

**TECHNICAL SPECIFICATION OF 12KV INDOOR VACUUM CIRCUIT BREAKER**  
**FOR PARO AIRPORT UPTO 1250A**  
**AND IN CUBICLE UPTO 25KA**

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## 1. TYPE OF SWITCHGEAR PANEL

The switchgear boards shall be indoor metal clad, single front, single tier, fully compartmentalised construction comprising of a row of free standing, floor mounted panels. Each circuit shall have a separate vertical panel with distinct compartments for circuit breaker, main bus bars, current transformers cum cable compartment and low voltage compartment. Compartmentalised Switchgear, **PM Class, LSC-2B**, Each compartments of individual cubicle shall be segregated by earth metallic sheet. Each compartments of individual cubicle shall be segregated by earth metallic sheet. Cubicle should be type tested for internal arc in all three compartment for 25 kA for 1 sec as per IEC 62271-200

## 2. TYPE OF SHEET STEEL & CUBICLE.

The cubicle shall be of bolted construction with minimum thickness of 2.0mm and for other non load bearing members such as flaps etc shall also be of 2.0 mm.

Sheet steel used for fabrication shall be cold rolled carbon annealed only and fabrication shall be done through CNC turret punch press and CNC bending machine. Painting is through epoxy based electrostatic powder spray painting or sheet steel shall be of aluzinc material without painting.

Width of cubicle is 600mm up to 1250A and 800 mm above 1250A. All covers & doors shall be of folded design . All operations with door closed condition, with door defeat feature in emergency condition. Positive Isolation through LOTO feature to be provided in switchgear panel for complete safety.

## 3. CIRCUIT BREAKER

The circuit breaker shall be mounted on a withdrawable truck which shall roll out horizontally from service position to isolated position with ease and it shall also be possible to take out the breaker truck from cubicle smoothly on to the floor without use of any separate handling equipment. It is preferable to provide three point guide for withdrawal and insertion of truck into the cubicle with ball bearing arrangement on the top of the truck. Circuit breaker shall be of vacuum only and the truck shall have distinct '**SERVICE**' and '**TEST**' position. Isolated position by defeating the interlock shall also be inside the cubicle so that the front door of breaker compartment can

be closed even in breaker isolated position. Special more than three point hinged locking arrangement shall be provided to prevent opening of door in the event of internal arc in breaker compartment. Isolation shall be horizontal.

All the three interrupters of individual phases shall be mounted on a common phase segregated epoxy body mounted on a truck for better insulation and avoidance of non-simultaneity of poles. Circuit breaker shall be vacuum type only. Bidders should be the manufacturer of **vacuum interrupter in india** as pre requisite for qualifying .Interrupter mounted on the conventional individual insulators will not be accepted. No separate fiberglass sheet barrier to be used.

It shall be operated through a common motor wound spring charged mechanism with electrical release coil for closing and shunt trip coil for tripping. Operating mechanism must have manual charging, closing and tripping facility with the provision locking facility in push to close & push to trip mechanical push button.

The mechanism shall be such that motor will automatically recharge the mechanism springs after a closing operation enabling breaker to perform OCO operation. **Operating duty cycle shall be O-0.3sec-CO-3min-CO.** The charging time of motor shall be less than 15 secs making it suitable for rapid auto reclosing duty. Emergency mechanical push to trip button shall be provided for emergency manual tripping with front door closed. All the 'MS' components of circuit breaker mechanism shall be treated with zinc plating with olive green passivation for longer life even in adverse climatic condition. Yellow passivation shall not be acceptable. All mechanism springs shall be powder coated. Plating on mechanism spring is not acceptable .The normal current rating of circuit breaker shall be in panel rating without fan. CB shall comply to S1, E2, M2 and C2 class as per IEC specifications. **Vacuum circuit breakers must be capable enough to handle maximum asymmetry criteria with more than 42% DC component in T-100a duty.**

#### 4. INTERLOCKS

Circuit breaker can be inserted only in open position. Likewise circuit breaker in closed position cannot be withdrawn. Attempt to draw out closed breaker shall not trip the breaker.

