Instructions for assembly, operation and maintenance of outdoor circuit breakers OSM Tavrida Electric

three-pole design
rated voltage 15.5 and 27 kV
rated current 630 A

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OSM type vacuum circuit breakers

The OSM outdoor circuit breaker (recloser) from Tavrida Electric is intended for automatic switching in power networks, and to serve as outdoor circuit breaker in power distribution stations for voltages up to 27 kV.

The OSM circuit breakers are distinctive by their highly reliable switching mechanism. Conventional circuit breakers use a rather complex operating mechanism for the transfer of forces from the actuator to the main contacts, and moving contacts are kept in ON and OFF positions by mechanical latches exposed to critical stresses which are the main reasons for defects.

The Tavrida Electric vacuum circuit breakers feature an extremely simplified switching mechanism, with particular focus on the minimization of the number of mechanical components.

Contact erosion is kept at a minimum owing to the switching process taking place in axial magnetic field. All switching elements are aligned in one straight axis symmetrical line, which means that all mechanical movements are direct and linear.

The OSM uses a well-sealed and insulated vacuum switching module, encapsulated in an aluminium tank and being the result of the “combined insulation” concept. The concept is based on the capability of the insulation barrier to slow down the spreading of the main discharge. Each live part is all the time surrounded by this insulation barrier.

The OSM reclosers are using up-to-date materials, such as silicone rubber for connections and flexible parts, polymers for solid structures (which provide the product with mechanical resistance). The processing of the materials takes place in specially developed high-pressure casting molds to eliminate the emergence of cavities which might give rise to difficulties related to partial discharges.

The weight of the vacuum circuit breaker module from Tavrida, along with the robust aluminium tank is approx. 70 kg.

The result is a recloser with by far the most compact size and lightest weight. In addition, there is no oil or SF6 gas used in the switching device thanks to which the environmental risks can be eliminated. Patented combined insulation delivers an environmentally friendly product.

Key benefits of the circuit breakers

The Tavrida Electric vacuum interrupters combine a simple structure with extremely long mechanical and electrical lifespan.

The use of a specially designed axial magnetic field distribution provides for even current density between the contacts and, consequently, substantial improvement of the interrupting performance in vacuum.

Carefully selected contact material, expert contact design and optimized switching are the result of bounce-free contact closing.

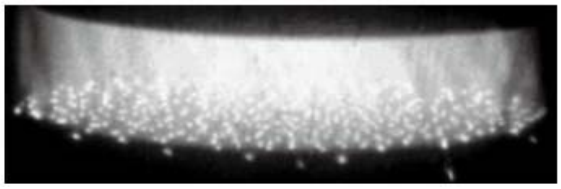
The substantially increased mechanical service life and reduction of the size of vacuum interrupters has been achieved by using steel sleeves composed from the individual discs welded together, in comparison with the traditionally used bent steel sleeve.

The result is 30 000 to 150 000 (applies for special design) C-O operating cycles at rated current, or 200 C-O cycles at maximum short-circuit breaking current without replacing or adjusting any part of the OSM circuit breaker.

The vacuum circuit breakers are entirely maintenance free over a total life expectancy of at least 25 years.

The OSM circuit breakers are designed with regard to a maximum compactness and minimum weight.

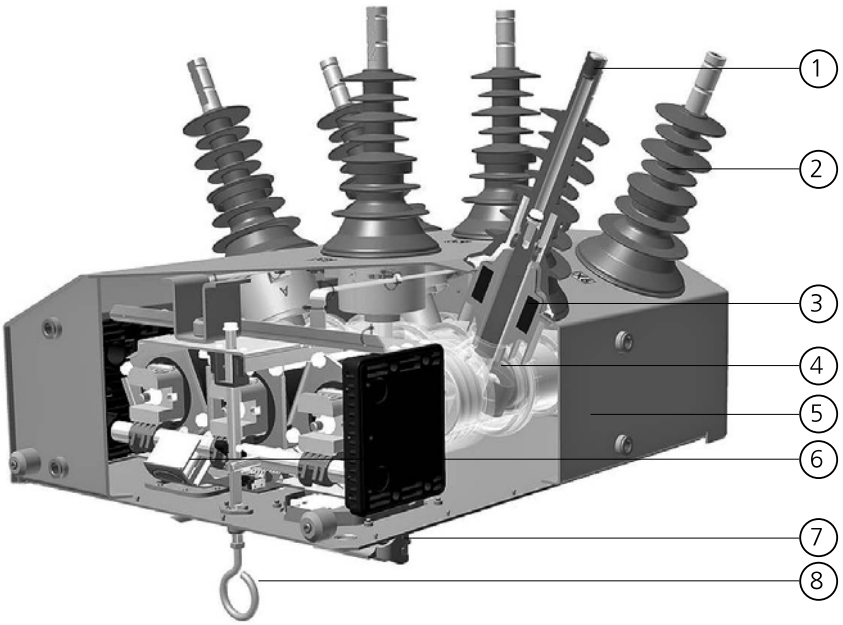
The vacuum interrupters are made from environmentally friendly materials, the disposal of which does not require any special procedures to be utilized..



Softly dispersed electric arc in vacuum owing to the effects of axial magnetic field.

Comparison of steel sleeves: composed steel sleeve of TEL type, welded together from individual discs.

