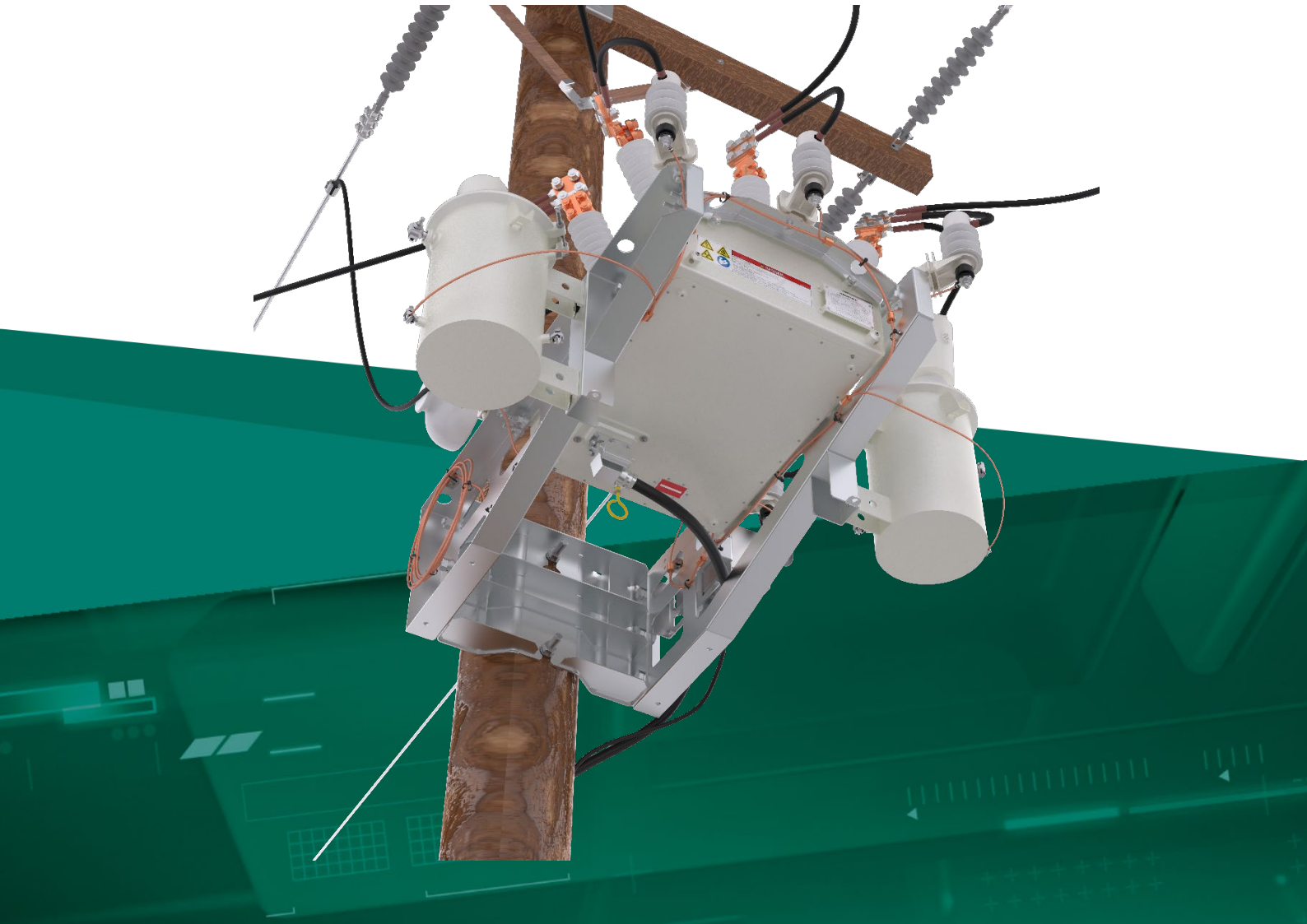
TAVRIDA ELECTRIC
Excellence in Engineering

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



TECHNICAL MANUAL

VERSION 7.7

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.

Contents

1 Introduction

Applicability

This Technical Manual applies to a range of Outdoor Switching Modules manufactured by Magvatech and Tavrida Electric, designed to operate with third-party recloser controls and associated stainless steel mounting accessories.

OSM model	Description
OSM25_AI_4(ALL)	27 kV, three-phase independent pole operated Outdoor Switching Module, with 600:1 CT ratio
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:

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

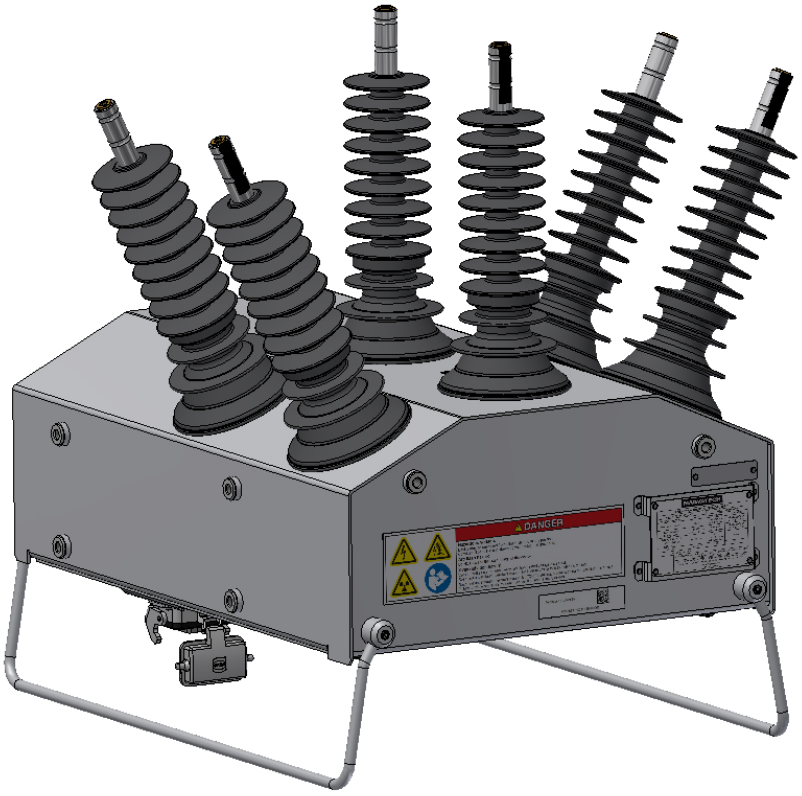


Figure 1

Outdoor Switching Module general view

2 Technical Parameters

Table 1 – Switching module technical parameters

Parameter	OSM25_AI_4(ALL)	OSM25_AI_5(600.200_150_ALL)
Rated data		
Rated voltage (Ur)	15.5 kV and 27 kV	
Rated continuous current (Ir)	800 A	800 A[1)]
8-hour overload current	960 A	960 A
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	
Switching performance		
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[2)]	40 ms	
Opening time, not more than[2)]	15 ms	
Interrupting time, for 50/60 Hz, not more than[2)]	25/23 ms	
Rated operating sequence	O-0.2s-CO-1.5s-CO-2s-CO-2s-CO[3)]	
Standards		
International Standard American Standard	IEC 62271-100, IEC 62271-111 IEEE C37.60	
Other data		
Current sensing	3 current transformers	6 current transformers[4]
Voltage sensing	6 voltage sensors	
Main contact resistance, not more than	95 µOhm	
Solar radiation	≤ 1.1 kW/m²	
Degree of protection	IP65	
Weight	80 kg	

1) Refer to recloser control manual for secondary current inputs limitations when used with 200:1 CT ratio.
2) 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.
3) Fastest operating sequence when used with SEL-651R-2 Recloser Control. Subject to change when used with different controls.
4) 6 current transformers are installed to provide variable CT ratio functionality. At any time only 3 current transformers measurement are available.

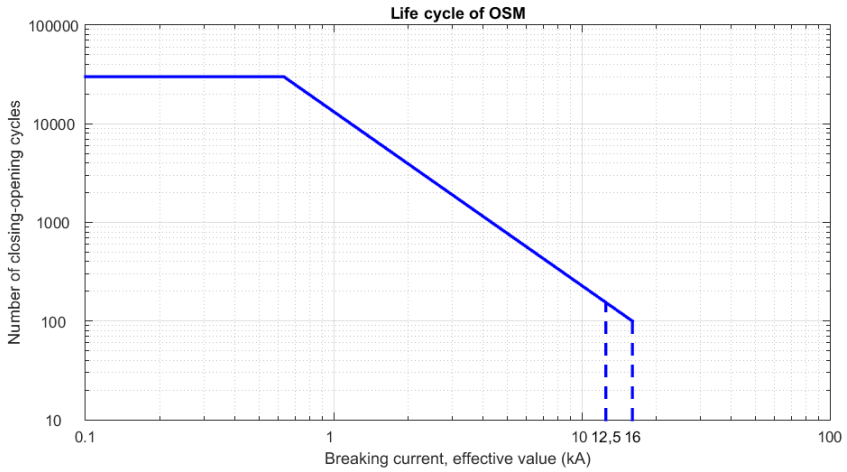


Figure 2

Outdoor Switching Module electrical endurance

Table 2 – Parameters of Current Transformers and Voltage Sensors

Parameter	OSM25_AI_4(ALL)	OSM25_AI_5(600.200_150_ALL)	
Current transformers			
CT ratio	600:1	600:1	200:1
Rated primary current	600 A	600 A	200 A
Rating factor according to C57.13 [1),2)]	1.75	1.75	5.0
Rated secondary current	1 A	1 A	
Rated output, at PF=0.8...1	1.0 VA	1.0 VA	
Accuracy class of protection transformers according to IEC 61869	5P30	5P30	5P20
Measuring accuracy class, IEC 61869-2	0.1/0.2s	0.1/0.2s	0.2/0.5s
Accuracy limit factor (ALF), IEC 61869-6 at:			
25% of rated burden	40	40	52
50% of rated burden	38	38	40
100% of rated burden	33	33	28
Accuracy class of protection transformers according to IEEE C57.13	C100	C100	C20
Accuracy limit factor (ALF) according to IEEE C57.13	20	20	
Voltage Sensors			
Voltage sensor ratio range	0.108 - 0.123 V/kV		
Voltage sensors ratio error within rated temperature range	1.0 % for all 6 sensors		

1) Rating factor curves are calculated from standard curves shown in C57.13.
2) Rating factor values are applicable to CTs only, continuous current values should not exceed values of the recloser.

