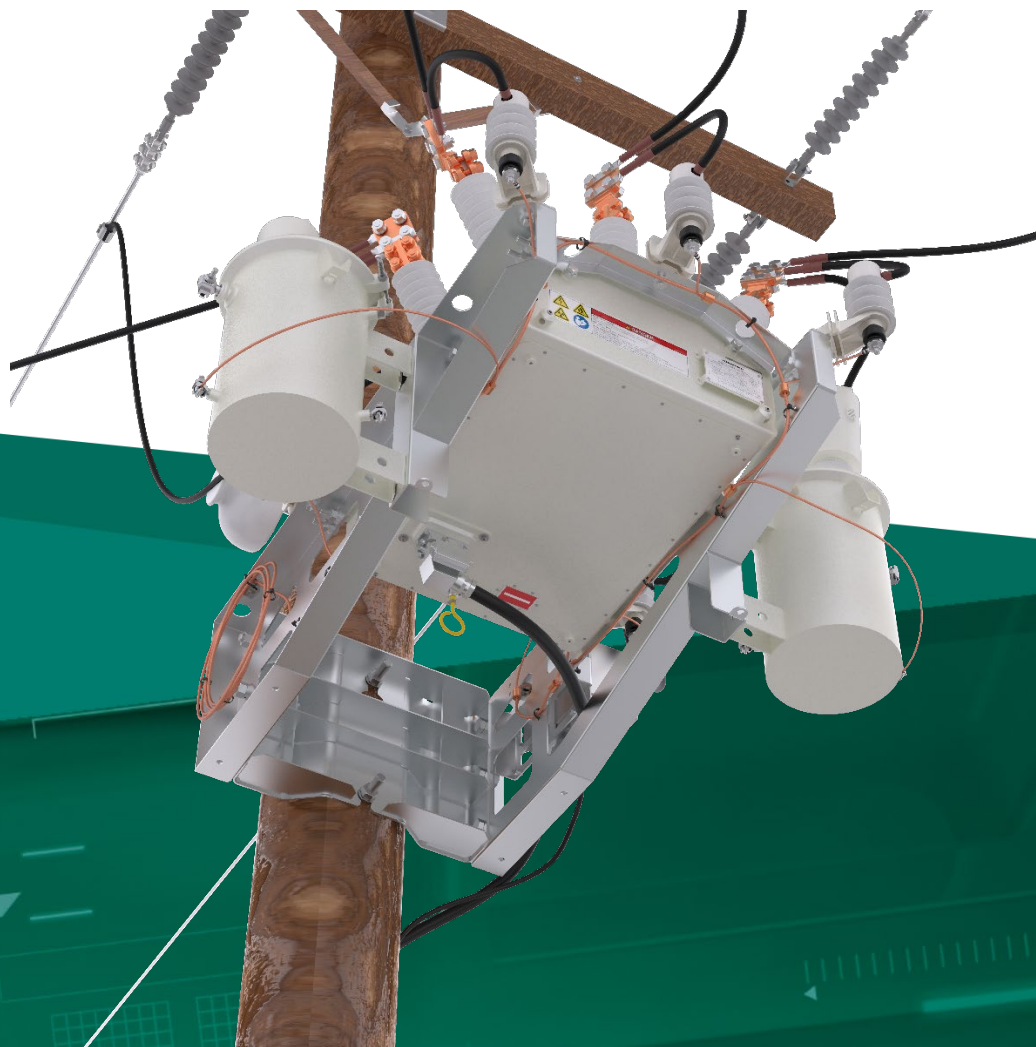


# Rec25\_Al\_SSline Rec25\_Al\_SSsub

## With Stainless Steel Mounting Kit

**AUTOMATIC  
CIRCUIT  
RECLOSER**

15 kV, 16 kA, 800 A  
27 kV, 12.5 kA, 800 A



The present Technical Manual contains information necessary for installation, commissioning and operation. It is absolutely necessary for the proper and safe use of the recloser to read the Technical Manual carefully and to adhere to the instructions as well as relevant regulations.

## **Safety First**

- Installation, operation and maintenance shall only be carried out by trained and experienced personnel who are familiar with the equipment and electrical safety requirements;
- During installation, commissioning, operation and maintenance of the equipment the relevant legal regulations (such as NFP70E, CEC, ANSI), accident prevention regulations and the connecting conditions of the electric utilities shall be followed;
- Take note that during operation of the recloser certain parts are subject to dangerous voltage. Mechanical parts, also remote-controlled, can move quickly. Failure to comply may result in death, severe personal injury or damage to equipment;
- Pay attention to the hazard statements located throughout this manual;
- The operating conditions of the recloser shall comply with the technical data specified in this manual;
- Personnel installing, operating and maintaining the equipment shall be familiar with this manual and its contents.

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# 1 Introduction

## Applicability

This Technical Manual applies to a range of Outdoor Switching Modules manufactured by Tavrida Electric that work in conjunction with third-party recloser controls and associated stainless steel mounting accessories.

OSM model	Description
OSM25_AI_2(630_150_ALL)	27 kV, three-phase gang operated Outdoor Switching Module, with 600:1 CT ratio
OSM25_AI_4(ALL)	27 kV, three-phase independent pole operated Outdoor Switching Module, with 600:1 CT ratio
OSM25_AI_5(100.150_150_ALL)	27 kV, three-phase gang operated Outdoor Switching Module, with (300:1, 150:1, 100:1, 60:1) CT ratios and improved voltage measurement accuracy
OSM25_AI_5(600.200_150_ALL)	27 kV, three-phase gang operated Outdoor Switching Module, with (600:1, 200:1) CT ratios and improved voltage measurement accuracy

The model number is shown on the equipment rating plates. If your equipment does not correspond to the numbers in the table above then this manual is not applicable. Please contact your nearest Tavrida Electric office or Sales Representative for the correct documents.

Every care has been taken in preparation of this manual. However, please note that not all the details or variations in the equipment or process being described can be covered. Nor it expected to address all contingencies associated with the installation and operation of this equipment. For any further information please contact your nearest Tavrida Electric office or Sales Representative.

## Hazard Statements

This manual contains three types of hazard statements, as follows:

- DANGER:** Indicates an imminently hazardous situation that, if not avoided, will result in death or serious injury.
- WARNING:** Indicates a potentially hazardous situation that, if not avoided, could result in death or serious injury.
- CAUTION:** Indicates a potentially hazardous situation that, if not avoided, could result in personal injury or equipment damage.

## Safety Instructions

General hazard statements applying to this equipment are described in this section. Statements relating to specific tasks or procedures are located throughout this manual.

- DANGER:** Contact with hazardous voltage will cause death or severe personal injury. Contact with Recloser or Control Cubicle terminals should only be undertaken when equipment is isolated from applicable sources of voltage.
- WARNING:** This equipment is not intended to protect human life. Follow all locally approved safety procedures when installing or operating this equipment. Failure to comply may result in death or severe personal injury.
- WARNING:** Before working with equipment described in this manual carefully read and understand the contents of this manual. Improper handling, installation, operation or maintenance can result in death, severe personal injury or damage to equipment.
- WARNING:** Power distribution equipment must be properly selected for the intended operation. It must be installed, used and understand all relevant safety procedures. Failure to comply can result in death, personal injury or equipment damage.

# 1.1 Definitions

The following abbreviations are used in this operating manual:

<b>AR</b>	Automatic Reclosing
<b>CM</b>	Control Module
<b>CO</b>	Close Open cycle
<b>SM</b>	Switching Module
<b>LED</b>	Light Emitting Diode
<b>MCB</b>	Miniature Circuit Breaker
<b>NC</b>	Normally Closed contact
<b>NO</b>	Normally Open contact
<b>OSM</b>	Outdoor Switching Module
<b>PCD</b>	Pole Center Distance
<b>RC</b>	Recloser Control
<b>SCADA</b>	Supervisory Control and Data Acquisition
<b>VCB</b>	Vacuum Circuit Breaker
<b>VI</b>	Vacuum Interrupter

## Make time

The make time is the time period from the energizing of the closing circuit to the time when the current begins to flow in the first pole.

## Closing time

The closing time is the time period from the energizing of the closing circuit to the time when all three poles have contact.

## Pre-arcing time

Interval of time between the initiation of current flow in the first pole during a closing operation and the instant when the contacts touch in all poles for three-phase conditions and the instant when the contacts touch in the arcing pole for single-phase conditions.

## Opening time

The opening time is the time period from energizing of the closing circuit to the time when all the switching poles are separated.

## Interrupting time

The interrupting time is the time period from the energizing of the closing circuit to the time when the arcs of all the poles are extinguished.

## Open-close time (during AR)

Interval of time between the instant when the arcing contacts have separated in all poles and the instant when the contacts touch in the first pole during a reclosing cycle.

## Dead time (during AR)

Interval of time between final arc extinction in all poles in the opening operation and the first reestablishment of current in any pole in the subsequent closing operation.

## 1.2 General

The Outdoor Switching Module is designed for use as an automatic circuit recloser or a sectionalizer on overhead distribution lines and as an outdoor switching module in distribution substation applications for voltages up to 27 kV.

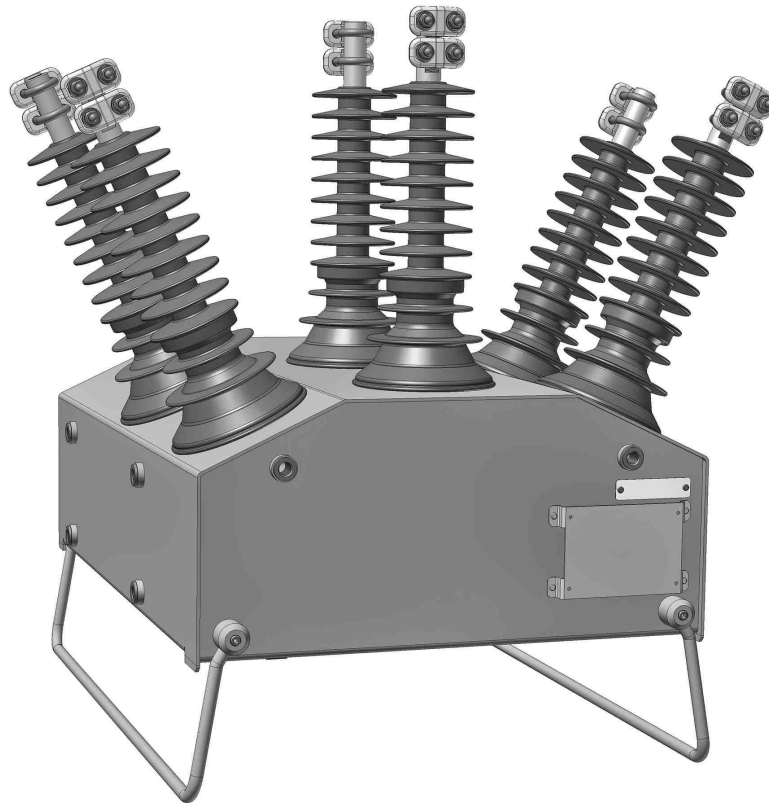


Figure 1  
*Outdoor Switching Module general view*

## **2 Technical Parameters**



Table 1 – Switching module technical parameters

Parameter	OSM25_AI_2 (630_150_ALL)	OSM25_AI_4 (ALL)	OSM25_AI_5 (100.150_150_ALL)	OSM25_AI_5 (600.200_150_ALL)
<b>Rated data</b>				
Rated voltage (Ur)	15.5 kV and 27 kV			
Rated continuous current (Ir)	800 A		630 A	800 A
Rated continuous overload current (Ir)	960 A <sup>1</sup>		630 A	960 A <sup>1</sup>
Rated power frequency withstand voltage (Ud), 1 min dry	60 kV			
Rated power frequency withstand voltage (Ud), 10s wet	55 kV			
Rated lightning impulse withstand voltage closed contacts/open contacts (peak) (Up)	150/125 kV			
Partial discharge decay level, not less than	16.4 kV			
Rated short-circuit breaking current (Isc)	16kA @ 15.5kV / 12.5kA @ 27kV			
Rated short-circuit making current, peak	41.6kA @ 15.5kV / 32.5kA @ 27kV			
Rated short-time withstand current, 4s (Ik)	16kA @ 15.5kV / 12.5kA @ 27kV			
Rated frequency (fr)	50/60 Hz			
Cable charging current	31.5 A			
Line charging current	5 A			
<b>Switching performance</b>				
Mechanical life (CO-cycles)	30 000			
Operating cycles, rated current (CO-cycles)	30 000			
Maximum number of CO-cycles per hour	Refer to recloser control manual			
Electrical endurance, breaking current (O-CO cycles)	See Figure 2			
Closing time, not more than <sup>2)</sup>	40 ms			
Opening time, not more than <sup>2)</sup>	15 ms			
Interrupting time, for 50/60 Hz, not more than <sup>2)</sup>	25/23 ms			
Rated operating sequence	Refer to recloser control manual			
<b>Standards</b>				
International Standard American Standard	IEC 62271-100, IEC 62271-111 IEEE C37.60			
<b>Other data</b>				
Current sensing	3 current transformers		6 current transformers <sup>3</sup>	
Voltage sensing	6 voltage sensors			
Main contact resistance, not more than	95 μOhm			
Solar radiation	≤ 1.1 kW/m <sup>2</sup>			
Degree of protection	IP65			
Weight	80 kg			

<sup>1)</sup> Contact company technical support for details.

<sup>2)</sup> Outdoor Switching Module value only. Does not include control processing time. Refer to control manual for more information on additional time to calculate a complete fault interruption cycle.

<sup>3)</sup> 6 current transformers are installed to provide variable CT ratio functionality. At any time only 3 current transformers measurement are available.

