall have a degree of protection of IP4X.

4.6 All barriers used shall be manufactured from non-inflammable material. All hardware shall be corrosion resistant. Doors & openings shall be provided with neoprene gaskets.

4.7 Adequate lifting facilities shall be provided on each section. Lifting eyes may be of removable/foldable design. When removed, these shall not leave any openings on the boards.

4.8 Access between the circuit breaker (or withdraw-able voltage transformer) and bus bar/ cable compartments shall be made through epoxy encapsulated spout bushings of uniform shape and dimension. Spouts are covered by automatic metal shutters, covering all three phases unless the circuit breaker is in service position.

4.9 An arrangement in which the panel door is integral with the circuit breaker truck is not acceptable.

4.10 Cable head compartment of the CB shall be so designed to receive, in addition to cable incoming/ outgoings, wound or bar primary current transformers etc.

4.11 Suitable arc propagation barriers shall be provided between the panels. Independent pressure release flaps shall preferably be provided for different compartments.

4.12 The bus bar system shall be air insulated and housed in a separate compartment and shall be accessible for inspection only with special tools. In the bus bar compartment of the CB, the triple pole bus bars shall be arranged on supports like epoxy resin, to provide long air insulation distance and creepage path.

4.13 The bus bar compartment shall be provided with bolted covers. Necessary extra precaution like additional covers, caution signs etc. shall be provided to prevent inadvertent contact with live busbars.

4.14 Low voltage compartment shall be fitted with all protection relays, auxiliary relays, instruments etc. It shall be mounted on top side of the front compartment receiving the movable section of the CB.

4.15 All relays and meters mounted on this compartment shall be flush type and different items shall be logically laid out on the front of this compartment. Relays which require adjustment, resetting shall be mounted at reasonable operating height from the floor level. Max. operating height shall be 1900 mm and min. 400 mm from the floor level.

5 CIRCUIT BREAKER

5.1 The circuit breaker shall be of suitable type and rating as mentioned in the data sheet and suitable for indoor use. The CB shall be of three pole, horizontal drawout, low surge, roll on the floor type . The breaking medium of circuit breaker contactor shall be vacuum.

5.2 The circuit breaker shall be designed so as to have class E2 (circuit breaker with extended electrical endurance), class M2 (circuit breaker with extended mechanical endurance, mechanically type tested for 10,000 cycles)and class C2 (very low probability of restrike), as defined by IEC 62271-100.The offered circuit breaker should have valid type tests to support mentioned duty class.

5.3 Breakers of same rating shall be interchangeable. Wiring and termination of plug in contacts shall be identical in all interchangeable breaker.

5.4 Vacuum interrupters of the circuit breakers shall not be openly exposed design and shall be completely encapsulated in epoxy housing.

5.5 A minimum of 3 sets (NO&NC)of auxiliary contacts each are to be provided on breaker operating mechanism as spare, exclusively for the use of purchaser. Multiplication shall be done only mechanically. All auxiliary contacts shall be wired to the terminal block. Auxiliary contacts and limit switches shall be in dust tight enclosures.

5.6 Circuit breaker shall be provided with electrically operated motor charged spring closing mechanism.

5.7 In motor charged spring closing mechanism, the charging of the closing spring shall be automatically initiated after every closing operation. It shall be ensured that the closing operation shall be possible only when the springs are fully charged. Suitable protection circuit, limit switches, etc. shall be provided for protection of the spring charging motor and to cut out the motor when the springs are fully charged.

5.8 Irrespective of the mode of operation of the breaker, independent manual closing arrangements shall also be provided as a standard feature, for emergency and testing purposes. Necessary operating handles shall also be supplied.

5.9 Closing and tripping devices for both electrical and mechanical arrangements shall be provided & shall be located in the front of CB.

5.10 A mechanical interlock shall be provided for preventing any inadvertent, undesired operation. For instance, closing the breaker when the springs are being charge.

5.11 Anti pumping relay & circuitry / anti pumping feature shall be provided in the closing circuit of the CB to ensure that it does not reclose automatically after a tripping or in the case of failure to close, even if the closing impulse is maintained.

5.12 The control circuit shall be suitable for local as well as remote control. Each control circuit tapping shall be provided with fuses/MCB.

5.13 The control and other auxiliary connections from the CB to the cubicle shall be through plugs and sockets, rated for 10A (minimum) / 650 V, located at either ends and connected through flexible jumpers. The jumper shall have sufficient number of spare cores to utilize all the spare auxiliary contacts and it shall be long enough to maintain connection in the test position of the truck. The multi pin plug provided shall have scraping earth terminal.

5.14 There shall be three distinct positions for circuit breaker, viz. "service position", "test position" and "isolated position" and these positions shall be clearly marked and provided with mechanical stops at each position. Circuit breaker shall be electrically and mechanically trip free in all positions. The "test position" shall have locking device. Fully racked in, racked out, and isolated positions shall also be clearly marked.

5.15 An automatic visual indication shall be provided to indicate "spring charged" / "discharged" positions, in the case of circuit breaker with spring charging mechanism.

