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(TRS) Manufacturing Company

Pole Mounted SF6 Load Break Switch & Sectionalizer

Types: THO-12, THO-24 & THO-36

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General:

Pole mounted LBS Disconnecting Switches and Sectionalizer Switches have great important rule in overhead medium voltage distribution lines in order to secure reliable electric energy supply to consumers and demanding centers.

The ability of switching of the line feeders facilitates rapid restoration of the distribution grids under loaded conditions and/or during dead time of reclosing shots in permanent faults of the distribution networks.

THO-12, THO-24 and THO-36 are SF6 gas insulated type pole mounted Disconnecting Switches with Sectionalizing capability of faulty sections in the medium voltage networks. The outstanding performance of these products insures reliability and availability in continues electric energy supply.

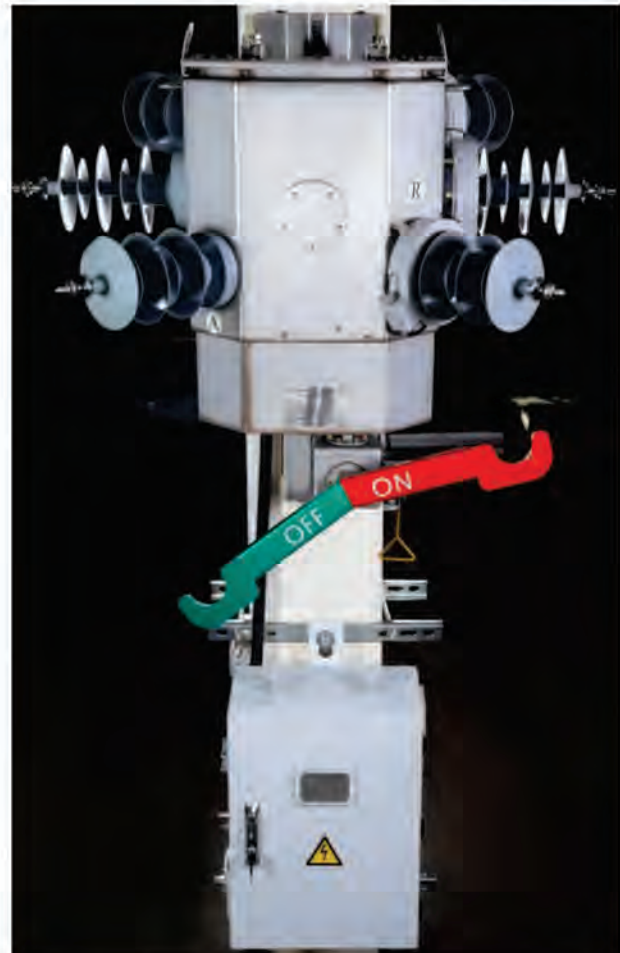
Application:

THO MV LBS is a pole mounted load break disconnecting switch with ability of sectionalizing of faulty part of over head lines in medium voltage distribution network during permanent faults.

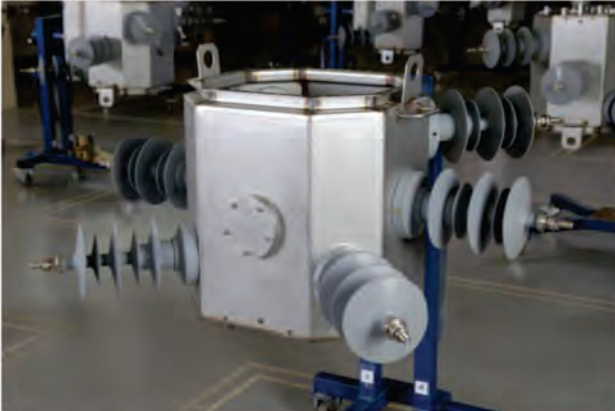
Tight and dust proof degree of protection, anti corrosive stainless steel body enclosure and UV resistant hydrophobic silicone rubber cover of bushings and the design of the THO facilitating secure and reliable operation of the switch under severe environmental conditions and different climate such as "Tropical Very Warm and Humid" or "Desert Very Warm and Dry" weather with sand storm and intensive UV radiation or extremely cold weather with ice and freezing conditions. THO MV LBS shows the best operational performance even in highly polluted industrial areas.

Switch Design:

The three phase switch poles is mounted in a perfectly sealed stainless steel tank, as MV compartment, filled by SF6 gas and the connections are provided through insulator bushings. The operating mechanism and control and protection circuits of the switch are installed in a separate compartment. The design of the switch provides easy access to all parts of the poles and the operating mechanism for maintenance and repair purposes. Relative light weight of the switch prevents over stress of installation poles during normal operation or earthquake conditions.