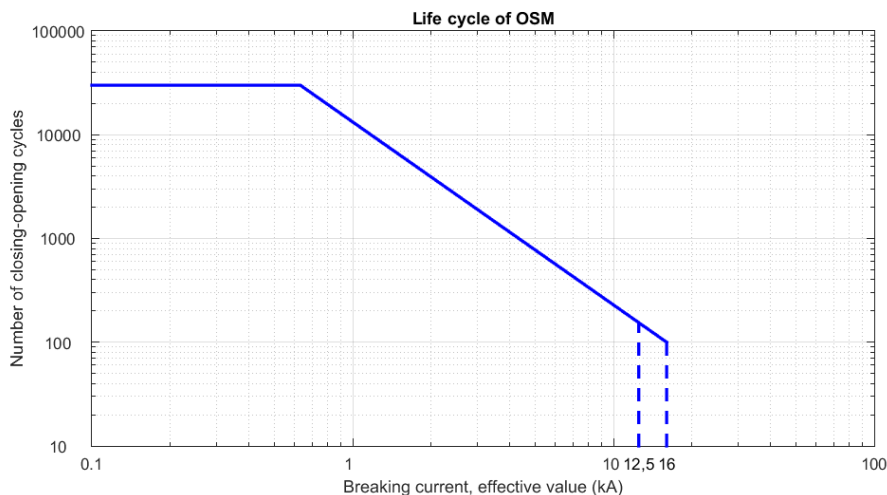
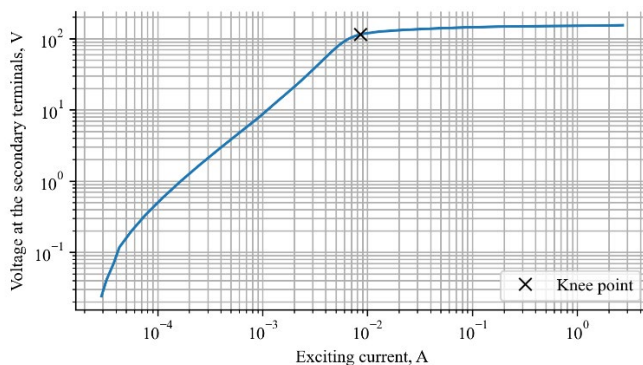


Figure 2  
Outdoor Switching Module electrical endurance

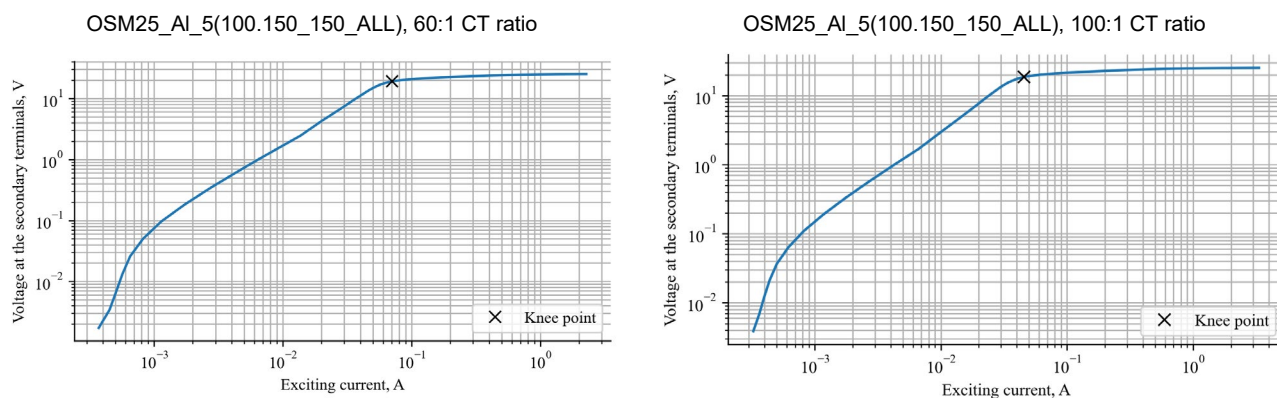
**Table 2 – Parameters of Current Transformers and Voltage Sensors**

Parameter	OSM25_AI_2 (630_150_ALL)	OSM25_AI_4 (ALL)	OSM25_AI_5 (100.150_150_ALL)	OSM25_AI_5 (600.200_150_ALL)
<b>Current transformers</b>				
CT ratio	600:1	600:1	60:1 / 100:1 / 150:1 / 300:1	200:1 / 600:1
Rated primary current	600 A	600 A	60 / 300 / 300 / 300	200 / 600
Rated secondary current	1 A	1 A	1 A	1 A
Rated output, at PF=0.8...1	1.0 VA	1.0 VA	1.0 VA	1.0 VA
Accuracy class of protection transformers according to IEC 61869	5P20	5P20	5P20	5P20
Accuracy limit factor according to IEEE C57.13	20	20	20	20
Accuracy class of protection transformers according to IEEE C57.13	C100	C100	C20	C20 / C50
Measuring accuracy class, IEC 61869-2	1.0	1.0	1.0	1.0
Accuracy limit factor (ALF), IEC 61869-6 at:				
25% of rated burden	43	43	58 / 40 / 40 / 58	34 / 25
50% of rated burden	40	40	36 / 35 / 35 / 36	29 / 24
100% of rated burden	35	35	22 / 28 / 28 / 22	22 / 22
<b>Voltage Sensors</b>				
Voltage sensor ratio range	0.108 - 0.123 V/kV	0.108 - 0.123 V/kV	0.108 - 0.123 V/kV	0.108 - 0.123 V/kV
Voltage sensors ratio error within rated temperature range	1.0 % for all 6 sensors			



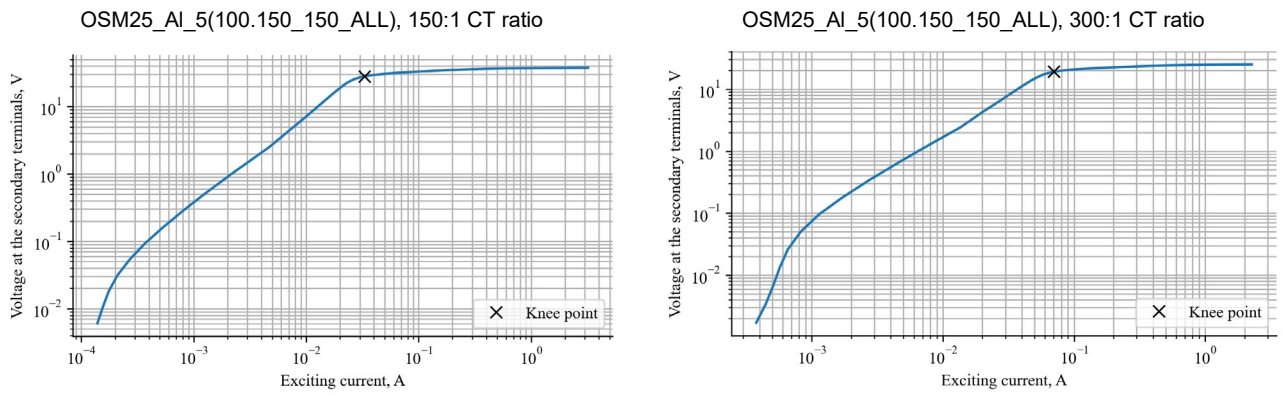
**Figure 3**

**Current transformers excitation curves for OSM25\_AI\_2(630\_150\_ALL) and OSM25\_AI\_4(ALL)**

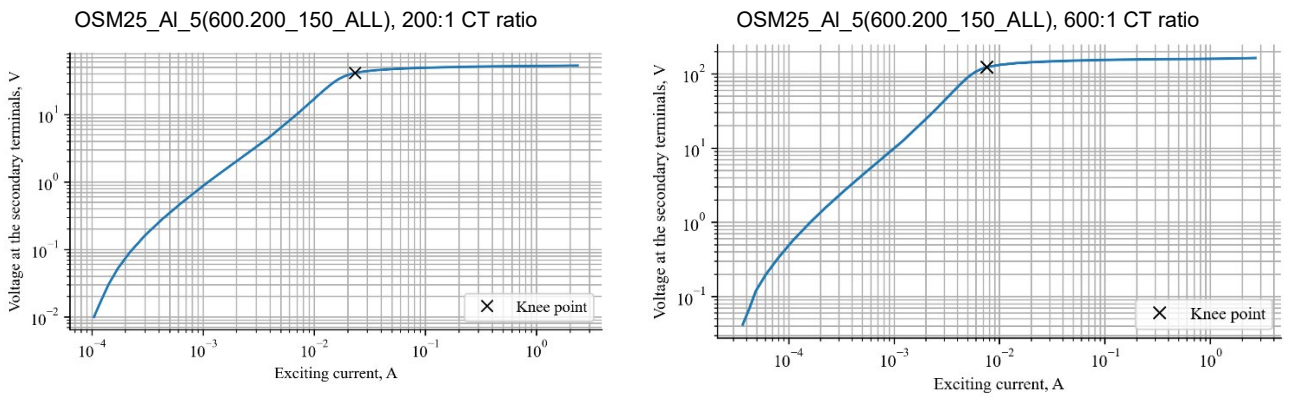


**Figure 4**

**Current transformers excitation curves for OSM25\_AI\_5(100.150\_150\_ALL) - 60:1 CT and 100:1 CT ratio**



**Figure 5**  
**Current transformers excitation curves for OSM25\_AI\_5(100.150\_150\_ALL) - 150:1 CT and 300:1 CT ratio**



**Figure 6**  
**Current transformers excitation curves for OSM25\_AI\_5(600.200\_150\_ALL) – 200:1 CT and 600:1 CT ratio**

**Table 3 – Ambient conditions**

Maximum ambient temperature	+ 55 °C
Minimum ambient temperature	- 60 °C
Humidity	100% condensing
Altitude	Up to 3000 m <sup>1</sup>
Pollution level	Very heavy (according to IEC 60815)
Salt fog	1000 h (according to IEC 62217)

<sup>1</sup> Derating according to ANSI C37.60 is applied for altitudes above 1000 m

# **3 Outdoor Switching Module**

## 3.1 Overview

Tavrada Electric's outdoor switching module provides the following advantages:

### Environmentally Friendly

The Outdoor Switching Module is an air insulated switchgear with a patented combined insulation that makes it the environmentally friendly option - no oil or SF6 despite its compact size.

The reliability of the design is proven by the world's most severe climate and pollution conditions test at the Koeberg Insulator Pollution Test Station (KIPTS) in South Africa.

### Smallest Dimensions and Lowest Weight

Tavrada Electric's innovative vacuum circuit breaker and the robust aluminum tank contribute to the light weight of the Outdoor Switching Module – only 80 kg, making these the most light weight outdoor switching modules on the market, greatly simplifying shipping, handling and installation.

### Highest Availability

30,000 CO operations at rated continuous current and up to 100 CO operations with full short circuit breaking current without any maintenance, makes them the most reliable product on the market.

### Optimized Measurement

All Outdoor Switching Modules are equipped with six voltage sensors and three current transformers built into the bushings. It guarantees high accuracy over a wide measurement range and makes the recloser an ideal device for self-healing loop automation solutions.

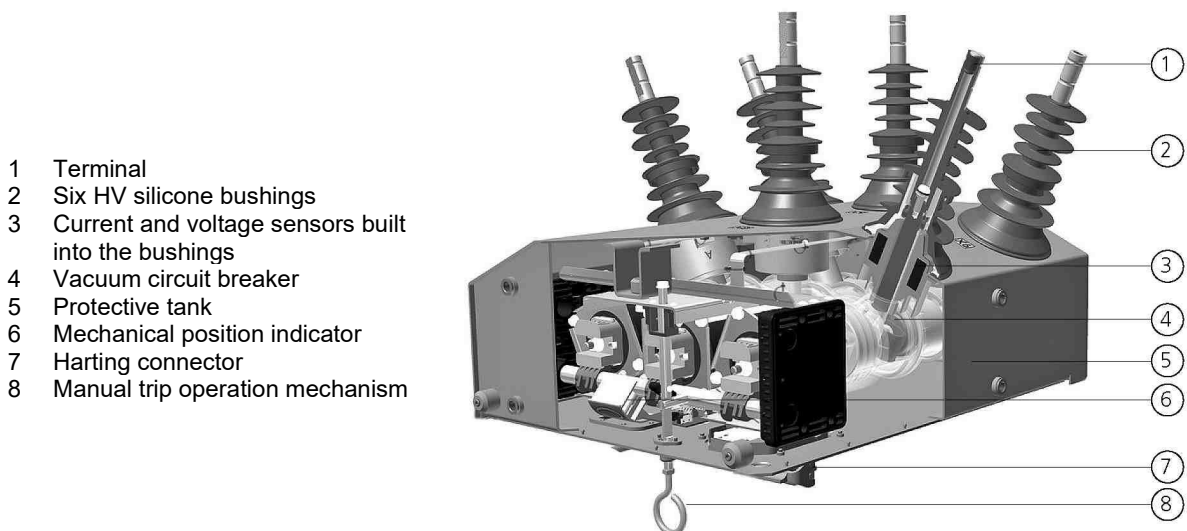


Figure 7

*Internal arrangement of the Outdoor Switching Module*

## 3.2 Vacuum Circuit Breaker – VCB

Each Outdoor Switching Module is equipped with Tavrada Electric's innovative vacuum circuit breaker (VCB). Tavrada Electric has simplified the mechanical structure of the vacuum circuit breaker to the greatest possible degree. It uses three single-coil magnetic actuators, one per pole. All switching elements are assembled along a single axis. All mechanical movements are therefore direct and linear. The three actuators are mounted in a steel frame. Optimal selection of all components makes these the most compact vacuum circuit breakers in the world.

Failure of critical components, such as

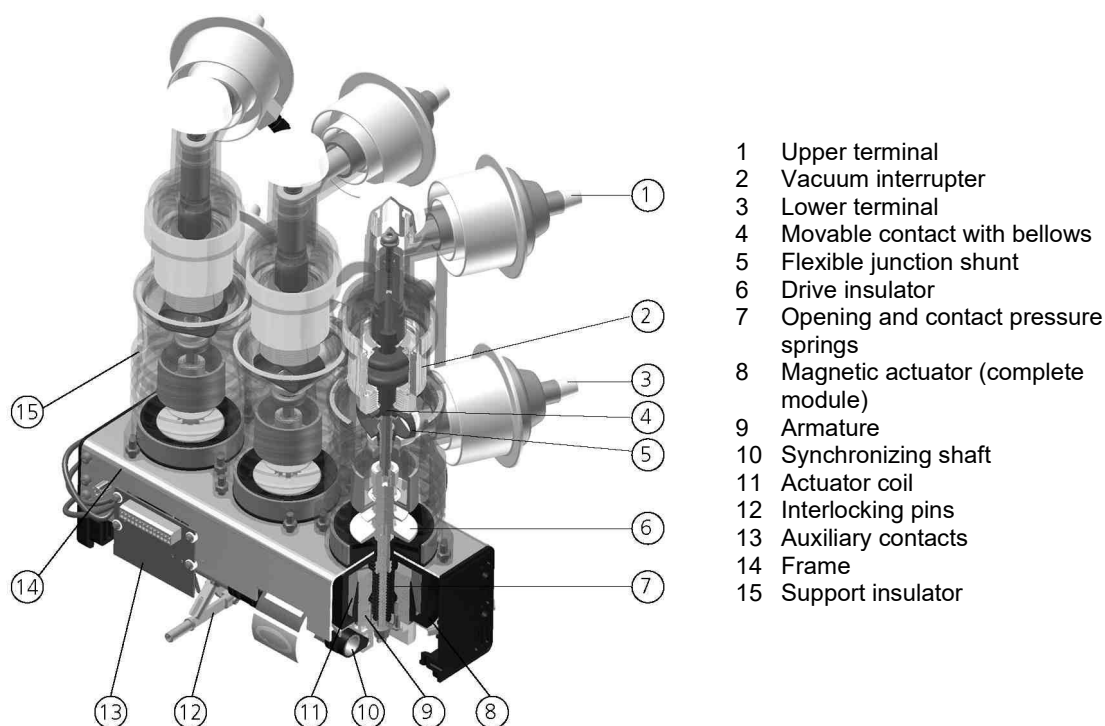
- mechanical latching
- gears, chains, bearings and levers
- tripping and closing coils
- spring charging motors
- ...are completely eliminated.

Maximizing the benefits of the drive mechanism requires vacuum interrupters that combine small dimensions with an extraordinarily long mechanical and electrical lifespan. The use of a predefined axial magnetic field shape provides even distribution of current density and consequently substantial improvement of vacuum interrupting performance. Carefully selected contact material and expert contact design as well as optimized movement and switching speed result in bounce-free closing.

Substantial increase in mechanical lifespan as well as size reduction of Tavrida Electric vacuum interrupters was achieved by utilizing metal bellows consisting of welded single discs as opposed to the conventional use of folded steel.