The circuit breaker shall operate only in one of the three defined positions i.e. service, test and isolated. The breaker shall not close in any of the intermediate positions.

The circuit breaker cannot be inserted into service position till auxiliary contacts are made. Similarly interlock prevent auxiliary contacts from being disconnected, if circuit breaker is in service position. **Racking padlock facility shall be preferred.**

**Positive Isolation interlock to be provided for complete safety of the switchgear.**

## 5. SAFETY SHUTTERS

Safety shutters (**gravity operated**) shall be metallic and shall be provided to cover up the fixed High voltage contacts on bus bar and cable sides when the truck is moved to Test / isolated position. The shutters shall move automatically, through a Linkage with the movement of the truck and shall be of gravity fall type only. It shall be possible to padlock shutters individually.

## 6. FIXED ISOLATING CONTACTS

Switch gear cubicle shall have seal off bushing arrangement between the circuit breaker compartment and bus bar / C.T. cum cable compartment, i.e. the fixed isolating contacts shall be embedded in epoxy cast bushing so the these act as seal off bushing to prevent transfer of arc from one compartment to the other in the event of internal arc within the cubicle & must be tested for internal arc in all three HV compartments as per new IEC 62271-200.

## 7. CABLE COMPARTMENT

It shall be at the rear side with rear bolted box type back covers. There shall be an inspection window at the rear back cover enabling operator to have visual inspection without opening back cover in live condition . The gland plate of cable chamber shall be of minimum 3mm thickness MS sheet in two halves section with built in adjustable cable holding clamp. In case of single core cable it shall be supplied with non magnetic gland plate. Cable box shall accommodate 2-3Core 300 sq. mm. Cables or 6-1C cables. Addition rear extension box of minimum 300-500 mm depth shall be provided for cables more than the quantity mentioned above.

Sufficient headroom shall be provided for cable termination. The distance between gland plate and terminal shall be minimum 650mm.

#### **8. LOW VOLTAGE COMPARTMENT**

Low voltage compartment shall be mounted at the front on the top of breaker compartment and shall also have hinged type of door. All wiring shall be routed through PVC ducts and shall be terminated on to stud type terminal with plastic cover. For current transformer terminal shall be disconnecting link type only. The wire shall be of 1.1KV grade and suitable for 2KVrms for 1 minute power frequency high voltage.

#### **9. AUXILIARY SWITCH AND AUXILIARY PLUG & SOCKET**

There shall be minimum 4NO and 4NC contacts in breaker auxiliary switch. In case of Additional contacts the same can be multiplied through contact multiplication through electrically latched relay. Auxiliary plug and socket shall be of minimum 24 pin plug type and shall have scrapping earth feature. Auxiliary contacts shall be suitable for continuous thermal current rating of 10A. It must also offer 6NO+6NC minimum, **preference will be given for more NO + NC.**

#### **10. ELECTRICAL & MECHANICAL POSITION INDICATION.**

In addition to mechanical position indication for test and service position in the cubicle at the bottom, electrical indication shall also be provided through limit switch. There shall be minimum 2NO + 2 NC contacts available in each position for electrical indication and for any other interlocking purpose.

#### **11. CONTROL AND POWER CABLE ENTRY**

Control cable entry shall be from front and there should be a possibility of terminating to LV chamber from both right hand and left hand side. Power cable entry shall be from rear bottom. Provision shall be available for entry of power cable or bus duct from rear bottom or rear top. Control cable entry in LV compartment shall be through earthed metallic compartment segregated from HV compartments .

## 12. PRESSURE DISCHARGE FLAPS

Pressure discharge flaps shall be provided at the top in all high voltage compartments for the exit of hot gases in the event of internal arc in any of the HV compartments.

## 13. LOUVERS

Louvers can be provided for higher normal current rating however, same shall be backed up by fine wire mesh. Upto 1250A cubicle without louvers shall be preferred. Switchgear must be tested up to highest in panel current rating without fan for 2700A and bus bars up to 5000A in panel at CPRI.

