TAVRIDA ELECTRIC
Excellence in Engineering

VCB

VACUUM CIRCUIT BREAKER

17,5 kV, …31,5 kA, …3150 A
24 kV, …25 kA, …2500 A

PRODUCT GUIDE

VERSION 21

Contents

1. Introduction

This Product Guide describes the Vacuum Circuit Breakers manufactured by Tavrida Electric.

Tavrida Electric circuit breakers are designed for rated voltages up to 24 kV.

Vacuum Circuit Breakers described in the current document can be used in various kinds of switchgear and RMUs and are intended to perform switching operations in network rated and faulty modes.

The breakers are comprised of following main components:

- Indoor Switching Module (ISM) - The air insulated ISM incorporates Tavrida Electric vacuum interrupters with monostable magnetic actuators and solid dielectric insulating materials. No SF-6 or oil insulation is used in the ISM;

- Control Module (CM) - The CM is a microprocessor based controller that provides ISM operation, protection and data logging functions;

- Kits - The kits of components are used to provide circuit breaker application properties.

This guide contains information about the circuit breaker technical parameters, functionality and operating principles. The purpose of the document is to provide necessary product information for application engineers and technical personnel utilizing the equipment.

List of other technical documents covering the product:

Document name	Target audience	Purpose of the document
User guide	Users providing installation, commissioning and utilizing installed equipment	Provide information on switching operations, required check-ups and maintenance, as well as service and disposal procedures
Routine test certificate	Customer procurement service	Provides information on routine tests that were carried out on the particular device before dispatching it to the customer

1.1 Abbreviations

AC	Actuator Coil
AS	Auxiliary Switch
BIL	Basic Insulation Level
EMC	Electromagnetic Capatibility
CM	Control Module
CO	Close - Open Operations Cycle
Com	Common Point of Contact
I/O	Input / Output
ISM	Indoor Switching Module
LED	Light Emitting Diode
(P)MCB	Protective Miniature Circuit Breaker
PS	Position Switch
NA	Not Applicable
NC	Normally Closed Contact
NO	Normally Open Contact
PCD	Phase Center Distance
USB	Universal Serial Bus
VCB	Vacuum Circuit Breaker
VI	Vacuum Interrupter

1.2 Definitions

Closing time

The interval of time between the initiation of the closing operation (close command is applied to the CM) and the instant when the contacts touch in all poles.

Opening time

The interval of time between the initiation of the opening operation (trip command is applied to the CM) and the instant when the galvanic contacts is lost in all poles.

Break time

The interval of time between the initiation of the opening operation (trip command is applied to the CM) and the instant of arc extinction in all poles.

1.3 Disclaimers

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.

The Product Guide contains information necessary for the installation, commissioning and operation. It is absolutely necessary for the proper use of the Vacuum Circuit Breakers to read the Product Guide carefully before starting and to adhere to the instructions and the relevant regulations. Tavrida Electric will not accept any claims for damages caused by improper usage of the Vacuum Circuit Breakers. In case of special configurations please contact Tavrida Electric prior of usage of the Vacuum Circuit Breakers.

1.4 Precautions

- Check whether the installation position (distances, spatial separation, and the surroundings) is suitable for the switching devices.
- Installation, operation and maintenance shall only be carried out by trained and experienced personnel who are familiar with the equipment and the electrical safety requirements.
- During installation, commissioning, operation and maintenance of the equipment the relevant legal regulations (such as DIN/VDE/IEC), accident prevention regulations and the connecting conditions of the electric utilities shall be followed.
- Take note that during operation of the Vacuum Circuit Breakers 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 the Product Guide.
- The operating conditions of the Vacuum Circuit Breakers shall comply with the technical data specified in the Product Guide.
- Personnel installing, operating and maintaining the equipment shall be familiar with the Product Guide and its contents.

1.5 Warranty

Unless otherwise stated in the contract, the warranty period is stated in Standard warranty policy. 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) … the operating conditions, ambient conditions, transport and storage conditions have not been adhered to according to the application description or the Installation and Operating Instructions;

c) … an 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 of supply voltage of auxiliary circuits.

2. Presentation

2.1 Product Application Field

The circuit breaker is usually installed in radial or loop cable and overhead lines distribution systems. The main applications are:

- Switching different types of load in normal and fault modes;
- Isolating faults in the cable and overhead line network.

Due to their short closing and opening times (see Table 17), Tavrida Electric circuit breakers can bring significant benefits to the following applications:

- Arc flash protection;
- Automatic backfeed restoration;
- Controlled switching applications;
- Arc furnaces and motor switching.

2.2 Key Benefits

Tavrida Electric circuit breakers provide the following competitive advantages:

- **Environmentally friendly**

  The ISM does not use SF-6 insulation materials.
  The CM and ISM modules are manufactured from environmentally friendly materials.

- **Light weight and compact dimensions**

  Compact design and light weight of switching modules make the VCB an advantageous solution for many applications of compact air or SF-6 insulated switchgear. For compact air insulated switchgear Tavrida Electric has designed special insulating kits to provide required dielectric strength for small phase to phase and phase to ground distances.

- **Highest Reliability**

  50,000 CO operations at rated current and 100 full rated short-circuit operations without any maintenance make it the most reliable circuit breaker on the market.

2.3 Compliance

Tavrida Electric Vacuum Circuit Breakers have been tested by world-renowned testing laboratories.
A list of test reports is presented in "Appendix 1. Type Tests".

3. Product Coding

3.1 Circuit Breaker Coding

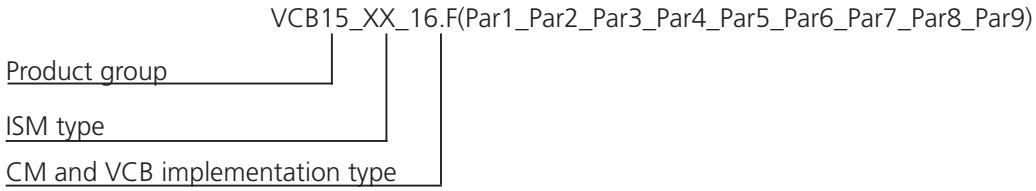


Table 1 - Product Group Description

Code	Description
VCB15	Vacuum Circuit Breaker with rated voltage up to 17.5 kV
VCB25	Vacuum Circuit Breaker with rated voltage up to 24 kV

Table 2 - ISM Type Description

Code XX	Description
LD1	Three-phase Light duty Indoor Switching Module
LD2	Three-phase Light duty Indoor Switching Module for SF6 switchgears
LD3	Single-phase Light duty Indoor Switching Module
LD6	Three-phase Light duty Indoor Switching Module for British retrofit (LMT/AG16 retrofit)
LD8	Three-phase Light duty Indoor Switching Module with rated normal current up to 800 A
MD1	Three-phase Medium duty Indoor switching module with rated normal current up to 1250 A
MD3	Single-phase Medium duty Indoor switching module with rated normal current up to 1250 A
Shell2	Three-phase Shell Series Indoor switching module with rated normal current up to 2500 A
HD1	Three-phase Heavy duty Indoor switching module with rated normal current up to 3150 A

Table 3 - CM and VCB Implementation Type Description

Code	Description
16.F	The 16th series of Control Module and Fixed type VCB
16.RD	The 16th series of Control Module and Retrofit Draw-out type VCB

VCB15_XX_16.F(Par1_Par2_Par3_Par4_Par5_Par6_Par7_Par8_Par9)

Product group

ISM type

CM and VCB implementation type

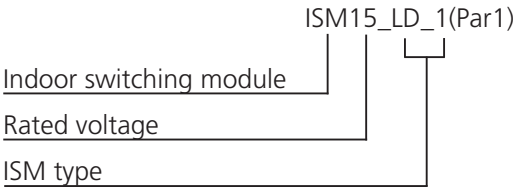
Table 4 - Circuit Breaker Parameters Description

Parameter	Parameter description	Applicable options	Code
Par1	Customization	Default (Without customization) [1]	0
		Without auxiliary switch boards for the ISM, without mechanical position indicator	Basic
		Without auxiliary switch boards for the ISM, with mechanical position indicator	Aux0
		With one auxiliary switch board (3NO+3NC) for the ISM, with mechanical indicator	Aux3.1
		Contact your nearest sales representatives to choose the option suitable for you	AG16
			LMT
Par2	Rated voltage	12 kV	12
		17.5 kV	17.5
		24 kV	24
Par3	Rated short circuit current	16 kA	16
		20 kA	20
		25 kA	25
		31.5 kA	31.5
Par4	Rated normal current	630 A	630
		800 A	800
		1250 A	1250
		2000 A	2000
		2500 A	2500
		3150 A	3150
Par5	Phase center distance	Not applicable (for single-phase ISM)	NA
		133 mm	133
		150 mm	150
		180 mm	180
		210 mm	210
		275 mm	275
Par6	ISM lower terminal design	One main lower terminal	1
		Two main lower terminals	2
Par7	CM settings	Basic circuit breaker functionality	1
		Without CM	NA
Par8	Rated auxiliary supply voltage	24-60 V DC	60
		110-220 V AC/DC	220
		Without CM	NA
Par9	Language	English	EN
		Spanish	ES
		Portuguese	PT

1) By default all TEL VCBs are supplied with auxiliary switch boards (6NO+6NC). ISM15_LD8, ISM15_Shell_2, ISM15_MD1, ISM15_MD3, ISM15_HD1 are supplied by default with a mechanical position indicator.

3.2 Circuit Breaker Component Coding

3.2.1 ISM Coding



The following ISM types are available:

- ISM15_LD_1(Par1)
- ISM15_LD_3
- ISM15_LD_6
- ISM15_LD_8(Par1_Par2)
- ISM15_MD_1(Par1_Par2)
- ISM15_MD_3
- ISM15_Shell_2(Par1_Par2)
- ISM15_HD_1(Par1)
- ISM25_LD_1(Par1_Par2)
- ISM25_LD_2(Par1)
- ISM25_LD_3
- ISM25_Shell_2(Par1)

ISM15 - Indoor Switching Module with rated voltage up to 17.5 kV
ISM25 - Indoor Switching Module with rated voltage up to 24 kV

See Table 2 for description of ISM types.

Table 5 - ISM Parameters Description

Parameter	Applicable ISM	Parameter description	Applicable options	Code
Par1	ISM15_LD_1	Design type (Phase centre distance and main lower terminal design and BIL level)	Phase centre distance 210 mm, one main lower terminal (rated voltage up to 12 kV)	55
			Phase centre distance 150 mm, one main lower terminal (rated voltage up to 12 kV)	67
			Phase centre distance 150 mm, two main lower terminals (rated voltage up to 12 kV)	80
			Phase centre distance 180 mm, one main lower terminal (rated voltage up to 12 kV)	90
			Phase centre distance 150 mm, one main lower terminal (rated voltage up to 17.5 kV)	150
			Phase centre distance 210 mm, one main lower terminal (rated voltage up to 17.5 kV)	210
	ISM15_LD_8	Phase centre distance	150 mm	150
			210 mm	210
	ISM15_MD_1		150 mm	150
			180 mm	180
			210 mm	210
			275 mm	275
	ISM15_Shell_2		150 mm	150
			210 mm	210
			275 mm	275
	ISM15_HD_1		210 mm	210
			275 mm	275
	ISM25_LD_1		210 mm	210
			275 mm	275
	ISM25_Shell_2		210 mm	210
			275 mm	275
	ISM25_LD_2	Design type (One or two main lower terminals)	One main lower terminal	1
			Two main lower terminal	2

Table 5 - ISM Parameters Description

Parameter	Applicable ISM	Parameter description	Applicable options	Code
Par2	ISM15_LD_8	Low terminal design	Low terminal with two 10 mm holes. The terminal and interlock outlets have contra directions	1
				1C
	ISM15_MD_1	Side of position indicator connection to ISM	Left side (between phases A and B)	L
	ISM15_Shell_2	Upper terminal type (High upper terminal allows for higher normal rated current)	Low upper terminal for rated normal current up to 1250 A	L
			High upper terminal for rated normal current up to 2000 A	H
	ISM25_LD_1	ISM auxiliary contacts type (ISM auxiliary contacts material)	Silver contacts	s_0

Please specify the rated voltage required with your order.

Each ISM has the following plate and label:

- Label
- Serial number plate

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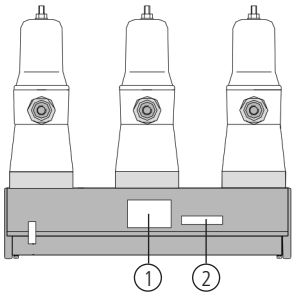
Ur	17.5	kV	Ir	1250	A	p	210	mm
Ud	42	kV	Isc	31.5	kA	W	52	kg
Up	95	kV	tk	4	s	Year	2018	
IEC 62271-1, IEC 62271-100						O - 0.3s - CO - 15s - CO		
ISM15_Shell_2(210_L)								

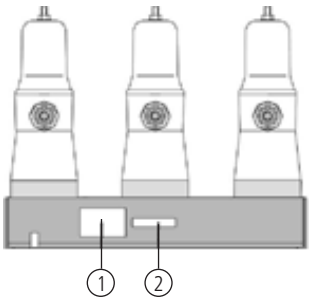
Figure 1
ISM label

Figure 2
Serial number plate placement

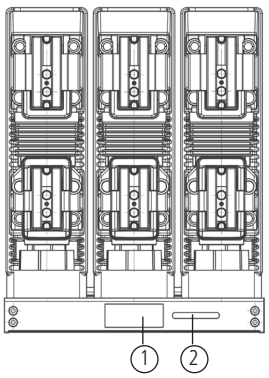
The serial number plate contains information about ISM type and serial number.
The label contains brief information about ISM technical parameters.
Label and serial number plate arrangement is shown below



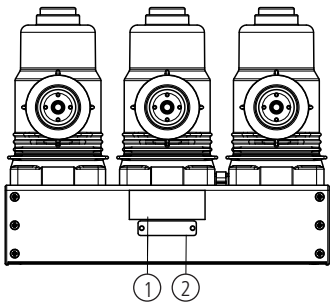
a) ISM15_LD (except LD_8) and ISM25_LD labeling



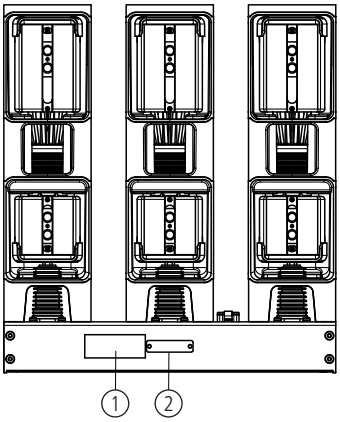
b) ISM15_LD_8 labeling



c) ISM15_Shell, ISM25_Shell labeling



d) ISM15_MD labeling



e) ISM15_HD labeling

1. Label
2. Serial number plate

Figure 3
Serial number plate and label arrangement

3.2.2 CM Coding

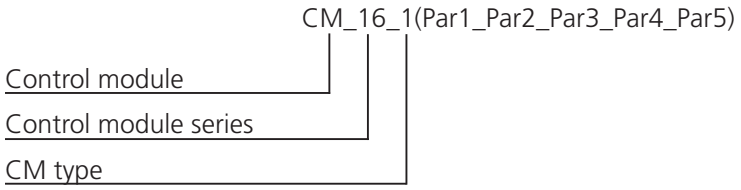


Table 6 - CM Parameters Description

Parameter	Parameter description	Applicable options	Code
Par1	Language	English	EN
		Spanish	ES
		Portuguese	PT
Par2	Rated supply voltage and CM hardware version	24-60V DC, version 2	60.2
		110-220 V AC/DC, version 2	220.2
Par3	Firmware functionality	Basic circuit breaker functionality	1
Par4	ISM driver firmware used in CM[1)] and Protection setting	ISM15_LD_1, ISM15_LD_6 and Without protection	15LD1-000
		ISM15_LD_3 and Without protection	15LD3-000
		ISM15_LD_8 and Without protection	15LD8-000
		ISM15_MD_1 and Without protection	15MD1-000
		ISM15_MD_3 and Without protection	15MD3-000
		ISM15_Shell_2 and Without protection	15Shell2-000
		ISM15_HD_1 and Without protection	15HD1-000
		ISM25_Shell_2 and Without protection	25Shell2-000
		ISM25_LD_1, ISM25_LD_2 and Without protection	25LD1-000
		ISM25_LD_3 and Without protection	25LD3-000
Par5	Factory configurable settings	Relay 1 - Switching module position functionality; Relay 2 - Ready functionality; Relay 3 - Malfunction or Loss of auxiliary supply functionality; Trip by dry contacts close command Close by dry contacts close command	A.A

1) This parameter describes the ISM type(s) that the CM can control. To optimize the operation of each ISM, corresponding settings are used in the CM firmware. Usage of CM with incorrect type of ISM can lead to a mismatch of declared parameters of VCB.

Each CM has the following labels:

Figure 4
Serial number label

Figure 5
Label with applicable ISM designation

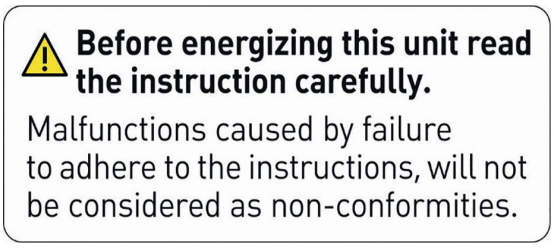


Figure 6

Warning label

Figure 7

Firmware version label

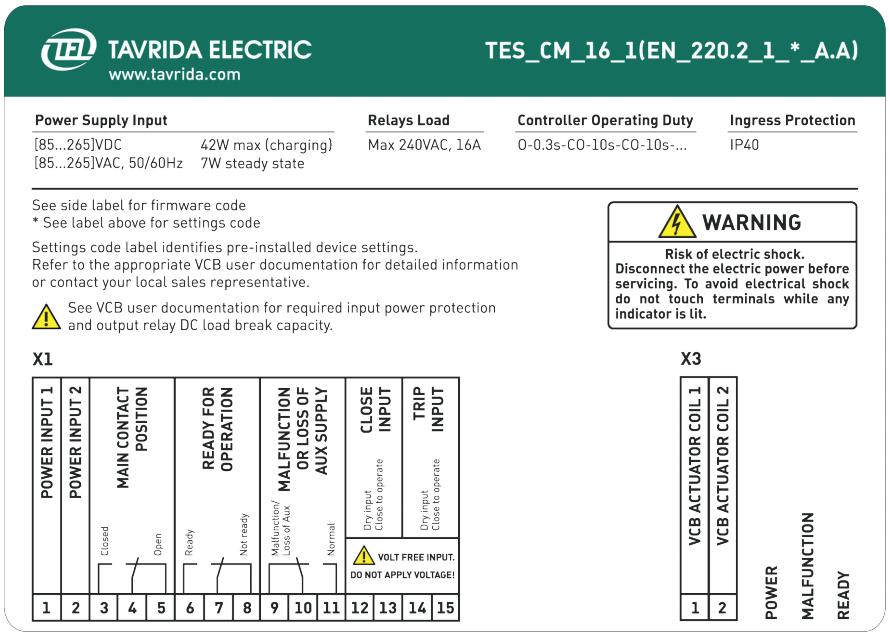
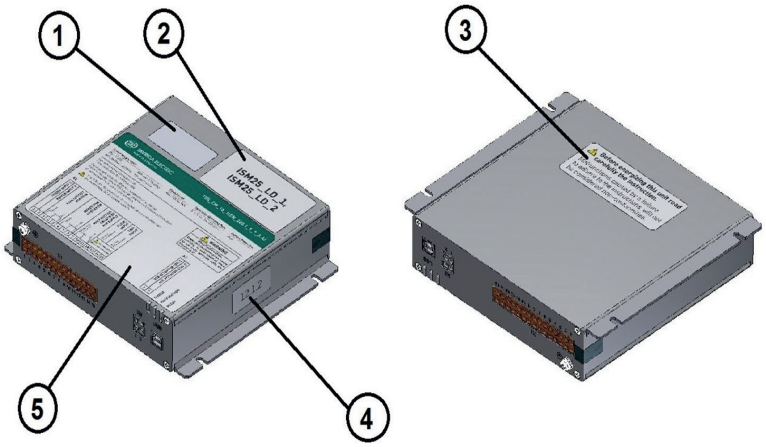


Figure 8

Information label with terminals connections and main parameters

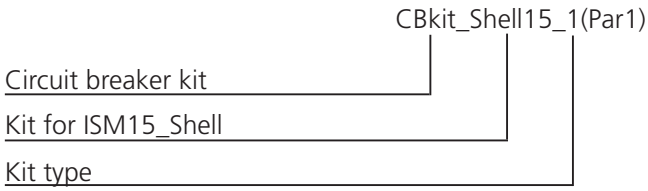


1. Serial number label
2. Label with applicable ISM designation
3. Warning label
4. Firmware version label
5. Information label with terminals connections and main parameters

Figure 9

CM labels arrangement

3.2.3 Circuit Breaker Insulation Kits Coding



CBkit_Shell15_1 is applicable for the ISM15_Shell_2 only. This kit provides for flat busbar connection to the ISM while maintaining the declared BIL level.

Table 7 - CBkit Parameters Description

Parameter	Parameter description	Applicable options	Code
Par1	Terminal distance [1)]	205 mm	205
		310 mm	310

1) Parameter describes the distance between busbar connection points on the upper and lower terminals of the ISM15_Shell_2 per Figure 10 and Figure 11.

The mounting kit for 205 mm terminal distance is used for the ISM15_Shell_2 with lower upper terminal and normal rated currents up to 1250 A, 310 mm is used for the ISM15_Shell_2 with higher upper terminal and normal rated currents up to 2000 A.

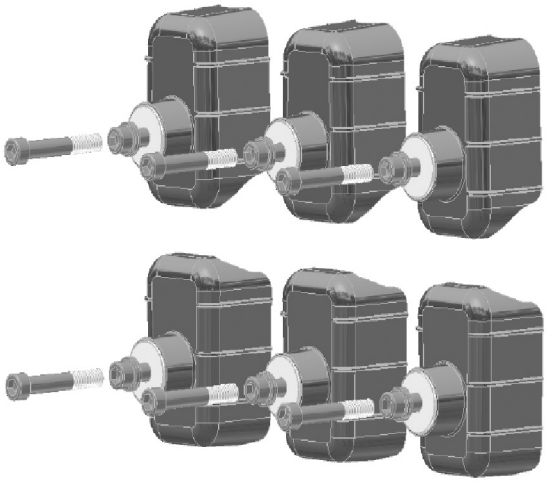


Figure 10
CBkit_Shell15_1(205)

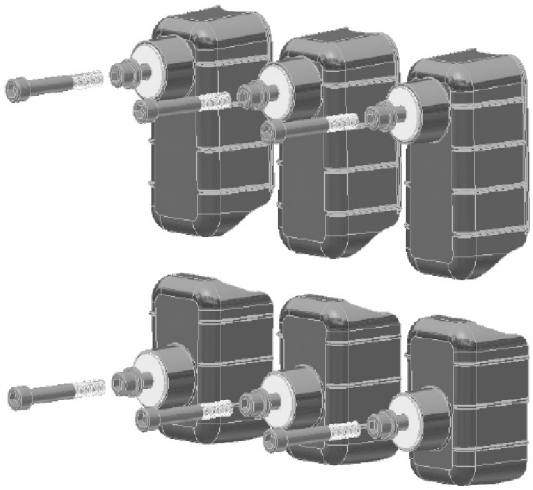
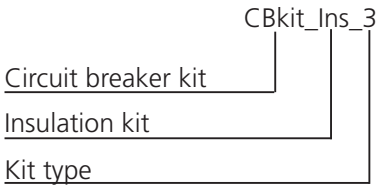


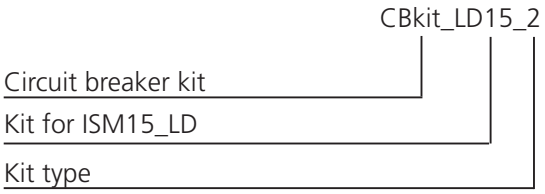
Figure 11
CBkit_Shell15_1(310)

Insulation caps provide ISM terminal insulation. Two sets of bolts are provided for different busbar configurations (single or double stacked).



CBkit_Ins_3 is used with the ISM25_LD_1 and ISM25_LD_3 switching modules only and provides compliance with declared BIL level.

Figure 12
CBkit_Ins_3



CBkit_LD15_2 is used with the ISM15_LD_6 only. CBkit_LD15_2 is a kit of plastic parts providing insulation of main circuits and indication of main contacts state for LMT Retrofit Draw-out type VCB. Please contact your nearest Tavrida Electric sales representative for more information.

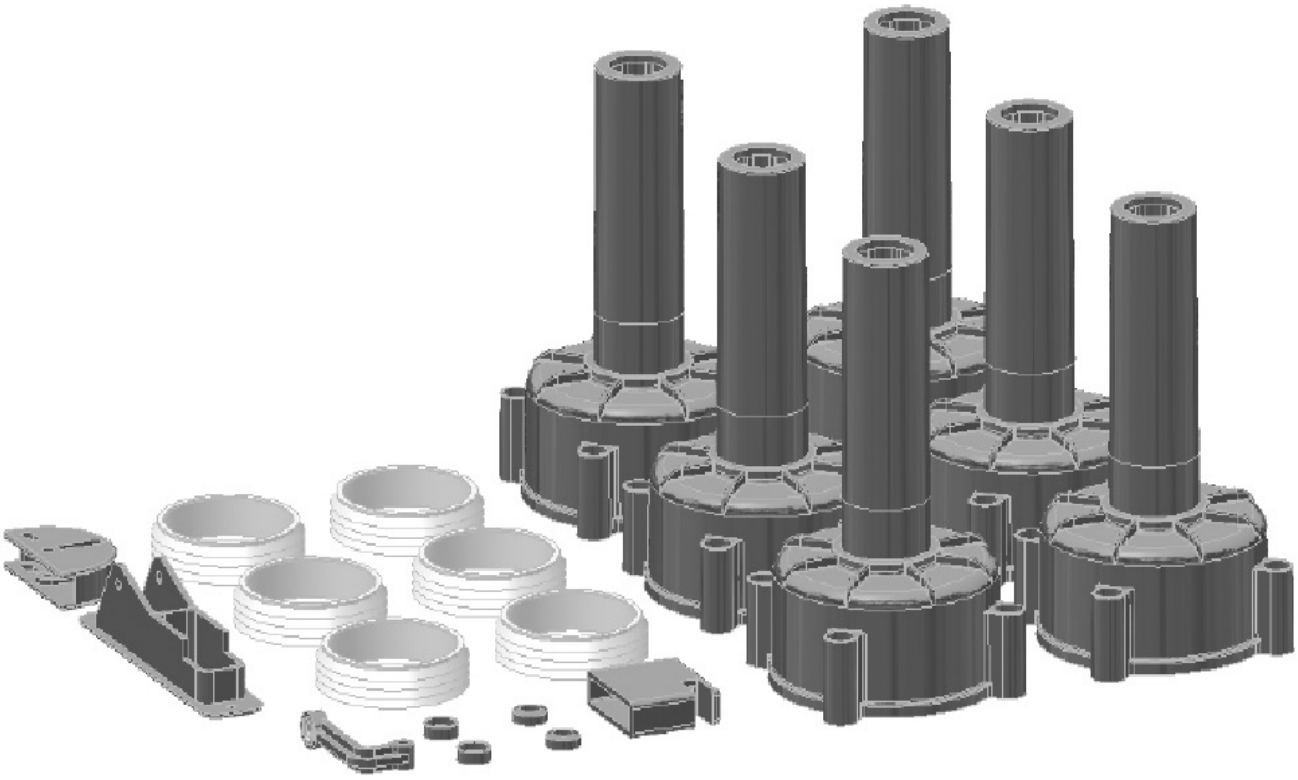
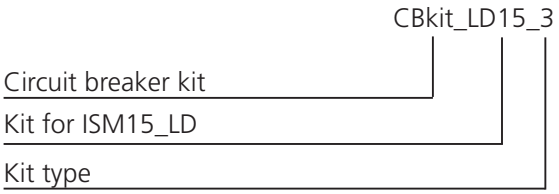
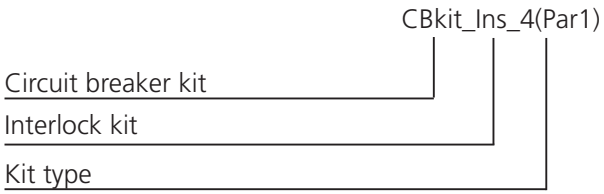


Figure 13
CBkit_LD15_2



CBkit_LD15_3 is used with the ISM15_LD_6 only. CBkit_LD15_3 is a kit of plastic parts providing insulation of main circuits and indication of main contacts state for AG16 Retrofit Draw-out type VCB. Please contact your nearest Tavrida Electric sales representative for more information.

Figure 14
CBkit_LD15_3



Optional CBkit_Ins_4 is used with the ISM15_MD_1 and ISM15_MD_3 only and provides compliance with declared BIL level (95 kV BIL).

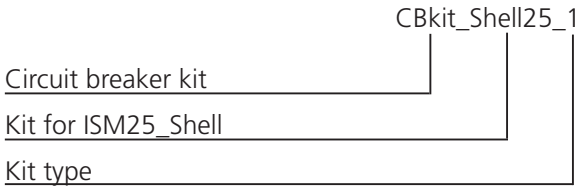
Note: CBkit_Ins_4(Par1) is not included in the VCB delivery, CBkit_Ins_4(Par1) should be ordered separately as an accessory.

Table 8 - Circuit Breaker Parameters Description

Parameter	Parameter description	Applicable options	Code
Par1	Busbars type	10x40 mm Single or Double bars	1
		10x80 mm Single bars	2

a) 10x40 mm b) 10x80 mm

Figure 15
CBkit_Ins_4



CBkit_Shell25_1 is applicable for the ISM25_Shell_2 only. This kit provides for flat busbar connection to the ISM while maintaining the declared BIL level.

The mounting kit provides 310 mm terminal distance for the ISM25_Shell_2 with normal rated currents up to 2500 A.

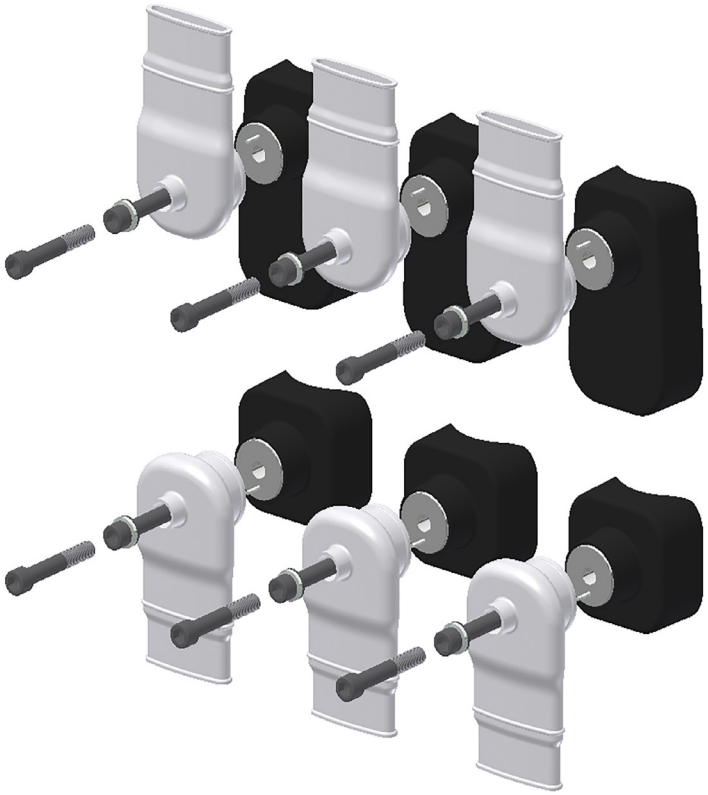
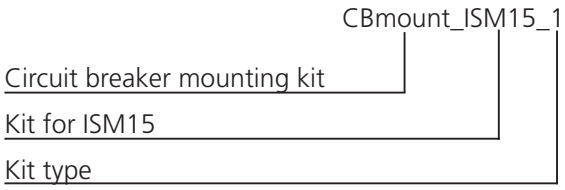


Figure 16
CBkit_Shell25_1

Insulation caps provide ISM terminal insulation. Two sets of bolts are provided for different busbar configurations (single or double stacked).



Optional CBmount_ISM15_1 is used with the ISM15_HD_1 only. The kit attaches to the ISM required mounting points to provide 95 kV BIL.

Note: CBmount_ISM15_1 is not included in the VCB delivery. CBmount_ISM15_1 should be ordered separately as an accessory.

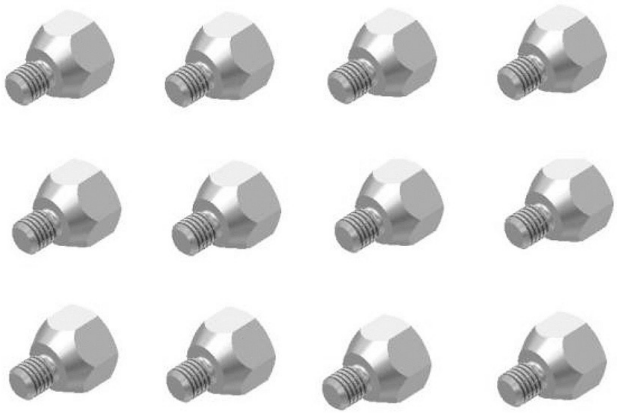
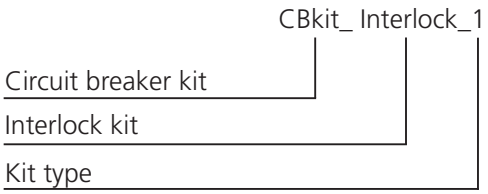


Figure 17
CBmount_ISM15_1

3.2.4 Optional Circuit Breaker Interlocking/Manual Trip Kits Coding



CBkit_Interlock_1 is used with the ISM15_LD_1, ISM25_LD_1 and ISM25_LD_2 only (ISM15_LD_3 and ISM25_LD_3 are already equipped with the CBkit_Interlock_1 pre-installed.). The kit attaches to the ISM synchronizing shaft and serves as an interface for various manual trip / indication / lockout accessories.

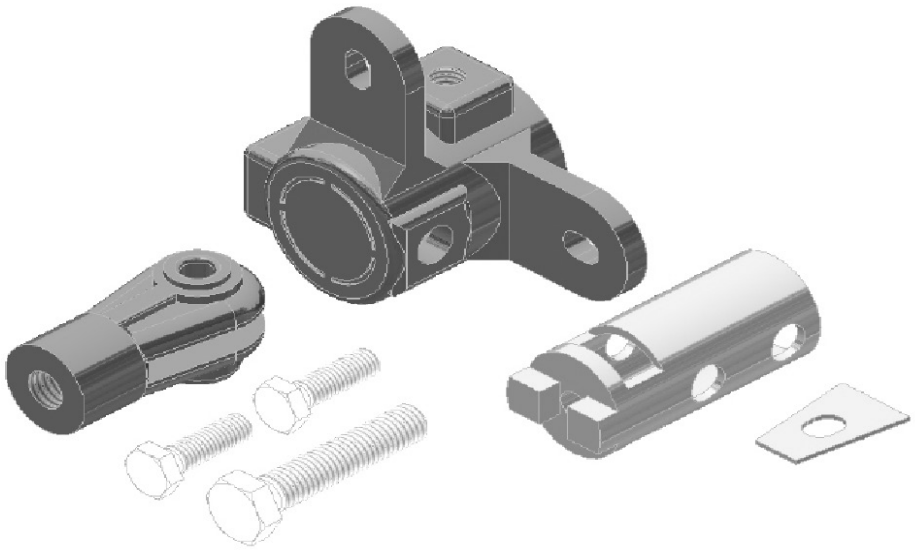
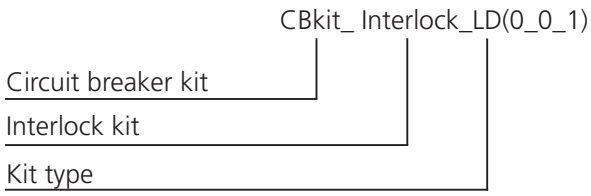


Figure 18
CBkit_ Interlock_1



CBkit_Interlock_LD(0_0_1) is used with the ISM15_LD_1, ISM25_LD_1 and ISM25_LD_2. The kit attaches to the ISM Interlocking shaft and serves as an interface for manual trip / lockout accessories (CBkit_Interlock_3, CBkit_Interlock_4, CBkit_Interlock_5) connection. Also this kit allows to attach a position indicator (CBkit_PosInd_1). CBkit_Interlock_3, CBkit_Interlock_4, CBkit_Interlock_5 and CBkit_PosInd_1 are presented further in the guide.

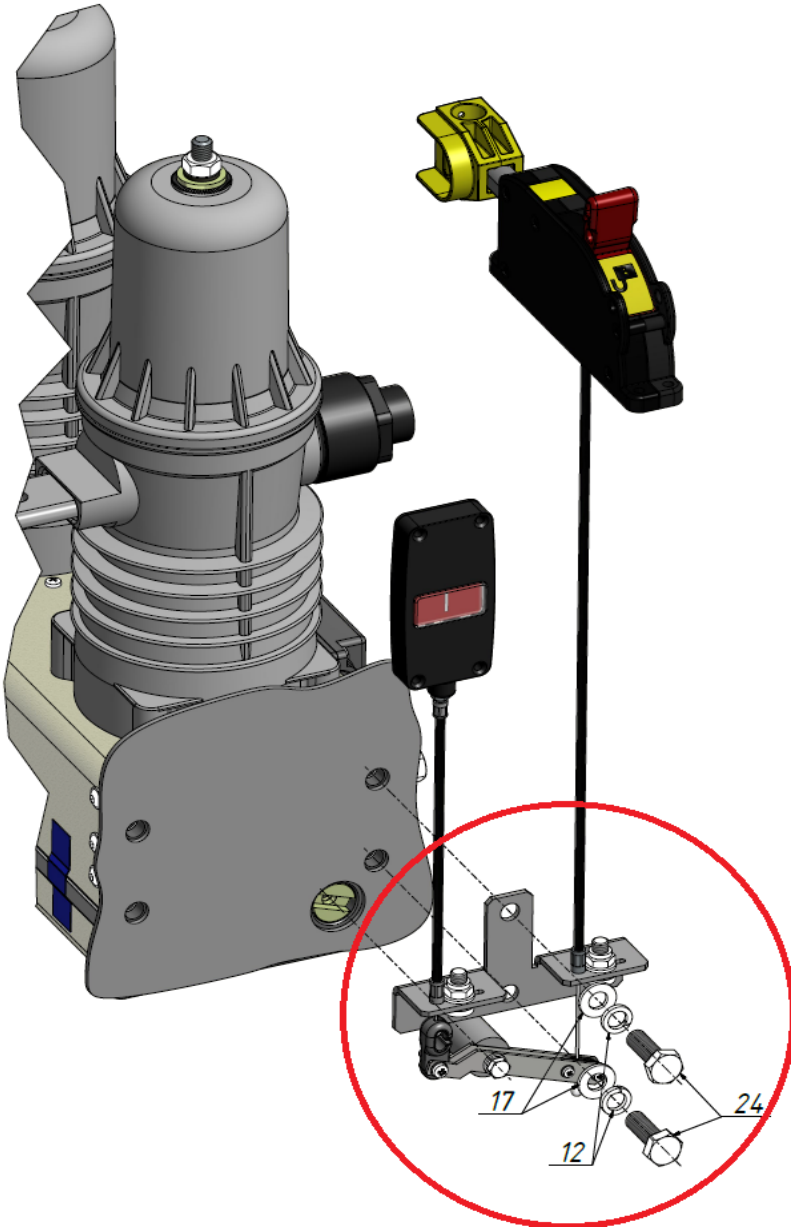


Figure 19

CBkit_Interlock_LD(0_0_1) with attached CBkit_Interlock_3 and CBkit_PosInd_1

CBkit_ Interlock_8

Circuit breaker kit

Interlock kit

Kit type

CBkit_Interlock_8 is used with the ISM15_Shell_2 only. The kit attaches to the ISM Interlocking shaft and serves as an interface for manual trip / lockout accessories (CBkit_Interlock_3, CBkit_Interlock_4, CBkit_Interlock_5) connection

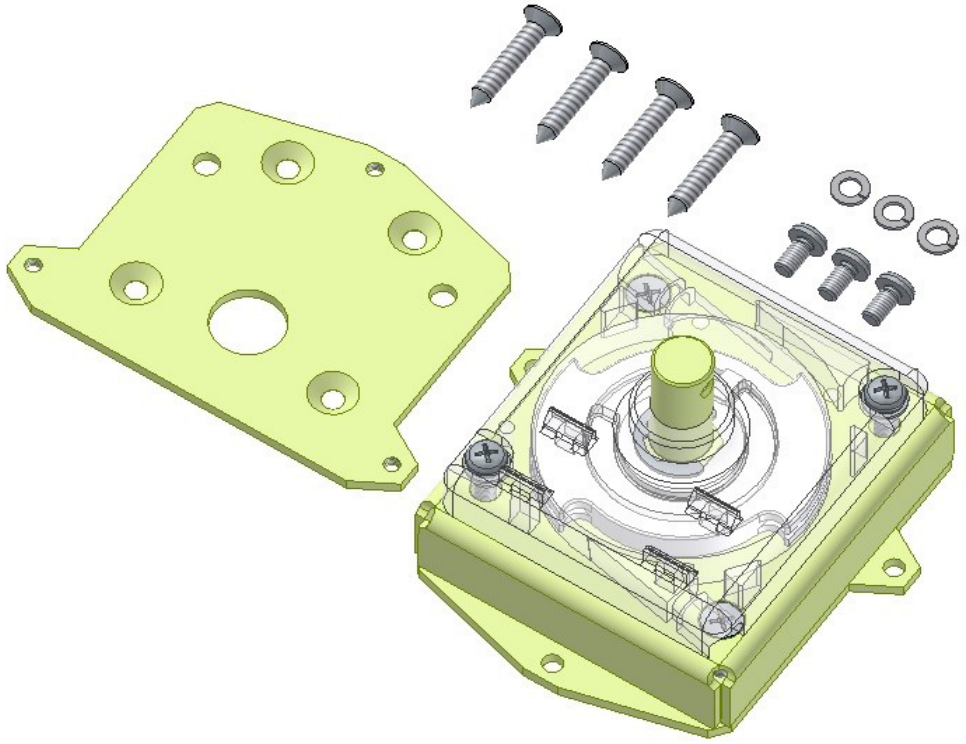
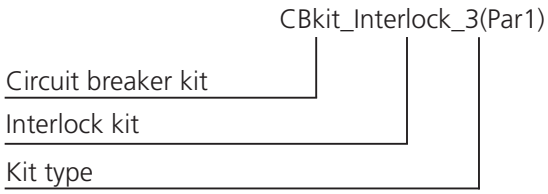


Figure 20

CBkit_ Interlock_8



CBkit_Interlock_3 is used directly only with the ISM15_LD_8, ISM15_MD_1, ISM15_MD_3, ISM15_HD_1 and ISM25_Shell_2 and with ISM15_Shell_2 via CBkit_Interlock_8 installed on this ISM. The kit attaches to the ISM Interlocking shaft and serves as a manual trip / lockout accessory by key switch.

Table 9 - Circuit Breaker Parameters Description

Parameter	Parameter description	Applicable options	Code
Par1	Cable length	1000 mm	1000
		1500 mm	1500
		2000 mm	2000

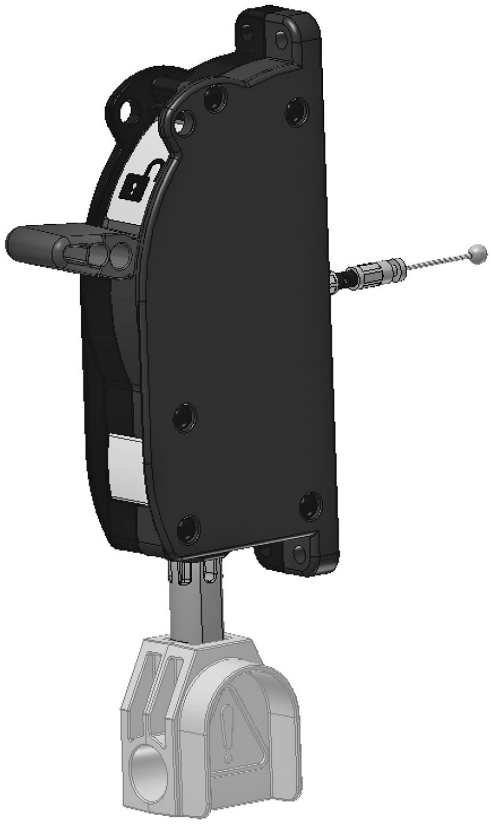
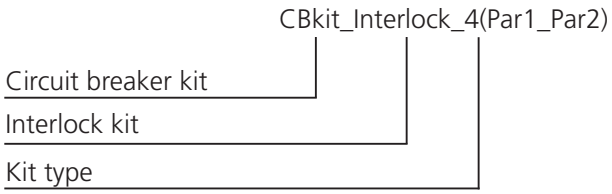


Figure 21
CBkit_Interlock_3



CBkit_Interlock_4 is used directly only with the ISM15_LD_8, ISM15_MD_1, ISM15_MD_3, ISM15_HD_1 and ISM25_Shell_2 and with ISM15_Shell_2 via CBkit_Interlock_8 installed on this ISM. The kit attaches to the ISM Interlocking shaft and serves as a manual trip / lockout accessory by rotary switch.

