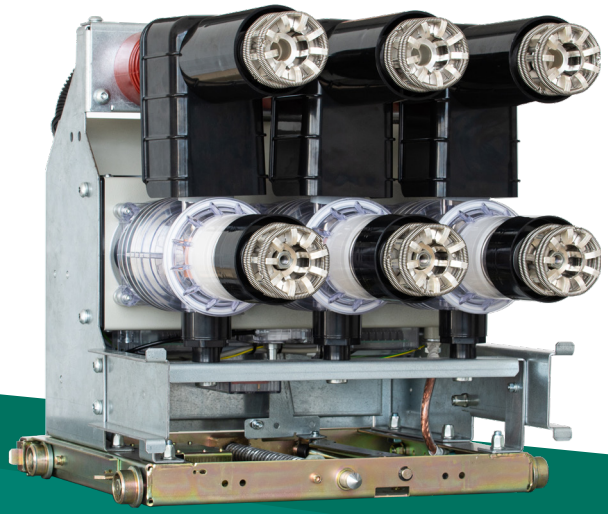
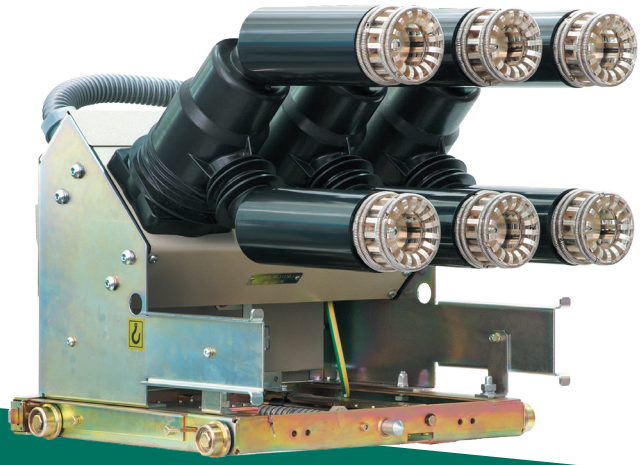
TAVRIDA ELECTRIC
Excellence in Engineering

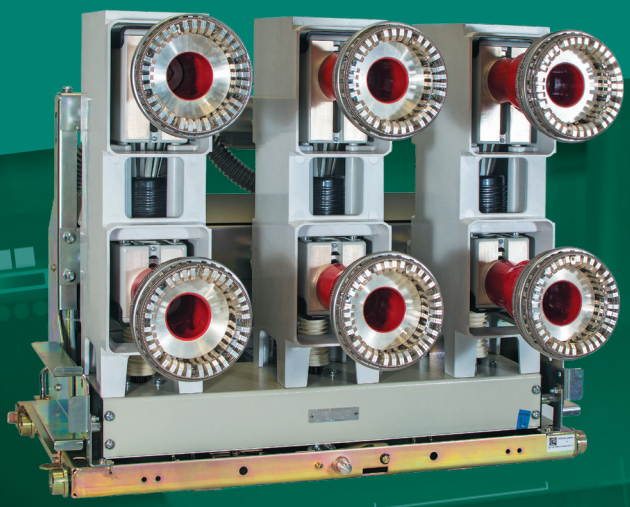
WITHDRAWABLE VCB

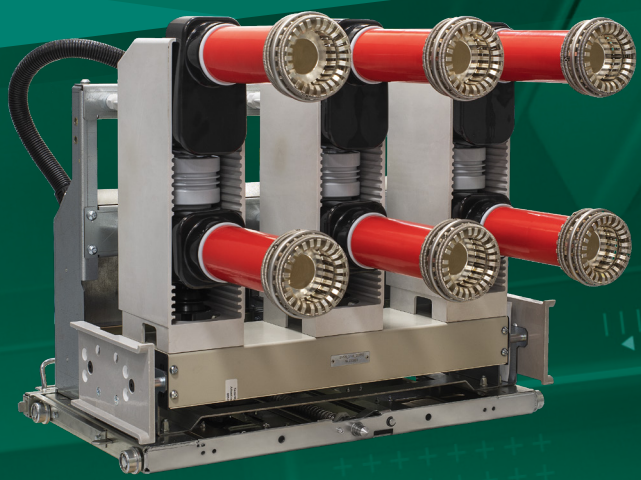
VACUUM CIRCUIT BREAKER

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









USER GUIDE

VERSION 6

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1. Product Description

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

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

Withdrawable vacuum circuit breakers are designed for indoor installation in air-insulated switchgear panels and are intended to perform switching operations in network rated and faulty modes.

The breakers consist of the following main components:

- Indoor Switching Module (ISM) - The air-insulated ISM incorporates Tavrida Electric vacuum interrupters incorporated in solid dielectric insulator controlled by per phase monostable magnetic actuators. 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.

This guide contains information on switching operations, required check-ups and maintenance, as well as service and disposal procedures. The purpose of the document is to provide necessary product information for users providing installation, commissioning and utilizing installed equipment.

1.1 Abbreviations

AC	Actuator Coil
AS	Auxiliary Switch
BIL	Basic Insulation Level
EMC	Electromagnetic Compatibility
CM	Control Module
CO	Close - Open Operations Cycle
Com	Common Point of Contact
DOU	Draw-Out Unit
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 closing time is the time period from the moment the close command is applied to the CM to the time when all ISM poles make contact.

Opening Time

The opening time is the time period from the moment the trip command is applied to the CM to the time when all ISM poles are separated.

Break Time

The break time is the time period from the moment the trip command is applied to the CM to the time when the arcs in all phases are extinguished.

1.3 Main Technical Parameters

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

Table 1 - VCB15 Technical Parameters

Type	VCB15_LD8		VCB15_MD1		VCB15_HD1	
Rated voltage (Ur)	17.5 kV		17.5 kV		17.5 kV	
Phase centre distance (PCD), mm	150	210	150	210	210/275	275
Rated normal current (Ir)	800 A		1250 A		2500 A [1]	3150 A
Rated power frequency withstand voltage (Ud)	38 (42) [2] kV		38 (42) [2] kV		38 (42) [2] kV	
Rated lightning impulse withstand voltage (peak) (Up)	95 kV		95 kV		95 kV	
Rated short-circuit breaking current (Isc)	25 kA [3]		31.5 kA [4]		31.5 kA [4]	
Rated peak withstand current (Ip)	65 kA		82 kA		82 kA	
Rated short-time withstand current (Ik)	25 kA		31.5 kA		31.5 kA	
Rated duration of short circuit (tk)	4 s		4 s		4 s	
Rated frequency (fr)	50/60 Hz					
Mechanical life (CO-cycles)	50 000		30 000		30 000	
Number of operated-isolated operations	500 cycles		500 cycles		500 cycles	
Maximum number of CO-cycles per hour	60					
Operating cycles, rated–short circuit breaking current	50		50		50	
Closing time	≤ 60 ms [5]					
Opening time	≤ 35 ms [5]					
Break time	≤ 45 ms [5]					
Resistance of main circuit	≤ 55 µOhm		≤ 31 µOhm		≤ 25 µOhm	≤ 20 µOhm
Rated operating sequence at rated normal current	O-0.3s-CO-10s-CO-10s-CO [6]					
Rated operating sequence at rated short-circuit breaking current	O-0.3s-CO-15s-CO					
Auxiliary Circuits Insulation Strength [7]						
Power frequency test voltage (1 min) in accordance with IEC62271-100, IEC60255-27	2 kV					
Lightning impulse 1.2ms/50ms/0.5 J in accordance with IEC60255-27	5 kV					
Insulation resistance of 1000V DC in accordance with IEC60255-27	≥ 5 MOhm					
Design class of switching module with regard to severity of service conditions in accordance with IEC 60932	Class 0		Class 0		Class 0	

Table 1 - VCB15 Technical Parameters

Type	VCB15_LD8	VCB15_MD1	VCB15_HD1
Standards	IEC 62271-100, GB 1984-2003		
Mechanical vibration withstand capability according to IEC 60721-3-4	Class 4M4		
Weight (depending on Phase Centre Distance)	70-81 kg	72-88 kg	128-165 kg
Altitude above sea level	1000 m [8)]		
Relative humidity in 24 hours	≤ 95 %		
Relative humidity over 1 month	≤ 90 %		
Temperature Range	-25 °C ... +55 °C		
Degree of protection of main circuit terminals in accordance with IEC 60529	IP00		
Degree of protection of actuators compartment in accordance with IEC 60529	IP40		
Type of driving mechanism	Monostable magnetic actuator		
Weight of CM	1 kg		
Overall dimensions of CM [9)]	190x165x45 mm		
Design/Switching Capacity of ISM Auxiliary Contacts			
Number of available auxiliary contacts for three-phase ISM	6 NO + 6 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 [10)]		
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 [10)]		
Maximum current for 125 V AC, inductive load (cosj =0,3)	5 A		
Maximum current for 250 V AC, ohmic load	10 A [10)]		
Maximum current for 250 V AC, inductive load (cosj =0,3)	5 A		
Design/Switching Capacity of DOU Plate Auxiliary Contacts			
Number of available auxiliary contacts	5 NO + 5 NC	5 NO + 5 NC	5 NO + 5 NC

Table 1 - VCB15 Technical Parameters

Type	VCB15_LD8	VCB15_MD1	VCB15_HD1
Maximum current for voltage up to 660 V AC	10 A		
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 [11)]		
CM Supply Voltage			
Rated range of supply voltage of CM_16_1(Par1_60.2_Par2_Par3_Par4_Par5)	24 V to 60 V DC		
Rated range of supply voltage of CM_16_1(Par1_220.2_Par3_Par4_Par5)	110 V to 220 V AC/DC		
Operating range (80-120%) of CM_16_1(Par1_60.2_Par3_Par4_Par5)	19 V to 72 V DC		
Operating range (80-120%) of CM_16_1(Par1_220.2_Par3_Par4_Par5)	85 V to 265 V 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 [12)] ≤ 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 [13)] ≤ 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		
Maximum switching current 250 V DC	0.35 A		
Maximum switching current 125 V DC	0.45 A		

Table 1 - VCB15 Technical Parameters

Type	VCB15_LD8	VCB15_MD1	VCB15_HD1
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 the CM			
Output voltage	≥ 30 V		
Contacts closed current	≥ 50 mA		
Steady state current	≥ 5 mA		

1) The rating depends on the metal-enclosed switchgear ventilation. Temperature rise type test at 2500 A in Cradle was successfully passed in KEMA.
2) The information in brackets refers to the national Chinese standards GB1984-2003 at an installation altitude of 1000 m maximum.
3) At 34% DC component.
4) At 40% DC component.
5) Smaller timing on request.
6) 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.
7) Isolation resistance check is not applicable for "Actuator Coil" circuits of CM.
8) 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.
9) Overall dimensions of VCB are provided in "Appendix 2. Overall Drawings".
10) At 5 min short-term duty. Continuous current – 5 A.
11) In case of dry contacts "close" and "trip" are open.
12) At Cos j >0.66.
13) At Cos j >0.33.

Table 2 - VCB25 Technical Parameters

Type	VCB25_Shell2	
Rated voltage (Ur)	24 kV	
Phase centre distance (PCD), mm	210/275	275
Rated normal current (Ir)	630 A 1250 A	2500 A
Rated power frequency withstand voltage (Ud)	60 kV	
Rated lightning impulse withstand voltage (peak) (Up)	125 kV	
Rated short-circuit breaking current (Isc)	25 kA [1.]	
Rated peak withstand current (Ip)	65 kA	
Rated short-time withstand current (Ik)	25 kA	
Rated duration of short circuit (tk)	4 s	
Rated frequency (fr)	50/60 Hz	
Mechanical life (CO-cycles)	30 000	
Number of operated-isolated operations	500 cycles	
Maximum number of CO-cycles per hour	60	
Operating cycles, rated–short circuit breaking current	50	
Closing time	≤ 60 ms [2.]	
Opening time	≤ 35 ms [2.]	
Break time	≤ 45 ms [2.]	
Resistance of main circuit	≤ 35 μOhm (for Ir 630 A) ≤ 30 μOhm (for Ir 1250 A) ≤ 22 μOhm (for Ir 2500 A)	
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) in accordance with IEC62271-100, IEC60255-27	2 kV	
Lightning impulse 1.2ms/50ms/0.5 J in accordance with IEC60255-27	5 kV	
Insulation resistance of 1000V DC in accordance with IEC60255-27	≥ 5 MOhm	
Design class of switching module with regard to severity of service conditions in accordance with IEC 60932	Class 0	
Standards	IEC 62271-100, GB 1984-2003	
Mechanical vibration withstand capability according to IEC 60721-3-4	Class 4M4	

Table 2 - VCB25 Technical Parameters

Type	VCB25_Shell2
Weight (depending on Phase Centre Distance)	101-190 kg
Altitude above sea level	1000 m [5.]
Relative humidity in 24 hours	≤ 95 %
Relative humidity over 1 month	≤ 90 %
Temperature Range	-25 °C ... +55 °C
Degree of protection of main circuit terminals in accordance with IEC 60529	IP00
Degree of protection of actuators compartment in accordance with IEC 60529	IP40
Type of driving mechanism	Monostable magnetic actuator
Weight of CM	1 kg
Overall dimensions of CM [6.]	190x165x45 mm
Design/Switching Capacity of ISM Auxiliary Contacts	
Number of available auxiliary contacts for three-phase ISM	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
Design/Switching Capacity of DOU Plate Auxiliary Contacts	
Number of available auxiliary contacts	5 NO + 5 NC
Maximum current for voltage up to 660 V AC	10 A

Table 2 - VCB25 Technical Parameters

Type	VCB25_Shell2
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 [8.]
CM Supply Voltage	
Rated range of supply voltage of CM_16_1(Par1_60.2_Par2_Par3_Par4_Par5)	24 V to 60 V DC
Rated range of supply voltage of CM_16_1(Par1_220.2_Par3_Par4_Par5)	110 V to 220 V AC/DC
Operating range (80-120%) of CM_16_1(Par1_60.2_Par3_Par4_Par5)	19 V to 72 V DC
Operating range (80-120%) of CM_16_1(Par1_220.2_Par3_Par4_Par5)	85 V to 265 V 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 [9.] ≤ 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 [10)] ≤ 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
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

Table 2 - VCB25 Technical Parameters

Type	VCB25_Shell2
Maximum switching current 24 V DC	12 A
Switching time	5 ms
“Close” and “Trip” Dry Contacts Inputs of the 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. 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.
6. Overall dimensions of VCB are provided in “Appendix 2. Overall Drawings”.
7. At 5 min short-term duty. Continuous current – 5 A.
8. In case of dry contacts “close” and “trip” are open.
9. At Cos j >0.66.
10. At Cos j >0.33.

