

**UNITED ARAB EMIRATES**  
**FEDERAL ELECTRICITY & WATER AUTHORITY**

**SPECIFICATION FOR**  
**433 VOLTS SWITCHGEARS**  
**(LVAC BOARD)**

## LVAC SWITCHBOARDS

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## **433V SWITCHBOARDS**

### **1.0 GENERAL**

This section covers the complete design, supply, factory inspection, installation, testing and commissioning of LVAC panels.

Switchboards for supplies to substation and building services shall be of the single bus bar, air insulated metal-clad type incorporating air circuit breakers with electrical control, molded case circuit breakers (MCCB), miniature circuit breakers (MCB) suitable for operation indoors on 433 volt, 3-phase, 4-wire, 50Hz systems, having the neutral solidly earthed.

All switchboards shall be rated to meet the maximum fault levels and the Contractor shall demonstrate this by calculation. The enclosure protection shall be IP 55 degree to BS 5420.

### **2. TEMPERATURE RISE**

Switchboards shall be capable of carrying currents continuously without exceeding the maximum temperature rise given in the appropriate IEC or BS recommendations. Where currents are not specified, the full load current with all services connected plus 30% of this full load current shall be used as the criterion.

The switchboards shall be designed with special consideration given to the environmental conditions prevailing in U.A.E. and as stated elsewhere in the specification.

### **3. BUSBARS**

Switchboards and Distribution boards shall each include 3-phase busbars and one neutral busbar of high conductivity copper supported to withstand all normal and fault condition stresses.

The neutral busbar shall have a rating not less than that of the associated phase busbars. Unless otherwise specified switchboard/switchgear shall have a busbar rating not less 800 amperes and Distribution boards a busbar rating not less than 200 amperes. At all points where connections or joints occur, the busbars and connecting pieces shall be tinned or silver-plated. The resistance of any length of conductor containing a joint shall not be greater than that of an equal length without a joint.

The short time withstand capacity of the busbars shall be 50 kA for 1 seconds.

### **4. CONSTRUCTION**

Each switchboard shall be of air insulated, metal enclosed type formed into complete switchboards which may be multi-tier design, subject to the approval of the FEWA, and shall preferably be of a folded sheet construction. The switchboards when built up into a complete board with its components shall be of a flush fronted design having a neat and clean appearance. The switchboards shall be of a type which are readily extensible to double their capacity, and shall be suitable for indoor use as specified. The construction shall be robust and be designed to prevent the spreading of damage due to fire, short-circuits or other causes. The cubicle shall be free standing type manufactured from sheet steel of minimum thickness 2.5 mm.

All components shall be accessibly mounted in the switchboard and shall not impede access to wiring or terminals. All faults occurring within any individual unit shall be contained within that unit and except for busbar faults shall not cause shut down of any section of board other than the unit itself. All equipment shall be constructed of non-hygroscopic and non-flammable material. Insulating barriers and bus supports shall be of an approved material. The design shall cater for the interconnection of busbars, both primary and secondary, between adjacent units. The apertures for secondary bus wires between adjacent units and for secondary wiring in individual units shall be 'bushed' to prevent damage to wires on sharp edges of metal.

The dimensions of the cubicle shall be selected in such a way that adequate space/ access is provided for all components mounted internally and is subject to Authority's approval.

The internal and external surface shall be painted and the minimum paint thickness shall be 70 microns and average of 90 microns, to be proved during factory inspection of cubicles.

The internal paint colour shall be semi-gloss white and external light grey RAL 7032; however, this colour shall be subjected to FEWA's approval during detailed design stage.

The incoming and outgoing cable entry shall be from bottom and suitable gland plate (non-magnetic) shall be supplied.

The busbars shall be segregated from the incomer/outgoing MCCBs.

All wiring inside the cubicle shall be carried out with suitably rated power cable, copper conductor, XLPE insulated, fire proof switchboard wire 0.6/1 kV with minimum cross section of 2.5 sq.mm. The wiring method and identification system shall be as per Volume-4 section-1 part-3 of this specification.