Table 10 - Circuit Breaker Parameters Description

Parameter	Parameter description	Applicable options	Code
Par1	Cable length	1000 mm	1000
		2000 mm	2000
Par2	Labels language	English language	EN

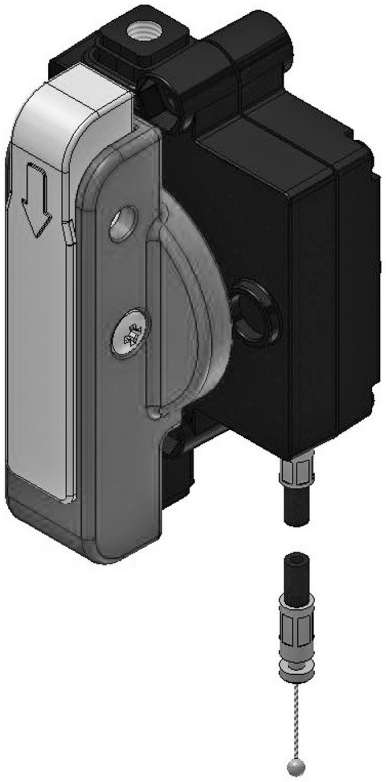
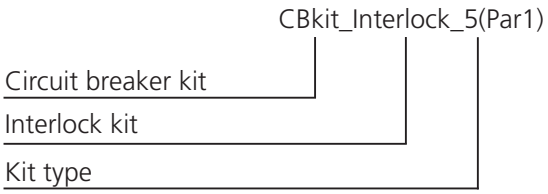


Figure 22
CBkit_Interlock_4

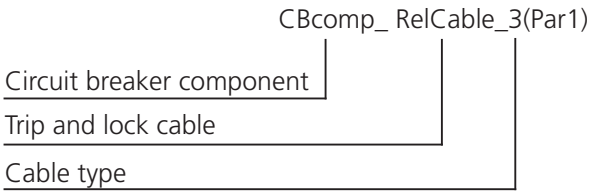


CBkit_Interlock_5 is used directly only with the ISM15_LD_8, ISM15_MD_1, ISM15_MD_3, ISM15_HD_1 and ISM25_Shell_2 and with ISM15_Shell_2 via CBkit_Interlock_8 installed on this ISM. The kit attaches to the ISM Interlocking shaft and serves as a manual trip button.

Table 11 - Circuit Breaker Parameters Description

Parameter	Parameter description	Applicable options	Code
Par1	Cable length	1000 mm	1000
		2000 mm	2000

Figure 23
CBkit_Interlock_5



Optional CBcomp_RelCable_3 is a flexible cable used for ISM manual trip or interlock connection to the ISM.

Table 12 - Trip and Lock Cable Parameters Description

Parameter	Parameter description	Applicable options	Code
Par1	Cable length	500 mm	500
		1000 mm	1000
		1500 mm	1500
		2000 mm	2000

Parameter describes length of trip and lock cable.

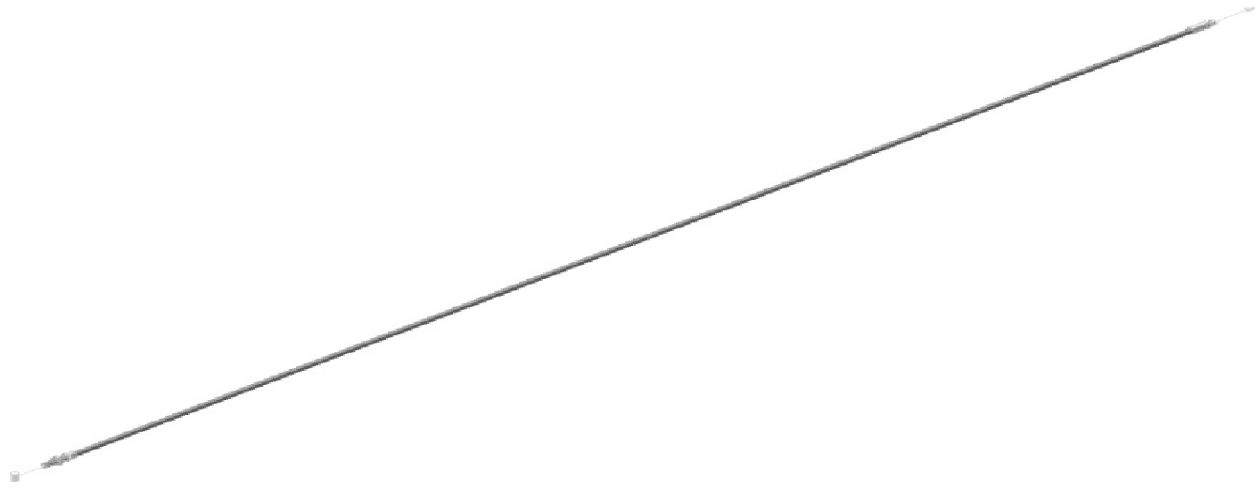
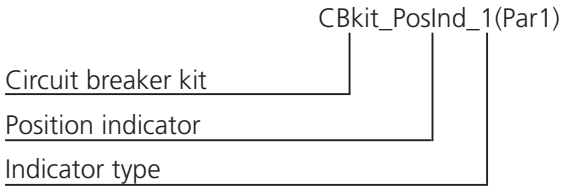


Figure 24
CBcomp_RelCable_3

3.2.5 Optional Position Indicator Coding



CBkit_PosInd_1(Par1) is used to indicate the ISM main circuit position. VCB15_MD1_16.F, VCB15_MD3_16.F, VCB15_Shell2_16.F, VCB15_HD1_16.F , VCB25_Shell2_16.F already include CBkit_PosInd_1(Par1).

Table 13 - CBkit_PosInd_1 Parameters Description

Parameter	Parameter description	Applicable options	Code
Par1	Cable length	1000 mm	1000
		2000 mm	2000

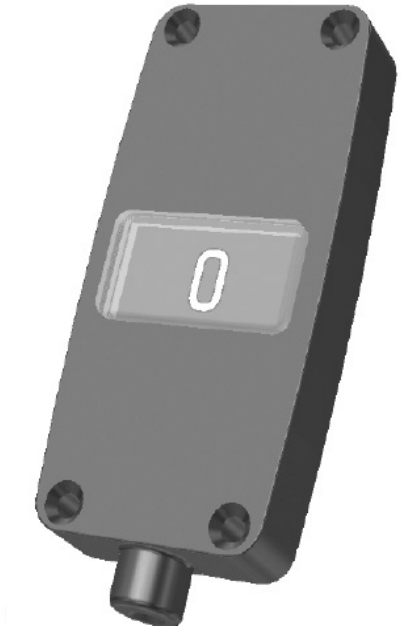
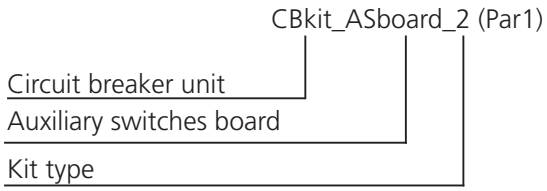


Figure 25
CBkit_PosInd_1(Par1)

3.2.6 Optional Auxiliary Switches Board Kit Coding



CBkit_ASboard_2 (Par1) is a kit of the auxiliary switches board and its holder for the circuit breaker.
CBkit_ASboard_2 (Par1) can be used with the ISM15_LD8, ISM15_MD1, ISM15_HD_1 and ISM25_Shell_2.

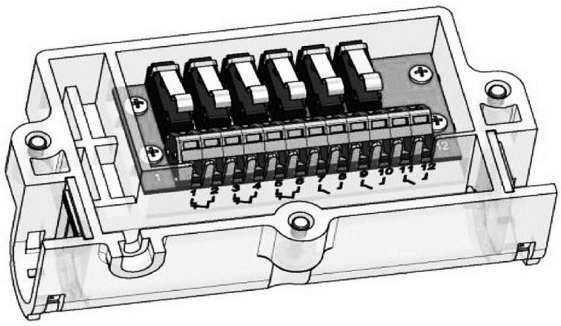
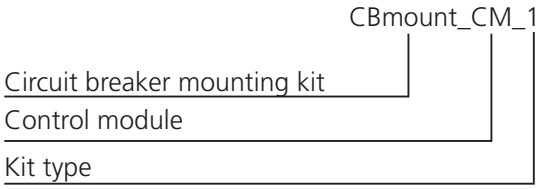


Figure 26
CBkit_ASboard_2

Table 14 - CBkit_ASboard_2 Parameters Description

Parameter	Parameter description	Applicable options	Code
Par1	Auxiliary switches board type	3NO+3NC, silver plated	3S
		4NO+4NC, silver plated	4S
		6NO+6NC, silver plated	6S

3.2.7 Optional Kit for Control Module Installation on a DIN Rail



The CBmount_CM_1 is used to mount CM_16_1 on DIN rail.

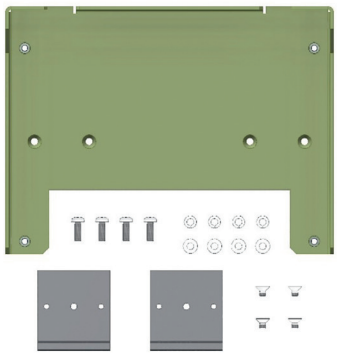
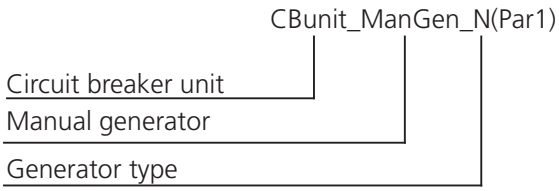


Figure 27
CBmount_CM_1

3.2.8 Optional Manual Generator Coding



CBunit_ManGen is used to charge the CM_16_1 in cases where the main auxiliary power supply is not available.

Table 15 - Generator Type Description

Code N	Description
1	Manual generator for use with CM_16_1(Par1_220.2_Par3_Par4_Par5)
2	Manual generator for use with CM_16_1(Par1_60.2_Par3_Par4_Par5)

Table 16 - CBunit_ManGen Parameters Description

Parameter	Parameter description	Applicable options	Code
Par1	Plug	Generator has wire with auxiliary plug and counterpart	1

Figure 28

CBunit_ ManGen_1 (CBunit_ ManGen_2)

Figure 29

Designation label

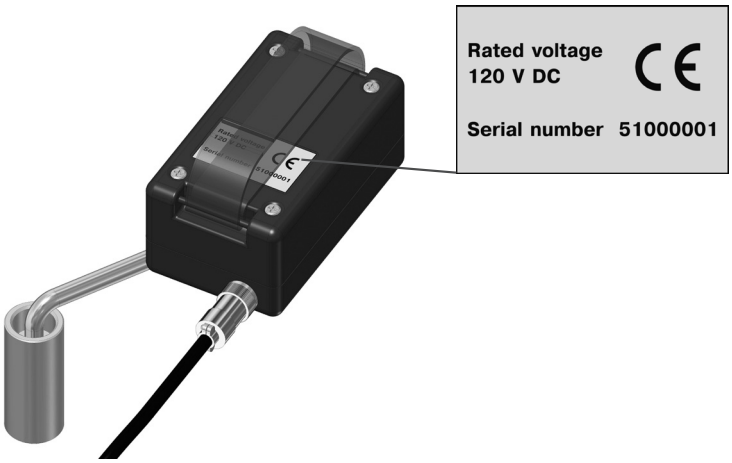


Figure 30

Serial number label

4. Technical Parameters

Main technical data and circuit breaker technical parameters are presented in the tables below.

Table 17 - VCB15 Technical Parameters

	VCB15_									
Type	**LD1**		**LD3**	**LD6**	**LD8**	**MD1**	**MD3**	**Shell2**	**HD1**	
Rated voltage (Ur)	12 kV	17.5 kV	12 kV	12 kV	17.5 kV	17.5 kV	17.5 kV	17.5 kV	17.5 kV	
Phase centre distance (PCD), mm	150 180 210	180 210	-	133	150 210	150 180 210 275	-	150 210 275	210 275	275
Rated normal current (Ir)	800 A		800 A	630 A	800 A	1250 A	1250 A	1250 A[1)] 2000 A	2500 A[2)]	3150 A[3)]
Rated power frequency withstand voltage (Ud)	28 (42) [4)] kV	38 (42) [4)] kV	28 (42) [4)] kV	28 (42) [4)] kV	38 (42) [4)] kV	38 (42) [4)] kV	38 (42) [4)] kV	38 (42) [4)] kV	38 (42) [4)] kV	
Rated lightning impulse withstand voltage (peak) (Up)	75 kV	95 kV	75 kV	75 kV	95 kV	95 kV [5)]	95 kV [5)]	95 kV [6)]	95 kV	
Rated short-circuit breaking current (Isc)	20 kA [7)]		20 kA [7)]	20 kA [7)]	25 kA [19)]	31.5 kA [7)]	31.5 kA [7)]	31.5 kA [7)]	31.5 kA [7)]	
Rated peak withstand current (Ip)	52kA		52kA	52 kA	65 kA	82 kA	82 kA	82 kA	82 kA	
Rated short-time withstand current (Ik)	20 kA		20 kA	20 kA	25 kA	31.5 kA	31.5 kA	31.5 kA	31.5 kA	
Rated duration of short circuit (tk)	4 s		4 s	4 s	4 s	4 s	4 s	4 s	4 s	
Rated frequency (fr)	50/60 Hz									
Mechanical life (CO-cycles)	50 000		50 000	20 000	50 000	30 000	50 000	30 000 [8)]	30 000	
Maximum number of CO-cycles per hour	60									
Operating cycles, rated–short circuit breaking current	100		100	100	100	50	50	50	50	
Closing time	≤ 70 [9)] ms		≤ 70 [9)] ms	≤ 70 [9)] ms	≤ 70 [9)] ms	≤ 60 [9)] ms	≤ 60 [9)] ms	≤ 60 [9)] ms	≤ 60 [9)] ms	
Opening time	≤ 35 [9)] ms									
Break time	≤ 45 [9)] ms									
Rated operating sequence at rated normal current	O-0.3s-CO-10s-CO-10s-CO [10)]									
Rated operating sequence at rated short-circuit breaking current	O-0.3s-CO-15s-CO									
Auxiliary Circuits Insulation Strength [11)]										
Power frequency test voltage (1 min) according to IEC60255-27	2 kV									

Table 17 - VCB15 Technical Parameters

	VCB15_							
Type	**LD1**	**LD3**	**LD6**	**LD8**	**MD1**	**MD3**	**Shell2**	**HD1**
Lightning impulse 1.2 m s/50 m s/0.5 J according to IEC60255-27	5 kV							
Insulation resistance, 1000V DC according to IEC60255-27	≥ 5 MOhm							
Design class of switching module with regard to severity of service conditions in accordance with IEC 60932	Class 1	Class 1	Class 1	Class 1	Class 0	Class 0	Class 0	Class 0
Standards	IEC 62271-100 GB 1984- 2003							
Mechanical vibration withstand capability according to IEC 60721-3-4	Class 4M4							
Resistance of main circuit	≤ 40 µOhm	≤ 40 µOhm	≤ 40 µOhm	≤ 40 µOhm	≤ 17 µOhm	≤ 17 µOhm	≤ 18 µOhm	≤ 15 µOhm
Weight (depending on Phase centre distance)	34-36 kg	13 kg	55 kg	26 kg	33-35 kg	13 kg	51-55 kg	70-72 kg
Weight of CM	1 kg							
Overall dimensions of CM [12)]	190x165x45 mm							
Altitude above sea level	1000 m [13)]							
Relative humidity in 24 hours	≤ 95 %							
Relative humidity over 1 month	≤ 90 %							
Temperature Range	-25 °C ... +55 °C							
Degree of protection according to IEC 60529 of actuator compartment	IP40							
Type of driving mechanism	Monostable magnetic actuator							
Design, Switching Capacity of Silver Auxiliary Contacts								
Number of available auxiliary contacts for three-phase ISM	6 NO + 6 NC	2 NO + 2 NC	6 NO + 6 NC	Variable:Up to 12NO+12NC	6 NO + 6 NC	2 NO + 2 NC	6 NO + 6 NC	6 NO + 6 NC
Minimum current for 12 V AC / DC, ohmic load	100 mA							
Minimum current for 12 V AC / DC, inductive load (t=20 ms, cosj =0,3)	100 mA							
Maximum current for 30 V DC, ohmic load	10 A [14)]							
Maximum current for 30 V DC, inductive load (t=20 ms)	3 A							
Maximum current for 60 V DC, ohmic load	0.9 A							
Maximum current for 60 V DC, inductive load (t=20 ms)	0.9 A							

Table 17 - VCB15 Technical Parameters

	VCB15_							
Type	**LD1**	**LD3**	**LD6**	**LD8**	**MD1**	**MD3**	**Shell2**	**HD1**
Maximum current for 125 V DC, ohmic load	0.5 A							
Maximum current for 125 V DC, inductive load (t=20 ms)	0.03 A							
Maximum current for 250 V DC, ohmic load	0.25 A							
Maximum current for 250 V DC, inductive load (t=20 ms)	0.03 A							
Maximum current for 125 V AC, ohmic load	10 A [14)]							
Maximum current for 125 V AC, inductive load (cosj =0,3)	5 A							
Maximum current for 250 V AC, ohmic load	10 A [14)]							
Maximum current for 250 V AC, inductive load (cosj =0,3)	5 A							
Design, Switching Capacity of Gold-Plated Auxiliary Contacts [15)]								
Number of available auxiliary contacts for three-phase ISM	-	-	-	-	-	-	-	-
Minimum current for 5 V AC / DC	1 mA							
Maximum current for 10 V AC / DC	300 mA							
Maximum current for 30 V AC / DC	100 mA							
Maximum voltage AC / DC	30 V							
CM Reaction Times								
Preparation time for the operation of the CM after switching on the auxiliary power supply	≤ 15 s							
Preparation time for the close operation of the CM after a previous close operation	≤ 10 s							
Preparation time for the trip operation of the CM after switching on the auxiliary power supply	≤ 0.1 s							
Trip capability after failure of the auxiliary power supply	≥ 60 s [16)]							
CM Supply Voltage								
Rated range of supply voltage of CM_16_1(Par1_60.2_Par2_Par3_Par4_Par5)	24V to 60V DC							

Table 17 - VCB15 Technical Parameters

	VCB15_							
Type	**LD1**	**LD3**	**LD6**	**LD8**	**MD1**	**MD3**	**Shell2**	**HD1**
Rated range of supply voltage of CM_16_1(Par1_220.2_Par3_Par4_Par5)	110V to 220V AC/DC							
Operating range (80-120%) of CM_16_1(Par1_60.2_Par3_Par4_Par5)	19V to 72V DC							
Operating range (80-120%) of CM_16_1(Par1_220.2_Par3_Par4_Par5)	85V to 265V AC/DC							
CM Power Consumption								
Charging the close and trip capacitors of CM_16_1(Par1_60.2_Par3_Par4_Par5)	≤ 25 W							
Charging the close and trip capacitors of CM_16_1(Par1_220.2_Par3_Par4_Par5)	≤ 42 W AC [17] ≤ 37 W DC							
Permanent power consumption (standby) of CM_16_1(Par1_60.2_Par3_Par4_Par5)	≤ 5 W							
Permanent power consumption (standby) of CM_16_1(Par1_220.2_Par3_Par4_Par5)	≤ 7 W AC [18] ≤ 5 W DC							
Inrush current of CM_16_1(Par1_60.2_Par3_Par4_Par5) with discharged capacitors	≤ 120 A							
Inrush current of CM_16_1(Par1_220.2_Par3_Par4_Par5) with discharged capacitors	≤ 18 A							
Inrush time constant of CM_16_1(Par1_60.2_Par3_Par4_Par5) with discharged capacitors	≤ 0.5 ms							
Inrush time constant of CM_16_1(Par1_220.2_Par3_Par4_Par5) with discharged capacitors	≤ 4 ms							
Design, Switching Capacity of CM Inbuilt Relays								
Number of relays in CM	3							
Number of available contacts for one relay	1 NO + 1 NC with common point							
Rated voltage	240 V							
Rated current AC	16 A							
Maximum breaking power AC	4000 VA							

Table 17 - VCB15 Technical Parameters

	VCB15_							
Type	**LD1**	**LD3**	**LD6**	**LD8**	**MD1**	**MD3**	**Shell2**	**HD1**
Maximum switching current 250 V DC	0.35 A							
Maximum switching current 125 V DC	0.45 A							
Maximum switching current 48 V DC	1.3 A							
Maximum switching current 24 V DC	12 A							
Switching time	5 ms							
“Close” and “Trip” Dry Contacts Inputs of CM								
Output voltage	≥ 30 V							
Contacts closed current	≥ 50 mA							
Steady state current	≥ 5 mA							

1) For VCB ISM15_Shell with Low upper terminal – up to 1250 A, with High upper terminal – up to 2000 A.
2) Rating for metal enclosed switchgear with limited ventilation. Temperature rise type test at 2500 A in Cradle was successfully passed in KEMA.
3) 3150 A – for PCD 275 mm.
4) The information in brackets refers to the national Chinese standards GB1984-2003 at an installation altitude of 1000 m maximum.
5) Parameter valid only when ISM is used with insulation kit. For details see dimensional drawings and accessory information.
6) Parameter valid only when ISM is used with insulation caps. For details see dimensional drawings and accessory information.
7) At 40% DC component.
8) 10 000 CO – for ISM15_Shell_2(150_L) and ISM15_Shell_2(210_L) in horizontal actuator position.
9) Smaller timing on request.
10) The number of sequential Close-Trip operations with a 10 second interval should not exceed 10. The number of Close-Trip operations should not exceed 60 per hour. Sequence of 10s Close-Trip operations can be repeated only after 260 s pause.
11) Isolation resistance check is not applicable for “Actuator Coil” circuits of CM.
12) Overall dimensions of ISM are given in “Appendix 3. Overall Drawings”.
13) Up to an installation altitude of 1000 m above sea level. Above 1000m, the external insulation measurement of the ISM must be increased by the atmospheric correction factor Ka according to IEC 62271-1 compared to the insulation measurement at sea level. The maximum allowed altitude is 2000 m above sea level.
14) At 5 min short-term duty. Continuous current – 5 A.
15) Gold-plated auxiliary contacts are availbale on request. Contact your nearest sales representatives.
16) In case of Dry contacts “Close” and “Trip” are open.
17) At Cos j >0.66.
18) At Cos j >0.33.
19) At 34% DC component.

Table 18 - VCB25 Technical Parameters

	VCB25_			
Type	**LD1**	**LD2**	**LD3**	**Shell2**
Rated voltage (Ur)	24 kV	24 kV	24 kV	24 kV
Phase centre distance (PCD), mm	210 275	150	-	210 275
Rated normal current (Ir)	800 A	800 A	800 A	2500 A
Rated power frequency withstand voltage (Ud)	50 kV	50 kV	50 kV	50 kV
Rated lightning impulse withstand voltage (peak) (Up)	125 kV	125 kV	125 kV	125 kV
Rated short-circuit breaking current (Isc)	20 kA [1.]	20 kA [1.]	20 kA [1.]	25 kA [1.]
Rated peak withstand current (Ip)	52 kA	52 kA	52 kA	65 kA
Rated short-time withstand current (Ik)	20 kA	20 kA	20 kA	25 kA
Rated duration of short circuit (tk)	3 s	3 s	3 s	4 s
Rated frequency (fr)	50/60 Hz			
Mechanical life (CO-cycles)	30 000			
Maximum number of CO-cycles per hour	60			
Operating cycles, rated–short circuit breaking current	50	50	50	25
Closing time	≤ 60 [2.] ms			
Opening time	≤ 35 [2.] ms			
Break time	≤ 45 [2.] ms			
Rated operating sequence at rated normal current	O-0.3s-CO-10s-CO-10s-CO [3.]			
Rated operating sequence at rated short-circuit breaking current	O-0.3s-CO-15s-CO			
Auxiliary Circuits Insulation Strength [4.]				
Power frequency test voltage (1 min) according to IEC60255-27	2 kV			
Lightning impulse 1.2 m s/50 m s/0.5 J according to IEC60255-27	5 kV			
Insulation resistance, 1000V DC according to IEC60255-27	≥ 5 MOhm			
Design class of switching module with regard to severity of service conditions in accordance with IEC 60932	Class 0	Class 1	Class 0	Class 0
Standards	IEC 62271-100			
Mechanical vibration withstand capability according to IEC 60721-3-4	Class 4M4			

Table 18 - VCB25 Technical Parameters

	VCB25_			
Type	**LD1**	**LD2**	**LD3**	**Shell2**
Resistance of main circuit	≤ 40 µOhm	≤ 40 µOhm	≤ 40 µOhm	≤ 17 µOhm
Weight (depending on Phase centre distance)	35-38 kg	35-37 kg	14 kg	53-55 kg
Weight of CM	1 kg			
Overall dimensions of CM [5.]	190x165x45 mm			
Altitude above sea level	1000 m [6.]			
Relative humidity in 24 hours	≤ 95 %			
Relative humidity over 1 month	≤ 90 %			
Temperature Range	-25 °C ... +55 °C			
Degree of protection according to IEC 60529 of actuator compartment	IP40			
Type of driving mechanism	Monostable magnetic actuator			
Design, Switching Capacity of Silver Auxiliary Contacts				
Number of available auxiliary contacts for three-phase ISM	6 NO + 6 NC	6 NO + 6 NC	2 NO + 2 NC	6 NO + 6 NC
Minimum current for 12 V AC / DC, ohmic load	100 mA			
Minimum current for 12 V AC / DC, inductive load (t=20 ms, cosj =0,3)	100 mA			
Maximum current for 30 V DC, ohmic load	10 A [7.]			
Maximum current for 30 V DC, inductive load (t=20 ms)	3 A			
Maximum current for 60 V DC, ohmic load	0.9 A			
Maximum current for 60 V DC, inductive load (t=20 ms)	0.9 A			
Maximum current for 125 V DC, ohmic load	0.5 A			
Maximum current for 125 V DC, inductive load (t=20 ms)	0.03 A			
Maximum current for 250 V DC, ohmic load	0.25 A			
Maximum current for 250 V DC, inductive load (t=20 ms)	0.03 A			
Maximum current for 125 V AC, ohmic load	10 A [7.]			
Maximum current for 125 V AC, inductive load (cosj =0,3)	5 A			
Maximum current for 250 V AC, ohmic load	10 A [7.]			
Maximum current for 250 V AC, inductive load (cosj =0,3)	5 A			

Table 18 - VCB25 Technical Parameters

	VCB25_			
Type	**LD1**	**LD2**	**LD3**	**Shell2**
Design, Switching Capacity of Gold-Plated Auxiliary Contacts [8.]				
Number of available auxiliary contacts for three-phase ISM	6 NO + 6 NC	-	-	-
Minimum current for 5 V AC / DC	1 mA			
Maximum current for 10 V AC / DC	300 mA			
Maximum current for 30 V AC / DC	100 mA			
Maximum voltage AC / DC	30 V			
CM Reaction Times				
Preparation time for the operation of the CM after switching on the auxiliary power supply	≤ 15 s			
Preparation time for the close operation of the CM after a previous close operation	≤ 10 s			
Preparation time for the trip operation of the CM after switching on the auxiliary power supply	≤ 0.1 s			
Trip capability after failure of the auxiliary power supply	≥ 60 s [9.]			
CM Supply Voltage				
Rated range of supply voltage of CM_16_1(Par1_60.2_Par2Par3_Par4_Par5)	24V to 60V DC			
Rated range of supply voltage of CM_16_1(Par1_220.2_Par3_Par4_Par5)	110V to 220V AC/DC			
Operating range (80-120%) of CM_16_1(Par1_60.2_Par3_Par4_Par5)	19V to 72V DC			
Operating range (80-120%) of CM_16_1(Par1_220.2_Par3_Par4_Par5)	85V to 265V AC/DC			
CM Power Consumption				
Charging the close and trip capacitors of CM_16_1(Par1_60.2_Par3_Par4_Par5)	≤ 25 W			
Charging the close and trip capacitors of CM_16_1(Par1_220.2_Par3_Par4_Par5)	≤ 42 W AC [10.] ≤ 37 W DC			
Permanent power consumption (standby) of CM_16_1(Par1_60.2_Par3_Par4_Par5)	≤ 5 W			
Permanent power consumption (standby) of CM_16_1(Par1_220.2_Par3_Par4_Par5)	≤ 7 W AC [11.] ≤ 5 W DC			
Inrush current of CM_16_1(Par1_60.2_Par3_Par4_Par5) with discharged capacitors	≤ 120 A			
Inrush current of CM_16_1(Par1_220.2_Par3_Par4_Par5) with discharged capacitors	≤ 18 A			
Inrush time constant of CM_16_1(Par1_60.2_Par3_Par4_Par5) with discharged capacitors	≤ 0.5 ms			
Inrush time constant of CM_16_1(Par1_220.2_Par3_Par4_Par5) with discharged capacitors	≤ 4 ms			

Table 18 - VCB25 Technical Parameters

	VCB25_			
Type	**LD1**	**LD2**	**LD3**	**Shell2**
Design, Switching Capacity of CM Inbuilt Relays				
Number of relays in CM	3			
Number of available contacts for one relay	1 NO + 1 NC with common point			
Rated voltage	240 V			
Rated current AC	16 A			
Maximum breaking power AC	4000 VA			
Maximum switching current 250 V DC	0.35 A			
Maximum switching current 125 V DC	0.45 A			
Maximum switching current 48 V DC	1.3 A			
Maximum switching current 24 V DC	12 A			
Switching time	5 ms			
“Close” and “Trip” Dry Contacts Inputs of CM				
Output voltage	≥ 30 V			
Contacts closed current	≥ 50 mA			
Steady state current	≥ 5 mA			

1. At 34 % DC component.
2. Smaller timing on request.
3. The number of sequential Close-Trip operations with a 10 second interval should not exceed 10. The number of Close-Trip operations should not exceed 60 per hour. Sequence of 10s Close-Trip operations can be repeated only after 260 s pause.
4. Isolation resistance check is not applicable for “Actuator Coil” circuits of CM.
5. Overall dimensions of ISM are given in “Appendix 3. Overall Drawings”.
6. Up to an installation altitude of 1000 m above sea level. Above 1000m, the external insulation measurement of the ISM must be increased by the atmospheric correction factor Ka according to IEC 62271-1 compared to the insulation measurement at sea level. The maximum allowed altitude is 2000 m above sea level.
7. At 5 min short-term duty. Continuous current – 5 A.
8. Gold-plated auxiliary contacts are availbale on request. Contact your nearest sales representatives.
9. In case of Dry contacts “Close” and “Trip” are open.
10. At Cos j >0.66.
11. At Cos j >0.33.

Table 19 - CM EMC Parameters

Parameter	Applicable standard	Rated Value
Electromagnetic compatibility (EMC) requirements [1]		
Electrostatic discharge	IEC 60255-26 IEC 61000-4-2	8 kV contact 1 5 kV air
Radiated EM field Immunity	EC 60255-26 EC 61000-4-3	80 MHz – 3 GHz Sweep & spot AM 1 kHz 80% 10 V/m
Fast transient burst Immunity	IEC 60255-26 IEC62271-1 IEC 61000-4-4	4 kV common mode
Surge Immunity	EC 60255-26 EC 61000-4-5	4 kV common mode 2 kV differential mode
Conducted disturbance induced by Radio frequency fields	IEC 60255-26 IEC 61000-4-6	150 kHz – 80 MHz AM 1 kHz 80% 10 V
Power Frequency Magnetic Field	EC 60255-26 EC 61000-4-8	100 A/m continuously 1000 A/m 1 sec
Pulse Magnetic Field	IEC 61000-4-9	1000 A/m
100 kHz Damped Oscillatory Magnetic Field	EC 61000-4-10	100 A/m
1 MHz damped oscillatory magnetic field	IEC 61000-4-10	100 A/m
AC Voltage Dips and Interruptions	EC 60255-26 EC 61000-4-11	ΔU 30% 1 period ΔU 60% 50 periods ΔU 100% 5 periods ΔU 100% 50 periods
Power Frequency Disturbance Voltage	IEC 60255-26 IEC 61000-4-16	300 V common mode 150 V differential mode [2]
100 kHz and 1 MHz Damped Oscillatory Wave Immunity	EC 60255-26 EC 62271-1 EC 61000-4-18	2.5 kV common mode 1 kV differential mode
Ripple on DC Power Supply	IEC 60255-26 I EC 61000-4-27	10% of Supply voltage, 100 Hz
DC Voltage Dips and Interruptions	EC 60255-26 EC 62271-100 EC 61000-4-29	ΔU 30% 2 sec ΔU 60% 2 sec ΔU 100% 0,3 sec ±20 % 10 sec

1) Cable from electronic relay to connector block should be shielded and the case grounded near the connector. The total length of unshielded wires from connector block to CM WAGO connector should not exceed 200 mm. Electromagnetic compatibility requirements are not applicable for the CM USB port as this port is used only for CM programming during production and not used under service conditions.

2) Test influence is not applicable for CM "Close" and "Trip" dry contacts.

5. Design and Operation

5.1 Design

5.1.1 Indoor Switching Module

The VCB main component is the innovative Tavrida Electric Indoor Switching Module. Tavrida Electric has simplified the mechanical structure of the switching module to the greatest possible extent. It uses three single-coil magnetic actuators, one per pole. All power kinematic chain elements are assembled along a single axis. All mechanical operations are therefore direct and linear. Three actuators are installed in a steel frame and mechanically linked by a synchronizing shaft.

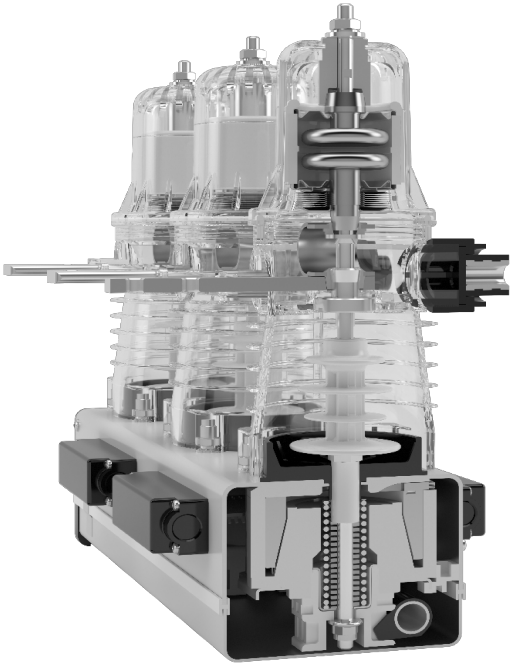


Figure 31
ISM15_LD_1 cross section

This design eliminates failure modes caused by components in conventional technology such as gears, charging motors, and trip / closing coils.

Tavrida Electric manufactures vacuum interrupters that combine small dimensions with an extraordinarily long mechanical and electrical lifespan. Tavrida Electric pays great attention to geometry of the main contacts to provide the most preferable axial magnetic field distribution.

The result is even current density distribution and consequently a substantial improvement of vacuum interrupting performance: up to 50,000 CO cycles at rated current or up to 50 O-CO cycles at maximum short-circuit breaking current without replacing or adjusting any parts of the circuit breaker.

Tavrida Electric Vacuum Circuit Breakers are completely maintenance free over a total life expectancy of at least 30 years.

5.1.2 Control Module

Tavrida Electric Control modules provide the following advantages:

Low power consumption
A low energy level required to close or trip the ISM, no energy consumption by the ISM in its closed or open state and optimizatioxn of CM electrical diagrams leads to

- low CM power consumption in standby mode (not more than 7 Watts);
- not more than 42 Watts during CM capacitors charging.

Optimal ISM Control

The CM is programmed for use with a particular ISM type, but it can be reprogrammed for use with another ISM type if needed (to reprogram the CM for another ISM type, please contact our nearest regional unit). The result is optimal ISM operation (the lowest tripping and closing time, no contact bouncing, perfect latching in the closed state, extraordinary prolonged mechanical and electrical lifespan) in the whole specified temperature range.

Self-Diagnostic Functionality

The CM has an internal self-diagnostic system that monitors ISM connection, power supply level and internal states of the CM. As a result, the CM can indicate issues by means of LEDs and built-in relays. The malfunction types are indicated by the number of corresponding LED blinks.

The CM has an internal self-diagnostic system that monitors:

- Internal states of the CM (hardware malfunctions and warnings)
- External power supply availability
- Health status of the ISM actuators
- Proper close, trip command execution

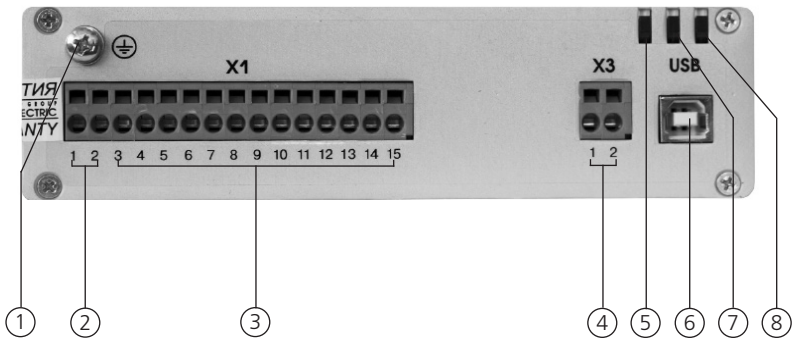
Detected issues CM will indicate by means of LEDs and built-in relays. The malfunction types are indicated by the number of corresponding LED blinks and built-in relays. All detected issue are logged inside the CM and can be downloaded via USB port. For the full list of the issues that can be indicated via CM please check Chapter 6.1.

Wiring Optimization

The CM controls the ISM main contact state via the same circuit used to close or trip the ISM. Therefore, only one circuit connection between ISM and CM is required. The CM can provide external circuits with information about ISM main contacts state by means of built in relays, which simplifies the switchgear secondary wiring significantly. Position indication of ISM provided by CM can be incorrect, in case CM is not operable due to absence of auxiliary supply. The relay keeps its state after CM power supply disconnection.

Compact Dimensions and Small Weight of CM

The compact size and weight of the CM (190x165x45 mm, 1 kg) simplifies the installation. The aluminum housing of the CM provides a high EMC level (Table 20). The CM is delivered with mounting brackets for mounting on flat surfaces (in addition the mounting kit CBmount_CM_1 for CM installation on a DIN rail is available). The LED indicators are visible from two directions.



1. Earthing stud
2. Terminals for power supply
3. Terminals for I/O (control and indication)
4. Terminals for Switching Module
5. “Power” LED indicator
6. USB port (for CM programming during production, not used under service conditions)
7. “Malfunction” LED indicator
8. “Ready” LED indicator

Figure 32
CM_16

5.1.3 Insulation Kits

Tavrida Electric switching modules have a very compact design allowing for easy installation in many applications. Tavrida Electric offers several kits to ensure that external busbar connection will not reduce the insulation level of the switchgear.

CBkit_Ins_3

To comply with the rated impulse withstand voltage of 125 kV according to IEC 62271-1 it is recommended to cover the top connections of ISM25_LD_1 and ISM25_LD_3 with insulation kit CBkit_Ins_3. The arrangement is shown below. If the insulation cap set is not used, compliance with the rated insulation level must be verified by a dielectric test. Not applicable for ISM25_LD_2.

CBkit_Ins_4

To comply with the rated impulse withstand voltage of 95 kV according to IEC 62271-1 it is recommended to cover the terminals of ISM15_MD_1 and ISM15_MD_3 with insulation kit CBkit_Ins_4. The arrangement is shown below. If the insulation cap set is not used, compliance with the rated insulation level must be verified by a dielectric test.

CBkit_Shell15_1

This kit is used to provide 95 kV BIL level between terminals of the ISM15_Shell_2. The external air insulation can withstand 75 kV BIL. The ISM15_Shell_2(150_L) requires CBkit_Shell15_1 for 75 kV BIL. CBkit_Shell15_1 also includes round copper bars and screws for flat bars connection to the ISM15_Shell_2 terminals.

CBkit_Shell15_1 has two sets of bolts with different lengths, selection of their usage depends on the number of bars connected to ISM terminals - single or double bars.

CBkit_Shell25_1

This kit is used to provide 125 kV BIL level between terminals of the ISM25_Shell_2. CBkit_Shell25_1 includes round copper bars and screws for flat bars connection to the ISM25_Shell_2 terminals.
CBkit_Shell25_1 has two sets of bolts with different lengths, selection of their usage depends on the number of bars connected to ISM terminals - single or double bars.

CBkit_LD15_2 and CBkit_LD15_3

Kits CBkit_LD15_2 and CBkit_LD15_3 provide 75 kV BIL level for ISM15_LD_6 when this ISM is used as an LMT or AG16 Retrofit Draw-out type VCB. The kits also include plastic moulded parts to provide emergency (manual) trip and main contacts position indication. For details of these Retrofit Draw-out type VCB designs please contact your nearest Tavrida Electric office or Distributor.