5.16 Red / Green / Amber / Clear indicating lamps shall be provided for ON /OFF / TRIPPED ON FAULT / BREAKER READY FOR ON indications respectively. Blue lamps shall be provided in the case of non trip alarms and DC failure alarms. A White lamp and test button shall also be provided for 'TRIP CIRCUIT HEALTHY' indication. Indication circuit shall be through separate contacts only. For remote operation, remote indication facilities shall be provided in the CB panel ,if specified in the data sheet.

5.17 It shall not be possible to close the circuit breaker unless it is fully "plugged in" (truck in service position) or fully isolated (truck in the test position) or has been completely removed from the cubicle.

5.18 Interlock shall be provided to prevent pushing in/ drawing out of the breaker truck when the breaker is in the closed position.

5.19 The above positive mechanical interlocks are the minimum requirements. Manufacturers can include any other safety interlocks which maybe necessitated by the particular design feature of the CB.

5.20 Since vacuum circuit breakers are used suitable surge suppressors need to be installed on all motor feeders , outgoing feeders and spare

6 BUS BARS

6.1 Busbar shall conform to Standards mentioned in clause 3.1 .All phase bus bars shall be of uniform cross-section through out the switchboard.

6.2 Bus bars shall be of high conductivity aluminium/ copper as specified in the data sheet. Busbars shall be continuously rated for the rated current and service conditions specified. Busbars shall be provided with heat shrinkable PVC insulated sleeves and busbar joints shall be shrouded.

6.3 The horizontal and vertical bus bars shall be rated for the same fault level specified in the data sheet.

6.4 It shall be possible to extend the busbars on either side without any further fabrication/modification on the existing busbars. Removable end covers with fixed nut & bolting arrangement shall be provided on either end and the ends of the bus bars shall be suitably drilled.

6.5 Appropriate identification marking / labels shall be provided on the busbars and tapings for distinguishing the various phases.

7 INSTRUMENT TRANSFORMERS

7.1 CURRENT TRANSFORMER

7.1.1 CTs shall conform to Standards mentioned in clause 3.1 and shall be cast resin insulated. They shall be mounted on switchgear stationary part.

7.1.2 CTs shall withstand the short circuit current specified for switchgear and it shall be designed to withstand stresses resulting from the maximum short circuit currents.

7.1.4 CTs for metering purposes shall have adequate capacity to cater for 130% of full load conditions. Instrument security factor for metering CTs shall not be more than 5 and shall have an accuracy class of 1, unless otherwise specified.

7.1.5 CTs for protection purposes shall have sufficient accuracy, burden and accuracy limit factor for necessary co-ordination/discrimination for clearing the faults. Accuracy limit factor for protection shall not be less than 10 and accuracy class shall be 5P.CT's for differential protection shall have an accuracy class of 5PS.

7.1.6 Separate CTs/cores shall be used for metering and protection. Dual purpose CTs are not acceptable

7.1.7 CTs shall be provided with polarity markings, adjacent to terminals, both for primary and secondary. These shall be legible even after years of service.

7.1.8 CTs shall be provided with insulation class as indicated in the data sheet.

7.1.9 Unused CT terminals must be short circuited

7.1.10 The CT terminals which have been used shall be provided with links to facilitate shorting as and when required (when load / burden on CT is disconnected.)

7.1.11 All live terminals shall be shrouded to prevent accidental contact.

7.2.0 VOLTAGE TRANSFORMER

7.2.1 VTs shall conform to Standards mentioned in clause 3.1 and shall be cast resin insulated.

7.2.2 VTs shall have suitable accuracy and capacity for the satisfactory operation of the protection, instrumentation and metering specified in the data sheet / drawings enclosed.

The class of accuracy and the burden of VTs selected shall be adequate for the destined different purposes.

7.2.3 Voltage transformer shall be of fully draw out type and shall be provided with HRC fuses on both HV & LV sides. The draw out mechanism shall disconnect the bus bars and shall earth the VT primary and secondary terminals. The primary connection shall be disconnected before the VT or its primary fuses become accessible.

7.2.4 The primary rated voltage shall be equal to the rated voltage of the system and unless other-wise specified, secondary voltage shall be110V.

8 RELAYS

8.1 The Digital Protective Relay shall be a per clause 3.1.

8.2 Relays shall be flush mounted and of a type and make approved by the buyer. List of acceptable makes is indicated in the data sheet.

8.4 There shall be provision for latched trip to restrict accidental closing of CB after a trip .

8.5 Relay shall have suitable minimum 2 line LCD display with backlight and sufficient number of input so that all electrical control interlocks can be fulfilled by numerical relay. Relay shall have the provision for custom alarm message based on logics created using Programmable relay inputs.

8.7 Protection relays shall be suitable for the CT/ VT secondary currents/voltages and other auxiliary relays shall be rated for the auxiliary voltage available.

8.8 Protection relays shall be back connected, suitable for flush mounting and fitted with dust tight covers.

8.9 Provisions shall be made in the switchgear cubicles for testing and calibrating the relay by current injection using external source, without disconnecting the permanent wiring.

8.10 Non-protective relays can be in fixed execution.

8.11 All the relays shall have minimum 2 nos. of spare programmable output relay.

8.12 All Protective relays shall connected and programmed by PC with windows10 or higher with USB cable(vendor needs to supply 2 number of USB cable for this purpose). They shall follow IEC standard tripping curves.