## 14. BUSBARS

Bus bar material shall be of high conductivity electrolytic copper only and accessibility of the same shall be from top only. All bus bars shall be insulated with heat shrinkable PVC sleeves and **joints shall be covered with full voltage soft PVC shrouds**. Phase identification shall be made at the end by coloured tape. Bus bars shall be mounted on integral seal off bushings All interconnection shall be of electrolytic grade copper only with joints silver plated.

Double busbar shall be with front operated single throw off load switch duly interlocked with the breaker so that changeover can take place only when breaker is off. It should have clear mechanical indication of the position of the change over switch.

## 15. EARTH BUS

There shall be a continuous **GI** earth bus of size **30x6** sq. mm running at the bottom of the panel. Earth bus shall be robust and shall be capable of carrying full short circuit current for 1 second. Doors, covers and all non-current carrying metallic parts shall be earthed through flexible copper wires. This also includes instrument casing and cable armour which are also connected to the earth bus. **Earth bus must be type tested for STC at 25KA for 1 sec**

## 16. BUS & CABLE EARTHING

Separate earthing truck shall be provided for bus earthing and cable earthing. The earthing truck shall be so designed that it is impossible to earth a live. It shall be supplied with potential transformer and

audio visual alarm so that closing of earth switch is blocked by a solenoid actuated from P.T. incase of circuit being live. Earthing circuit shall be suitable of carrying full fault current for 1 second. Special electrical interlocking shall be provided for incomer earthing at cable side with secondary plug and socket arrangement.

## **17. SCRAPPING EARTH.**

In addition to scrapping earth in auxiliary plug and socket proper arrangement should be made so that during engagement of the breaker in service condition earthing contacts is made first before isolating power contacts are engaged.

## **18. CURRENT AND POTENTIAL TRANSFORMER**

Current transformers shall be double core window/bar primary for higher rating or wound primary for lower rating. Maximum VA burden shall be of 15 VA and shall be rated for full short circuit current for 1 second. Differential /REF CTs can be in one mould. Incase of numerical relays 10VA burden shall be sufficient

Potential transformer shall be 3phase 3 limb type with 100VA per phase of class 1.0 accuracy and can either be mounted on incomer breaker truck or separate Line P.T. panel can be provided. For bus connected P.T. it should be separate panel truck mounted.

CT preferred make : ABB / Siemens / Pragati / Kappa / OEMs

## **19. Protection Relays**

The offered relays Relay shall be multifunction numerical type Only the aux relays for lockout, transfer fault indication etc can be electro-mechanical type .All Numerical relays Relay shall have minimum following features

- Relay shall be suitable for both 1A and 5A CT secondary
- Relay Relay shall be drawtout type
- Relay Relay shall have front RS232 port for communication to a local PC.
- Relay Relay shall be provided with rear RS485 port for connection to remote operation.
- The communication protocol Relay shall be MODBUS only. The relay Relay shall provide the MODBUS protocol directly from the relay

without any external converter so that it Relay shall be possible to perform all the following functions through it.

- Relay setting change.
- Relay Fault, Event & Disturbance recorder extraction.
- Reading the measurement values.
- Relay Relay shall have capacity to store atleast 25 fault records. Each fault records Relay shall have the fault flag and the current values during the fault
- Relay shall have capacity to store at least 75 event records each with 1ms accuracy.
- The relay Relay shall be provided with its own real time clock
- Relay shall have disturbance recording function to capture the waveform during faults. It Relay shall have memory to store 5 records of atleast 3s each..
- Relay shall be provided with a alpha numeric LCD display and key pad for navigation and setting.
- Relay shall display on-line value of current & voltage (only for directional relay).
- Relay shall have circuit breaker failure protection built-in.
- Relay shall have circuit breaker condition monitoring. It Relay shall be possible to record the energy interrupted by the breaker and raise alarm when the total energy interrupted exceeds a set limit.
- Relay shall have trip circuit monitoring.
- Relay shall have broken conductor detection.
- Relay shall have atleast 2 setting groups.
- Relay shall have atleast 4 programmable LEDs
- Relay shall have 3 phase directional over current and earthfault protection. It Relay shall have three stages with first stage programmable as IDMT or DT. The second and third stages Relay shall be programmable as DT or instantaneous.
- Relay shall have thermal overload protection.
- Relay shall have negative sequence over current protection.
- Relay shall have blocking logic.
- Relay shall have 4 shots auto reclose function built-in
- Relay shall be provided with under and over voltage protection elements.