Structural elements, circuit breaker assembly steps



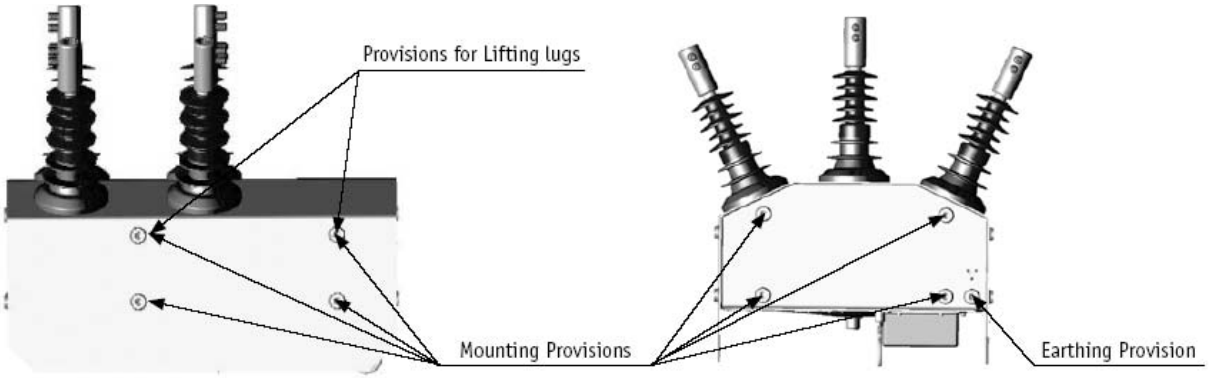
1 – MV terminals
2 – MV bushings
3 – Current and voltage sensors built into the bushings
4 – Vacuum circuit breaker module
5 – Protective tank
6 – Mechanical position indicator
7 – Harting connector
8 – Manual trip operation mechanism

Protective tank

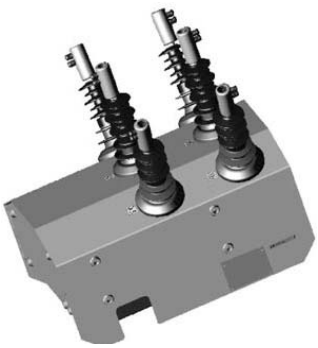
The OSM protective tank is made from aluminium alloy. It consists of two parts: the case and the bottom protective cover. The tank is coated with light gray (RAL 7038) powder coating. The tank along with the control cable connector provides IP65 degree of protection.

Four threaded holes (M12x30) on each side of the tank make it possible to fasten the circuit breaker to the pole or in the switching station. Two of the threaded holes can also be used to install a set of lifting lugs on the tank.

The earthing (M12x40 threaded openings) is situated at the tank edge, close to the fixing holes. The earthing point is appropriately marked. The screw is to be tightened with 30 Nm torque.

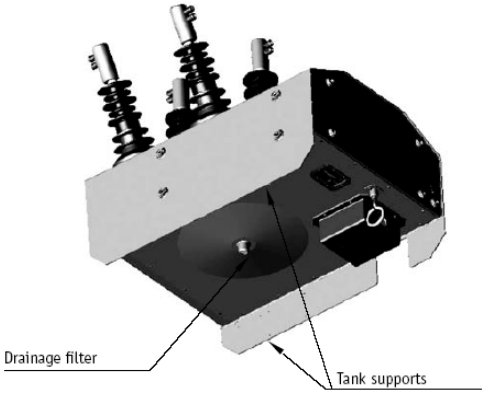


The protective tank serves to a fixed and stable attachment of the circuit breaker. During the transport the tank edges are protected with a rubber profile which is to be removed after the installation.

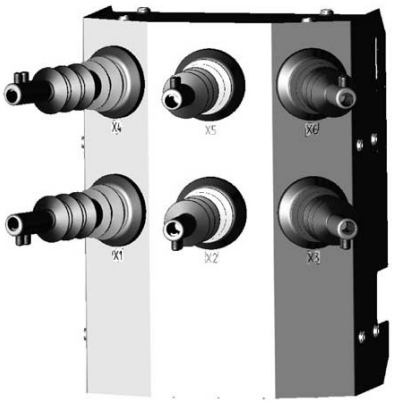


The protective tank includes a ceramic ventilation kit mounted on the tank bottom. The ventilation kit is designed in a way to provide protection against the ingress of dust and dirt.

The tank side also bears the nameplate and plate with the circuit breaker serial number.



Bushings of the main circuit and power connection

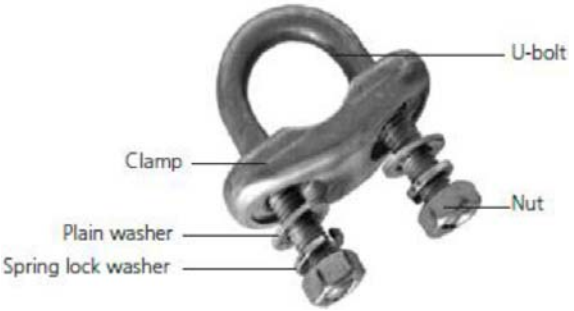


The OSM contains six main bushings made from a polymer resistant to UV radiation. The bushings are covered with silicone rubber that ensures creepage distance of 500 mm for 15.5 kV bushings, and 860 mm for 27 kV bushing version. The bushings are clearly marked with labels carrying the terminal marking X1, X2, X3 at the input side, and X4, X5 A X6 at the output side.

The bushings have cylindrical endings with milled cable connection surfaces. All parts are tin coated which provides for the possibility of connection of both aluminium and copper conductors. The bushing ends contain threaded inserts covered with plastic plugs that need to be removed before connecting the cable lugs..

The OSM inlets may be equipped with various types of terminals, such as the two-hole and four-hole NEMA terminal blocks, or cable clamps.

The NEMA inlets are designed for screw connection.



Cable clamps are intended for the connection of cables or busbars. The clamps can accommodate conductors of 35 to 240 mm2 of cross-sectional area. The nuts are tightened with a torque of 20 Nm. The clamps may be completed with protective cover which, if conductor diameter exceeds 10 mm, can be cut at its tapered end section.