8.13 The relay shall be communicable on standard Modbus protocol with at least one communication Port for SCADA connection. The relay should offer multi-level password protection to guard against unauthorized access.

8.14 Relay output shall be programmable with basic logical operation and provision for using any input to derive output and there shall be provision for inverting input/output. Minimum 1 output shall be kept free for future use.

8.15 All the relevant input shall be taken to Numerical relay like process interlock ,Trip, breaker

status etc. ,There shall be provision for recording at least 25 numbers of input & alarm events with time stamp and 25 number of fault details with time stamp .All the external inputs from field taken as input to numerical relay shall be through suitable interfacing relay.

8.16 Numerical relays shall have suitable navigation and operation keys to set/edit all parameters without using computer

9 INDICATING INSTRUMENTS

9.1 Meters shall be flush mounted and of a type and make approved by the buyer.

9.2 Meters shall be of reputed make and shall conform to relevant Indian Standards.

9.3 Voltmeter shall be moving iron type complete with suitable selector switch and control fuses and it shall be of class 1 accuracy as per IS:1248. Voltmeter shall have initial suppressed scale for the lower values in the range.

9.4 Ammeter shall be of moving iron type complete with selector switch. Ammeters for motor feeders shall have uniform scale up to rated full load current and suppressed scale at the end to indicate the motor starting current. A red mark shall be provided on the ammeter dial to indicate rated full load. Calibration of the ammeter shall tally with the ratio of the CT. Ammeters shall be of Class 1.5 accuracy as per IS:1248, unless other-wise specified.

9.5 Multi-function meter shall be operated through CTs and VTs only. The rating shall correspond to full load requirements.

9.6 Cushion stoppers and zero correction screws shall be provided for all meters. Meters shall have knife edge pointer and preferably with anti parallax mirror.

9.7 All meters shall be square type of size 96 mm x96 mm. unless otherwise specified. Dials shall be white with black numerals and letters.

9.8 All control / selector switches used shall be of rotary type, spring loaded and of robust construction. The operating handle of these switches shall be knob type and of black colour. The switches shall have 3 way with OFF position. Necessary facia plates shall be black anodized aluminium with white lettering.

9.9 Digital type meters shall be provided wherever specified in the data sheet.

9.10 All auxiliary equipment such as shunts, transducer, etc., as required, shall be included in the supply of switchboard.

10 ANTICONDENSATION HEATER

10.1 Space heater shall be provided in the CB panel. It shall be of adequate capacity and rated for the auxiliary supply specified in the data sheet.

10.2 Necessary ON / OFF isolator, HRC protection fuses & link and thermostat shall be provided for the heater.

10.3 Heater shall be provided inside the panel in easily accessible position for removal / replacement.

10.4 Wiring of space heater shall be isolated or separately bundled from other internal wiring.

11 ANNUNCIATION SCHEMES FOR TRIP, NON-TRIP & DC FAILURE ALARMS

11.1 Separate visual and audible annunciation scheme shall be available for;

a) Automatic tripping on fault conditions

b) D.C. failure condition

c) Non-trip alarm conditions

11.2 Common facilities and accessories for the trip & non trip annunciation scheme & DC failure annunciation scheme like flasher relay, hooter, buzzer, push buttons, etc, shall be mounted on the bus coupler panel. Alarm operation and cancellation relays for trip annunciation scheme shall be mounted on the respective panels. The trip annunciation schemes shall be rated for D.C. auxiliary supply indicated in the data sheet covering the switchboard.

11.3 In the event of a fault in any one of the feeders, the relay sensing the fault shall cause actuation of the flag indication and initiate trip or non-trip annunciation scheme in that panel in addition to initiating the tripping(in case of trip condition) of the circuit breaker concerned. The amber lamp provided on the panel starts flashing on the flasher bus (derived from flasher relay) and the common hooter starts sounding. When the alarm accept PB is pressed the hooter shall stop and the amber lamp shall glow steady. After resetting the contacts on the protective relay which initiated the alarm, the alarm scheme can be reset by pressing the reset. Now the amber lamp, which was glowing steady till then, shall be turned off.

11.4 The annunciation scheme shall be repetitive and shall be ready to receive and initiate systematically a second or third fault, irrespective of whether the alarm due to first or second fault in other panels is in 'initiated' or 'accepted' or 'relay reset' condition prior to fully resetting of the annunciation scheme.

11.5 It shall be possible to check the healthiness of all amber lamps by pressing the lamp test PB.

11.6 Necessary interlock shall be provided to prevent closing of the circuit breaker before resetting the alarm in numerical relay.

11.7 For DC failure, DC under voltage relay shall sense the DC failure and shall initiate the flag indication and the DC failure annunciation scheme .The indicating lamp comes ON and the buzzer is initiated. On pressing the 'accept' Push button, the audible alarm shall stop. When DC is restored, the scheme shall automatically reset.

11.8 The DC failure sensing relay shall have hand reset flag indication.

11.9 It shall be possible to test the whole DC failure scheme. A push button shall be provided in the sensing relay circuit to simulate DC failure and test the scheme.

12 CABLE TERMINATION

12.1 Identification / numbering / lettering shall be provided for each terminal.

12.2 Not more than one incoming / outgoing cable is to be connected per terminal.

12.3 Minimum 20% spare terminals shall be provided on each terminal block.

12.4 Shorting links shall be provided for all CT terminals.

12.5 Conductors shall be terminated with adequately sized tinned copper lugs for connection to equipment terminals and strips. Stranded conductors shall be soldered at the ends before connections are made to the terminals.