1.4 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 User Guide contains information necessary for the installation, commissioning and operation. Please read the User 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 Withdrawable Vacuum Circuit Breakers. In case of special configurations please contact Tavrida Electric prior to usage of the Withdrawable Vacuum Circuit Breakers.

1.5 Precautions

Before selecting the circuit breaker, please check whether the installation place (contact interfaces, pole centre and terminal centre distances, fixed contact shutters operating mechanism, and the surroundings) is suitable for the withdrawable vacuum circuit breakers.

- 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 the 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 the operation of the withdrawable 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 this User Guide.

- The operating conditions of the withdrawable vacuum circuit breakers shall comply with the technical data specified in this User Guide.

- Personnel installing, operating and maintaining the equipment shall be familiar with this User Guide and its contents.

1.6 Warranty

Unless otherwise stated in the contract, the warranty period is stated in the Standard Warranty Policy. If otherwise agreed to, the contract conditions apply. No warranty is given in the following cases:

a) The warranty period has 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. Labels and Seals

The Vacuum Circuit Breaker itself does not have labels or seals; however, its main components (ISM, CM and manual generators) have them.

2.1 VCB, ISM Labels and Seals

Each VCB has an electrical data label with a serial number:

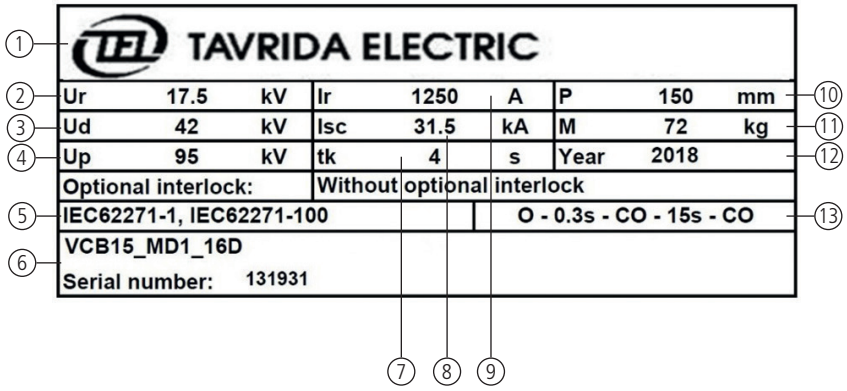


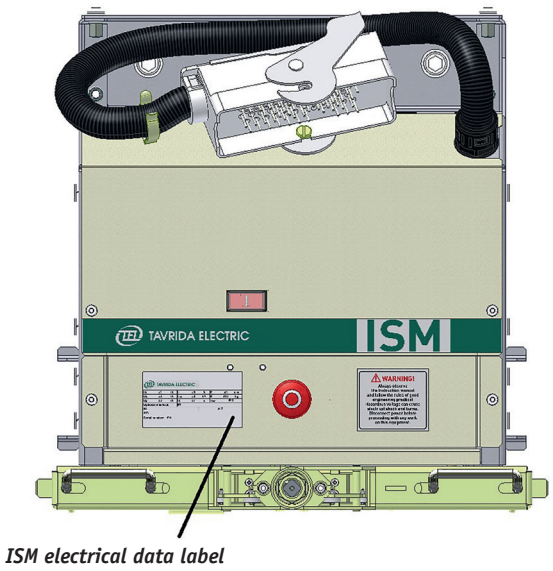
Figure 1

VCB electrical data label with serial number

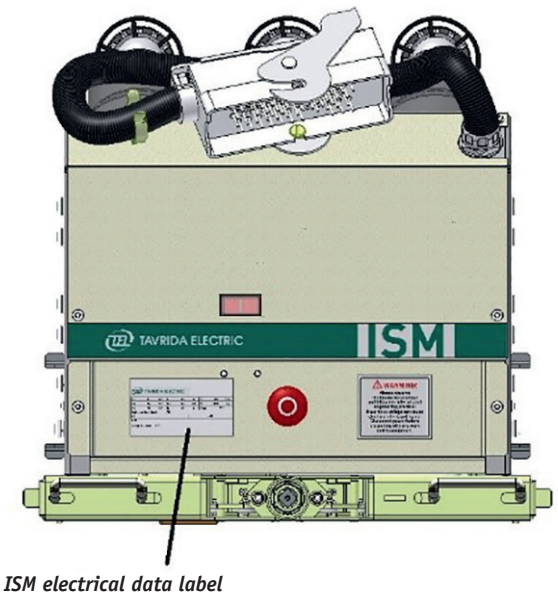
1. Manufacturer
2. Rated voltage Ur
3. Rated power frequency withstand voltage Vd
4. Rated impulse withstand voltage Up
5. Applicable standards
6. VCB designation and serial number
7. Rated duration of short circuit tk
8. Rated short-circuit current Isc
9. Rated normal current Ir
10. Phase center distance P
11. Weight W
12. Year of manufacturing
13. Rated operating sequence

The electrical data label contains information about the VCB type, its technical parameters and serial number.

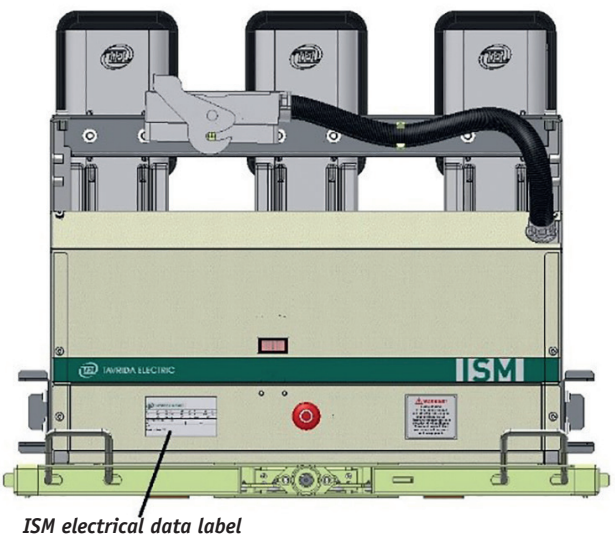
The placement of the electrical data label is shown below.



a) VCB15_LD8_16D labeling



b) VCB15_MD1_16D labeling



c) VCB15_HD1_16D labeling

d) VCB25_Shell2_16D labeling

Figure 2

Electrical data label placement

The serial number plate contains information about the ISM type and serial number.

The label contains brief information about the VCB technical parameters.

There are warranty seal labels on each side of the ISM metal frame.

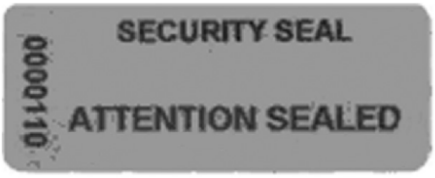
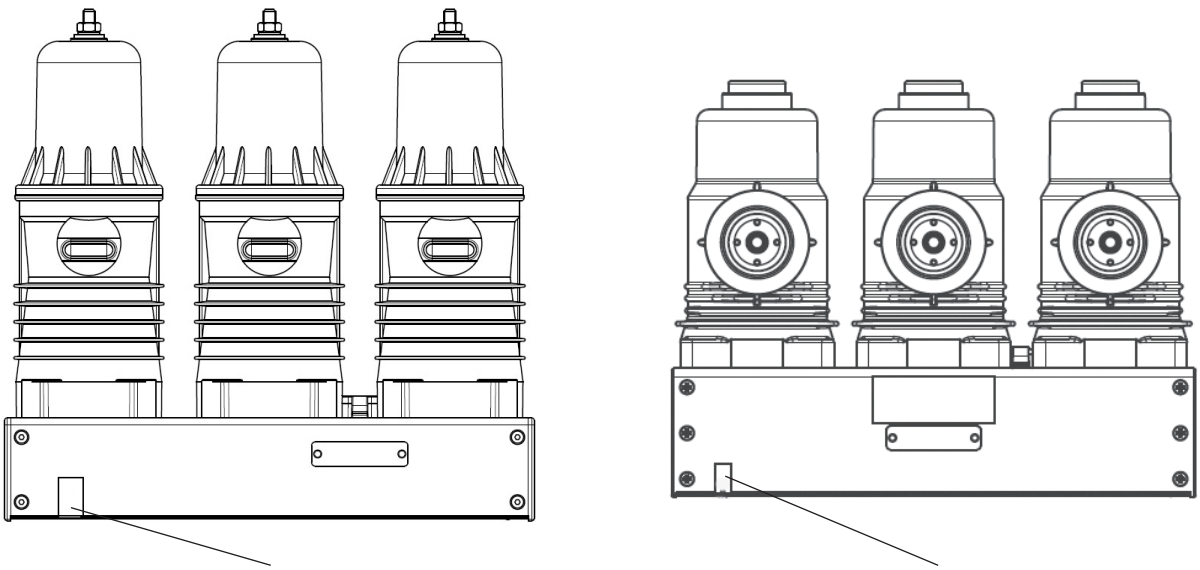


Figure 3

ISM warranty seal



a) ISM15_LD

b) ISM15_MD

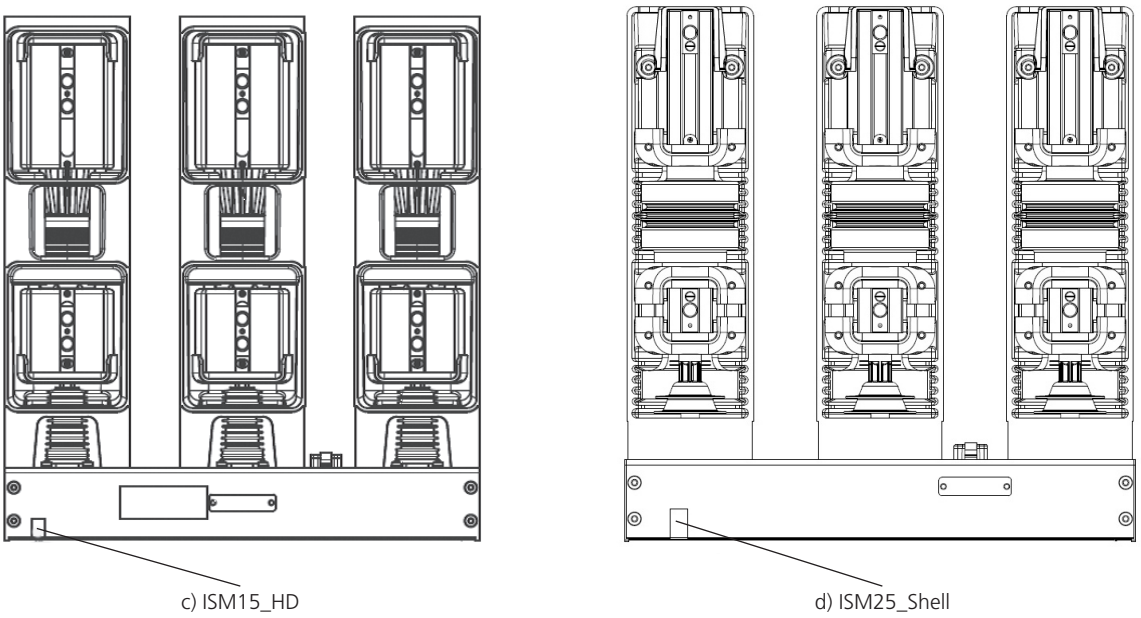


Figure 4

ISM warranty seal labels arrangement

2.2 CM Labels and Seals

Each CM has the following labels:

- Serial number label
- Label with applicable ISM designation
- Warranty seal labels
- Warning label
- Firmware version label
- Information label with terminals connections and main parameters