Enclosure of the THO MV load break switch is made of high quality stainless steel type AISI 304L which provides great resistance against corrosive atmosphere of the industrial heavy polluted areas like Sulfur and acid rains or Chlorine ion.



To provide safety in the over pressure condition, a rupture plate is considered in the side of the switch body enclosure as a pressure relief.



In order to measure line currents, three current transformers are installed on the load side bushings of the switch. These CT's are covered by a weather proof UV resistant plastic case. These CT cases are attached to the enclosure by means of stud-weld screws which are provided on the switch enclosure.

Also there are stainless steel tie wrap bases which are welded to the enclosure to fastening of the CT's connection cables by use of stainless steel tie wraps.

All enclosure welding parts are done by means of Argon TIG welding method.

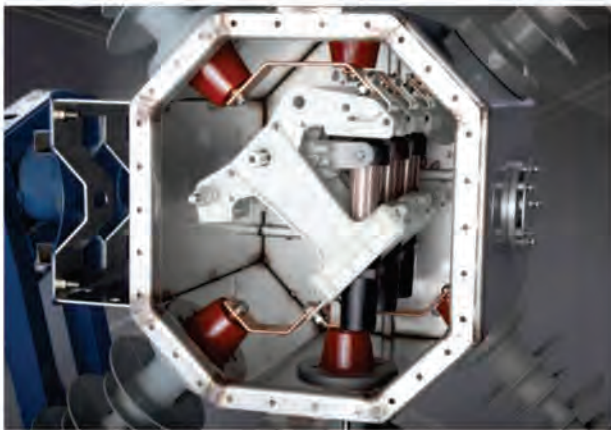
By mounting of the "Pole Installation Support" which is perfectly welded to the main body enclosure, the switch can be installed directly to all kinds of round or square shape concrete, wooden or metallic poles without any additional steel structure.



Protective earth connection node, lifting eye holes and carrying handles are provided on the enclosure of the switch.



Poles are made of pure electrical copper material insulated by excellent glass fiber reinforced polycarbonate housing. The SF6 gas puffing technology of the moving contacts during breaking operation ensures reliable arc quenching process under high current load conditions and worse power factor circumstances. The contact puffer which is made of pure electrical copper type E Cu58 extends durable operation of the switch poles to several hundreds of make and break operation as electrical endurance.



All parts of the poles are Silver plated to achieve lower contact resistance (below $180 \mu\Omega$) and are protected against rust and corrosion by applying of contact grease.

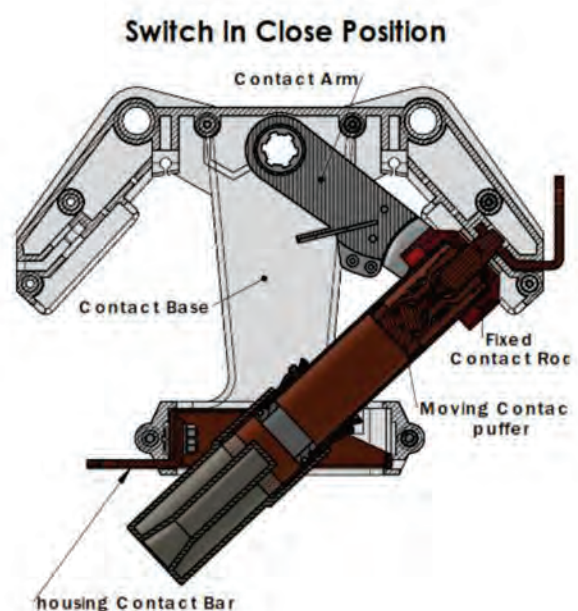
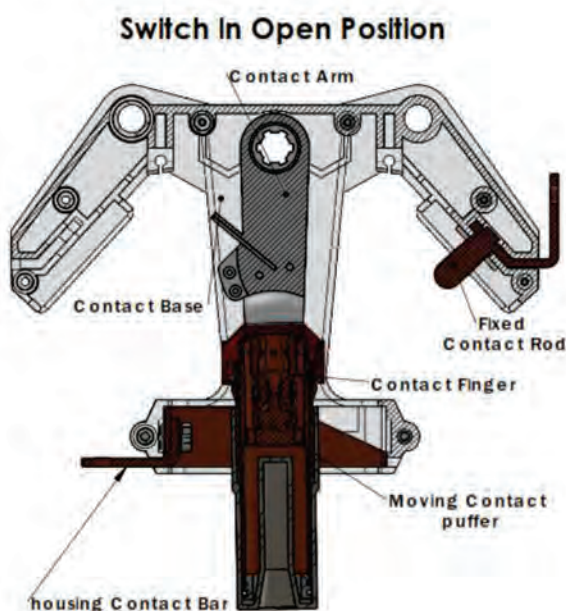
Appropriate cross section of conducting parts and high purity of the copper grants higher thermal short circuit withstand currents and better performance from temperature rise point of view due to passing heavy load conditions.