12.6 Terminal strip for outgoing control cable connections shall be accessible to facilitate working and testing with breaker in test / service condition and while the switchboard is energized.

13 WIRING

13.1 Control and power wiring shall be kept separate.

13.2 All wiring for controls shall in general be carried out with copper conductor of size not less than 2.5 sqmm.

13.3 The wiring shall be of suitable grade and shall have flame resisting insulation. The insulation grade shall be 1100V / 650V min.

13.4 Wiring shall be terminated in easily accessible terminal blocks.

13.5 The wires shall be arranged neatly and the two ends of each wire and the terminal blocks shall bear the circuit number by using printed ferrules for identification purposes.

13.6 Control wiring wherever terminated shall be in single layer formation.

13.7 All inter panel control wiring shall be taken through PVC sleeves and this shall be done by the switchgear manufacturer with identification of wires and terminals for interconnection.

13.8 Whenever a VT is mounted on the breaker carriage, all auxiliary wiring shall be done in conduits.

13.9 All spare contacts of aux. relays, timers, etc. shall be wired up to the terminal block.

14 EARTHING

14.1 Earthing arrangement shall be in accordance with relevant Indian Standards.

14.2 Continuous earthing strips shall be provided for the complete length of the switch board. Strips shall be connected to the body of the switchboard by means of integral bolts, spring washers and nuts.

14.3 Earthing terminals shall be provided on the trucks to earth the body of the truck when pushed into the cubicle.

14.4 A minimum of 2 terminals shall be provided on the strip for external connections to earth grid.

14.6 All doors and movable parts shall be connected to earth bus with flexible copper connection.

14.7 All non-current carrying metallic parts of the equipment shall be earthed.

14.8 Earth bus shall be extended up to each cable compartment and earthing bolts shall be provided to ground cable armours.

15 PAINTING AND LABELLING

15.1 The sheet steel housing and all the metal surfaces shall be properly painted as per relevant Indian standards suitable for corrosive environment. Non-painted steel parts shall be zinc-plated or galvanized.

15.2 All panels shall have, on the front and the rear sides, nameplates in large sized letters, giving feeder details.

15.3 Painted SLD shall be provided on all the panels of the switchboard.

15.4 Special warning plates shall be provided on all removable covers or doors giving access to high voltage cables / bus bars and inside the switchboard also wherever considered necessary.

15.5 Nameplates shall be fastened by "screws" and not by adhesives.

15.6 Name plates shall be provided for each equipment, such as lamps, PBs, switches, relays, aux. contactors etc., mounted on the switchboard, indicating the operation / function

16 FOUNDATION BOLTS

16.1 Necessary foundation channels (if not integral),bolts and nuts shall be supplied along with the equipment.

17 EARTHING TRUCK

17.1 One number Earthing Truck shall be supplied for each type of section. The Earthing truck shall be fully draw out type, complete with necessary earthing links to facilitate earthing on the cable side. Locking facility shall be available. Earthing links shall be of size to withstand the fault current specified in the single line diagram/data sheet.

17.2 The earthling switch shall have full making capacity in accordance with IS/IEC standard 62271.

18 SPARE & SPECIAL TOOLS

18.1 Spare parts(as per spare part list given below) and special tools recommended for keeping in stock for trouble free operation of CB panel for a minimum period of 2 years shall be supplied. List and catalogue numbers of these spare parts shall also be furnished.

Spare List	Qty
VCB with trolley 1250A capacity	1
VCB with trolley 2000A capacity	1
VCB with trolley 630A capacity	1
Tripping coil for each type of breaker	1 of each kind
Closing coil for each type of breaker	1 of each kind
spring charging motor for each type of breaker	1 of each kind
Bus support insulator (each type)	4 of each kind
Every type of numerical relay used in Panel	1 of each kind
Surge suppressor	3 No of each kind

19 DRAWINGS & DOCUMENT REQUIREMENT

19.1 Duly filled in Technical particulars , compliance statement and un priced copy of price bid of the quoted panel in the format given in 'Annexure I,II & III' ,type test certificate as per IS/IEC 62271 for the quoted panel issued to the vendor , Bill of material for complete switchgear and complete details shall be submitted along with offer .After commitment all the detailed engineering drawings, schemes and control drawings shall be submitted for FACT CD's approval . Final as built drawings and all standard documents(like maintenance and user manuals of complete switchgear and components) shall be supplied along with panel.

20 INSPECTION & TESTS

20.1 Vendor needs to conduct and submit report for all routine test as per relevant Indian/IEC standards and needs to arrange inspection of panel and provision for witnessing tests demanded (as per IS/IEC standard) by FACT CD electrical department. Vendor needs to submit Copy of type test certificates/reports of quoted panel having same voltage level and current capacity issued to vendor along with tender documents and along with panel.