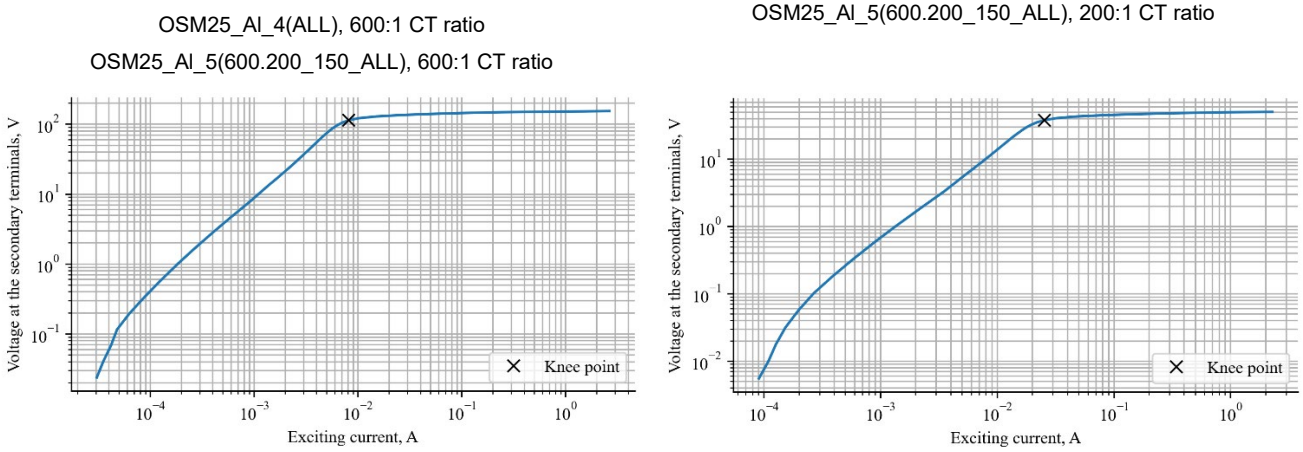
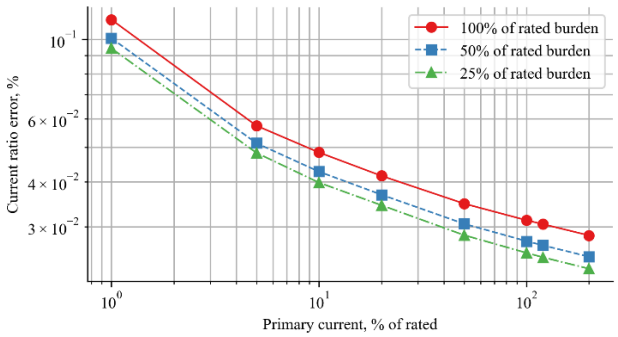


Figure 3

Current transformers excitation curves for OSM25_AI_4(ALL) 600:1 CT ratio and OSM25_AI_5(600.200_150_ALL) – 600:1 CT and 200:1 CT ratio[1]

[1] Built-in current transformers should not be tested by injecting voltage into CTs secondary winding terminals due to design specifics of Tavrida Electric Switching Modules, that may have two current transformers working simultaneously or utilize overvoltage protection for CTs circuits.
The only valid method of ratio verification and measuring saturation curves is “direct” method by applying current to CT’s primary winding.

OSM25_AI_4(ALL), 600:1 CT ratio
OSM25_AI_5(600.200_150_ALL), 600:1 CT ratio



OSM25_AI_5(600.200_150_ALL), 200:1 CT ratio

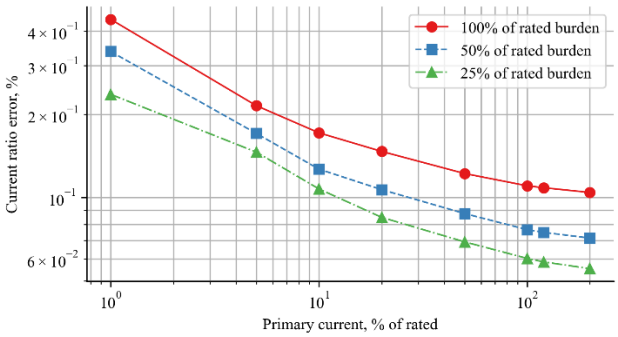


Figure 4

Current ratio error curves for OSM25_AI_4(ALL) 600:1 CT ratio and OSM25_AI_5(600.200_150_ALL) - 600:1 CT and 200:1 CT ratio

Table 3 – Ambient conditions

Maximum ambient temperature	+ 55 °C
Minimum ambient temperature	- 60 °C
Humidity	100% condensing
Altitude	Up to 3000 m[2]
Pollution level	Very heavy (according to IEC 60815)
Salt fog	1000 h (according to IEC 62217)

[2] Derating according to ANSI C37.60 is applied for altitudes above 1000 m

3 Outdoor Switching Module

3.1 Overview

Magvatech'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

Magvatech'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.

1 Terminal
2 Six HV silicone bushings
3 Current and voltage sensors built into the bushings
4 Vacuum circuit breaker
5 Protective tank
6 Mechanical position indicator
7 Harting connector
8 Manual trip operation mechanism

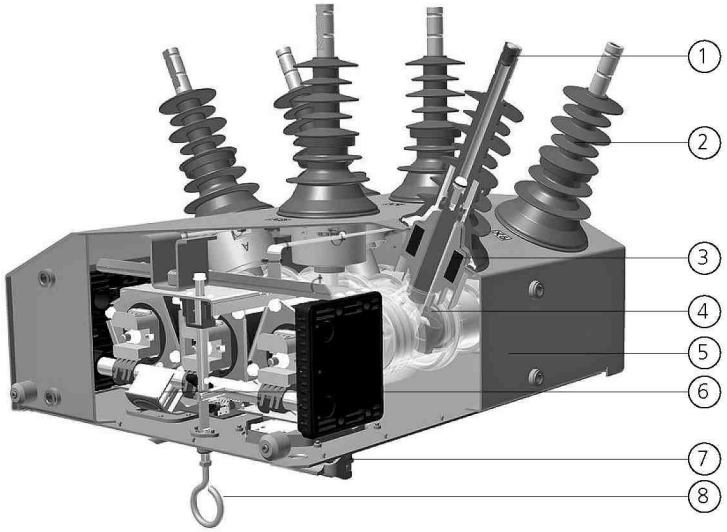


Figure 5

Internal arrangement of the Outdoor Switching Module

3.2 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.