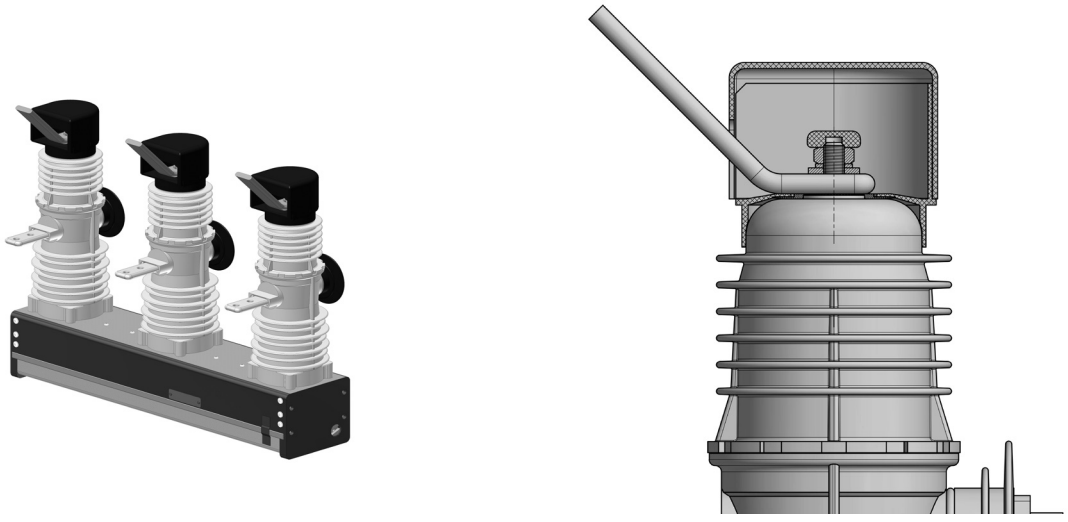


Figure 33
CBkit_Ins_3 installed on ISM25_LD

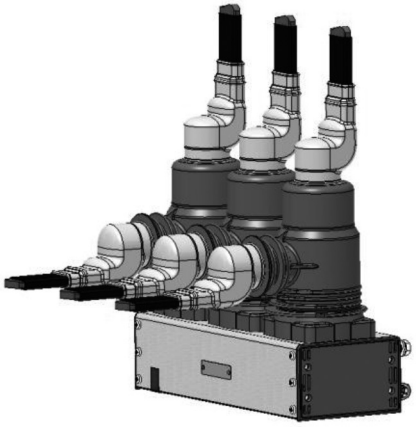


Figure 34

CBkit_Ins_4(1), Single 40x10 mm bars connection

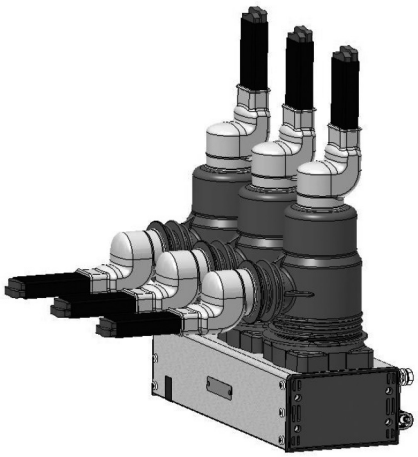


Figure 35

CBkit_Ins_4(1), Double 40x10 mm bars connection

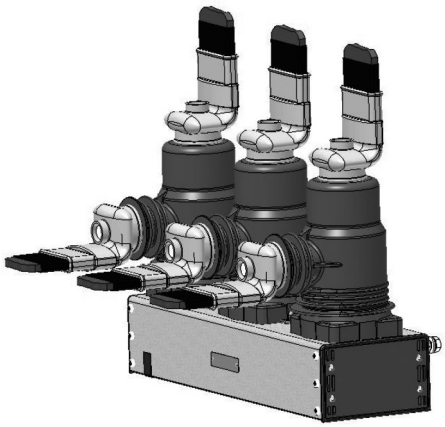


Figure 36

CBkit_Ins_4(2), Single 80x10 mm bars connection

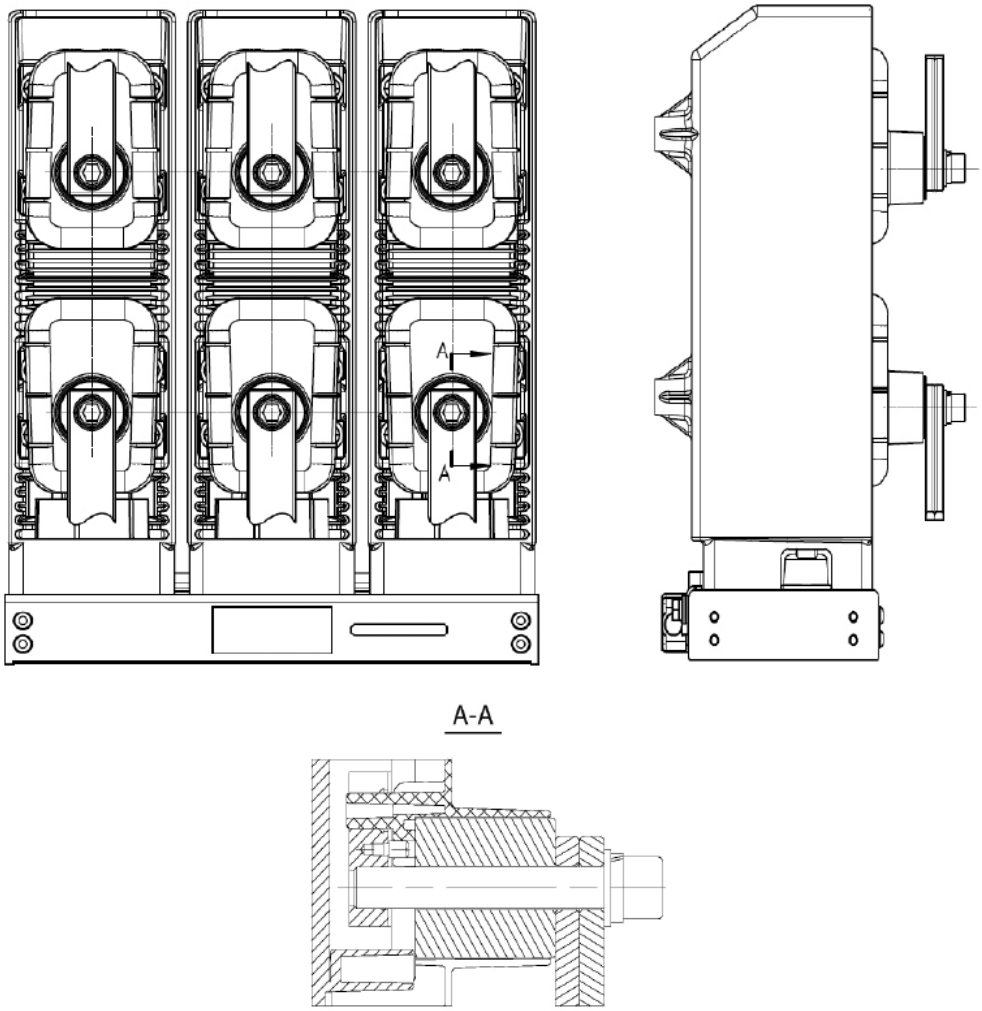


Figure 37

CBkit_Shell15_1(205) installed on ISM15_Shell_2(150_L)

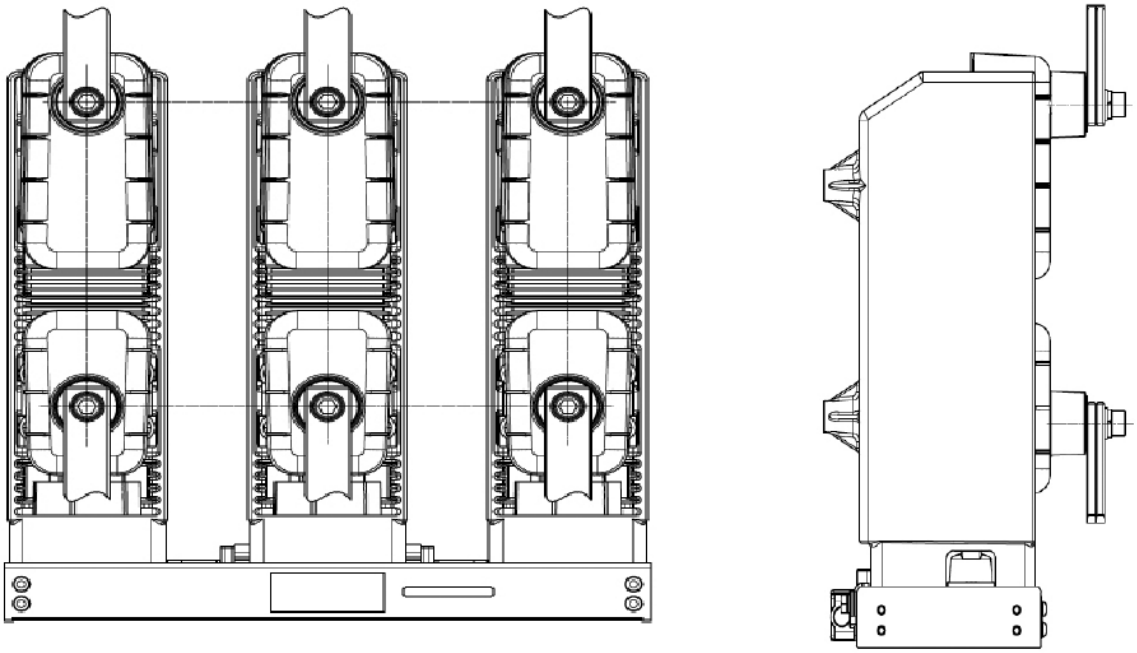


Figure 38

CBkit_Shell15_1(310) installed on ISM15_Shell_2(210_H)

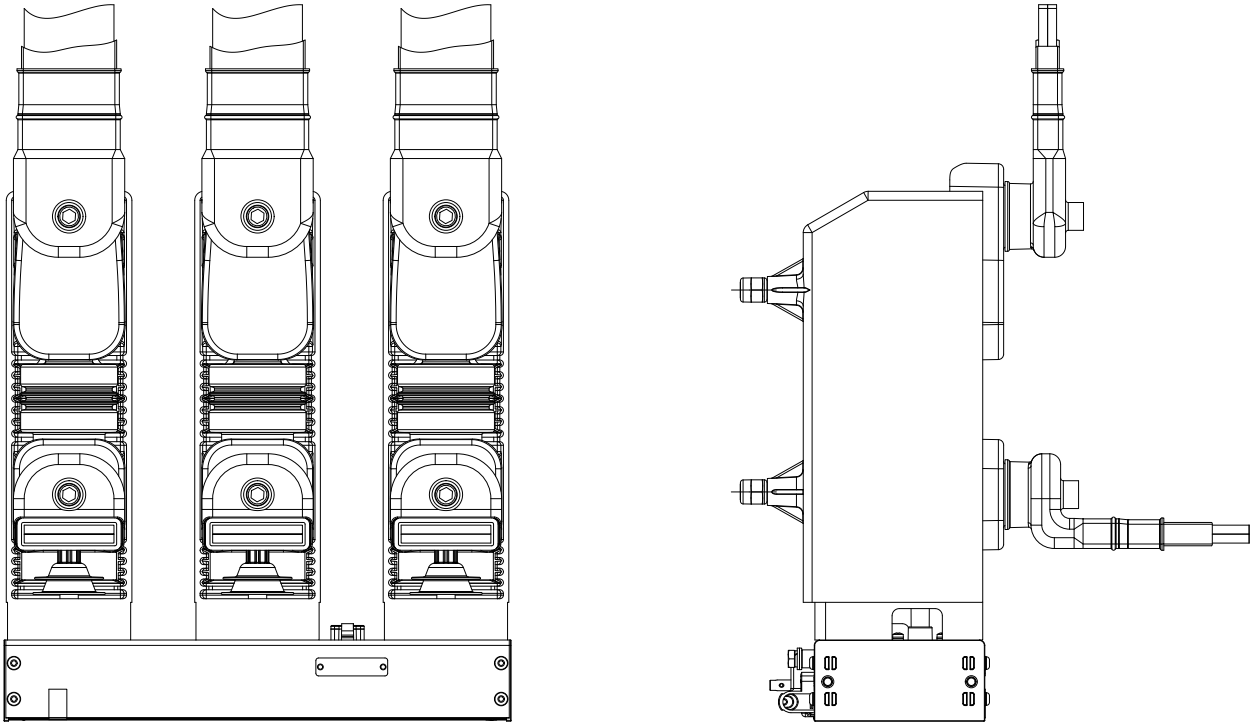


Figure 39

CBkit_Shell25_1 installed on ISM25_Shell_2(210)

5.1.4 Interlocking Kits

CBkit_Interlock_1

This kit is used to link the ISM synchronizing shaft with mechanical interlocks. CBkit_Interlock_1 linked with ISM's shaft can provide information about ISM main contacts state (closed, open), emergency (mechanical) trip of ISM and mechanical blocking of ISM closing.

CBkit_Interlock_1 is optional for ISM15_LD_1 and ISM25_LD_1. ISM15_LD_3 and ISM25_LD_3 are already equipped with the CBkit_Interlock_1 pre-installed.

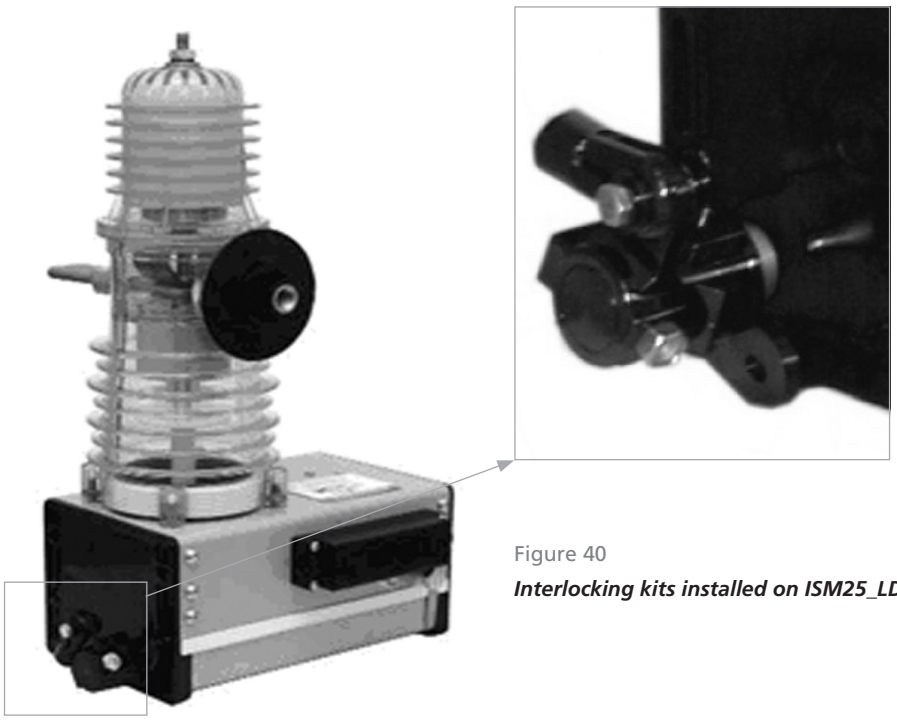


Figure 40

Interlocking kits installed on ISM25_LD_3

CBkit_Interlock_LD(0_0_1)

This kit is used to link the ISM15_LD_1, ISM25_LD_1 and ISM25_LD_2 interlocking shaft with mechanical interlocks or manual trip. CBkit_Interlock_LD(0_0_1) linked with ISM's shaft can provide interface for next manual (emergency) trip / lockout (mechanical blocking of ISM closing) connection to ISM (CBkit_Interlock_3, CBkit_Interlock_4, CBkit_Interlock_5). Also this kit allows to attach a position indicator (CBkit_PosInd_1).

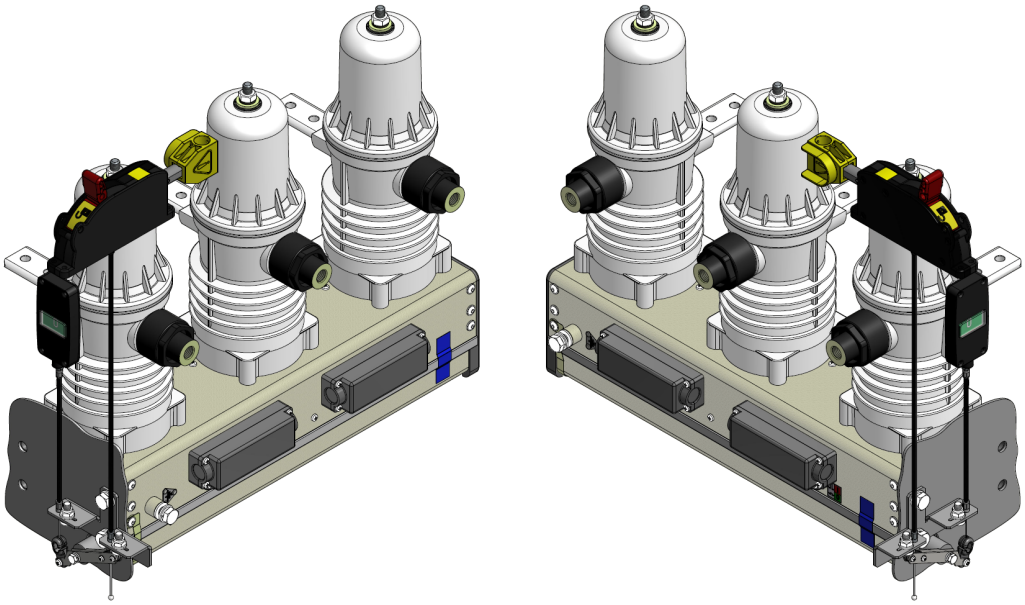


Figure 41

Interlocking kit CBkit_Interlock_LD(0_0_1) installed on ISM25_LD_1 with attached CBkit_Interlock_3 and CBkit_PosInd_1

CBkit_Interlock_8

This kit is used to link the ISM15_Shell_2 interlocking shaft with mechanical interlocks or manual trip. CBkit_Interlock_8 linked with ISM's shaft can provide interface for next manual (emergency) trip / lockout (mechanical blocking of ISM closing) connection to ISM. The kit has an interface for connection with other mechanical interlocks of switchgear and RMU.

Figure 42

Interlocking kits CBkit_Interlock_8

CBkit_Interlock_8 is applicable for ISM15_Shell only

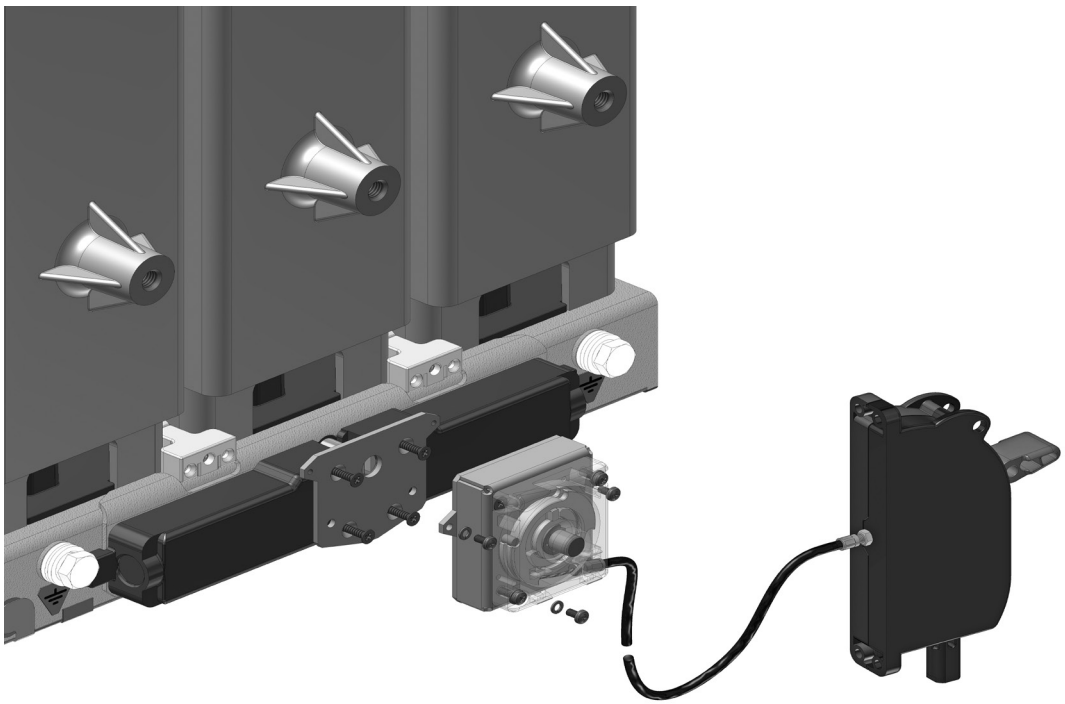


Figure 43

Interlocking kits installed on ISM15_Shell_2 (with connected CBkit_Interlock_3)

CBkit_Interlock_3

This kit is used to link the ISM interlocking shaft with mechanical interlocks. CBkit_Interlock_3 linked with ISM's shaft can provide manual (emergency) trip / lockout (mechanical blocking of ISM closing) functionality by key switch.

The key switch mechanical interlock and the ISM are interconnected with a flexible release cable that provides additional flexibility of the installation location of the key switch. The key switch interlock by default is supplied with 1m release cable that allows to install it remotely from the ISM (if required) or in the most preferable location according to switchgear manufacturer preferences.

The kit has an interface for connection with other mechanical interlocks of switchgear and RMU.

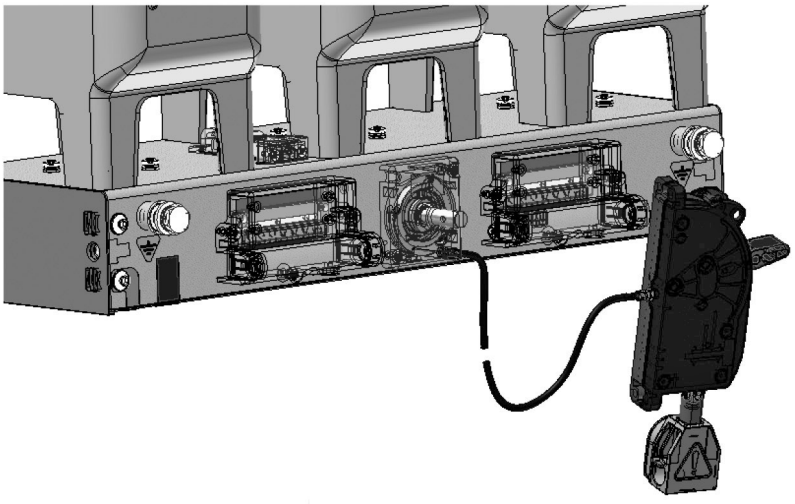


Figure 44

CBkit_Interlock_3 Interlocking kit installed on ISM15_HD_1

CBkit_Interlock_3 is applicable for ISM15_LD_8, ISM15_MD, ISM15_HD and ISM25_Shell only and with ISM15_Shell via CBkit_Interlock_8

CBkit_Interlock_4

This kit is used to link the ISM interlocking shaft with mechanical interlocks. CBkit_Interlock_4 linked with ISM's shaft can provide manual (emergency) trip / lockout (mechanical blocking of ISM closing) functionality by rotary switch.

The rotary switch mechanical interlock and the ISM are interconnected with flexible release cable that provides additional flexibility of the installation location of the key switch. The rotary switch interlock by default is supplied with 1m release cable that allows to install it remotely from the ISM (if required) or in the most preferable location according to switchgear manufacturer preferences.

The kit has an interface for connection with other mechanical interlocks of switchgear and RMU.

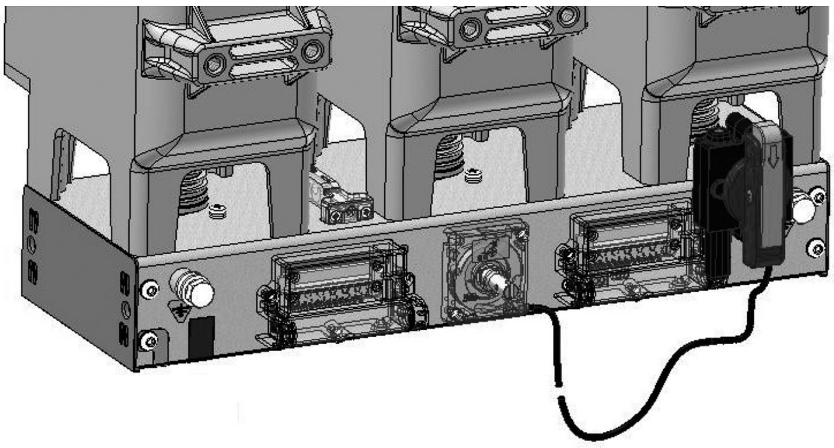


Figure 45

CBkit_Interlock_4 Interlocking kit installed on ISM15_HD_1

CBkit_Interlock_4 is applicable for ISM15_LD_8, ISM15_MD, ISM15_HD and ISM25_Shell only and with ISM15_Shell via CBkit_Interlock_8

CBkit_Interlock_5

This kit is used to link the ISM interlocking shaft with mechanical interlocks. CBkit_Interlock_5 linked with ISM's shaft can provide manual (emergency) trip by push-button switch.

The emergency trip push button and the ISM are interconnected with flexible release cable that provides additional flexibility of the installation location of the emergency trip push button. The emergency trip push button by default is supplied with 1m release cable that allows to install it remotely from the ISM (if required) or in the most preferable location according to switchgear manufacturer preferences.

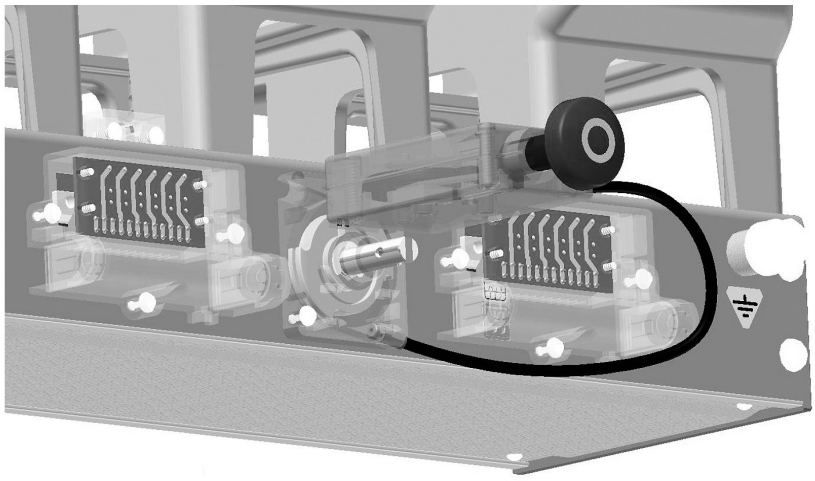


Figure 46

CBkit_Interlock_5 Interlocking kit installed on ISM15_HD_1

CBkit_Interlock_5 is applicable for ISM15_LD_8, ISM15_MD, ISM15_HD and ISM25_Shell only and with ISM15_Shell via CBkit_Interlock_8

5.1.5 Switching Module Main Contacts Position Indicator

If position indicator is needed CBkit_PosInd_1 (Figure 47) shall be connected to ISM to provide ISM main contact position indication. ISM15_MD_1, ISM15_MD_3, ISM15_Shell_2, ISM15_HD_1 and ISM25_Shell_2 already include the position indicator.
The position indicator and the ISM are interconnected with flexible cable that provides additional flexibility of the installation location of the position indicator. The position indicator by default is supplied with 1m cable that allows to install it remotely from the ISM (if required) or in the most preferable location according to switchgear manufacturer preferences.
Note: in addition ISM15_LD_8, ISM15_MD_1, ISM15_HD_1, ISM25_Shell_2 have additional main contacts position indication built into the frame (Figure 48).

Figure 47
CBkit_PosInd_1

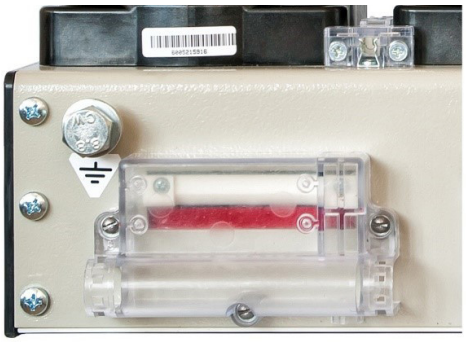


Figure 48
Embedded main contacts position indication

Figure 49
CBkit_PosInd_1 connected to the ISM15_SHELL_2

5.1.6 Manual Generator

CBunit_ManGen is used to charge the CM_16_1 in cases where the main auxiliary power supply is not available. This means that the circuit breaker can be closed even in the event of power supply loss.

Figure 50
CBunit_ManGen

The manual generator should be connected to the power supply circuit of the CM. By default, the manual generator is supplied with 1.5m cable but this cable can be prolonged up to 50m (2.5mm^2 double wire copper cable). Such prolonged length allows charge the CM via manual generator remotely from the switchgear or in the most preferable location.

Such solution significantly increases the personnel safety during manual operation when main auxiliary power supply is not available – so the personnel doesn't have to stay in front of the panel to operate the breaker but can stay on the safe distance.

This solution resolves the problem of manual operation when internal safety regulations prohibit manual closing of the circuit breaker in front of the panel.

5.2 Operation

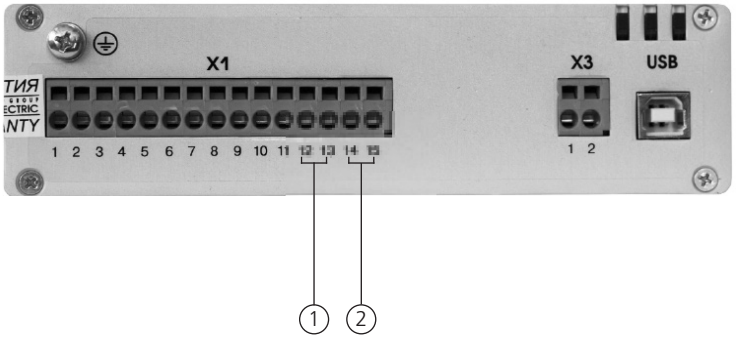
5.2.1 Closing

To close the ISM main contacts, the CM close command shall be applied. It is a "dry contact" input so no external voltage should be applied.

The Close command will be accepted if:
- CM state is "Ready" (Ready LED flashes green);
- no Trip command is applied;

CM is a smart device equipped with the watch dog that monitors health of the ISM actuator and CM. Ready LED will flash green in case:
- ISM actuator is healthy (no short- or open- circuit in between CM and ISM or insid the actuator coils
- External electrical interlock is unlocked
- Mechanical and electrical interlock is unlocked (in case of ISM15_LD_8, ISM15_MD_1, ISM15_MD_3, ISM15_Shell_2, ISM15_HD_1 and ISM25_Shell_2 only).
- CM is healthy and ready to execute trip command if required.

For details of the watchdog function please refer to chapter 6.1.
If Close command is applied and held before the CM is in a "Ready" state the Close command will not be accepted. If auxiliary power is not available, the manual generator CBunit_ManGen shall be used to charge the CM capacitors and to close the ISM. Mechanical closing is not possible.



1. Close command input
2. Trip command input

Figure 51
CM_16 close and trip inputs

If Manual generators CBunit_ManGen are used to charge the CM, the Manual generator handle shall be rotated until the Ready LED of the CM flashes green (approximately 30 seconds). Then the ISM close command can be applied to the CM.

5.2.2 Opening

To open the ISM main circuits, a trip command should be applied to the CM trip command input. It is a "dry contact" input so no external voltage should be applied.

The trip command will be accepted if:

- CM state is "Ready" (Ready LED flashes green)

If the trip command is applied and kept before the CM is in a "Ready" state, the trip command will be accepted after CM is in a "Ready" state.

5.2.3 Emergency Opening

The ISM can also be opened manually. When 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.

To open the ISM15_LD_1, ISM15_LD_3, ISM15_LD_6, ISM25_LD_1, ISM25_LD_2 and ISM25_LD_3 manually, the force shall be applied to the interlocking pins or torque shall be applied to the stub shaft evenly during their movement - see Figure 52 below. Force shall be applied along the pin's movement axis and directed to the ISM frame. The torque shall be applied in the direction of shaft rotation during ISM opening. The static force or torque influence shall not be applied at the end of pin's stroke or shaft rotation and shall not be applied to the pin or shaft before ISM closing.

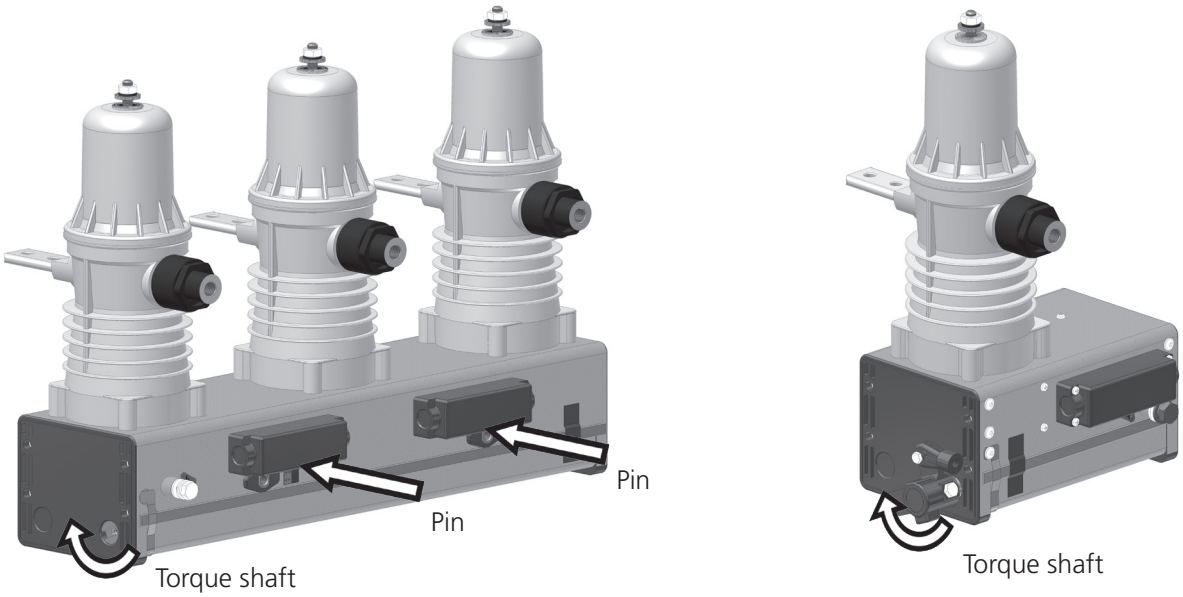


Figure 52

ISM15_LD_1, LD_3, LD_6, ISM25_LD_1, LD_2, LD_3 manual trip execution. Force or torque can be applied to any of the points shown below

To open the ISM15_LD_8, ISM15_MD_1, MD_3, ISM15_Shell_2, ISM15_HD_1 and ISM25_Shell_2 manually, the torque shall be applied to the interlocking shaft evenly during its movement - see Figure 53 below. The torque shall be applied counterclockwise of shaft rotation (90 degrees angle). The torque shall not be applied at the end of shaft rotation. ISM15_LD_8, ISM15_MD_1, ISM15_MD_3, ISM15_Shell_2, ISM15_HD_1 and ISM25_Shell_2 has a built in electrical interlock that interrupts the ISM coil circuit after the interlocking shaft is rotated counterclockwise. After manual trip, the shaft should be rotated clockwise to unlock the ISM.

Note: ISM15_LD_8, ISM15_MD_1, MD_3, ISM15_Shell_2, ISM15_HD_1 and ISM25_Shell_2 have optional manual trip/interlocking kits CBkit_Interlock_3, CBkit_Interlock_4, CBkit_Interlock_5 which provide convenient interfaces for emergency opening (detailed information on these kits is given in the Chapter 5.1.4)

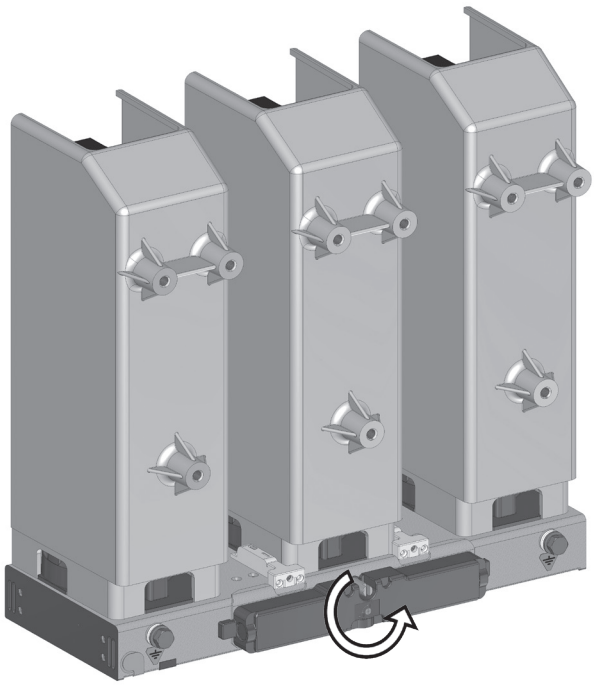


Figure 53

ISM15_Shell manual trip execution (ISM15_LD_8, ISM15_MD, ISM15_HD and ISM25_Shell have same manual trip execution)

6. Functionality

6.1 Indication

The VCB has the following indication functionality:

- indication provided by ISM:
  - ISM main contacts position (mechanical indication) - CBkit_PosInd_1(1000).
  - ISM main contacts position (electrical indication) - ISM auxiliary switches (6NO+6NC* switches for three phase ISMs and 2NO+2NC - for single phase ISMs).

*For ISM15_LD8 number of auxiliary switches is variable (up to 12NO+12NC)

- indication provided by CM:
  - ISM main contacts position (electrical indication) - one inbuilt CM relay (1 NO + 1 NC with common point);
  - M "Power" indication - LED indicator;
  - CM "Ready" state indication - LED indicator and one built in CM relay (1 NO + 1 NC with common point);
  - M "Malfunction" state indication - LED indicator and one built in CM relay (1 NO + 1 NC with common point).

Parameters of allowed ISM auxiliary switch load and built in CM relays are given in Chapter 4.

The self-diagnostic system inside the CM detects possible malfunctions and reports them via the Malfunction LED blink signals and Malfunction or Loss of auxiliary supply Relay state. The explanation of the LED blink codes is given in Table 20.

Table 20 - CM Self-Diagnostic Indication

CM State	Type of Indication	Indication				
		LED Power	LED Ready	LED Malfunction	Relay Ready	Relay Malfunction or Loss of auxiliary supply
Power supply voltage is absent more than 3 minutes	Warning and Loss of auxiliary supply	off	off	off	O	C
"Close" operation is preparing	Normal	continuous	off	off	O	O
CM is ready and operable	Normal	continuous	continuous	off	C	O
Power supply voltage is absent for more than 1.5 seconds	Warning and Loss of auxiliary supply	off	continuous	1 blink	C	C
Excessive trip or close time	Malfunction	continuous	off	2 blinks	O	C
Actuator coil isolated	Malfunction	continuous	off	3 blinks	O	C
Short circuit of Actuator coil	Malfunction	continuous	off	4 blinks	O	C
Manual Trip and Lock	Warning	continuous	off	5 blinks	O	O
Out of temperature range	Warning	continuous	off	6 blinks	O	O
ISM state is open without command from the CM	Malfunction	continuous	off	7 blinks	O	C
Internal fault of the CM	Malfunction	continuous	off	continuous	O	C

Notes.
1. Number of blinks in series followed by 1.5 s intervals, continuous light or off state are shown for LED indicators.
2. State of relay contact groups (C – closed, O – opened) is indicated for NC Ready Relay and Malfunction or Loss of auxiliary supply Relay.
3. Period of checking Actuator Coil state (short circuit / isolated) – 10 s.

Priority of the fault indication starting from the lowest one:
1. CM is out of temperature range;
2. ISM state is open without command from the CM;
3. Excessive trip or close time;
4. ISM manual Trip and Lock;
5. ISM actuator coil isolated;
6. Short circuit of ISM Actuator coil;
7. Power supply voltage is absent more than 1.5 seconds.

The CM performs the checkup of ISM main contacts position and updates the "'ISM main contacts position" relay status in the following cases:

- In case Close command was applied from the CM. In this case the update is performed not later than in 150 ms after ISM main contacts closing;
- In case Trip command was applied from the CM. In this case the update is performed not later than in 70 ms after ISM main contacts opening;
- Periodically every 10 s in case no Close or Open command was applied from the CM.

In case application project requires to define main contacts position faster than the timing mentioned above it is recommended to use auxiliary switches installed at the ISM.

The CM logs all the VCB malfunctions. The length of the logs is 1000 lines.

6.2 Protection Functionality

It is possible to configure the CM to trip and/or close the breaker when it's corresponding dry contacts are opened. This functionality may be used as an additional safety feature to monitor the health of the tripping circuits- if the external tripping circuit is damaged (open circuited) or has poor contact – the breaker will trip.

To configure the CM for such functionality please contact the nearest Tavrida Electric sales representative.

It is possible to configure the CM to trip in case of the auxiliary power supply loss. This functionality may be used as an additional safety feature when the CM and the relay that provides overcurrent and other protection is fed from the same source and has no backup: in case of auxiliary power supply loss and shutdown of the protection relay - the CM will automatically trip the breaker. The reclosing functionality is also available: CM can be programmed to automatically close the breaker if the auxiliary power supply is restored.

To configure the CM for such functionality please contact the nearest Tavrida Electric sales representative.

7. Application Notes

7.1 Configuration Options

Lower Terminal Design of ISM

The one lower main terminal (conventional terminal) of ISM is usually sufficient for standard applications, but there may be applications where the switchgear is so compact that ISM terminals are used as busbars, for example Ring main units in city electrical networks.

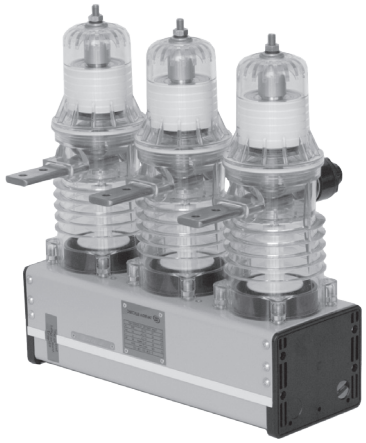


Figure 54
ISM with one lower main terminal

Figure 55
ISM with two lower main terminals

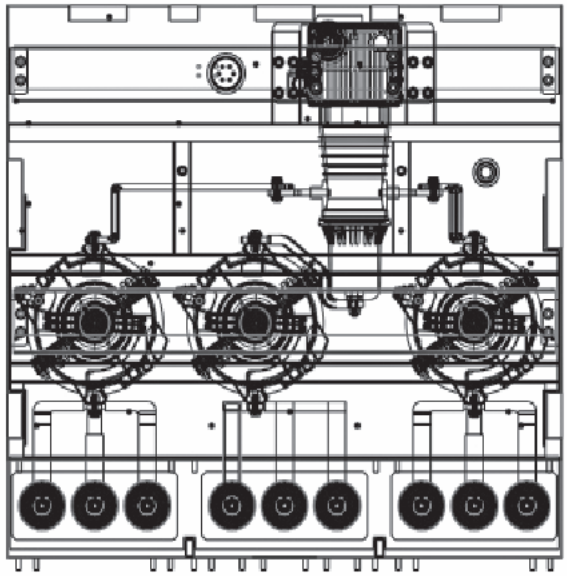


Figure 56
Example of ISM with two lower main terminals inside of SF-6 isolated Ring main unit

BIL Level of ISM

The selection of BIL level of an ISM is related to the VCB and associated insulation parts kits, not necessarily to the ISM itself. Selection of either 75 kV or 95 kV BIL defines whether VCB15_MD1_16.F and VCB15_MD3_16.F will be equipped with CBkit_Ins_4. This kit is optional accessory as its selection depends on the type of bars used for ISM15_MD_1 and ISM15_MD_3 main terminals connection:

- for bars with cross-section 40x10 mm (single or double bars) the CBkit_Ins_4(1) shall be used for 95 kV BIL;
- for bars with cross-section 80x10 mm (single bar) the CBkit_Ins_4(2) shall be used for 95 kV BIL.

The bars with cross-section 80x10 mm are not applicable for ISM15_MD_1 with PCD 150 mm due to the bars width that decreases the distance between bars.

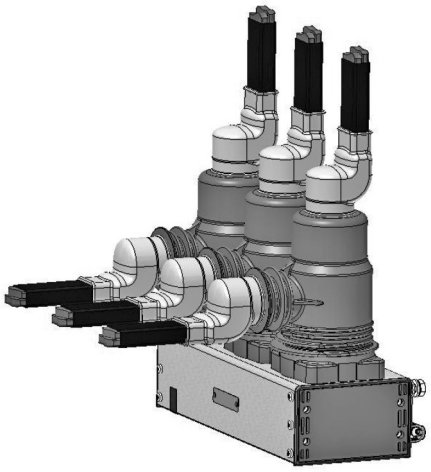


Figure 57

ISM15_MD_1 with CBkit_Ins_4(1) and double bars 40x10 mm

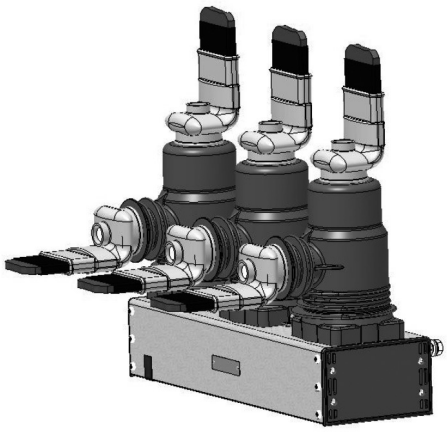


Figure 58

ISM15_MD_1 with CBkit_Ins_4(2) and single bars 80x10 mm

The selection of BIL level of an ISM is related to the VCB and associated insulation parts kits, not necessarily to the ISM itself. Selection of either 75 kV or 95 kV BIL defines whether VCB15_Shell2_16.F will be equipped with CBkit_Shell15_1. Only the VCB15_Shell2_16.F with PCD 150 mm is always equipped with CBkit_Shell15_1(205) since distance between poles of ISM15_Shell_2(150_L) requires it at 75 kV BIL.

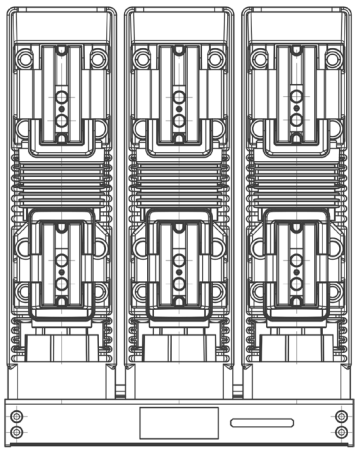


Figure 59

ISM15_Shell_2 without CBkit_Shell15_1:

- ***ISM15_Shell_2(150_L) - BIL 60 kV due to short distance between poles;***
- ***ISM15_Shell_2 with other PCD - BIL 75 kV.***

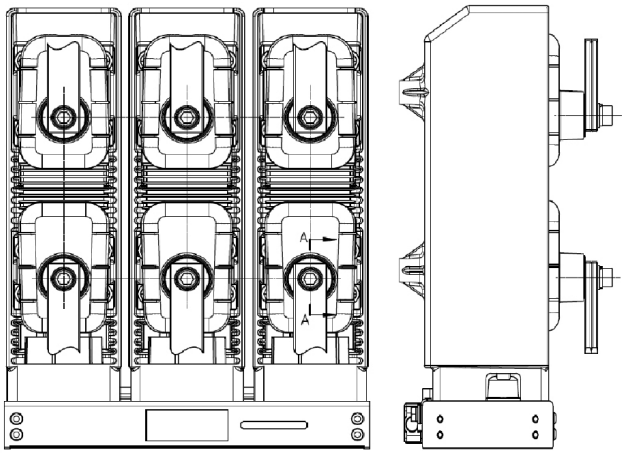


Figure 60

ISM15_Shell_2 with CBkit_Shell15_1 - BIL 95 kV for all variants of PCD

Selection of either 75 kV or 95 kV BIL defines whether VCB15_HD1_16.F will be equipped with bare or isolated bars used for ISM15_HD_1 main terminals connection. The shrinkable tube is recommended for the bars isolating. The bars shall have radius at least 3 mm on their edges.