The permitted pull force of conductors acting on the bushings is 300 N. The plug-in connectors are suitable for cables of 40 to 260 mm2 (8 mm to 22 mm diameter).

In case of cable connections the minimum opening of **cable lug** is to be 10.5 mm. The range of cable cross-sections terminated with cable lugs is from 16 to 240 mm2. This type of connection uses M10x25 screws tightened with 30 Nm torque. In such a case, however, the protective plugs are no more used.

The attachment to the OSM is done using inlets with two or four openings. Either of the NEMA inlet options is using screws and washers with tightening torque of 25 Nm.

Conductors intended to be connected to the terminals must be cleaned and degreased. Conductors with insulation should be stripped at a length of 70 mm, at minimum.

Apply a thin layer of petroleum jelly at a thickness of max. 1 mm onto the cable end. Prior applying the petroleum jelly the conductor must be cleaned using wire brush and cloth.

Current transformers

The circuit breakers are equipped with current instrument transformers with protection function, encapsulated in the X1, X2 and X3 bushings.

Mechanical opening

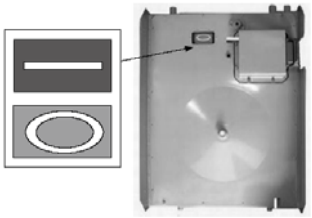
A mechanical trip hook made from galvanized steel is located at the bottom of the tank. When the hook is pulled down, the OSM is mechanically tripped, and electrically locked in the OFF position and secured from switching ON. The OSM remains locked and cannot be operated until the trip hook is pushed back into the ON position.

The circuit breaker can be switched ON by electrical operation, only!

If it becomes necessary to change the moving direction of the mechanical trip hook to make the operation more comfortable, the hook can be turned. In such a case pull the mechanical trip hook into withdrawn position, loosen the M8 lock nut, turn the hook round and secure by tightening the nut with a torque of 10 Nm.

Mechanical indicator of the position of main contacts

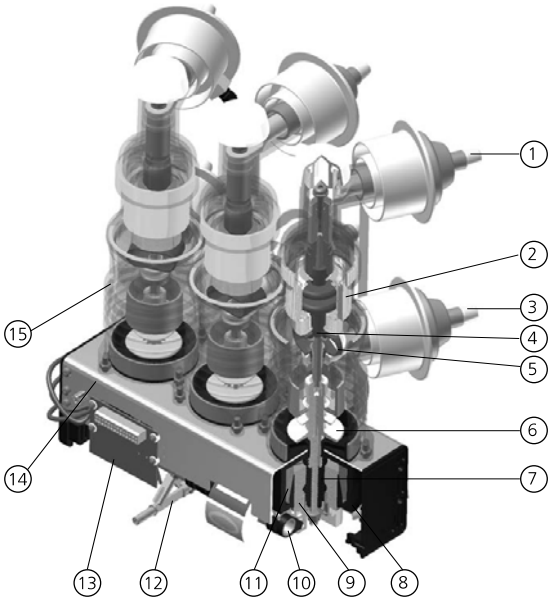
The position indicator is located on the base of the tank, under protective cover, and is clearly visible from the ground. In case the circuit breaker is ON, the indicator is red (I). The OFF (0) position is indicated in green.



Control cable cover

The cover with the protection degree of IP65 provides protection to the terminal board. The cover is fixed to the tank using M5x20 screws. The cover can serve as a fixing base for other accessories which can be mounted using four M3x14 screws and two M3 threaded openings.

Vacuum circuit breaker module



1. Upper power terminal
2. Vacuum interrupter
3. Lower power terminal
4. Movable contact with sealing bellows
5. Flexible conductive junction piece
6. Insulated pull rod
7. Opening and contact pressure spring
8. Magnetic actuator (drive)
9. Armature
10. Synchronizing shaft
11. Magnetic actuator coil
12. Interlocking pins
13. Auxiliary contacts
14. Supporting structure
15. Insulators

Commissioning

In the course of the testing the circuit breaker should be disconnected from the MV power line! During the commissioning check the following:

- Function of the circuit breaker (emergency) manual tripping hook: pull the manual tripping hook down with circuit breaker in ON position. The hook should stop in bottom position and the module should switch OFF. Try to switch the circuit breaker ON using the control system. If the circuit breaker drive operates correctly, this attempt should be ignored. Push the hook upwards. Now the hook should snap in upper position. Try once more to switch the circuit breaker ON using the control system. Now the recloser should respond properly, i.e. switch ON.
- Correct earthing of the circuit breaker tank.
- Correct interconnection between the control system and the CB unit.
- Not used secondary terminals of current transformer (XT3-TX1:3, TX2:4 a TX3:5) should be mutually interconnected by jumpers.

In the course of manufacture the coils of the drive mechanism are connected and tested in line with the recommended wiring diagram. It may happen that the drive coil will be connected with reversed polarity and, consequently, the first switching operations will not be carried out with success. This is not a defect of the circuit breaker. After changing the coil polarity and performing a few test operations this effect will disappear completely.

After checking and carrying out the above tests the circuit breaker may be subject to load switching testing.

Packaging, handling and storing

Packaging and transportation of the OSM circuit breakers

The OSM circuit breakers are delivered in crates with (D x W x H) dimensions of 810x810x890 mm, weighing approx. 76 kg. The crates bear the handling symbols for packaging. The packing further contains information on the product and logistic data. Two crates may be stacked on top of each other.

The circuit breakers are allowed to be transported in its original package, only. The package should be handled in accordance with the symbols. Packing cases are intended to be handled using forklift trucks or cranes. When lifting the case/crate by crane use the lifting lugs on both sides of the package.

