

KARNATAKA POWER TRANSMISSION CORPORATION LIMITED

Technical specification for outdoor 36kV vacuum circuit breakers

1.0 Scope

This specification covers design, manufacture, assembly, testing at manufacturer's works, packing and forwarding of outdoor 36KV Vacuum Circuit Breakers with all accessories and galvanized supporting structures for breaker mounting.

2.0 Standards

The Circuit Breakers shall comply in all respect with the requirements of IEC62271-100.

3.0 Specific Technical Requirement

The equipment to be supplied under this specification is outdoor type vacuum circuit breakers for use in 36 kV system.

The circuit breaker shall be mechanically gang operated i.e. it should have three identical poles operated through a common shaft, interlinked mechanically to a common operating mechanism unit. The circuit breaker should be complete with all devices including galvanized breaker supporting structures.

The offered breakers shall be suitable for outdoor operation under climatic conditions specified without any protection from sun, rain and dust storm.

The pole of the circuit breaker should have vacuum interrupters (as interrupting media) housed in porcelain insulators. The pole assembly should be hermetically sealed to avoid moisture entry during operation at site.

All mechanical parts and linkages shall be robust in construction to work for at least 10,000 switching operations at rated current, except for lubrication of pins/articulated joints and minor adjustments.

The circuit breaker shall be supplied complete with all auxiliary equipment, meant necessary for the safe operation, routine and periodic maintenance. All internal wiring including those of spare auxiliary contacts shall be complete and wired up to terminal blocks.

Minimum clearance between phases, between live parts and grounded objects shall be as per relevant standard

A non-resettable, mechanical operation counter shall be provided such that it is visible from the ground level even with the mechanism housing door closed.

4.0 Vacuum Interrupter

The Vacuum Interrupters (VI) shall be designed to provide a long contact life at all currents up to rated making and breaking current during switching operation.

VI shall be encapsulated with silicone material for long service life and avoid moisture condensation on the surface which may lead to flashover from VI's external surface. The interrupter should be such that contact gap setting is not required to be done during service life. VI with contrate cup arrangement of main contacts are not allowed.

VI should be capable of C2 class capacitor switching operations and should be capable of handling fault currents up to 25kA for 3 secs.

VI should be of same make as the circuit breaker to ensure reliable performance during service life of the circuit breaker.

5.0 Support Insulator

Support insulator shall conform to relevant IEC standard. The minimum creepage distance of the insulator shall be 25 mm/KV (severely polluted atmosphere)

6.0 Enclosure

Control cabinet shall be weather and vermin-proof with IP55 degree of protection to provide protection against dust and foreign objects

The enclosure shall be made out of MS sheet metal not less than 2.5 mm thick and of light section structural steel. Each cabinet section shall have full width and full length hinged doors mounted on the front that swing fully open. The doors shall be provided with latches to securely hold it with the cabinet.

Doors shall be of sturdy construction, with resilient material covering, fully perimetrically contacting the cabinet frame to provide dust protection and prevent metal to metal contact except at the latch points.

All screws and bolts used for assembling and mounting wire and cable termination, supports, devices and other equipment shall be provided with lock washers or other locking devices. All metal parts shall be clean and free of weld splatter, rust and mill scale prior to painting. The mounting structure shall be galvanized.

7.0 Operating Mechanism

Operating mechanism shall be stored energy type and capable of giving specified operating duty of the breaker (sequence of opening and closing). It should be capable to perform 10,000 CO operations at rated current efficiently. The closing spring shall be automatically charged by motor immediately after closing operation.

The mechanism should also have an integrated spring charging handle (always connected to the mechanism) to charge the closing spring mechanically in the event of loss of auxiliary power supply. Separate spring charging handle that needs to be inserted and properly aligned inside the mechanism in case of emergency situation is not allowed.

Mechanism shall be 'trip free' permitting the circuit breaker to be tripped by the protective relay even if it is under the process of closing. The operating mechanism should have mechanical anti-pumping feature.

Working parts of the mechanism shall be noncorrosive material. Bearings which require grease shall be equipped with pressure type fillings. Bearing pins, bolts, nuts and other parts shall be adequately pinned or locked to prevent loosening or changing adjustment with repeated operation of the circuit breaker. It shall be possible to trip the circuit breaker even in the event of failure of power supply.