After complete assembly of the poles and bushings, to achieve best possible insulation between poles and switch enclosure, first the inside air of the switch tank is extracted to a pressure of less than 3 mbar by vacuum pump, then pure SF6 gas will be injected inside the tank.

The quality of the SF6 gas is as below:

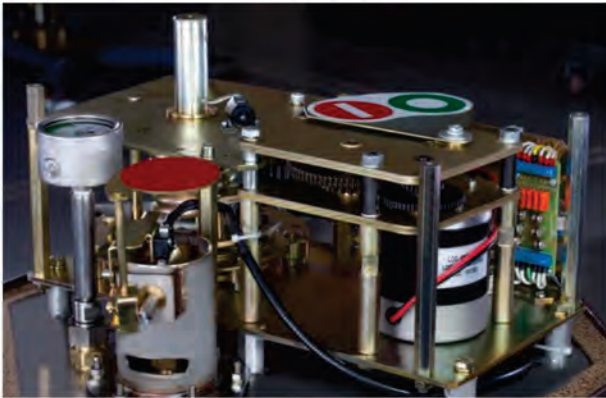
- Purity of SF6 gas 99.995%
- Moisture content $\leq 2 \text{ ppm}_V = 16.2 \text{ ppm}_W$
- Air content $\leq 0.003\%$
- CF4 content $\leq 0.001\%$
- Mineral oil content $\leq 2 \text{ ppm}_W$
- Dew point $\leq -50^\circ\text{C}$

Also to absorb possible remaining moisture content inside the tank, a pack of active alumina is put inside the tank.

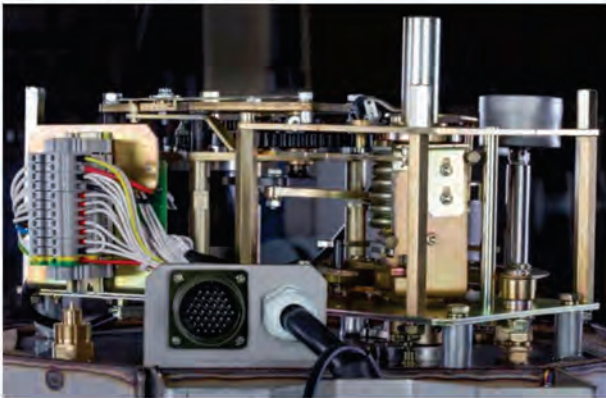


Mechanism of the switch consists of a spring charge energy stored mechanism with a self-release cam system to facilitate a fast open and close operation of the switch, independent of the operator's hand speed.

By use of motorized mechanism, the total operating time of the open or close commands is limited to about 1 second that makes the switch suitable for sectionalizing function.



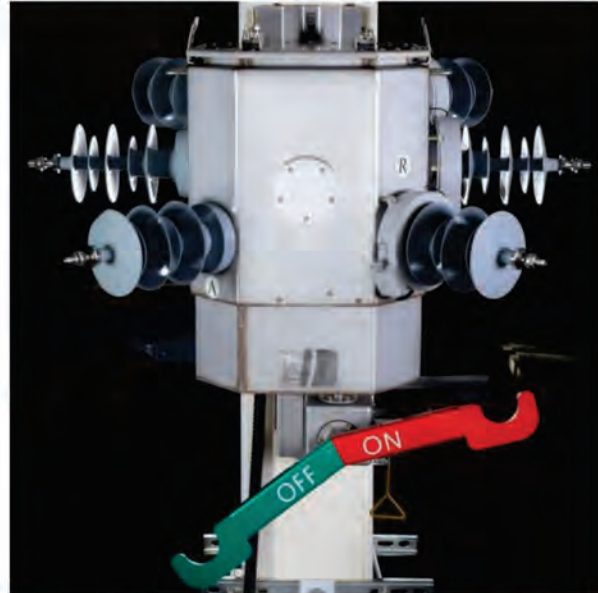
In case of leakage of the SF6 gas, to prevent explosion due to severe arc, a low pressure mechanical and electrical interlock system blocks manual or motorized open and close operation of the switch.