The result is 30,000 CO cycles at rated continuous current or up to 100 CO operations at full short-circuit breaking current without the need to replace or adjust any parts of the vacuum circuit breaker.

Tavrida Electric's vacuum circuit breaker is entirely maintenance free over a total life expectancy of at least 30 years.



**Figure 8**  
**View into the VCB**

### Closing

Closing operation is possible only if manual trip hook is in upper position. In the open position the contacts are kept open by the force of the opening springs. To close the contacts the coils of the magnetic actuators are excited by a current impulse of the close capacitors within the recloser control. As a result the contacts close. At the same time the opening springs are compressed. In the close position the contacts are kept closed by means of the magnetic force only. The VCB maintains the closed position without mechanical latching also in case of a failure of the auxiliary power supply.

### Opening

To open the contacts a current impulse in the reverse polarity derived from the opening capacitors within the recloser control is injected in the coils of the magnetic actuators releasing the magnetic holding force. The compressed opening springs and contact pressure springs open the contacts.

## Manual Closing

The switching module can only be closed electrically via the recloser control. In the case of a failure of auxiliary power supply the contacts can be closed using an alternative auxiliary power supply such as a battery. Mechanical closing is not possible since this may lead to destruction of the switching module.

## Manual Trip

When the manual trip hook is pulled down the synchronizing shaft is rotated. A force exceeding the magnetic attraction forces of the ring magnet is applied to the armature, which subsequently starts to move. As the air gap increases, the opening springs and the contact pressure springs overcome the magnetic holding force, and the vacuum interrupter opens.

## 3.3 Protective Tank

The OSM is constructed with the vacuum circuit breaker with single coil magnetic actuators all within an aluminum tank. The protective tank consists of two main parts: The housing and the bottom protective cover riveted to the housing. The OSM housing and the cover are made of a corrosion resistant aluminum alloy. Water-tight aluminum rivets are used to secure the cover. The tank is powder coated in light grey. The tank including the control cable cover provides IP65 degree of protection.

Four threaded holes (M12x30) on each side of the tank allow mounting equipment for pole or substation installation to be fitted. Two of these threaded holes are used to install the set of lifting lugs on the tank.

The grounding provision (M12x30 threaded hole) is labelled for easy identification.

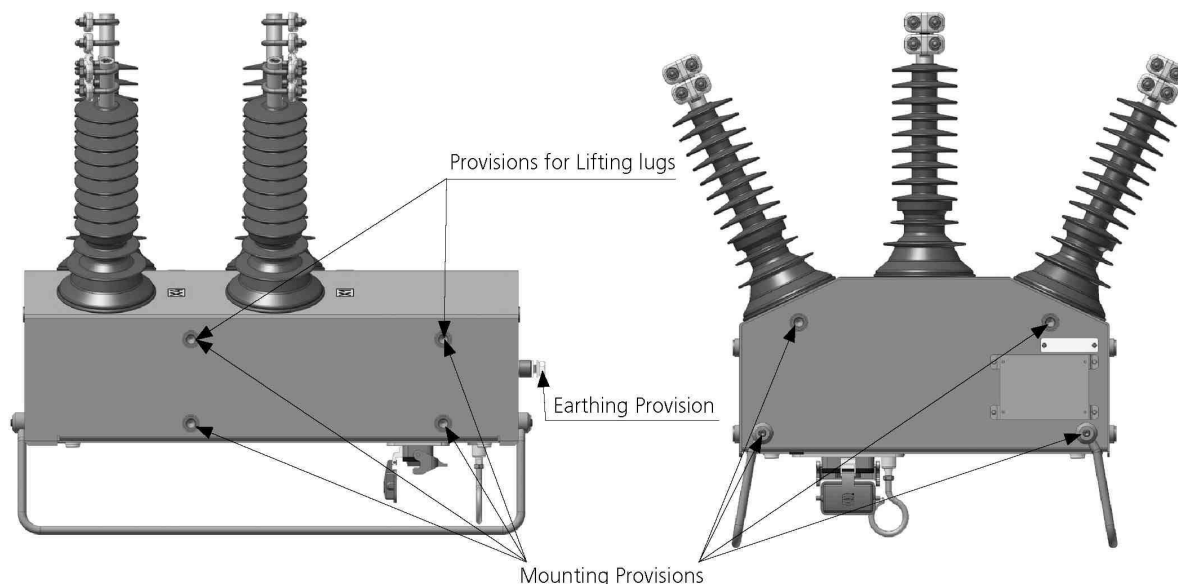
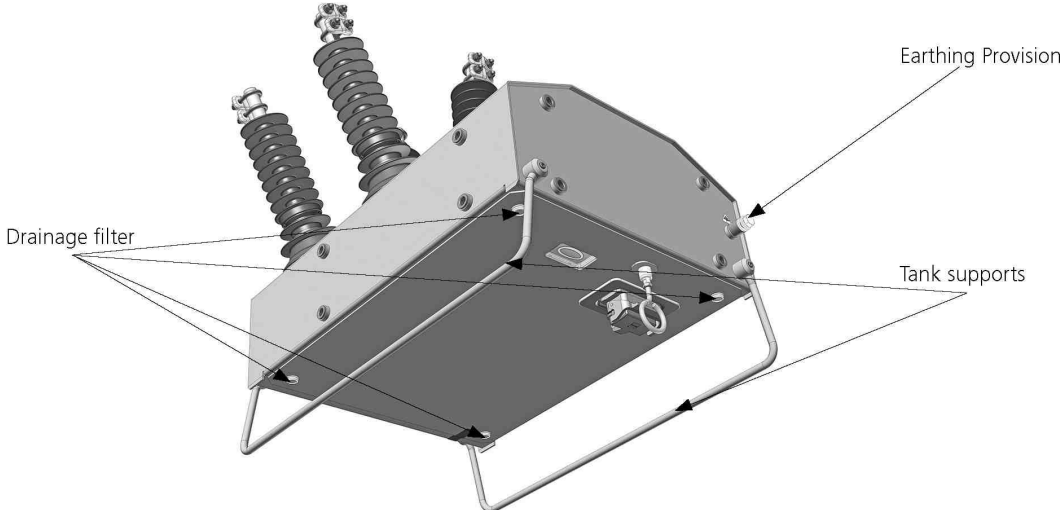


Figure 9

**Threaded holes arrangement**

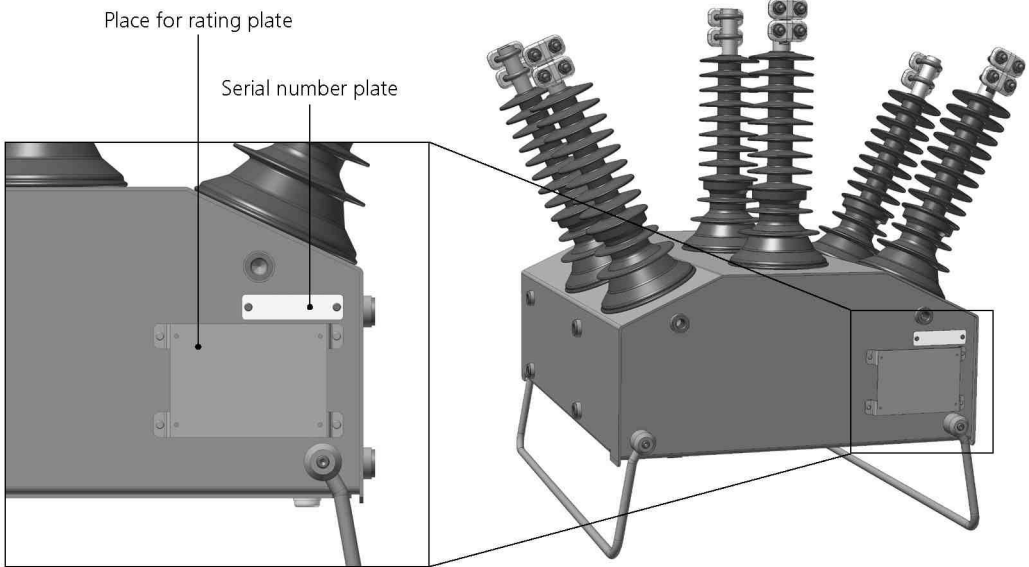
The protective tank is equipped with ceramic breathers on the bottom. The breathers ensure that no dust or pollution ingress occurs.



**Figure 10**  
**Drainage filters arrangement**

Each Outdoor Switching Module has the following rating plates:

- Serial number plate
- Rating plate



**Figure 11**  
**Outdoor Switching Module nameplates arrangement**



The following information is also provided on the Outdoor Switching Module tank:

- Label with calibration coefficients of the delivered unit (Figure 12)
- Warning label (Figure 13)

<b>TEL TAVRIDA ELECTRIC</b>	
<b>Recloser:</b>	
Type	OSM25_AI_2(630_150_5)
Serial number	424723
<b>Control:</b>	
Type	0651R17CGA83111110
Serial number	1122200599
<b>Current transformer ratio settings:</b>	
Phase (CTR)	600:1
Residual (CTRN)	600:1
<b>Voltage sensor correction ratio settings:</b>	
Phase AY (X1)	0.992
Phase BY (X2)	0.991
Phase CY (X3)	1.005
Phase AZ (X4)	0.994
Phase BZ (X5)	0.993
Phase CZ (X6)	0.983
Tavrída Electric North America 1-866-551-8362	

Figure 12  
Label with calibration coefficients

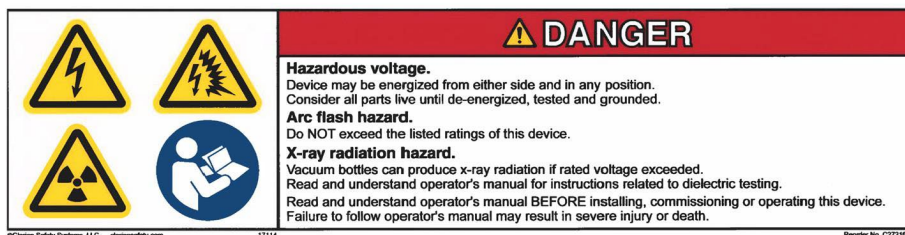


Figure 13  
Warning label

### 3.4 Main Circuit Bushings

The main circuit bushings are manufactured from UV stable polymer. They are covered by light grey silicon rubber bushing boots which provide a creepage distance of 860 mm.

The bushings were subjected to and passed salt fog test according to IEC 62217-2005 (1000 hours). They are marked by stickers with the terminal designation X1, X2, X3, X4, X5 and X6 for identification. Built-in CTs are installed in terminals X1, X2, X3.

Allowable wire pull at the connection point is 300 N.



Figure 14  
*Phase marking*

### 3.5 Bushing extensions and cable terminals

Bushing extensions end with cylindrical rods with a milled surface for cable connections. All parts are tin plated, which allows the connection of both aluminum and copper conductors. 2-hole or 4-hole NEMA pads are used for connection of the cables.

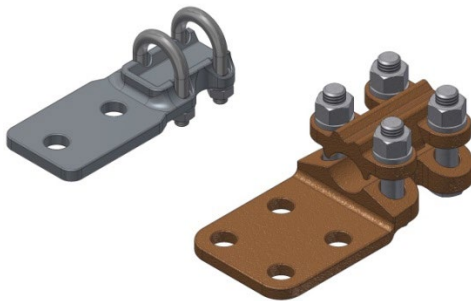


Figure 15

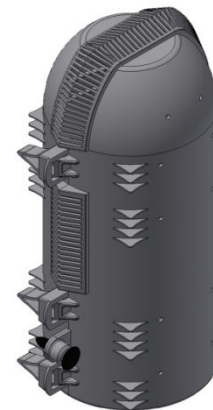
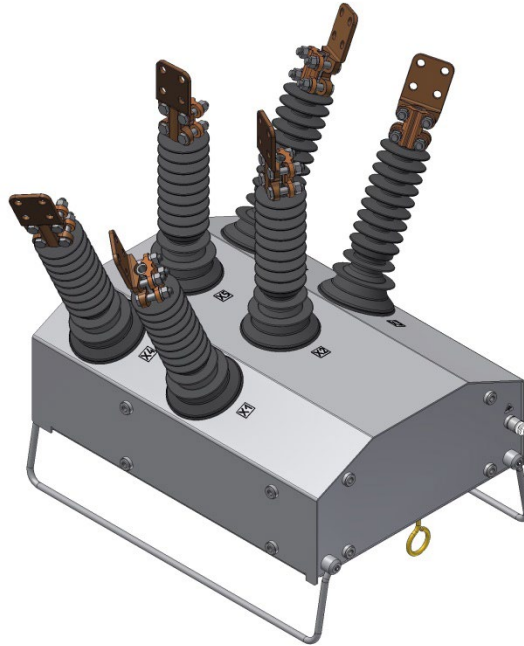


Figure 16



**Figure 17**  
*NEMA pads installed*

### 3.6 Current Transformers

The Outdoor Switching Module is equipped with protection current transformers in the bushings X1, X2, X3 (for OSM25\_AI\_5(100.150\_150\_ALL) also in the bushings X4, X5, X6). The parameters of the current transformers are specified in the Chapter “Technical Data”.



**Figure 18**  
*Current Transformer*

### 3.7 Mechanical Trip

The mechanical trip hook is made of zinc anodized steel and coated with powder polymer paint RAL1023 (Figure 19).

**NOTE:** The hook shall be pulled down sharply without stopping in intermediate positions. This is especially concerns for OSM25\_AI\_4. The hook shall be pulled down up to the position when all three poles are opened.

When pulled down, the Outdoor Switching Module is mechanically locked in the OPEN position and electrically interlocked against closing. Until the hook stick lever is pushed back in the closed position, the Outdoor Switching Module remains locked and cannot be electrically operated.

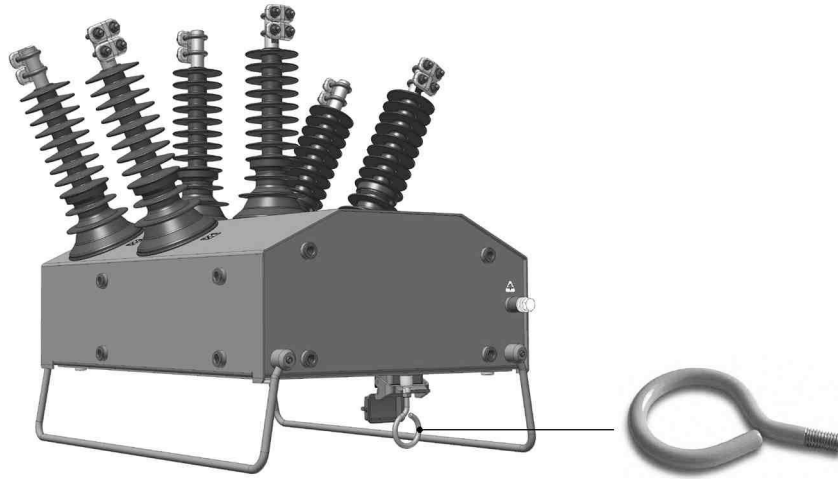




Figure 19  
Manual trip hook

### 3.8 Mechanical Position Indicator

The position indicators are located under a protective cover underneath the tank and are clearly visible from the ground. The indicator color is red  when the contact is closed and green  when it is opened.