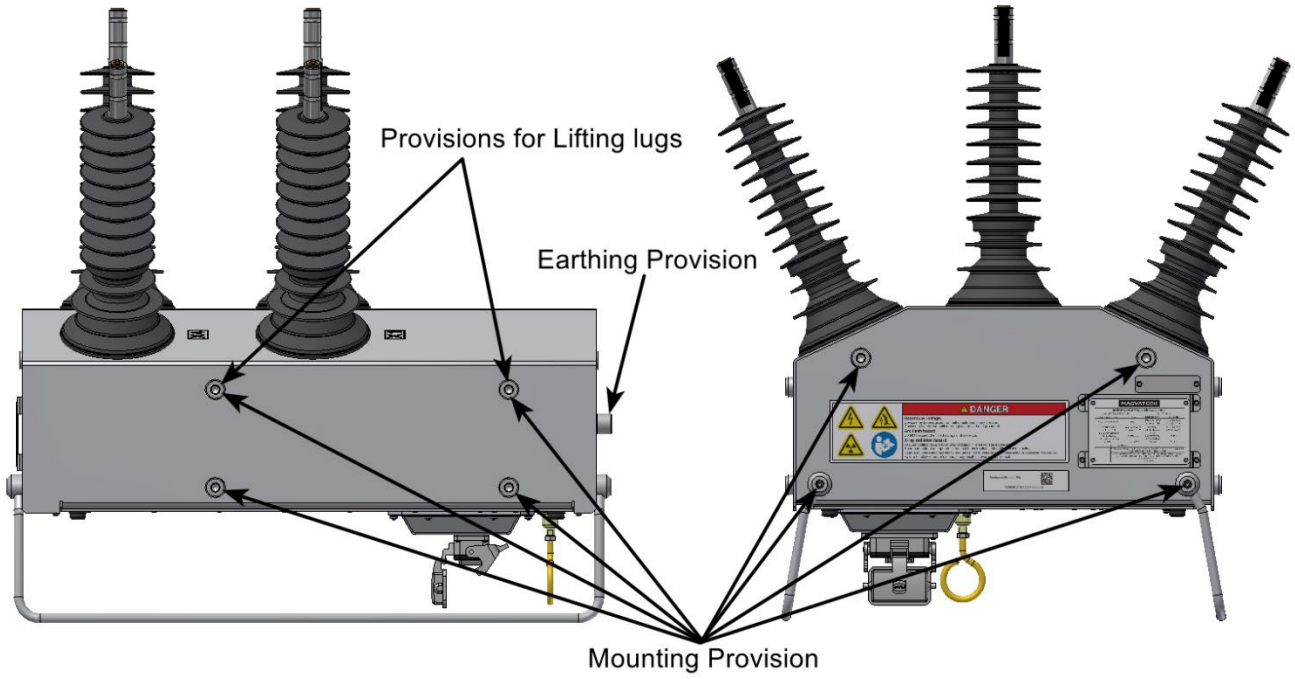


Figure 6

Threaded holes arrangement

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

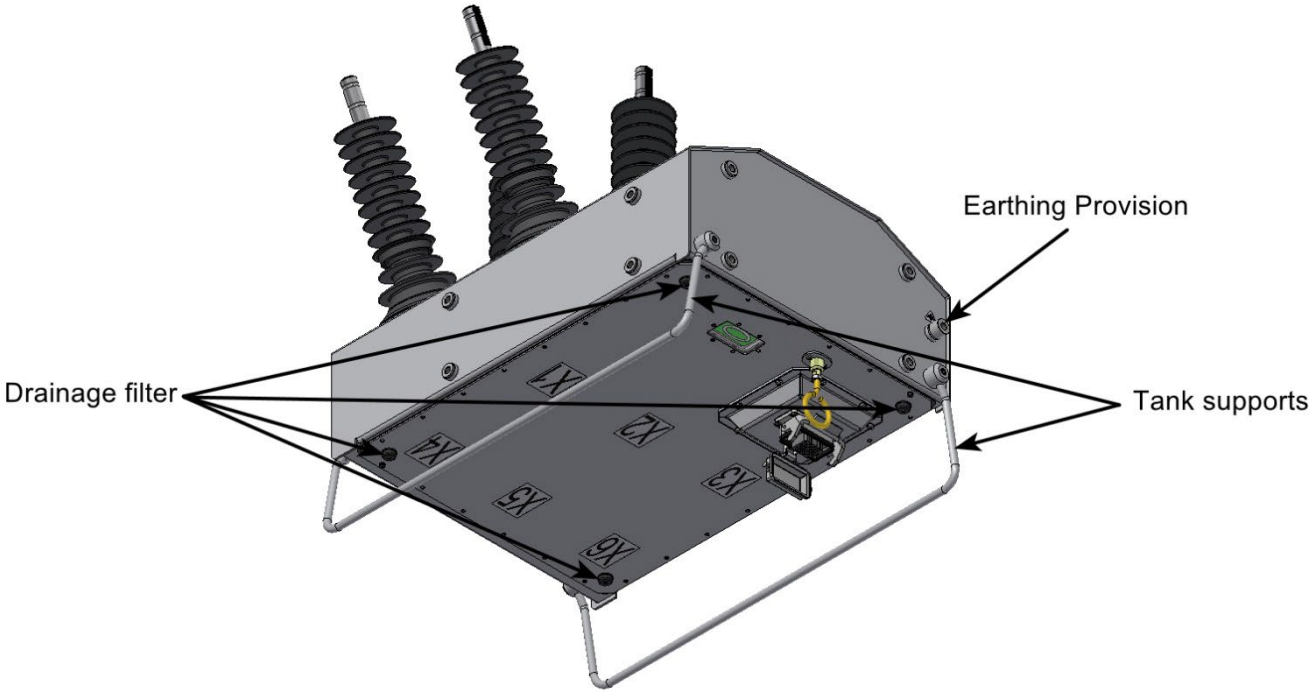


Figure 7

Drainage filters arrangement

Each Outdoor Switching Module has the following rating plates:

- Serial number plate
- Rating plate

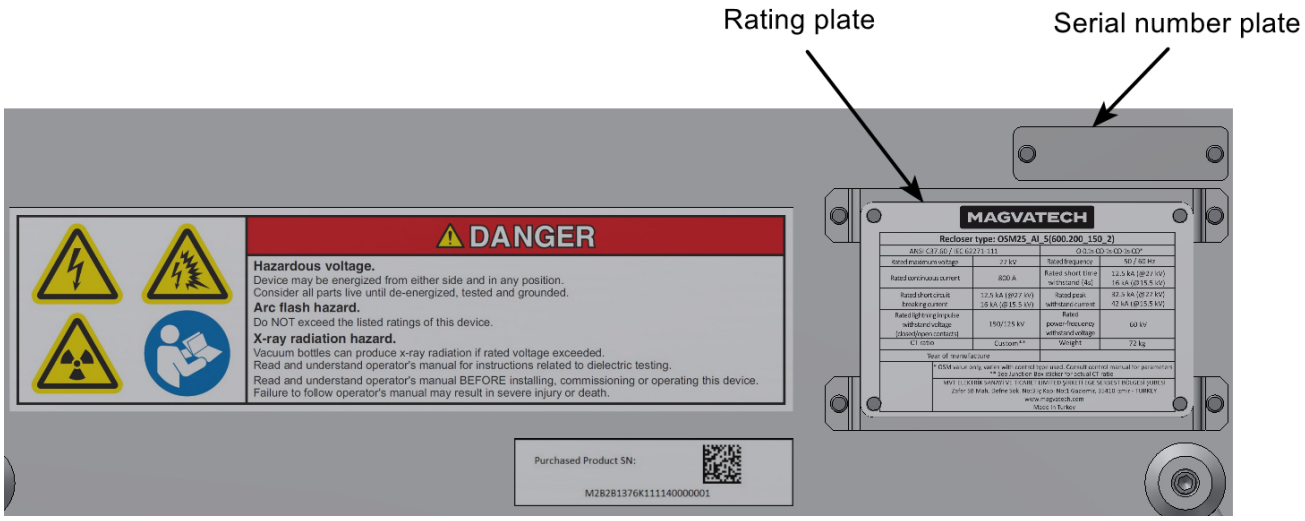


Figure 8

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 9)
- Warning label (Figure 10)

TAVRIDA ELECTRIC

Recloser:	
Type	OSM25_AI_2(630_150_5)
Serial number	424723
Control:	
Type	0651R17CGA83111110
Serial number	1122200599
Current transformer ratio settings:	
Phase (CTR)	600:1
Residual (CTRN)	600:1
Voltage sensor correction ratio settings:	
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

Tavrida Electric North America
1-866-551-8362

Figure 9

Label with calibration coefficients

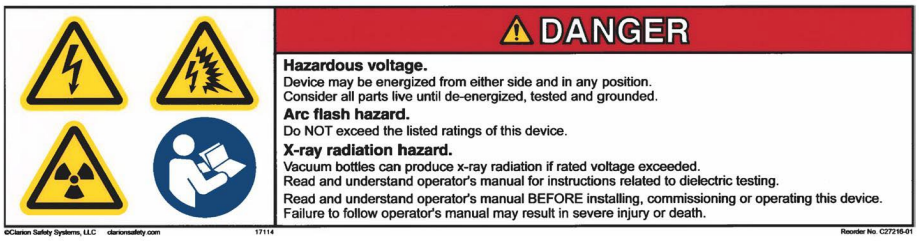


Figure 10

Warning label

3.3 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.

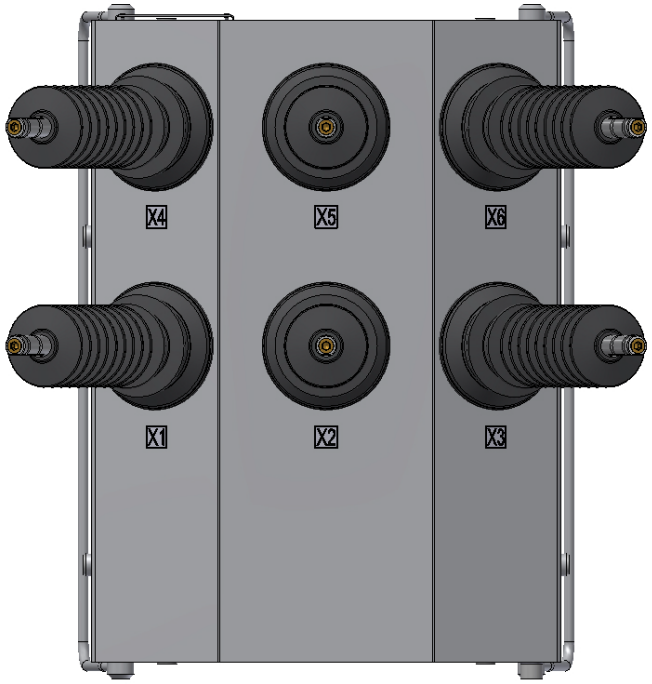


Figure 11

Phase marking

3.4 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.

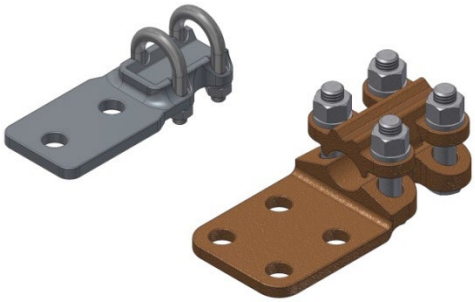


Figure 12

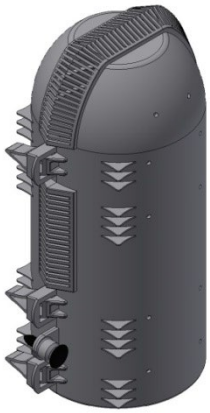


Figure 13

Figure 14

NEMA pads installed

3.5 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 15

Current Transformer

3.6 Mechanical Trip

The mechanical trip hook is made of zinc anodized steel and coated with powder polymer paint RAL1023 (Figure 16).

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.

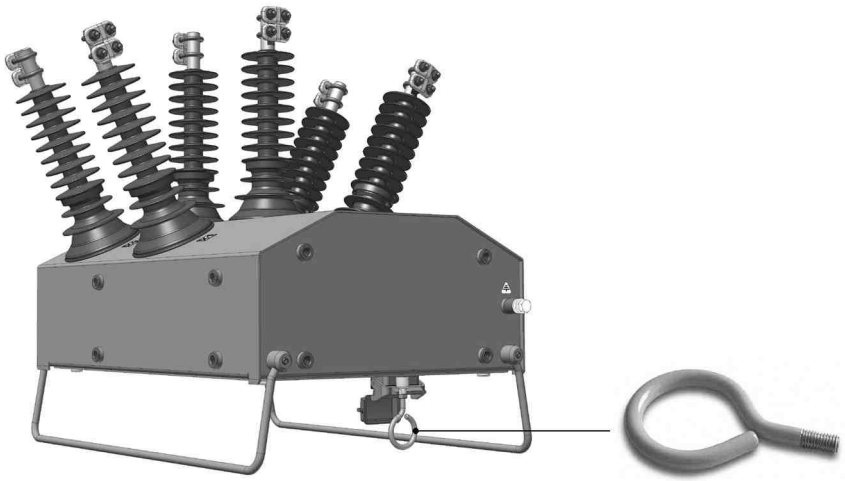


Figure 16

Manual trip hook

3.7 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.