Also 2NO+2NC auxiliary contacts are provided for status monitoring in the remote end or any required interlocking logic. The no of auxiliary contacts can be increased to 4NO+4NC by customer order.

The filling gas valve size DN 8 is also provide for any possible recharging/discharging of the SF6 gas under mechanism box cover plate and will be accessible by opening of the cover screws.

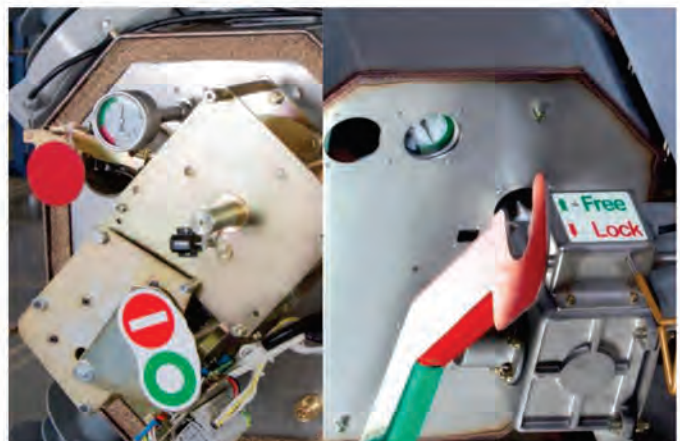
There is also a hand-lock mechanism to prevent remote or unconscious manual operation of the switch during service operations.



For manual close and open operation of the switch by use of a medium voltage insulating stick, a right angle 1:1 gear box and a lever is provide below the switch mechanism.

The installation height of the lever on the pole could be selected by customer. Normally it is attached to the switch in top of the pole.

For periodic inspection of the switch a pressure gauge and also a low pressure SF6 gas flag as well as mechanical close/open operation counter are installed under mechanism box cover plate and are visible from the outside of the box from the ground level.



Control Panel In case that a motorized mechanism is required by customer, a Control Panel equipped with Power Supply, Battery, Battery Charger, RTU and Communication Modem (optional) is supplied to facilitate control commands, status monitoring, analog signals measurement and collecting of faults and events.



All side walls and the roof plate are covered by thermal insulation flame retardant foam, preventing overheats of the instruments due to direct exposure of the Control Panel to the sunshine.

For connecting of the control panel to disconnecting switch/sectionalizer through control cable, a 37 pin receptacle socket is provided in bottom side of the panel. Also two weather proof cable glands are considered.

One for connection of auxiliary AC power supply cable and the second one for connection of communication modem antenna cable.

The auxiliary AC power supply is protected by a two pole AC mcb. Also a two pole surge arrester is provided to protect the incoming auxiliary power supply from possible surge. This makes it possible to supply the control panel directly from medium voltage line by use of a PT or auxiliary voltage transformer.

The output of the AC/DC power supply, is also protected by a two pole DC mcb.



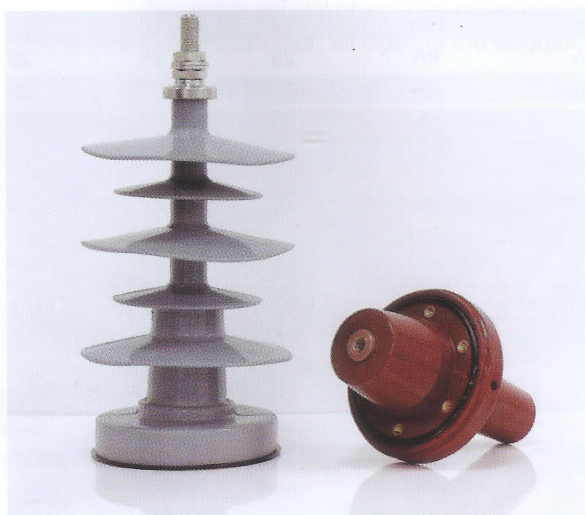
The body enclosure of the Control Panel is made of non-corrosive stainless steel material coated with electrostatic dry powder epoxy polyester painting.



Insulator Bushings consist of two separate parts. Epoxy resin core and the Silicone Rubber glove to cover the Epoxy core. The Silicone Rubber part which is made of UV resistant hydrophobic material provides longer creepage distance for the whole bushing and is attached to the core as an extension cover by means of a threaded screw rod. The silicone rubber glove is made of HTV (High Temperature Vulcanization) material which has self-washing property under rain conditions.

This kind of design makes it possible to change the cover in case of damage, without any need to discharge and recharge the SF6 gas from the tank.