Below listed routine test shall be performed as final acceptance tests before the delivery of cubicles:

- Withstand voltage at power frequency
- Withstand voltage on the auxiliary circuits
- Operation of functional locks, interlocks, signalling devices and auxiliary devices
- Suitability and correct operation of protections, control instruments and electrical connections of the circuit breaker operating mechanism
- Measurement of the resistance of the main circuit
- Verification of wiring

21 APPROVED MAKE

21.1 VCB PANEL

SIEMENS

SCHNEIDER ELECTRIC

ABB

L & T

CROMPTON

21.2 PROTECTIVE RELAYS (NUMERICAL)

ALSTOM/AREVA

ABB

SIEMENS

SCHNEIDER ELECTRIC

GE

L & T

CROMPTON

21.2 INSTRUMENT TRANSFORMERS

OEM's own make or instrument transformers from below mentioned manufactures.

AUTOMATIC ELECTRIC

PRAGATHI

SILKANS

SIEMENS

ALSTOM /AREVA

ABB

ECS

INTRANS

KAPPA

SCHNEIDER ELECTRIC

22 DATA SHEET

1	GENERAL DATA	
1.1	Altitude	3000mm above mean sea level
	Humidity design	100% at 40^0C
	Ambient temperature Design	45^0C
	Environment	Highly corrosive industrial area, Presence of SO2 and other corrosive gases and chemical dusts, which can form conductive tracks.
1.2	Rating details	
	a) Voltage	3.3kV (+/-) 10%
	b) short-duration power-frequency withstand voltage	28
	c) lightning impulse withstand voltage	75
	b) No. of phases /wires	3 phase 3 wire
	c) Frequency	50 Hz (+/-) 5%
	d)Internal arc classification	31.5 KA for 1 sec
	d) Rated short-time withstand current and duration	31.5 KA for 3sec
	e) Neutral earthing	Solid
	f) Continuous rated current of bus	Power bus 1500A
1.3	Location	Indoor
1.4	Enclosure	IP4X
1.4	a) Type of Circuit breaker	Vacuum CB
1.5	Breaker closing	Motor charged spring closing
1.6	DC auxiliary supply voltage	110V DC for shunt trip coil, closing coil, indication lamps,etc.
1.7	AC aux supply voltage	240V AC for panel anti condensation heater and spring charging motor supply
1.8	VT secondary voltage (Phase to phase)	110V AC
1.9	Bus bars-material	Insulated aluminium/copper, Bus bars shall be insulated with heat shrinkable sleeves rated for phase voltage and joints shall be shrouded.
1.10	Earth bus – size & material	As per relevant IS/IEC standard
1.11	Mimic SLD diagram on panel	Required
1.12	Current transformers	
	a) Metering CT- 10 VA Accuracy Instrument security factor	0.5

	b) Protection CT- Accuracy limit factor	5 P 10 for numerical relay (over current & earth fault protection)5PS for differential protection
	c) Insulation Class	E
1.13	Ammeter – accuracy class	1.5
1.14	Push button contacts	As required
1.15	Type of relays	Numerical relays with Modbus port for SCADA interfacing
1.16	Size of indication instruments	As per standard.
1.17	a) Cable termination kits, glands etc.	Not Required. Hardware's for cable termination shall be provided except glands lugs and termination kits
1.18	Trip annunciation scheme	Required
1.19	DC failure annunciation scheme	Required
1.20	Non trip annunciation scheme	Required
1.21	Earthing truck - Required	
	a) Quantity	1 no.
	b) Connection	Cable side
	c) Audio visual indication	required
1.22	Painting	Anticorrosive epoxy based powder coating where aluminium zinc or GI not used
1.23	Interlocks	Required
1.24	Cable entry	Bottom

2	COMPONENT DETAILS-FEEDER WISE (Refer SLD)					
2.1	**Type of feeder**	**Incomer**	**Bus coupler**	**Motor Feeder**	**Outgoing Feeder**	**Spare**
2.2	**No. of feeders (breakers)**	5	2	16	9	2
2.3	**Current Transformers**					
	a) for metering &remote ammeter (1A secondary) 3 Nos.	Reqd.		Reqd.	Reqd.	Reqd.
	b) for O / C & E / F protection 3 Nos.	Reqd.		Reqd.	Reqd.	Reqd.
	c)for Differential protection 3 Nos.	Reqd.				
2.4	**Voltage transformers**					
	a) on cable side (Draw out dry cast Line VT)	Reqd.		-		-
2.5	**Lamps (All Indication lamps shall be 110volts, LED's)**					