During the transport or handling it is strongly forbidden to expose the product to a fall or collision!

Prior unpacking the product, check the packing for damage. Remove the equipment carefully from the packaging. Put aside the upper part of the package and lift the circuit breaker using crane. After unpacking the content check the completeness of the delivery.

After unpacking the goods check it for possible damage. Look for visual signs of mechanical damage, scratches, abrasions or corrosion. Check the state of nameplates and verify the nameplate data by comparing them with the delivery documents.

Any transport damage must be immediately notified to the carrier, in written. Document the damage by taking pictures. Putting damaged equipment in operation is forbidden.

Storage

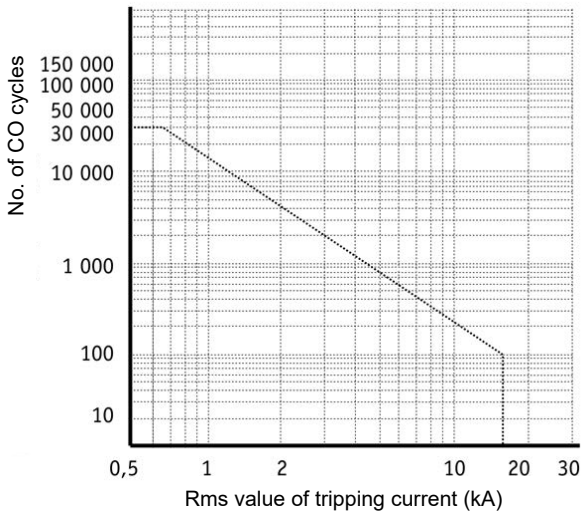
The OSM circuit breakers may be stored by keeping to the following conditions:

- The circuit breaker is in OFF position.
- The storage is allowed in dry, duly ventilated areas at a temperature of -40°C to +40 °C.
- It is allowed to stock two packings on top of each other, at maximum.

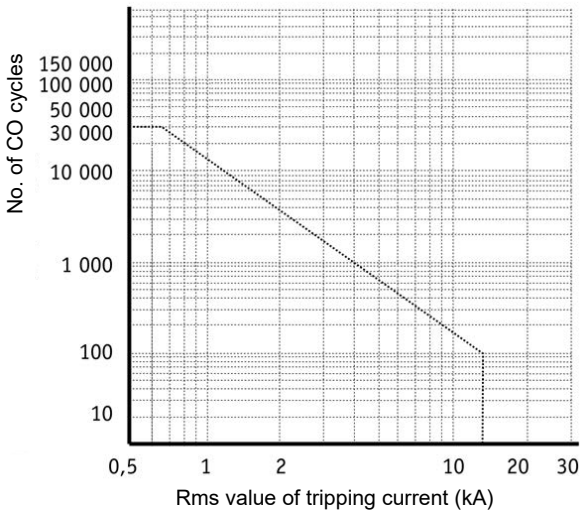
Maintenance

Under normal operating (climatic) conditions the OSM circuit breaker is a maintenance-free product for a period of 25 years, or until the highest number of switching operations is reached – see the diagram below.

Service life curve of the OSM circuit breaker



OSM15_AI



OSM25_AI

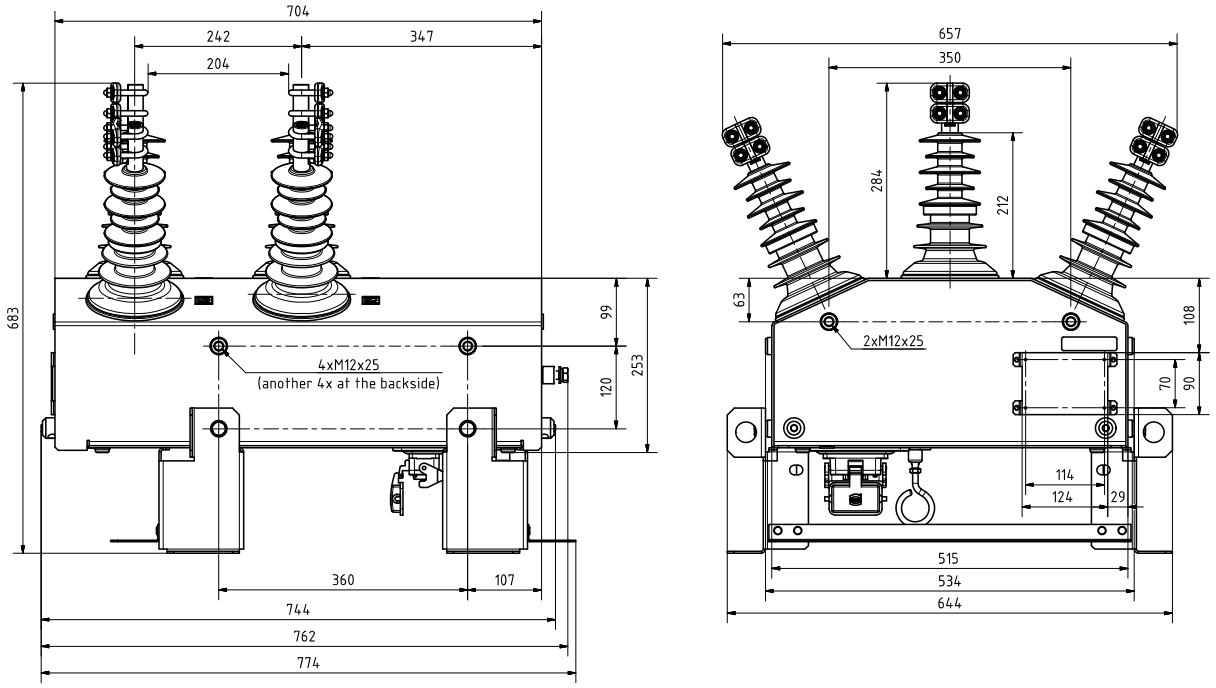
Regular preventative checks are aimed at finding the signs of wilful or accidental damage. Rubber insulation has been tested in extreme environmental conditions. Natural aging process causes a specific damage to the product surface, but has no effect on the product function as such.