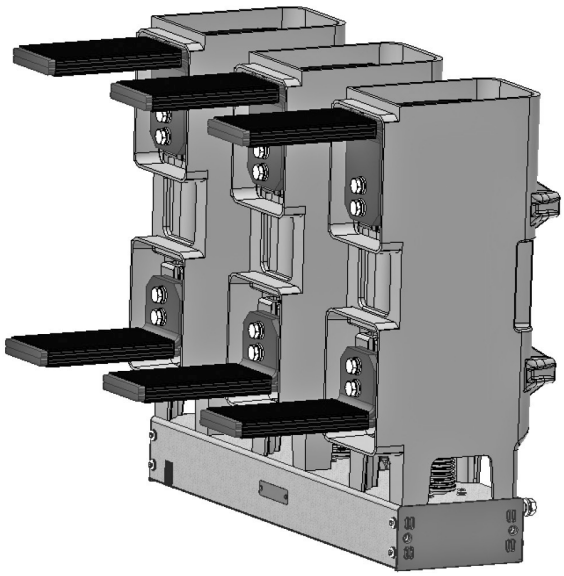


Figure 61

ISM15_HD_1 with isolated double bars 100x10 mm

Selection of either 95 kV or 125 kV BIL defines whether VCB25_LD1_16.F or VCB25_LD3_16.F will be equipped with CBkit_Ins_3.

Figure 62

ISM25_LD_1, ISM25_LD_3 without CBkit_Ins_3 - BIL 95 kV

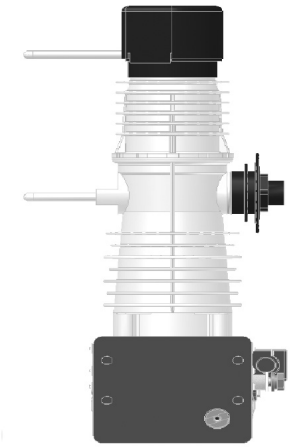


Figure 63

ISM25_LD_1, ISM25_LD_3 with CBkit_Ins_3 - BIL 125 kV

CBkit_Ins_3 used in place of bar connections to ISM upper terminals to provide 125 kV BIL. If another design is used, the rated insulation level shall be verified by a dielectric test.

CBkit_Ins_3 is not applicable for VCB25_LD2_16.F as VCB25_LD2_16.F is intended for usage inside of SF-6 isolated switchgear which already provide 125 kV BIL.

VCB25_Shell2_16.F is equipped with CBkit_Shell25_1 for flat bars connection to ISM25_Shell_2 main terminals. The shrinkable tube shell be used for the bars isolating.

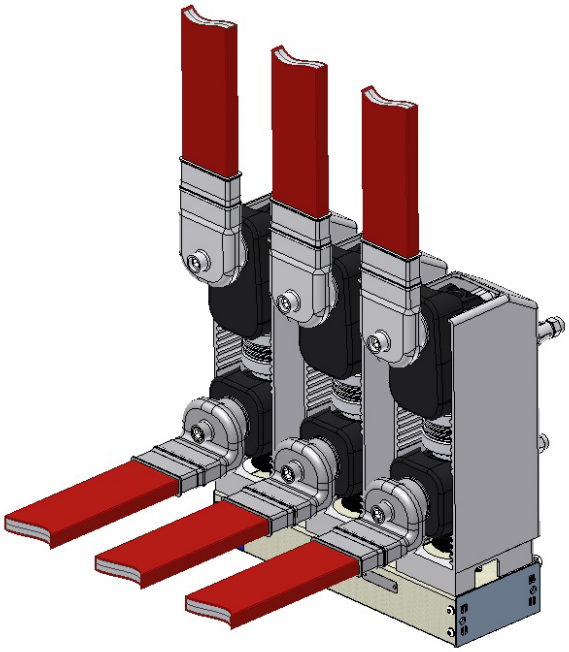


Figure 64
ISM25_Shell_2 with CBkit_Shell25_1

Rated voltage of auxiliary circuits

Selection of rated supply voltage range defines the rated supply voltage of the CM. Information about ranges of rated voltage of other VCB auxiliary circuits such as ISM auxiliary switches, CM built in relay switching contacts and CM control input circuits is given in Chapter 4.

7.2 Primary Circuit Connection

7.2.1 ISM Installation

In any switchgear application, the ISM15_Shell_2, ISM15_HD_1 and ISM25_Shell_2 may be installed in position "actuator up" or "actuator down". The ISM15_LD_1, LD_3, LD_6, LD_8, ISM15_MD_1, MD_3 and ISM25_LD_1, LD_2, LD_3 can be installed in any position.

Additionally ISM15_Shell_2(150_L) and ISM15_Shell_2(210_L) can be installed in horizontal actuator position. In this case the plane of all ISM terminals surfaces shall be horizontal as well and terminals surfaces shall be up oriented.

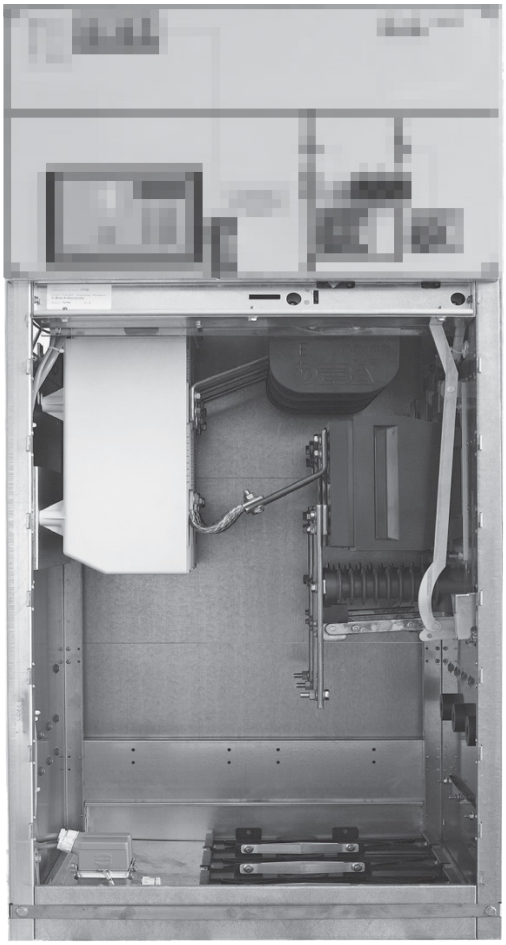


Figure 65
Fixed compact installation of ISM, vertical arrangement, actuator up

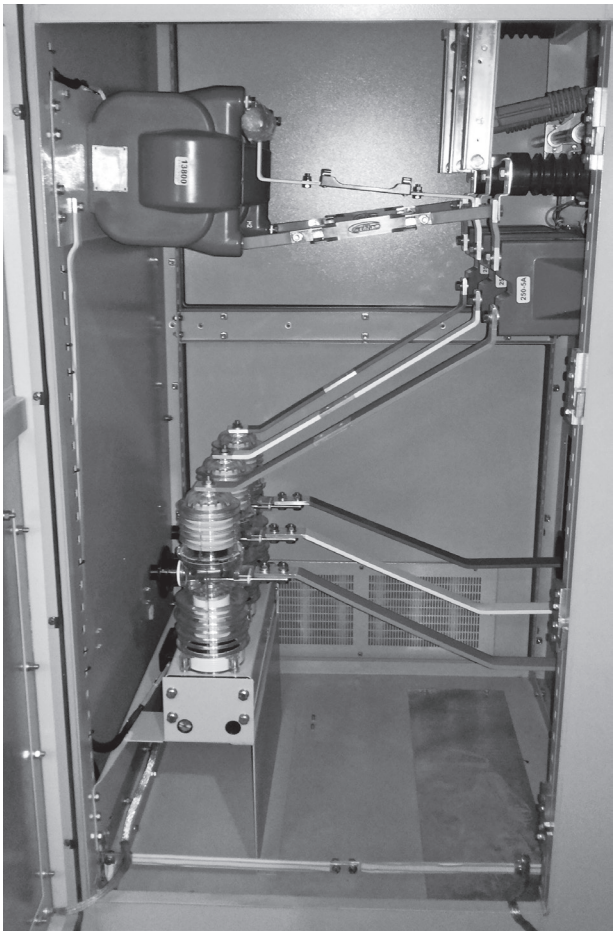


Figure 66
Fixed compact installation of ISM LD series, vertical arrangement, actuator down

Points shown below should be used for mounting the ISM.

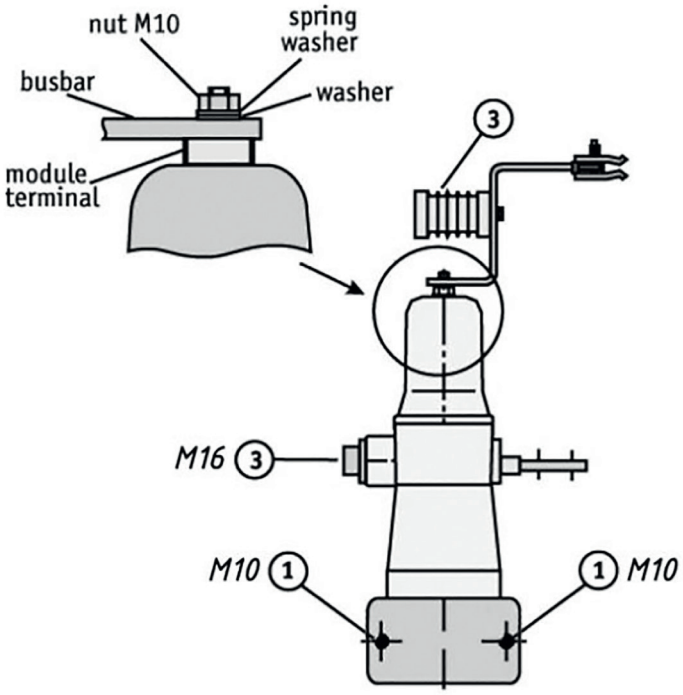


Figure 67

ISM15_LD_8 mounting points

1 – mandatory mounting points;
3 – additional mounting points (required in case uncontrolled horizontal force will be applied to ISM terminals, ex. draw-out unit).

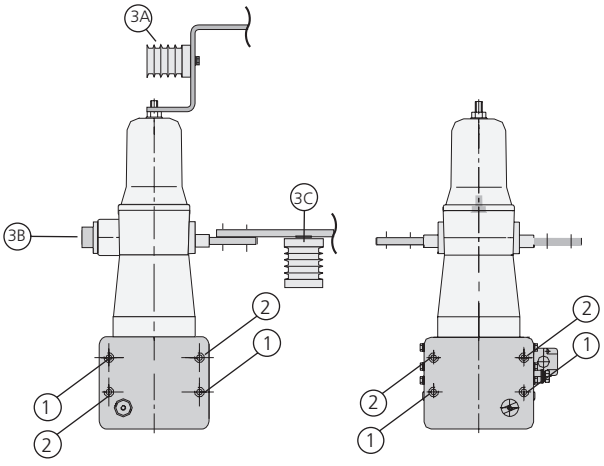


Figure 68

ISM15_LD and ISM25_LD mounting points

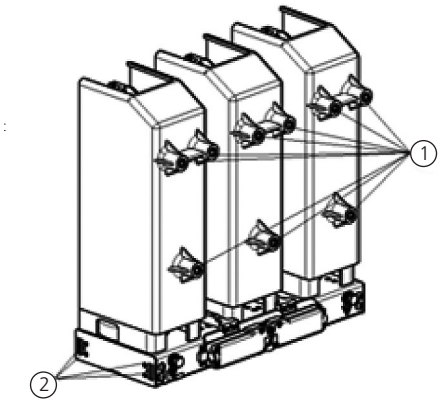


Figure 69

ISM15_Shell and ISM25_Shell mounting points

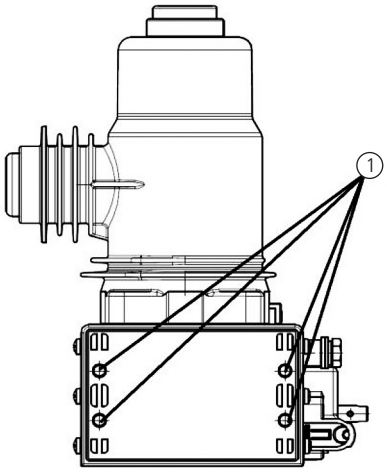


Figure 70

ISM15_MD mounting points

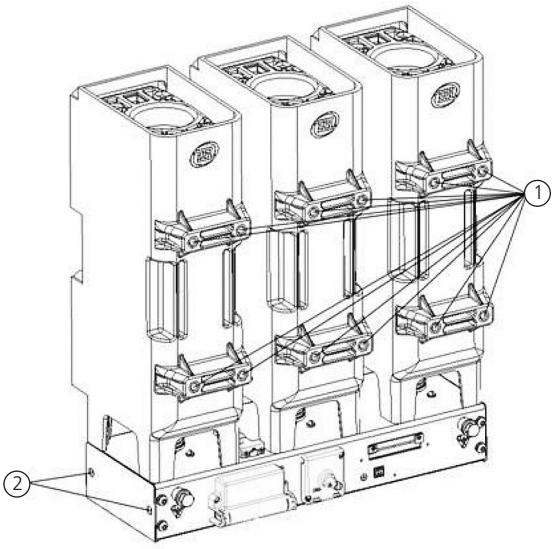


Figure 71

ISM15_HD mounting points

ISM15_HD_1 for 95 kV BIL installation extension part between obligatory mounting holes and an external frame has to be used. CBmount_ISM15_1 includes the studs to provide required extension:

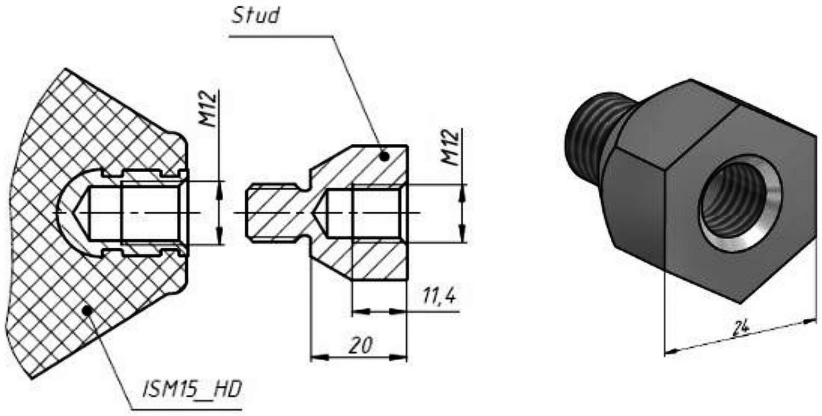


Figure 72

ISM15_HD mounting with help of studs from CBmount_ISM15_1

① Required mounting points

② Optional mounting points

③ Each two mounting points are required, either 3A+3B or 3A+3C

ISM25_Shell_2 for 125 kV BIL installation extension studs are included in the ISM delivery set:

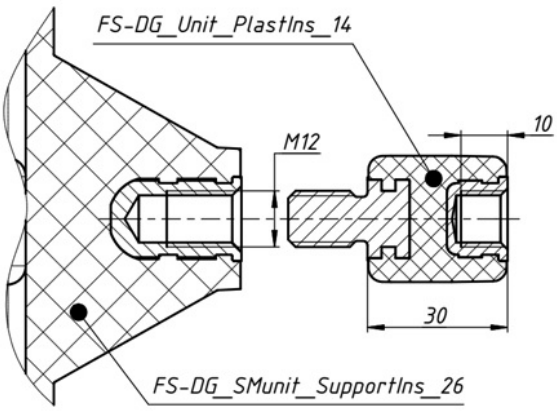


Figure 73

ISM25_Shell_2 mounting with help of studs

7.2.2 Electromagnetic Clearances

Short-circuit current magnetic field influences the ISM magnetic actuator. To avoid unwanted tripping, the minimum clearances between busbars and the ISM frame should be not less than stated in Table 21.

Table 21 - Electromagnetic Clearances

Short circuit current	Minimum clearance (a)	Applicable for
< 20 kA	100 mm	ISM15_MD
	120 mm	all ISM excluding ISM15_MD
	190 mm	ISM25_Shell
25 kA	120 mm	ISM15_MD
	150 mm	ISM15_Shell
	190 mm [1)]	ISM15_HD
	240 mm	ISM25_Shell
31.5 kA	150 mm	ISM15_MD
	190 mm	ISM15_Shell
	240 mm [1)]	ISM15_HD

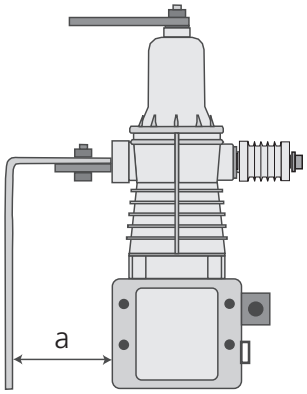


Figure 74
Electromagnetic clearances

Notes.
1. Smaller clearance on request

7.2.3 Insulation Clearances

The recommended minimum phase-to-phase and phase-to-ground air clearances are stated in Table 22. Shorter clearances shall be verified by a voltage test.

Table 22 - Insulation Clearances

Power frequency rated voltage	Impulse test vol-tage (BIL)	Minimum clearance (b) for LD ISM
12 kV	75 kV	120 mm
17.5 kV	95 kV	140 mm (160 mm for ISM15_LD_8)
24 kV	125 kV	220 mm

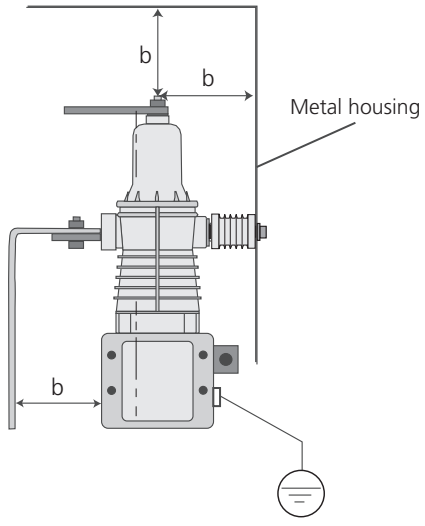


Figure 75
LD series ISM dielectric clearances

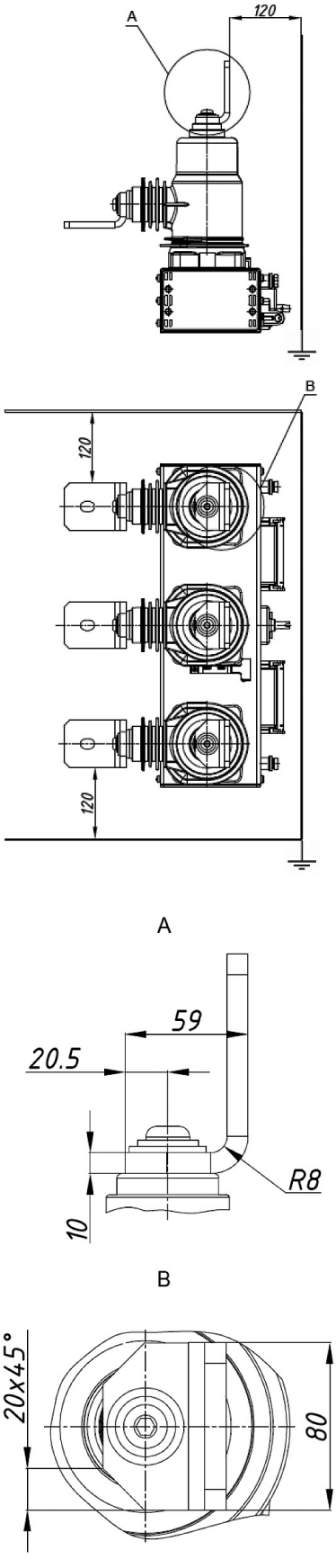


Figure 76

ISM15_MD dielectric clearances - 75 kV BIL

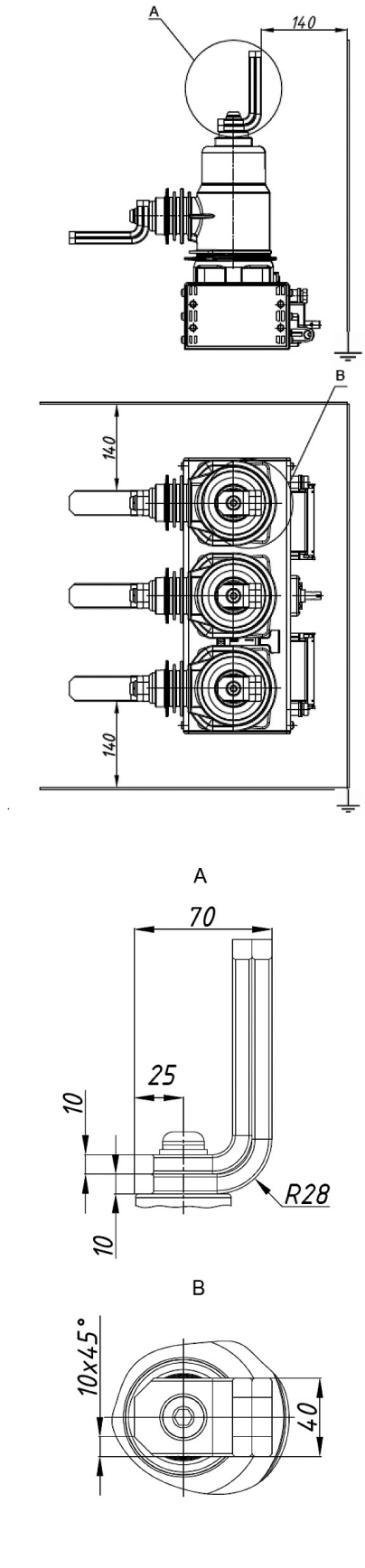


Figure 77

ISM15_MD dielectric clearances - 95 kV BIL

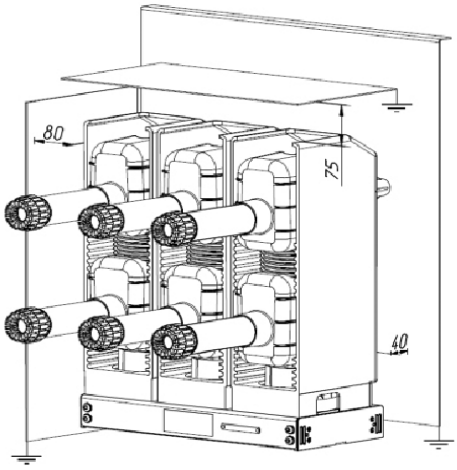


Figure 78

ISM15_Shell_2 with low upper terminal insulation clearances

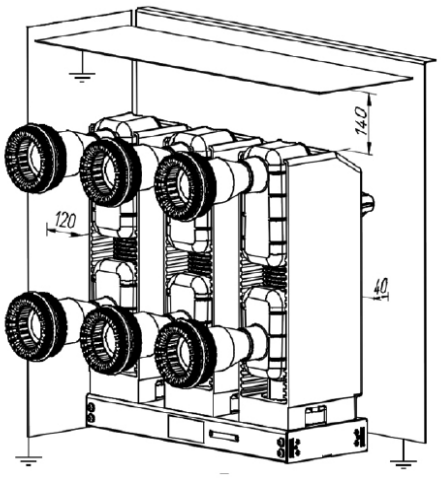


Figure 79

ISM15_Shell_2 with high upper terminal insulation clearances

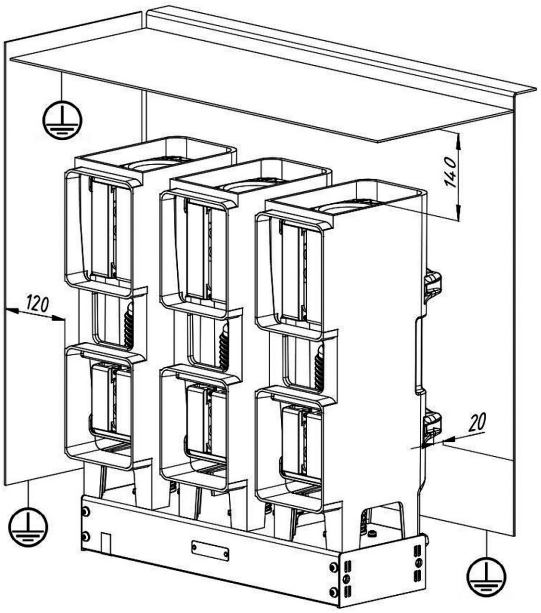


Figure 80

ISM15_HD_1 insulation clearances

The minimum clearance between busbars and the HD ISM frame shall be no less than 120 mm for 75 kV BIL and no less than 140 mm for 95 kV BIL.

Coordination of minimum clearances

Based on electromagnetic influence (a) and rated insulation voltage (b), the greater clearance should be selected.

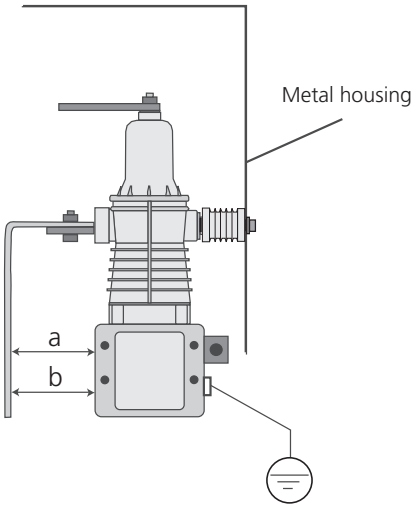


Figure 81

Clearance coordination

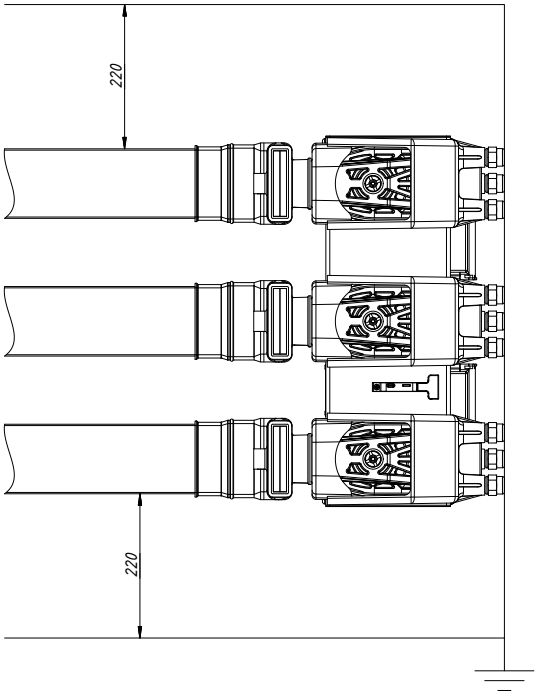


Figure 82

ISM25_Shell_2 insulation clearances

7.3 Secondary Circuit Connections

7.3.1 Three-Phase ISM Secondary Connections

All three-phase ISM15_LD (except ISM15_LD_8), ISM15_Shell and ISM25_LD have secondary connectors as shown below. Please make sure that the secondary circuit load complies with the auxiliary contacts switching capacity given in chapter 4.

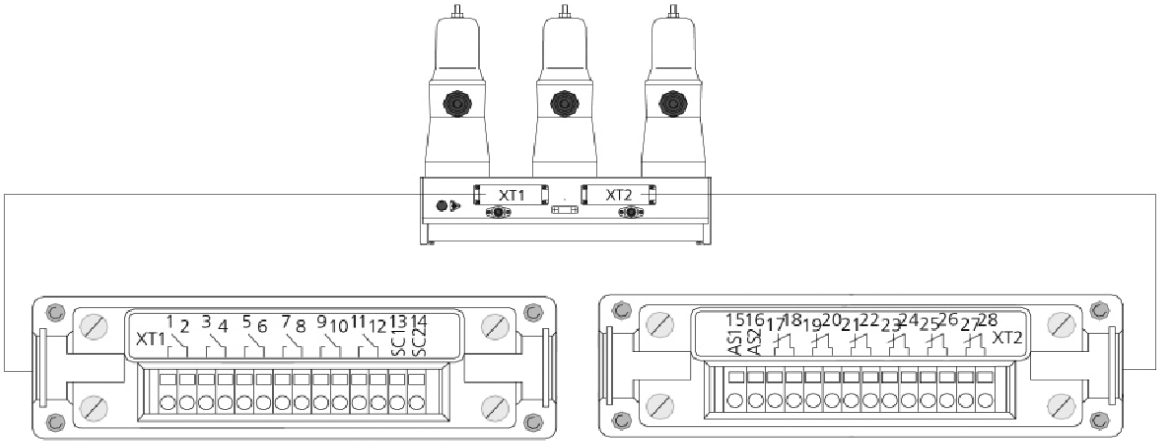


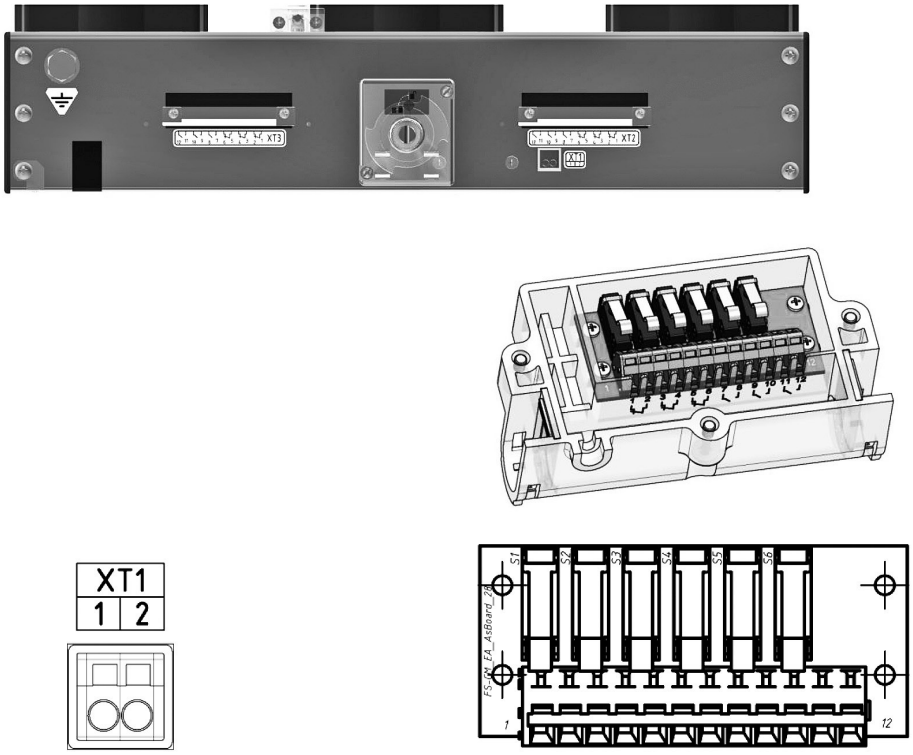
Figure 83

Terminal arrangement of the three-phase ISM15_LD, ISM15_Shell and ISM25_LD

Table 23 - Three-Phase ISM15_LD, ISM15_Shell and ISM25_LD Terminal Arrangement

XT1		XT2	
Terminal No.	Connection	Terminal No.	Connection
1	Auxiliary switch S 1 (1)	15	Auxiliary switch S 13 (AS1)
2	Auxiliary switch S 1 (4)	16	Auxiliary switch S 13 (AS2)
3	Auxiliary switch S 2 (1)	17	Auxiliary switch S 7 (1)
4	Auxiliary switch S 2 (4)	18	Auxiliary switch S 7(2)
5	Auxiliary switch S 3 (1)	19	Auxiliary switch S 8 (1)
6	Auxiliary switch S 3 (4)	20	Auxiliary switch S 8 (2)
7	Auxiliary switch S 4 (1)	21	Auxiliary switch S 9 (1)
8	Auxiliary switch S 4 (4)	22	Auxiliary switch S 9 (2)
9	Auxiliary switch S 5 (1)	23	Auxiliary switch S 10 (1)
10	Auxiliary switch S 5 (4)	24	Auxiliary switch S 10 (2)
11	Auxiliary switch S 6 (1)	25	Auxiliary switch S 11 (1)
12	Auxiliary switch S 6 (4)	26	Auxiliary switch S 11 (2)
13	Actuator coil (SC1)	27	Auxiliary switch S 12 (1)
14	Actuator coil (SC2)	28	Auxiliary switch S 12 (2)

ISM15_LD_8, ISM15_MD_1 and ISM15_HD_1 have secondary connectors as shown below.



a) ISM actuator coil terminal

b) Auxiliary switches board EA_Asboard_28 (XT2, XT3)

Figure 84

Terminal arrangement of the ISM15_LD_8, ISM15_MD_1, ISM15_HD_1 and ISM25_Shell_2
Each of the ISM15_MD_1 and ISM15_HD_1 has two auxiliary switches boards EA_Asboard_28.

ISM15_LD_8 is supplied without auxiliary switches board (auxiliary switches boards could be ordered separately). Following auxiliary switches boards are available: auxiliary board with 3NO + 3NC, 4NO + 4NC, 6NO + 6NC contacts.

Table 24 - ISM15_LD_8, ISM15_MD_1 and ISM15_HD_1 Terminal Arrangement

XT1	
Terminal No.	**Connection**
1	Actuator coil (SC1)
2	Actuator coil (SC2)
XT2, XT3 (Auxiliary switches board EA_Asboard_28)	
Terminal No.	**Connection**
1	NC auxiliary switch S 1(1)
2	NC auxiliary switch S 1(1)
3	NC auxiliary switch S 2(1)
4	NC auxiliary switch S 2(1)
5	NC auxiliary switch S 3(1)
6	NC auxiliary switch S 3(1)
7	NC auxiliary switch S 4(1)
8	NC auxiliary switch S 4(1)
9	NC auxiliary switch S 5(1)
10	NC auxiliary switch S 5(1)
11	NC auxiliary switch S 6(1)
12	NC auxiliary switch S 6(1)

7.3.2 Single-Phase ISM Secondary Connections

Single-phase ISM15_LD_3 and ISM25_LD_3 have secondary connectors as shown below.

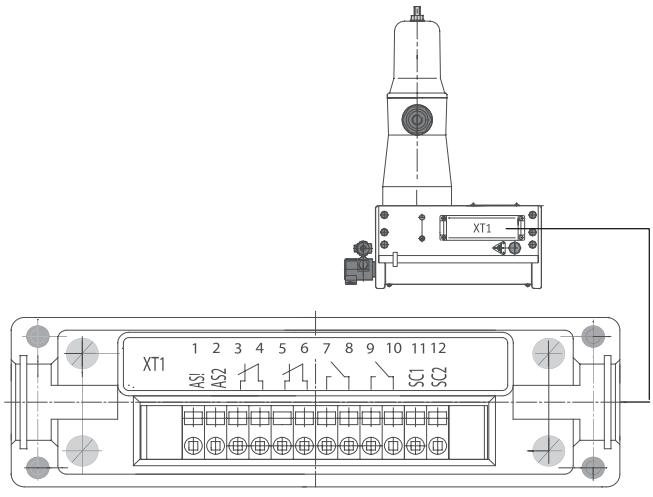


Figure 85

Terminal arrangement of the single-phase ISM15_LD_3 and ISM25_LD_3

Table 25 - Single-Phase ISM15_LD_3 and ISM25_LD_3 Terminal Arrangement

XT1	
Terminal No.	**Connection**
1	Auxiliary switch SF1 (AS1)
2	Auxiliary switch SF1 (AS2)
3	Auxiliary switch SF2
4	Auxiliary switch SF2
5	Auxiliary switch SF3
6	Auxiliary switch SF3
7	Auxiliary switch SF4
8	Auxiliary switch SF4
9	Auxiliary switch SF5
10	Auxiliary switch SF5
11	Actuator coil (SC1)
12	Actuator coil (SC2)

Single-phase ISM15_MD_3 has secondary connectors as shown below.

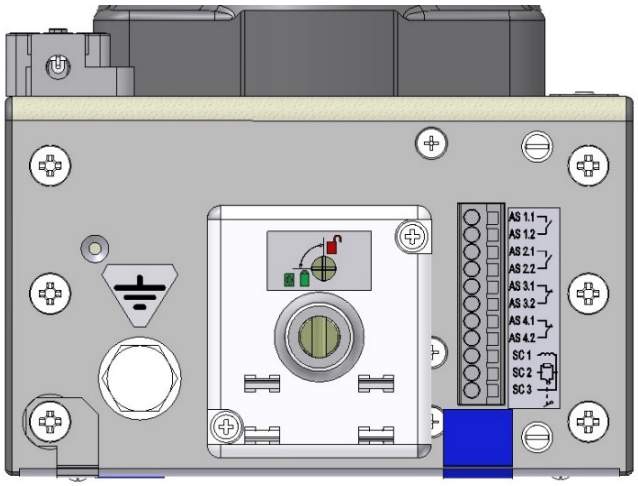


Figure 86

Terminal arrangement of the single-phase ISM15_MD 3

Table 26 - Single-Phase ISM15_MD_3 Terminal Arrangement

XT1	
Terminal No.	**Connection**
1	Auxiliary switch AS1 (AS1.1)
2	Auxiliary switch AS1 (AS1.2)
3	Auxiliary switch AS2 (AS2.1)
4	Auxiliary switch AS2 (AS2.2)
5	Auxiliary switch AS3 (AS3.1)
6	Auxiliary switch AS3 (AS3.2)
7	Auxiliary switch AS4 (AS4.1)
8	Auxiliary switch AS4 (AS4.2)
9	Actuator coil (SC1)
10	Actuator coil (SC2) with internal interlock
11	Actuator coil (SC3) without interlock

Note: Actuator coil input CS3 is intended for case when internal interlock is not required. For instance, when three single-phase ISM15_MD_3 are connected in prarallel to one control module. In such case the interlock of one of these ISMs can be used.

7.3.3 CM Secondary Circuits Connections

CM_16_1 has secondary connectors as shown below. Please make sure that the secondary circuit load complies with the auxiliary contacts switching capacity given in chapter 4.

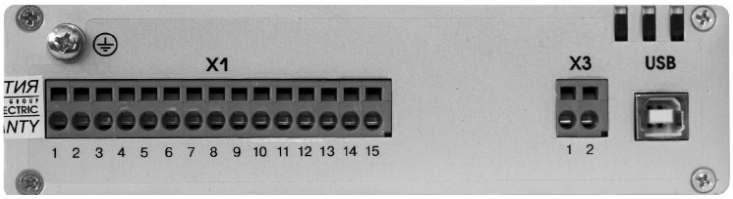


Figure 87
Terminal arrangement of the CM

Table 27 - CM Terminal Arrangement

XT1		XT2	
Terminal No.	Connection	Terminal No.	Connection
1	Power supply input (+)	1	Actuator coil output
2	Power supply input (-)	2	Actuator coil output
3	Relay output 1 NO		
4	Relay output 1 Com		
5	Relay output 1 NC		
6	Relay output 2 NO		
7	Relay output 2 Com		
8	Relay output 2 NC		
9	Relay output 3 NO		
10	Relay output 3 Com		
11	Relay output 3 NC		
12	Close dry input		
13	Close dry input		
14	Trip dry input		
15	Trip dry input		

CM relay functionality:

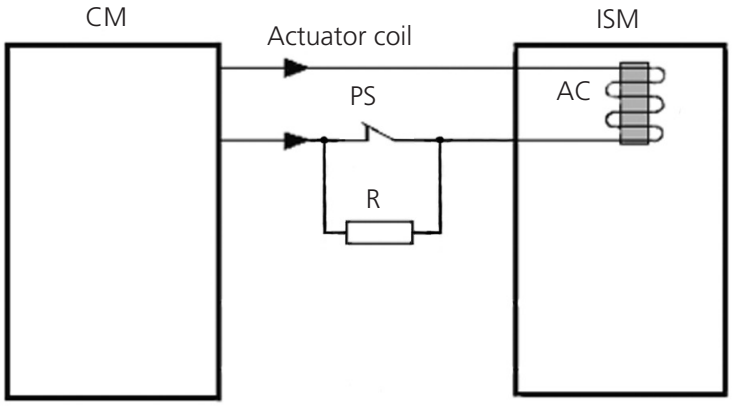
- Relay 1 - “ISM main contact position” relay;
- Relay 2 - “Ready” relay;
- Relay 3 - “Malfunction or Loss of auxiliary supply” relay.

Relay “ISM main contact position“ keeps its state (1 NO and 1 NC contacts with common point) after CM power supply disconnection.

Relays functionality and number of relays with same functionality can be changed on request. Please contact the nearest Tavrida Electric sales representative for more information.

7.3.4 CM and ISM Secondary Connections

The CM is connected to the ISM actuator coil circuits only. The position of the ISM main contacts is determined by detecting the ISM coil inductance level. CM relay "ISM main contact position" indicates the result.



AC — actuator coil;
PS — position switch with current not less than 10 A;
R — resistor 22 kOhm±5%, average power 0.15 W, peak power 8 W

Figure 88
CM and ISM secondary connections

Resistor "R" is used to prevent the CM alarm "Actuator Coil Isolated" while position switch PS is open.

PS - optional electrical interlock position switch. PS and R are not required for ISM15_LD_8, ISM15_MD_1, ISM15_MD_3, ISM15_Shell_2, ISM15_HD_1 and ISM25_Shell_2 since these ISMs already have a built in electrical interlock.

Capacity of the cable between CM and ISM shall be no more than 2 nF and its resistance shall be no more than 0.3 Ohm.

7.4 Auxiliary Supply

Connection of CM_16_1 to power supply is shown below.

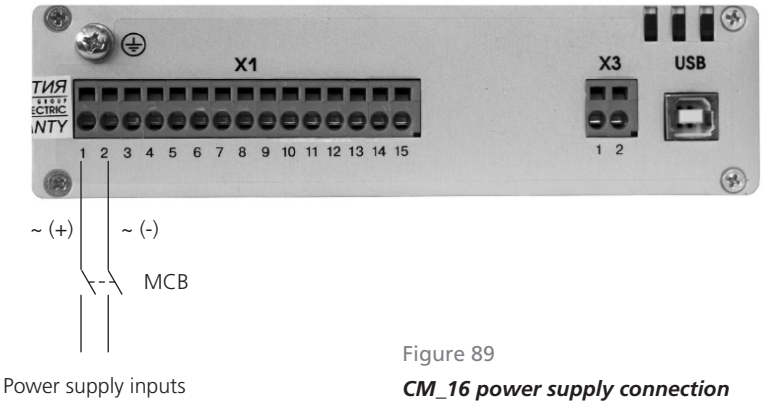


Figure 89
CM_16 power supply connection

Type of MCB shall be selected according to the CM. Consumption data given in Chapter 4.

If Manual generators CBunit_ManGen are used for charging, the CM DC voltage outputs shall be connected to power supply inputs of CM_16_1.

