

PESHAWAR ELECTRIC SUPPLY COMPANY (PESCO)

TECHNICAL SPECIFICATION

11kV, 630A, 25kA Vacuum Circuit Breaker (VCB),
Auto/Manual Change-Over Panel (WAPDA/NTDC Approved)

1. Scope

This specification covers the design, manufacture, factory testing and supply of one (1) set of 11kV, 630A, 25kA indoor metal-clad switchgear panel (WAPDA/NTDC Approved) providing automatic / manual change-over of load between two independent 11kV incoming sources, complete with two (2) Vacuum Circuit Breakers (VCB) and all associated protection, control, metering, instrument-transformer and accessory equipment specified herein.

2. Applicable Standards

All equipment shall conform to the latest edition of the relevant IEC standards listed below, or an equivalent recognized national/international standard (e.g. IEEE/ANSI, BS, DIN) accepted by PESCO:

- IEC 62271-1 – Common specifications for high-voltage switchgear and controlgear
- IEC 62271-100 – High-voltage alternating-current circuit-breakers
- IEC 62271-200 – AC metal-enclosed switchgear and controlgear for rated voltages above 1kV and up to and including 52kV
- IEC 61869-1, -2, -3 – Instrument transformers: general requirements, current transformers, and inductive voltage transformers
- IEC 60255 (series) – Measuring relays and protection equipment
- IEC 60947 (series) – Low-voltage switchgear and controlgear (MCBs, push buttons, selector switches, indicator lights)
- IEC 60529 – Degrees of protection provided by enclosures (IP code)

3. General & Constructional Requirements

- Type: indoor, metal-clad/metal-enclosed, floor-mounted, free-standing switchgear panel, factory-assembled and factory-wired
- Configuration: two (2) incoming VCB feeder cubicles arranged for change-over duty between two independent 11kV sources, with a common or interlinked low-voltage control scheme as described in Section 4
- Rated (nominal) system voltage: 11kV; highest voltage for equipment (U_m): 12kV
- Rated frequency: 50Hz
- Rated normal current (busbar and breaker): 630A
- Rated short-circuit breaking current / short-time withstand current: 25kA
- Rated insulation level: power-frequency withstand voltage 36kV (1 minute); lightning-impulse withstand voltage (BIL) 95kV — applicable uniformly to the breaker, busbar, and instrument transformers
- Degree of protection of enclosure: minimum IP4X, indoor duty
- Compartmentalized construction with segregated breaker, low-voltage/control, and cable/instrument-transformer compartments, each independently accessible
- Panel finish: corrosion-protected, powder-coated indoor switchgear finish;
- Nameplates, danger/caution labels, and a mimic diagram of the change-over scheme shall be provided on the panel front
- Earthing: continuous earth bus running the length of the panel with provision for connection to the station earthing grid

4. Functional Requirements – Auto/Manual Change-Over Scheme

- The panel shall control two independent 11kV incoming sources, each through its own dedicated VCB, feeding a common downstream bus/load
- Electrical interlocking (supplemented by mechanical interlocking where offered) shall positively prevent both incoming breakers from being closed simultaneously, so the two sources can never be paralleled through the panel
- A panel-mounted, key-operated or padlockable Auto/Manual selector switch shall allow the operator to select the mode of control:
 - Automatic mode: control logic shall sense the healthy/unhealthy status of each incoming source (via the dedicated voltage transformers specified in Section 7) and automatically transfer the load to the available source, with an adjustable time delay to prevent nuisance/hunting transfers
 - Manual mode: each breaker shall be operable only via its local ON/OFF push buttons, with automatic transfer logic disabled
- Auxiliary interposing relays shall implement the source-healthy sensing, transfer sequencing and any required trip/close lockout functions of the change-over scheme
- Each breaker's trip circuit shall be backed up by an independent capacitor-trip device, ensuring the breaker can be tripped by its protection relay even in the absence of the station DC supply

5. Vacuum Circuit Breaker – Breaker Compartment

Quantity: two (2) — one per incoming source.