Any signs of local damage or extreme deterioration of the product condition should be considered abnormal and should be reported to the supplier.

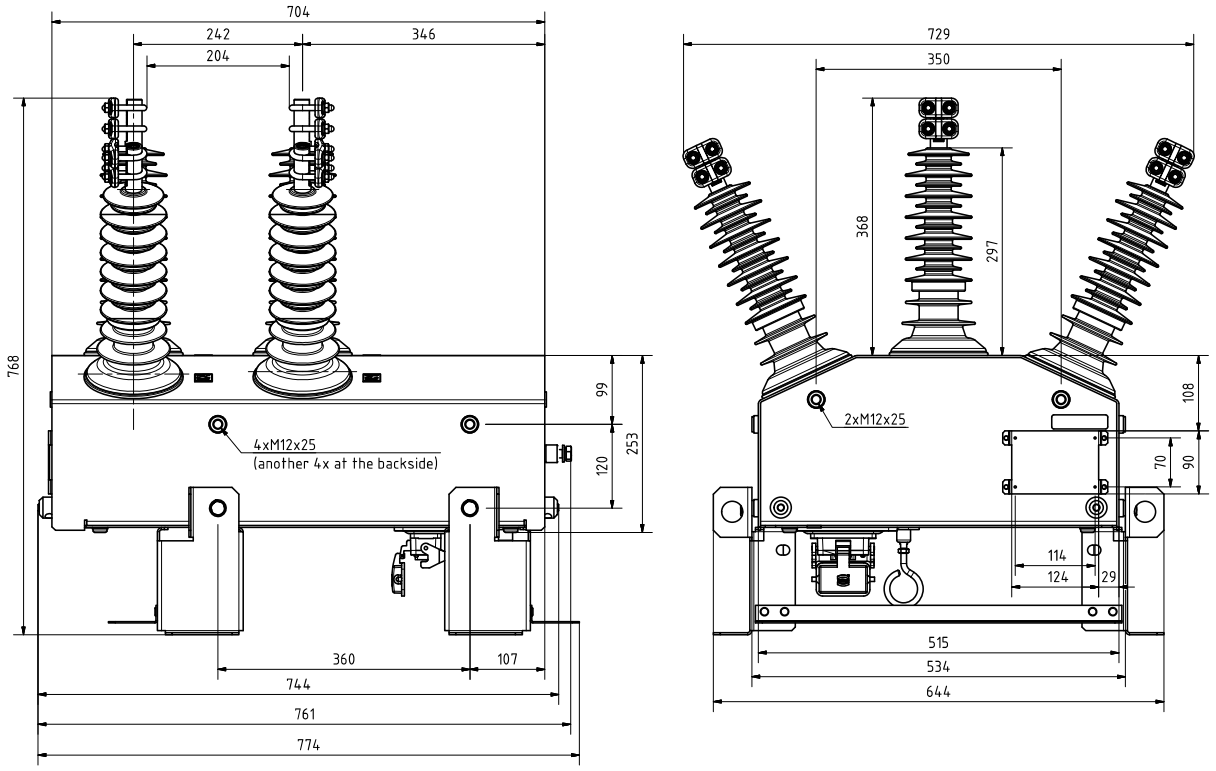
Regarding the restoration of the product insulation state it is recommended to clean the circuit breaker bushings using standard procedures such as high-pressure washing. Don´t use solvents or detergents for cleaning.

The condition of the sealing material of the control cabinets needs to be checked for damage or degradation. The control contactors have been subject to 25 000 C-O switching operations and do not need to be replaced.