Appendix 1.
Type Tests

Type Tests of ISM15_LD (Except ISM15_LD_8)

Standard	Chapter	Test name	Test center name	Test report
IEC 62271-100	6.2.6.1	Power-frequency withstand voltage test	KEMA	KEMA_70271147_000-HVL03-1032
IEC 62271-100	6.2.6.2	Lightning impulse withstand voltage test	KEMA	KEMA_70271147_000-HVL03-1032
IEC 62271-100	6.4	Measurement of the resistance of the main circuit	KEMA	KEMA_70271147_000-HVL03-1032
IEC 62271-100	6.5	Temperature-rise tests	KEMA	KEMA_70271147_000-HVL03-1032
IEC 62271-100	6.6	Short-time withstand current and peak withstand current tests	KEMA	KEMA_79-03
IEC 62271-100 IEC 60694	6.10 6.2.10	Additional tests on auxiliary and control circuits	KEMA	KEMA_70271147_000-HVL03-1032
IEC 60056		Mechanical operation test at ambient temperature	KEMA TEL Testlab	KEMA_267-03 EDRTL_321-2007E
IEC 62271-100	6.102-6.106	Short-circuit current making and breaking tests	KEMA	KEMA_79-03
IEC 62271-100	6.108	Single-phase earth fault test	KEMA	KEMA_79-03
IEEE C37.09	Table 1	Short-circuit current making and breaking tests	KEMA	KEMA_26-08 V1
IEEE C37.09	4.9.1	Load current switching test	KEMA	KEMA_26-08 V1
IEC 62271-100	6.111.5.1	Cable charging current switching test	KEMA	KEMA_438-03
IEEE C37.09	Table 2	Cable charging current switching test	KEMA	KEMA_27-08 V1
IEEE C37.09	Table 2	Capacitor switching current tests	KEMA	KEMA_27-08 V1
IEC 62271-1	6.11 7.11	X-radiation test for vacuum interrupters	CESI	CESI B8012099

Type Tests of ISM15_LD_8

Standard	Chapter	Test name	Test center name	Test report
IEC 62271-100	6.2.6.1	Power-frequency withstand voltage test	LacTec	EAL/EM – 12812/2019
IEC 62271-100	6.2.6.2	Lightning impulse withstand voltage test	LacTec	EAL/EM – 12812/2019
IEC 62271-100	6.4	Measurement of the resistance of the main circuit	LacTec	EAL/EM – 12812/2019
IEC 62271-100	6.5	Temperature-rise tests	LacTec	EAL/EM – 12812/2019
IEC 62271-100	6.6	Short-time withstand current and peak withstand current tests	KEMA	KEMA_79-03
IEC 62271-100 IEC 60255-27	6.2.10 10.6.4.2	Dielectric tests on auxiliary and control circuits	KEMA	KEMA 1398-18
IEC 60056		Mechanical operation test at ambient temperature	LacTec	EAL/EM – 12812/2019
IEC 62271-100	6.102- 6.106	Short-circuit current making and breaking tests	KEMA	KEMA_79-03
IEC 62271-100	6.108	Single-phase earth fault test	KEMA	KEMA_79-03
IEEE C37.09	4.9.1	Load current switching test	KEMA	KEMA_26-08 V1
IEC 62271-100	6.111.5.1	Cable charging current switching test	KEMA	KEMA_438-03
IEEE C37.09	Table 2	Cable charging current switching test	KEMA	KEMA_27-08 V1
IEEE C37.09	Table 2	Capacitor switching current tests	KEMA	KEMA_27-08 V1
IEC 62271-1	6.11 7.11	X-radiation test for vacuum interrupters	CESI	CESI B8012099
IEC 62271-100	6.2.9	Partial discharge tests	LacTec	EAL/EM – 12812/2019

Type Tests of ISM15_MD

Standard	Chapter	Test name	Test center name	Test report
IEC 62271-100	6.2.6.1	Power-frequency withstand voltage test	KEMA	KEMA 1398-18
IEC 62271-100	6.2.6.2	Lightning impulse withstand voltage test	KEMA	KEMA 1398-18
IEC 62271-100	6.2.9	Partial discharge tests	KEMA	KEMA 1398-18
IEC 62271-100 IEC 60255-27	6.2.10 10.6.4.2	Dielectric tests on auxiliary and control circuits	KEMA	KEMA 1398-18
IEC 62271-100	6.10.3	Electrical continuity of earthed metallic parts test	KEMA	KEMA 1398-18
IEC 62271-100	6.4	Measurement of the resistance of the main circuit	KEMA	KEMA 1399-18
IEC 62271-100	6.5	Temperature-rise tests on the main circuits	KEMA	KEMA 1399-18
IEC 62271-100	6.5.5	Temperature-rise tests on auxiliary and control equipment	KEMA	KEMA 1399-18
IEC 62271-200	6.102.2	Mechanical and electromechanical inter-locks tests	KEMA	KEMA 2221-18
IEC 62271-100	6.6	Short-time withstand current and peak withstand current tests	KEMA	KEMA 2222-18
IEC 62271-100	6.102-6.106	Short-circuit current making and breaking tests	KEMA	KEMA 2085-19
IEC 62271-100	6.102-6.105, 6.108	Single-phase earth fault test	KEMA	KEMA 2222-18
IEC 62271-100	6.102-6.105, 6.108	Double-earth fault test	KEMA	KEMA 2222-18
IEC 62271-100	6.102-6.105, 6.112	Making and breaking tests on class E2	KEMA	KEMA 2085-19
IEC 62271-100	6.101.2	Mechanical operation test at ambient temperature	KEMA	KEMA 2324-18
IEC 62271-100	6.101.3	Low and high temperature tests	KEMA	KEMA 2324-18
IEC 62271-100	6.111.5.1	Line-charging and cable-charging current switching tests	KEMA	KEMA 2269-18
IEC 62271-1	6.11 7.11	X-radiation test for vacuum interrupters	CESI	CESI B8012097

Type Tests of ISM15_HD

Standard	Chapter	Test name	Test center name	Test report
IEC 62271-100	6.2.6.1	Power-frequency withstand voltage test	KEMA	KEMA 1656-18 KEMA 1717-18
IEC 62271-100	6.2.6.2	Lightning impulse withstand voltage test	KEMA	KEMA 1656-18 KEMA 1717-18
IEC 62271-100	6.2.9	Partial discharge tests	KEMA	KEMA 1656-18 KEMA 1717-18
IEC 62271-100 IEC 60255-27	6.2.10 10.6.4.2	Dielectric tests on auxiliary and control circuits	KEMA	KEMA 1656-18
IEC 62271-100	6.10.3	Electrical continuity of earthed metallic parts test	KEMA	KEMA 1656-18 KEMA 1717-18
IEC 62271-100	6.4	Measurement of the resistance of the main circuit	KEMA	KEMA 1719-18 KEMA 1721-18
IEC 62271-100	6.5	Temperature-rise tests on the main circuits	KEMA	KEMA 1719-18 KEMA 1721-18
IEC 62271-100	6.5.5	Temperature-rise tests on auxiliary and control equipment	KEMA	KEMA 1719-18 KEMA 1721-18
IEC 62271-200	6.102.2	Mechanical and electromechanical interlocks tests	KEMA	KEMA 2355-18 KEMA 2370-18
IEC 62271-100	6.6	Short-time withstand current and peak withstand current tests	KEMA	KEMA 2351-18
IEC 62271-100	6.102-6.106	Short-circuit current making and breaking tests	KEMA	KEMA 2351-18
IEC 62271-100	6.102-6.105, 6.108	Single-phase earth fault test	KEMA	KEMA 2351-18
IEC 62271-100	6.102-6.105, 6.108	Double-earth fault test	KEMA	KEMA 2351-18
IEC 62271-100	6.102-6.105, 6.112	Making and breaking tests on class E2	KEMA	KEMA 2351-18
IEC 62271-100	6.101.2	Mechanical operation test at ambient temperature	KEMA	KEMA 2343-18
IEC 62271-100	6.101.3	Low and high temperature tests	KEMA	KEMA 2343-18
IEC 62271-100	6.111.5.1	Line-charging and cable-charging current switching tests	KEMA	KEMA 2353-18
IEC 62271-1	6.11 7.11	X-radiation test for vacuum interrupters	CESI	CESI B8012097

Type Tests of ISM15_Shell

Standard	Chapter	Test name	Test center name	Test report
IEC 62271-100	6.2.6.1	Power-frequency withstand voltage test	CESI	CESI_B2023637
IEC 62271-100	6.2.6.2	Lightning impulse withstand voltage test	CESI	CESI_B2023637
IEC 62271-100	6.4	Measurement of the resistance of the main circuit	CESI	CESI_B2021760 CESI_B2024116
IEC 62271-100	6.5	Temperature-rise tests	CESI	CESI_B2021760 CESI_B2024116
IEC 62271-100	6.6	Short-time withstand current and peak withstand current tests	CESI	CESI_B3001808
IEC 62271-100	6.10 6.2.10	Additional tests on auxiliary and control circuits	XIHARI	XIHARI_120442G
IEC 62271-100	6.101.2	Mechanical operation test at ambient temperature	CESI XIHARI	CESI_B2025746 XIHARI_120442G
IEC 62271-100	6.102 - 6.106	Short-circuit current making and breaking tests	CESI	CESI_B3001808
IEC 62271-100	6.112	Short-circuit current making and breaking tests, E2 class	CESI	CESI_B3001808
IEC 62271-100	6.108	Single-phase and double-earth fault tests	CESI	CESI_B3001808
GB 1984-2003	6.108	Cable charging current switching test	XIHARI	XIHARI_120442G
IEC 62271-1	6.11 7.11	X-radiation test for vacuum interrupters	CESI	CESI B8012097

Type Tests of ISM25_LD

Standard	Chapter	Test name	Test center name	Test report
IEC 62271-100	6.2.6.1	Power-frequency withstand voltage test	KEMA	KEMA_08-64919A
IEC 62271-100	6.2.6.2	Lightning impulse withstand voltage test	KEMA	KEMA_08-64919A
IEC 62271-100	6.4	Measurement of the resistance of the main circuit	KEMA	KEMA_08-64919A
IEC 62271-100	6.5	Temperature-rise tests	KEMA	KEMA_08-64919A
IEC 62271-100	6.6	Short-time withstand current and peak withstand current tests	KEMA	KEMA 2338-21
IEC 62271-100	6.10	Additional tests on auxiliary and control circuits	KEMA	KEMA_08-64919A
IEC 62271-100	6.101.2.1-6.101.2.3	Mechanical operation test at ambient temperature	KEMA TEL Testlab	KEMA_08-64919A Pr143-2012E
IEC 62271-100	6.102 -6.106	Short-circuit current making and breaking tests	KEMA	KEMA 2338-21
IEC 62271-100	6.2.9	Partial discharge tests	CESI	CESI_A6029041
IEC 62271-100	6.111.5.1	Cable charging current switching test	CESI	CESI_A6033728 CESI_A6031640 CESI_A6031641
IEC 62271-100	6.108	Double-earth fault tests	KEMA	KEMA 2338-21
IEC 62271-1	6.11	X-radiation test for vacuum interrupters	KEMA	KEMA Final 1493-15

Type Tests of CM_16

Standard	Test name	Test center name	Test report
IEC 60255-26 IEC 61000-4-2	Electrostatic discharge immunity test	KEMA	KEMA TIC 1371-14
IEC 60255-26 IEC 61000-4-3	Radiated electromagnetic field immunity test	KEMA	KEMA TIC 1371-14
IEC 60255-26 IEC 62271-1 IEC 61000-4-4	Fast transient burst immunity test	KEMA	KEMA TIC 1371-14
IEC 60255-26 IEC 61000-4-5	Surge immunity test	KEMA	KEMA TIC 1371-14
IEC 60255-26 IEC 61000-4-6	Conducted disturbance induced by radio frequency fields immunity test	KEMA	KEMA TIC 1371-14
IEC 60255-26 IEC 61000-4-8	Power frequency magnetic field immunity test	KEMA	KEMA TIC 1371-14
IEC 61000-4-9	Pulse magnetic field immunity test	KEMA	KEMA TIC 1371-14
IEC 61000-4-10	100 kHz damped oscillatory magnetic field immunity test	KEMA	KEMA TIC 1371-14
IEC 61000-4-10	1 MHz damped oscillatory magnetic field immunity test	KEMA	KEMA TIC 1371-14
IEC 60255-26 IEC 61000-4-11	AC voltage dips and interruptions immunity test	KEMA	KEMA TIC 1371-14
IEC 60255-26 IEC 61000-4-16	Power frequency disturbance voltage immunity test	KEMA	KEMA TIC 1371-14
IEC 60255-26 IEC 62271-1 IEC 61000-4-18	100 kHz damped oscillatory wave immunity test	KEMA	KEMA TIC 1371-14
IEC 60255-26 IEC 62271-1 IEC 61000-4-18	1 MHz damped oscillatory wave immunity test	KEMA	KEMA TIC 1371-14
IEC 60255-26 IEC 61000-4-27	Ripple on DC power supply immunity test	KEMA	KEMA TIC 1371-14
IEC 60255-26 IEC 62271-100 IEC 61000-4-29	DC voltage dips and interruptions immunity test	KEMA	KEMA TIC 1371-14
IEC 60255-27 IEC 62271-100	Power frequency withstand voltage test	KEMA	KEMA TIC 1371-14
IEC 60255-27	Insulation resistance test	KEMA	KEMA TIC 1371-14
IEC 60255-27	Impulse withstand voltage test	KEMA	KEMA TIC 1371-14

Appendix 2. VCB Package Dimensions and Weights

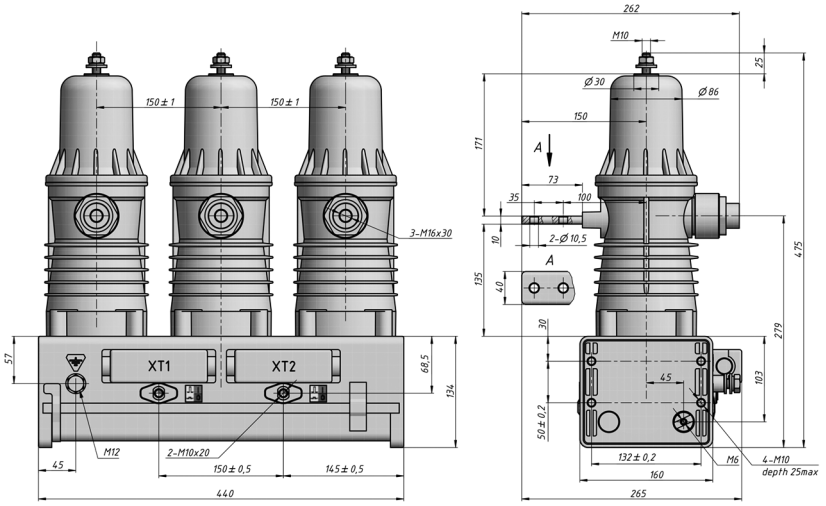
VCB Package Dimensions and Weights

VCB	Package dimensions, not more than (LxWxH), mm	Gross weight, not more than, kg
VCB15_LD1_16.F	645x330x550	39.1
VCB15_LD3_16.F	645x290x550	17.1
VCB15_LD6_16.RD	470x410x700	62.3
VCB15_LD8_16.F	790x290x550	31,3
VCB15_MD1_16.F	760x315x490	41.5
VCB15_MD3_16.F	300x315x190	16.1
VCB15_Shell2_16.F	790x275x800	68.4
VCB15_HD1_16.F	830x330x680	79.5
VCB25_LD1_16.F	775x290x550	41.7
VCB25_LD2_16.F	645x330x550	40.1
VCB25_LD3_16.F	645x290x550	18.3
VCB25_Shell2_16.F	825x328x874	73

Appendix 3.
Overall Drawings

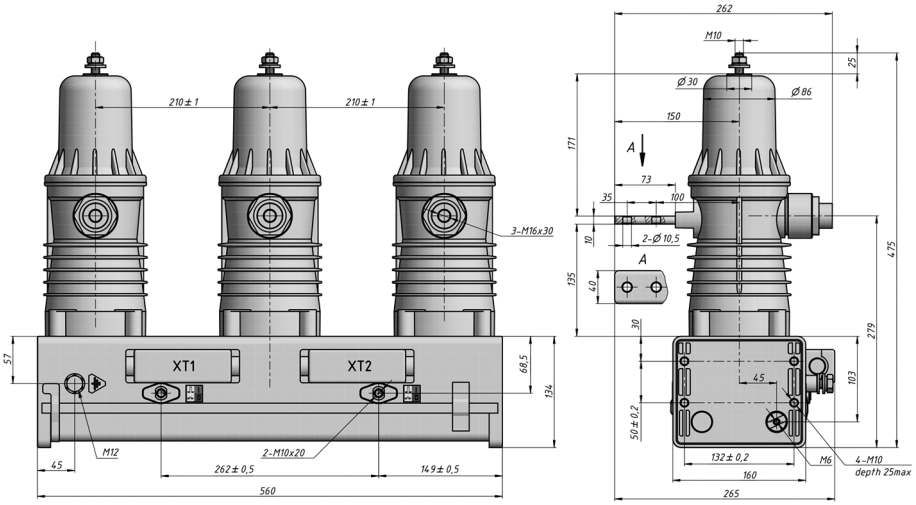
Dimensions of Indoor Switching Modules

ISM15_LD



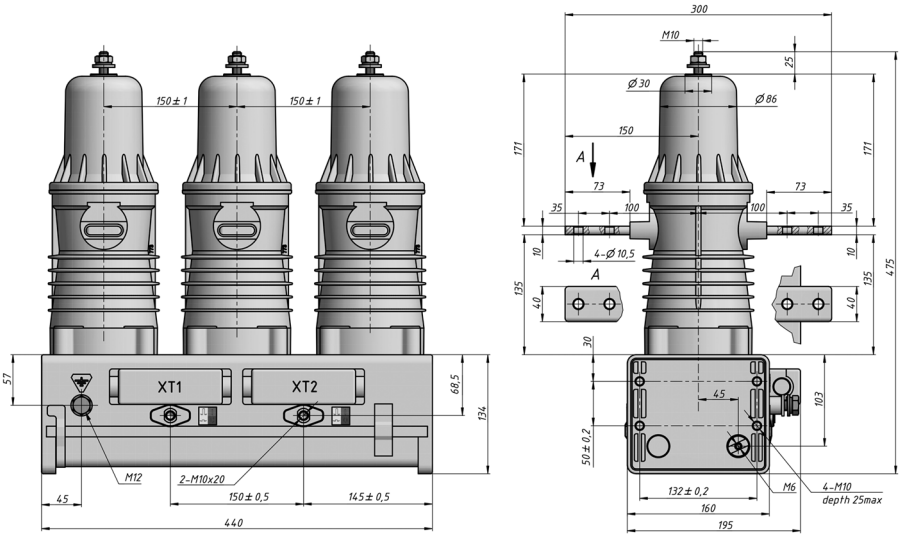
ISM15_LD_1(67),
PCD 150 mm
Weight: 34 kg

L_{max} = 265 mm
W_{max} = 440 mm
H_{max} = 475 mm



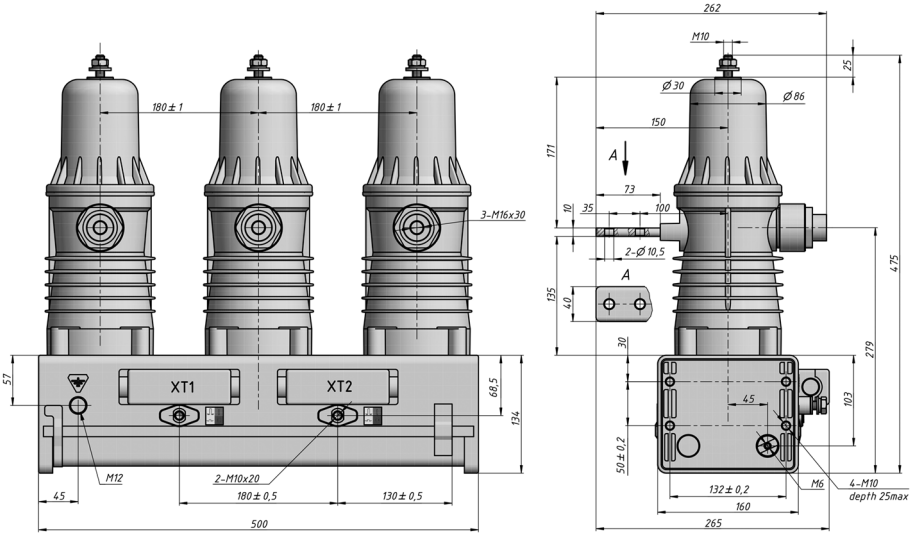
ISM15_LD_1(55),
PCD 210 mm
Weight: 36 kg

L_{max} = 265 mm
W_{max} = 560 mm
H_{max} = 475 mm



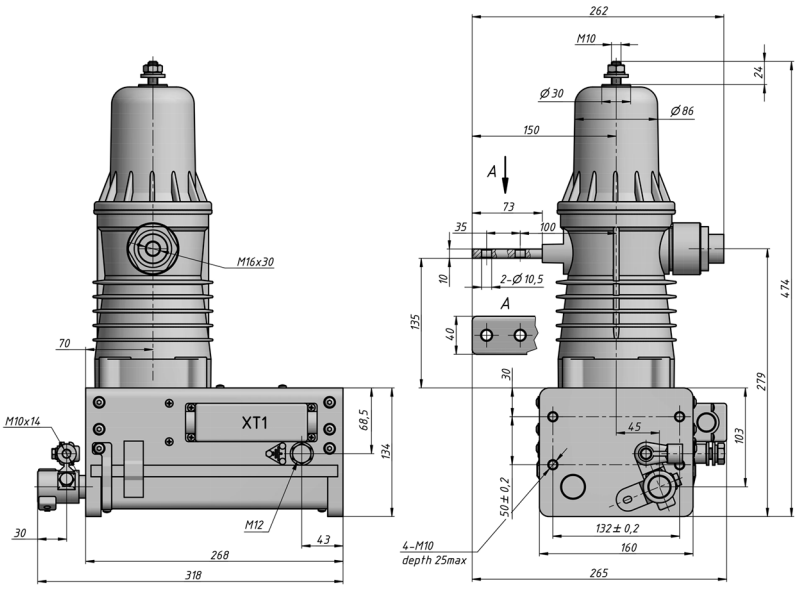
ISM15_LD_1(80), two lower terminals (continuous busbar),
PCD 150 mm
Weight: 36 kg

L_{max} = 300 mm
W_{max} = 440 mm
H_{max} = 475 mm



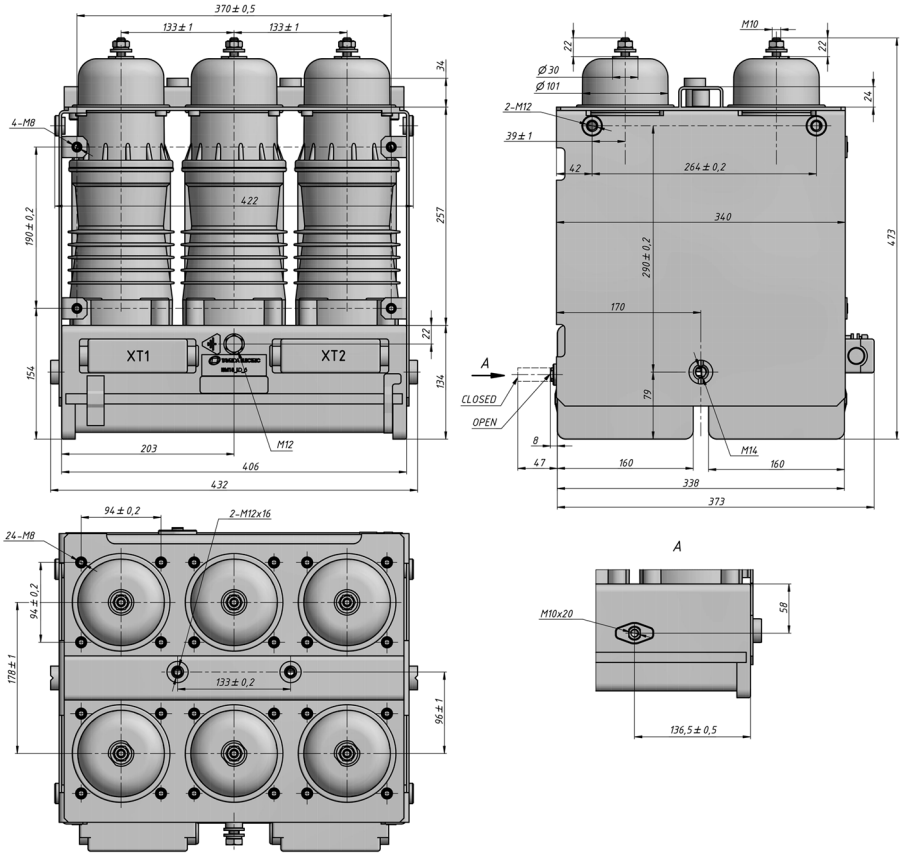
ISM15_LD_1(90),
PCD 180 mm
Weight: 36 kg

L_{max} = 265 mm
W_{max} = 500 mm
H_{max} = 475 mm



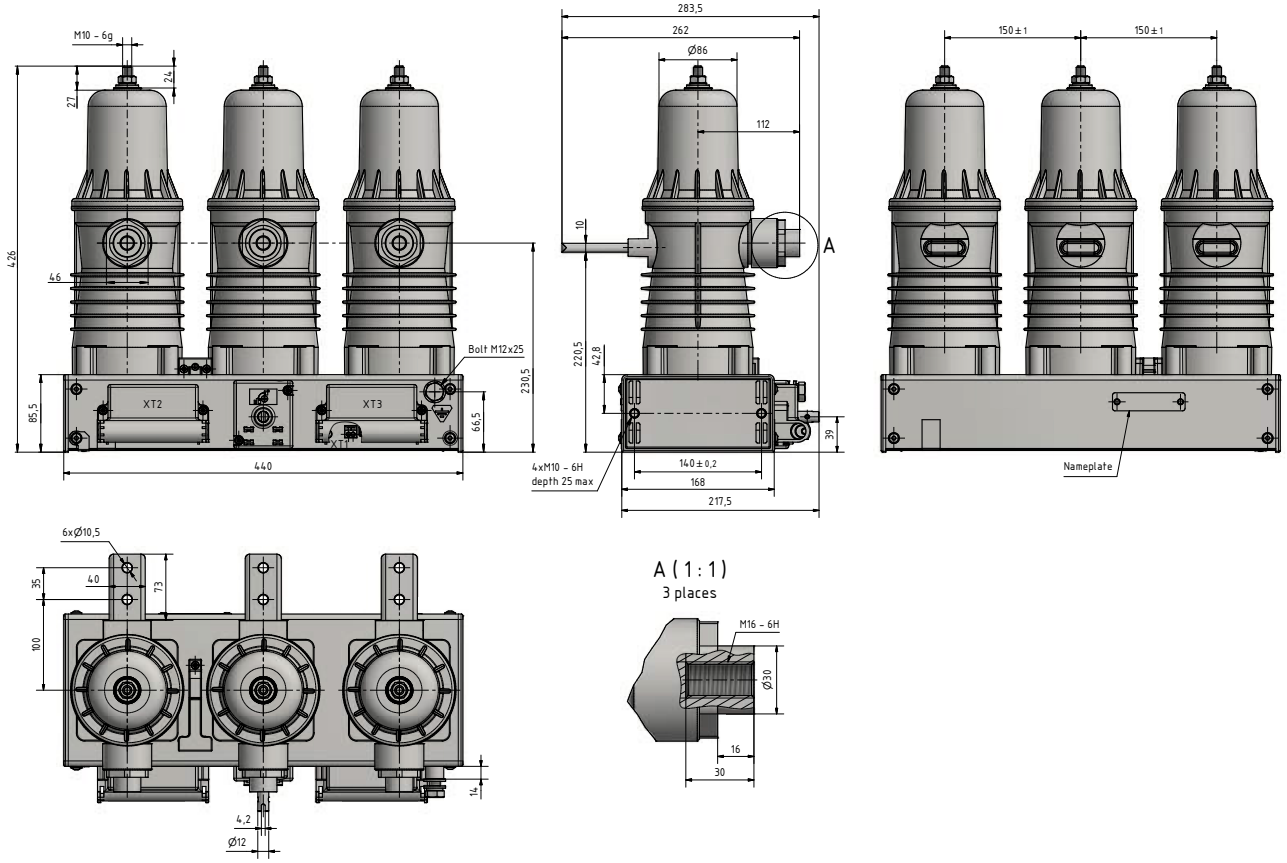
ISM15_LD_3,
Weight: 13 kg

L_{max} = 265 mm
W_{max} = 318 mm
H_{max} = 474 mm



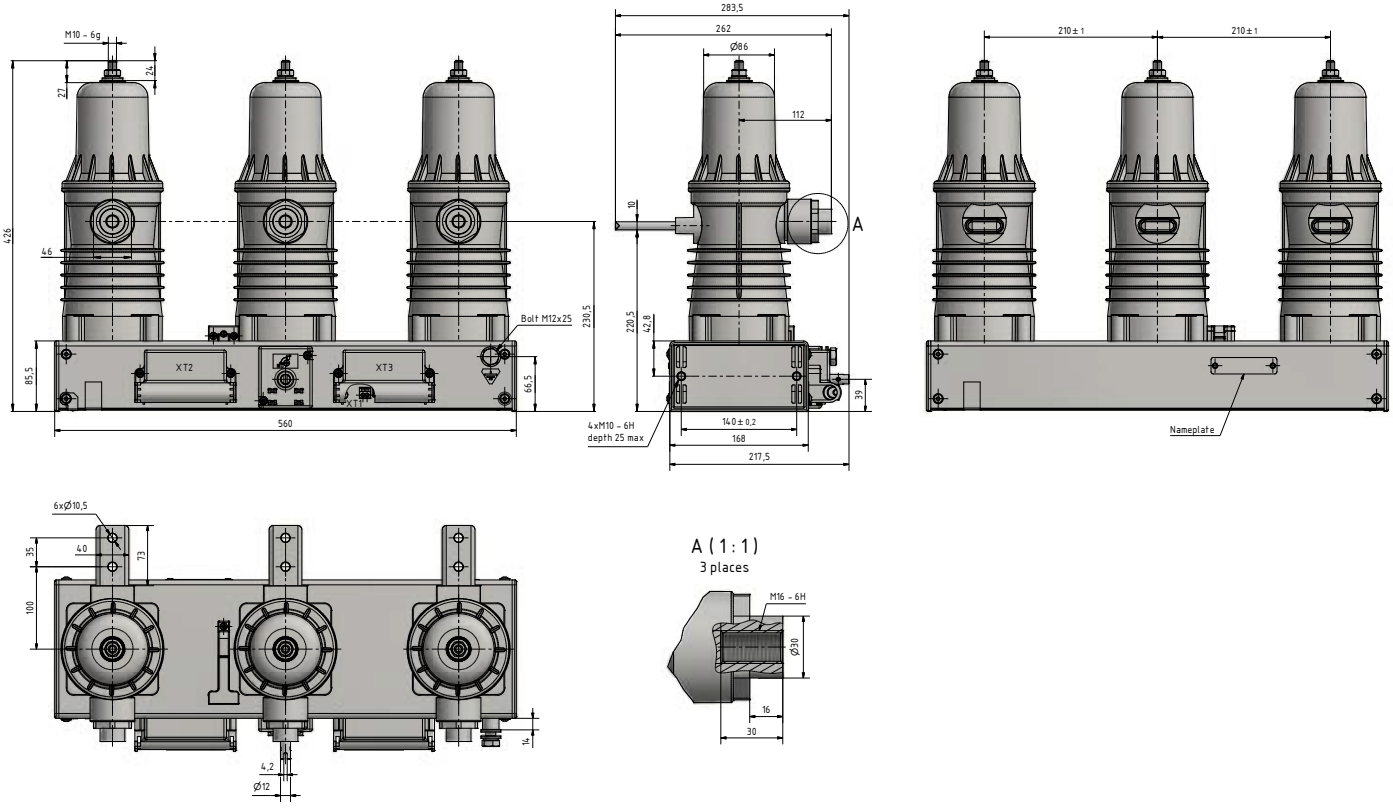
ISM15_LD_6,
PCD 133 mm
Weight: 55 kg

L_{max} = 381 mm
W_{max} = 432 mm
H_{max} = 473 mm



ISM15_LD_8(150_1),
PCD 150 mm
Weight: 25 kg

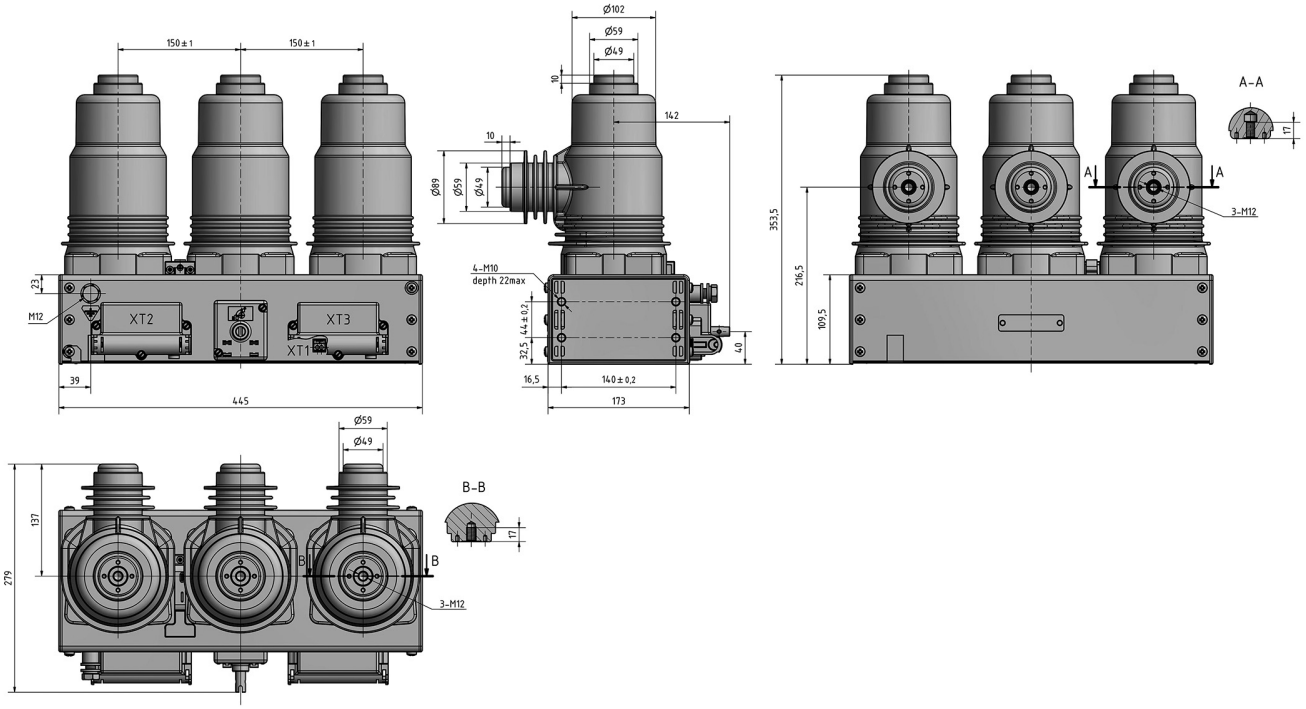
L_{max} = 283.5 mm
W_{max} = 440 mm
H_{max} = 426 mm



ISM15_LD_8(210_1C),
PCD 210 mm
Weight: 26 kg

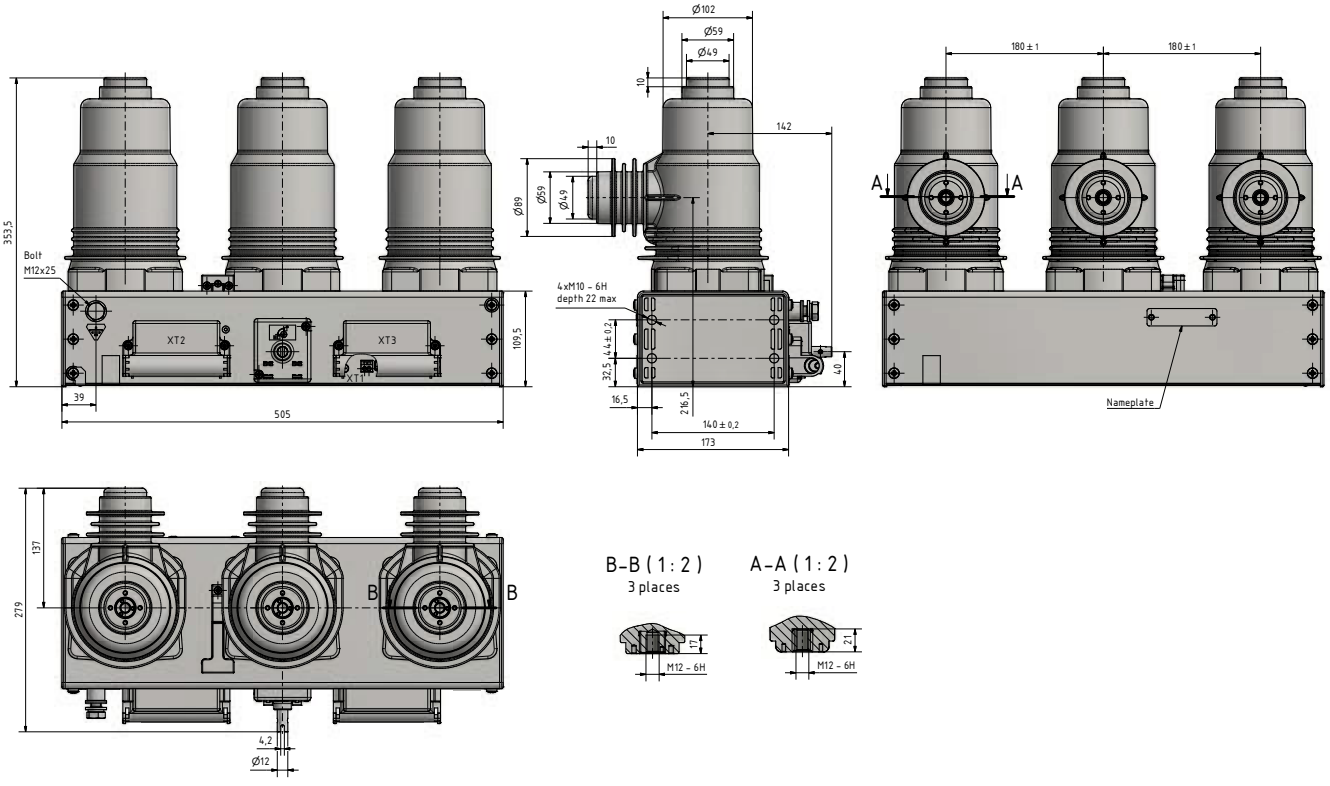
L_{max} = 283.5 mm
W_{max} = 560 mm
H_{max} = 426 mm

ISM15_MD



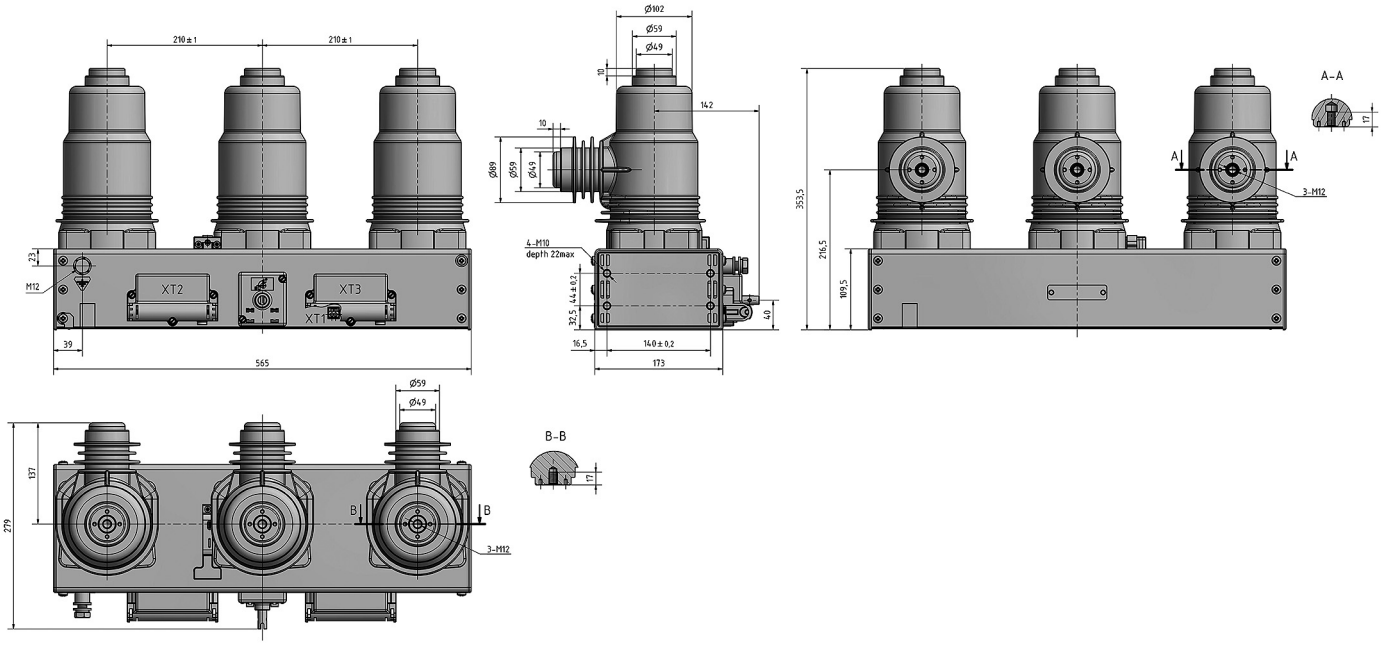
ISM15_MD_1(150_L),
PCD 150 mm,
Weight: 33 kg

L_{max} = 279 mm
W_{max} = 445 mm
H_{max} = 353.5 mm



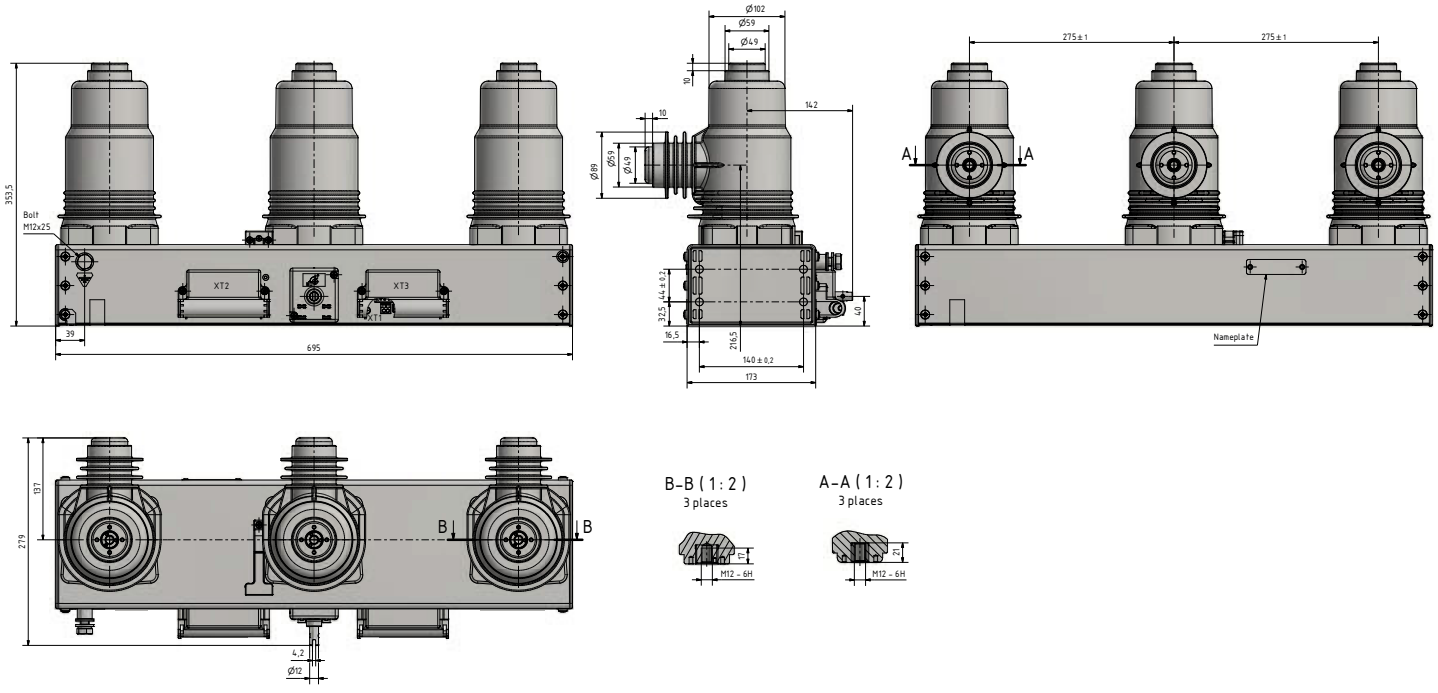
ISM15_MD_1(180_L),
PCD 180 mm,
Weight: 34 kg