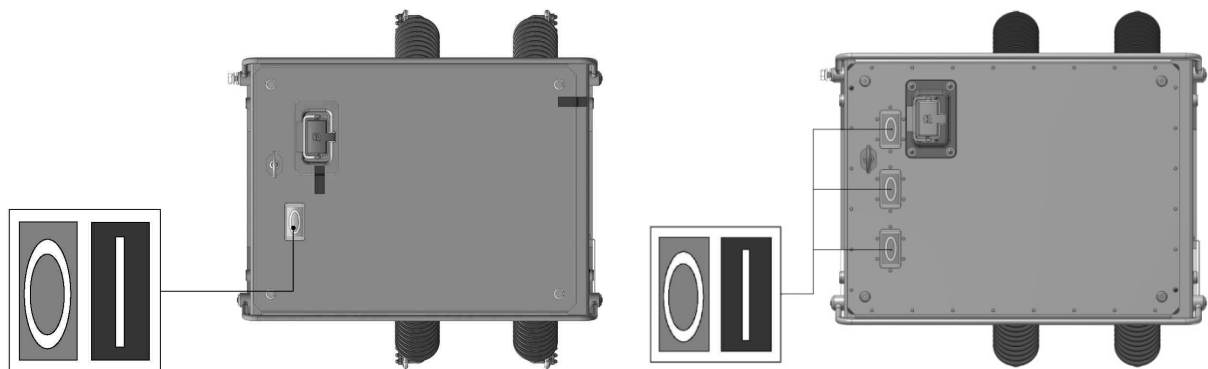


Figure 20  
Open / Close position indication of OSM25\_AI\_2, OSM25\_AI\_5 (left) and OSM25\_AI\_4 (right)

# **4 Installation: Primary Part**

## 4.1 General, Preparation

All local and national electrical codes, standards and practices must be adhered to during installation and commissioning of this device. Only licensed and qualified personnel shall perform installation, commissioning and operation.

## 4.2 Mounting bracket

There are different mounting kits available on request. They are equipped with provisions for surge arrestors, Control Power Transformers and protective grounding.

Application sample for round wooden pole installation with two 2kVA transformers is shown on Figure 21.

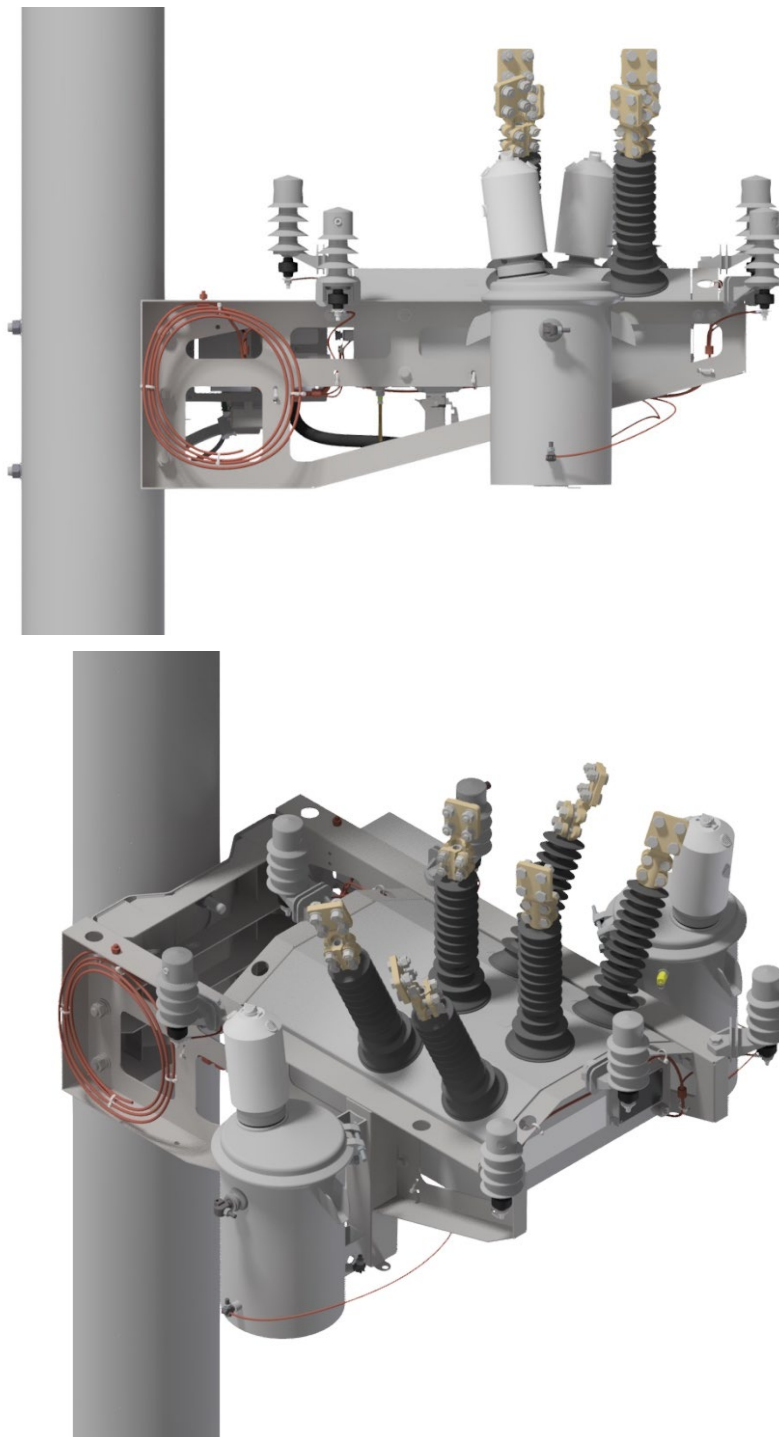


Figure 21

*Mounting kit for round wooden pole*

Application sample for substation installation with adjustable height is shown on Figure 22.

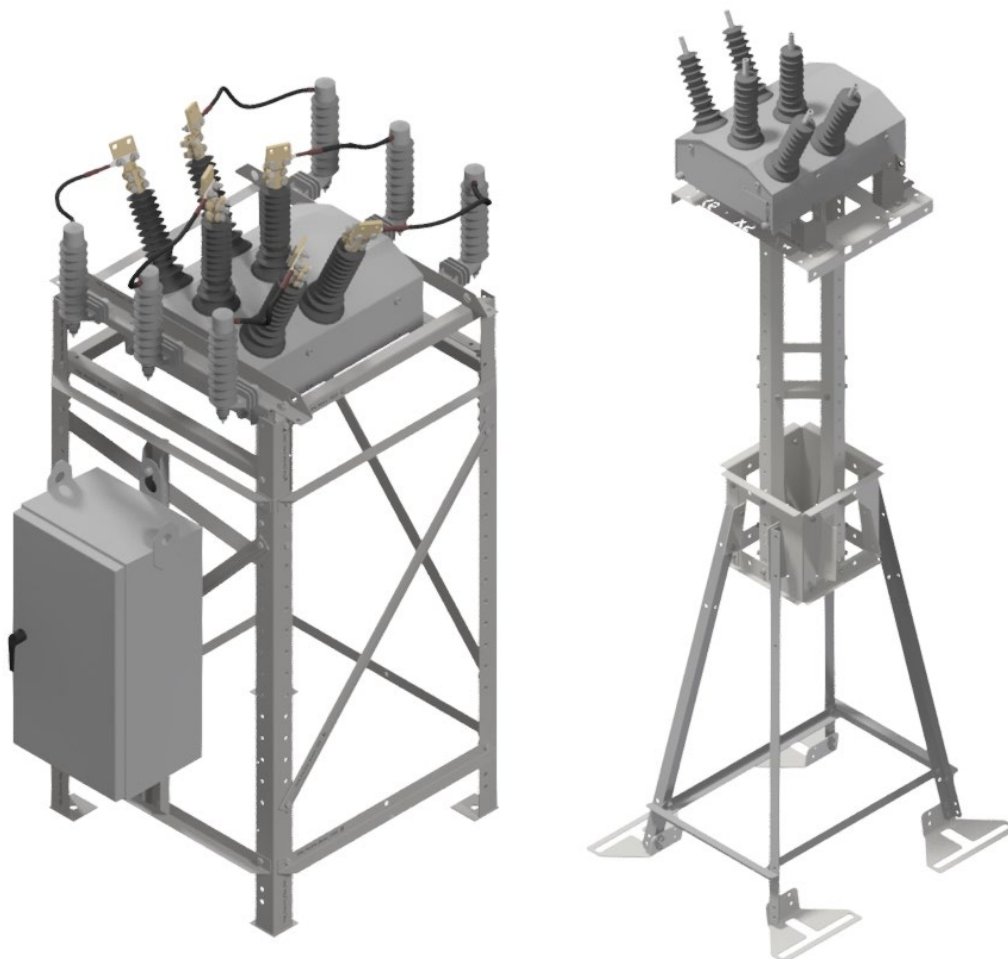


Figure 22  
*Substation mounting kit*

## 4.3 Main Terminal Connection

Depending on terminal connector type the cable should be prepared accordingly.

Connection to the NEMA terminals:

- Crimp NEMA terminal lug to a cable according to manufacturer's recommendations.
- Contact surfaces shall be preliminarily smoothed out with a steel file card or metallic brush and the abrasive dust shall be removed with rags.
- Connect cable lug to NEMA terminal installed onto Outdoor Switching Module using M12 bolt and nuts.
- Fix the lugs to the NEMA terminals tighten the nuts hard to 20 Nm
- For protection of connections against environments use corresponding protective covers

# **5 Installation: Secondary Part**



## 5.1 Secondary Connections of the OSM

The Outdoor Switching Module secondary connection is made by the Harting terminal 42 pin (Han-DD type) which is located on the bottom of Outdoor Switching Module protective tank.



Figure 23

### *Harting terminal arrangement*

All auxiliary circuits are placed inside the Outdoor Switching Module protective tank. The IP65 degree of protection of the module provides reliable protection from water and dust.

## 5.2 Junction Box

In case the scope of your recloser supply contains a junction box the connection between Outdoor Switching Module and Recloser Control has to be made through this junction box. Connect the control cable to the junction box as it is shown in

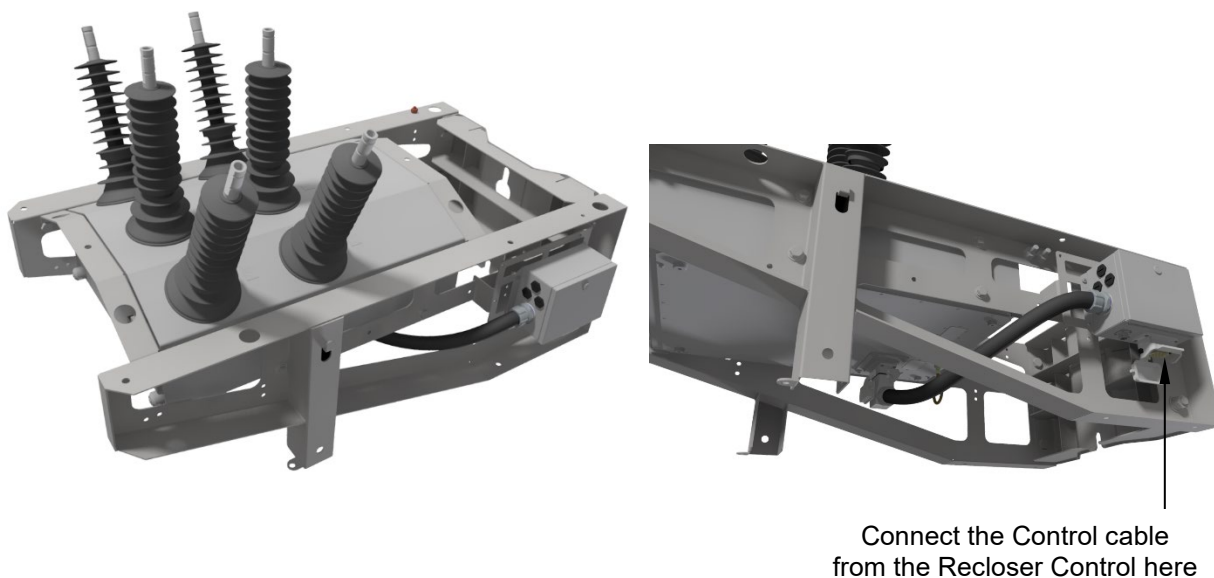


Figure 24

### *Control cable connection through the junction box*

## 5.3 Auxiliary Circuit Terminations

Pin arrangement of Harting Han-42 DD terminal is as follows:

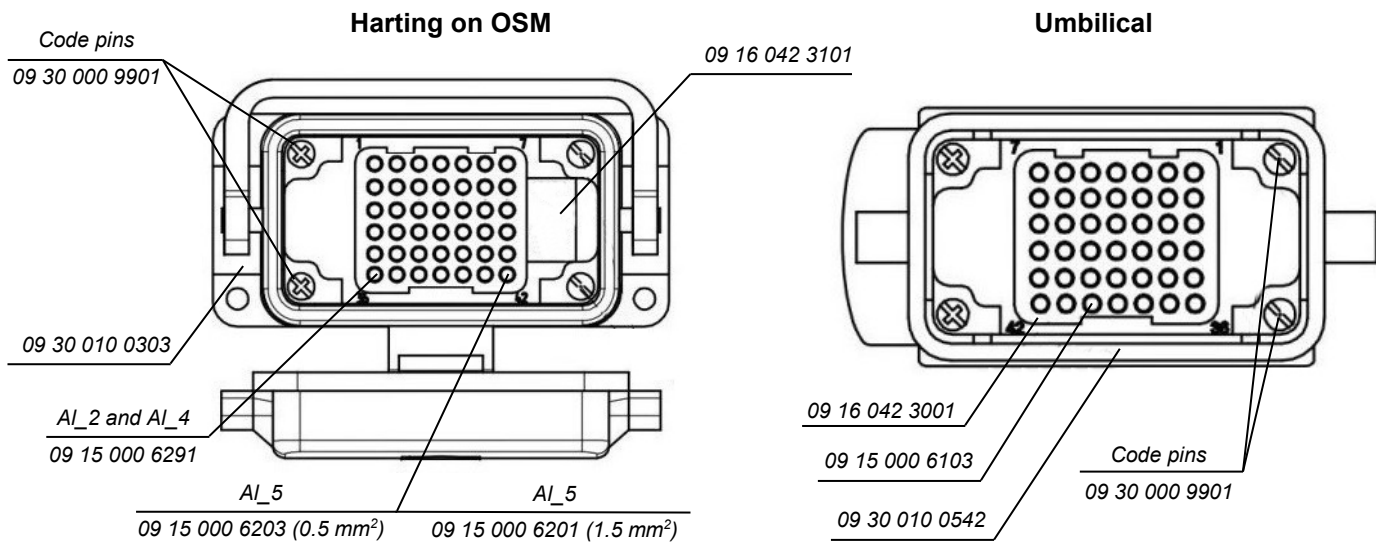


Figure 25

### Harting terminal pin arrangement

Termination of Harting terminals for OSM25\_AI\_2 (630\_150\_ALL), OSM25\_AI\_4 (ALL), OSM25\_AI\_5 (100.150\_150\_ALL) and OSM25\_AI\_5(600.200\_150\_ALL):