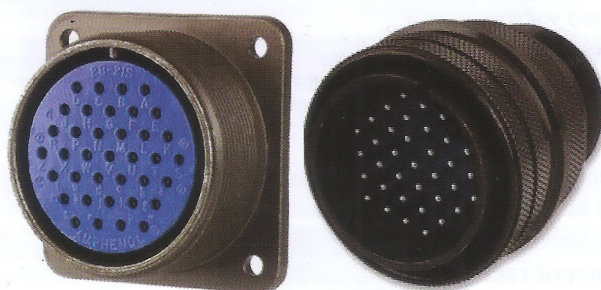
In order to measure the line voltages in source and load sides of the switch, a cylindrical capacitive voltage divider is provided inside the Epoxy Resin core of the bushings.



The silicone rubber glove is UV resistant and has been test according to IEC 60137 for artificial pollution salt spray on high voltage insulators: 1000 Hours and ageing test according to IEC 61109 (1992-03): 5000 hours accelerated ageing.

The silicone rubber is made of flame retardant material and its hardness is between 60 to 70 shores.

Control Cable connects the disconnecting load break switch/ sectionalizer to the control panel to control electrically from local or remote positions.



This cable consists of 37 copper wires with a cross section of 1 mm each, which is terminated with military class weather proof receptacle socket & plug on both ends.

Installation:

Mounting system design of the THO facilitates mounting of this switch on the all kinds of pole including square or round type concrete, steel or wooden poles. By this mounting system the switch can be installed by use of bolts passing through holes in top section of the pole or by use of steel U profiles and bolts on the perimeter of the top section of the pole.

Standards:

The following standards are applicable for THO pole mounted SF6 load break switch:

IEC 62271-103, IEC 60694, IEC 60265-1, IEC 60694, IEC 60129, IEC 60815, ANSI 3037.71, IEC 62217

Technical Specification:

Disconnecting switch / Sectionalizer

Ratings

	Designation	Unit	THO-12	THO-24	THO-36
Insulation level					
	BIL				
Rated voltage	U_r	kV	12	24	36
Rated frequency	F_r	Hz	50 / 60	50 / 60	50 / 60
Power frequency withstand voltage (1 min)	U_d				
- to earth and between phases		kV	28	50	70
- across isolating distance		kV	32	60	85
Lightning impulse withstand voltage (1.2/50 μ Sec)	U_p				
- to earth and between phases		kV _{peak}	75	125	170
- across isolating distance		kV _{peak}	85	145	185
Current ratings					
Rated current	I_r	A	630	630	630
Mainly active load breaking current (100 CO operations)	I_{load}	A	630	630	630
Rated distribution line closed loop breaking current	I_{loop}	A	630	630	630
able charging breaking current	I_{cc}	A	16	16	20
Line charging breaking current	I_{lc}	A	1.5	1.5	2
Short circuit making current	I_{ma}	kA _{peak}	40	40	40
Number of short circuit making operation: 50 kA	n_{sc}	Turn	3	3	3
Number of short circuit making operation: 40 kA	n_{sc}	Turn	5	5	5
Number of short circuit making operation: 31.5 kA	n_{sc}	Turn	10	10	10
Rated short time withstand current (1 Sec)	I_k	kA	25	25	20
Rated peak withstand current	I_p	kA	62.5	62.5	50
Rated earth fault breaking current	I_{ef1}	A	50	50	60
No load transformer breaking current	I_{tml}	A	6.3	6.3	8.5
Rated cable and line charging breaking current under earth fault condition	I_{ef2}	A	28	28	35

Characteristics

	Designation	Unit	THO-12	THO-24	THO-36
Creepage distance	Cr	mm	400	780	1150
Degree of protection:					
Main switch body including mechanism & motor	IP		IP67	IP67	IP67
Control panel including RTU	IP		IP54	IP54	IP54
Switch class	$Class$		M2 & E3	M2 & E3	M2 & E3
Mechanical endurance	E_m	CO	5000	5000	5000
Motorized mechanism opening time	t_{open}	Sec	≈ 1	≈ 1	≈ 1
Motorized mechanism closing time	t_{close}	Sec	≈ 1	≈ 1	≈ 1
Ambient air temperature working range	T_a	°C	-30 ~ +60	30 ~ +60	30 ~ +60
SF6 Gas filling pressure at 20°C (Absolute)	P_{rm}	Bar	1.25	1.25	1.3
SF6 Gas alarm pressure at 20°C (Absolute)	P_{am}	Bar	1.05	1.05	1.05
Mechanical operation blocking pressure of SF6 gas	P_{mm}	Bar	1.05	1.05	1.05
Weight: (including installation accessories)					
manual operating mechanism	W	kg	98	109	120
motorized operating mechanism	W	kg	106	117	126
motorized operating mechanism with CT	W	kg	112	123	132
control panel (THO-CP)	W	kg	57	57	57