Dimensional drawings

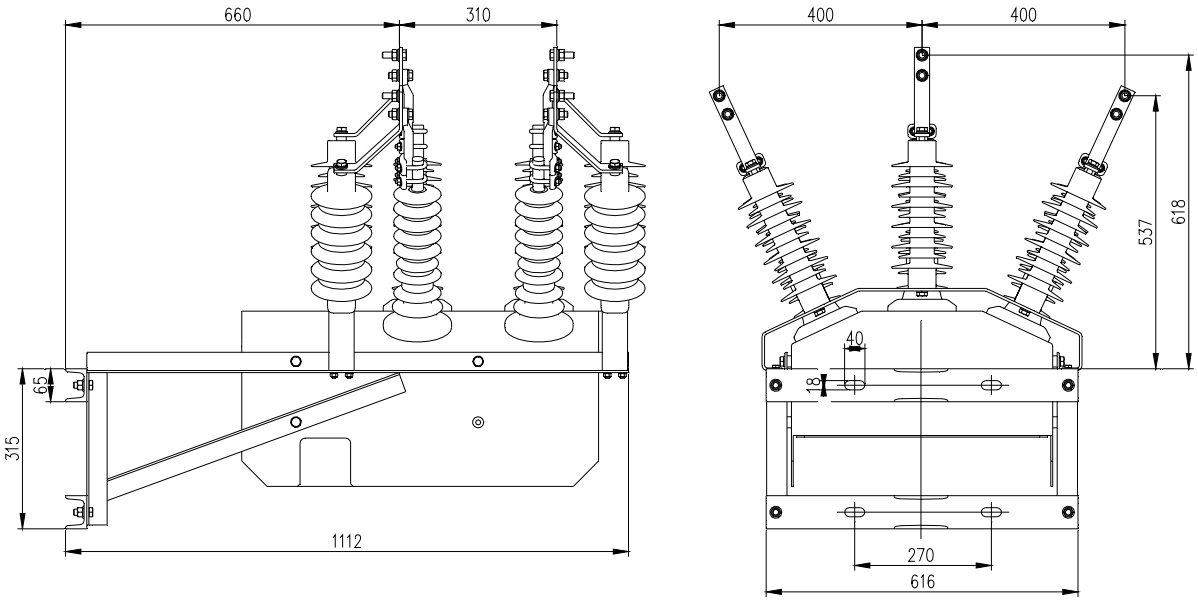


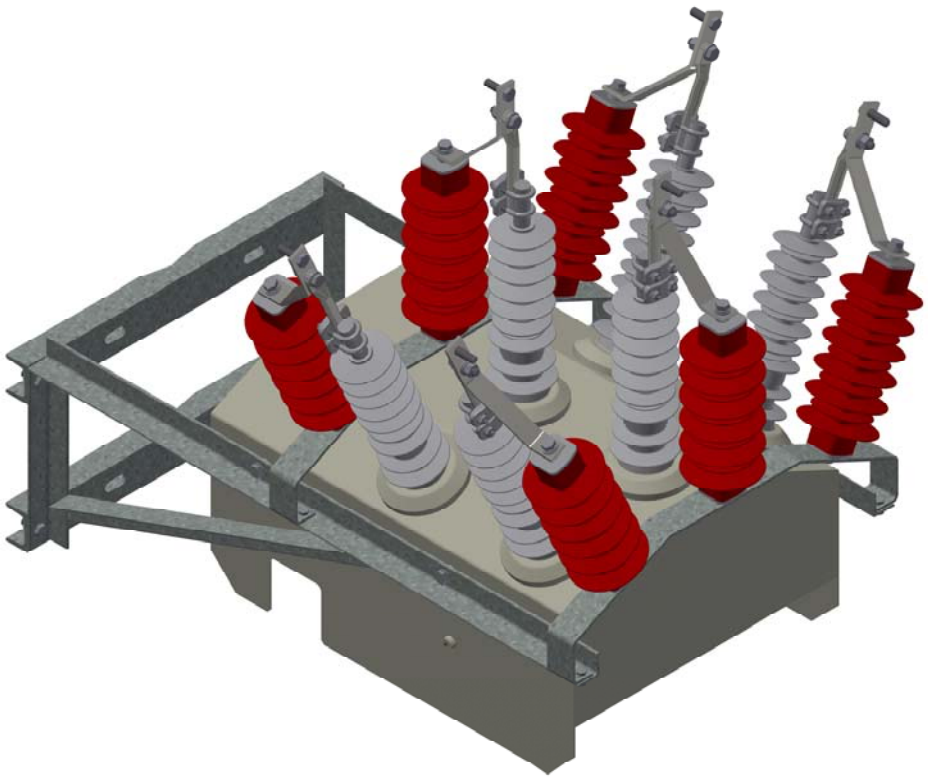
OSM15_AI circuit breaker