		Incomer	Bus coupler	Motor Feeder	Outgoing Feeder	Spare
	a) Breaker ON (Red),	Reqd.	Reqd.	Reqd.	Reqd.	Reqd.
	b) Breaker OFF (Green)	Reqd.	Reqd.	Reqd.	Reqd.	Reqd.
	c) Breaker auto trip (Amber)	Reqd.	Reqd.	Reqd.	Reqd.	Reqd.
	d) Breaker ready for on (Clear)	Reqd.	Reqd.	Reqd.	Reqd.	Reqd.
	g) DC failure (Blue)	Reqd.	Reqd.	Reqd.	Reqd.	Reqd.
	h) Trip alarm()	Reqd.	Reqd.	Reqd.	Reqd.	Reqd.
	I) Non trip alarm(White)			Reqd.		Reqd.
2.6	**Meters**					
	a) Volt meter (analog type)	Reqd.		Reqd.	Reqd.	Reqd.
	a) Ammeter (analog type)	Reqd.		Reqd.	Reqd.	Reqd.
	b) Numerical meter measuring current, voltage, kW, KWh, kVA, kVAr, frequency, pf etc -Required.	Digital energy meter which shall display current, voltage, power, pf and energy consumption (Meters should have atleast 3 line parameter display of all three phases in single screen, and also communicate with SCADA via modbus interface.				
2.7	Surge suppressor	-	-	Reqd	Reqd	Reqd
2.8	**Protective relays – composite numerical relays**					
	a) Numerical / microprocessor based relay for total protection and control of medium voltage motors with serial, USB ports and multiple protocols for SCADA connectivity. The relay should have LCD display, fault/alarm indication and keyboard for setting parameters or to scroll through different functions etc.. The relay should have programmable I/O contacts. It should have protection features such as Overcurrent,undercurrent, current unbalance, acceleration time, Thermal/stall protection, Breaker failure/welded contactor, ground fault, short circuit, mechanical jam, Neutral OC, negative seq. OC, Phase OV, Starts per hour & time b/w starts, restart block, thermal inhibit,trip circuit supervision , lock out, UV trip, transient waveform analysis etc.			Reqd		Reqd

		Incomer	Bus coupler	Motor Feeder	Outgoing Feeder	Spare
	b) Numerical / microprocessor based feeder protection relay with serial, USB ports and multiple protocols for SCADA connectivity. The relay should have LCD display, fault/alarm indication and keyboard for setting parameters o. to scroll through different functions etc. The relay should have programmable I/O contacts. It should have protection features such as undercurrent, current unbalance, trip circuit supervision, ground fault, short circuit, Neutral OC, negative seq. OC, etc.	Reqd			Reqd.	
2.8	**Aux. Relays**					
	a) Common Trip alarm (for incoming & Outgoing)	Reqd.		Reqd.	Reqd.	Reqd.
	b) Process interlock trip / Remote Stop (Normally Energised should provide suitable interfacing relay)	-		Reqd.	-	Reqd.
	c) Starting interlock	-		Reqd.	-	Reqd.
	d) PT selection scheme		Reqd.			
	e) Ready for start Interfacing relay			Reqd.		Reqd.
2.9	**Control switches and PBs**					
	a) Breaker Trip- Neutral-Close switch "ODC	Reqd.	Reqd.	Reqd.	Reqd.	Reqd.
	b) 3 way & OFF ammeter selector switch	Reqd.		Reqd.	Reqd.	Reqd.
	c) 3 way & OFF volt meter selector switch	Reqd.		Reqd.	Reqd.	Reqd.
	d) MCB & Thermostat for panel anticondensation heater	Reqd.	Reqd.	Reqd.	Reqd.	Reqd.
	e) MCB for Spring charging motor	Reqd.	Reqd.	Reqd.	Reqd.	Reqd.
	f) Trip circuit healthy checking by numerical relay	Reqd.		Reqd.	Reqd.	Reqd.

		Incomer	Bus coupler	Motor Feeder	Outgoing Feeder	Spare
	g) Local / remote selector switch (Lockable)			Reqd.		Reqd.
	h) Control switch fuse / MCB for motor anti- condensation heater			Reqd.		Reqd.
2.10	**Other items**					
	a) Breaker operation counter	Reqd.	Reqd.	Reqd.	Reqd.	Reqd.
	b) Panel anti – condensation heater	Reqd.	Reqd.	Reqd.	Reqd.	Reqd.
	c) Interlocks	Reqd.	Reqd.	Reqd.	Reqd.	Reqd.
	d) Test & Service position limit switches	Reqd.	Reqd.	Reqd.	Reqd.	Reqd.
2.11	**Wiring and terminals for**					
	a) Remote control trip PB			Reqd.		Reqd.
	b) Remote control close PB			Reqd.		Reqd.
	c) Remote ON indication			Reqd.		Reqd.
	d) Remote OFF indication			Reqd.		Reqd.
	e) Remote trip indication			Reqd.		Reqd.
	f) Remote ready for ON indication (volt free contact)			Reqd.		Reqd.
	h) Remote ammeter & CT shorting links			Reqd.		Reqd.
	i) AC supply to remote heater equipment	-		Reqd.		Reqd.
	j) Spare breaker NO & NC contacts (3Nos, each)	Reqd.	Reqd.	Reqd.	Reqd.	Reqd.
	k) Inter trip–send & receive	Reqd.		-	-	-
	n) Receive process interlock, starting interlock, etc.	-		Reqd.	-	Reqd.

3	COMPONENT DETAILS – COMMON TO SWITCH BOARD	
3.1	Relay for PT selection scheme	Reqd.
3.2	Control switch fuse / MCB for AC aux. Supply	Reqd.
3.3	Control switch fuse / MCB for DC aux. Supply	Reqd.
3.4	DC ON lamp (red) & DC failure lamp	Reqd.
3.5	DC ON lamp (red) & DC failure lamp	Reqd.
3.6	DC fail sensing relay	Reqd.
3.7	DC fail aux. Relay	Reqd.