Suitable trunking arrangement shall be provided for routing of cables.

All incoming and outgoing terminals are suitable for terminating the cables as per the requirement.

Phase identification colours/insulation sleeves shall be provided for all conductors (R, Y, B and Black) The busbars shall be suitably supported to withstand all stresses during normal operation and fault conditions.

Padlocking facility with suitable lock and key shall be provided for the cubicle.

The internal of the cubicle shall be illuminated with suitable lamp controlled by door limit switch.

An anti condensation heater controlled by thermostat/hygrostat shall be supplied for the cubicle.

Suitable labels shall be provided internal and external to all components.

All current carrying parts shall be manufactured from high conductivity copper only, the main busbars and earth bars shall be liberally sized.

Suitable ventilation arrangement shall be provided for the control panel to dissipate the heat generated inside the cubicle.

The metal surface adjacent to any live parts and all spaces between phases shall be protection by barriers of fire proof insulation materials.

Each ACB/MCCB shall employ thermal means of inverse time overload protection supplemented by an instantaneous magnetic short circuit trip. ACB shall be equipped with suitable shunt trip.

The ratings and number of outgoing indicated in the tender drawings are minimum requirement only and any additional feeders/higher ratings etc. required shall be supplied without any contractual implications to FEWA.

The panel shall have an earth bar of not less than 30mmx 6mm copper conductor and shall be properly earthed.

Suitable phase indicating lamps shall be provided for incomer and an under voltage relay shall be supplied to indicate a 'LVAC fail' alarm when the supplies to both busbar sections are interrupted for more than 5 secs.. The indication lamps shall be neon type.

All ACB/MCCBs shall have sufficient number of auxiliary contacts (NO and NC contacts) for status indications.

The switchboards shall be designed to prevent accidental contact with live parts. Distribution MCB boards shall be of the metal-clad type with protective insulating barriers between the phases and between phase and neutral. Neutral connections for each circuit shall be made direct to the neutral busbar in each MCB board via removable links. The metal casing of the MCB boards shall be provided with knock out or other approved cable entries for accommodation of the cables and cable glands, the number and sized of such knock outs being such that the MCB-ways can be used in any combination of single phase and 3-phase circuits.

A no volt relay shall be fitted

## **5. AIR CIRCUIT BREAKERS**

Each air circuit breaker shall meet the requirements of IEC 947-2.

It shall be motorized with drawable type with DC shunt trip facilities and mechanical hand trip device.

Each circuit breaker unit shall be housed in a separate metal compartment and provided with a hanged metal door interlocked with the circuit breaker mechanism so that:

- a) The door cannot be opened whilst the circuit breaker is closed.
- b) The door, on opening, automatically locks the circuit breaker in the "off" position. Facilities shall be incorporated to allow for the deliberate release of this interlock should, for maintenance purposes, it is desired to observe the circuit breaker in operation.

- c) Circuit breakers of same rating shall be interchangeable.
- d) Additional safety and interlocking features as required by the FEWA shall be provided without any cost implication. The operating mechanism and the indication facilities shall be to the approval of the FEWA.

Insulating barriers shall be fitted to segregate the individual phases and neutral.

Provision shall be made for padlocking the circuit breaker in the 'off' position.

The circuit breaker shall have a quick make and quick break action independent of the speed at which any operation and closing device is operated and shall be entirely suitable for switching the inductive loads associated with motor circuits.

## **6. MOULDED CASE CIRCUIT BREAKERS**

Moulded case circuit breakers (MCCBs) shall be of the thermal/ magnetic type to IEC 947-2, with quick make and quick break, trip free mechanisms which prevent the breaker being held in against overloads or faults, Tripping shall be such as to ensure simultaneous opening of all phases. Arc extinction shall be by deionising arc chutes.

MCCBs shall be fitted with adjustable thermal releases and instantaneous magnetic release. The thermal over-current release shall be of the inverse definite minimum time type. This shall be designed provide satisfactory discrimination with other protective equipment. Earth leakage protection shall also be provided.