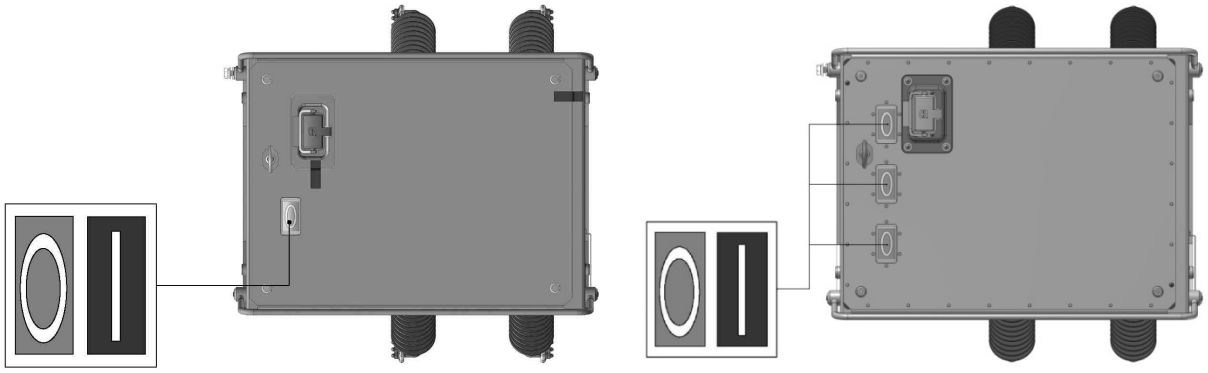


Figure 17

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 18.

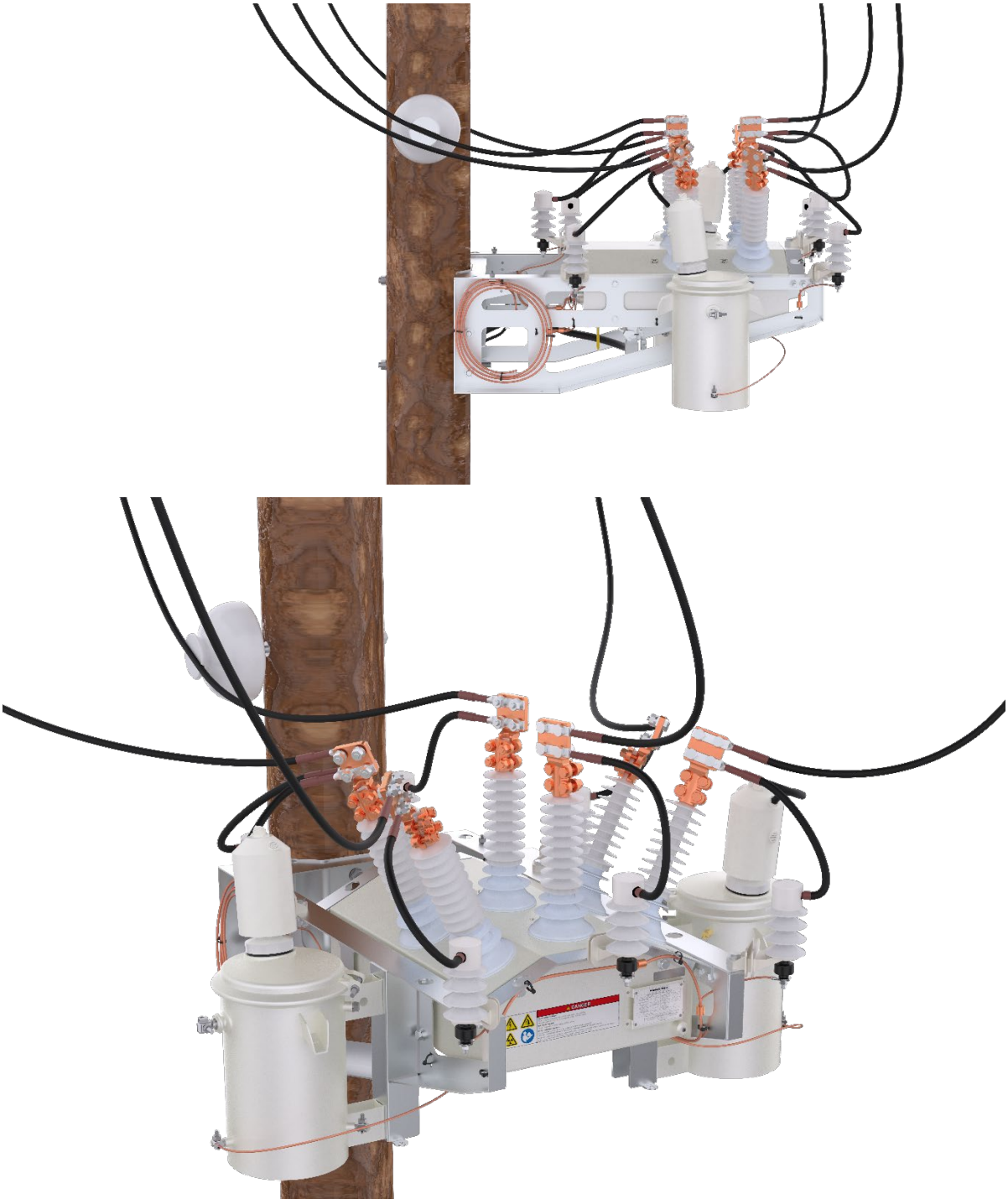


Figure 18

Mounting kit for round wooden pole

Application sample for substation installation with adjustable height is shown on Figure 19.

Figure 19

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 20

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

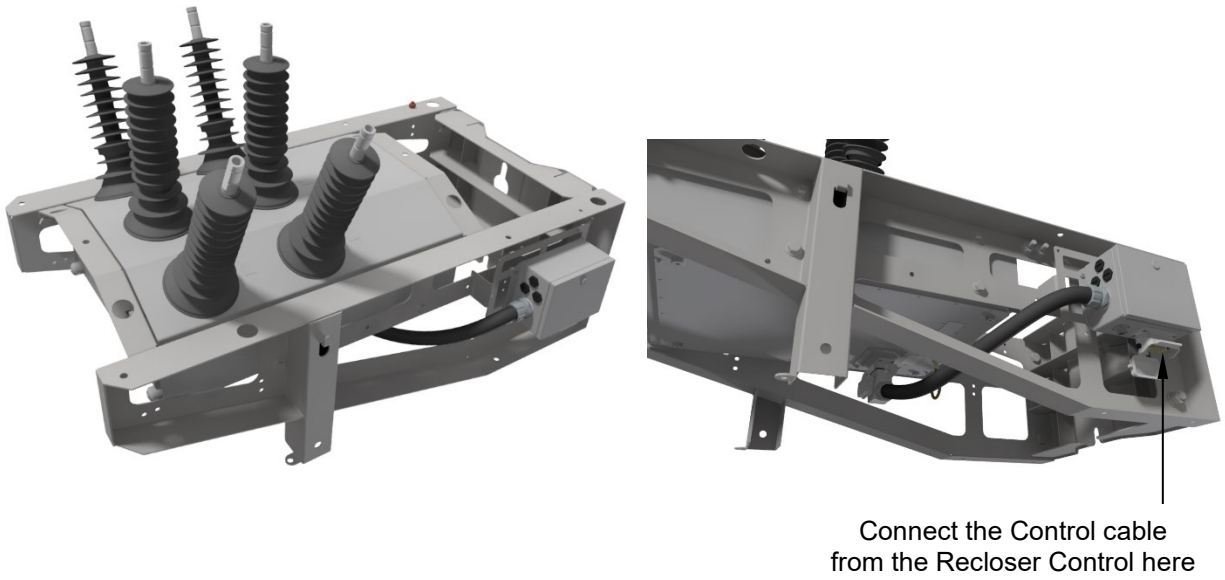


Figure 21

Control cable connection through the junction box

5.3 Auxiliary Circuit Terminations

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

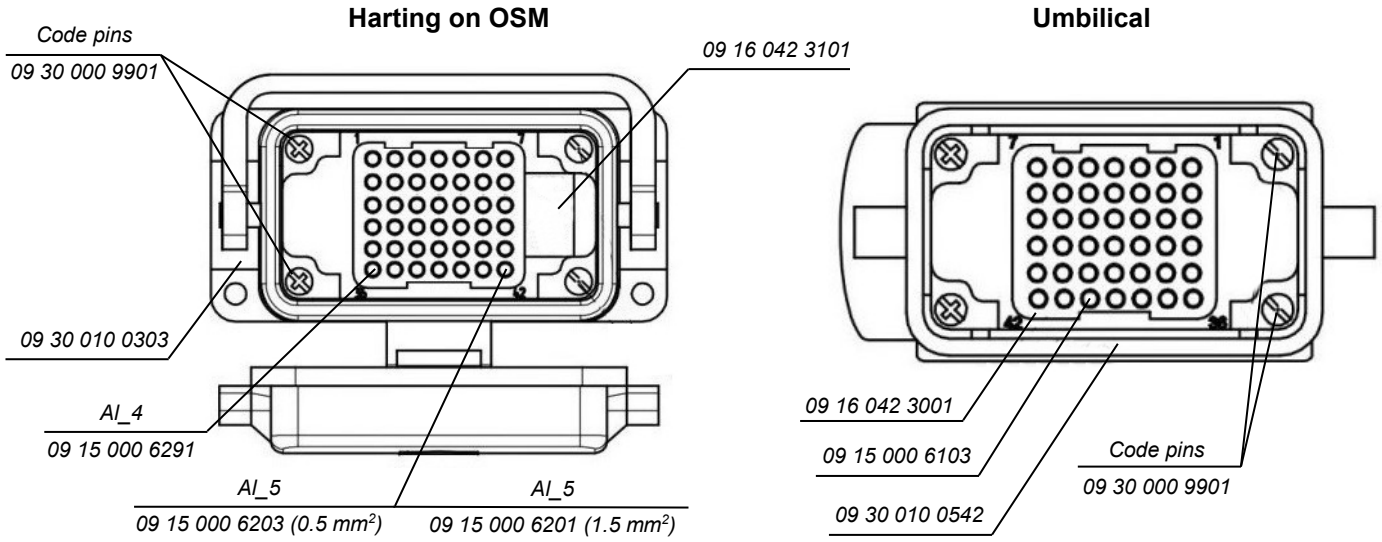


Figure 22

Harting terminal pin arrangement

Termination of Harting terminals for OSM25_AI_4 (ALL) and OSM25_AI_5(600.200_150_ALL):