Figure 5

Serial number label

Figure 6

Label with applicable ISM designation

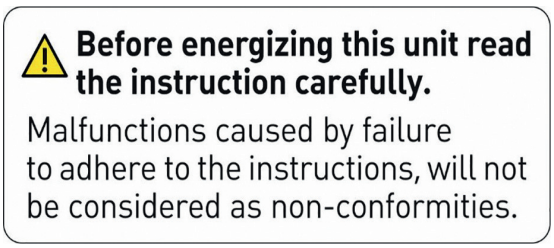


Figure 7

Warning label

Figure 8

Firmware version label

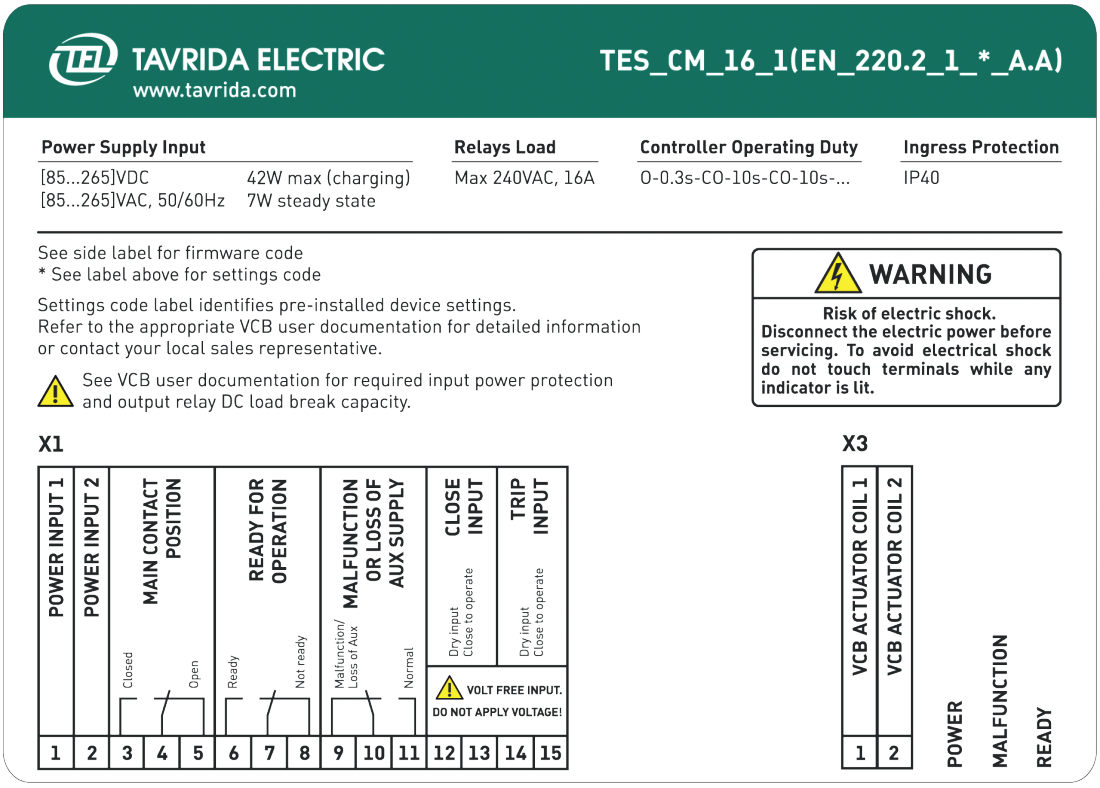
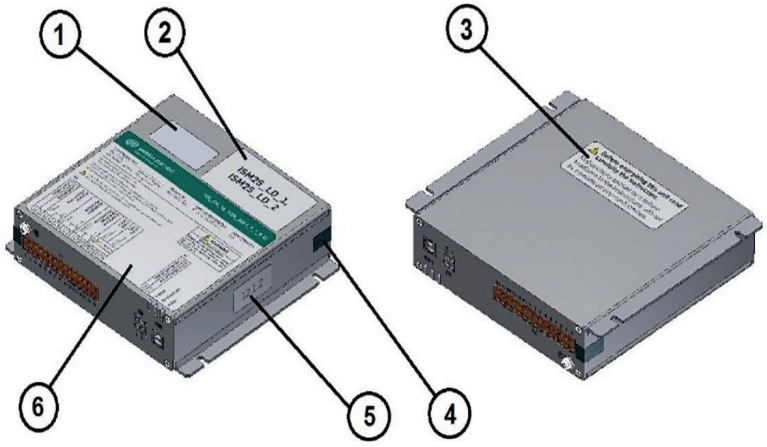


Figure 9

Information label with terminals connections and main parameters



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

Figure 10

CM labels placement

2.3 Manual Generator Labels

Each manual generator has the following labels:

- Designation label
- Serial number label

Figure 11

Designation label

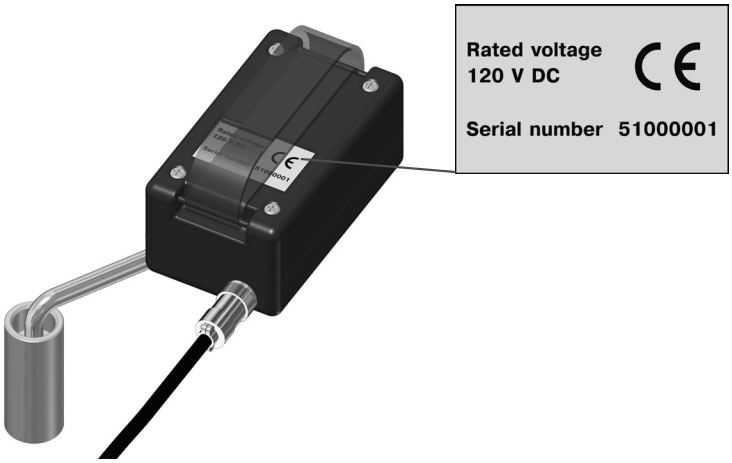


Figure 12

Serial number label

3. Product Handling

3.1 Transportation

The VCBs are transported in the original package only. Any kind of transport and combinations thereof are applicable.

Transportation shall be provided in waterproof compartments. If air transportation is used all products shall be transported inside heated, pressurized compartments. Packages with goods shall be handled in accordance with the handling symbols. Loading procedures for VCB package shall be carried out only using forklifts, hoists or cranes. During transportation the VCB must not be subjected to sharp impacts or dropped.

3.2 Storage

If immediate installation is not possible, the VCB shall be stored in the original packing under the following conditions:

- The ISM is switched off.
- Desiccant must be placed inside the packaging.
- Storage must be dry, well ventilated and the room temperature should be between – 25°C and + 55°C.

Average humidity measured over a 1 year period shall not exceed 75% at 50°C. If the storage term exceeds one year from the production date, it is recommended to perform the procedure of CM electrolytic capacitor conditioning:

- Apply power to the CM for 20 seconds.
- Switch off the power supply and wait for 60 seconds.
- Repeat the above actions 2 times.
- Apply power to the CM continuously for 8 hours.

This procedure shall be performed annually during CM storage.

3.3 Unpacking and Inspection

3.3.1 Unpacking and Checking the VCB

Before unpacking, check the package for damage. Removal of the products from the original packaging must be carried out with care and in accordance with lifting procedures. Every VCB component shall be checked for completeness against the packing list included within the routine test certificate supplied with the CM and VCB.

Unloading procedures for VCB shall be carried out by hoists or cranes only. Methods of lifting the VCB out of the package are shown below and must be strictly followed.

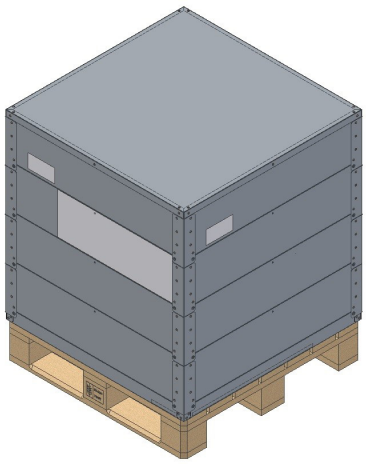


Figure 13
Withdrawable VCB package

Unscrew the packing metal holder's fastening screws as shown below and remove the package cover

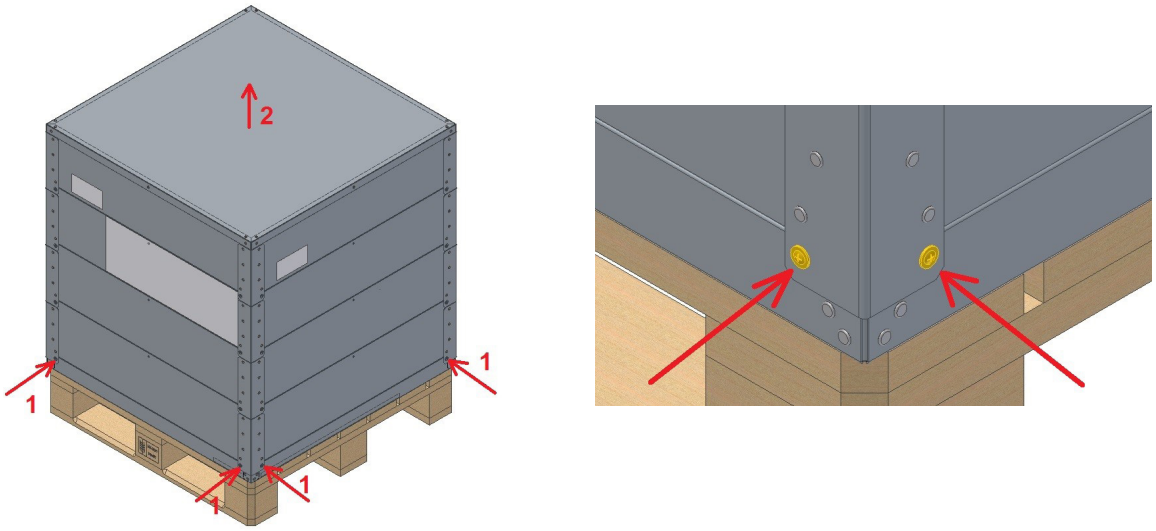
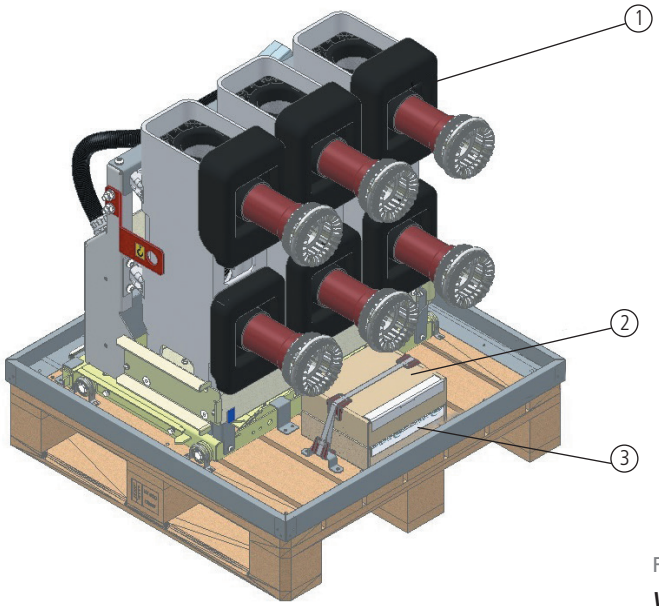


Figure 14
Unpacking of VCB



1. Withdrawable VCB
2. CM
3. CBkit_Plug_1

Figure 15
VCB components on the pallet

Unscrew withdrawable VCB fastening provisions as shown below.

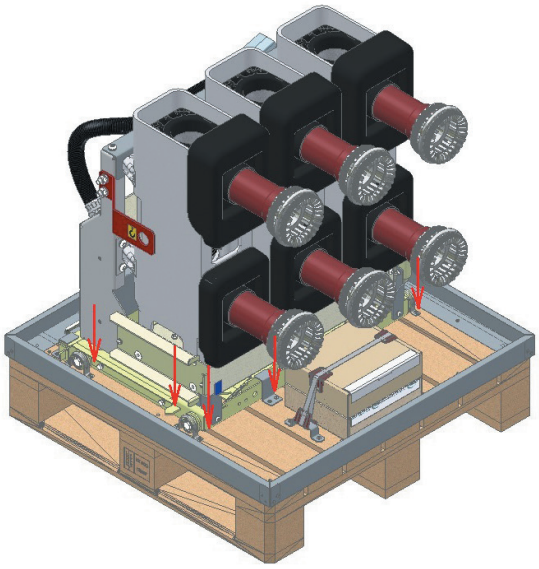
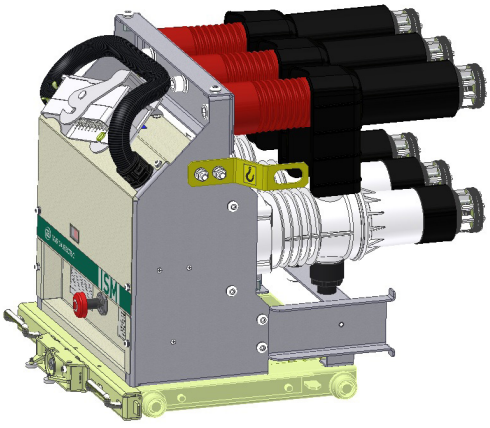
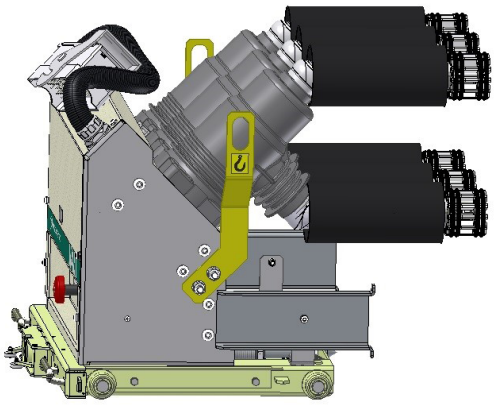