The mechanism shall have three positions, "on", "off" and "tripped" and shall have clear indications. To reset from the "tripped" position the mechanism shall first pass into the "off" position. MCCBs shall have the facility to be locked in the "off" position.

The circuit breakers shall have the facility to initiate an alarm in the event of an automatic trip.

MCCBs shall be of 4 pole or 2 pole construction as required.

The MCCB characteristics shall be coordinated with the upstream LV board incomer/bus coupler for selective and fast fault clearance. The details shall be submitted for approval by the FEWA.

The number of MCCBs, rating shall be as per drawings and to the approval of the FEWA and the distribution, in general, be made by providing separate MCCBs for each load like outgoing feeder for lighting distribution, oil treatment plant, AC / ventilation, battery charger, other distribution boards.. etc. At least 20% spares of approved rating on each section shall be provided.

## **7. MINIATURE CIRCUIT BREAKERS**

Miniature circuit breakers shall conform to BS 3871 or relevant IEC or any other internationally approved standard.

Circuit breakers shall be of the thermal/magnetic type to BS 3871 or equivalent standard with quick make and quick break trip free mechanisms which prevent the breaker being held in against overloads or faults.

Tripping arrangements shall be such as to ensure simultaneous opening of all phases. Arc extinction shall be by de-ionizing arc chutes.

The dolly shall have three positions, "on", "off" and "tripped". To reset from the "tripped" position the dolly shall first pass into the "off" position.

MCBs on the main switchboard shall have facilities for locking in the "off" position.

The rupturing capacity of the MCB shall not be less than that of the switchboard itself, or if this is not the case MCCBs of adequate fault withstand and fault breaking capacity shall be provided.

The number of MCBs, is indicated in the typical arrangement drawing. The rating... etc. shall be subject to the approval of the FEWA.

## **8. CONTACTORS**

Contactors for controlling supplies to the "Substation Services" switchboards shall be of the 3-phase type with neutral links. The contactors shall be provided with electrical closing and hold-on-coils the no-volt release provided with a time delay feature adjustable between 0 and 5 seconds.

When in the 'Standby Supply' position, the contactors shall automatically revert to the 'Normal Supply' position as soon as such supply is restored.

The contactors shall be provided with an indicating lamp coloured amber to indicate when the contactors are in the standby position, and with clearly indicated 'Normal' and 'Standby' mechanical indications visible with the distribution board door in the closed position.

## **9. FUSES**

Fuses shall be of the HRC cartridge type for operation at a prospective fault level of 50 kA and conforming to IEC 269. The mounting of the fuses shall be such that they can be readily withdrawn and replaced whilst the associated busbars and circuits are alive.

## **10. RESIDUAL CURRENT CIRCUIT BREAKERS**

Residual current breakers shall comply with the requirements of BS 4293, and shall be complete with current transformer, ON/OFF switch, test button and trip free mechanism. Each shall be of suitable rating and sensitivity for its application and shall be provided for each outgoing feeders.

## **11. INTERLOCKS AND AUTO CHANGEOVER**

The switchboards shall be provided with interlocks in order to prevent the two normal incoming supplies being paralleled. The breakers controlling the normal incoming supplies and the switchboard bus section breaker shall be interlocked so that only two of these three can be closed at any one time.

The switchboard will be operating normally with bus section open and both the incomers closed. In case of trip of any one of the Incomers, the bus section shall auto close and on restoration of the normal incoming supply, the bus section shall auto trip to return to the normal operating condition. All necessary auxiliary contactors/relays to achieve the above shall be included. The auto changeover shall be blocked for LV Incomer/Bus Section Trip under LV fault conditions.

**12. INSTRUMENTATION**

The minimum instrumentation required to be provided is shown in the typical drawing enclosed.

**13. CABLE BOXES AND GLANDS**

Switchboards and distribution boards shall be provided with cable glands and terminations suitable for cables entering from below. Provision must be included for glands plates so arranged that there can be no access by vermin and insects to the interior of switch and distribution board.