L_{max} = 279 mm
W_{max} = 505 mm
H_{max} = 353.5 mm



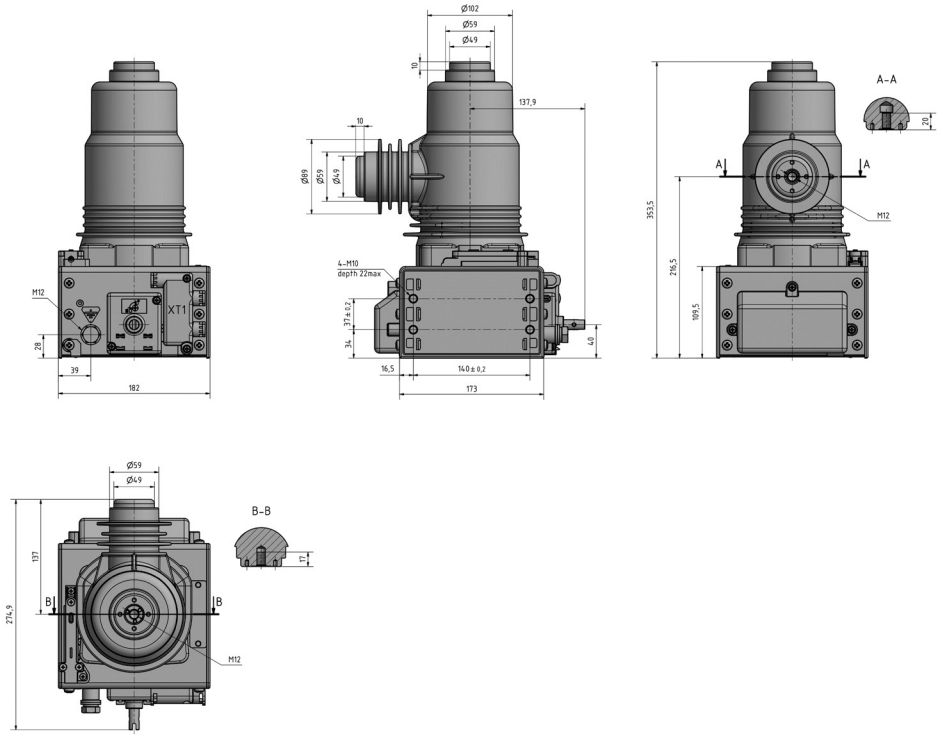
ISM15_MD_1(210_L),
PCD 210 mm,
Weight: 35 kg

L_{max} = 279 mm
W_{max} = 565 mm
H_{max} = 353.5 mm



ISM15_MD_1(275_L),
PCD 275 mm,
Weight: 37 kg

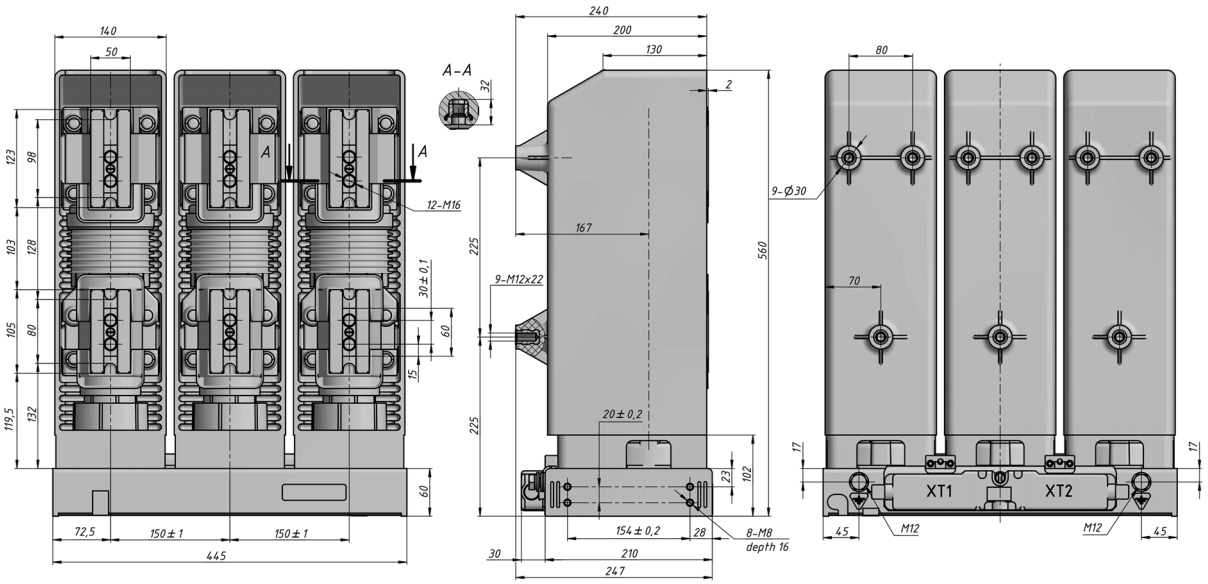
L_{max} = 279 mm
W_{max} = 695 mm
H_{max} = 353.5 mm



ISM15_MD_3,
Weight: 13 kg

L_{max} = 274.9 mm
W_{max} = 182 mm
H_{max} = 353.5 mm

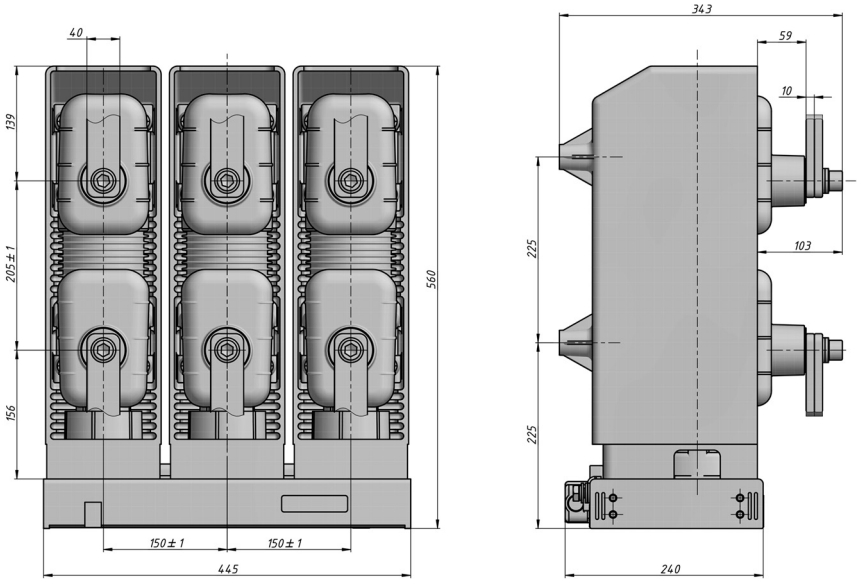
ISM15_Shell



ISM15_Shell_2(150_L), ***L_{max} = 247 mm***

PCD 150 mm, ***W_{max} = 445 mm***

Weight: 51 kg ***H_{max} = 560 mm***

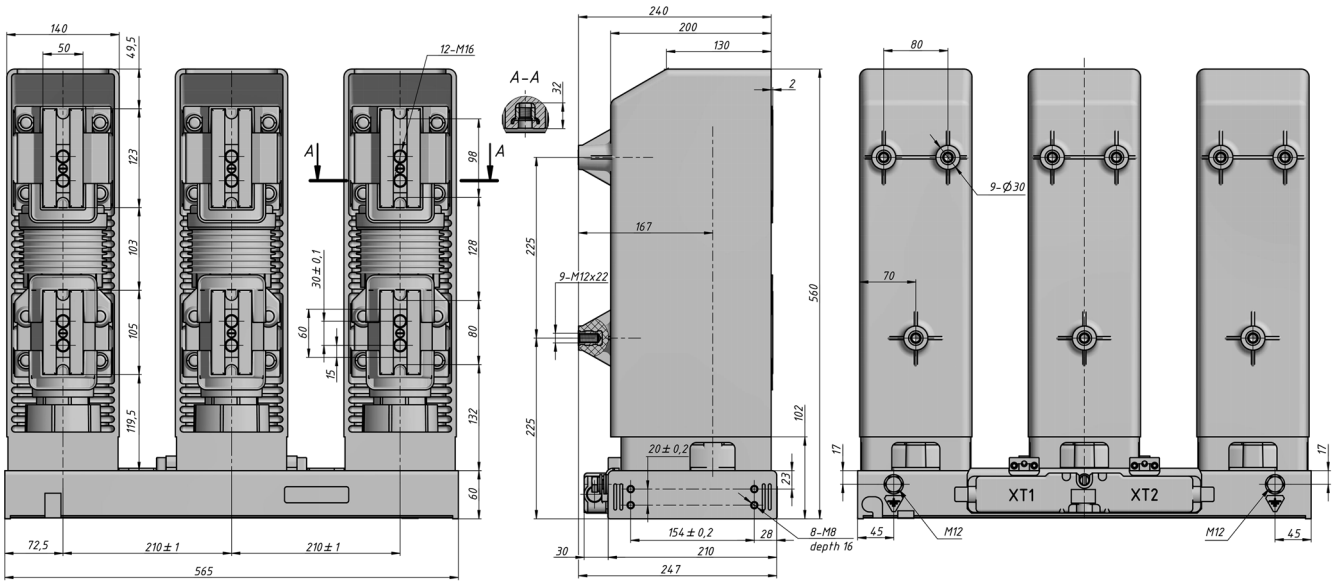


ISM15_Shell_2(150_L) with CBkit_Shell15_1(205) installed*, ***L_{max} = 343 mm***

PCD 150 mm, ***W_{max} = 445 mm***

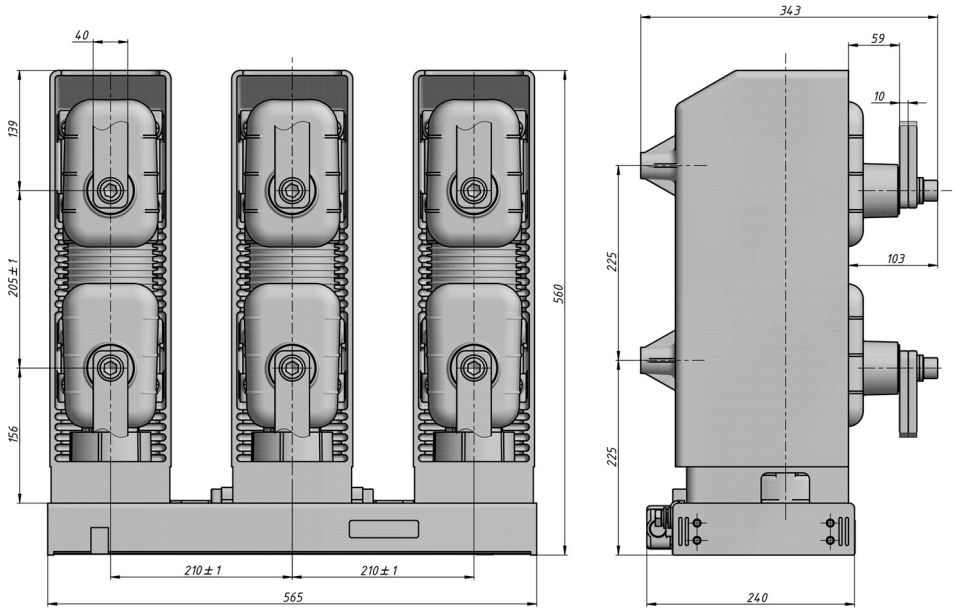
Weight: 59,5 kg ***H_{max} = 560 mm***

****- busbars shown for reference and are not supplied.***



ISM15_Shell_2(210_L),
PCD 210 mm,
Weight: 52 kg

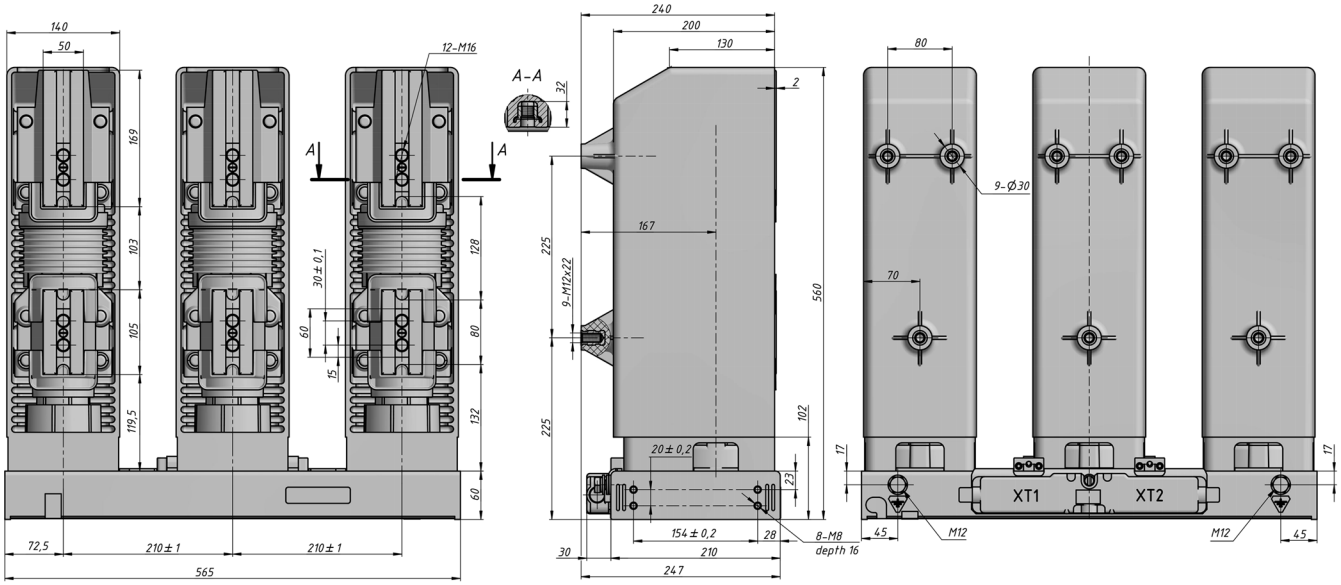
L_{max} ***= 247 mm***
W_{max} ***= 565 mm***
H_{max} ***= 560 mm***



ISM15_Shell_2(210_L) with CBkit_Shell15_1(205) installed*,
PCD 210 mm,
Weight: 60,5 kg

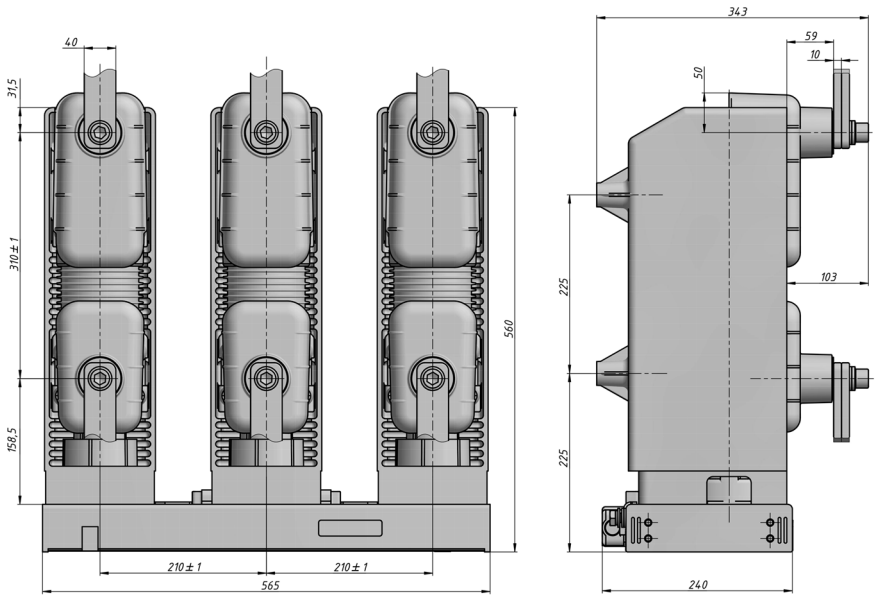
L_{max} ***= 343 mm***
W_{max} ***= 565 mm***
H_{max} ***= 560 mm***

****- busbars shown for reference and are not supplied.***



ISM15_Shell_2(210_H),
PCD 210 mm,
Weight: 53 kg

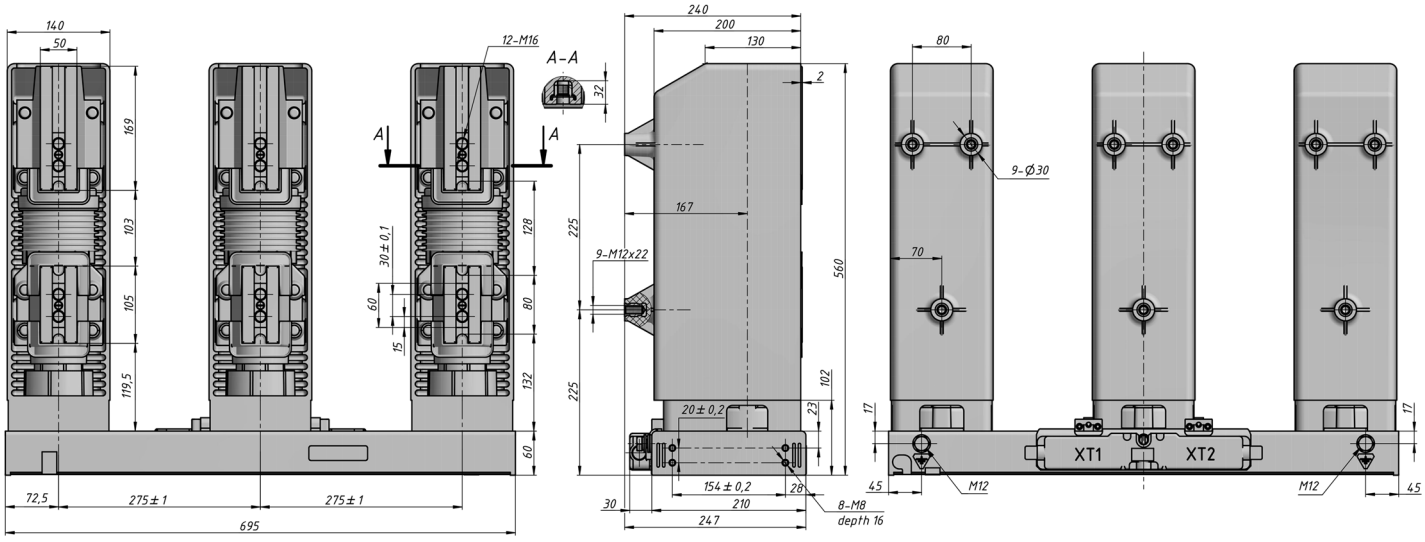
L_{max} = 247 mm
W_{max} = 565 mm
H_{max} = 560 mm



ISM15_Shell_2(210_H) with CBkit_Shell15_1(310) installed*,
PCD 210 mm,
Weight: 61,5 kg

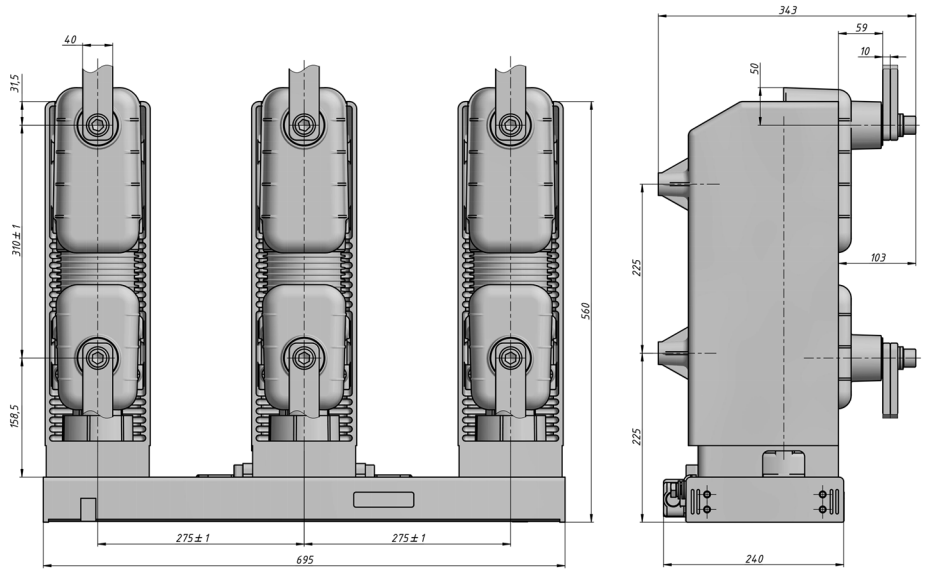
L_{max} = 343 mm
W_{max} = 565 mm
H_{max} = 560 mm

****- busbars shown for reference and are not supplied.***



ISM15_Shell_2(275_H),
PCD 275 mm,
Weight: 55 kg

L_{max} ***= 247 mm***
W_{max} ***= 695 mm***
H_{max} ***= 560 mm***

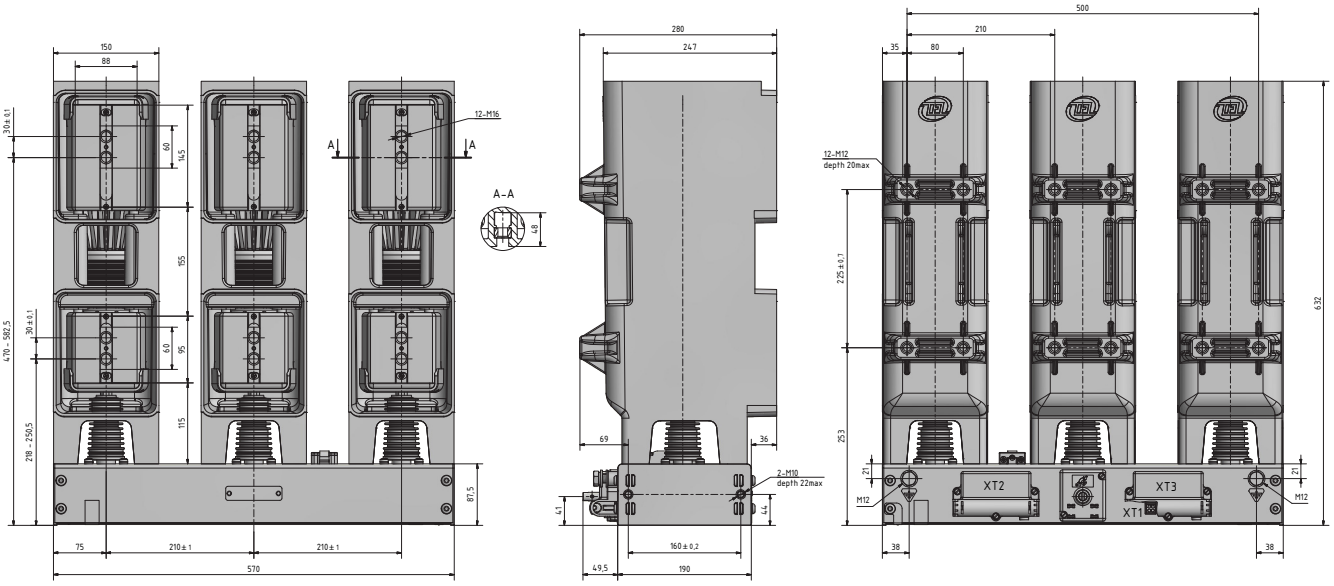


ISM15_Shell_2(275_H) with CBkit_Shell15_1(310) installed*,
PCD 275 mm,
Weight: 63,5 kg

L_{max} ***= 343 mm***
W_{max} ***= 695 mm***
H_{max} ***= 560 mm***

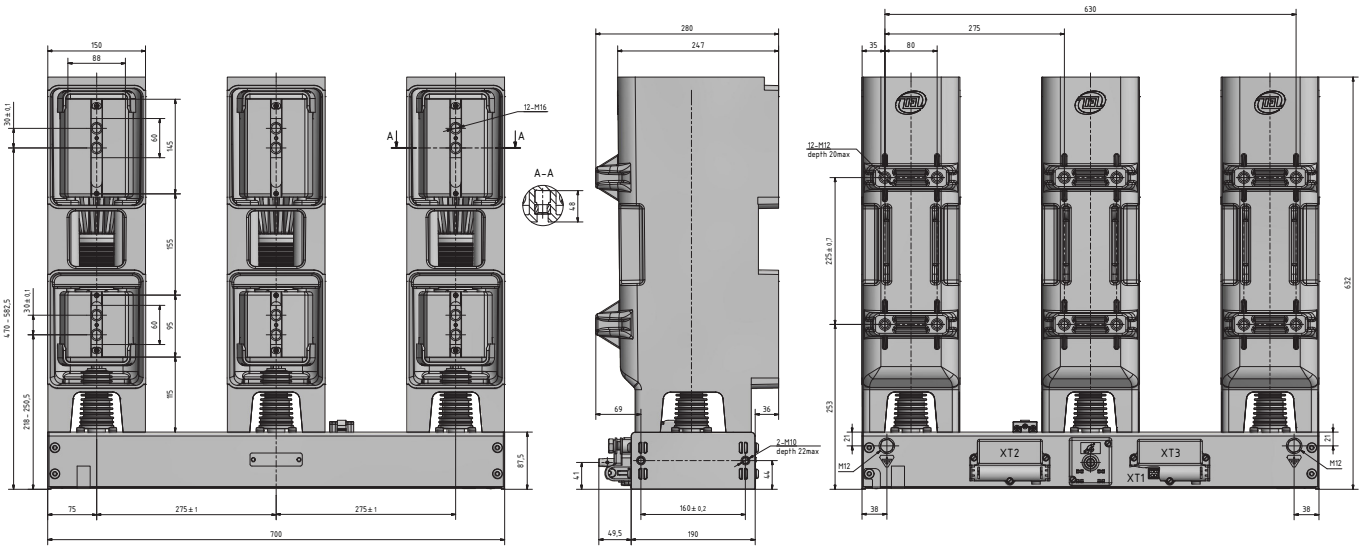
****- busbars shown for reference and are not supplied.***

ISM15_HD



ISM15_HD_1(210),
PCD 210 mm,
Weight: 70 kg

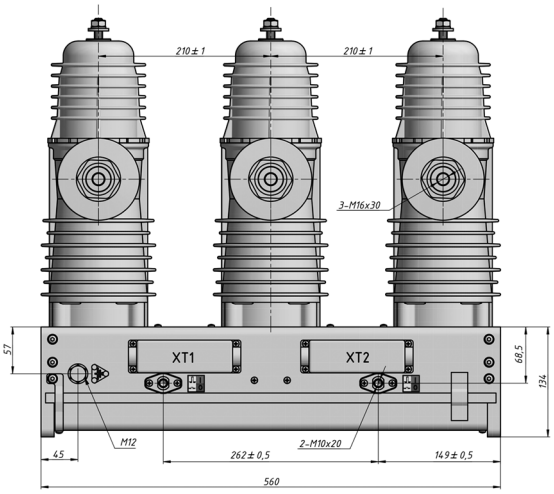
L_{max} = 280 mm
W_{max} = 570 mm
H_{max} = 632 mm

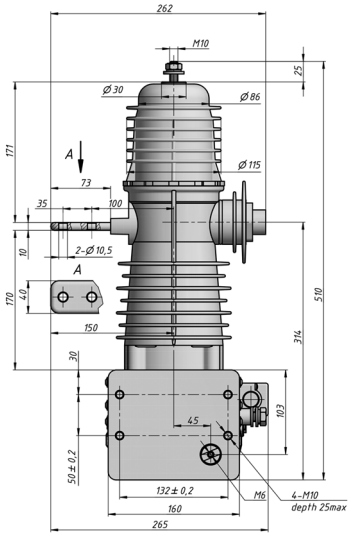


ISM15_HD_1(275),
PCD 275 mm,
Weight: 72 kg

L_{max} = 280 mm
W_{max} = 700 mm
H_{max} = 632 mm

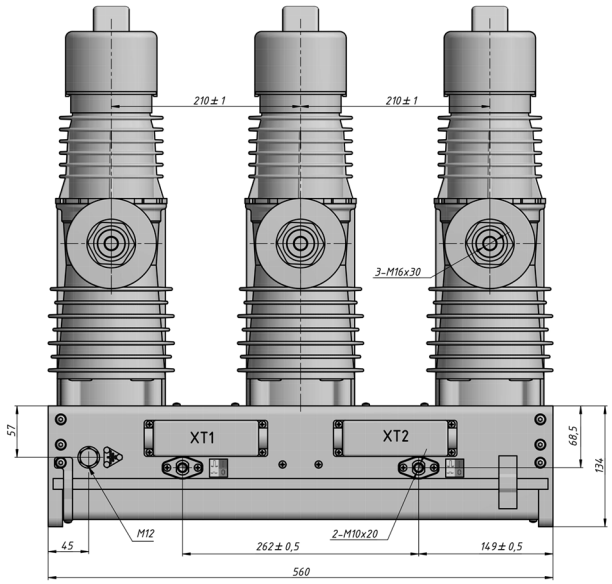
ISM25_LD

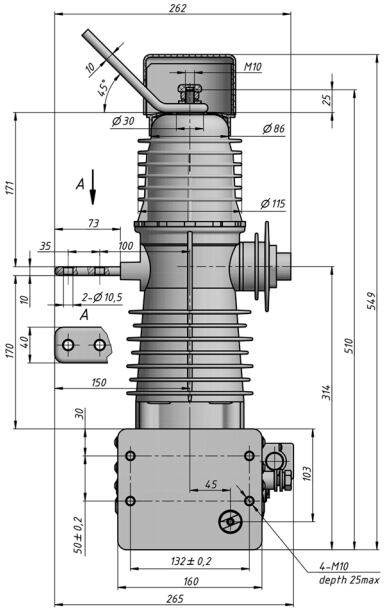




ISM25_LD_1(210_Par2),
PCD 210 mm
Weight: 36 kg

L_{max} = 265 mm
W_{max} = 560 mm
H_{max} = 510 mm

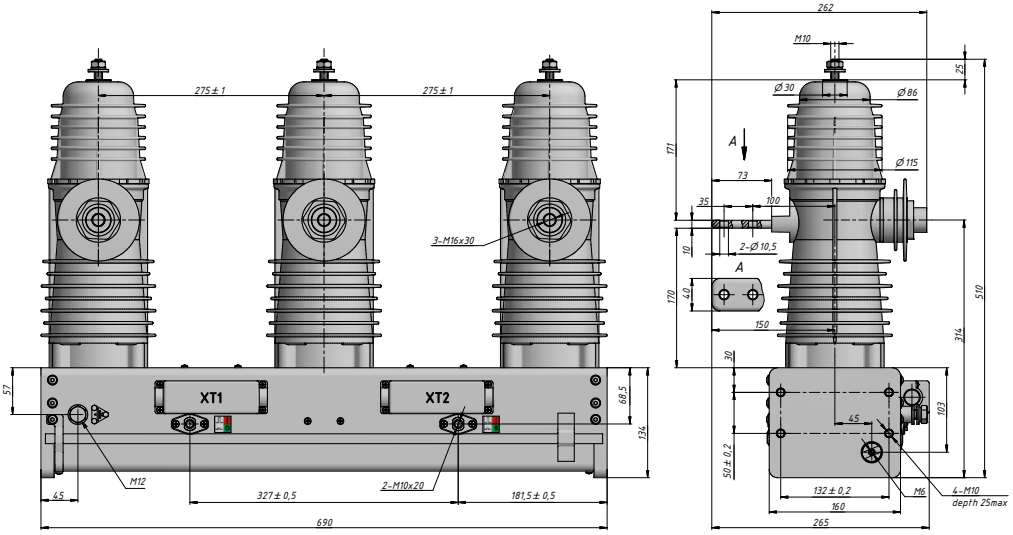




ISM25_LD_1(210_Par2) with CBkit_Ins_3 installed*,
PCD 210 mm,
Weight: 36,5 kg

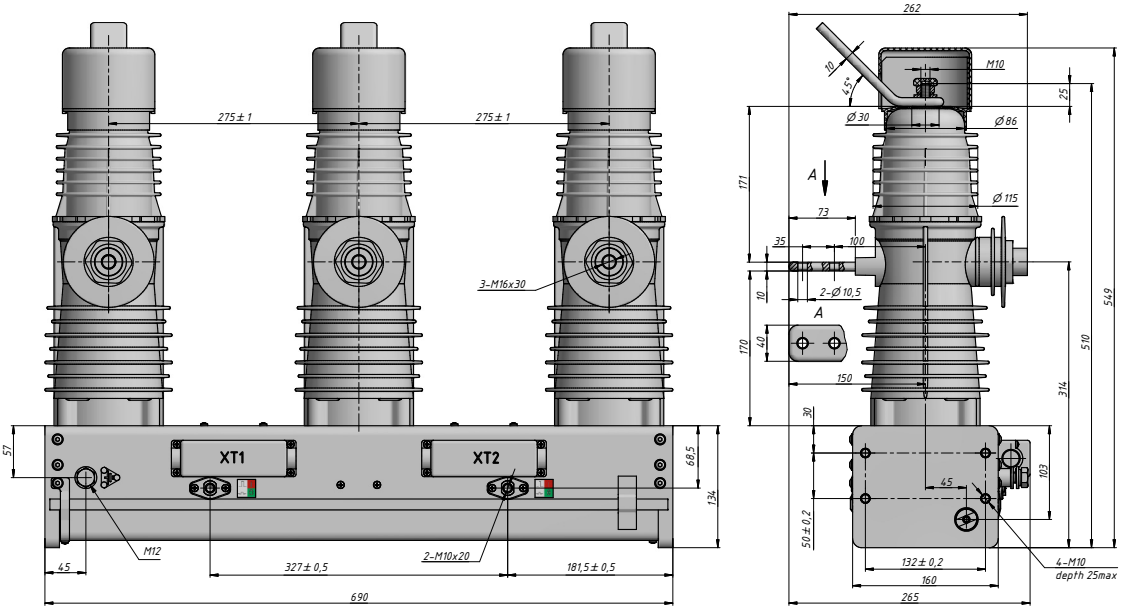
L_{max} = 265 mm
W_{max} = 560 mm
H_{max} = 549 mm

****- upper busbars shown for reference and are not supplied.***



ISM25_LD_1(275_S),
PCD 275 mm
Weight: 38 kg

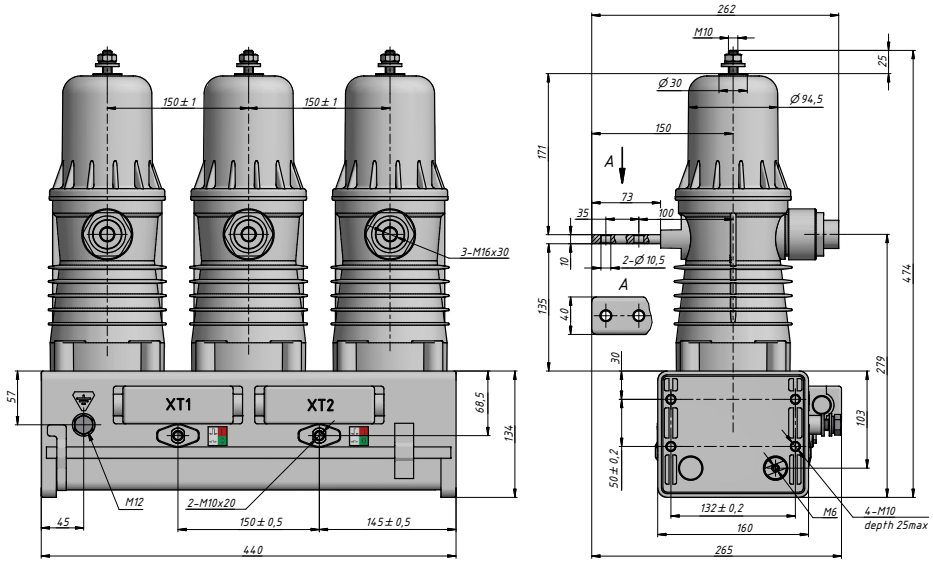
L_{max} = 265 mm
W_{max} = 690 mm
H_{max} = 510 mm



ISM25_LD_1(275_S) with CBkit_Ins_3 installed*,
PCD 275 mm,
Weight: 38,5 kg

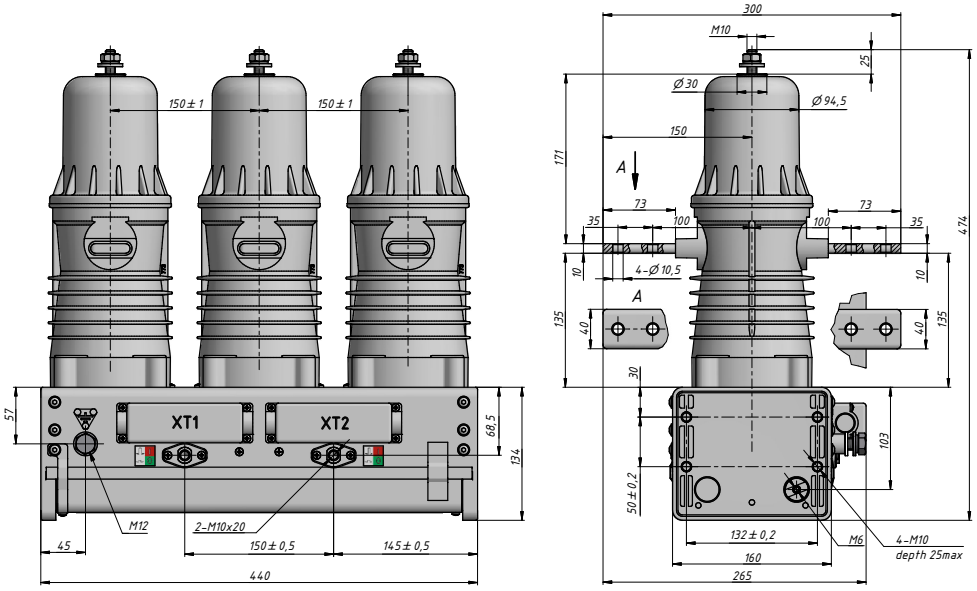
L_{max} = 265 mm
W_{max} = 690 mm
H_{max} = 549 mm

****- upper busbars shown for reference and are not supplied.***



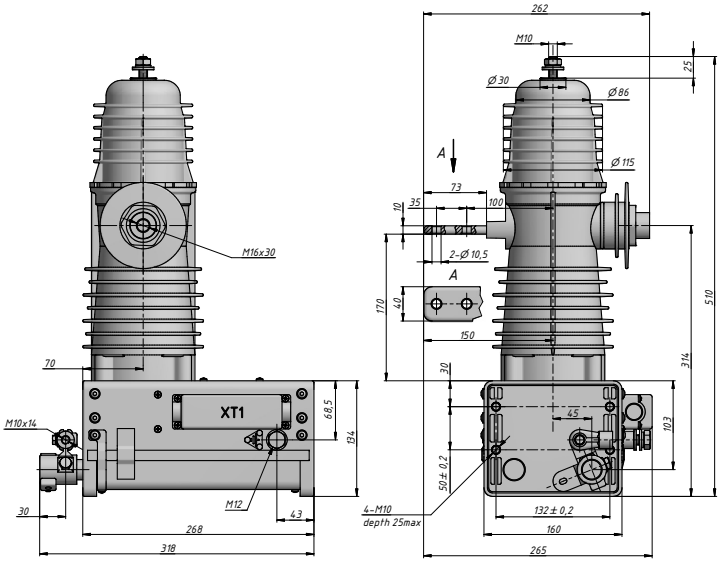
ISM25_LD_2(1),
PCD 150 mm
Weight: 35 kg

L_{max} = 265 mm
W_{max} = 440 mm
H_{max} = 474 mm



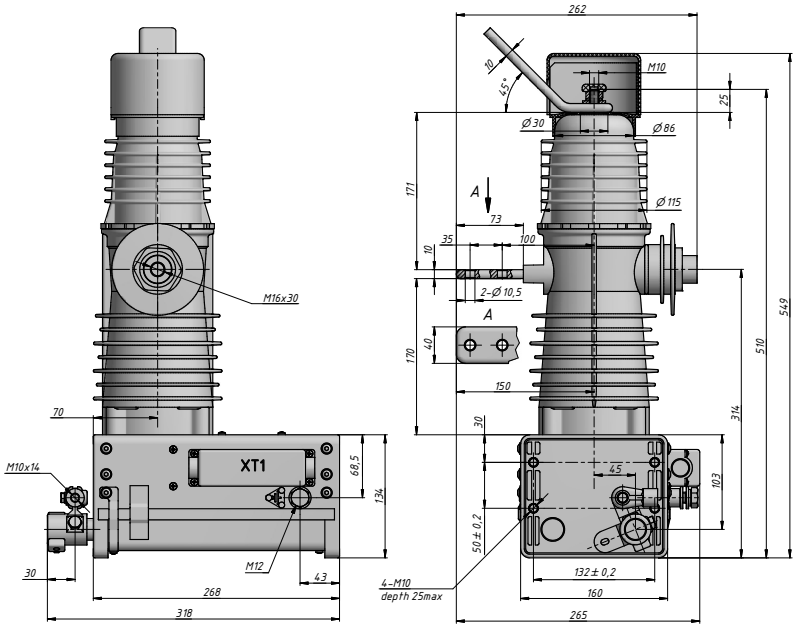
ISM25_LD_2(2),
PCD 150 mm
Weight: 37 kg

L_{max} = 300 mm
W_{max} = 440 mm
H_{max} = 474 mm



ISM25_LD_3,
Weight: 14 kg

L_{max} = 265 mm
W_{max} = 318 mm
H_{max} = 510 mm

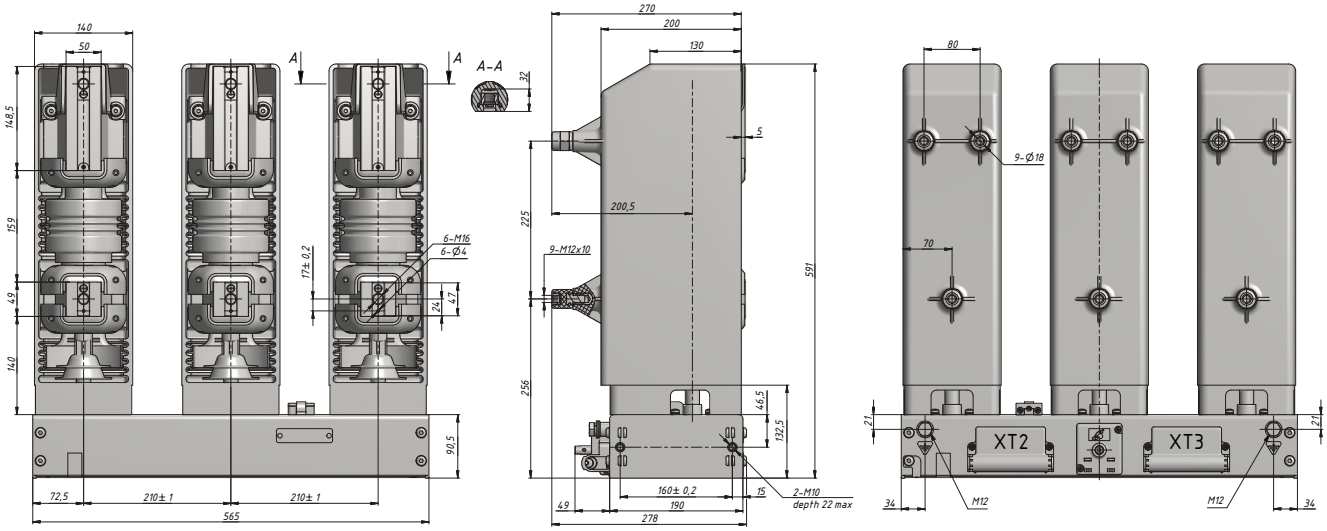


ISM25_LD_3 with CBkit_Ins_3 installed*,
Weight: 14,5 kg

L_{max} = 265 mm
W_{max} = 318 mm
H_{max} = 549 mm

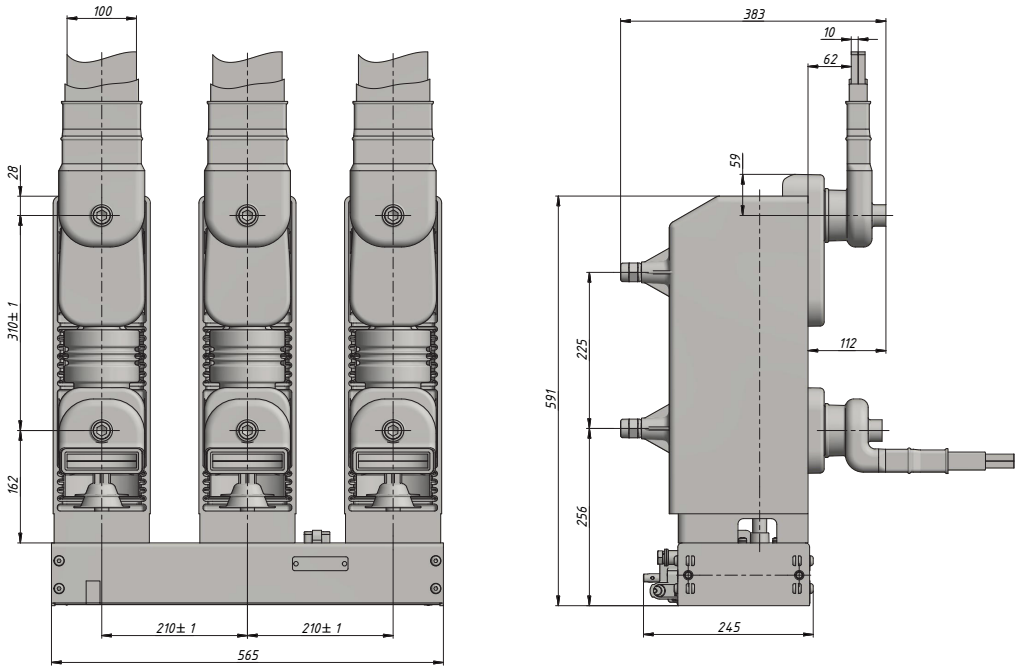
****- upper busbar shown for reference and is not supplied.***