Operating mechanism and all accessories shall be enclosed in control cabinet.

8.0 Tripping / closing coils

The circuit breakers shall be provided with one trip coil and one closing coil per breaker. The trip coils should be of continuous rating to improve reliability and reduce the possibility of burning of the coils during service.

Closing coil shall operate correctly at all value between 85 % to 110% of control voltage. Trip coils shall operate correctly under all operating conditions of the circuit breaker up to the rated breaking capacity, and at all values between 70% to 110% of control voltage.

9.0 Controls

Circuit breaker shall be controlled by a breaker control switch (TNC) located in the control cabinet. Local/remote selector switch shall be provided for selection of 'Local' control/ 'Remote' control. The control arrangement shall be such as to disconnect the remote control circuits of the breaker, when it is under test.

Mechanical ON/OFF indicator, spring charged indicator and operation counter shall be provided on the front of the control cabinet.

The variation in A.C. supply voltage shall be -15% to +10% while variation in frequency shall be $\pm 3\%$.

10.0 Wiring and cabling

Unless otherwise specified control wire shall be stranded copper wire having 1.1 kV PVC insulation (FRLS type) conforming to the requirements of relevant IEC standards.

All the control circuit and secondary wiring shall be wired completely and brought out to terminal block ready for external connections in the control cabinet. The cross-section of control wire shall not be less than 1.5 mm² copper.

11.0 Supporting structure

The circuit breakers shall be supplied complete with necessary galvanized steel supporting structures, foundation and fixing bolts, etc. The mounting of the breaker shall be such as to ensure the safety of the operating staff and should conform to local electrical safety rules. Minimum ground clearance of live part from ground level shall be 3400 mm from finished ground level.

12.0 TYPE TEST CERTIFICATES:

Type tested VCB shall be offered. The type test reports shall not be older than Five (5) years as on the last date of submission of bid.

a) For VCB manufactured in India:

- i. The type tests on indigenous equipment for which testing facility is available in India, should have been conducted in any independent laboratories approved by the Government or the laboratories accredited by the National accreditation body of the country like Central Power Research Institute (CPRI), Electrical Research and Development Association (ERDA), etc.
- ii. The type tests on indigenous equipment, for which testing facility is not available in India, should have been conducted in a laboratory of foreign country accredited by National accreditation body of that country.
- iii. The type tests conducted in-house by a manufacturer shall also be acceptable provided the laboratory is accredited by National accreditation body of the country and the tests has been conducted in the presence of a representative of NABL accredited laboratory or any of the purchasing utilities or CEA in that order. Such type test reports shall record the details of such witness including the signature/authentication in the type test report.

b) For VCB manufactured Abroad:

- i. Type tests on imported equipment should have been conducted in an Indian Laboratory or foreign laboratory accredited by National accreditation body of the country where the Type test has been conducted.
- ii. The type tests conducted in-house by a manufacturer shall also be acceptable provided the laboratory is accredited by National accreditation body of the country and the tests has been conducted in the presence of a representative of accredited laboratory or any of the purchasing utilities or CEA in that order. Such type test reports shall record the details of such witness including the signature/authentication in the type test report.

In case of in-house type tested imported equipment of foreign OEM, the term “Purchasing Utility” covers the foreign Utility who has purchased that equipment

Each circuit breaker shall comply with requirements of type tests prescribed in IEC 62271-100

- i) Short time and peak withstand current test.
- ii) Short circuit breaking capacity and making capacity.
- iii) Capacitive current switching test for C2 class: Line charging, cable charging and single capacitor bank switching.
- iv) Dielectric test i.e., power frequency voltage withstand, and impulse voltage withstand test.
- v) Temperature rise test.
- vi) Extended Mechanical Endurance Test at ambient temperature for 10,000 CO operations.
- vii) Measurement of resistance of the main circuit.

Routine tests

Routine Tests as per IEC-62271-100 shall be carried out on each breaker in presence of purchaser’s representative at manufacturer’s works except, where agreed to otherwise.