**14. EARTHING**

A copper earth bus of minimum 150 sq.mm shall be provided inside the switchboard and earth metal of switchboards, switch-fuse units, MCCBs, and distribution boards shall be bonded together and earthed to the main station earthing system. Earthing connections shall be carried out in bare copper strip of cross sectional area appropriate to the fault current but not less than 150 sq.mm.

**15. TESTING AT MANUFACTURER'S WORKS**

Circuit breakers, CTs, VTs, relays shall be subject to all routine, type and special tests according to relevant British or any other international standards. Certified copies of type test certificate shall be attached along with the offer. If type test certificates are not enclosed with the offer, FEWA reserves its rights to ask for conducting these tests in presence of FEWA inspectors without any extra cost to FEWA. Routine tests will be carried out in presence of FEWA inspectors at manufacturer's works. The supplier shall make provision in his offer to bear all costs that are incurred in carrying out these tests to the satisfaction of FEWA. However cost towards travel, accommodation etc. of FEWA representatives shall not be included in the tendered price.

**16. LVAC MANUFACTURER.**

The LVAC board must be manufactured by quality manufacturer and shall have sufficient satisfactory service in GCC countries not less than 3 years. The equipments, instruments, operating devices etc. shall be from Europe, North America and Japan. However, cubicles fabricated within UAE are also accepted subjected to the condition that all components are sourced from countries as specified above.

All necessary devices/instruments etc. required for satisfactory operation/maintenance purpose shall be included.

## 17. **CONTROL LOGIC.**

In hand mode, breakers can be operated through the ON / OFF push buttons provided on door. Incomers can be switched 'ON' only if the incoming Voltage is available and the voltage sensing relays are in healthy mode.

"ALL THE THREE BREAKERS ARE INTERLOCKED ELECTRICALLY AND MECHANICALLY IN SUCH A WAY THAT ANY TWO BREAKERS CAN BE SWITCHED ON AT A TIME"

### 17.1 **INTER LOCKING SCHEME AS FOLLOWS.**

	<b>INC - 1</b>	<b>BUS COUPLER</b>	<b>INC - 2</b>
<b>CASE 1</b>	<b>ON</b>	<b>OFF</b>	<b>ON</b>
<b>CASE 2</b>	<b>OFF</b>	<b>ON</b>	<b>ON</b>
<b>CASE 3</b>	<b>ON</b>	<b>ON</b>	<b>OFF</b>

### 17.2 **IN AUTO MODE**

The incomer – 1 will come 'ON' after the delay of timer – T1(0 – 20 sec) if incomer – 2 & bus coupler are not closed.

Incomer 2 will come on after a time delay of Timer t 3.

If supply fails in incomer 2 side, the voltage sensing relay will de energize and it will trip the Incomer 2 ACB.

Then after a time delay T2, bus coupler ACB will come 'ON'

If supply fails in incomer 1 side, the voltage sensing relay will de energize and trip the incomer – 1ACB. After a time delay the bus couple ACB will come 'ON'

If supply restores at incomer – 1 section, Bus coupler ACB will switch off after a time delay and Incomer – 1 ACB will come 'ON' after an extended time delay.

ACB, ON, OFF and TRIP signals are to be wired to terminals for remote signaling.

## 18.0 **Drawings/Documents**

The Tenderer shall include in his offer complete details of the LVAC System being offered with the relevant drawings, equipment catalogues, details of auto changeover and interlocking scheme. etc. The requirement of works mentioned in the drawing and specification shall be complementary. Any discrepancy between drawings and specification shall be clarified with FEWA and their decision in their regards shall be final.

The following drawings/documents (minimum) shall be submitted to FEWA's approval.

- 19.1 General arrangement of LVAC panel and essential DB
- 19.2 Single line diagram for LVAC system
- 19.3 Schematic diagrams for LVAC and Essential DB

- 19.4 CT calculations
- 19.5 Catalogue of all components to be used in LVAC/Essential DB
- 19.6 Cable schedule and termination schedule
- 19.7 Cable sizing calculations and load schedule
- 19.8 Any other drawings/ documents as required by FEWA during detailed engineering stage.