Terminal No.	OSM25_AI_2 (630_150_ALL)		OSM25_AI_4 (ALL)		OSM25_AI_5 (100.150_150_ALL) OSM25_AI_5(600.200_150_ALL)	
1	-	free	-	free	CT4.2	CT4.2
2	SC1.1	Phase A-1 actuator coil	SC1.1	Phase A-1 actuator coil	SC1.1	Phase A-1 actuator coil
3	SC1.2	Phase A-2 actuator coil	SC1.2	Phase A-2 actuator coil	SC1.2	Phase A-2 actuator coil
4	SC2.1	Phase B-1 actuator coil	SC2.1	Phase B-1 actuator coil	SC2.1	Phase B-1 actuator coil
5	SC2.2	Phase B-2 actuator coil	SC2.2	Phase B-2 actuator coil	SC2.2	Phase B-2 actuator coil
6	SC3.1	Phase C-1 actuator coil	SC3.1	Phase C-1 actuator coil	SC3.1	Phase C-1 actuator coil
7	SC3.2	Phase C-2 actuator coil	SC3.2	Phase C-2 actuator coil	SC3.2	Phase C-2 actuator coil
8	-	free	-	free	CT5.2	CT5.2
9	-	free	-	free	CT6.2	CT6.2
10	-	free	-	free	-	free
11	-	free	-	free	-	free
12	-	free	-	free	CT4.1	CT4.1
13	-	free	-	free	-	free
14	-	free	-	free	-	free
15	YH1.1	Yellow handle contact	YH1.1	Yellow handle contact	YH1.1	Yellow handle contact
16	AS3.1	NC3 auxiliary contact	AS3.1	NC3 auxiliary contact	AS3.1	NC3 auxiliary contact
17	AS2.1	NC2 auxiliary contact	AS2.1	NC2 auxiliary contact	AS2.1	NC2 auxiliary contact
18	-	free	-	free	CT6.1	CT6.1
19	GND	Ground	Ground	GND	GND	Ground
20	GND	Ground	Ground	GND	GND	Ground
21	CT1.1	Phase A CT	CT1.1	Phase A CT	CT1.1	CT1.1
22	AS1.1	NC1 auxiliary contact	AS1.1	NC1 auxiliary contact	AS1.1	NC1 auxiliary contact
23	AS4.1	NO4 auxiliary contact	-	free	AS4.1	NO4 auxiliary contact
24	-	free	-	free	CT5.1	CT5.1
25	GND	Ground	GND	Ground	GND	Ground
26	GND	Ground	GND	Ground	GND	Ground
27	CTs GND	CTs common point	CTs GND	CTs common point	CTs GND	CTs common point
28	CT2.1	Phase B CT	CT2.1	Phase B CT	CT2.1	CT2.1

Terminal No.	OSM25_AI_2 (630_150_ALL)		OSM25_AI_4 (ALL)		OSM25_AI_5 (100.150_150_ALL) OSM25_AI_5(600.200_150_ALL)	
	Common	Auxiliary contacts common point	Common	Auxiliary contacts common point	Common	Auxiliary contacts common point
29	Common	Auxiliary contacts common point	Common	Auxiliary contacts common point	Common	Auxiliary contacts common point
30	GND	X1-2 voltage sensor	GND	X1-2 voltage sensor	GND	X1-2 voltage sensor (GND)
31	GND	X2-2 voltage sensor	GND	X2-2 voltage sensor	GND	X2-2 voltage sensor (GND)
32	GND	X3-2 voltage sensor	GND	X3-2 voltage sensor	GND	X3-2 voltage sensor (GND)
33	GND	X5-2 voltage sensor	GND	X5-2 voltage sensor	GND	X5-2 voltage sensor (GND)
34	GND	X6-2 voltage sensor	GND	X6-2 voltage sensor	GND	X6-2 voltage sensor (GND)
35	CT3.1	Phase C CT	CT3.1	Phase C CT	CT3.1	CT3.1
36	VS1.1	X1-1 voltage sensor	VS1.1	X1-1 voltage sensor	VS1.1	X1-1 voltage sensor
37	VS2.1	X2-1 voltage sensor	VS2.1	X2-1 voltage sensor	VS2.1	X2-1 voltage sensor
38	VS3.1	X3-1 voltage sensor	VS3.1	X3-1 voltage sensor	VS3.1	X3-1 voltage sensor
39	GND	X4-2 voltage sensor	GND	X4-2 voltage sensor	GND	X4-2 voltage sensor (GND)
40	VS4.1	X4-1 voltage sensor	VS4.1	X4-1 voltage sensor	VS4.1	X4-1 voltage sensor
41	VS5.1	X5-1 voltage sensor	VS5.1	X5-1 voltage sensor	VS5.1	X5-1 voltage sensor
42	VS6.1	X6-1 voltage sensor	VS6.1	X6-1 voltage sensor	VS6.1	X6-1 voltage sensor

## 5.4 Protective Grounding

The metal housing of the Outdoor Switching Module must be connected according to the applicable regulations, such as DIN VDE 0141, via the marked screw to the earth arrangement. Tighten the earthing bolt to  $30 \pm 2$  Nm torque.

Reference values for cross sections of earth connection (copper):

Duration of fault current (1 s)	Max. temperature of earth connection	Cross section earth connection
<10 kA/10 kA	300 °C	35-70 mm <sup>2</sup> (1...3/0 AWG)
16 kA	300 °C	70-95 mm <sup>2</sup> (3/0...4/0 AWG)

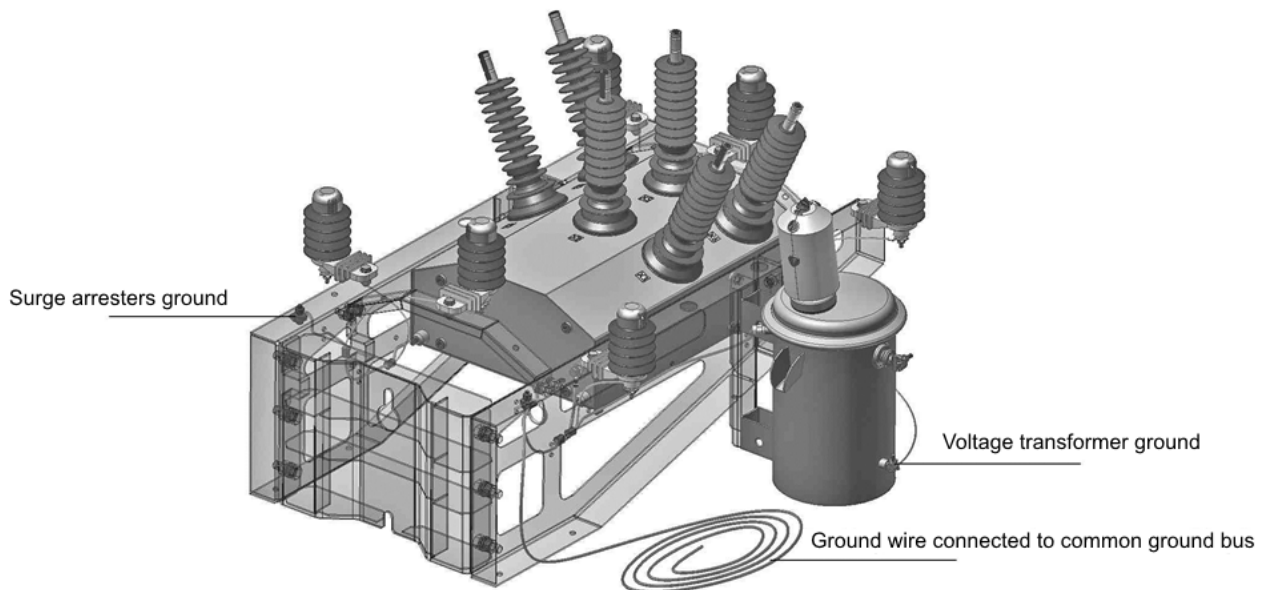


Figure 26  
Switching module and accessories grounding arrangement

# **6 Commissioning and Maintenance**

## 6.1 General

Commissioning, operation and maintenance is only permitted for qualified and trained personnel.

**Danger** Insofar as installation, commissioning or retrofit is carried out on energized equipment, the relevant safety regulations, including all national and local standards must be adhered to.

**Caution** The Outdoor Switching Module must always be tested and operated together with the appropriate recloser control. Individual testing is not possible and may lead to the destruction of the Outdoor Switching Module.

## 6.2 Commissioning Primary Part

Commissioning tests should include:

- Operating conditions of Outdoor Switching Module comply with requirements of the rating plate.
- Check for damage, remove dirt.
- Check bolted connections for fixing points and main terminals (also torques).
- Protective earthing.
- Check the manual trip mechanism as follows:

Pull down the manual trip hook when the module is in the closed position. Manual trip hook shall remain in the lowered position and the module shall open. Initiate "Close" instruction. It shall be ignored, as in this position of the manual trip hook the actuator coils are isolated. Push the hook upward. It shall remain in the upper position. Initiate "Close" instruction again. This time it shall be executed.

## 6.3 Commissioning Secondary Part

Please consult the Recloser Control manual for commissioning procedures with the control.

## 6.4 Maintenance

Under normal operating conditions (see chapter "Ambient conditions") the Outdoor Switching Module is maintenance free for a period of at least 30 years or until it has reached the permissible number of operating cycles.

## 6.5 High Voltage Test

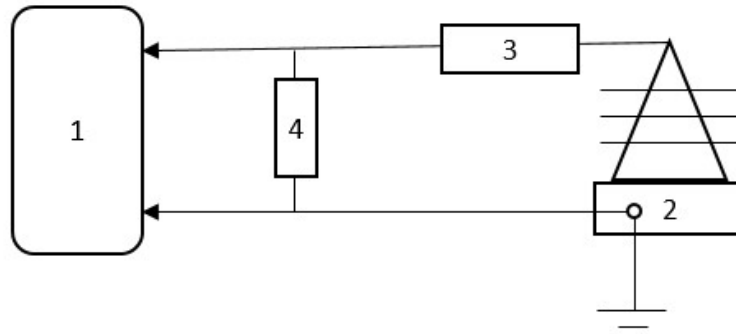
All Tavrida Electric switching modules have successfully passed necessary high voltage tests and do not require field testing. However, if installation procedures require such testing, below are instructions specific to testing Tavrida Electric switching modules.

The module shall be clean. Use a dry cloth to clean the insulation prior to testing.

The test after shipment, service or maintenance shall be made at 80% rated value – for equipment rated to 60kV testing voltage should be 48kV (see IEC 62271-111:2012 and IEEE Std C37-60-2012).

Assemble the circuit for the test:

- Connect the high voltage source to the two terminals of the pole in which the tested VI is installed.
- Connect the surge arrester in parallel with the sample.
- Connect a resistor in series between source and sample.



**Figure 27**  
**Test circuit**

Scheme in which: 1 - SM; 2 - high voltage source; 3 - high voltage resistor; 4 - a set of surge arrestors.

Test instructions:

- The voltage increases smoothly up to the test value at a speed of 2 kV / s.
- In the event of discharges in the VI, the rise in the test voltage should be stopped or slightly reduced, and after a hold time of 10-15 s, continue to increase the voltage. The series of discharges increase the dielectric strength of the vacuum insulation. This is normal in the presence of a vacuum.
- In case of loss of air tightness of the VI, the increase in electrical strength does not occur, and it is impossible to raise the voltage to 80% of the declared value due to the operation of the protection of the high voltage source.

## 6.6 Non-conformity

If during installation, commissioning, operation or maintenance any non-conformity occurs, contact your local Tavrida Electric representative or use technical or warranty support request form on our web site [www.tavrida.com/tena/](http://www.tavrida.com/tena/).



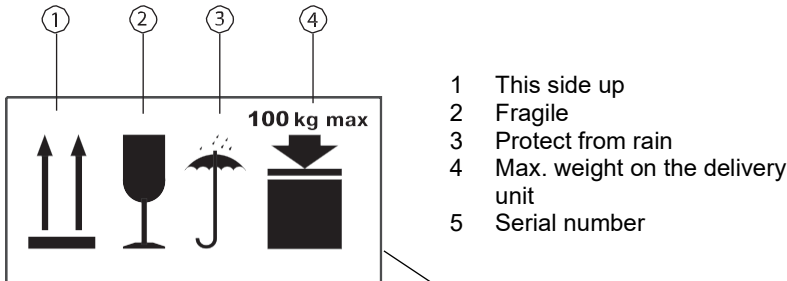
# **7 Receiving and Inspection**



# 7.1 Packing

The recloser is delivered in a corrugated box with dimensions 810 (L) x 810 (b) x 890 (h) or in a wooden crate packaged as a 'single lift' device with mounting hardware, Outdoor Switching Module and accessories pre-assembled (Figure 32). The following information are provided on the Outdoor Switching Module packing cartons:

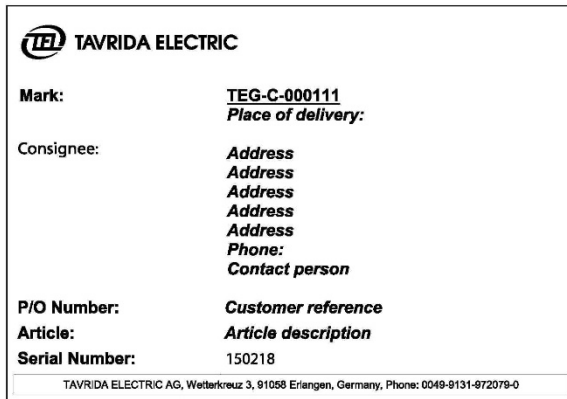
- Handling symbols for transport and storage of the delivery unit (Figure 28)
- Label 1 for manufacturers' product information (Figure 29)
- Label 2 for logistics data (Figure 30)



**Figure 28**  
*Handling symbols*



**Figure 29**  
*Label 1 for manufacturers' and product information*



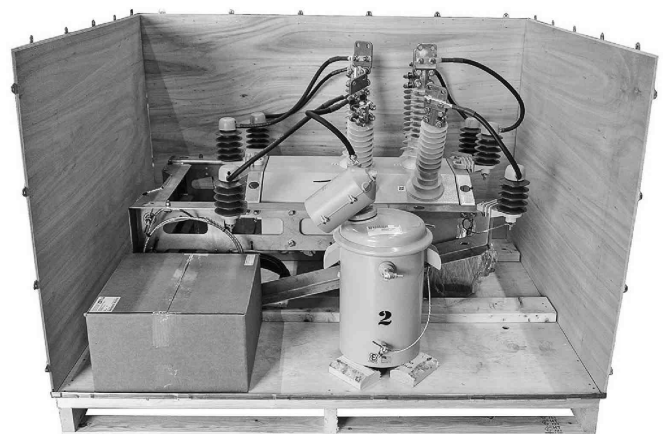
**Figure 30**  
*Label 2 Logistics data*



**Figure 31**  
*Packing carton*



**Figure 32**  
*Recloser wooden crate*



The following information is provided on wooden crate with recloser:

- Label with calibration coefficients of the delivered unit
- Warning label

## 7.2 Transport

The recloser shall be transported in the original packing only. The packed goods shall be handled in accordance with the handling symbols. Loading procedures for recloser packing units shall be carried out only with fork lifts or cranes.