ISM25_Shell



ISM25_Shell_2(210),
PCD 210 mm,
Weight: 53 kg

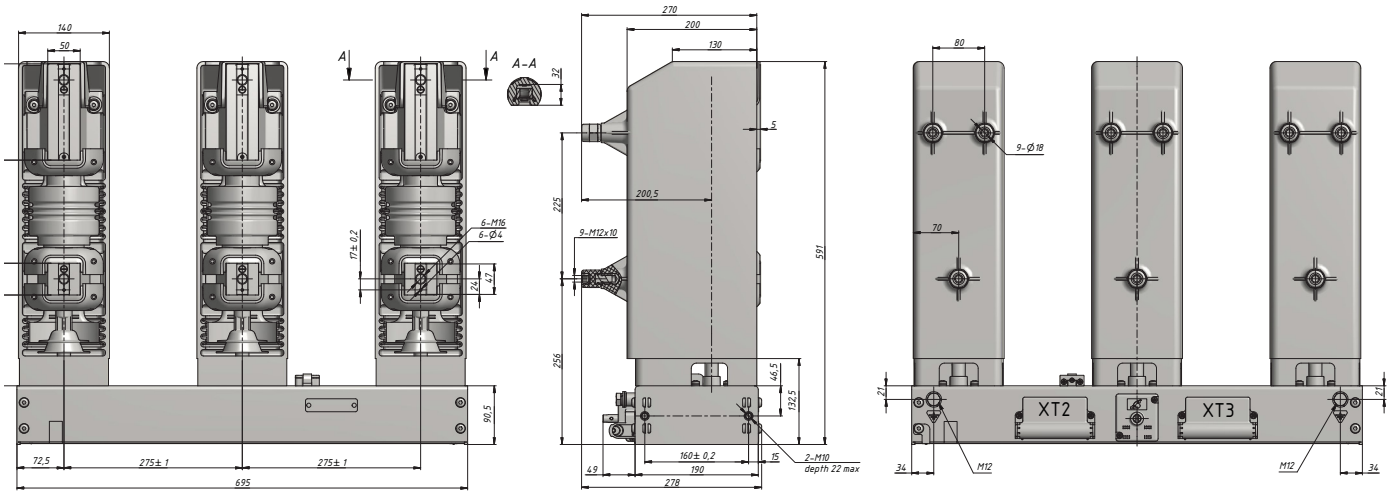
L_{max} = 278 mm
W_{max} = 565 mm
H_{max} = 591 mm



ISM25_Shell_2(210) with CBkit_Shell25_1 installed*,
PCD 210 mm,
Weight: 65,5 kg

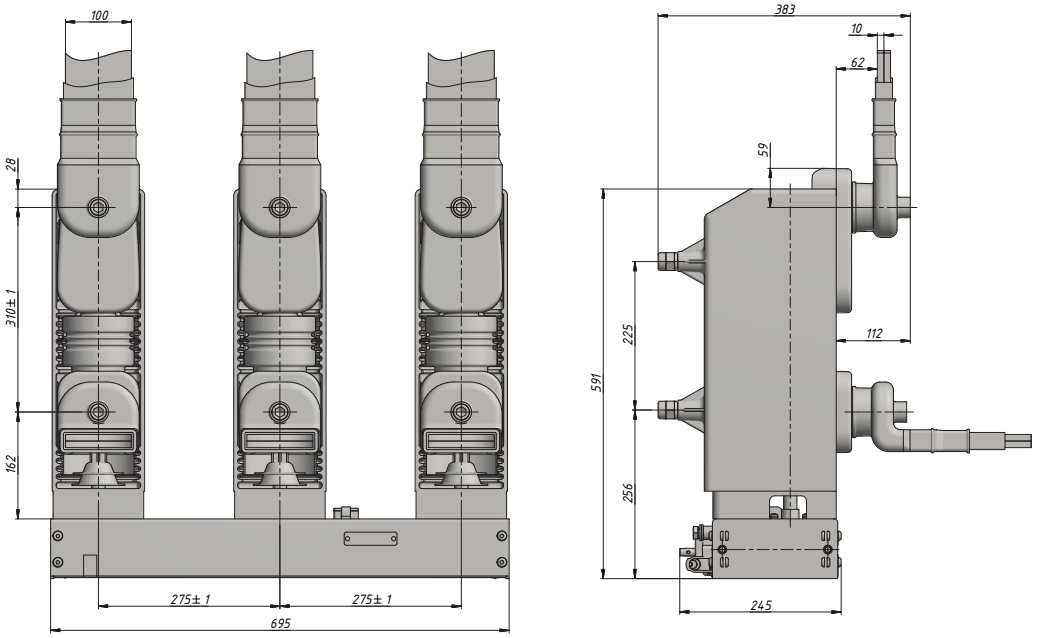
L_{max} = 383 mm
W_{max} = 565 mm
H_{max} = 622 mm

****- busbars shown for reference and are not supplied.***



ISM25_Shell_2(275),
PCD 275 mm,
Weight: 55 kg

L_{max} = 278 mm
W_{max} = 695 mm
H_{max} = 591 mm

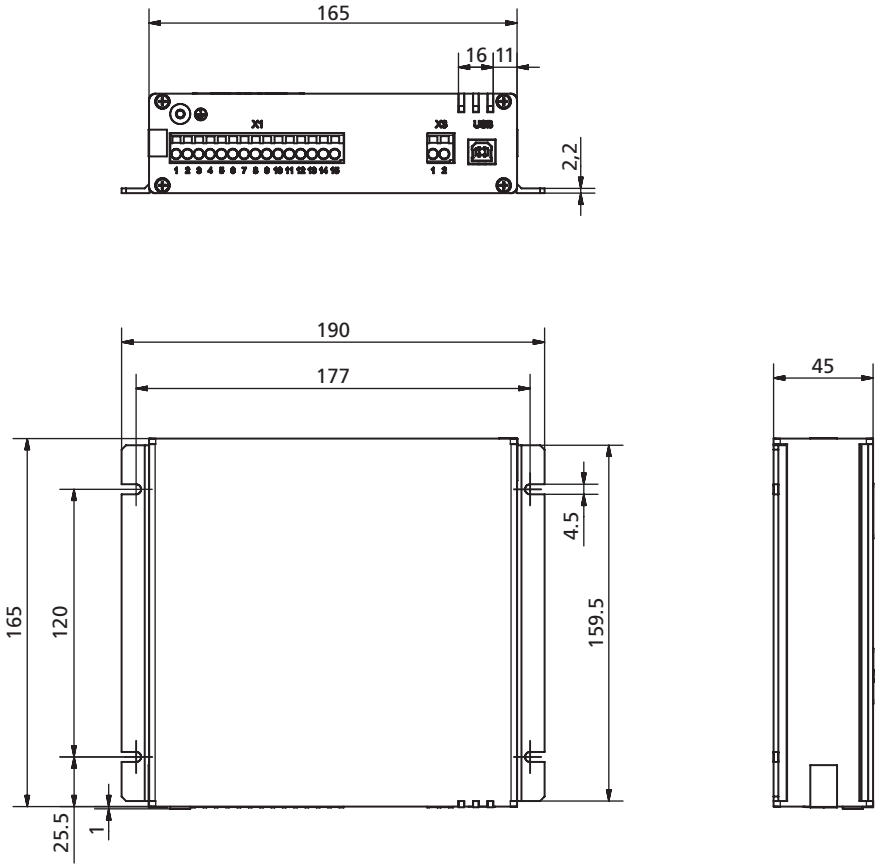


ISM25_Shell_2(275) with CBkit_Shell25_1 installed*,
PCD 275 mm,
Weight: 67,5 kg

L_{max} = 383 mm
W_{max} = 695 mm
H_{max} = 622 mm

****- busbars shown for reference and are not supplied.***

Dimensions of Control Module

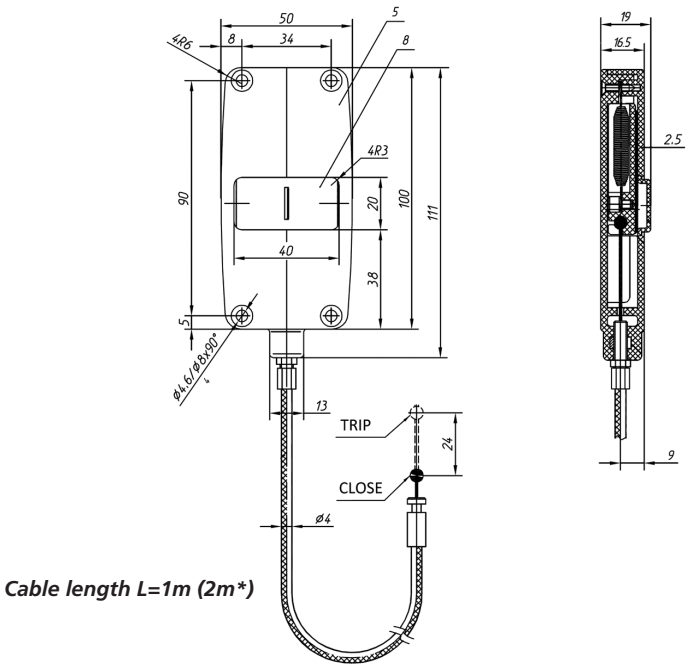


CM_16_1(Par1_Par2_Par3_Par4_Par5)
Weight: 1 kg

L_{max} = 165 mm
W_{max} = 190 mm
H_{max} = 45 mm

Dimensions of accessories

Dimensions of Position Indicator

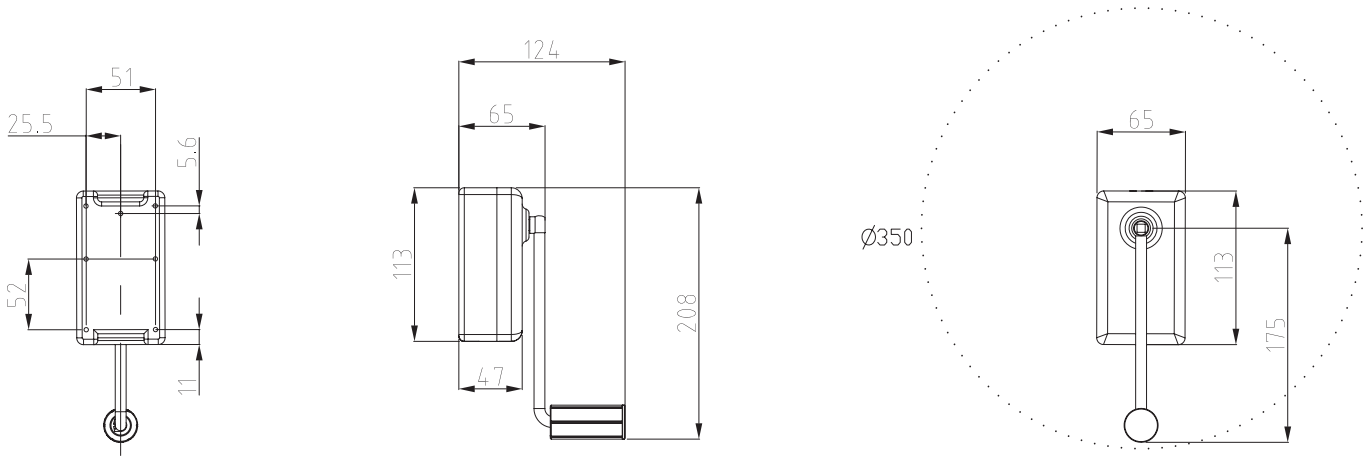


Cable length L=1m (2m*)

CBkit_PosInd_1(1000)

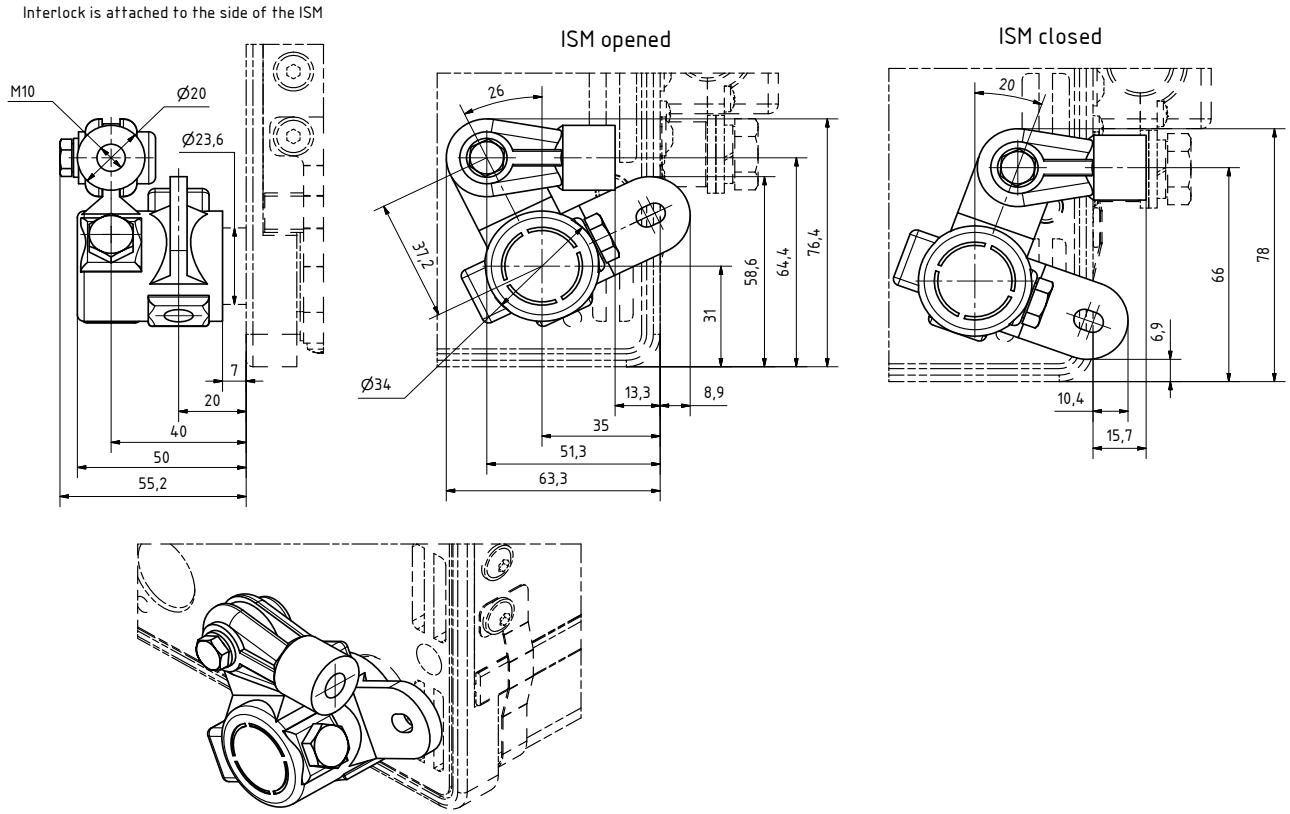
**** 2 m for CBkit_PosInd_1(2000)***

Dimensions of Manual Generator

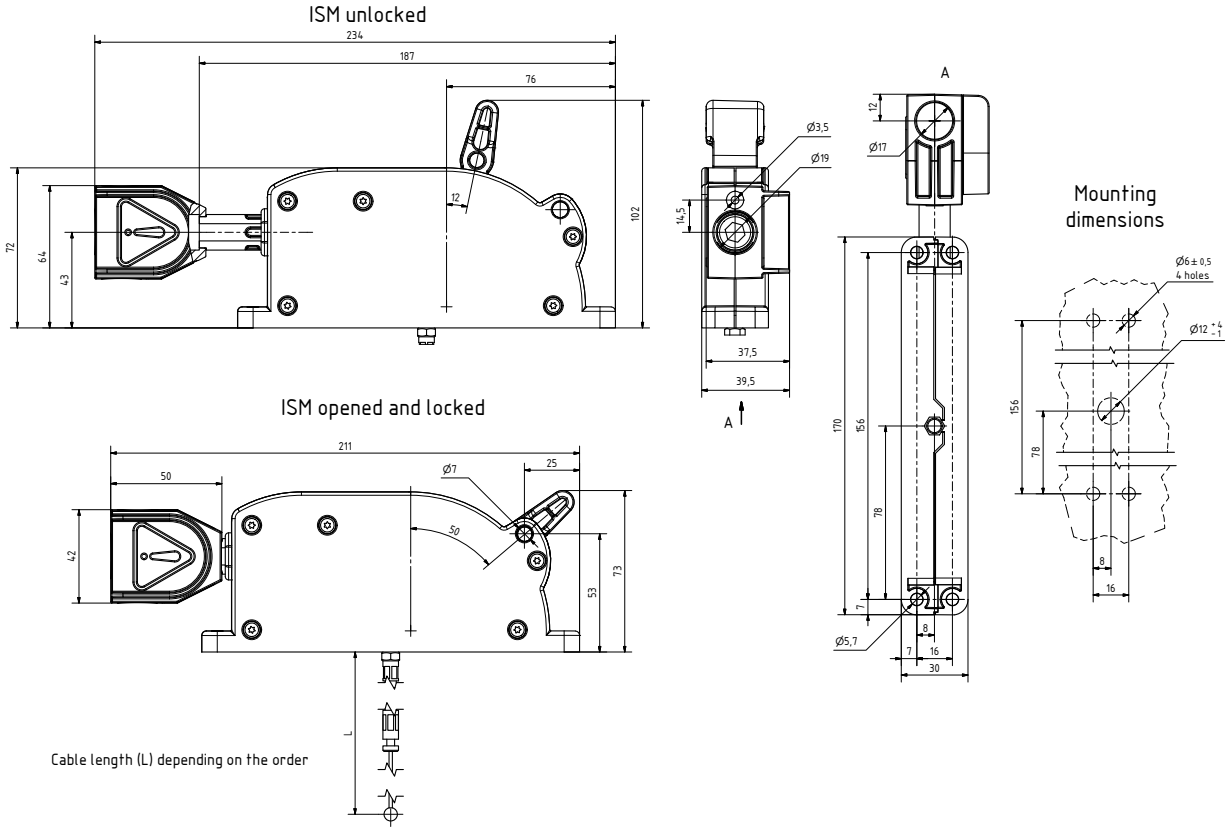


CBunit_ManGen_1, CBunit_ ManGen_2

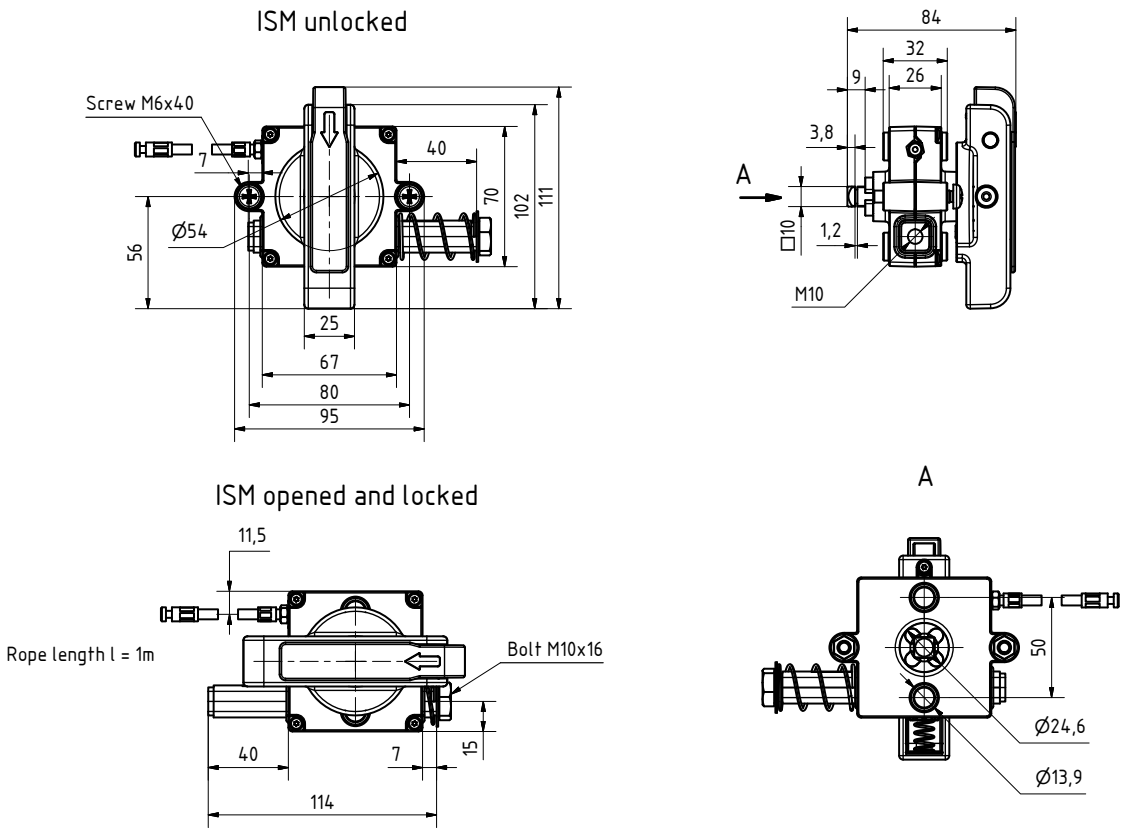
Dimensions of Interlocking Kits



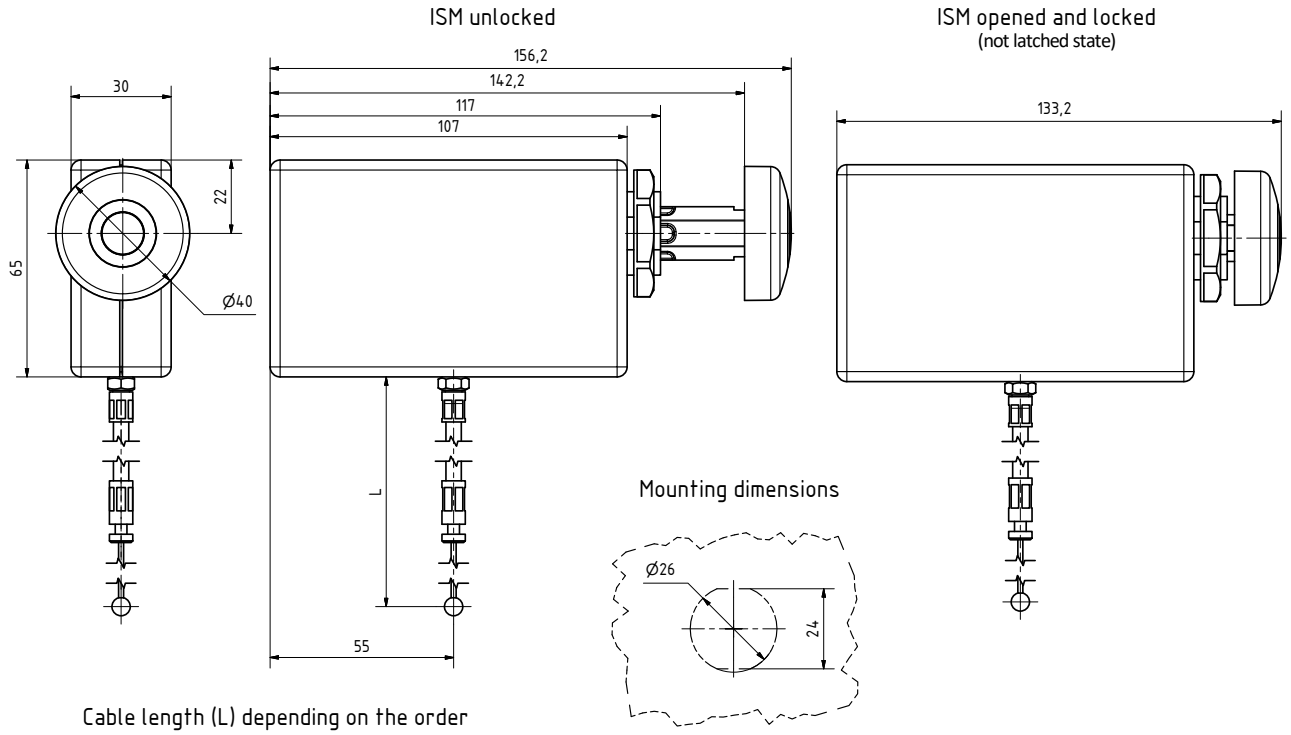
CBkit_Interlock_1



CBkit_Interlock_3



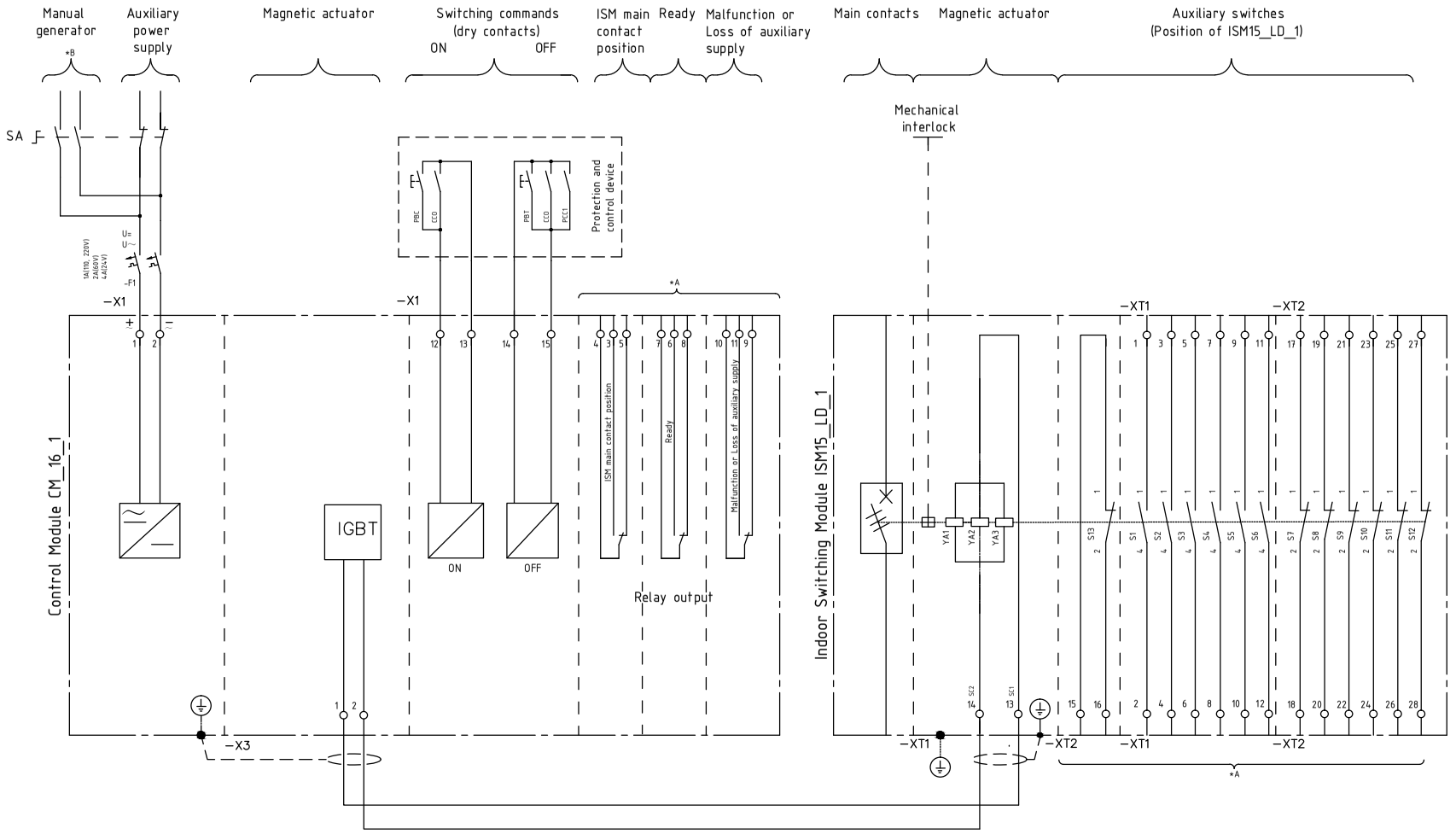
CBkit_Interlock_4



CBkit_Interlock_5

Appendix 4.
Secondary Schemes

VCB15_LD1_16.F
Standard circuit breaker application (CB)



Legend:

*A	Wiring of auxiliary switches, relay outputs, according to customer specification;	CCO	Control command ON, OFF;
*B	Manual generator (optional);	PCC1	Protection control contact 1;
SA	Power supply selector switch (optional);	XT1–XT2	Terminal block of switching module;
F1	Miniature protective circuit breaker (MPCB); F1 should be selected to withstand CM inrush current levels given in VCB Product Guide;	X1, X3	Terminal block of control module;
		S1–S13	Auxiliary switch of ISM;
		YA1–YA3	Actuator coils.
PBC	Push button close;		
PBT	Push button trip;		
IGBT	Transistor bridge (coils control);		

States of the relays „Malfunction or Loss of auxiliary supply" and „Ready" are shown at power supply off.
State of the relay „ISM main contact position" is shown at ISM open state. It keeps its position at absent of power supply.

Projection

Dimensions in mm

Designed by	Checked by	Approved by	Date	Filename	Date	Weight	Scale
I.Matlakova	A.Migunov	A.Migunov	07.10.2019	TES_VCB15_LD1_16.FED4	07.10.2019	–	

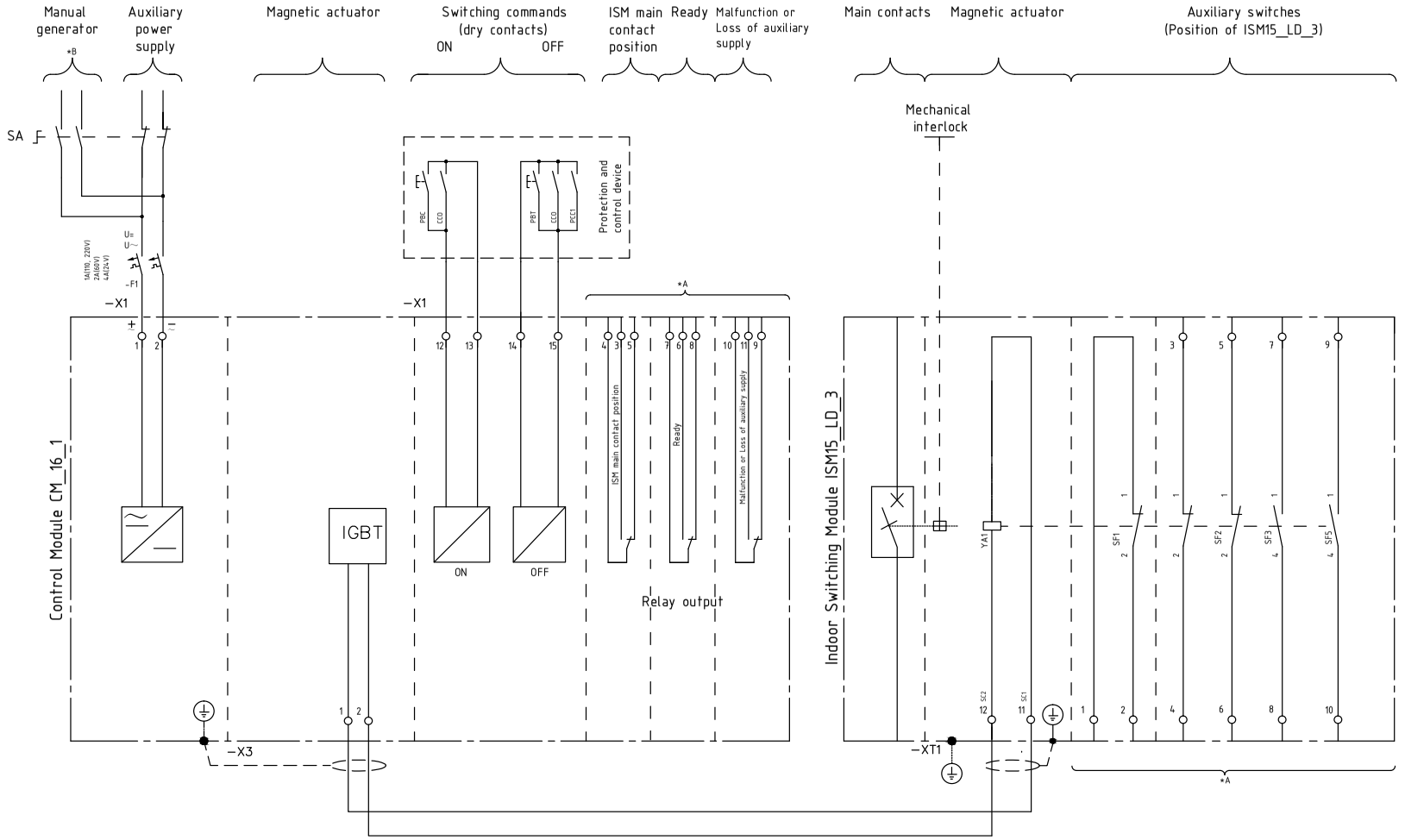
TAVRIDA ELECTRIC TES

Switching module
Electrical Connection Diagram

TES_VCB15_LD1_16.FED4	Edition	Sheet
	B	1 / 1

VCB15_LD3_16.F

Standard circuit breaker application (CB)



Legend:

*A	Wiring of auxiliary switches, relay outputs, according to customer specification;
*B	Manual generator (optional);
SA	Power supply selector switch (optional);
F1	Miniature protective circuit breaker (MPCB); F1 should be selected to withstand CM inrush current levels given in VCB Product Guide;
PBC	Push button close;
PBT	Push button trip;
IGBT	Transistor bridge (coils control);
CCO	Control command ON, OFF;
PCC1	Protection control contact 1;
XT1	Terminal block of switching module;
X1, X3	Terminal block of control module;
YA1	Actuator coil.

States of the relays „Malfunction or Loss of auxiliary supply" and „Ready" are shown at power supply off.
State of the relay „ISM main contact position" is shown at ISM open state. It keeps its position at absent of power supply.

Projection

Dimensions in mm

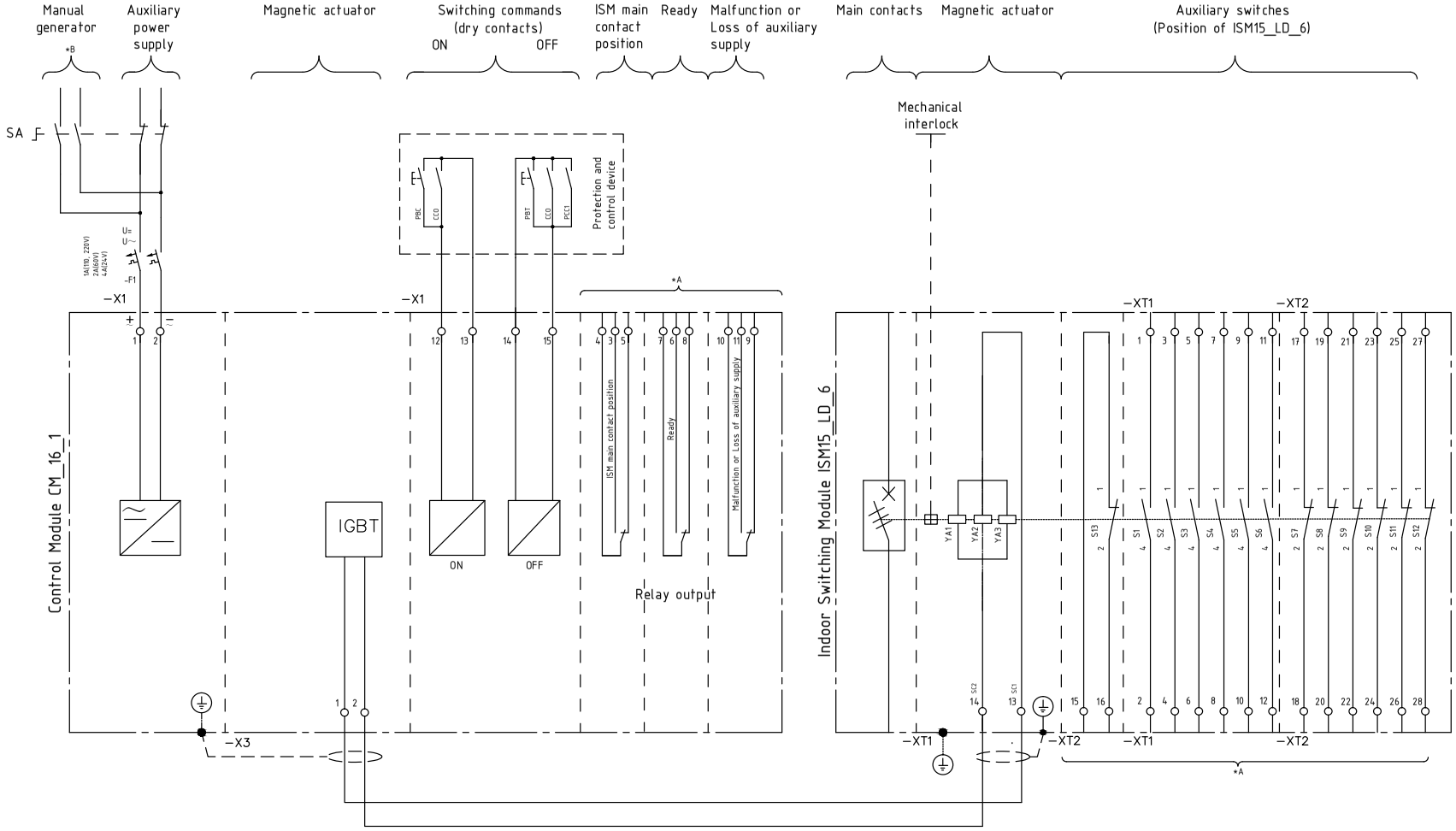
Designed by	Checked by	Approved by	Date	Filename	Date	Weight	Scale
I.Matlakova	A.Migunov	A.Migunov	07.10.2019	TES_VCB15_LD3_16.FED4	07.10.2019	-	

TAVRIDA ELECTRIC
TES

Switching module
Electrical Connection Diagram

TES_VCB15_LD3_16.FED4	Edition	Sheet
	B	1 / 1

VCB15_LD6_16.RD
Standard circuit breaker application (CB)



Legend:

*A	Wiring of auxiliary switches, relay outputs, according to customer specification;	CCO	Control command ON, OFF;
*B	Manual generator (optional);	PCC1	Protection control contact 1;
SA	Power supply selector switch (optional);	XT1-XT2	Terminal block of switching module;
F1	Miniature protective circuit breaker (MPCB); F1 should be selected to withstand CM inrush current levels given in VCB Product Guide;	X1, X3	Terminal block of control module;
		S1~S13	Auxiliary switch of ISM;
PBC	Push button close;	YA1-YA3	Actuator coils.
PBT	Push button trip;		
IGBT	Transistor bridge (coils control);		

States of the relays „Malfunction or Loss of auxiliary supply" and „Ready" are shown at power supply off.
State of the relay „ISM main contact position" is shown at ISM open state. It keeps its position at absent of power supply.

Projection

Dimensions in mm

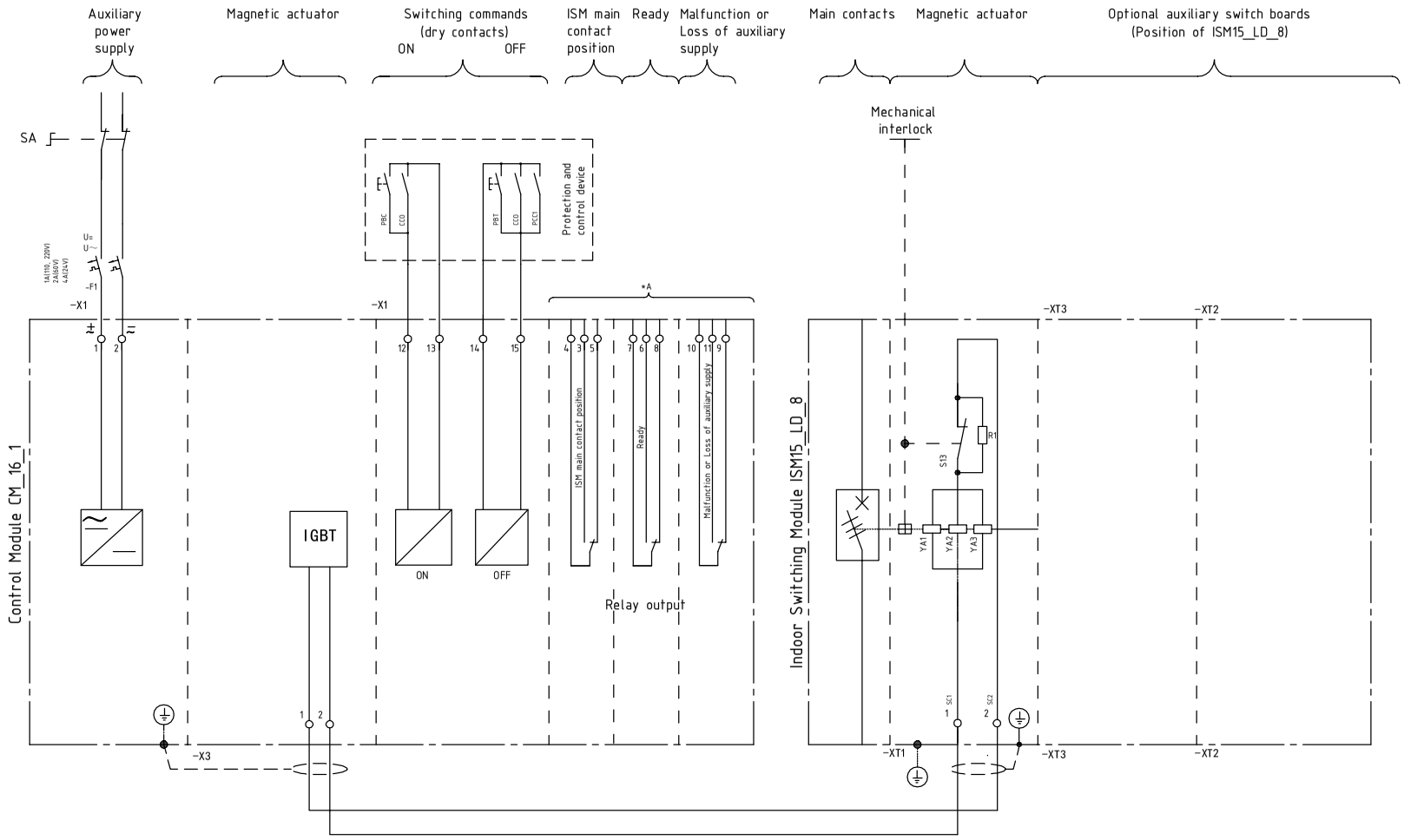
Designed by	Checked by	Approved by	Date	Filename	Date	Weight	Scale
I.Matlakova	A.Migunov	A.Migunov	07.10.2019	TES_VCB15_LD6_16.RDED4	07.10.2019	-	

TAVRIDA ELECTRIC
TES

Switching module
Electrical Connection Diagram

TES_VCB15_LD6_16.RDED4	Edition	Sheet
	B	1 / 1

VCB15_LD8_16F
Standard circuit breaker application (CB)



Legend:

*A	Wiring of auxiliary switches, relay outputs, according to customer specification;	CCO	Control command ON, OFF;
SA	Power supply switch (optional);	PCC1	Protection control contact 1;
F1	Miniature protective circuit breaker (MPCB); F1 should be selected to withstand CM inrush current levels given in VCB Product Guide;	XT1–XT3	Terminal block of switching module;
		X1,X3	Terminal block of control module;
		S1–S12	Auxiliary switch of ISM;
PBC	Push button close;	S13	Auxiliary switch for mechanical interlock; S13 is at inactivated position;
PBT	Push button trip;	YA1–YA3	Actuator coils;
IGBT	Transistor bridge (coils control);	R1	Resistor 22kOhm.