## 20. THERMAL RATING OF SWITCHGEAR

End temperature of all current carrying parts including breaker shall be governed by IEC 694. All joints and isolating contacts shall be Tin plated. All rating shall be in panel only.

## 21. AUXILIARY SUPPLY

Control supply for closing and tripping shall be 220 or 110Volts D.C. through external battery source. 230 Volts single phase A.C. supply shall also be available for the operation of spring charging motor and cubicle space heater. Wattage of closing and tripping coils shall be within 250 watts.

## 22. SURGE SUPPRESSORS.

In all motor feeders non linear metal oxide gap less surge suppressors shall be provided **to limit over voltage with in 2.2 p.u.**

## 23. GASKETS

Joints for All front door shall be provided with neoprene or cross linked poly ethylene gaskets self adhesive type. For Compressibility step type channel base shall be provided for easy compressibility. It shall be preferable to provide cross linked poly ethylene type. It shall be preferable to supply cubicle with gaskets between all metal to metal proper vermin proof. Minimum degree of protection shall be IP5X. Manufactures having tested for second digit shall be preferred.

## 24. OVERALL DIMENSION

Width of the switch gear cubicle shall be minimum 650mm and maximum width must not exceed 900mm. Depth without extension chamber for more no. of cables shall be restricted to 2000mm. In case of outgoing feeders rating upto 1250A lower width upto 660mm shall be preferred for the reduction of civil cost.

## 25. TYPE TEST.

Following minimum type test reports shall be submitted for the evaluation of offers. Switchgear meets the following requirement

- All short circuit switching duties from **T-10 to T-100a** including single phase and double line to ground as per IEC62271-100
- Short time rating for 3 seconds **at 25kA level** as per IEC 62271-100
- Temperature rise test as per IEC 62271-200
- Mechanical endurance test as per IEC 62271-100 **minimum M2 category**
- Capacitor bank switching for 400A minimum & cable charging 25 A test as per IEC 62271-100, **minimum C2 category**
- Degree of protection test **as per IEC 60529**
- Lightning impulse voltage test **minimum 75kVp,**
- Power freq. HV withstand at **28kVrms minimum requirement**
- Internal arc test in all the three high voltage compartments as per -IEC 62271-200 **for AFLR category, minimum 25kA for 1 sec. duration with gas duct chamber and evacuation tunnel for entire switchboard.**
- High Voltage Motor Switching test **as per clause 6.114 of IEC 62271-110**
- Switchgear must comply Loss of service continuity class, **LSC-2B category**
- All mechanical operations shall be closed door condition, fully safety door interlock with emergency door defeat feature
- Manual spring charging shall be of multi-turn type with roller clutch mechanism, in order to restrict mal-operation in reverse direction
- Partial discharge and Humidity cycle test as per IEC must be furnished

## 26. QUALIFYING REQUIREMENT.

- a. Having supplied minimum 3000 nos.VCB of minimum 25KA fault rating, **minimum 100 + nos. 44/50kA VCB panel.**
- b. Bidders must enclose along with their bid minimum 3 **performance certificate. of minimum 40KA fault rating.**
- c. Bidder is a manufacturer of vacuum circuit breaker for **past 10 years.**
- d. Minimum turn over should be **300 crores.**
- e. Bidders must meet the above **Type Test Criteria.**
- f. Bidder should be the **manufacturer of Interrupter in India.**