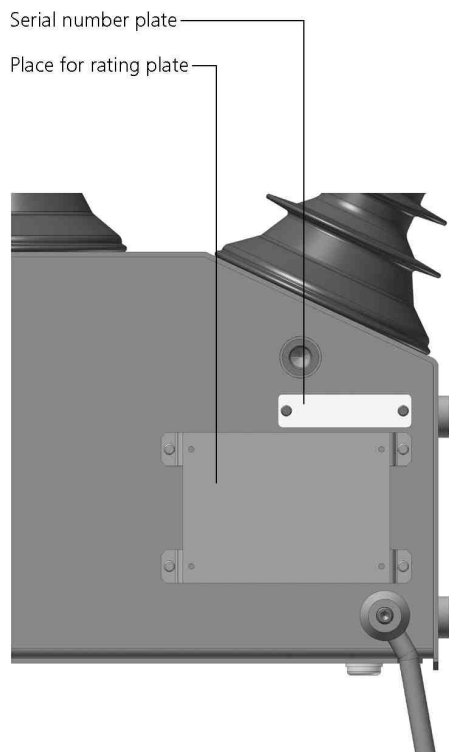
Lifting gear must not be attached to the bushings, use only lifting lugs attached to the side mounts with suitable clearance of straps or chains. During transportation the recloser must not be exposed to impacts or dropped.

## 7.3 Unpacking, Goods Received Control

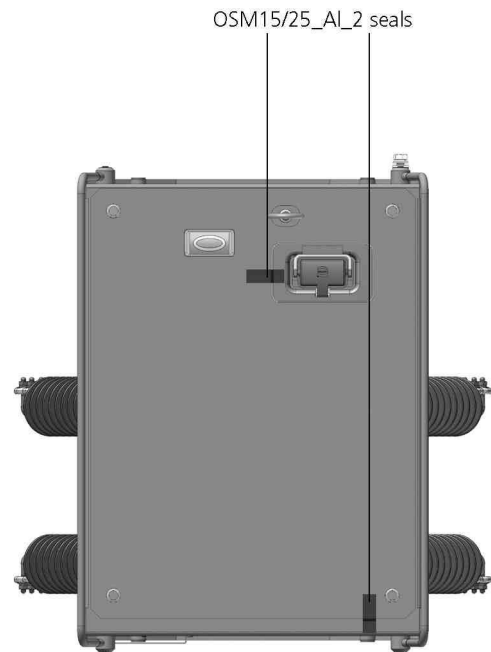
Before unpacking, please check the carton for damage and dampness. Removal of the products from the original packing must be carried out with due care. Every recloser and shall be subject to a completeness control.

Each Recloser is configured individually according to specification. Scope of supply varies. If you need to get scope of supply of your ordered Recloser, please contact your local representative for support.

## 7.4 Rating Plate, Seal



**Figure 33**  
**Labelling of the Outdoor Switching Module**



**Figure 34**  
**Seals of the Outdoor Switching Module**

Please check that the rating plates of the delivered devices correspond to the data of the order and technical data.

Tavrída Electric accepts no warranty for a device if the seal is broken or has been removed.

## 7.5 Storage

Should immediate installation not be possible, the recloser shall be stored in the original packing under the following conditions:

- The Outdoor Switching Module is switched off.
- Desiccants must be placed in the packing.
- Storage must be closed dry, well ventilated and the room temperature should be between - 40°C and + 40°C (IEC62271-1/ DIN VDE 0670 Part 1000).
- If several reclosers are stacked a maximum stack of two is permitted.

# 8 Legal Information

## 8.1 Warranty

Unless otherwise stated in the contract, the warranty period is 5 years from date of invoice. If agreed to otherwise, the contract conditions apply. No warranty is given in the case of:

- the warranty period having run out during the period of storage with the customer;
- operating conditions, ambient conditions, transport and storage conditions have not been adhered to according to the application description or the application guide;
- unauthorized manipulation of the device has been carried out, such as opening the housing or damaging the seal;
- the device has not been properly installed, such as incorrect connection voltages.

## 8.2 Quality Regulations



All manufacturing facilities of the company have been certified and comply with (DIN EN) ISO 9001:2015, ISO 14001:2015 and BS OHSAS 18001:2007.

All technical data of the vacuum circuit breaker are stored in an electronic database for each step of the manufacturing process. Testing of the circuit breakers is carried out in accordance with the relevant standards and beyond that the following routine tests are carried out:

- Visual check and functionality tests
- Mechanical operation test (1000 C-O cycles)
- Dielectric withstand test
- Partial discharge test
- Measurement of the resistance of the main circuit
- Sensors calibration

## 8.3 Complaints and Transport Damage

All products are shipped exclusively with original packing to ensure safe transport and avoid transport damage (see Packing, Goods Received).

Tavrída Electric will not accept any claims for damages caused by improper transport, storage as well as unpacking. Transport damage must be reported in writing to the supplier as soon as it is discovered. A period of maximum 3 weeks after receipt is allowed for this.

For legitimate claims Tavrída Electric will supply replacement equipment free of charge according to our warranty regulations. Tavrída Electric reserves the right to verify any claim.

## 8.4 Environmental Friendliness

The modules are manufactured from environmentally friendly material. Therefore, special disposal is not required.

## 8.5 Liability

Damages and demands for reimbursement of expenses incurred by the customer (in the following: compensation) for what-ever legal reasons, especially due to non-compliance of obligations of the contractual obligations and for unauthorized actions, are excluded. This does not apply, insofar as there is a compulsory liability such as according to the product liability law in cases of malice, gross negligence, because of damage to life, the body or health, because of damage to important contractual obligations.

Compensation for damage to important contractual obligations, however, is limited to the damage which can be predicted as typical of the contract insofar as there is no malice or gross negligence, because of damage to life, the body or health. A change of the obligation to provide proof to the disadvantage of the customer is not connected with these regulations.

## 8.6 Copyright

Without our written permission, this documentation may not be used, also not in extract form, for own general publications, printouts, handbooks, training, lectures, etc. nor copied and further processed. This includes also the duplicating or re-copying in any form of data carriers and microfilms. A one-time written permission is not automatically to be taken as a part or complete surrender of the copyright provisions. We reserve the right to changes. The issue of a new version of these operating instructions renders all other older versions obsolete.

Tavrída Electric and its associated companies make every effort to adapt the contents of their documentation to the latest and most current state of development of the products.

The present documentation was produced with the greatest care. However, we are not liable for possible errors in this information text, user-side incorrect interpretation and/or for consequences arising therefrom.

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# 9 Appendices

# 9.1 Dimensions and Weights

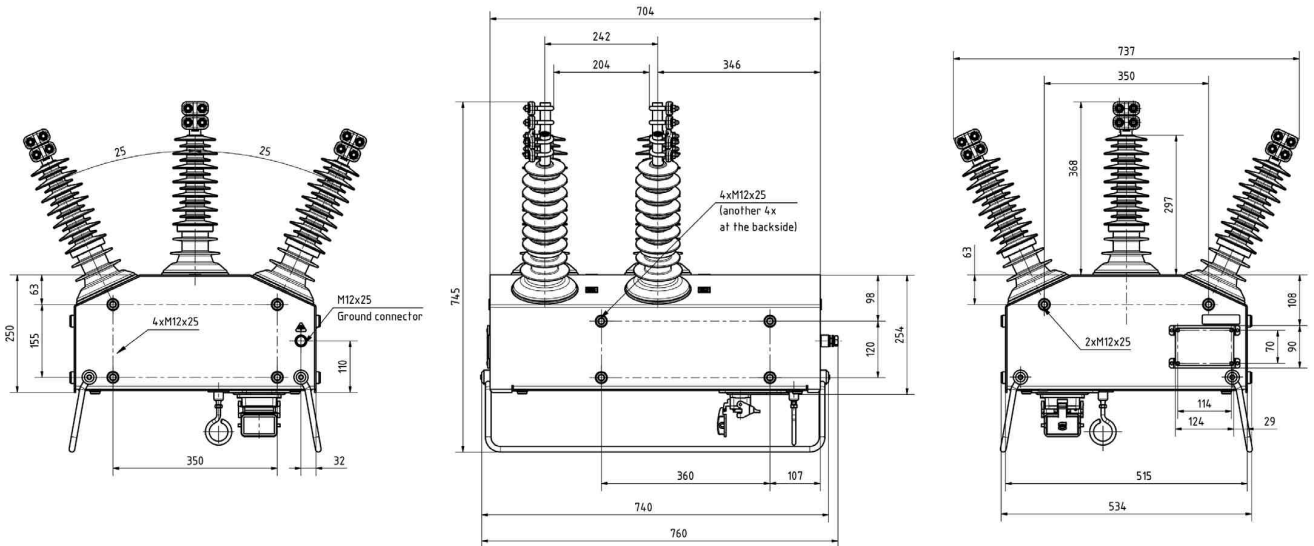


Figure 35  
*OSM25\_AI\_2(630\_150\_ALL), OSM25\_AI\_4(ALL), OSM25\_AI\_5(100.150\_150\_ALL) and OSM25\_AI\_5(600.200\_150\_ALL)*

Rated voltage, kV	Dimensions, mm		Weight, kg
	Creepage distance	Minimum taut string distance	
27	860	204	80

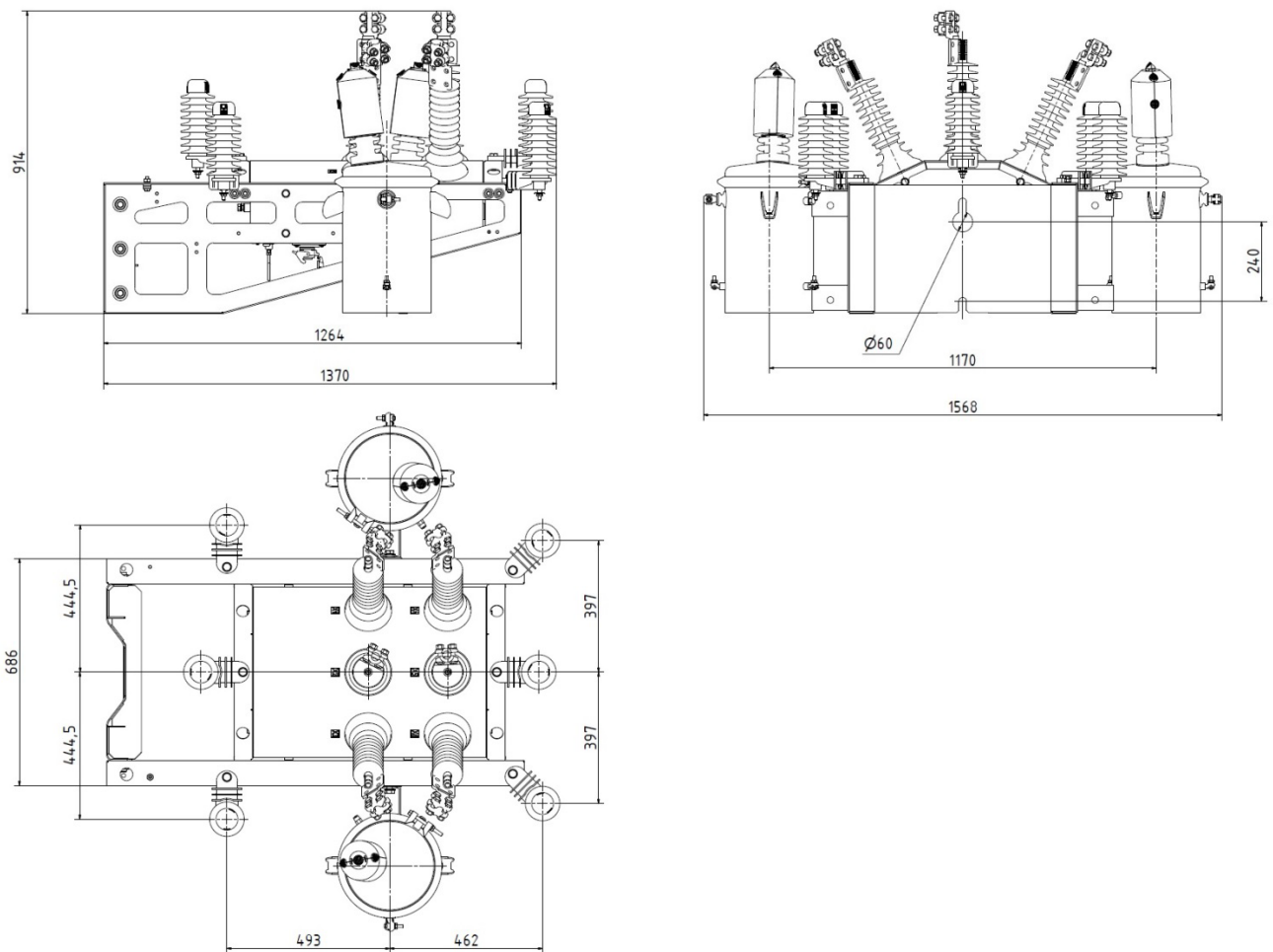
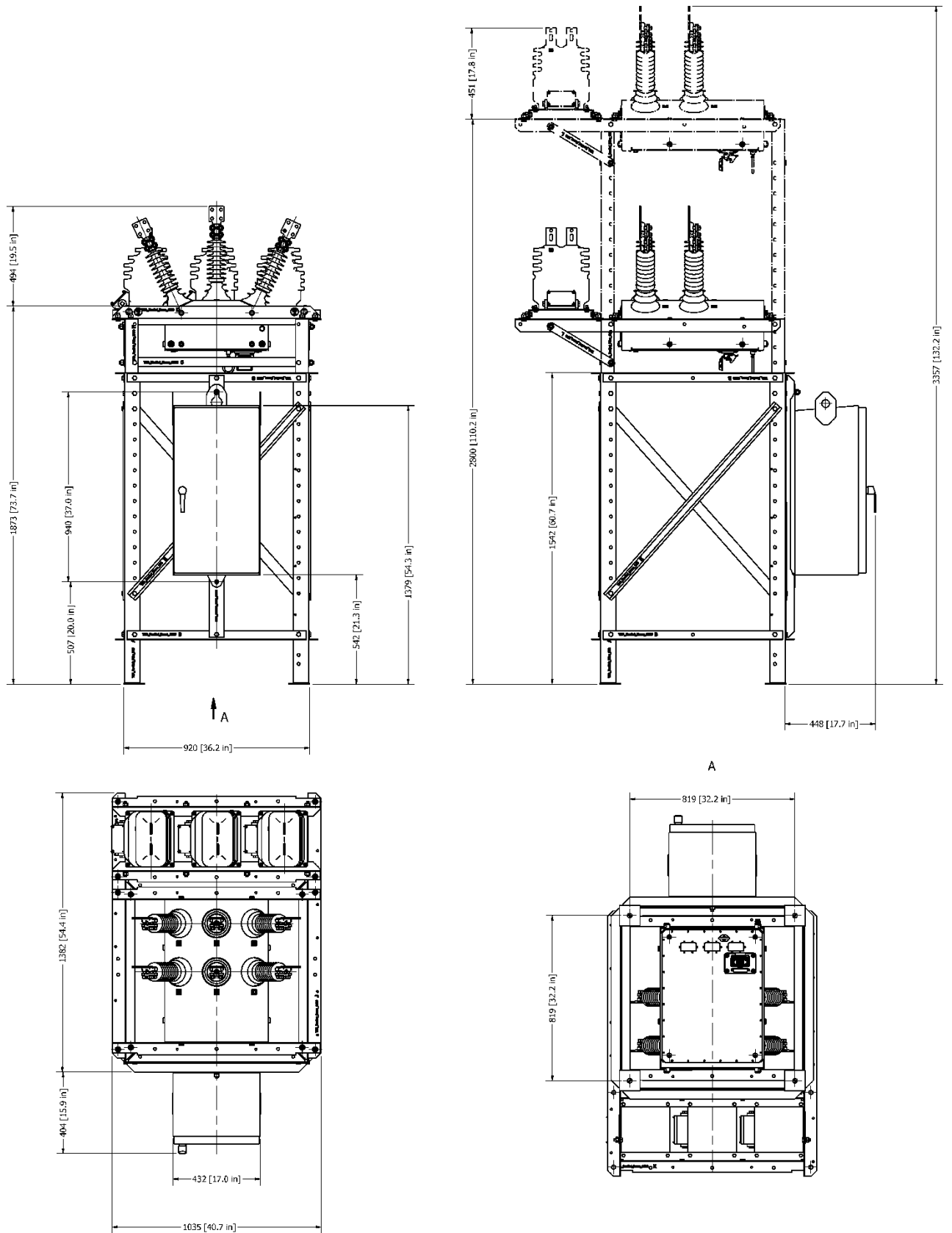