Figure 16
Unfastening the withdrawable VCB

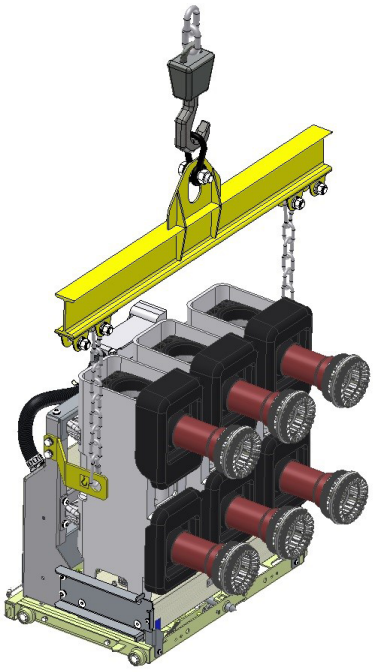
Lifting of the withdrawable VCB



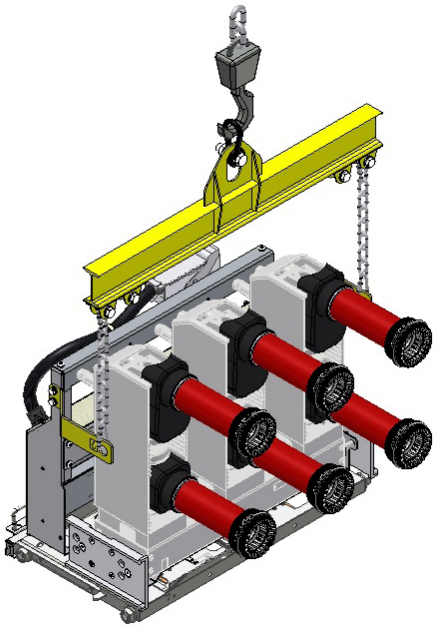
a) VCB15_LD



b) ISM15_MD



c) ISM15_HD



d) VCB25_Shell

Figure 17
Withdrawable ISM lifting provisions

To lift and handle the circuit-breaker, proceed as shown in Figure 17 c). The special lifting tool is not supplied. The lifting brackets of the VCB should be removed before using the withdrawable VCB. All items should be checked visually for:

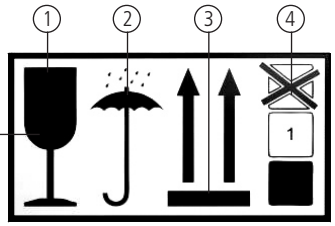
- Mechanical damage, scratches, discoloration, corrosion.
- Damage to the warranty seals (Figure 4, Figure 10).

Any transport damage must be reported immediately to the carrier in writing. Damages shall be photographically documented.

3.3.2 VCB Packaging and Scope of Supply

The VCB is placed in a metal box on the pallet (Figure 20) with following labels:

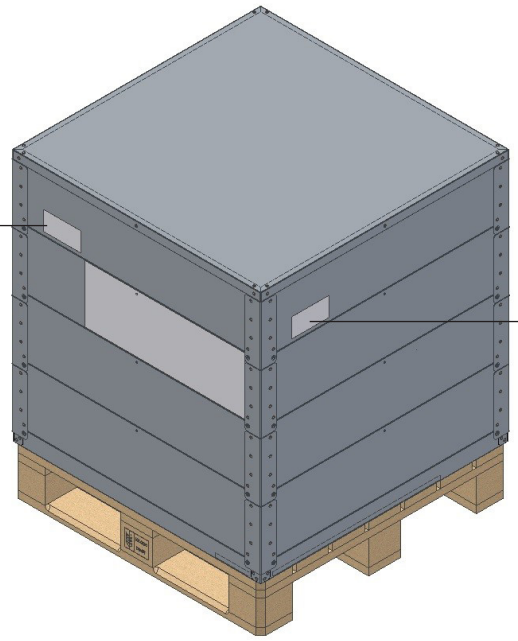
- Handling symbols label for transport and storage of the delivery unit (Figure 18).
- Labels for manufacturers and product information (Figure 19).



1. Fragile, handle with care
2. Keep dry
3. This side up
4. Stacking level limitation

Figure 18

Handling symbols



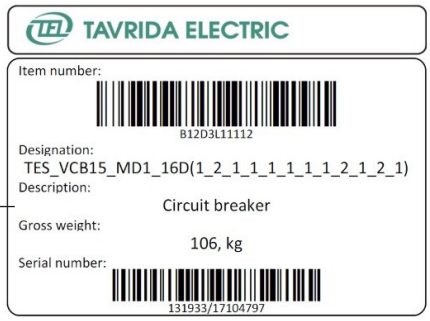


Figure 19

Label for manufacturer and product information

Figure 20

VCB package

The VCB delivery set contains:

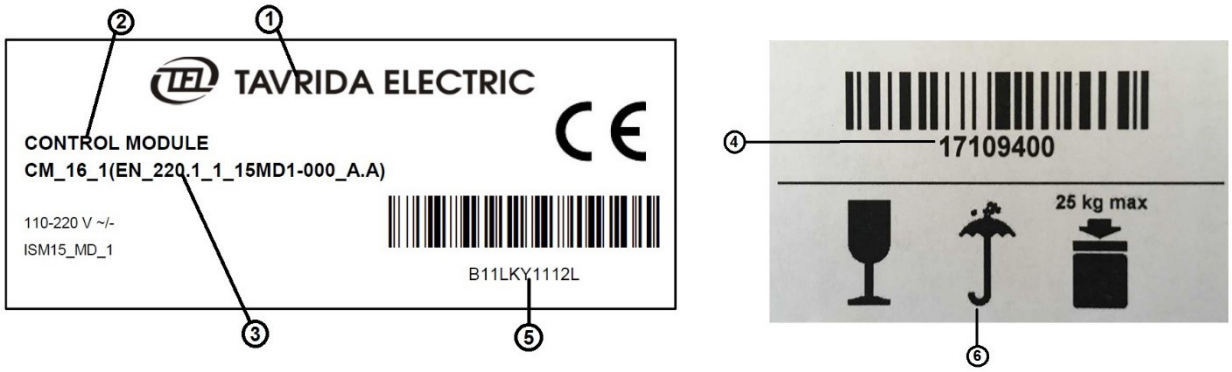
1. Withdrawable VCB
2. CM
3. CBkit_Plug_1

The ISM shall have undamaged warranty seals. The VCB designations and serial numbers shall comply with data in the VCB packing list and the VCB routine test certificate.

3.3.3 CM Packaging and Scope of Supply

As part of the VCB, the CM is delivered inside of the VCB package. The CM is packed in cardboard a box.

Figure 21
CM packaging



1. Manufacturer
2. Product name
3. Type of device
4. Serial number
5. Product code
6. Handling symbols

Figure 22
CM packaging labels

The CM shall have undamaged warranty seals (its placement on the CM is shown in Figure 10). The CM designation and serial number shall comply with data in the VCB packing list and the CM routine test certificate.

Each CM includes the following components:

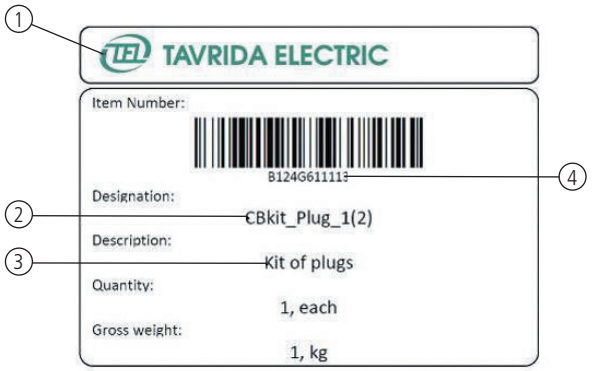
a) CM b) Screwdriver Unit_Screwdriver_1 c) Brackets Det_Holder_84

Figure 23
CM delivery set

3.3.4 CBkit_Plug_1 Scope of Supply

As part of the VCB, the CBkit_Plug_1 is placed inside the VCB package. The kit is packed in a cardboard box.

Figure 24
CBkit_Plug_1 packaging

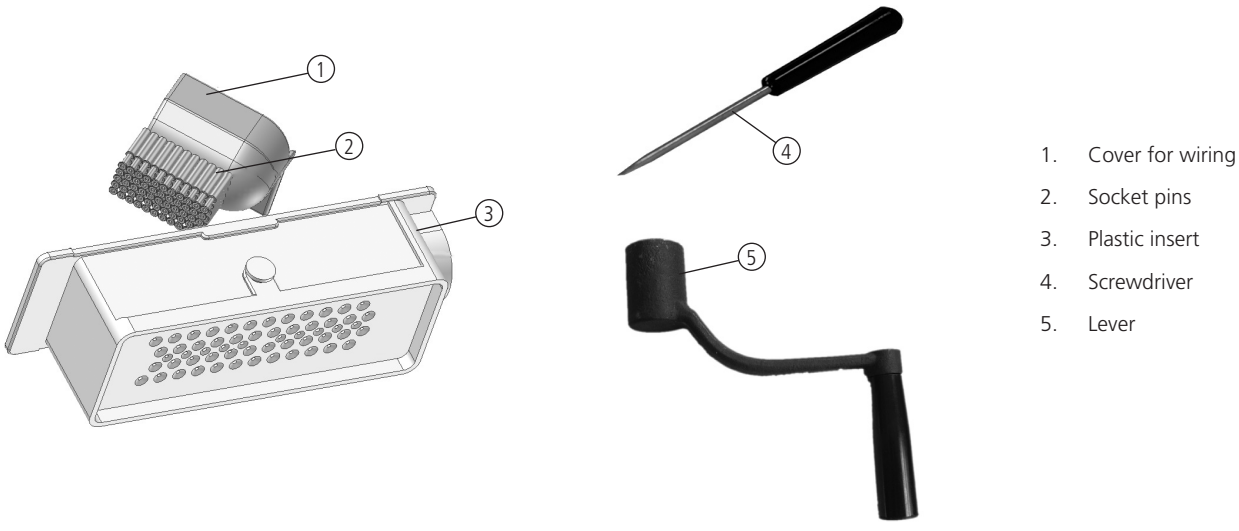


1. Manufacturer
2. Device type
3. Product name
4. Product code

Figure 25
CBkit_Plug_1 package labeling

CBkit_Plug_1(1)

The kit CBkit_Plug_1(1) includes:

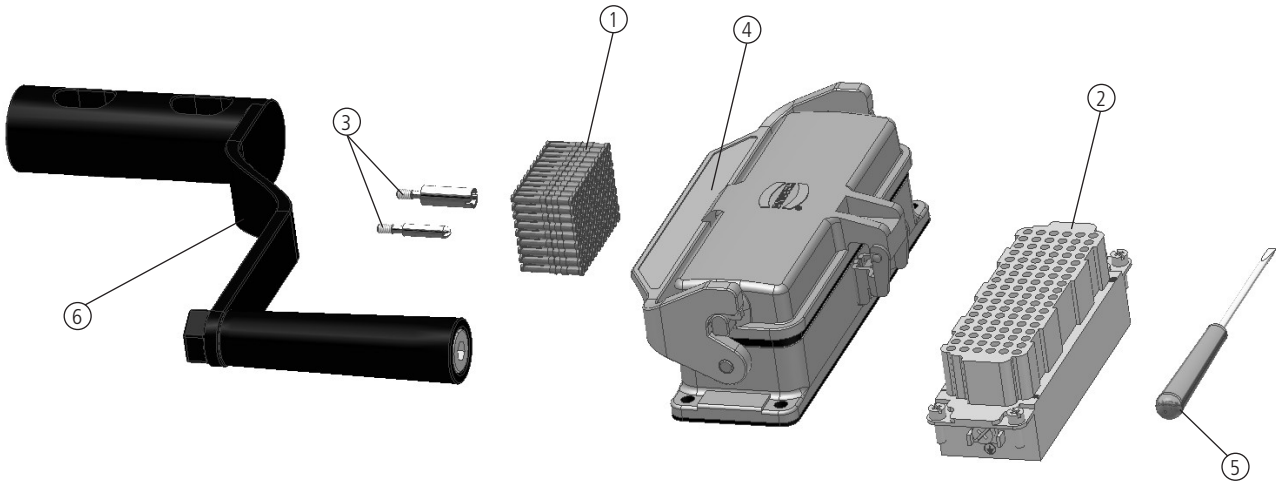


1. Cover for wiring
2. Socket pins
3. Plastic insert
4. Screwdriver
5. Lever

Figure 26
CBkit_Plug_1(1) delivery set

CBkit_Plug_1(3)

CBkit_Plug_1(3) includes:



1. Socket pins
2. Plastic insert
3. Coding pins
4. Plug hood
5. Screwdriver
6. Lever

Figure 27

CBkit_Plug_1(3) delivery set

3.3.5 VCB Accessories Unpacking and Checkup

CBunit_ManGen_1 and CBunit_ManGen_2 Packaging and Scope of Supply

The CBunit_ManGen is used to charge CM_16 in cases when main auxiliary power supply is unavailable.

It is packed in a cardboard box.