3.8	Flasher relay	Reqd.
3.9	PB for accept – Trip alarm	Reqd.
3.10	PB for reset – Trip alarm	Reqd.
3.11	PB for auto trip lamp test	Reqd.
3.12	PB for DC fail alarm accept	Reqd.
3.13	PB for DC fail lamp & alarm reset	Reqd.
3.14	Hooter for trip alarm	Reqd.
3.15	Buzzer for DC failure alarm	Reqd.
3.16	Bell for non trip alarm	Reqd.
3.18	Wiring and termination for	
3.21	a) DC failure alarm (volt free contact)	Reqd.

4	OTHER REQUIREMENTS
4.1	The breakers shall be fully withdrawable truck type. Cassette type breakers are not acceptable.
4.2	Since Loads needs to be feed from three different transformer simultaneously, switch board should have 2 sections and construction of switchboard should be in such a way that second section could be mounted either as continuation to section 1 or installed as separate section.
4.2	The cable compartment shall have ample space for termination kits suitable for XLPE cables of sizes specified in the data sheet and shall have facilities for support of the cables.
4.3	Wiring terminations inside the panels shall be by crimping type lugs only.
4.5	The connection to breaker from main busbars shall be rated for breaker rating of irrespective of CT rating of outgoing feeders.
4.6	There shall be one common annunciator for the switchboard for incomers and outgoing feeders.
4.7	Indicating lamps shall be of Clustered LED type
4.8	The vendor shall provide all software and hardware required programming of numerical relays.

FEEDER DETAILS

PANEL NO.	NAME	BREAKER RATING(A)	FEEDER PANEL RATING (A)	CT RATIO METERING	CT RATIO PROTECTION	NUMERICAL RELAY	POWER CABLE
	Section I						
1	SPARE	630	630	100/1	100/5 or 1	Reqd.	1 X 3C X 225 sqmm. PVC-A-PVC AL
2	PAP-HWP-NO:1	630	630	40/1	40/5 or 1	Reqd.	1 X 3C X 225 sqmm. PVC-A-PVC AL
3	KHOSLA COMPRESSOR NO:1	630	630	50/1	50/5 or 1	Reqd.	1 X 3C X 225 sqmm. PVC-A-PVC AL
4	SAP-CWP-NO:2	630	630	75/1	75/5 or 1	Reqd.	1 X 3C X 225 sqmm. PVC-A-PVC AL
5	PAP-CWP-NO:1	630	630	75/1	75/5 or 1	Reqd.	1 X 3C X 225 sqmm. PVC-A-PVC AL
6	ABU FEEDER NO:1	630	630	200/1	200/5 or 1	Reqd.	1 X 3C X 225 sqmm. PVC-A-PVC AL
7	NPK FEEDER NO:1	1250	1250	1250/1	1250/5 or 1	Reqd.	4 X 3C X 400 sqmm. PVC-A-PVC AL
8	NEW AMMONIA HANDLING NO:1	630	630	200/1	200/5 or 1	Reqd.	2 X 3C X 400 sqmm.XLPE
9	NEW AMMONIA HANDLING NO:2	630	630	400/1	400/5 or 1	Reqd.	2 X 3C X 400 sqmm. XLPE
10	INCOMER NO:1	2000	2000	1250/1	1250/5 or 1	Reqd.	4 X 3C X 400 sqmm. PVC-A-PVC AL
11	BUS COUPLER NO:1	2000	2000				
12	TIE FEEDER OUTGOING	2000	2000	1250/1	1250/5 or 1	Reqd.	4 X 3C X 400 sqmm. PVC-A-PVC AL

PANEL NO.	NAME	BREAKER RATING(A)	FEEDER PANEL RATING (A)	CT RATIO METERING	CT RATIO PROTECTION	NUMERICAL RELAY	POWER CABLE
13	INCOMER NO:2	2000	2000	1250/1	1250/5 or 1	Reqd.	4 X 3C X 400 sqmm.XLPE
14	BUS COUPLER NO:2	2000	2000			Reqd.	
15	INCOMER NO:3	2000	2000	1250/1	1250/5 or 1	Reqd.	4 X 3C X 400 sqmm.XLPE
16	NEW AMMONIA HANDLING NO:3	630	630	400/1	250/5	Reqd.	2 X 3C X 400 sqmm.XLPE
17	NEW AMMONIA HANDLING NO:4	630	630	200/1	250/5	Reqd.	2 X 3C X 400 sqmm.XLPE
18	NPK FEEDER NO:2	1250	1250	1000/1	1000/5	Reqd.	4 X 3C X 400 sqmm. PVC-A-PVC AL
19	ABU FEEDER NO:2	630	630	200/1	150/5	Reqd.	1 X 3C X 225 sqmm. PVC-A-PVC AL
20	PAP-CWP-NO:2	630	630	75/1	75/5	Reqd.	1 X 3C X 225 sqmm. PVC-A-PVC AL
21	SAP-CWP-NO:1	630	630	200/1	200/5	Reqd.	1 X 3C X 225 sqmm. PVC-A-PVC AL
22	KHOSLA COMPRESSOR NO:2	630	630	75/1	75/5	Reqd.	1 X 3C X 225 sqmm. PVC-A-PVC AL
23	PAP-HWP-NO:2	630	630	40/1	40/5	Reqd.	1 X 3C X 225 sqmm. PVC-A-PVC AL
24	SPARE	630	630	200/1	40/5	Reqd.	
	Section II						
25	PAP-HWP-NO:3	630	630	40/1	40/5 or 1	Reqd.	1 X 3C X 225 sqmm. PVC-A-PVC AL
26	PAP COMPRESSOR A	630	630	50/1	50/5 or 1	Reqd.	1 X 3C X 225 sqmm. PVC-A-PVC AL