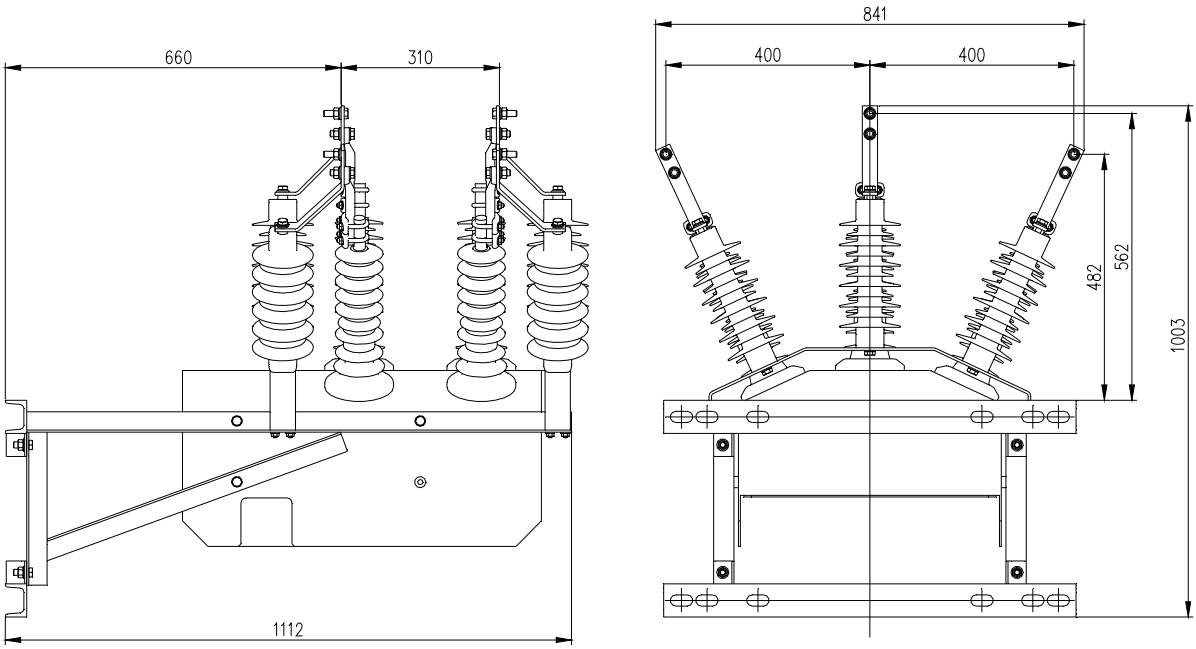
OSM25_AI circuit breaker

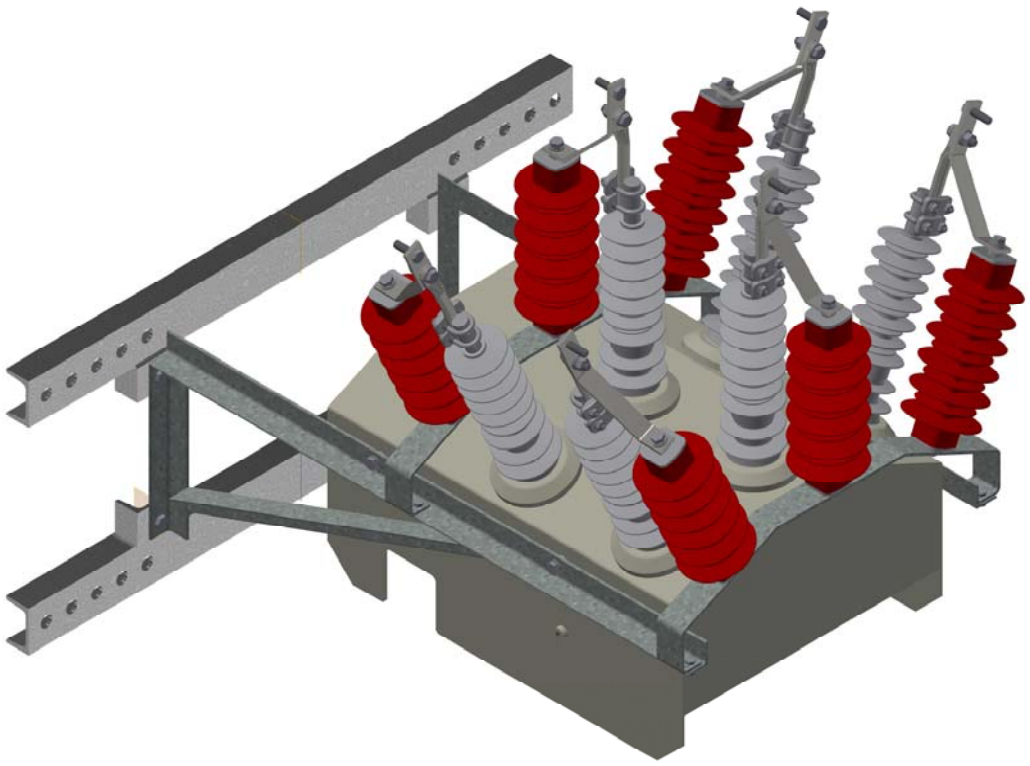
Tavrida OSM25_Al circuit breaker for mounting on concrete pole