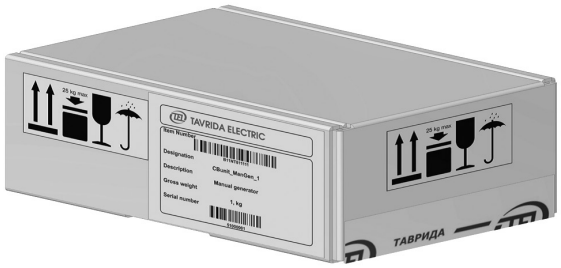
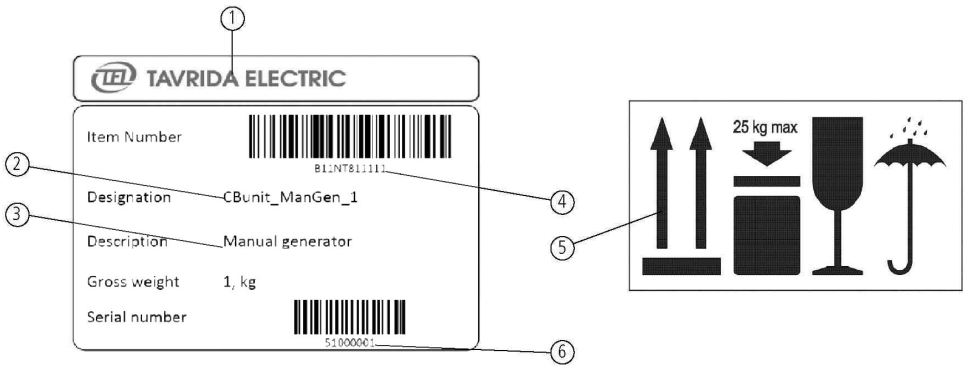


Figure 28

CBunit_ ManGen_1 and CBunit_ ManGen_2 packing



1. Manufacturer
2. Type of device
3. Product name
4. Product code
5. Handling symbols
6. Serial number

Figure 29

CBunit_ ManGen_1 package labeling

Figure 30

CBunit_ManGen_1 and CBunit_ManGen_2 delivery set

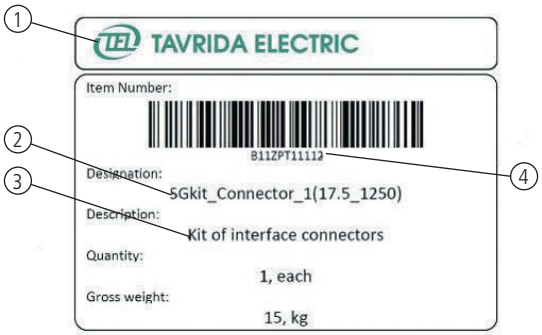
SGkit_Connector_1 Packaging and Scope of Supply

SGkit_Connector_1 is used to provide Switchgear fixed contact counterpart for DOU main circuits connection.

It is packed in a cardboard box.

Figure 31

SGkit_Connector_1 packing



1. Manufacturer
2. Type of device
3. Product name
4. Product code

Figure 32

SGkit_Connector_1 package labeling

Figure 33

SGkit_Connector_1(17.5_2000) delivery set

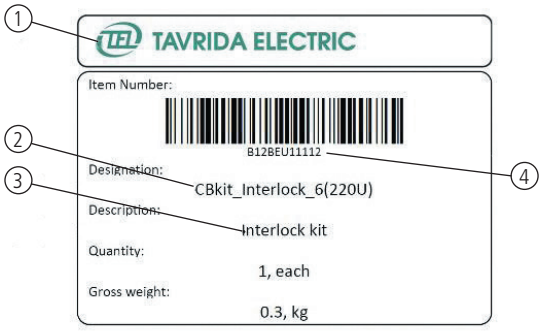
The difference between the SGkit_Connector_1(17.5_1250), SGkit_Connector_1(24_1250), SGkit_ Connector_1(17.5_2000) and SGkit_ Connector_1(17.5_3150) kits is the dimensions of the fixed contacts.

CBkit_Interlock_6 Packaging and Scope of Supply

CBkit_Interlock_6 is used with the DOU to provide it with an optional interlock in case this interlock turns out to be necessary after DOU production. This interlock blocks the DOU rack in/out functionality in case auxiliary voltage (provided for solenoid installed on DOU plate) is absent.

It is packed in a cardboard box.

Figure 34
CBkit_Interlock_6 packaging



1. Manufacturer
2. Type of device
3. Product name
4. Product code

Figure 35
CBkit_Interlock_6 package labeling

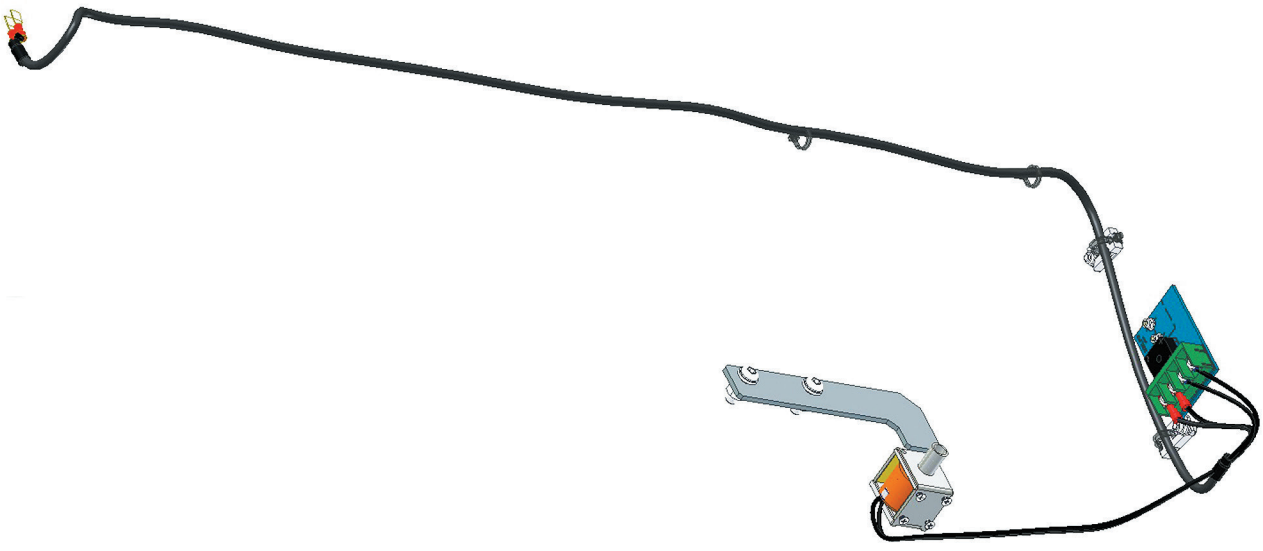


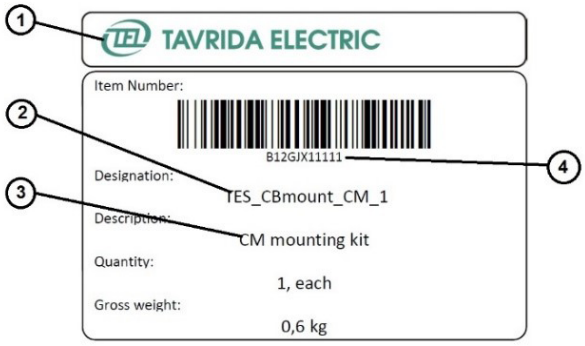
Figure 36
CBkit_Interlock_6 delivery set

CBmount_CM_1 Packaging and Scope of Supply

CBmount_CM_1 is used to mount CM_16_1 on a DIN rail.

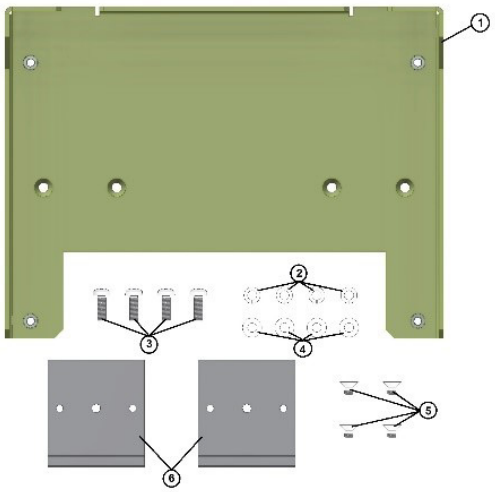
It is packed in a cardboard box.

Figure 37
CBmount_CM_1 packaging



1. Manufacturer
2. Type of device
3. Product name
4. Product code

Figure 38
CBmount_CM_1 package labeling



1. Holder CBunit_Holder_15
2. Washer StandDet_Washer_DIN127-A(4_Fe-Zn)
3. Screw StandDet_Screw_DIN7985 Ph(M4_12_Fe48 Zn)
4. Washer StandDet_Washer_DIN125-1A(4.3_Fe-Zn)
5. Screw StandDet_Screw_ISO7046-Ph(M4_6_Fe48-Zn)
6. Holder StandComp_Holder_DIN(1)

Figure 39
CBmount_CM_1 delivery set

3.4 Handling

To avoid equipment damage, please follow the handling recommendations listed below:

1. Handling shall be done in accordance with pictorial symbols.
2. Eliminate any drops.
3. Eliminate any mechanical impacts which can cause package damage.
4. Packages have to be stowed to ensure complete tightness. The boxes should be packed tightly so that they cannot shift inside of a container under any transportation conditions.
5. The modules shall be tied up twice with a 16 mm polyester band.

4. Installation

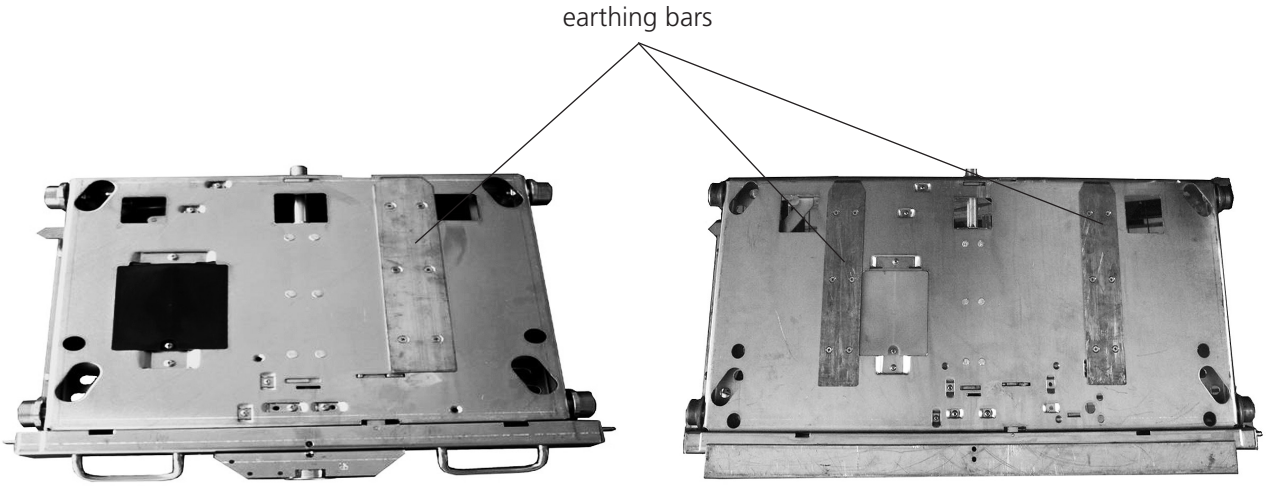
4.1 Primary Part

4.1.1 Protective Earthing

The draw-out unit is earthed through the use of truck wheels.

Optionally the earthing can be arranged via the earthing bar which is connected to the bottom of the truck.

In this case, the corresponding earthing has to be put in the switchgear (not part of the delivery).



a) Standard Draw-Out plate *b) The Draw-Out plate for VCB with PCD of 275 mm only*

Figure 40
DOU earthing bars

4.1.2 Primary Connections

Before the first VCB installation in service position it is essential to check the actual dimensions of the fixed contacts installed in the switchgear. In service position, the connection of VCB flexible contacts with fixed contacts of the switchgear should be in accordance with requirements presented in Figure 41. Otherwise, it can lead to overheating and other severe problems.

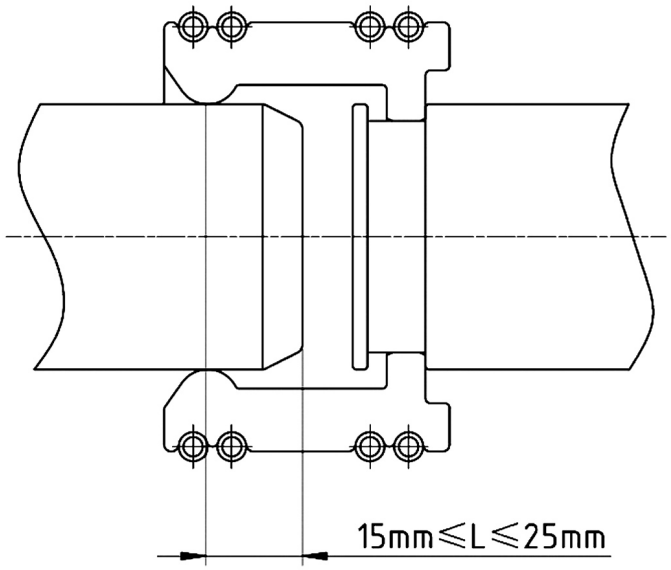


Figure 41
Connection of VCB removable contacts with switchgear fixed contacts

4.2 Secondary part

4.2.1 VCB Secondary Connections

Secondary circuits cable of the VCB can be either equipped by plastic (58 pins) or metal (108 pins) plug. The secondary plugs arrangement is presented in Table 3 (Plastic Plug Arrangement) and in Table 4 (Metal pug). See Appendix 3 for the auxiliary circuits details.