PANEL NO.	NAME	BREAKER RATING(A)	FEEDER PANEL RATING (A)	CT RATIO METERING	CT RATIO PROTECTION	NUMERICAL RELAY	POWER CABLE
27	SAP-BWFP-P3	630	630	50/1	50/5 or 1	Reqd.	1 X 3C X 225 sqmm. PVC-A-PVC AL
28	PAP-CWP-NO:3	630	630	75/1	75/5	Reqd.	1 X 3C X 225 sqmm. PVC-A-PVC AL
29	TIE FEEDER INCOMER	2000	2000	1250/ 1	1250/5 or 1	Reqd.	4 X 3C X 400 sqmm. PVC-A-PVC AL
30	FOR FUTURE EXPANSION	2000	2000	1250/ 1	1250/5 or 1	Reqd.	4 X 3C X 400 sqmm.XLPE
31	BALL MILL	1250	1250	300/1	300/5	Reqd.	1 X 3C X 225 sqmm. PVC-A-PVC AL
32	MILL FAN MOTOR	630	630	100/1	100/5	Reqd.	1 X 3C X 225 sqmm. PVC-A-PVC AL
33	SAP STARTUP BLOWER	630	630	200/1	200/5	Reqd.	1 X 3C X 225 sqmm. PVC-A-PVC AL
34	PAP COMPRESSOR B	630	630	50/1	50/5	Reqd.	1 X 3C X 225 sqmm. PVC-A-PVC AL

23. ANNEXURE I

Technical particulars

	Switchgear characteristics	
1	Number of poles	
1.1	Class - indoor, outdoor	
1.2	Type of compartment(specify type for each HV compartment)	
1.3	Busbar compartment	
1.4	Circuit Breaker compartment	
1.5	Cable termination compartment	
1.6	CT compartment	
1.7	PT compartment	
1.8	Partition class	
1.9	Withdrawable/Non withdrawable Circuit breaker	
1.10	Loss of service continuity category (LSC)	
1.11	Rated Voltage and number of phases	
1.12	short-duration power-frequency withstand voltage & impulse voltage rating	
1.13	Rated Frequency	
1.14	Rated Current	
	Incomer	
	Busbar	
1.15	Rated short-time withstand current	
	Main circuit (incomer/busbar/feeder)	

	Earth circuit	
1.16	Rated peak withstand current	
	Main circuit (incomer/busbar/feeder)	
	Earth circuit	
1.17	Rated normal current	
	Main circuit (incomer/busbar/feeder)	
	Earth circuit	
1.18	Rated supply Voltage of	
	Closing and Tripping	
	Indication	
	Control	
1.19	Degree of protection by enclosures	
	Door closed	
	Door open	
1.20	Internal fault IAC	
1.21	Details of anti corrosive treatment to make eqpt. suitable for the environment	
1.22	Technical particulars of surge absorbers.	
2	**CURRENT TRANSFORMERS**	
2.1	Conformity to standards	
2.2	Make	
2.3	Type	
2.4	VA capacity	
2.5	Insulation class	
2.6	Whether dual purpose CTs proposed contrary to the specification requirement	
2.7	Class accuracy for O/C & E/F protection	
2.8	Class accuracy for metering	
2.9	Short time current rating	
2.10	Duration of rated short time current	
2.11	Accuracy limit factor for protection class CTs	
2.12	Instrument security factor for metering CTs	
3	**VOLTAGE TRANSFORMERS**	

3.1	Conformity to standards	
3.2	Type – Oil immersed / resin cast?	
3.3	VA capacity	
3.4	Withdrawable or not	
3.5	Connection	
3.6	Class of accuracy	
3.8	Current limiting resistor provided or not?	
3.9	VTs connected to cable side or bus bar side	
3.10	Mounted on top of switchboard or in separate PT panel or Breaker	
4	**RELAYS**	
4.1	Conformity to standards	
4.2	Make	
4.3	Model	
5	**Multi-Function Meter**	
5.1	Conformity to standards	
5.2	Make	
5.3	Type	
5.4	Model	

24. ANNEXURE II

COMPLIANCE STATEMENT

We here by state that our Quotation No..... is in full compliance with the documents issued against the Enquiry No. .... except for the deviations listed below.

LIST OF DEVIATIONS

Sl.No	Description	Reasons for Deviation

Name of the Vendor:

Date: Name & Designation Seal & Signature

25. ANNEXURE III

PRICE FORMAT

Sl.No.	Description	Qty.	Unit price	Total price
1	Design, manufacture, testing ,supply, support of 3.3kV 1500A 31.5KA LSC2B, PM, IAC AFLR Indoor Vacuum Circuit Breaker switchboard for central substation conforming to attached specifications/documents	1 No		
2	Supply of spares as per "Spares List" attached.	1 set		
3	Arranging inspection and tests as per TPS.	1 set		
4	Installation and commissioning support as per TPS	1 set		

26. ANNEXURE IV

SLD