States of the relays „ Malfunction or Loss of auxiliary supply " and „Ready" are shown at power supply off.
State of the relay „ISM main contact position" is shown at ISM open state. It keeps its position at absent of power supply.

Projection

Dimensions in mm

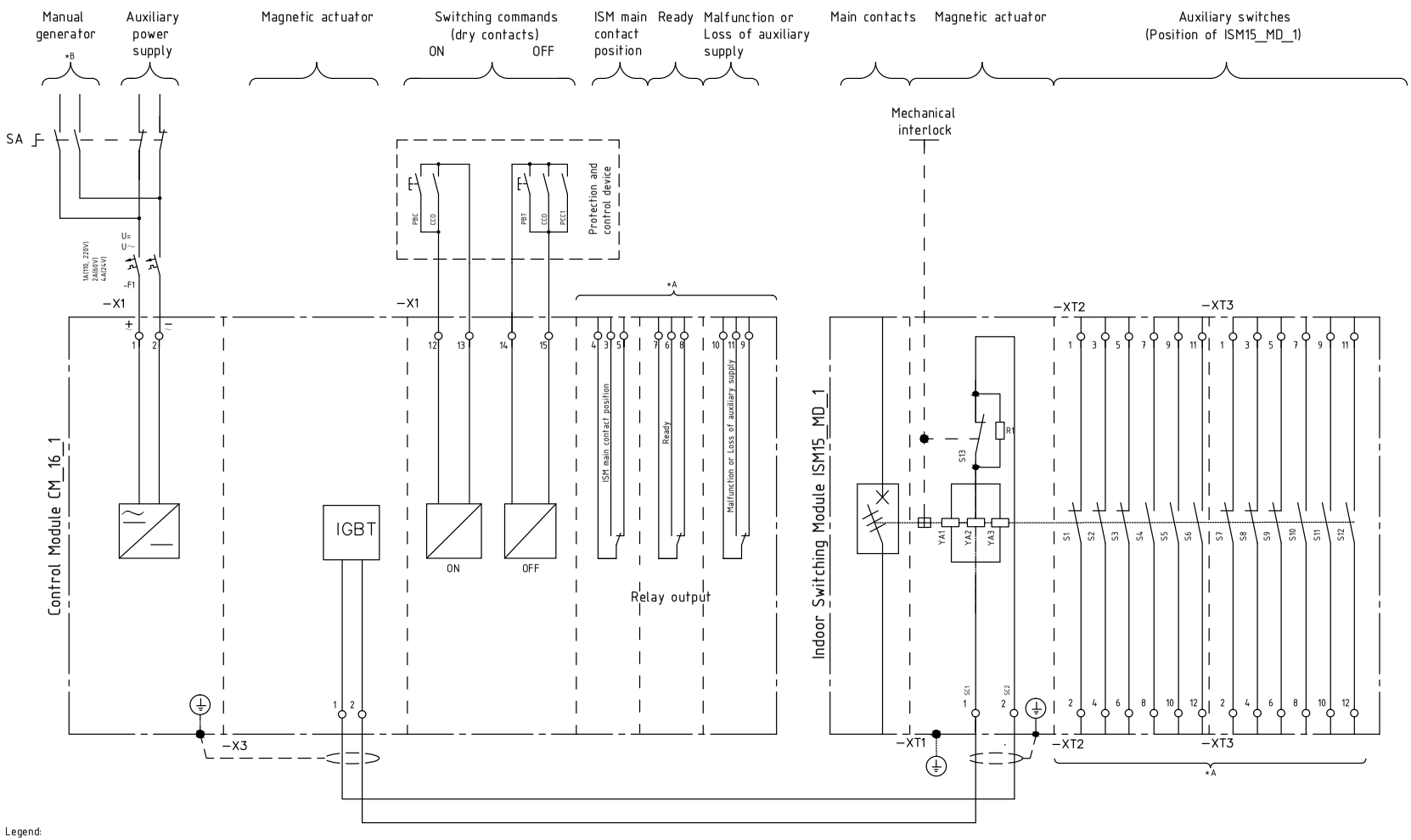
Designed by	Checked by	Approved by	Date	Filename	Date	Weight	Scale
A. Ishchenko	V. Shimchenko	A.Migunov	21.02.2020	TES_VCB15_LD8_16FED4	21.02.2020	-	

TAVRIDA ELECTRIC TES

Switching module
Electrical Connection Diagram

TES_VCB15_LD8_16FED4	Edition	Sheet
	C	1 / 1

VCB15_MD1_16.F
Standard circuit breaker application (CB)



Legend:

*A	Wiring of auxiliary switches, relay outputs, according to customer specification;	CCO	Control command ON, OFF;
*B	Manual generator (optional);	PCC1	Protection control contact 1;
SA	Power supply selector switch (optional);	XT1–XT2	Terminal block of switching module;
F1	Miniature protective circuit breaker (MPCB); F1 should be selected to withstand CM inrush current levels given in VCB Product Guide;	X1,X3	Terminal block of control module;
		S1—S12	Auxiliary switch of ISM;
		S13	Auxiliary switch for mechanical interlock; S13 is at inactivated position;
PBC	Push button close;	YA1–YA3	Actuator coils;
PBT	Push button trip;	R1	Resistor 22kOhm.
IGBT	Transistor bridge (coils control);		

States of the relays „Malfunction or Loss of auxiliary supply" and „Ready" are shown at power supply off.
State of the relay „ISM main contact position" is shown at ISM open state. It keeps its position at absent of power supply.

Projection

Dimensions in mm

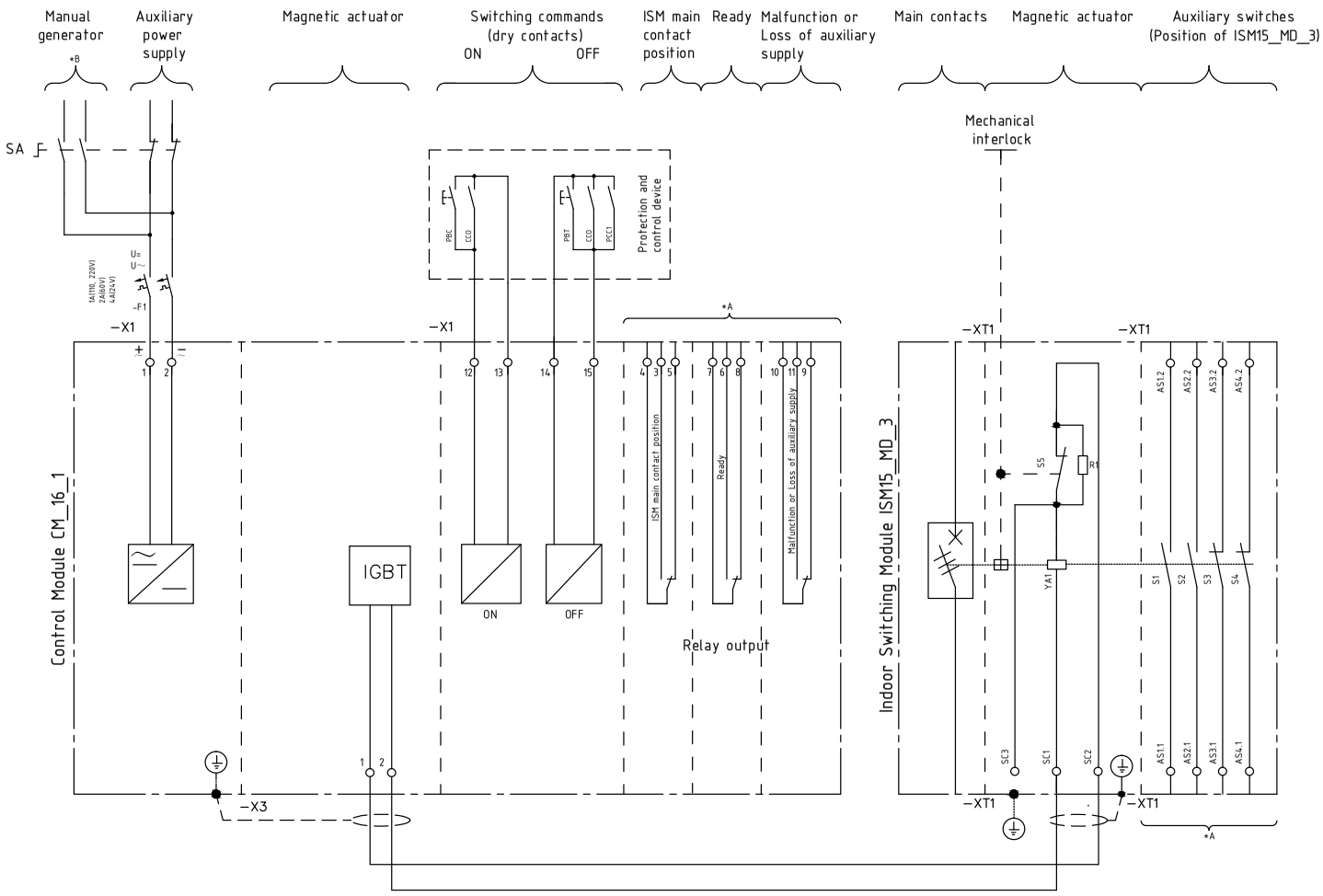
Designed by	Checked by	Approved by	Date	Filename	Date	Weight	Scale
A. Ishchenko	V. Shimchenko	A.Migunov	07.10.2019	TES_VCB15_MD1_16.FED4	07.10.2019	-	

TAVRIDA ELECTRIC TES

Switching module
Electrical Connection Diagram

TES_VCB15_MD1_16.FED4	Edition	Sheet
	B	1 / 1

VCB15_MD3_16.F
Standard circuit breaker application (CB)



Legend:

*A	Wiring of auxiliary switches, relay outputs, according to customer specification;	CCO	Control command ON, OFF;
*B	Manual generator (optional);	PCC1	Protection control contact 1;
SA	Power supply selector switch (optional);	XT1	Terminal block of switching module;
F1	Miniature protective circuit breaker (MPCB); F1 should be selected to withstand CM inrush current levels given in VCB Product Guide;	X1,X3	Terminal block of control module;
		S1—S4	Auxiliary switch of ISM;
		S5	Auxiliary switch for mechanical interlock; S5 is at inactivated position;
PBC	Push button close;	YA1	Actuator coil;
PBT	Push button trip;	R1	Resistor 22kOhm.
IGBT	Transistor bridge (coils control);		

States of the relays „Malfunction or Loss of auxiliary supply" and „Ready" are shown at power supply off.
State of the relay „ISM main contact position" is shown at ISM open state. It keeps its position at absent of power supply.

Projection

Dimensions in mm

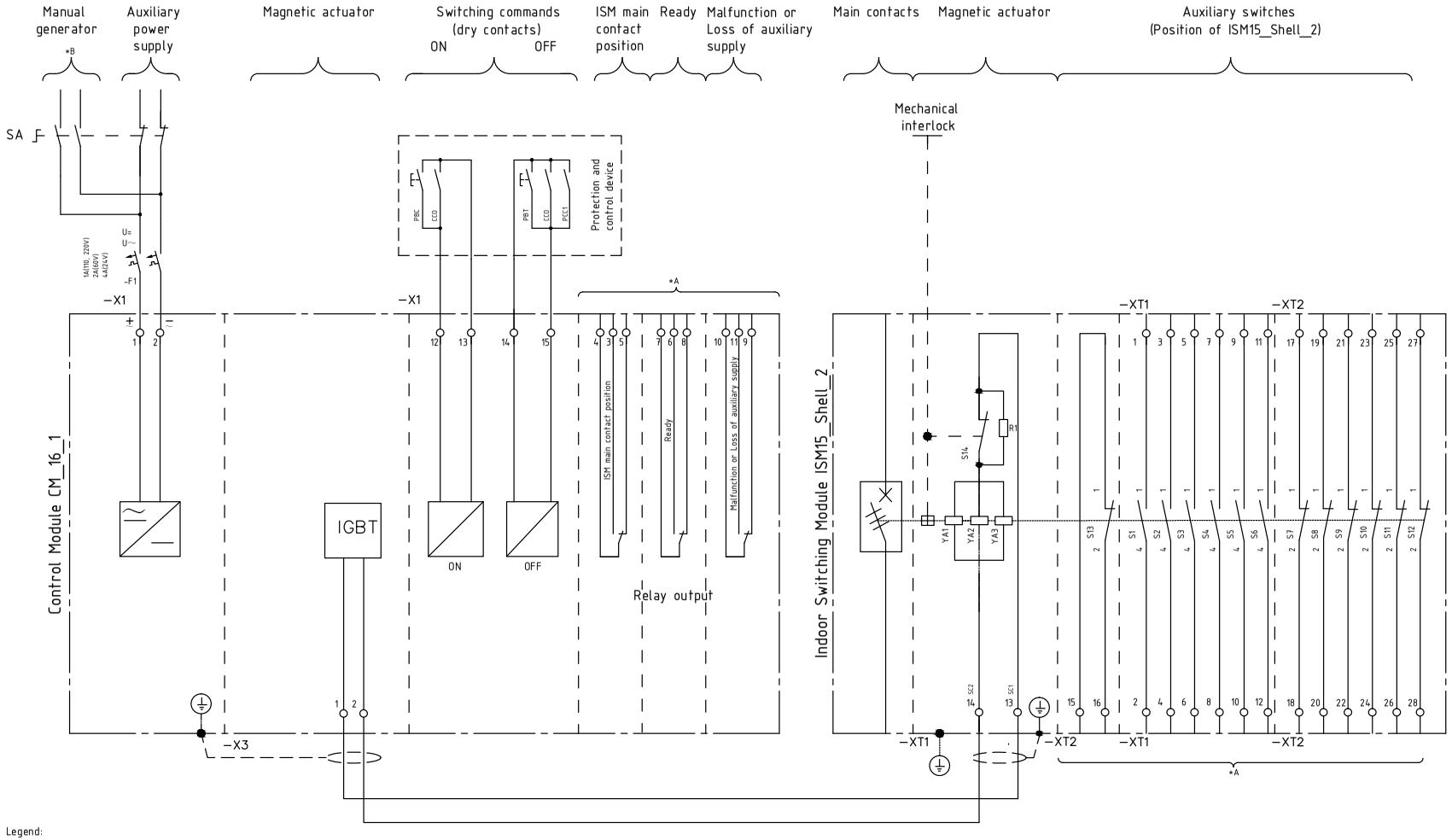
Designed by	Checked by	Approved by	Date	Filename	Date	Weight	Scale
R.Mudrak	A.Migunov	V.Minaev	07.10.2019	TES_VCB15_MD3_16.FED4	07.10.2019	-	

TAVRIDA ELECTRIC
TES

Switching module
Electrical Connection Diagram

TES_VCB15_MD3_16.FED4	Edition	Sheet
	B	1 / 1

VCB15_Shell2_16.F
Standard circuit breaker application (CB)



Legend:

*A	Wiring of auxiliary switches, relay outputs, according to customer specification;
*B	Manual generator (optional);
SA	Power supply selector switch (optional);
F1	Miniature protective circuit breaker (MPCB); F1 should be selected to withstand CM inrush current levels given in VCB Product Guide;
PBC	Push button close;
PBT	Push button trip;
IGBT	Transistor bridge (coils control);
CCO	Control command ON, OFF;
PCC1	Protection control contact 1;
XT1-XT2	Terminal block of switching module;
X1,X3	Terminal block of control module;
S1~S13	Auxiliary switch of ISM;
S14	Auxiliary switch for mechanical interlock; S14 is at inactivated position;
YA1-YA3	Actuator coils;
R1	Resistor 22kOhm.

States of the relays „Malfunction or Loss of auxiliary supply" and „Ready" are shown at power supply off.
State of the relay „ISM main contact position" is shown at ISM open state. It keeps its position at absent of power supply.

Projection
Dimensions in mm

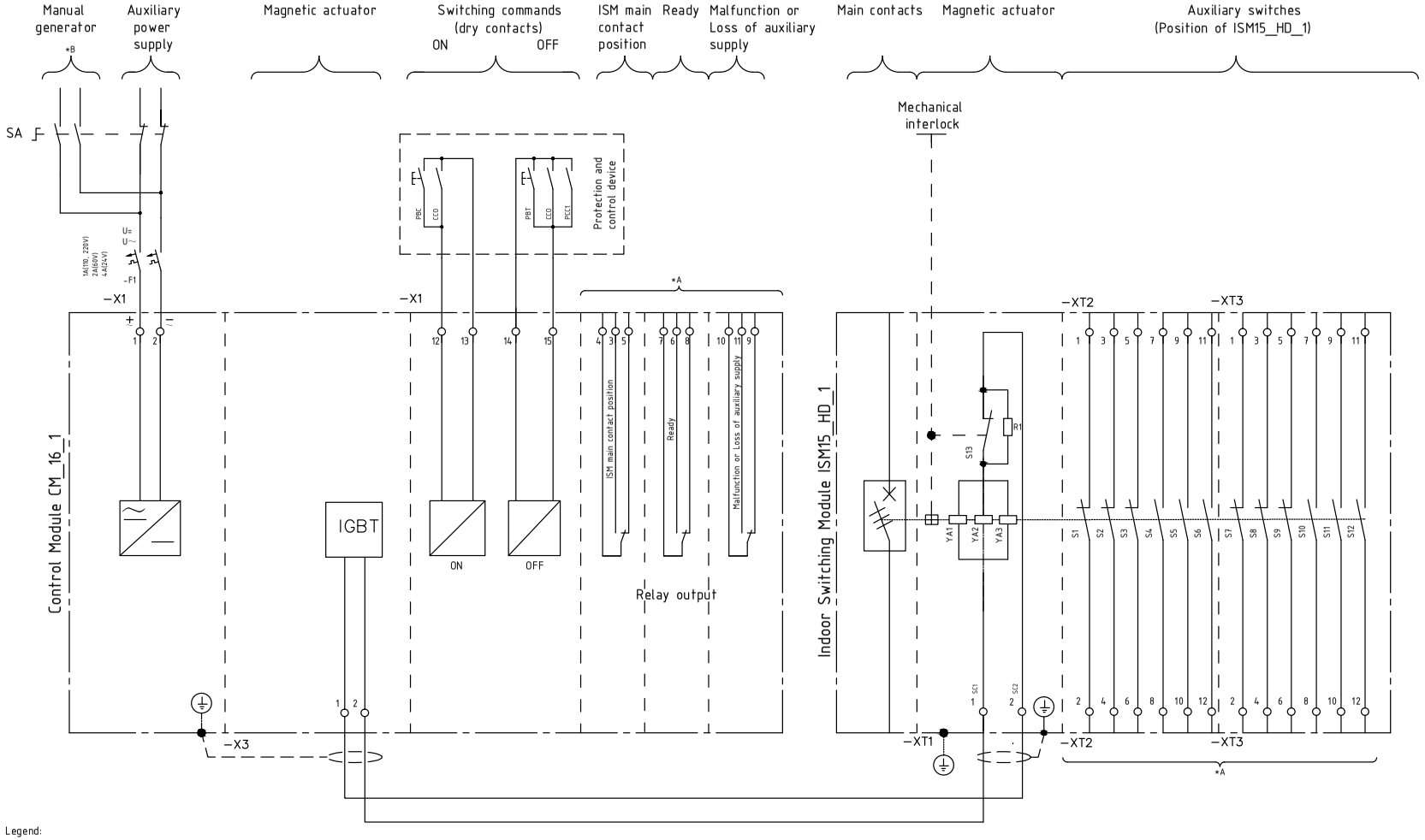
Designed by	Checked by	Approved by	Date	Filename	Date	Weight	Scale
I.Matlakova	A.Migunov	A.Migunov	07.10.2019	TES_VCB15_Shell2_16.FED4	07.10.2019	-	

TAVRIDA ELECTRIC TES

Switching module
Electrical Connection Diagram

TES_VCB15_Shell2_16.FED4	Edition	Sheet
	B	1 / 1

VCB15_HD1_16.F
Standard circuit breaker application (CB)



Legend:

*A	Wiring of auxiliary switches, relay outputs, according to customer specification;
*B	Manual generator (optional);
SA	Power supply selector switch (optional);
F1	Miniature protective circuit breaker (MPCB); F1 should be selected to withstand CM inrush current levels given in VCB Product Guide;
PBC	Push button close;
PBT	Push button trip;
IGBT	Transistor bridge (coils control);
CCO	Control command ON, OFF;
PCC1	Protection control contact 1;
XT1-XT2	Terminal block of switching module;
X1,X3	Terminal block of control module;
S1~S12	Auxiliary switch of ISM;
S13	Auxiliary switch for mechanical interlock; S13 is at inactivated position;
YA1-YA3	Actuator coils;
R1	Resistor 22kOhm.

States of the relays „Malfunction or Loss of auxiliary supply" and „Ready" are shown at power supply off.
State of the relay „ISM main contact position" is shown at ISM open state. It keeps its position at absent of power supply.

Projection

Dimensions in mm

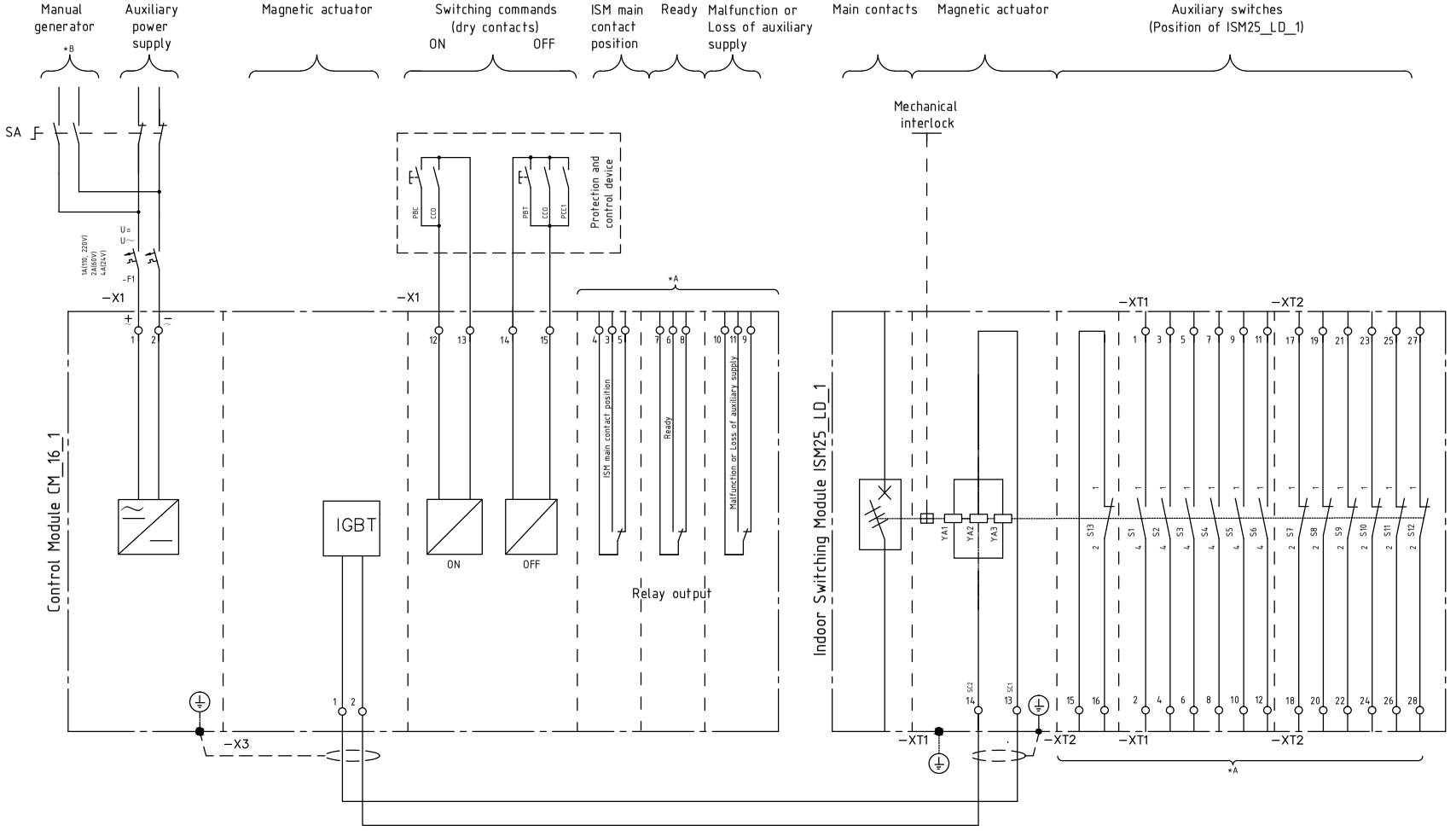
Designed by	Checked by	Approved by	Date	Filename	Date	Weight	Scale
A. Ishchenko	V. Shimchenko	A.Migunov	07.10.2019	TES_VCB15_HD1_16.FED4	07.10.2019	-	

TAVRIDA ELECTRIC
TES

Switching module
Electrical Connection Diagram

TES_VCB15_HD1_16.FED4	Edition	Sheet
	B	1 / 1

VCB25_LD1_16.F
Standard circuit breaker application (CB)



Legend:

*A	Wiring of auxiliary switches, relay outputs, according to customer specification;
*B	Manual generator (optional);
SA	Power supply selector switch (optional);
F1	Miniature protective circuit breaker (MPCB); F1 should be selected to withstand CM inrush current levels given in VCB Product Guide;
PBC	Push button close;
PBT	Push button trip;
IGBT	Transistor bridge (coils control);
CCO	Control command ON, OFF;
PCC1	Protection control contact 1;
XT1–XT2	Terminal block of switching module;
X1, X3	Terminal block of control module;
S1~S13	Auxiliary switch of ISM;
YA1–YA3	Actuator coils.

States of the relays „Malfunction or Loss of auxiliary supply" and „Ready" are shown at power supply off.
State of the relay „ISM main contact position" is shown at ISM open state. It keeps its position at absent of power supply.

Projection

Dimensions in mm

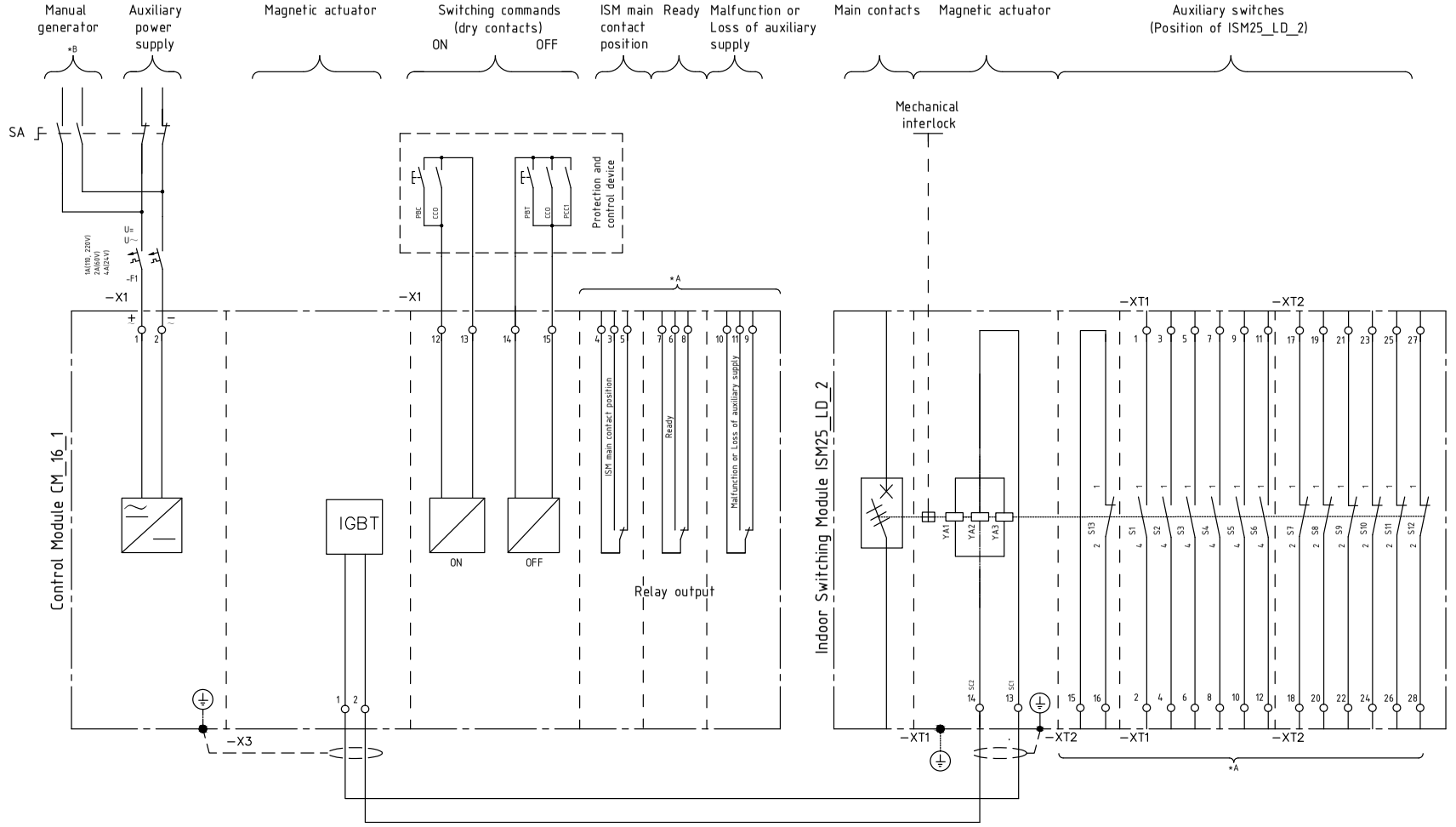
Designed by	Checked by	Approved by	Date	Filename	Date	Weight	Scale
I.Matlakova	A.Migunov	A.Migunov	07.10.2019	TES_VCB25_LD1_16.FED4	07.10.2019	-	

TAVRIDA ELECTRIC TES

Switching module
Electrical Connection Diagram

TES_VCB25_LD1_16.FED4	Edition	Sheet
	B	1 / 1

VCB25_LD2_16.F
Standard circuit breaker application (CB)



Legend:

*A	Wiring of auxiliary switches, relay outputs, according to customer specification;	CCO	Control command ON, OFF;
*B	Manual generator (optional);	PCC1	Protection control contact 1;
SA	Power supply selector switch (optional);	XT1–XT2	Terminal block of switching module;
F1	Miniature protective circuit breaker (MPCB); F1 should be selected to withstand CM inrush current levels given in VCB Product Guide;	X1, X3	Terminal block of control module;
		S1~S13	Auxiliary switch of ISM;
PBC	Push button close;	YA1–YA3	Actuator coils.
PBT	Push button trip;		
IGBT	Transistor bridge (coils control);		

States of the relays „Malfunction or Loss of auxiliary supply" and „Ready" are shown at power supply off.
State of the relay „ISM main contact position" is shown at ISM open state. It keeps its position at absent of power supply.

Projection

Dimensions in mm

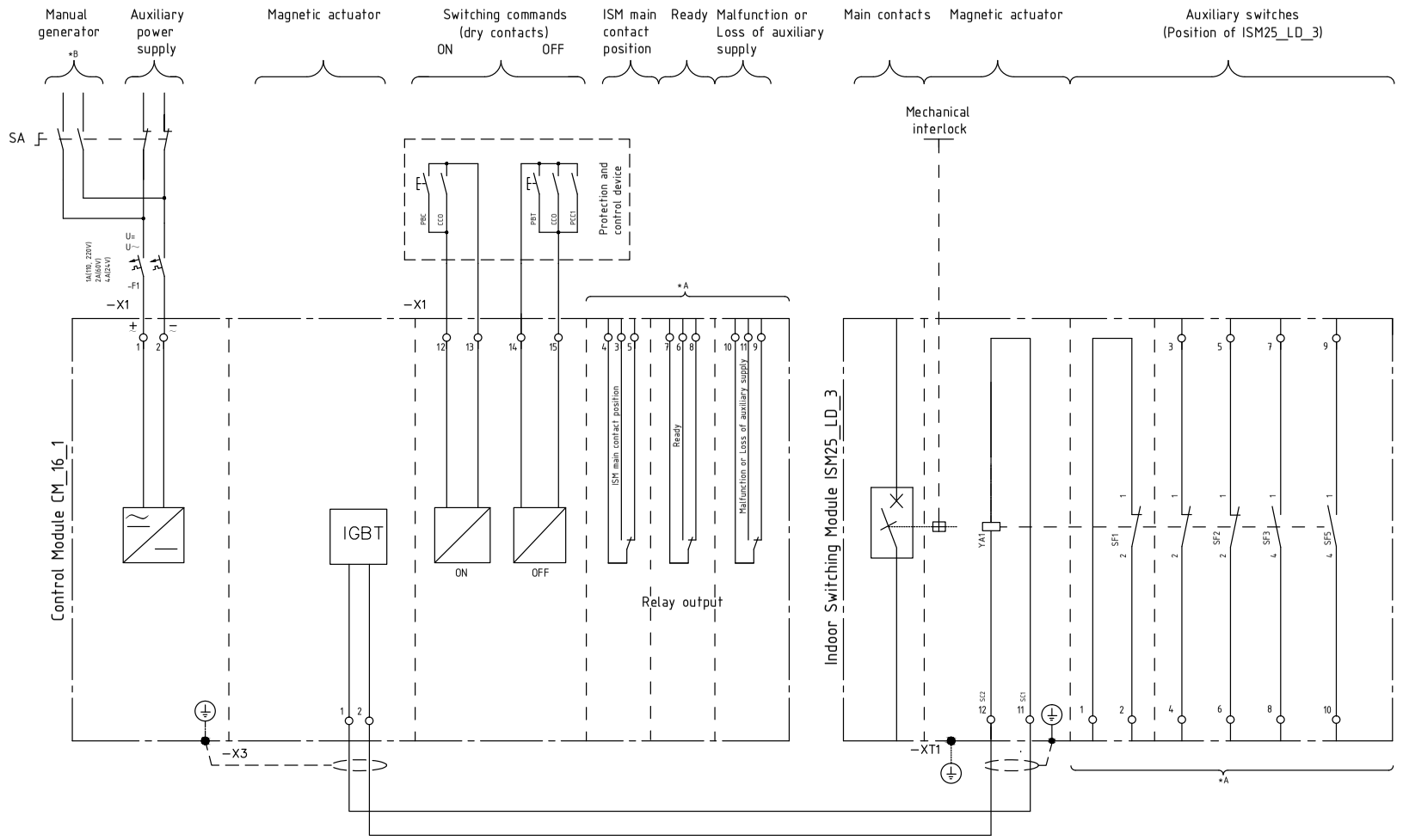
Designed by	Checked by	Approved by	Date	Filename	Date	Weight	Scale
I.Matlakova	A.Migunov	A.Migunov	07.10.2019	TES_VCB25_LD2_16.FED4	07.10.2019	-	

TAVRIDA ELECTRIC
TES

Switching module
Electrical Connection Diagram

TES_VCB25_LD2_16.FED4	Edition	Sheet
	B	1 / 1

VCB25_LD3_16.F
Standard circuit breaker application (CB)



Legend:

*A	Wiring of auxiliary switches, relay outputs, according to customer specification;
*B	Manual generator (optional);
SA	Power supply selector switch (optional);
F1	Miniature protective circuit breaker (MPCB); F1 should be selected to withstand CM inrush current levels given in VCB Product Guide;
PBC	Push button close;
PBT	Push button trip;
IGBT	Transistor bridge (coils control);
CCO	Control command ON, OFF;
PCC1	Protection control contact 1;
XT1	Terminal block of switching module;
X1, X3	Terminal block of control module;
YA1	Actuator coil.

States of the relays „Malfunction or Loss of auxiliary supply" and „Ready" are shown at power supply off.
State of the relay „ISM main contact position" is shown at ISM open state. It keeps its position at absent of power suppl

Projection

Dimensions in mm

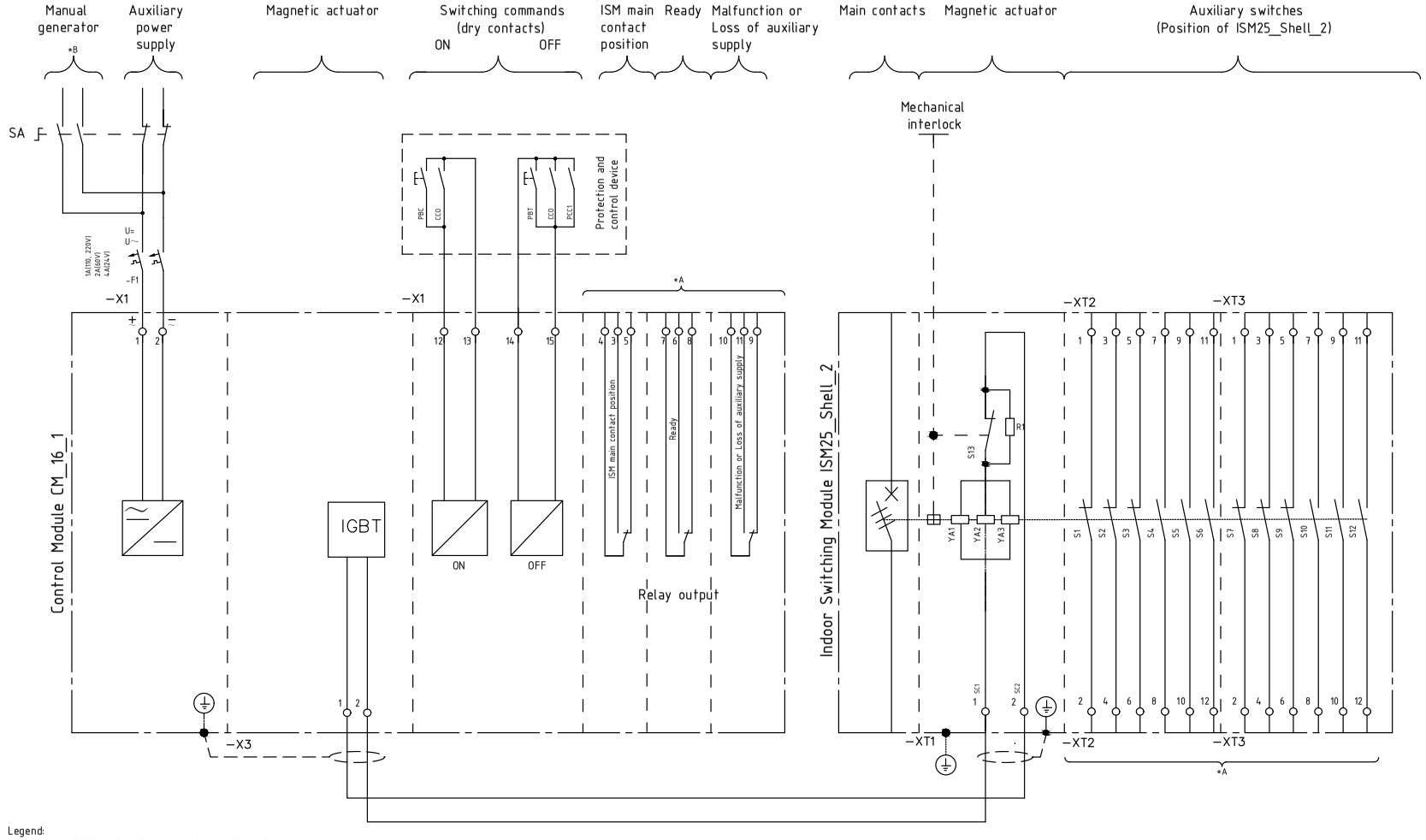
Designed by	Checked by	Approved by	Date	Filename	Date	Weight	Scale
I.Matlakova	A.Migunov	A.Migunov	07.10.2019	TES_VCB25_LD3_16.FED4	07.10.2019	-	

TAVRIDA ELECTRIC TES

Switching module
Electrical Connection Diagram

TES_VCB25_LD3_16.FED4	Edition	Sheet
	B	1 / 1

VCB25_Shell2_16.F
Standard circuit breaker application (CB)



Legend:

*A	Wiring of auxiliary switches, relay outputs, according to customer specification;
*B	Manual generator (optional);
SA	Power supply selector switch (optional);
F1	Miniature protective circuit breaker (MPCB); F1 should be selected to withstand CM inrush current levels given in VCB Product Guide;
PBC	Push button close;
PBT	Push button trip;
IGBT	Transistor bridge (coils control);
CCO	Control command ON, OFF;
PCC1	Protection control contact 1;
XT1–XT2	Terminal block of switching module;
X1,X3	Terminal block of control module;
S1–S12	Auxiliary switch of ISM;
S13	Auxiliary switch for mechanical interlock; S13 is at inactivated position;
YA1–YA3	Actuator coils;
R1	Resistor 22kOhm.

States of the relays „Malfunction or Loss of auxiliary supply" and „Ready" are shown at power supply off.
State of the relay „ISM main contact position" is shown at ISM open state. It keeps its position at absent of power supply.

Projection

Dimensions in mm

Designed by	Checked by	Approved by	Date	Filename	Date	Weight	Scale
A. Ishchenko	A. Migunov	A. Migunov	23.03.2021	TES_VCB25_Shell2_16.FED4	23.03.2021	-	

TAVRIDA ELECTRIC
TES

Switching module
Electrical Connection Diagram

TES_VCB25_Shell2_16.FED4	Edition	Sheet
	A	1 / 1

List of Changes

Documents version	Change Date	Scope of change	Reason of change	Version author
1.3	19.05.2015	VCB15_LD2_16F was added in product range	TES project 10-09	may
1.3	19.05.2015	Chapter „2.2 Key benefits“ was amended	TES SD request	may
1.4	01.07.2015	Chapter „2.2 Key benefits“ was amended	TES SD request	may
1.5	20.07.2015	Australian distributor address was removed	TES SD request	may
1.5	20.07.2015	Chinese distributor address was corrected	TES SD request	may
1.6	18.08.2015	Text corrections after proofreading	TES SD request	may
1.7	30.09.2015	Adding of VCB delivery sets	TES MD request	may
1.8	07.10.2015	Front page pictures correction	TES MD request	may
1.9	30.10.2015	Realy 3 functionality is changed from Malfunciton to Malfunciton or Loss of supply Rated operating sequence is changed to O-0.3s-CO-10s-CO-10s-CO	TEG TD request	may
1.10	01.12.2015	Parameter name “Rated supply voltage of auxiliary circuits” change to “Rated auxiliary supply voltage” Change of relay 3 name from „Malfunction“ to „Malfunction or Loss of auxiliary supply“ and adding for relay „ISM main contact position“ detailed description of its state change Amendment of Secondary schemes in Appendix 4	TES ED and TES TD requests	may
1.11	25.01.2016	Change of relays 1 and 2 contacts in the Table 18 from NC to NO and vice-versa	Mistype correction	may
1.12	22.04.2016	Overall dimensions of ISMs on the page 7 were corrected VCB25_LD1_16F BOM correction in Appendix 1 Adding of comment that CM‘s relay can have incorrect state in case CM is not operable due to absence of auxiliary supply Adding of description that USB port is not used in service CM and ISM secondary connection on the page 50 was corrected Adding of CBkit_Interlock_2 in scope of optional kits.	Mistype correction and TES MD request	may
1.13	27.01.2018	Rated operating sequence at rated short-circuit breaking current; ISM15_Shell_2 in horizontal actuator position;	Documentation elaboration; Mistypes correction;	may
14	31.08.2018	Adding of VCB15_MD1_16F and VCB15_HD1_16F Mistakes correction	Product range change	may
15	21.02.2019	Adding type test reports, mistypes correction;	Documentation elaboration	may
16	04.10.2019	Adding of VCB15_MD3_16.F. Change of VCB, ISM and CM classification. Removing of CBkit_Interlock_2, adding of CBkit_Interlock_8	Product range change	may
17	29.10.2019	Adding of the CBmount_CM_1	Product range change	may
18	28.02.2020	Adding of VCB15_LD8_16F, adding of interlocking kits drawings, mistypes correction	Product range change	Zhdi
19	27.03.2020	Adding of the auxiliary contacts board accessory , other minor changes, mistypes correction	Product range change	Zhdi

Documents version	Change Date	Scope of change	Reason of change	Version author
20	20.09.2021	Interlock interface for LD breakers added	Product range change	Zhdi
21	12.08.2022	Adding of VCB25_Shell2_16F Correction of the “CM terminal arrangement” table Division of the technical parameters table into VCB15 and VCB25	Product range change	may mariy

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