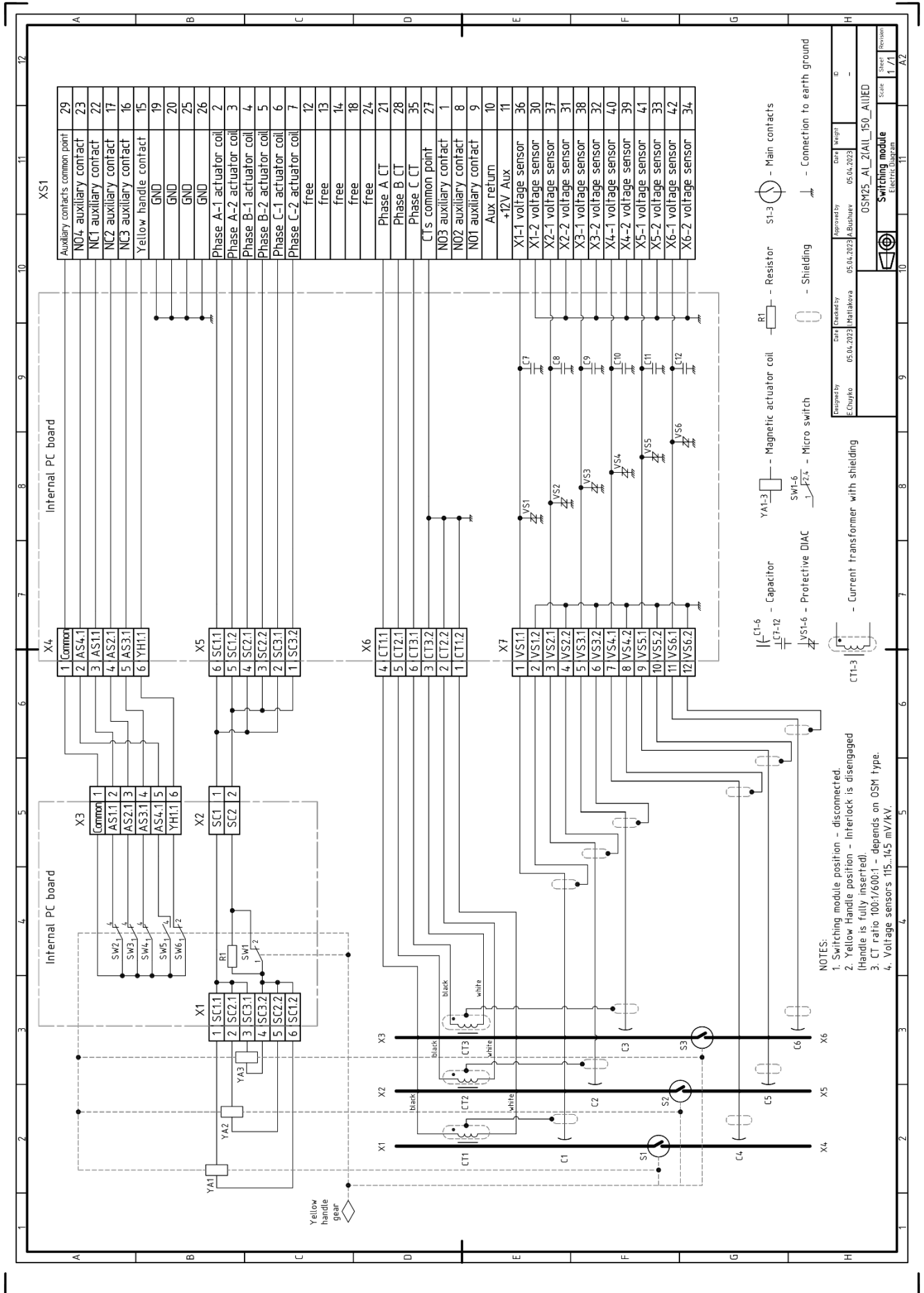
Figure 36  
*Stainless steel pole mounting kit with provision for up to x6 surge arresters and x2 1kVA transformers*

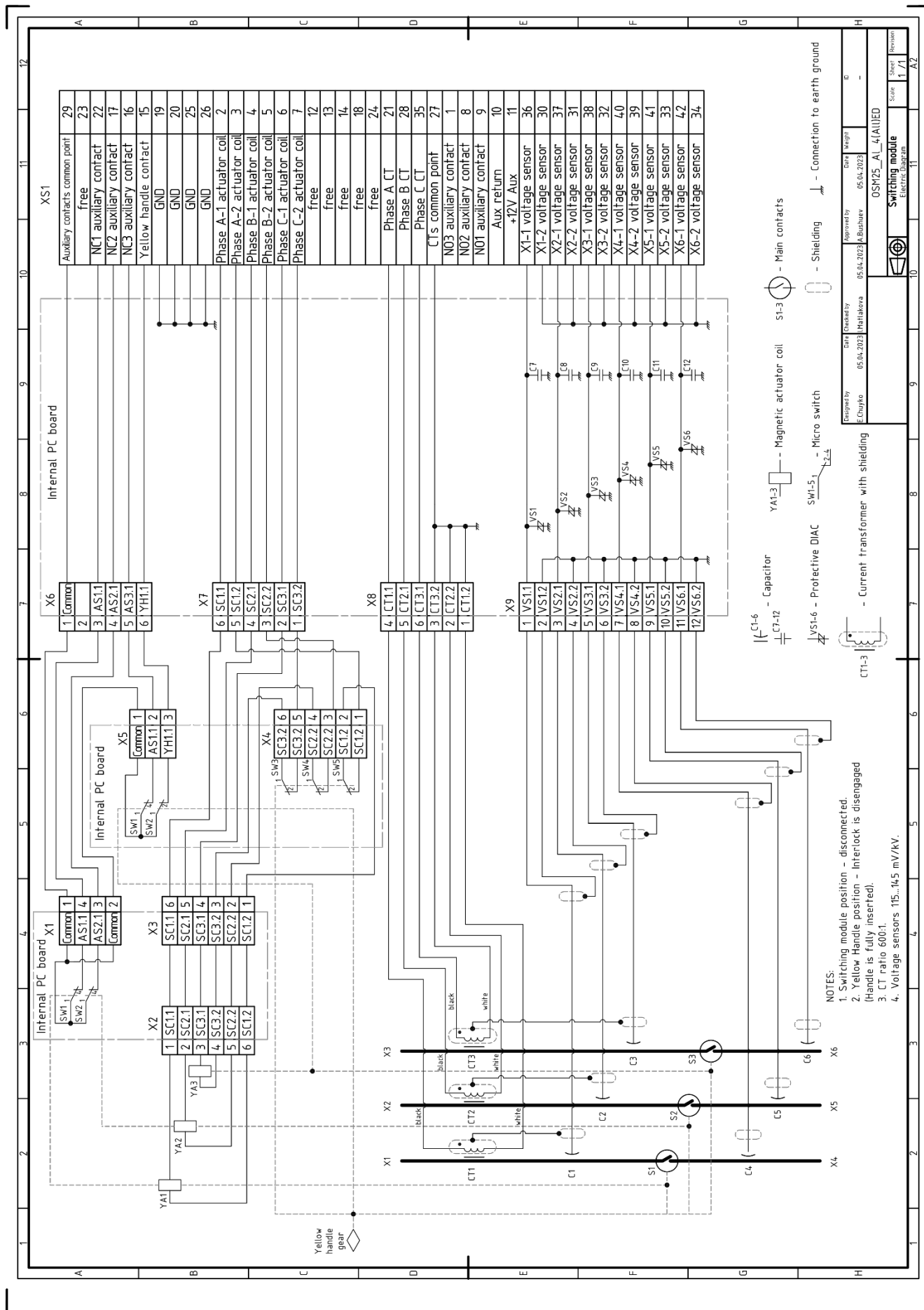




**Figure 37**  
**Stainless steel substation mounting kit**

# 9.2 Circuit Diagrams





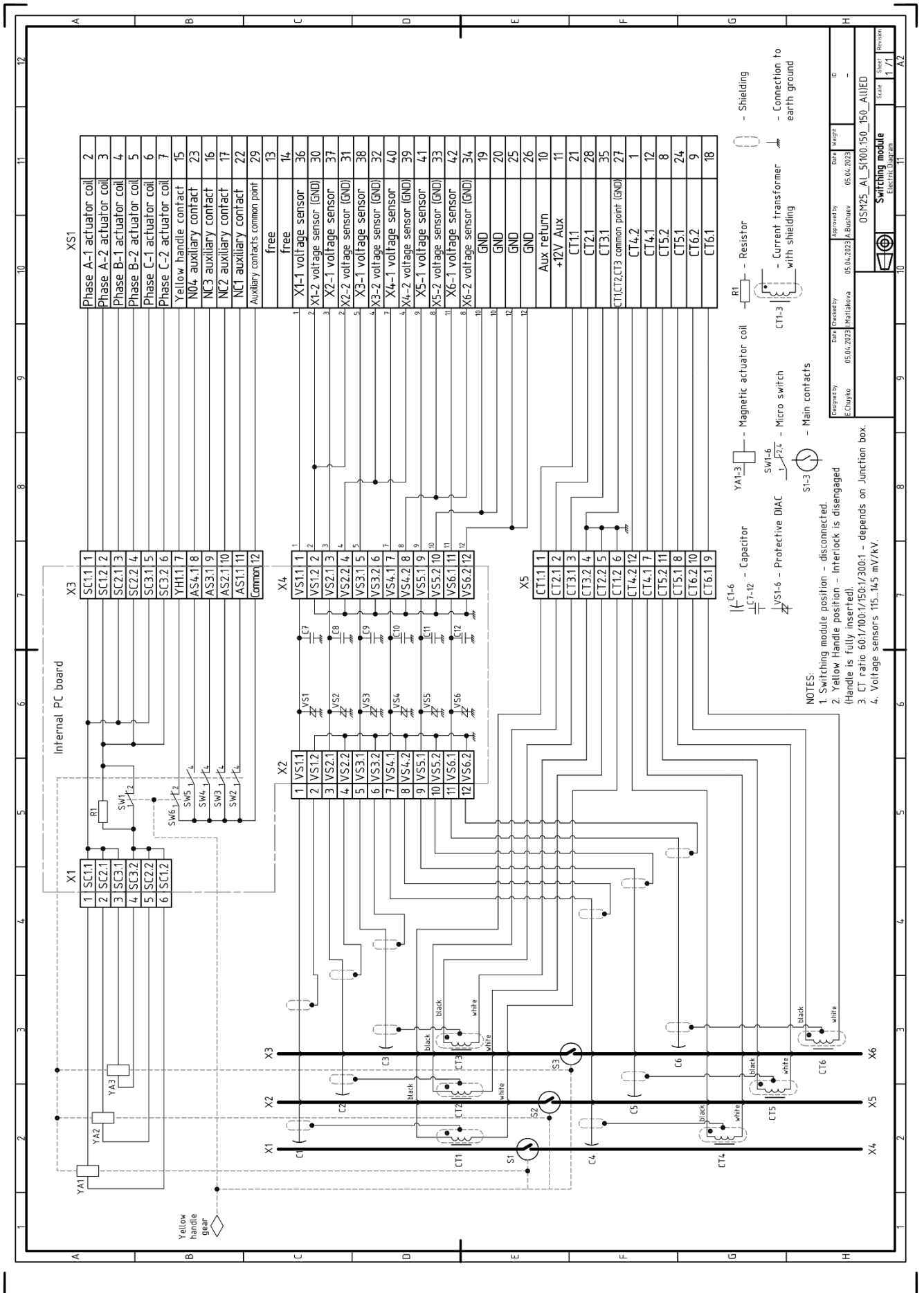
Terminal	Description	Terminal	Description
29	Auxiliary contacts common point	36	X1-1 voltage sensor
23	free	30	X1-2 voltage sensor
22	NC1 auxiliary contact	37	X2-1 voltage sensor
17	NC2 auxiliary contact	31	X2-2 voltage sensor
16	NC3 auxiliary contact	38	X3-1 voltage sensor
15	Yellow handle contact	39	X4-1 voltage sensor
19	GND	40	X4-2 voltage sensor
20	GND	41	X5-1 voltage sensor
25	GND	33	X5-2 voltage sensor
26	GND	42	X6-1 voltage sensor
2	Phase A-1 actuator coil	34	X6-2 voltage sensor
3	Phase A-2 actuator coil		
4	Phase B-1 actuator coil		
5	Phase B-2 actuator coil		
6	Phase C-1 actuator coil		
7	Phase C-2 actuator coil		
12	free		
13	free		
14	free		
18	free		
24	free		
21	Phase A CT		
28	Phase B CT		
35	Phase C CT		
27	CTs common point		
1	NO3 auxiliary contact		
8	NO2 auxiliary contact		
9	NO1 auxiliary contact		
10	Aux return		
11	+12V Aux		

- NOTES:
1. Switching module position - disconnected.
  2. Yellow Handle position - Interlock is disengaged (Handle is fully inserted).
  3. CT ratio 600:1
  4. Voltage sensors 115...1k5 mV/kV.