**19.0 List of Standards:**

- IEC 60947 - Low Voltage switchgear and control gear.
- IEC 60898 - Air circuit breakers for AC circuits.
- IEC 60269 - Low voltage fuses.
- BS 5486 - Low voltage switchgear and control gear assembly.
- IEC 189-2 - Cables inside installation
- IEC 228 - Conductors of insulated cables.
- BS 1442 - Specification of cables.
- BS 5467 - Cables for rated voltage 600/1000V.
- IEC 600 44
- BS 3938 - Current transformers
- IEC 60186 - Voltage transformers

## SCHEDULE OF REQUIREMENT

### 1.7 LVAC Switchboard

Design, supply, inspection, installation, testing and commissioning of 433 Volts three-phase four-wire A.C. metal clad switchboard complete with three-phase and neutral busbars of continuous current rating - 800A and short circuit current rating 50 kA, 1 sec. and all necessary auxiliary equipment as specified in the detailed technical specification :-

(a) Two incomer circuits each comprising:-

One 4 -pole power operated 800A amp circuit breaker complete with trip release coil and mechanical hand tripping device.

One selector switch manual / automatic.

One voltmeter scaled 0-500 volts having 96 mm dial.

One voltmeter selector switch.

Three ammeter scaled 0-1000 A having 96 mm dials 240° movement.

Four (4) Current transformers, 800/1A, 5P20, 15VA for mounting on the 415V switchgear for over current and earth fault protection.

Five (5) Current transformers, 800/1A, Class X with suitable  $V_k$  &  $I_{mag}$  for mounting on the 415V switchgear and transformer Neutral for restricted earth fault protection. The transformer Neutral CTs shall be suitable for mounting on the transformer neutral. Separate enclosure shall be provided for mounting the NCT if required.

Three (3) current transformers, 800/1A, Class 0.5,  $F_s \leq 5$ , with suitable output for connecting instruments.

One earth bar.

One 3 pole numerical, multi characteristic IDMT over current protection relay with high set over current element and hand reset flag indication.

One single pole numerical earth fault protection relay with hand reset flag indication.

One restricted earth fault relay with hand reset flag indication complete with stability/shunt resistors and over voltage protection devices as applicable.

One multi contact high speed high burden electrical resetting tripping relay with hand reset flag indication.

One multi contact high speed high burden hand resetting tripping relay with flag indication associated with REF protection.

Voltage failure relay to initiate automatic changeover with a pair of contacts for remote indication with necessary timer.

One close/open manual control switch.

One pushbutton for trip relay reset

One set of mimic diagram with semaphore indicators.

Set of test blocks for relays, pad locks, wiring, auxiliary relays, contacts etc.

(b) Bus section circuit comprising :-

One 4-pole power operated 800 Amp circuit breaker complete with shunt trip release coil and mechanical hand tripping device.

One 3-pole numeric multi characteristic IDMT over current protection relay with high set o/c element and hand reset flag indication.

One single pole numerical IDMT Earth fault protection relay with hand reset flag.

One close/open manual control switch.

One manual /automatic changeover switch (common).

One set of electro/mechanical interlocking.

One multi contact high speed high burden hand resetting trip relay with flag indication.

Four (4) CTs 800/1A, class 5P20, 15VA for over current and earth fault protection.

One set of mimic diagram with semaphore indicators.

Set of test blocks for relays, pad locks, wiring, auxiliary relays, contacts etc.

(c) Outgoing feeders

Two sections of busbars each with required number of MCCBs sized to suit application, all necessary phase splitter boxes, bolted links, outgoing terminal ways and cable clamps etc, to complete. A minimum of 30% spares of each size of MCCBs used shall be incorporated on the board subject to a minimum of one of each rating.

- One set of mimic diagram with operating switch front mounted.
- All outgoing MCCBs shall have over current, short circuit and earth leakage protection.

(e) Provision shall be made for, but not limited to the following feeders.