Table 3 - Plastic Plug Arrangement

Pin No	Connection	Pin No	Connection
1	-	30	-
2	-	31	ISM auxiliary switch XT3.12
3	DOU plate position switch SQ1.3	32	DOU plate position switch SQ2.5
4	ISM auxiliary switch XT2.1	33	DOU plate position switch SQ2.7
5	ISM auxiliary switch XT2.3	34	DOU plate position switch SQ2.9
6	ISM auxiliary switch XT2.5	35	-
7	ISM auxiliary switch XT2.7	36	ISM auxiliary switch XT3.3
8	ISM auxiliary switch XT2.9	37	ISM auxiliary switch XT3.5
9	ISM auxiliary switch XT2.11	38	ISM auxiliary switch XT3.7
10	DOU plate position switch SQ1.10	39	ISM auxiliary switch XT3.9
11	DOU plate position switch SQ1.12	40	Earthing
12	ISM auxiliary switch XT3.1	41	ISM auxiliary switch XT3.11
13	-	42	DOU plate position switch SQ1.11
14	DOU plate position switch SQ1.4	43	DOU plate position switch SQ1.9
15	ISM auxiliary switch XT2.2	44	DOU plate position switch SQ2.3
16	ISM auxiliary switch XT2.4	45	DOU plate position switch SQ1.8
17	ISM auxiliary switch XT2.6	46	DOU plate position switch SQ2.2
18	ISM auxiliary switch XT2.8	47	DOU plate position switch SQ1.7
19	ISM auxiliary switch XT2.10	48	DOU plate position switch SQ2.1
20	ISM auxiliary switch XT2.12	49	-
21	DOU plate position switch SQ2.4	50	DOU plate position switch SQ1.5
22	DOU plate position switch SQ2.6	51	DOU plate position switch SQ1.6
23	DOU plate position switch SQ2.8	52	Optional interlock (solenoid) XP3.1
24	DOU plate position switch SQ2.10	53	Optional interlock (solenoid) XP3.2
25	ISM auxiliary switch XT3.2	54	Actuator coil XT1.1
26	ISM auxiliary switch XT3.4	55	Actuator coil (via interlock switch) XT1.2
27	ISM auxiliary switch XT3.6	56	-
28	ISM auxiliary switch XT3.8	57	-
29	ISM auxiliary switch XT3.10	58	-

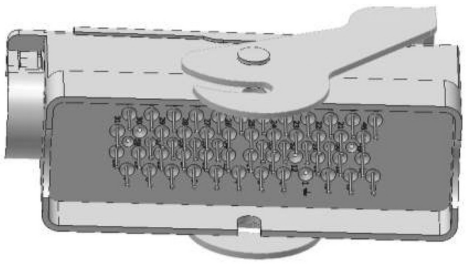


Figure 42

Plastic plug with 58 pins

Table 4 - Metal Plug Arrangement

Pin No	Connection	Pin No	Connection
1	ISM auxiliary switch XT2.7	45	-
2	ISM auxiliary switch XT2.9	46	-
3	ISM auxiliary switch XT2.11	47	-
4	ISM auxiliary switch XT3.7	48	-
5	ISM auxiliary switch XT3.9	49	Actuator coil XT1.1
6	ISM auxiliary switch XT3.11	50	-
7	ISM auxiliary switch XT2.1	51	-
8	ISM auxiliary switch XT2.3	52	-
9	ISM auxiliary switch XT2.5	53	-
10	ISM auxiliary switch XT3.1	54	-
11	-	55	ISM auxiliary switch XT3.3
12	-	56	ISM auxiliary switch XT3.5
13	-	57	DOU plate position switch SQ2.1
14	-	58	DOU plate position switch SQ2.2
15	-	59	DOU plate position switch SQ2.3
16	-	60	DOU plate position switch SQ2.4
17	-	61	DOU plate position switch SQ2.5
18	-	62	DOU plate position switch SQ2.6
19	ISM auxiliary switch XT2.8	63	DOU plate position switch SQ2.7
20	ISM auxiliary switch XT2.10	64	DOU plate position switch SQ2.8
21	ISM auxiliary switch XT2.12	65	-
22	ISM auxiliary switch XT3.8	66	Actuator coil (via interlock switch) XT1.2
23	ISM auxiliary switch XT3.10	67	-
24	ISM auxiliary switch XT3.12	68	Optional interlock (solenoid) XP3.2
25	ISM auxiliary switch XT2.2	69	-
26	ISM auxiliary switch XT2.4	70	-
27	ISM auxiliary switch XT2.6	71	-
28	ISM auxiliary switch XT3.2	72	-
29	-	73	ISM auxiliary switch XT3.4
30	-	74	ISM auxiliary switch XT3.6
31	-	75	DOU plate position switch SQ2.9
32	Optional interlock (solenoid) XP3.1	76	DOU plate position switch SQ2.10
33	-	77	DOU plate position switch SQ1.3
34	-	78	DOU plate position switch SQ1.4
35	-	79	DOU plate position switch SQ1.5
36	-	80	DOU plate position switch SQ1.6
37	-	81	DOU plate position switch SQ1.7
38	-	82	DOU plate position switch SQ1.8
39	-	83	-
40	-	84	-
41	-	85	-
42	-	86	-
43	-	87	-
44	-	88	-

Table 4 - Metal Plug Arrangement

Pin No	Connection	Pin No	Connection
89	-	100	-
90	-	101	-
91	-	102	-
92	-	103	-
93	DOU plate position switch SQ1.9	104	-
94	DOU plate position switch SQ1.10	105	-
95	DOU plate position switch SQ1.11	106	-
96	DOU plate position switch SQ1.12	107	-
97	-	108	-
98	-	GND	Earthing
99	-		

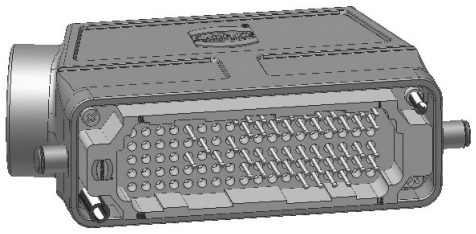


Figure 43

Metal plug with 108 pins

4.2.2 DOU Auxiliary Circuits Connector Counterpart Installation

To connect the DOU auxiliary circuits to the switchgear, the counterpart for the DOU auxiliary circuits connector shall be installed at the switchgear panel. The counterpart is provided as a part of delivery set.

The type of counterpart provided in the delivery set complies with the auxiliary circuits connector the VCB has. To install the counterpart at the switchgear panel, the following provisions should be used.

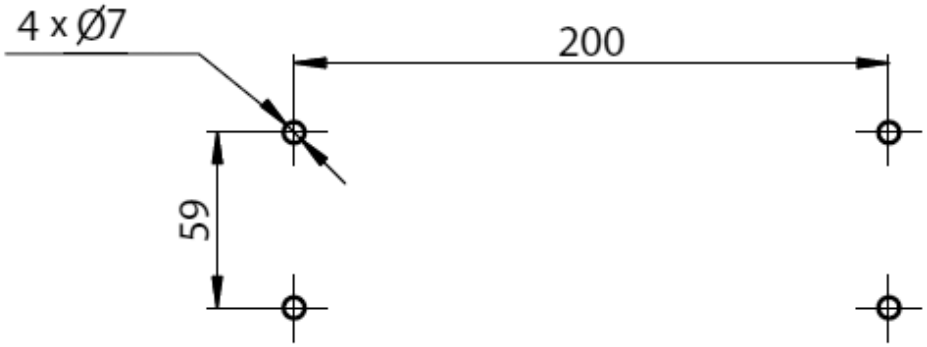


Figure 44

Plastic plug counterpart mounting provisions

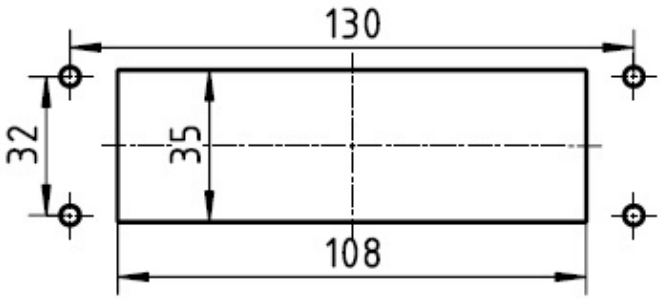


Figure 45

Metal plug counterpart mounting provisions and cut out

4.2.3 Secondary Cables Between Auxiliary Circuits Connector Counterpart and the CM

Warning! If the CM label does not show the correct ISM type, the connection shall not be established. It can lead to the damage of the ISM. Contact your nearest Tavrida Electric partner for replacement.

The secondary cable between auxiliary circuits connector counterpart and the CM shall be performed by a screened cable 2x1.5 mm^2 or equivalent. The degree of coverage of the cable shield shall be not less than 85%.

To achieve the best possible protection against electromagnetic influences, the earthing point of the cable screen shall be as close to the CM as possible. Unshielded parts of wires shall be no longer than 10 cm.

4.2.4 CM Secondary Connections

The CM_16_1 secondary connections are shown below.

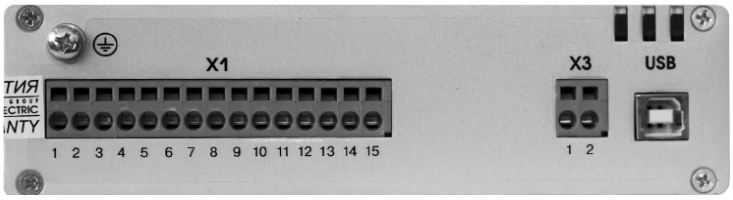


Figure 46

Terminal arrangement of the CM

Table 5 - CM Terminal Arrangement

XT1		XT3	
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 input		
13	Close input		
14	Trip input		
15	Trip input		

CM relay functionality:

- Relay 1 – "ISM main contact position" relay
- Relay 2 – "Ready" relay
- Relay 3 – "Malfunction or Loss of auxiliary supply" relay

The "ISM main contact position" relay keeps its state (1 NO and 1 NC contacts with common point) after the CM power supply disconnection.

The relay's functionality and the number of relays with the same functionality can be changed upon request. Please contact the nearest Tavrida Electric sales representative for more information.

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

4.2.5 Auxiliary Supply

The connection of CM_16_1 to the power supply is shown below.

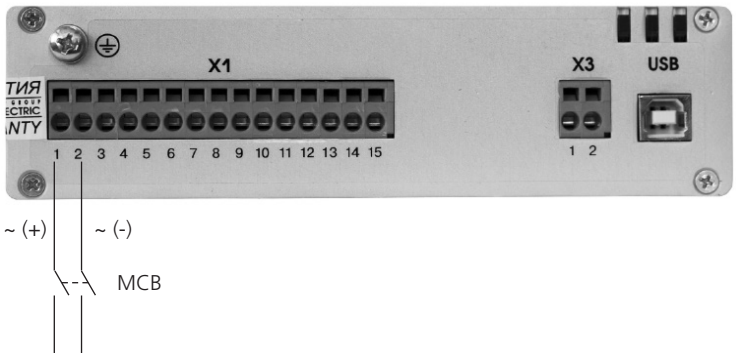


Figure 48

CM_16 power supply connection

The type of MCB shall be selected according to the CM consumption data provided in Chapter 1.

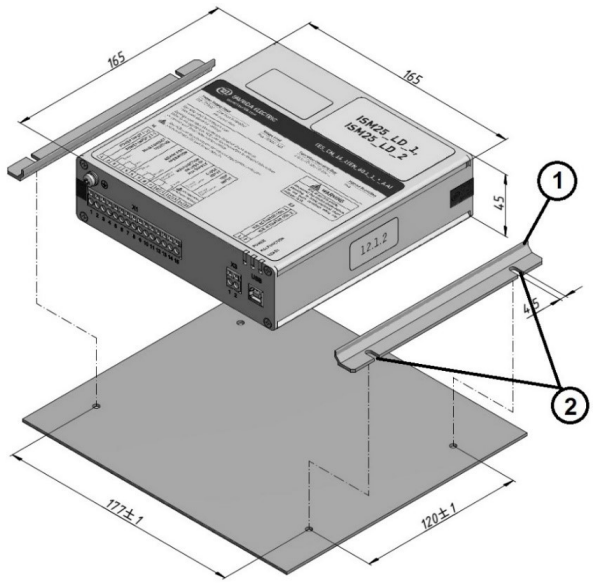
If the manual generator CBunit_ManGen is used for charging, its DC voltage outputs shall be connected to power supply inputs of CM_16_1. Pay special attention to the correct polarity for the low-voltage version of the CM (CM_16_1(Par1_60.1_Par3_Par4_Par5)).

Arrangement of output wires of Manual generators CBunit_ManGen_1 and CBunit_ManGen_2:

- red wire – positive polarity output wire;
- black wire – negative polarity output wire;
- yellow-green wire – manual generator earthing wire.

4.2.6 CM Installation

The installation of the CM is carried out in the low voltage compartment of the switchboard. It must be separated from the high-voltage compartment.



1. CM holders
2. Slots for CM mounting (by M4 screws)

Figure 47

Provisions for CM_16 installation

With help of the CBmount_CM_1 the CM can be mounted on DIN rail in the low voltage compartment of the Switchgear. There are two variants of the CM installation available.