Terminal No.	OSM25_AI_4 (ALL)		OSM25_AI_5(600.200_150_ALL)	
1	-	free	CT4.2	CT4.2
2	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
4	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
6	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
8	-	free	CT5.2	CT5.2
9	-	free	CT6.2	CT6.2
10	-	free	-	free
11	-	free	-	free
12	-	free	CT4.1	CT4.1
13	-	free	-	free
14	-	free	-	free
15	YH1.1	Yellow handle contact	YH1.1	Yellow handle contact
16	AS3.1	NC3 auxiliary contact	AS3.1	NC3 auxiliary contact
17	AS2.1	NC2 auxiliary contact	AS2.1	NC2 auxiliary contact
18	-	free	CT6.1	CT6.1
19	Ground	GND	GND	Ground
20	Ground	GND	GND	Ground
21	CT1.1	Phase A CT	CT1.1	CT1.1
22	AS1.1	NC1 auxiliary contact	AS1.1	NC1 auxiliary contact
23	-	free	AS4.1	N04 auxiliary contact
24	-	free	CT5.1	CT5.1
25	GND	Ground	GND	Ground
26	GND	Ground	GND	Ground
27	CTs GND	CTs common point	CTs GND	CTs common point
28	CT2.1	Phase B CT	CT2.1	CT2.1

Terminal No.	OSM25_AI_4 (ALL)		OSM25_AI_5(600.200_150_ALL)	
29	Common	Auxiliary contacts common point	Common	Auxiliary contacts common point
30	GND	X1-2 voltage sensor	GND	X1-2 voltage sensor (GND)
31	GND	X2-2 voltage sensor	GND	X2-2 voltage sensor (GND)
32	GND	X3-2 voltage sensor	GND	X3-2 voltage sensor (GND)
33	GND	X5-2 voltage sensor	GND	X5-2 voltage sensor (GND)
34	GND	X6-2 voltage sensor	GND	X6-2 voltage sensor (GND)
35	CT3.1	Phase C CT	CT3.1	CT3.1
36	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
38	VS3.1	X3-1 voltage sensor	VS3.1	X3-1 voltage sensor
39	GND	X4-2 voltage sensor	GND	X4-2 voltage sensor (GND)
40	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
42	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 ± 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 mm² (1...3/0 AWG)
16 kA	300 °C	70-95 mm² (3/0...4/0 AWG)

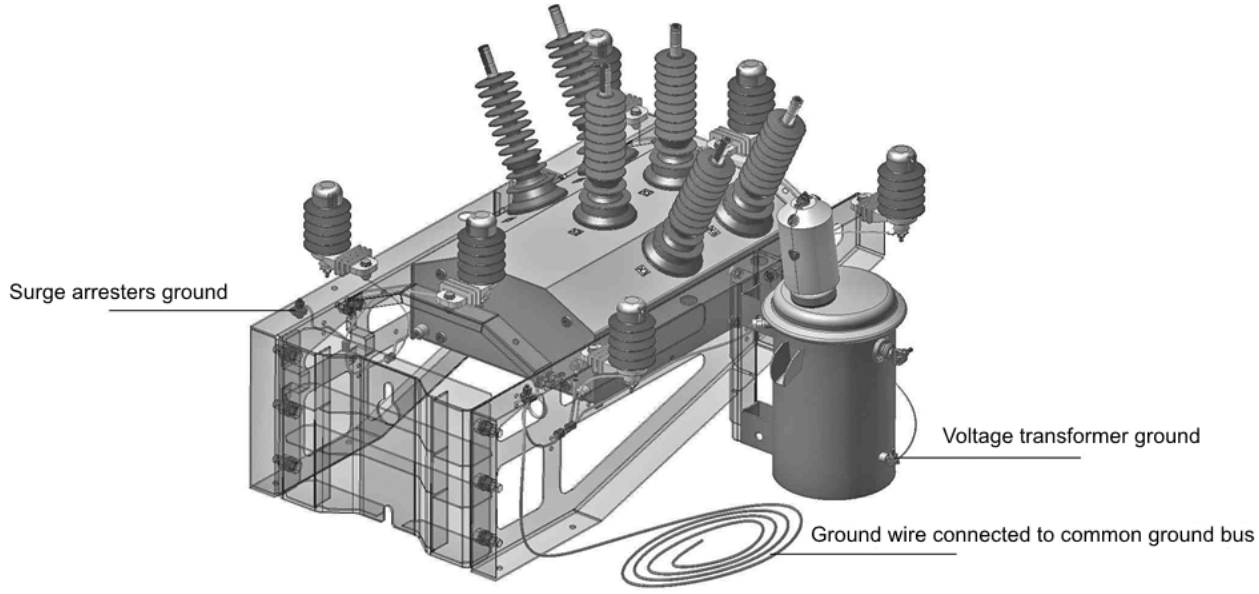


Figure 23

Switching module and accessories grounding arrangement

5.5 Settings Required for SEL-651R with Multi-Recloser Interface

When recloser is controlled by SEL-651R with Multi-Recloser Interface, it is necessary to make sure that settings of control relay are adjusted to provide compatibility with OSM25_AI_2, OSM25_AI_4, OSM25_AI_5 series Magvatech switching module.

Global Settings:

RECL_CFG := A2

V1YRCF, V2YRCF, V3YRCF, V1ZRCF, V2ZRCF, V3ZRCF should be set to RCF coefficients provided with each recloser.

Group 1-8 Settings:

PTRY := 234.5, PTRZ := 234.5

CTR and CTRN settings should be set to corresponding CT ratio of the recloser.

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.

SEL-651R settings specific for Tavrida Electric Rec35_Smart reclosers are shown below.

True PT ratio Vpri./Vsec. = 8793.75.

PTRY or PTRZ = Vpri./Vsec. * (8/300)234.5 = 8793.75 * (8/300) = 234.5

Mandatory SEL-651R setting specific for all Tavrida Electric reclosers are RECL_CFG:=A2.

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 Magvatech 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 Magvatech 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.

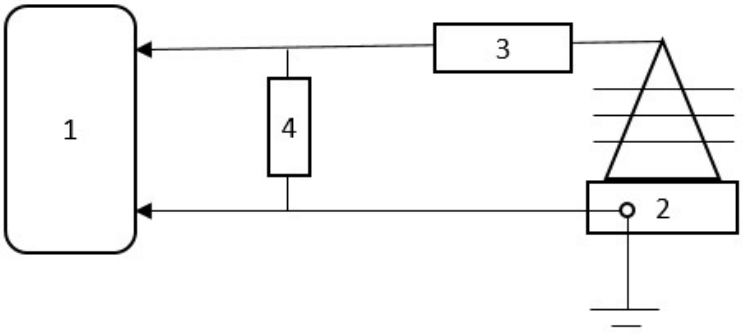


Figure 24

Test circuit

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

Requirements for selecting a surge arrester and a resistor for high-voltage testing:

- Surge Arrester:
  - For a test voltage of 48 kV, a surge arrester with **a Maximum Continuous Operating Voltage (MCOV)** of 39 kV should be used (e.g., model AZES005G039048).
- Resistor Specifications:
  - Voltage Rating: the resistor must have a nominal voltage rating of at least 48 kV. A 30% safety margin is recommended, resulting in **a minimum voltage rating** of 62.4 kV.
  - Wattage Rating: the resistor must have **a wattage rating** of no less than 500 W. (e.g., model 85-RG18 rod resistor).
  - Energy Rating: the resistor must have **a nominal energy rating** of at least 4,900 Joules for a 10 ms pulse duration.
  - Peak Pulse Wattage: the resistor must withstand **a minimum peak pulse wattage** of 100 Joules for a 10 ms pulse duration.

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

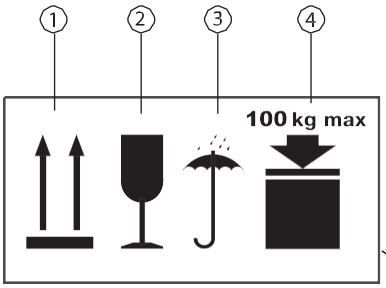
If during installation, commissioning, operation or maintenance any non-conformity occurs, contact your local Tavrida Electric representative or use technical or warranty support request form on our web site www.tavrida.com/tena/.