Control Panel

	Designation	Unit	THO-CP
Panel, battery & battery charger			
Insulation level	U_{max}	kV	2
Rated auxiliary voltage of control circuits	U_a	V _{dc}	24
Rated input voltage of the battery charger / power supply	U_{in}	V _{ac}	110 / 220
Range of AC input voltage	Range of U_{in}	%	80% ~ 115% U_{in}
Type & power of battery	P_{bat}	AH	2x12 volt VRLA 18 AH
Degree of protection	IP		IP54
Ambient air temperature working range	T_a	°C	-30 ~ +60
Maximum relative humidity	RH	%	100
Dimensions: (W x D x H)	Dim	mm	450x250x625
Weight (including installation accessories)	W	kg	57
Color			* RAL 7035

* Other shades on request

Packing:

The packing of the switch consist of wooden pallet plus wooden cage and plastic cover. In case of sea worthy packing is required by customer, all sides of the wooden cage will be covered by plywood from inside.



Dimensional Drawings:

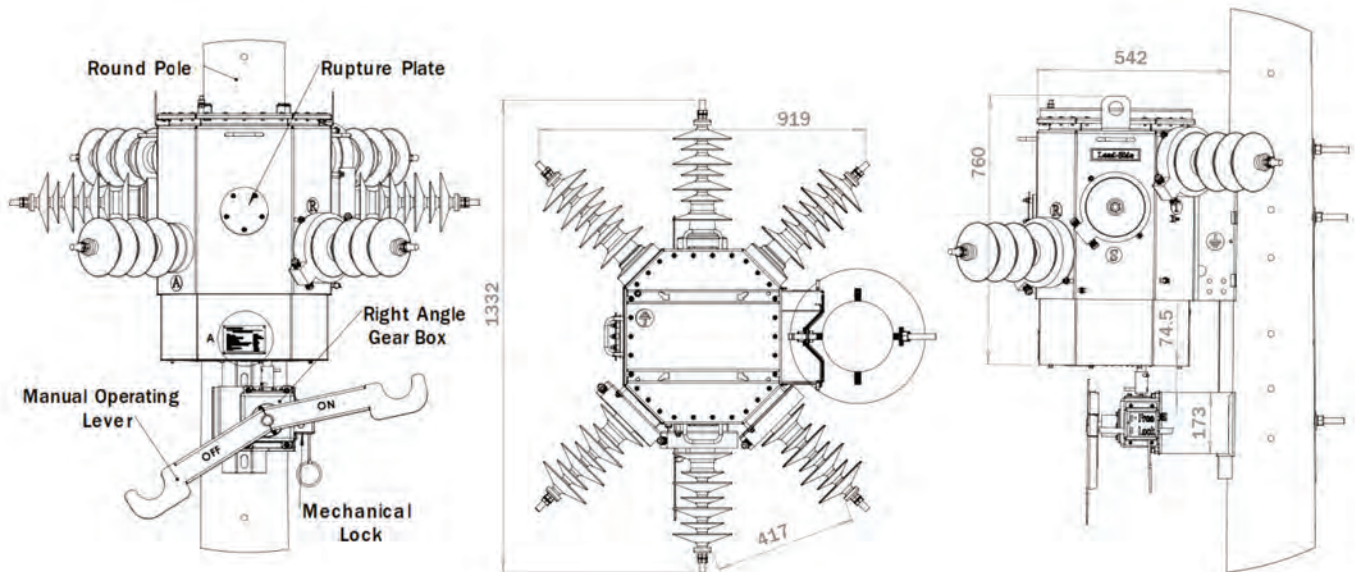


Fig. 1: THO-36

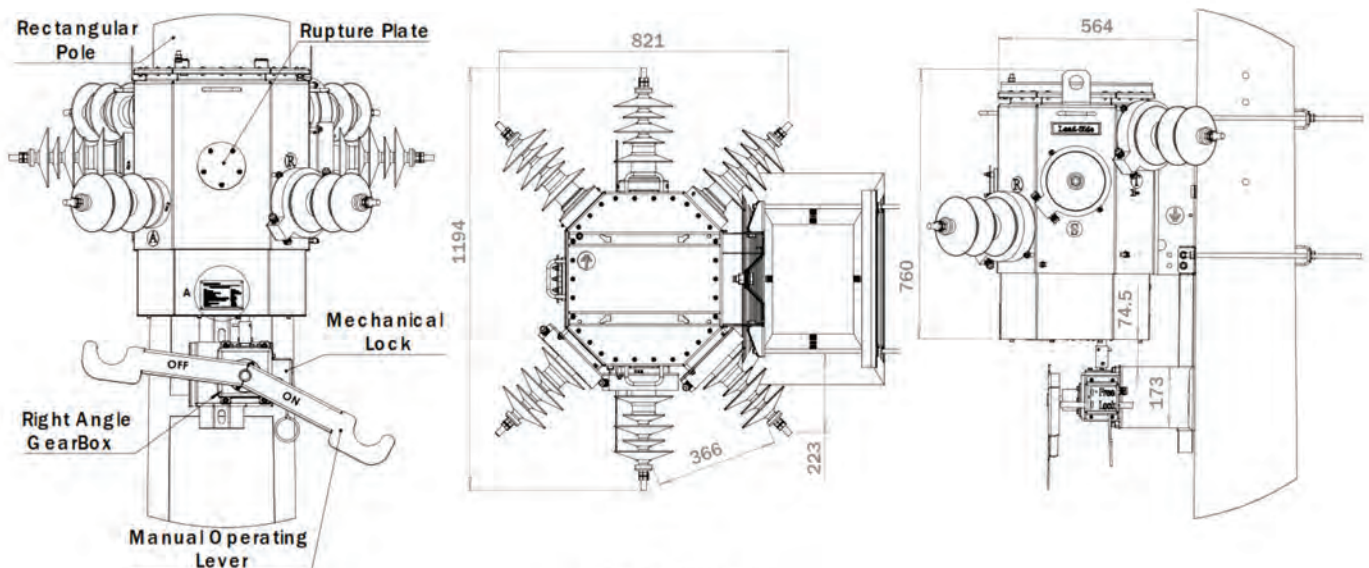


Fig. 2: THO-24

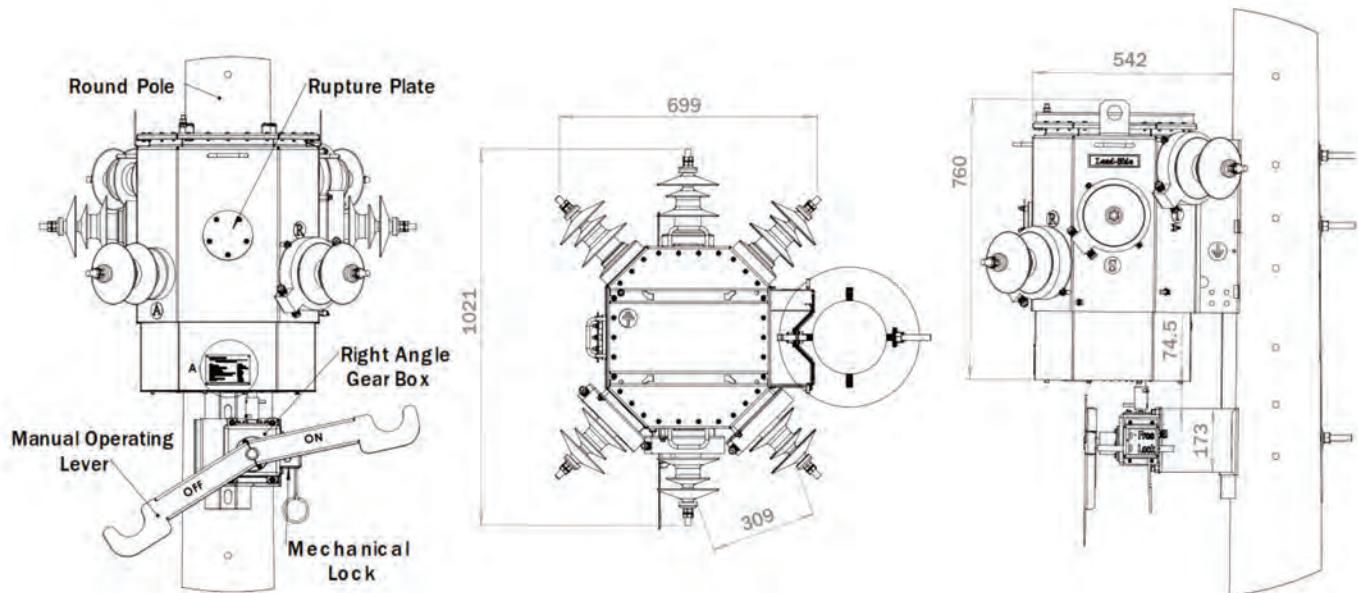


Fig. 3: THO-12

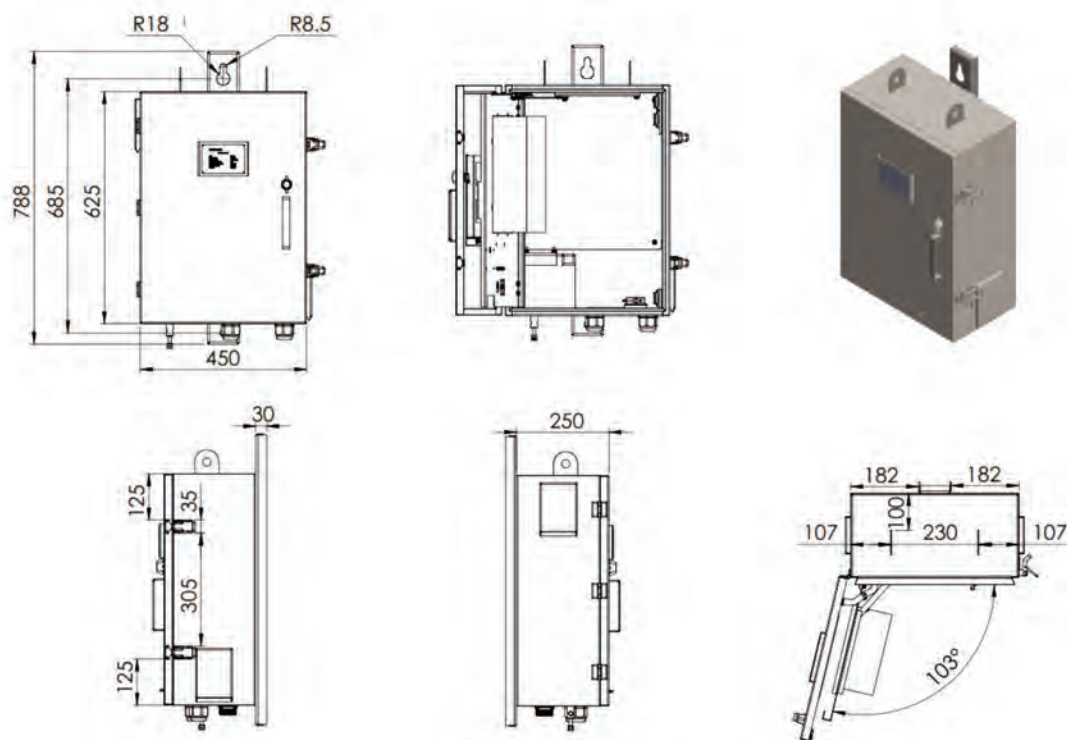
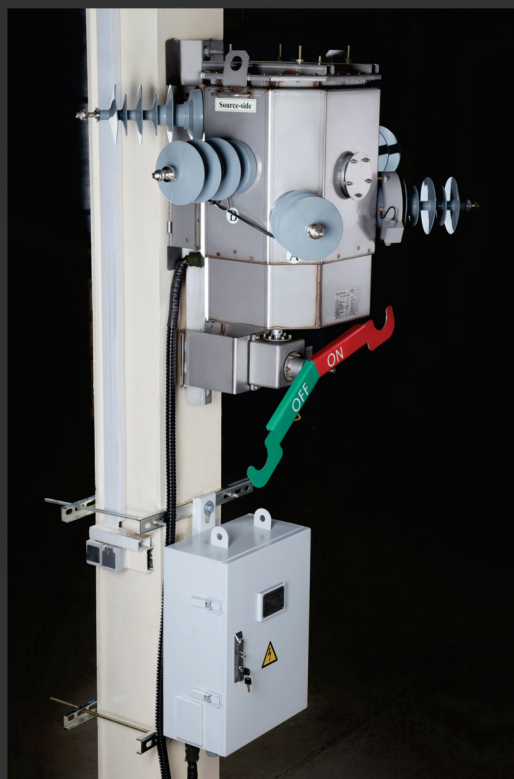
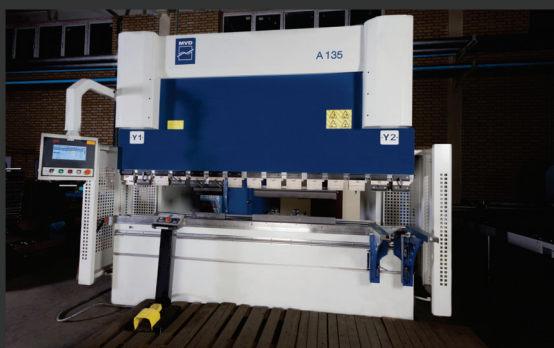


Fig. 4: THO-CP



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