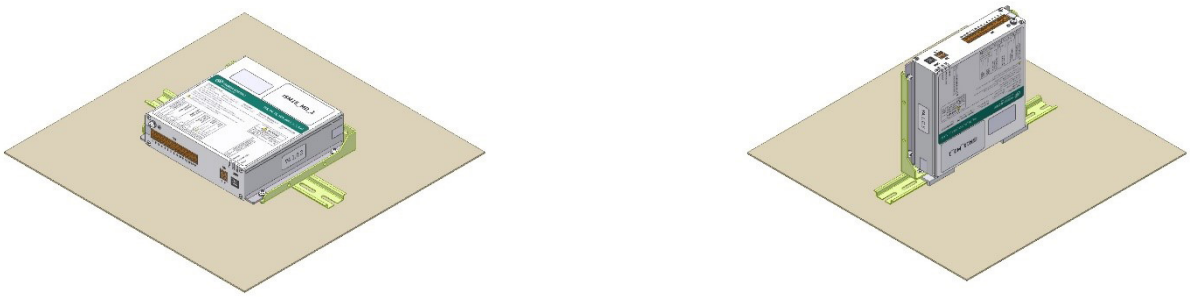


Figure 49

Variants of the CM installation on the DIN rail

The CM can operate in any mounting position. Care must be taken for good access and visibility of the terminals and LEDs.

Wires are connected to the CM terminals by using a screwdriver (Figure 50). The terminals can accept solid and stranded wire within the range 0.5–2.5 mm^2. The insulation stripping length shall be 6–10 mm. Insulated auxiliary circuits shall provide 2 kV power frequency dielectric strength.

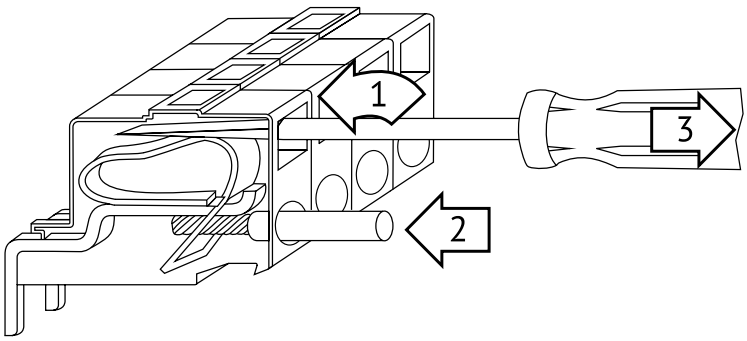


Figure 50

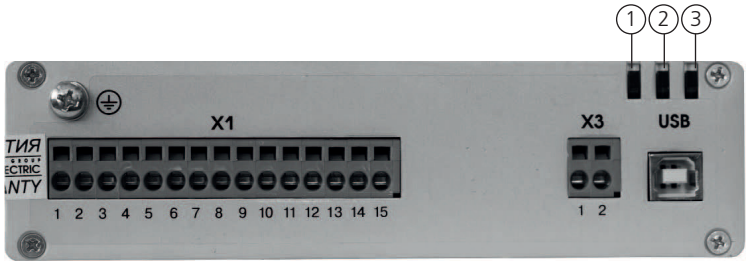
Installation to CM terminals

4.2.7 CM Indication

The CM has the following LED indication functionality:

- CM "Power" indication;
- CM "Ready" state indication;
- CM "Malfunction" state indication.

The placement of LED indicators is shown in Figure 51. The LED indicators are visible from two directions.



1. "Power" LED indicator
2. "Malfunction" LED indicator
3. "Ready" LED indicator

Figure 51
CM_16 LED indicators

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 provided in Table 6.

Table 6 - CM Self-Diagnostic Indication

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

Notes.

1. The number of blinks in series followed by 1.5 s intervals, continuous light or off state are shown for LED indicators.
2. Actuator coil checkup period (short circuit/isolated) – 10 s.

Priority of the fault indication starting from lowest to highest priority:

1. CM is out of temperature range;

2. ISM state is open without command from the CM;
3. Excessive trip or close time;
4. Manual trip and lock;
5. Actuator coil isolated;
6. Short circuit of Actuator coil;
7. Power supply voltage is absent more than 1.5 seconds.

4.2.8 CM Relay Contacts Operation

The relay contacts of CM_16_1 change their state as described below.

Table 7 - CM Relay "Ready" Contacts Operation

CM State	Relay "Ready" Contacts State	
	NC (terminals 7-8 by default)	NO (terminals 6-7 by default)
CM is ready for close or open operation	Open	Closed
CM is not ready for close or open operation	Closed	Open

Table 8 - CM Relay "ISM Main Contact Position" Contacts Operation

ISM State	Relay "ISM Main Contact Position" Contacts State	
	NC (terminals 4-5 by default)	NO (terminals 3-4 by default)
ISM is closed	Open	Closed
ISM is open	Closed	Open

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

- If the close command was applied from the CM. In this case, the update is performed not later than in 150 ms after the 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 if no close or open command was applied from the CM.

If the application project requires you to define the main contacts position faster than the timing mentioned above, it is recommended to use auxiliary switches installed at the ISM. The position indication of ISM provided by CM can be incorrect if the CM is not operable due to an absence of auxiliary supply.

Table 9 - CM Relay “Malfunction or Loss of Auxiliary Supply“ Contacts Operation

CM State	Relay “Malfunction or Loss of Auxiliary Supply“ Contacts State	
	NC	NO
Power supply voltage is absent for more than 1.5 seconds (1 blink of LED Malfunction)	Open	Closed
Excessive trip or close time (2 blinks of LED Malfunction)	Open	Closed
Actuator coil isolated (3 blinks of LED Malfunction)	Open	Closed
Short circuit of Actuator coil (4 blinks of LED Malfunction)	Open	Closed
Manual Trip and Lock (5 blinks of LED Malfunction)	Closed	Open
Out of temperature range (6 blinks of LED Malfunction)	Closed	Open
ISM state is open without command from the CM (7 blinks of LED Malfunction)	Open	Closed
Internal fault of CM (continuous light of LED Malfunction)	Open	Closed

5. Commissioning

The list of commissioning operations and checks is shown in Table 10 below. Initial state of VCB components before checks: ISM – open, CM – deenergized. Main circuits of VCB shall be disconnected/isolated from the main circuits of substation to avoid high-voltage being applied to the VCB before the commissioning procedure completion. Commissioning and maintenance should only be performed by qualified and trained personnel.

Table 10 - List of Commissioning Operations and Check-Ups

Operation description	Required tool	Approximate timing
Tests at the end of installation		
Check for damage, remove any dirt, contamination or moisture [1)]	Visual check, no tool is required	2 minutes
Protective earthing shall be according to subchapter 4.1.1	Visual check, no tool is required	1 minute
Check actual dimensions of the fixed contacts installed in the Switchgear according to subchapter 4.1.2	Ruler	2 minutes
Insert withdrawable VCB in the switchgear panel and check that the DOU plate of the ISM can be properly fixed in the panel according to Figure 52	Visual check, no tool is required	2 minutes
Installation of CM shall be according to subchapter 4.2.4	Visual check, no tool is required	1 minute
Availability of the CM auxiliary power supply. It is recommended to use the same auxiliary power supply as for protection and control devices. Type of voltage and voltage level should be according to selected CM type	Voltmeter with measurement range according to expected power supply voltage value	2 minutes
The polarity of auxiliary power supply and selection of MCB shall be according to subchapter 4.2.5. Check for compliance between ISM type on VCB electrical data label and on CM designation label	DC voltmeter with measurement range according to expected power supply voltage value – for voltage polarity check. Visual check, no tool is required – for MCB check	2 minutes
The connection between the auxiliary circuits connector counterpart and CM shall be according to subchapters 4.2.1, 4.2.3, 4.2.4 and to the circuit diagrams in Appendix 3: Secondary schemes	Multimeter – for validation of correct wiring connections (utilizing the continuity function of the meter)	5 minutes
Check that all secondary connections have been secured adequately and that the VCB auxiliary circuits connector and its counterpart are properly connected	Visual and mechanical check of connections, no tool is required	1 minute
Turn on the CM auxiliary power supply, then check the following: • The "Power" LED must light up immediately. • The "Ready" LED must light up continuously within 15 s after switching on. • The "Malfunction" LED must not light up. • The "Ready" relay contact must close within 15 s. • The "Malfunction or Loss of auxiliary supply" relay contact must change its state [2)]. • The "ISM main contact position" relay contact must not change its state. • ISM main contacts must not change their state (ISM shall remain open).	Visual check, no tool is required	1 minute

1) Including the check of fixed contacts and bushings in the switchgear panel where these contacts are installed.

2) As mentioned earlier, after CM power supply disconnection this relay indicated the CM state: "Power supply voltage is absent for more than 1.5 seconds".

Table 10 - List of Commissioning Operations and Check-Ups

Operation description	Required tool	Approximate timing
Tests at the end of installation		
Apply the close command to the CM, then check the following: • The "Power" LED must light up continuously. • The "Ready" LED must light up continuously. • The "Malfunction" LED must not light up. • The "Ready" relay contact must not change its state. • The "Malfunction or Loss of Auxiliary Supply" relay contact must not change its state. • The "ISM main contact position" relay contact must change its state. • ISM main contacts must change their state (ISM shall be closed).	Visual check, no tool is required	1 minute
Apply the trip command to the CM, then check the following: • The "Power" LED must light up continuously. • The "Ready" LED must light up continuously. • The "Malfunction" LED must not light up. • The "Ready" relay contact must not change its state. • The "Malfunction of Loss of auxiliary supply" relay contact must not change its state. • The "ISM main contact position" relay contact must change its state. • VCB main contacts must change their state (ISM shall be open).	Visual check, no tool is required	1 minute
Do not remove trip command and apply close command to the CM, then check the following: • The "Power" LED must light continuously. • The "Ready" LED must light continuously. • The "Malfunction" LED must not light up. • The "Ready" relay contact must not change its state. • The "Malfunction or Loss of auxiliary supply" relay contact must not change its state. • The "ISM main contact position" relay contact must not change its state. • VCB main contacts must not change their state (ISM shall remain open).	Visual check, no tool is required	1 minute
Remove close and trip commands to the CM then check the following: • The "Power" LED must light up continuously. • The "Ready" LED must light up continuously. • The "Malfunction" LED must not light up. • The "Ready" relay contact must not change its state. • The "Malfunction or Loss of auxiliary supply" relay contact must not change its state. • The "ISM main contact position" relay must not change its state. • VCB main contacts must not change their state (ISM shall remain open).	Visual check, no tool is required	1 minute

Table 10 - List of Commissioning Operations and Check-Ups

Operation description	Required tool	Approximate timing
Tests at the end of installation		
Apply and keep the close command and then apply the trip command to the CM, then check the following: • The "Power" LED must light up continuously. • The "Ready" LED must go out after the trip of the ISM and then light up continuously within 10 s. • The "Malfunction" LED must not light up. • The "Ready" relay contact must change its state after the trip of the ISM and then change its state again within 10 s. • The "Malfunction or Loss of Auxiliary Supply" relay contact must not change its state. • The "ISM main contact position" relay contact must change its state each time when ISM is closed and open. • VCB main contacts must change their state each time the ISM is closed and opened.	Visual check, no tool is required	1 minute
Close ISM and try to rack VCB in the switchgear panel according to the Figure 53. It shall be impossible to rack the VCB in the panel.	Visual check, no tool is required	1 minute
Open ISM and try to rack VCB in the switchgear panel according to the Figure 54. by making one turn of the DOU plate operation lever. It shall be possible to rack the VCB in the panel.	Visual check, no tool is required	1 minute
Try to close ISM while the DOU plate in the intermediate position according to the Figure 55. It shall be impossible to close the ISM.	Visual check, no tool is required	1 minute
Rack out the DOU plate and close the ISM. Then trip the ISM mechanically by manual trip button according to the Figure 56. The VCB main contacts must change their state each time the ISM is closed and opened.	Visual check, no tool is required	1 minute
Primary Circuits Insulation Check [3)]		
Remove withdrawable VCB from the switchgear panel [4)].	-	2 minutes
Observe safety precautions listed in the danger and warning advisories. Construct proper barriers and warning light systems [5)].	Equipment to provide safety in the test area	10 minutes
Ground each pole of VCB that is not being tested [6)]	Wires	2 minutes
Apply slowly rising 100% [7)] of test voltage [8)] (50 or 60 Hz) across each pole for one minute [9)]. (ISM is open).	Power frequency withstand voltage test set	2 minutes

3) This test includes not only the vacuum interrupter test, but also the other insulation components tested in parallel with the interrupter. These include the standoff insulators and the insulated drive links, as well as the insulating (tension) struts between the upper and lower vacuum interrupter supports. If these insulation components are contaminated or defective, the test voltage will not be sustained. If so, clean or replace the affected components, and retest.

4) In cases where the VCB is tested separately from the switchgear panel.

5) The insulation barriers shall be also installed between the movable contacts of the withdrawable VCB to prevent the discharges appearance in this area for cases where the VCB is tested separately from the switchgear panel.

6) The VCB should be tested phase by phase only. Therefore, poles not under test should be grounded.

7) For test of separate VCB - 100% level of test voltage, for test of Switchgear with installed VCB - 80% level of test voltage in accordance with IEC 62271-200.

8) Rated test voltage levels (Ud) are given in Table 1.

9) To apply the test voltage, single-core short cables should be used. The application of high-voltage coaxial cables is strictly prohibited. To coordinate the surge impedance between the test set and ISM extra resistor (as shown in Figure 57) shall be used.