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 29). The following information are provided on the Outdoor Switching Module packing cartons:

- Handling symbols for transport and storage of the delivery unit (Figure 25)
- Label 1 for manufacturers' product information (Figure 26)
- Label 2 for logistics data (Figure 27)



1 This side up
2 Fragile
3 Protect from rain
4 Max. weight on the delivery unit
5 Serial number

Figure 25

Handling symbols

Figure 26

Label 1 for manufacturers' and product information

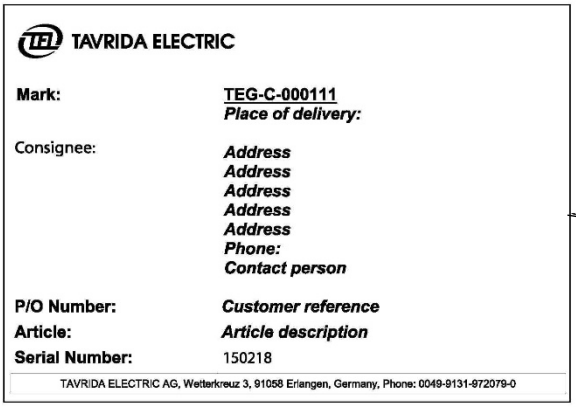


Figure 27

Label 2 Logistics data

Figure 28

Packing carton

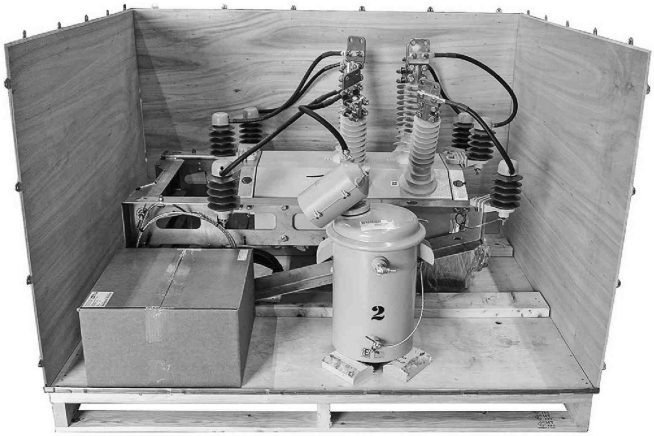


Figure 29

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

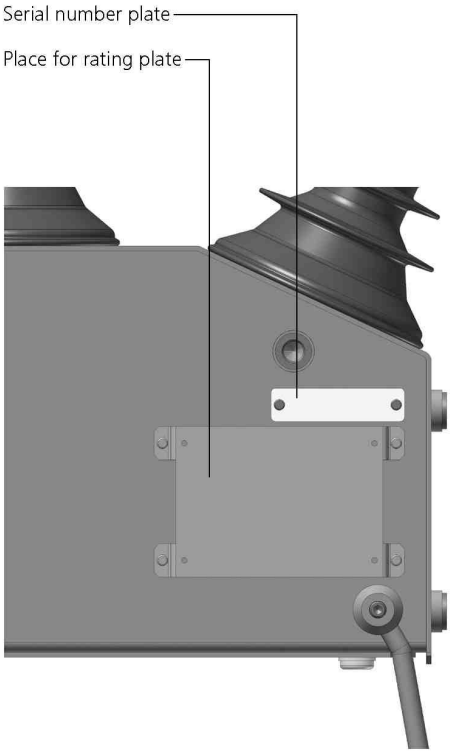


Figure 30

Labelling of the Outdoor Switching Module

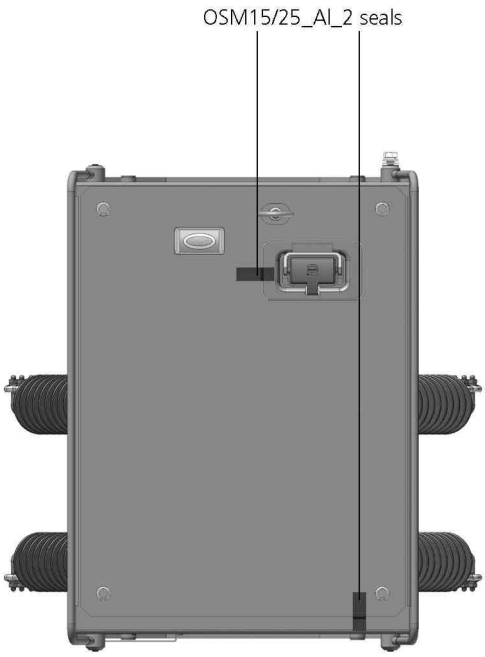


Figure 31

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.

Tavrida 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:

a) the warranty period having run out during the period of storage with the customer;

b) operating conditions, ambient conditions, transport and storage conditions have not been adhered to according to the application description or the application guide;

c) unauthorized manipulation of the device has been carried out, such as opening the housing or damaging the seal;

d) 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).

Tavrida 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 Tavrida Electric will supply replacement equipment free of charge according to our warranty regulations. Tavrida 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.

Tavrida 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.

9 Appendices

9.1 Dimensions and Weights

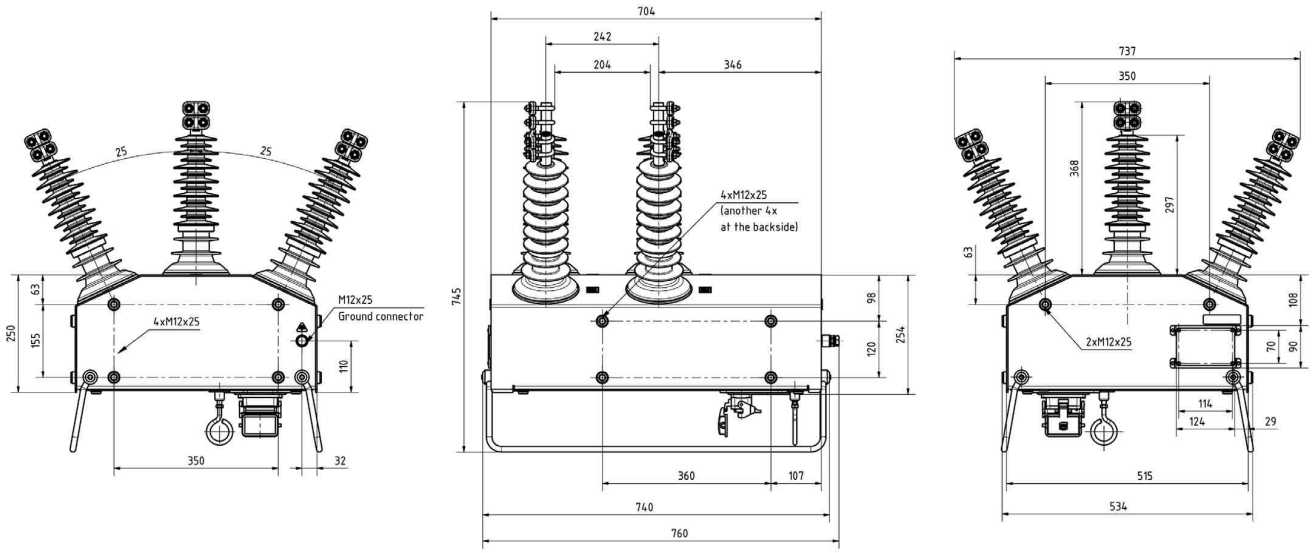


Figure 32

OSM25_AI_4(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

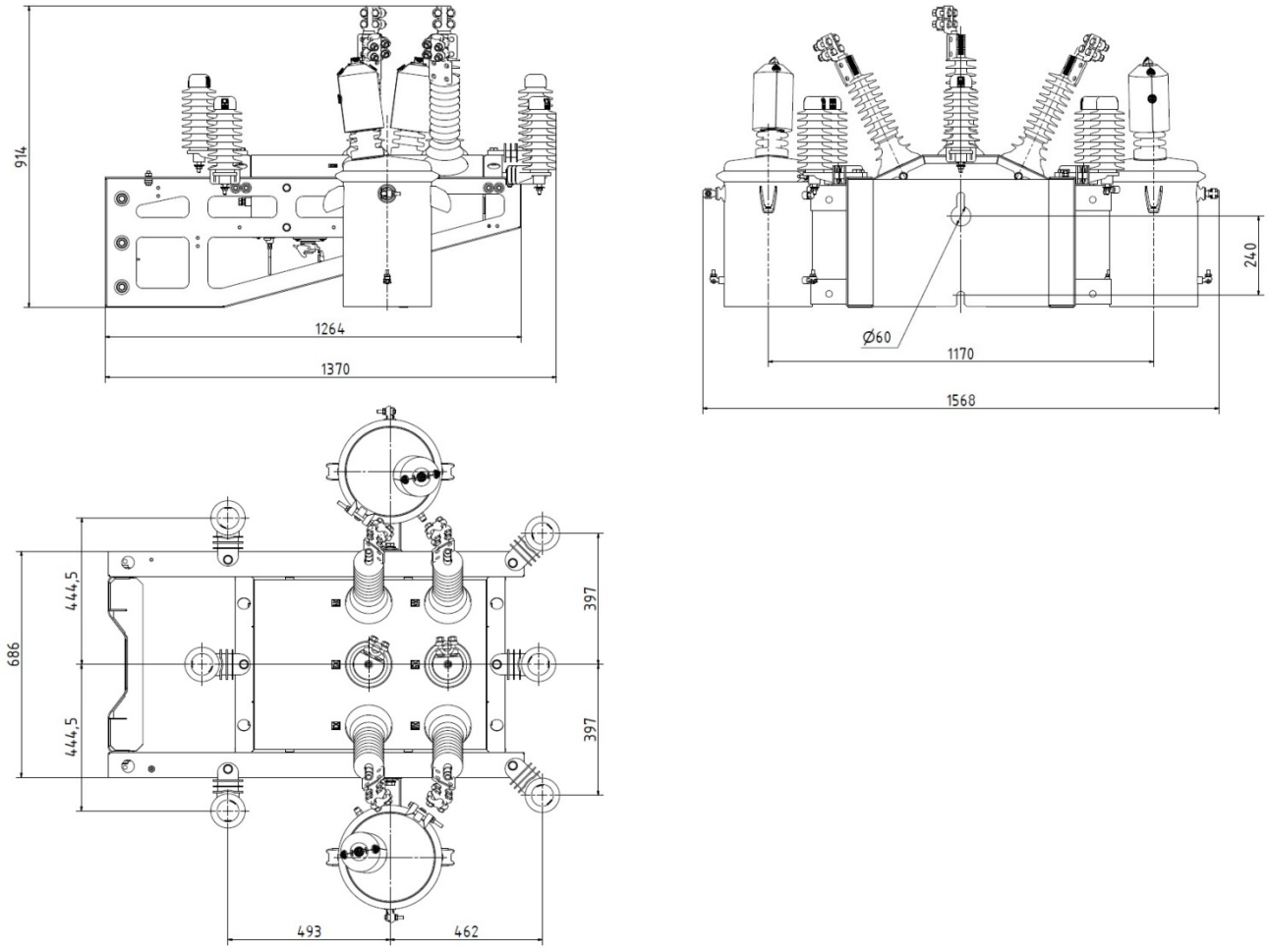


Figure 33

Stainless steel pole mounting kit with provision for up to x6 surge arrestors and x2 1kVA transformers