Supplies to each battery charger, transformer tap changer, air conditioning, ventilation, lighting, and heating within each transformer cell, switch halls, basement, all other rooms, corridors, access ways entrances, pump houses, gatehouses, outdoor lighting, site security lighting and all cubicles or kiosks, transformer oil filtration supply socket, all general purposes and heavy duty sockets in locations similar to above.

## Note

- (1) Normally the LVAC busbars shall be supplied through No. 1 and No. 2 incoming circuits with the bus section circuit-breaker open.

If one incoming circuit fails the LVAC busbars, shall be supplied via the other incoming circuit by the automatic closure of the bus section circuit breaker. When both incoming circuits are re-energised the system shall revert to normal after a time delay.

If a fault occurs on a section of the LVAC busbars the relevant circuit breakers shall open to isolate the faulty section and any auto-changeover onto a faulted section shall be inhibited.

Any auto-changeover shall not cause a failure of connected plant such as air-conditioning and ventilation, air compressors, battery chargers etc, and corresponding alarms and indication shall be inhibited during changeover.

- (2) To prevent paralleling of the incoming supplies under normal conditions electrical interlocking shall be provided so that:-
  - (a) No. 1 and No. 2 incoming circuit-breakers may only be closed when the bus section breaker is open or
  - (b) Only one of the incoming circuit breakers may be closed when the bus section breaker is closed.
- (3) When selected on Manual no automatic changeover shall occur but manual operation of the two incomers and bus section shall be possible.
- (4) Necessary timers shall be included along U/V relays, to prevent tripping of incomer breakers on momentary voltage drop.
- (5) All spring charging motors shall be supplied from and connected to 110 V D.C. power supply.
- (6) Automatic closure of the bus section shall be inhibited when there is a fault on the busbar or when a feeder protective device fails to operate or any other conditions that will result in automatic closure of the bus section onto a persistent uncleared fault and the subsequent trip of both the Main Incomers. All necessary protective relays auxiliary relays, etc shall be provided.
- (7) The incomers and the bus section circuit breakers shall have facilities to enable the circuit-breaker to be racked out and locked out under maintenance conditions.
- (8) All necessary operation, instruction and warning labels shall be provided.
- (9) Full operation features shall be available when the circuit breaker is racked out to the test position.

**Schedule of Technical Particulars**

Sr.No.	Description	Unit	Data / Particulars												
<b><u>L.V. SWITCHGEAR PANELS</u></b>															
<b>A <u>General</u></b>															
1	Name of the Manufacturer/Supplier														
2	Country of Manufacture/Assembly														
3	Standard of Design & Manufacture														
<b>B <u>Design Parameters</u></b>															
<b>B1 <u>L.V. Switchgear Panel &amp; Busbars</u></b>															
1	Type														
2	Standard														
3	Design Voltage	V													
4	Busbar nominal current rating	A													
5	Power frequency withstand voltage (1 min)	KV													
6	Busbar current rating at 50 deg. C ambient temperature	A													
7	Short circuit current rating of busbar	KA													
8	Short time current rating (3 sec) of busbar	KA													
9	Short circuit current rating of vertical drop bus	KA													
10	Short time current rating (1 sec) of vertical drop bus	KA													
11	Minimum clearance of busbar and connections														
	- Between phases	mm													
	- Phase to earth	mm													
12	Bus support insulators														
	- Type														
	- Make														
	- Voltage class														
13	Temp. rise at busbar and busbar joints above 50 deg. C ambient	Deg.C													
14	Busbar Material/Size														
	- Material														
	- Busbar size	mm x mm													
	- No. of busbar sections														
	- No. of cubicles														
<b>LV Switchgear Panel Technical Schedule</b>		<table border="1"> <tr> <td>Rev</td> <td>Date</td> <td>By</td> </tr> <tr> <td> </td> <td> </td> <td> </td> </tr> <tr> <td> </td> <td> </td> <td> </td> </tr> <tr> <td> </td> <td> </td> <td> </td> </tr> </table>	Rev	Date	By										We hereby confirm that above data is correct and will be demonstrated.
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Sheet 1 of 5			Signature _____ Date _____ Stamp _____												