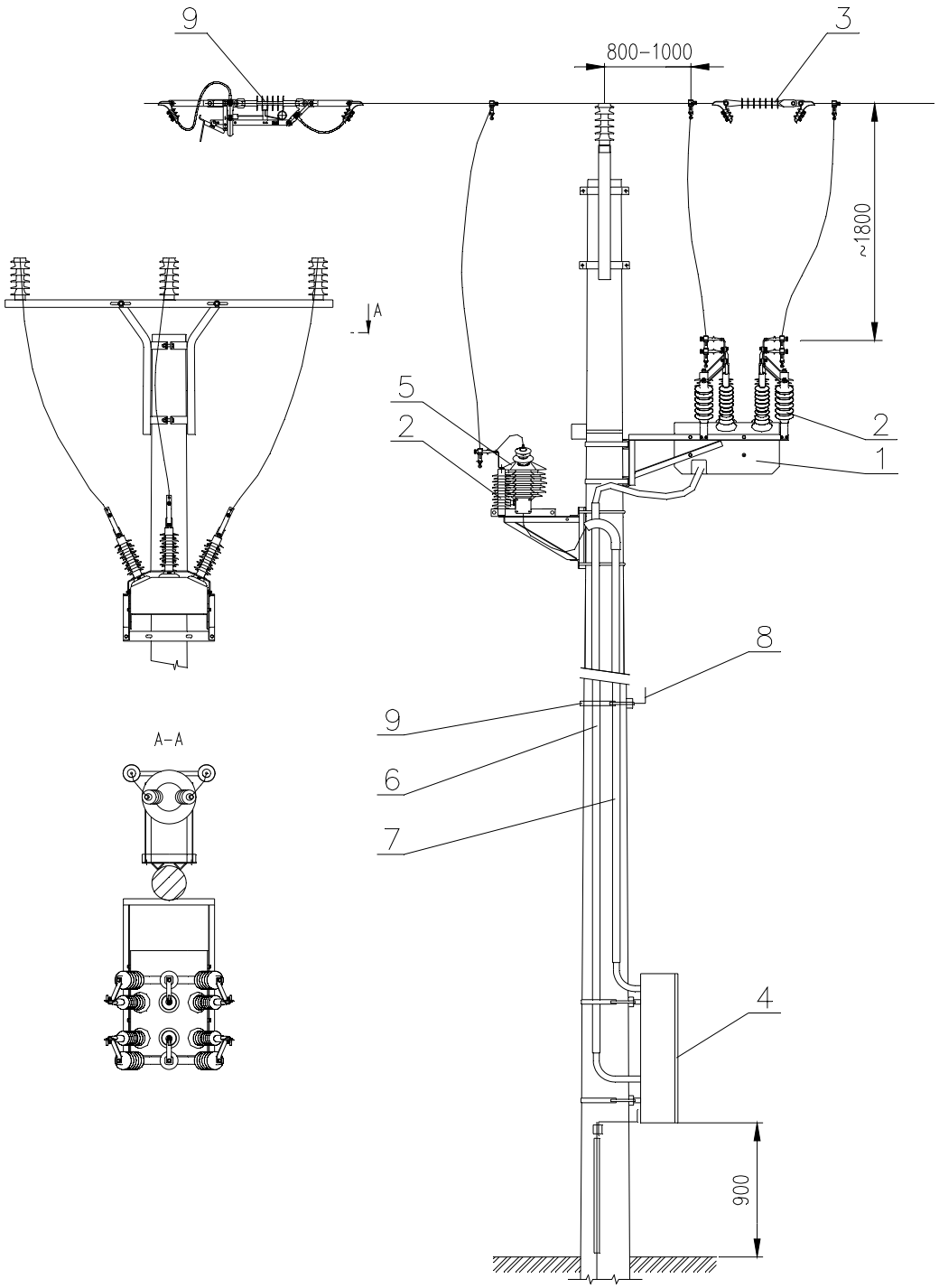


Tavrida OSM25_AI circuit breaker for mounting on lattice mast



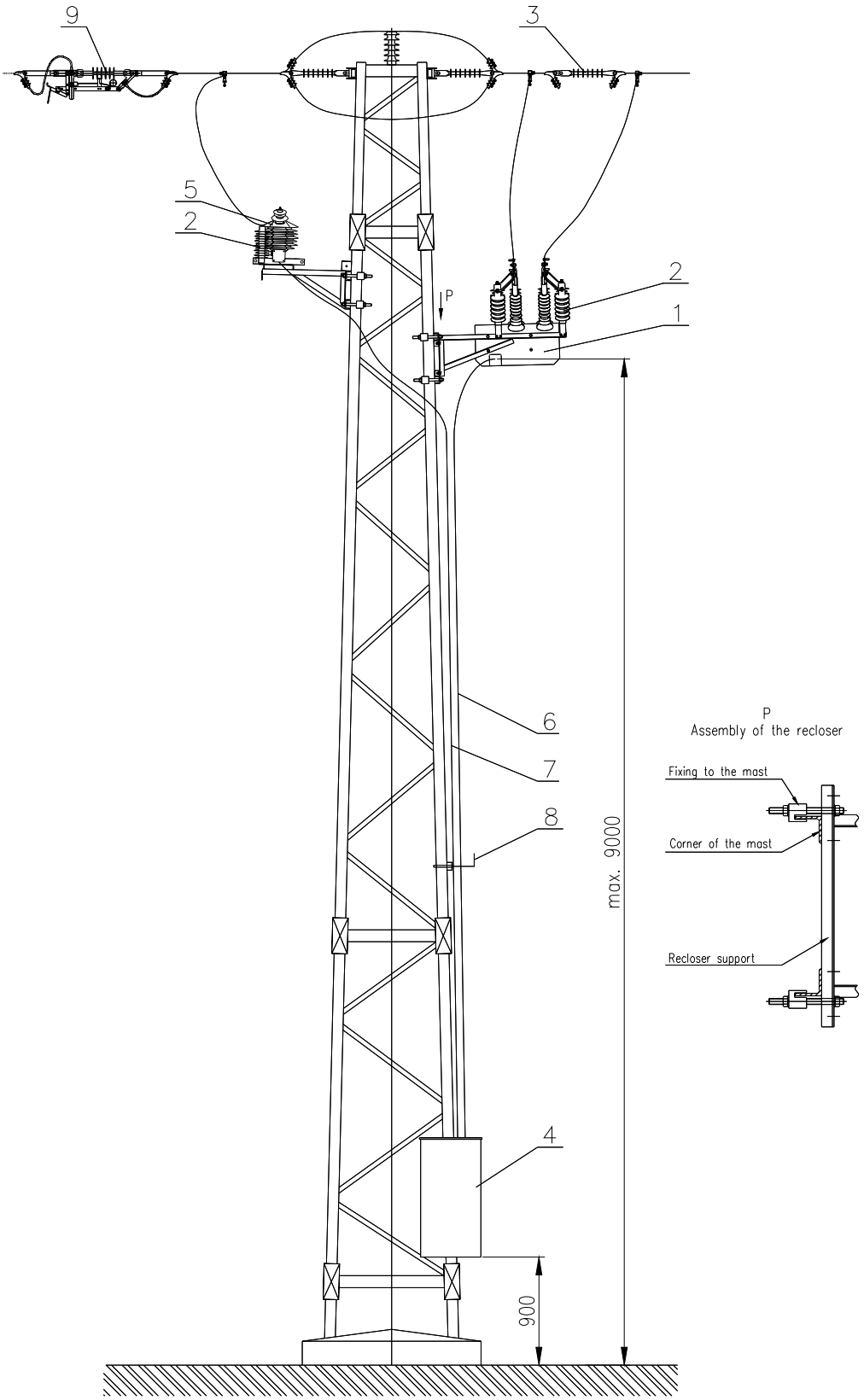


Assembly of the Tavrida OSM circuit breaker for mounting on concrete pole



1. Tavrida OSM circuit breaker
2. Surge arrestors
3. Tension insulator
4. DOV 1111R remote control cabinet
5. Two-pole power supply transformer for the DOV cabinet
6. Cable to establish interconnection between circuit breaker and the DOV cabinet
7. Power supply cable for the DOV cabinet
8. Aerial for GSM-GPRS communication (or a radio network)
9. FIr disconnector (to achieve higher withstand voltage level during atmospheric impulse at the isolating distance; seen from the power supply side).

Assembly of the Tavrida OSM circuit breaker for mounting on lattice mast



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