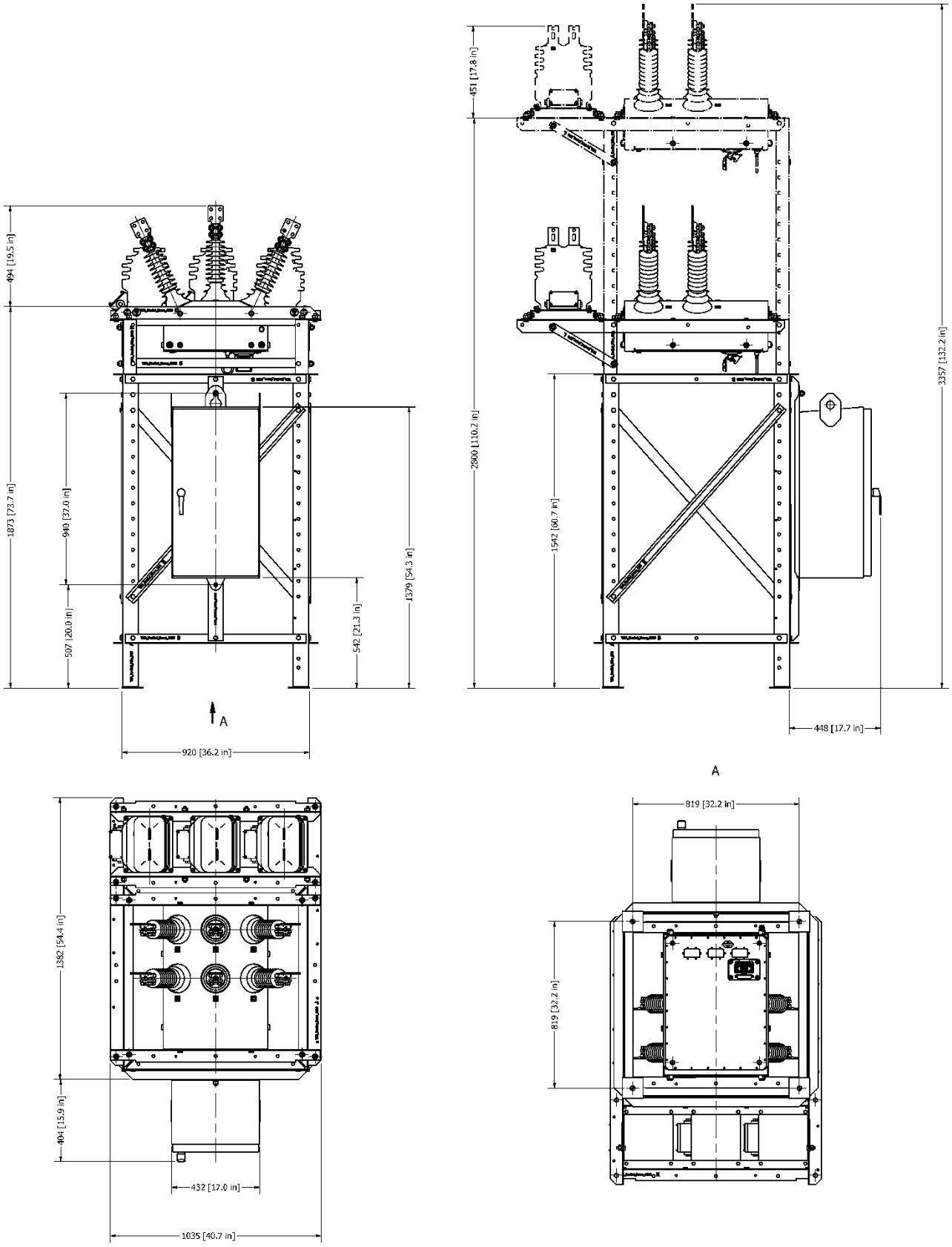
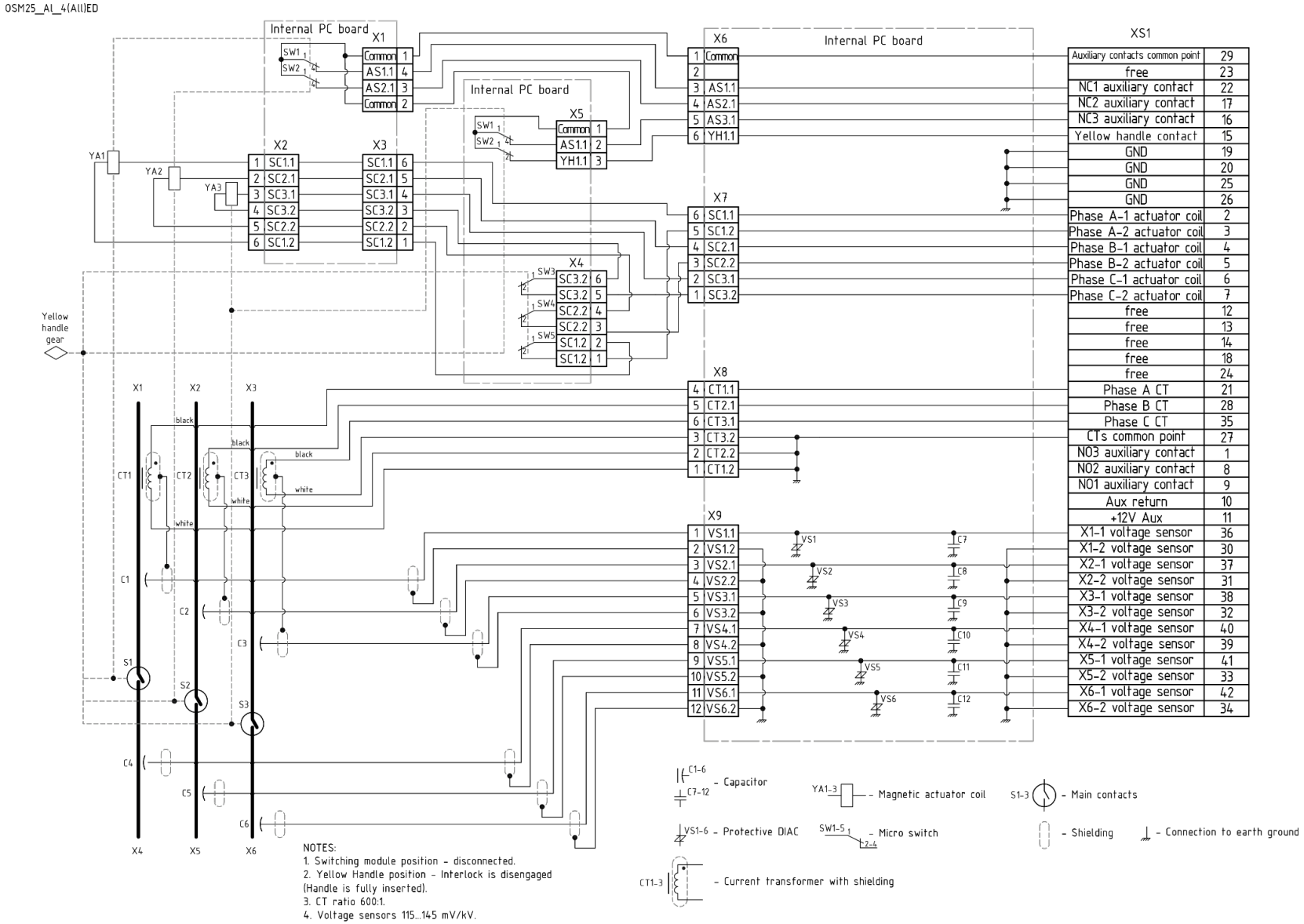


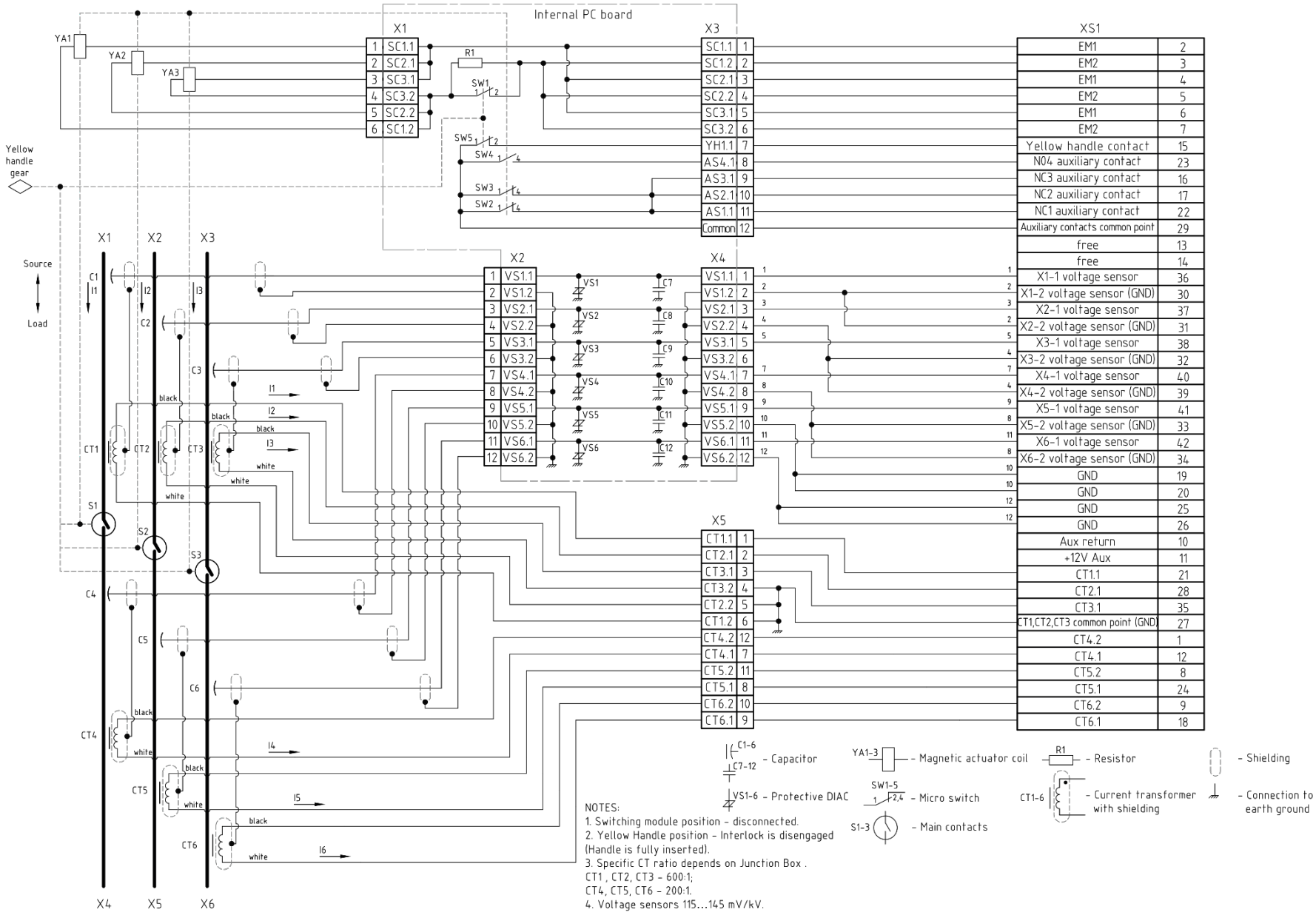
Figure 34

Stainless steel substation mounting kit

9.2 Circuit Diagrams



OSM25__All__5(600.200__150__All)ED



9.3 Safe Trip Device

The safe trip package contains:

1. **TNA_RecUnit_Umbilical_27** (junction box with built-in safe trip function for OSM25_AI_2) or **JunctionBox_MRI(AI_XXX_ST.YYYY)** (junction box with built-in safe trip function for OSM25_AI_5, where **XXX** is 60, 100, 150, 200, 300 or 600 depending on CT ratio, **YYYY** is type of 4-pin receptacle).
2. **Umbilical_22(12) or Umbilical_22.Amph(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 **Umbilical_22(12) or Umbilical_22.Amph(12)** to the junction box 4-pin receptacle supplied with the junction box
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 **Umbilical_22(12) or Umbilical_22.Amph(12)** through cable gland into SEL cabinet
5. Strip the cable and wires of the connection cable **Umbilical_22(12) or Umbilical_22.Amph(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.

   Example of logic that can be used to program OUT201 contact in SEL-651R is shown below. Actual programming may be different depending on the required functionality.

   OUT 201 = NOT [HALARM or (NOT PWR_SRC1 AND BTFAIL) or NOT IN204]

   HALARM – relay failure

   PWR_SRC1 – control power source available

   BTFAIL – battery/charger miss operation

   IN204 – yellow handle normal (monitors for main cable disconnect)

Table 4 – Connections Inside SEL-651R for Safe Trip Functionality

Harness	Wire marking	Connection point 1	Connection point 2
Umbilical_22(12) or Umbilical_22.Amph(12) 4-pin cable “Connection point 1” is pre-wired on factory.	1	Pin designation A (1)	C01
	2	Pin designation B (2)	C04
	3	Pin designation C (3)	B09
	Green/yellow	Pin designation D (4)	B04
Link connector (not in the scope of supply)	N/A	B01	B08

Functionality description:

The safe trip junction box **JunctionBox_MRI(AI_XXX_ST.YYYY)** provides safe trip of the following reclosers’ models:

- OSM25_AI_5(600.200_150_ALL)

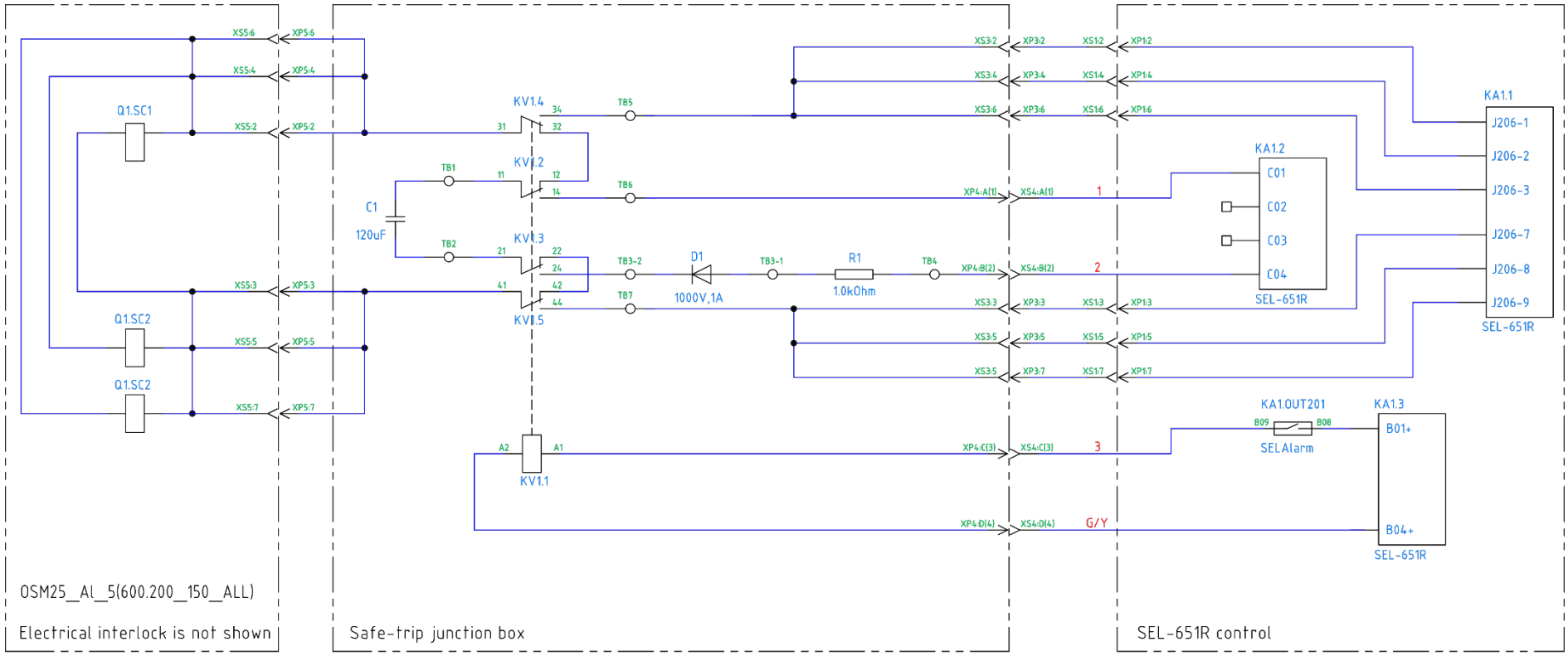
The safe trip junction box works with SEL-651R 42-pin Tavrida recloser interface with power supply 120VAC or 230VAC. It does not work with any type of SEL-651R with DC power supply.

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

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

1. Malfunction of SEL-651R relay if it happens not later than 12 hours after AC power supply loss.
2. Disconnection of connection cable Umbilical_22(12) or Umbilical_22.Amph(12) from junction box or SEL if it happens not later than 12 hours after AC power supply loss.
3. 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).

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 20°C. For lower temperature the storing time expecting to go down about 30% under -40°C. 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.



C1 - capacitor 120uF, 400V
D1, TB3 - terminal block with diode, 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
Q1 - outdoor switching module
R1 - resistor 1kOhm, 2W
TB1, TB2, TB4-TB7 - connection terminals
XP1:1-XP1:42 - Connection Plug Male, panel mounted, Harting (SEL control box)
XP3:1-XP3:42 - Connection Plug Male, cable mounted, Harting (umbilical cable)
XP4:1-XP4:4 - Connection Plug Male, 4-pin, panel mounted (junction box)
XP5 - Connection Plug Male, cable mounted (junction box)
XS1:1-XS1:42 - Connection Plug Female, cable mounted (umbilical cable)
XS3:1-XS3:42 - Connection Plug Female, panel mounted (junction box)
XS4:1-XS4:4 - Connection Plug Female, 4-pin, cable mounted (connection cable)
XS5 - Connection Plug Female, panel mounted (switching module)

Figure 35

Safe Trip device connection diagram

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	– Technical parameters of switching module corrections – Main terminals connection section revised – Note about manual trip hook operation added – Safe Trip device description added.	– Successful test reports for passing 800 A (960 A) continuous current – Improvement of the document
3.0	31.03.2020	– Stainless steel substation mounting kit added	– Mounting kits range extension
4.0	08.11.2021	– OSM25_AI_5(600.600_150_5) added – Terminology – Interrupting time – Ambient temperature	– Product range extension – Clarification
5.0	13.04.2023	– Table 1 and Table 2 – Junction Box – OSM25_AI_2 (630_150_ALL) – OSM25_AI_4 (ALL) – OSM25_AI_5 (100.150_150_ALL) – Current transformers excitation curves – 5.3 Auxiliary Circuit Terminations – 6.5 High Voltage Test – 9.2 Circuit Diagrams – 9.3 Safe Trip Device	– Making corrections
6.0	07.06.2023	For Ur = 15.5 kV and 27 kV – Ud, 1 min dry = 60kV – Ud, 10s wet = 55kV – Up = 150/125 kV	– Changes on request
7.0	28.12.2023	– OSM25_AI_5(600.200_150_ALL) added	– Product range extension
7.1	19.02.2024	– Changing technical parameters	– Changes on request
7.2	19.08.2024	– Changing technical parameters	– Changes on request
7.3	12.11.2024	– 5.5 Settings Required for SEL-651R with Multi-Recloser Interface	– Creation
7.4	13.01.2025	– Section 9.3 Safe Trip Device – Section 6.3 Commissioning Secondary Part	– Update
7.5	31.01.2025	– Applicability – 2 Technical Parameters – 5.3 Auxiliary Circuit Terminations – 9.1 Dimensions and Weights – 9.2 Circuit Diagrams – 9.3 Safe Trip Device – 6.5 High Voltage Test	– Update
7.6	03.04.2025	– The whole document	– Update
7.7	03.04.2025	– Technical parameters	– Update

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