Schedule of Technical Particulars

Sr.No.	Description	Unit	Data / Particulars
15	Cubicle dimensior Height Width Depth Total length of pane	mm mm mm	
16	Heat dissipation at full load	KW	
17	Degree of protection	IP	
B2	<u>LV Air Circuit Breaker</u>		
1	Manufacturer		
2	Country of origin		
3	Type		
4	Standard		
5	Rated voltage	V	
6	No. of poles		
7	Rated continuous current at 50 deg.C ambient	A	
8	Rated current of neutral pole	A	
9	Temperature rise at full load at 50 deg.C ambient temperature (hotspot)	Deg.C	
10	Duty rating		
11	Short circuit making current rating	KA	
12	Short circuit breaking curren	KA	
13	Rated short time current (1 sec)	KA	
14	Spring charging motor rated voltag (AC / DC)	V	
15	Spring charging motor rated curren	A	
16	Rated voltage for trip coi	V	
17	Rated voltage for closign coi	V	
18	Minimum pickup voltage of tripcoi	V	
19	Minimum pickup voltage for closing co	V	
20	Closing time	ms	
21	Opening time	ms	

**LV Switchgear Panel  
Technical Schedule**

Rev	Date	By

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Schedule of Technical Particulars

Sr.No.	Description	Unit	Data / Particulars
22	Weight (withdrawable part)	Kg	
23	Space required for complete withdrawa of circuit breakers	m2	
24	Type of built-in protection relay		
25	Phase o/c relay setting range - Inst. element - Time delay element	A A	
26	Setting range of earth fault o/c relay - Inst. element - Time delay element	A A	
27	No. of self powered release coil		
28	Number of spare aux. contacts		
B3	<u>MCCB/MCB</u>		
1	Manufacturer		
2	Country of origin		
3	Type		
4	Standard		
5	Rated voltage	V	
6	No. of poles		
7	Rated current at 50 deg. C ambient	A	
8	Short circuit breaking capacity of each pole - For A.C. - For D.C.	KA KA	
9	Maximum making capacity of each pole	KA	
10	Rated short time current (1 sec)	KA	
11	Protection - Magnetic trip range - Thermal trip range		
12	Type and No. of auxiliary contacts		
13	Operating time of the breaker	Cycles	
14	Whether backup fuse is necessary if so rating of back-up fuse	A	

**LV Switchgear Panel  
Technical Schedule**

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Schedule of Technical Particulars

Sr.No.	Description	Unit	Data / Particulars
B4	<u>LV Motor Starters and Contactors</u>		
1	Manufacturer		
2	Country of origin		
3	Type		
4	Standard		
5	Type of disconnect switch		
6	Type of contactor		
7	Rated voltage	V	
8	Rated current	A	
9	Rated duty		
10	Rated making current	KA	
11	Rated breaking current	KA	
12	Utilisation category		
13	Mechanical endurance (in million switching cycles)		
14	Control auxiliary supply voltage(AC/DC)	V	
15	Minimum pickup or closing voltage	V	
16	Minimum voltage for dropout/trip	V	
17	Degree of protection of enclosure	IP	
18	Type of protection relays		
19	Protections covered by the relays		
20	Relay characteristics and manufacturer's literature No.		
21	Spare auxiliary contacts for position protection alarm, failure		
<b>C</b>	<b><u>Material of Construction</u></b>		
	Contact material		
	Enclosure material		
	Supporting steel finish		
	Hot dipped galvanised with paint	Yes/No	

**LV Switchgear Panels  
Technical Schedule**

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Schedule of Technical Particulars

Sr.No.	Description	Unit	Data / Particulars
D	<p><b><u>Weights &amp; Dimensions</u></b></p> <p>Overall dimensions      Length                         Width                         Height</p>	<p>mm mm mm</p>	
E	<p><b><u>Documents Enclosed</u></b></p> <p>Product catalogue</p> <p>Relay Cataloges</p> <p>Type test certificates</p> <p>Overload and short circuit protection curves</p>	<p>Yes/No</p> <p>Yes/No</p> <p>Yes/No</p> <p>Yes/No</p>	

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