Designed by: E.Chuyko  
 Checked by: H.Halukova  
 Date: 05.04.2023  
 Approved by: A.Bishuev  
 Date: 05.04.2023

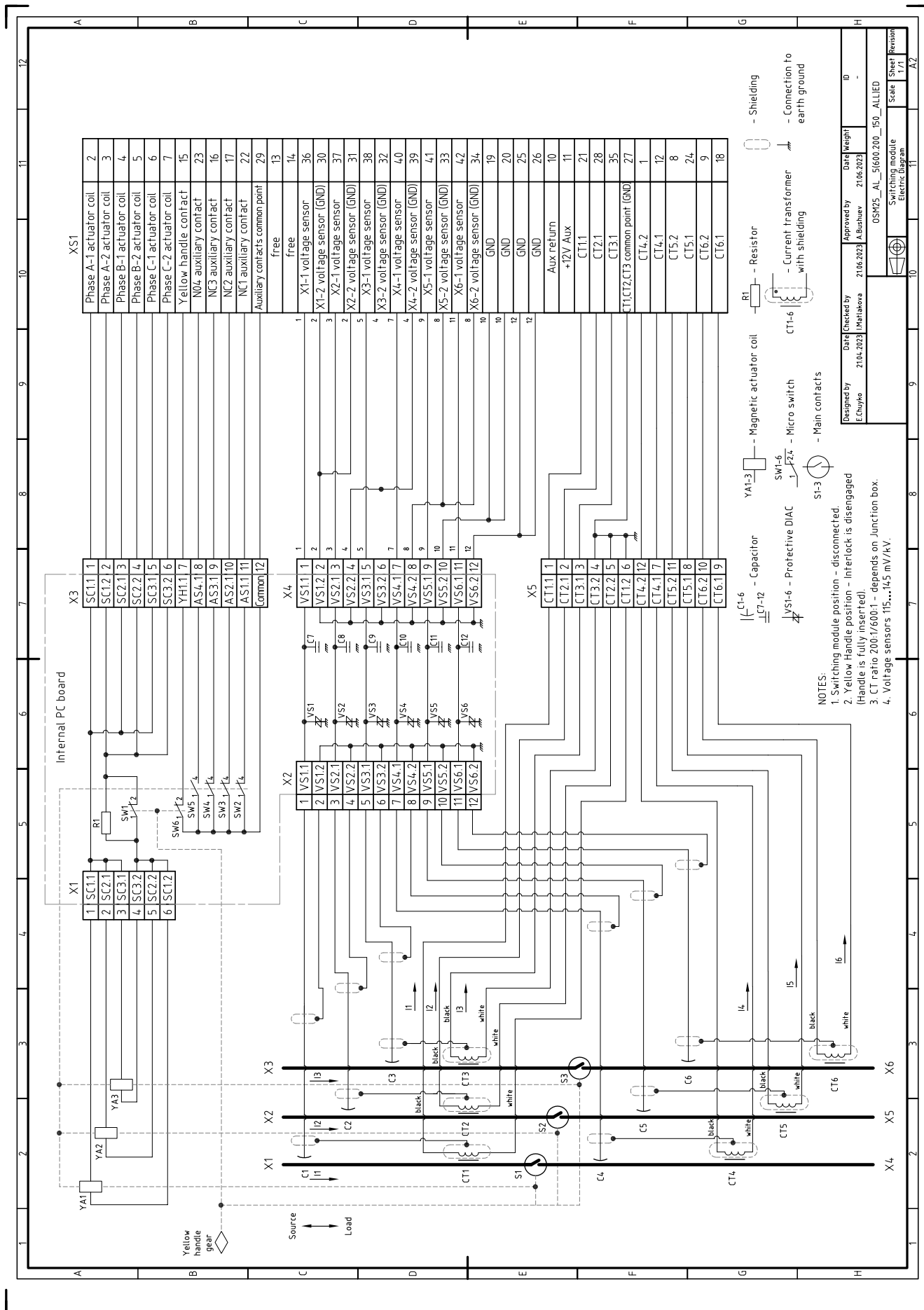
Scale: 1/1  
 Sheet: 1/1  
 Revision: -

**OSM25\_AL\_4(A)UED**  
**Switching module**  
 Electric Diagram



Designed by E.Chuyko	Date 05.04.2023	Checked by Hatalakova	Date 05.04.2023	Approved by A.Bubnyuk	Date 05.04.2023
Scale			Sheet		
1/1			1/1		
Revision			Sheet		
1/1			1/1		

OSM25\_A1\_S100:150\_150\_A1UD2  
Switching module  
Electric Diagram



NOTES:  
 1. Switching module position - disconnected.  
 2. Yellow Handle position - interlock is disengaged (Handle is fully inserted).  
 3. CT ratio 200.1/600.1 - depends on Junction box.  
 4. Voltage sensors 115...145 mV/kV.

Designed by	E.Chuyko	Date	21.04.2023	Checked by	M.Halavka	Date	21.06.2023	Approved by	A.Bushuev	Date	21.06.2023	Weight		ID			
Switching module Electric Diagram												Scale	1/1	Sheet	1/1	Revision	
OSM25_AI_51600.200_150_ALLIED																	

## 9.3 Safe Trip Device

The Safe Trip junction box provides safe trip functionality for the following recloser models:

- OSM25\_AI\_2(630\_150\_ALL), OSM25\_AI\_5(100.150\_150\_ALL) and OSM25\_AI\_5(600.200\_150\_ALL)

The safe trip junction box works with SEL-651R 42-pin Tavrida Electric recloser interface with power supply 120VAC or 230VAC. It does not work with any type of SEL-651R with DC power supply.

The SEL-651R shall have output 201 programmed for Relay Malfunction event.

The safe trip junction box provides recloser tripping in the following cases:

- Malfunction of SEL-651R relay if it happens not later than 12 hours after AC power supply loss.
- Disconnection of connection cable TNA\_RecUnit\_Umbilical\_22(12) from junction box or SEL if it happens not later than 12 hours after AC power supply loss.
- Two previous cases will work even if main umbilical cable is disconnected, so, to provide safe trip option when umbilical is disconnected it is recommended to add one more output 201 activation event: the event of yellow handle locked-open (ask SEL for more details).

**NOTE: It is not recommended to use junction boxes that are exposed to temperatures below -40 °C.**

The trip function is provided by 120uF capacitor installed inside the junction box. The stored energy of capacitor is enough to trip the recloser within 12 hours after AC power lost in case of ambient temperature is 20C. For lower temperature the storing time expecting to go down about 30% under -40C. So, it is recommended to set battery malfunction assigned to OUT201 not more than 8h after AC power loss. It is not mandatory as the SEL-651R can provide safe trip in case of low battery without actuation of safe trip junction box. However if the SEL-651R fails during battery back-up powering then safe trip junction box is able to trip within 8 hours after AC loss in worst case conditions.

The safe trip package contains:

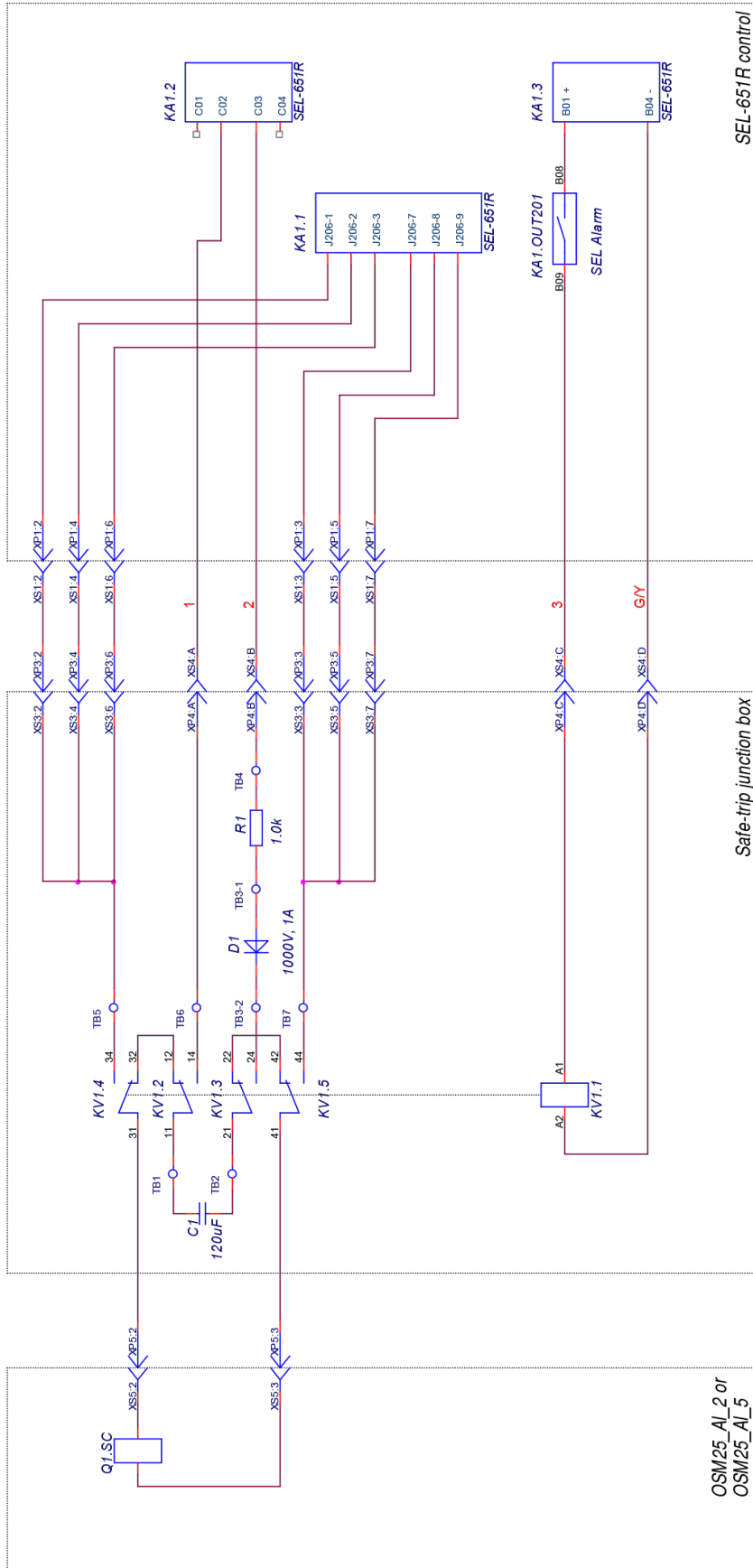
1. TNA\_RecUnit\_Umbilical\_27 or TES\_RecUnit\_JunctionBox\_1(XX\_ST) (junction box with built-in safe trip function)
2. TNA\_RecUnit\_Umbilical\_22(12) (cable for extra circuits connection between SEL and junction box, 12m long before gland + 2m for wiring inside SEL cabinet)
3. Cable gland LTCG ½ NPT with nut ½ NPT

Field installation procedure for pole mounted Outdoor Switching Module:

1. Connect umbilical supplied with recloser to the junction box
2. Connect connection cable TNA\_RecUnit\_Umbilical\_22(12) to the junction box with 4-pin Amphenol plug
3. Choose any of holes on SEL-651R bottom plate and fix cable gland in the hole.
4. Pass the other end of the connection cable TNA\_RecUnit\_Umbilical\_22(12) through cable gland into SEL cabinet
5. Strip the cable and wires of the connection cable TNA\_RecUnit\_Umbilical\_22(12) and crimp proper cable lugs to fit connection inside SEL-651R cabinet
6. Connect the cable to SEL-651R terminals according to the schematic below.
7. Using single insulated wire [14 – 18] AWG create short (~4”) link to connect terminals B01 and B08, connect B01 to B08 with this link.
8. Ensure output 201 of SEL-651R is programmed for relay malfunction.

Table of connections inside SEL-651R for safe trip functionality

Harness	Wire marking	Connection point 1	Connection point 2
TNA_RecUnit_Umbilical_22(12) 4-pin cable “Connection point 1” is pre-wired on factory.	1	Amphenol pin A	C02
	2	Amphenol pin B	C03
	3	Amphenol pin C	B09
	Green/yellow	Amphenol pin D	B04
Link connector (not in the scope of supply)	N/A	B01	B08



**Figure 38**  
**Safe Trip device connection diagram**

- C1 - capacitor 120uF, 400V, EKXG401ELL121MMP1S, United Chemi-Con
- D1, TB3 - WAGO terminal block 280-673/281-411 with diode 1N1007, 1000V, 1A, built-in
- KA1.1, KA1.2, KA1.3, KA.OUT201 - microprocessor control SEL-651R, Schweitzer Engineering Laboratories
- KV1.1 - KV1.5 - Pilot relay 12VDC coil, F55.34.9.012.0040, Finder
- Q1 - outdoor switching module OSM25\_AL\_2 or OSM25\_AL\_5, Tavrida Electric
- R1 - resistor 1kOhm, 2W, ERG-2SJ102, Panasonic
- TB1, TB2, TB4 - TB7 - connection terminals 870-831, WAGO
- XP1.1 - XP1.42 - Connection Plug Male, panel mounted, Harting (SEL control box).
- XP3.1 - XP3.42; XP5.1 - XP5.42 - Connection Plug Male, cable mounted, Harting (umbilical cable).
- XP4.1 - XP4.4 - Connection Plug Male, panel mounted, PT02E12-4P, Amphenol (junction box).
- XS1.1 - XS1.42 - Connection Plug Female, cable mounted, Harting (umbilical cable).
- XS3.1 - XS3.42; XS5.1 - XS5.42 - Connection Plug Female, panel mounted, Harting (OSM25 & Junction box).
- XS4.1 - XS4.4 - Connection Plug Female, cable mounted, PT06CGMSA-12-4S, Amphenol (connection cable).

# List of changes

Document version	Change date	Scope of change	Reason of change
1.0	11.06.2019	Initial version of the document	Rec25_AI_SSline classification introduction
2.0	11.09.2019	<ul style="list-style-type: none"> <li>- Technical parameters of switching module corrections</li> <li>- Main terminals connection section revised</li> <li>- Note about manual trip hook operation added</li> <li>- Safe Trip device description added.</li> </ul>	<ul style="list-style-type: none"> <li>- Successful test reports for passing 800 A (960 A) continuous current</li> <li>- Improvement of the document</li> </ul>
3.0	31.03.2020	<ul style="list-style-type: none"> <li>- Stainless steel substation mounting kit added</li> </ul>	<ul style="list-style-type: none"> <li>- Mounting kits range extension</li> </ul>
4.0	08.11.2021	<ul style="list-style-type: none"> <li>- OSM25_AI_5(600.600_150_5) added</li> <li>- Terminology</li> <li>- Interrupting time</li> <li>- Ambient temperature</li> </ul>	<ul style="list-style-type: none"> <li>- Product range extension</li> <li>- Clarification</li> </ul>
5.0	13.04.2023	<ul style="list-style-type: none"> <li>- Table 1 and Table 2</li> <li>- Junction Box</li> <li>- OSM25_AI_2 (630_150_ALL)</li> <li>- OSM25_AI_4 (ALL)</li> <li>- OSM25_AI_5 (100.150_150_ALL)</li> <li>- Current transformers excitation curves</li> <li>- 5.3 Auxiliary Circuit Terminations</li> <li>- 6.5 High Voltage Test</li> <li>- 9.2 Circuit Diagrams</li> <li>- 9.3 Safe Trip Device</li> </ul>	<ul style="list-style-type: none"> <li>- Making corrections</li> </ul>
6.0	07.06.2023	<p>For Ur = 15.5 kV and 27 kV</p> <ul style="list-style-type: none"> <li>- Ud, 1 min dry = 60kV</li> <li>- Ud, 10s wet = 55kV</li> <li>- Up = 150/125 kV</li> </ul>	<ul style="list-style-type: none"> <li>- Changes on request</li> </ul>
7.0	28.12.2023	<ul style="list-style-type: none"> <li>- OSM25_AI_5(600.200_150_ALL) added</li> </ul>	<ul style="list-style-type: none"> <li>- Product range extension</li> </ul>
7.1	19.02.2024	<ul style="list-style-type: none"> <li>- Changing technical parameters</li> </ul>	<ul style="list-style-type: none"> <li>- Changes on request</li> </ul>





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