- Type: triple-pole (3-phase), vacuum-interrupter type, horizontal draw-out/withdrawable from the fixed housing
- Rated voltage: 11kV; rated frequency: 50Hz
- Rated normal current: 630A
- Rated short-circuit breaking current: 25kA
- Insulation level: 36kV power-frequency withstand (1 min) / 95kV lightning-impulse withstand (BIL)
- Operating mechanism: motor-charged, spring-operated stored-energy mechanism; charging-motor supply 220V AC
- Closing (shunt-close) and tripping (shunt-trip) coils: 110V DC
- Under-voltage release/trip facility, coordinated with the change-over control scheme
- Mechanical anti-pumping and anti-reclosing protection, mechanical ON/OFF/spring-charged position indicators, and an integral operation counter
- VCB shall be Type Tested.
- Compliant with IEC 62271-100 and IEC 62271-200, or equivalent

6. Protection, Metering & Control Equipment – Low-Voltage Compartment

Unless stated otherwise, the following are provided per breaker (i.e. quantities below are per unit $\times$ 2 breakers):

- Numerical/digital overcurrent, earth-fault and short-circuit protection relay — microprocessor-based, adjustable pick-up and time-current characteristics, with self-supervision/diagnostics, complying with IEC 60255 — 1 no. per breaker (2 total)
- Digital panel-mounted voltmeter — 1 no. per breaker (2 total)
- Digital panel-mounted ammeter — 1 no. per breaker (2 total)
- Voltage selector switch, 7-position, rotary, panel-mounted — 1 no. per breaker (2 total)
- Current selector switch, 4-position, rotary, panel-mounted — 1 no. per breaker (2 total)
- LED-type phase indication lamps (Red/Yellow/Blue), rated 110V AC — 3 nos. per breaker (6 total)
- LED-type breaker-status indication lamps (ON / OFF / Trip), rated 110V DC — 3 nos. per breaker (6 total)
- LED-type heater-on indication lamp, rated 220V AC — 1 no. per cubicle (2 total)
- Panel-mounted push buttons for breaker ON and OFF, colour-coded and clearly labelled per applicable standard/PESCO practice — 2 nos. per breaker (4 total)

- Auto/Manual selector switch, key-operated or padlockable, for the change-over control scheme — 1 no. (panel-wide, per Section 4)
- Auxiliary interposing relays, plug-in type with base (minimum 11-pin), coil voltage 110V DC — 4 nos. (panel-wide, for change-over control/interlock logic)
- Capacitor-trip device (independent, DC-supply-free backup trip source) — 1 no. per breaker (2 total)
- Miniature circuit breaker (MCB), triple-pole, 6A, for the breaker's AC auxiliary supply circuit — 1 no. per breaker (2 total)
- Miniature circuit breakers (MCB), double-pole, 6A, for auxiliary metering/indication/heater/control circuits — 6 total

7. Instrument Transformers – Cable Compartment

- Current transformers: three-phase set (one CT per phase) per incoming source, dual-core — metering core Class 0.5 (burden 10VA), protection core Class 5P20 (burden 15VA); rated short-time/short-circuit withstand current 25kA (coordinated with breaker rating); rated voltage 11kV; primary ratio to be confirmed by PESCO based on the connected feeder/transformer's rated load current, with 5A secondaries on both cores — 3 nos. per source (6 total)
- Voltage transformers: single-phase, wye/star-connected, three units per incoming source; ratio 11kV/ $\sqrt{3}$: 110V/ $\sqrt{3}$; accuracy Class 0.5; burden 100VA; insulation level 36kV power-frequency withstand (1 min) / 95kV BIL — 3 nos. per source (6 total), used for metering, indication and the source-healthy sensing described in Section 4
- Compliant with IEC 61869-2 (current transformers) and IEC 61869-3 (voltage transformers), or equivalent

8. Panel Accessories

- Interior panel light with door-actuated limit switch, 220V AC — 1 no. per cubicle (2 total)
- Anti-condensation space heater with integral thermostat, minimum 60W, 220V AC — 1 no. per cubicle (2 total)
- Heater control selector switch, Manual/Off/Auto, 3-position, single-pole — 1 no. per cubicle (2 total)
- Wiring terminal blocks, sized for all incoming/outgoing control and CT/VT circuits — 1 set per cubicle (2 sets total)

9. Scope Boundary – For PESCO's Confirmation in the SBD

The following interface points should be explicitly assigned in the bidding document, since equipment-supply quotations in this class commonly exclude them by default:

- On-site installation supervision, testing and commissioning of the panel
- Unloading, panel placement/positioning, cable laying, cable termination, and panel-to-panel/panel-to-bus coupling at site
- Auxiliary 220V AC supply cabling from the station distribution board up to the panel
- Travel/lodging arrangements for PESCO representative(s) to witness the Factory Acceptance Test (FAT), if conducted at the manufacturer's works

10. Testing & Quality Assurance

- Routine tests shall be carried out on each panel at the manufacturer's works in accordance with IEC 62271-200.
- A Factory Acceptance Test (FAT) shall be offered prior to dispatch, covering functional checks of the protection, metering, indication and auto/manual change-over control scheme, to be witnessed by PESCO representative(s)
- Travel/lodging arrangements for PESCO representative(s) to witness the Factory Acceptance Test (FAT) will be bear by the manufacturer