Table 10 - List of Commissioning Operations and Check-Ups

Operation description	Required tool	Approximate timing
Tests at the end of installation		
If the pole sustains the test voltage for that period, its vacuum integrity has been verifed [10].	Power frequency withstand voltage test set	-
Repeat actions above to check each pole of VCB.	Power frequency withstand voltage test set	8 minutes
Close the ISM. Ground each pole of VCB that is not under test [6].	Wires	1 minute
Apply slowly rising 100% [7] of test voltage [8] (50 or 60 Hz) between a primary conductor of the pole and ground for one minute, repeat test for each pole of VCB	Power frequency withstand voltage test set	12 minutes
If no disruptive discharge occurs, the insulation system is satisfactory.	Power frequency withstand voltage test set	-
After the test, ground all main circuit terminals to dissipate any static charge.	Wires	2 minutes
Auxiliary Circuits Insulation Check		
Connect all points of the withdrawable VCB secondary circuits with a shorting wire [11]. VCB shall not be connected to the CM before the test.	Wires	5 minutes
Connect the shorting wire to the high potential lead of the high-voltage tester and ground the circuit breaker housing. Starting with zero volts, gradually increase the test voltage to 2000 V RMS, 50 or 60 Hz. Maintain test voltage for one minute.	Power frequency withstand voltage test set	3 minutes
If no disruptive discharge occurs, the secondary circuits insulation level is satisfactory.	Power frequency withstand voltage test set	-
Disconnect the shorting wire.	Visual check, no tool is required	2 minutes
Primary Circuits Contact Resistance Check		
ISM shall be closed before the test. There should not be any external circuits connected to VCB main terminals that provide parallel circuit with the VCB main circuits otherwise tests will be invalid.	Visual check, no tool is required	1 minute
Test equipment shall be connected to VCB main circuits terminals according to Figure 58 to exclude any additional contact resistance and to decrease measurement error. Main contact resistance shall be measured by appropriate equipment at test current not less than 50 A.	Resistance measurement test equipment with test current not less than 50 A	10 minutes
Measured values must not exceed limits specified in Table 1.	Visual check, no tool is required	-

10) During testing of vacuum interrupter, self-fading restrikes may appear. In case of restrikes, reduce the voltage slightly until the restrikes disappear (for 10-15 seconds) and then increase again.

11) The VCB auxiliary circuits connector counterpart may be used for this.

After these tests have been performed successfully, the VCB can be put into operation.

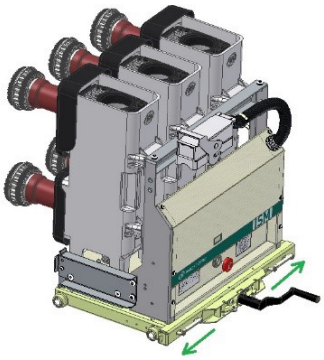


Figure 52
Checkup of the withdrawable VCB fixing in the switchgear panel

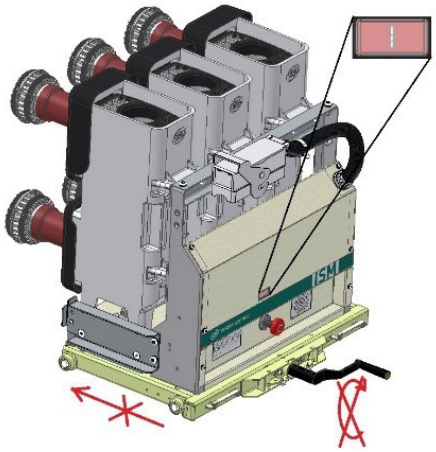


Figure 53
The DOU cannot be moved while the ISM is closed

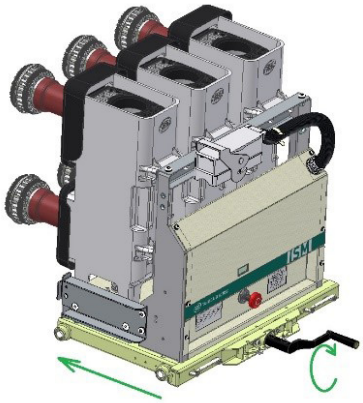


Figure 54
The DOU plate can be racked in while ISM is open

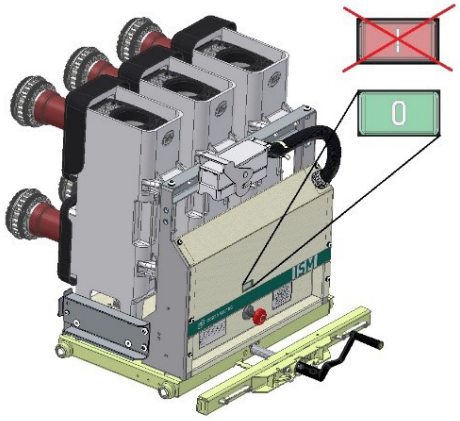


Figure 55
The ISM cannot be closed while DOU in the intermediate position

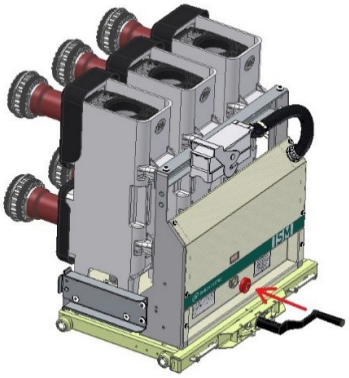


Figure 56
The ISM manual trip execution

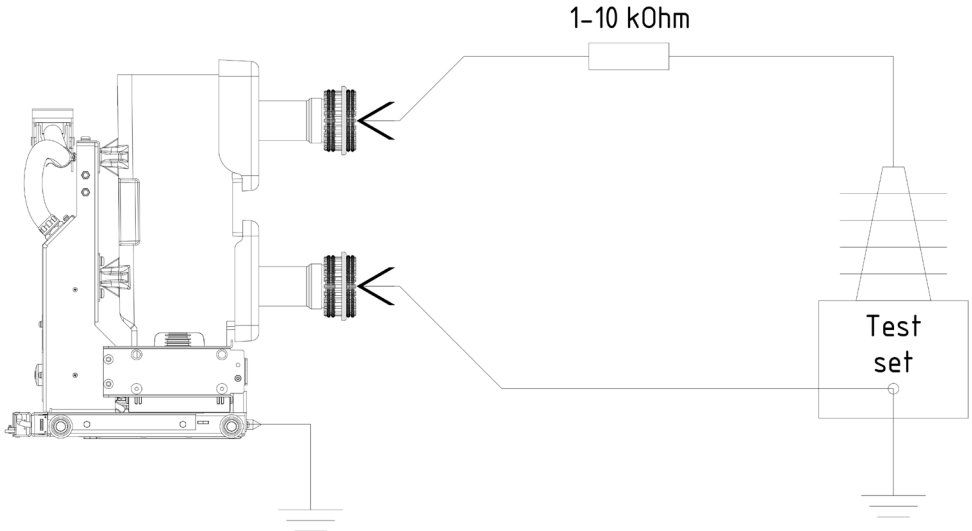
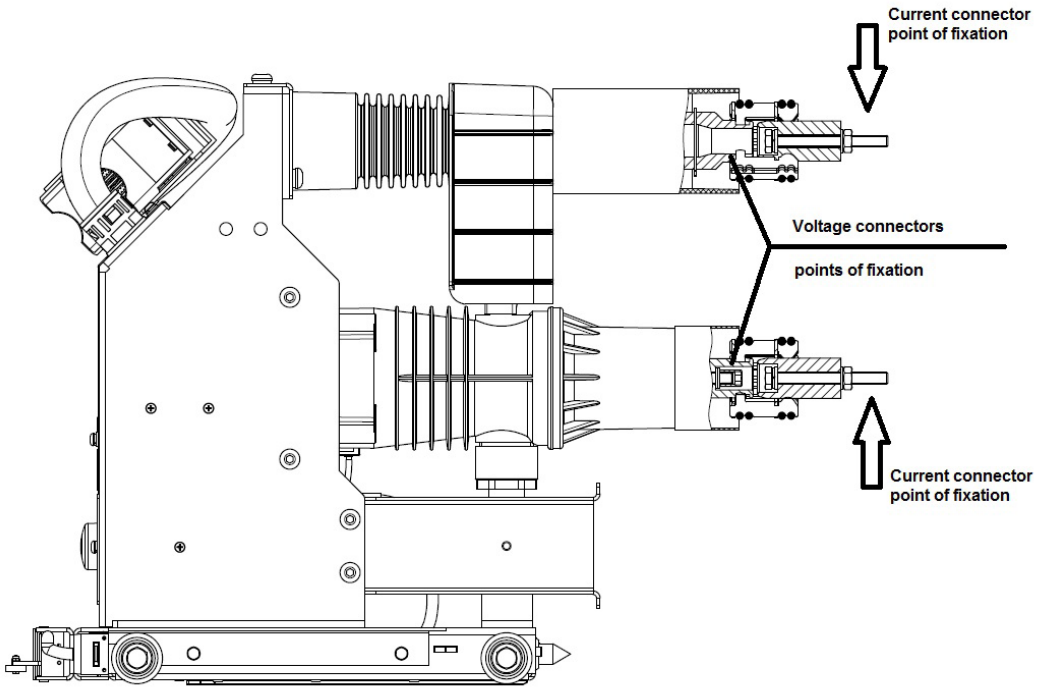
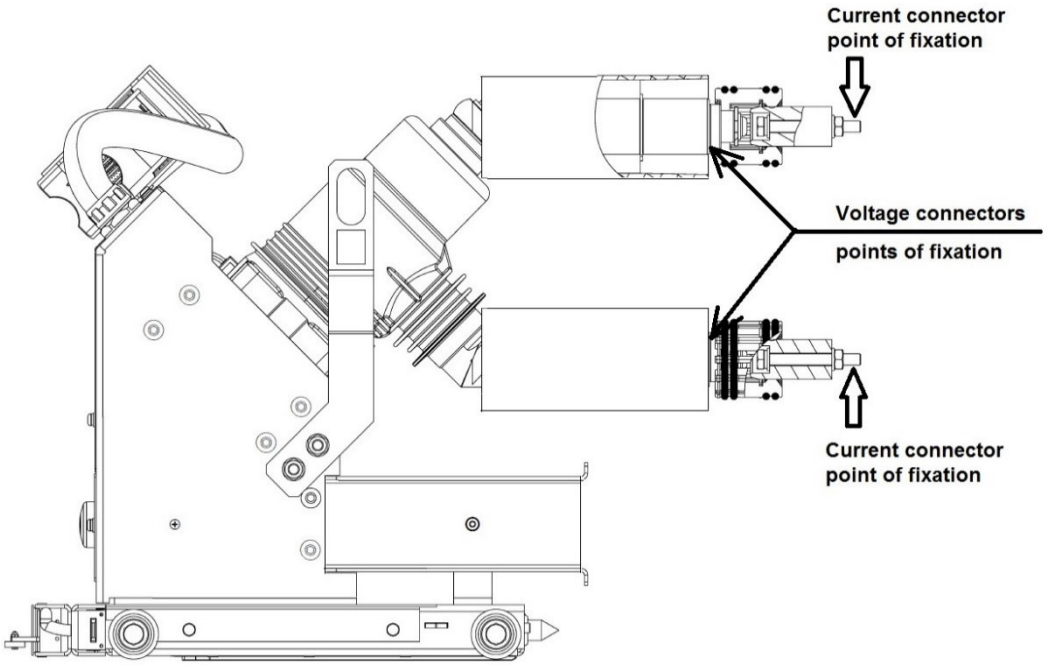


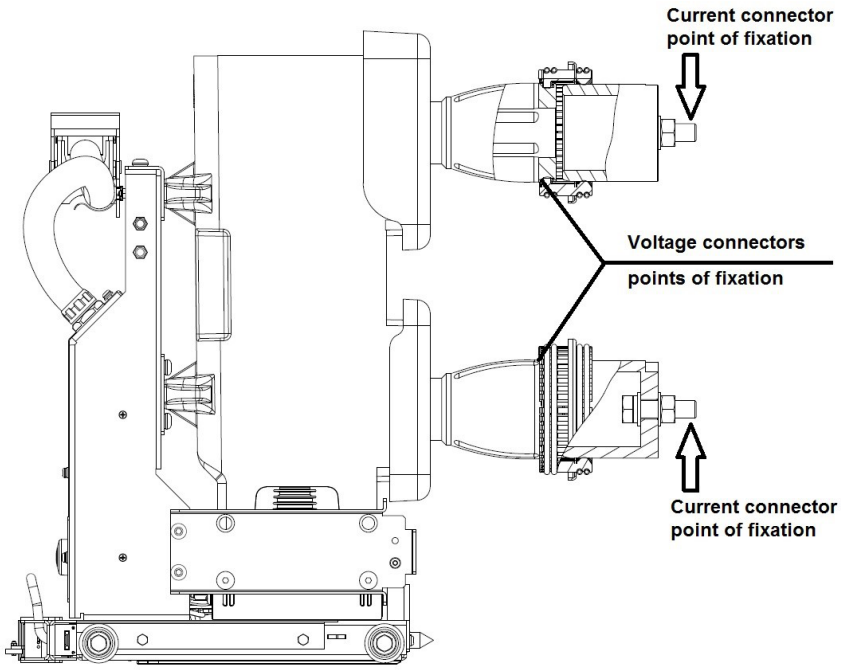
Figure 57
The vacuum integrity and solid insulation test installation



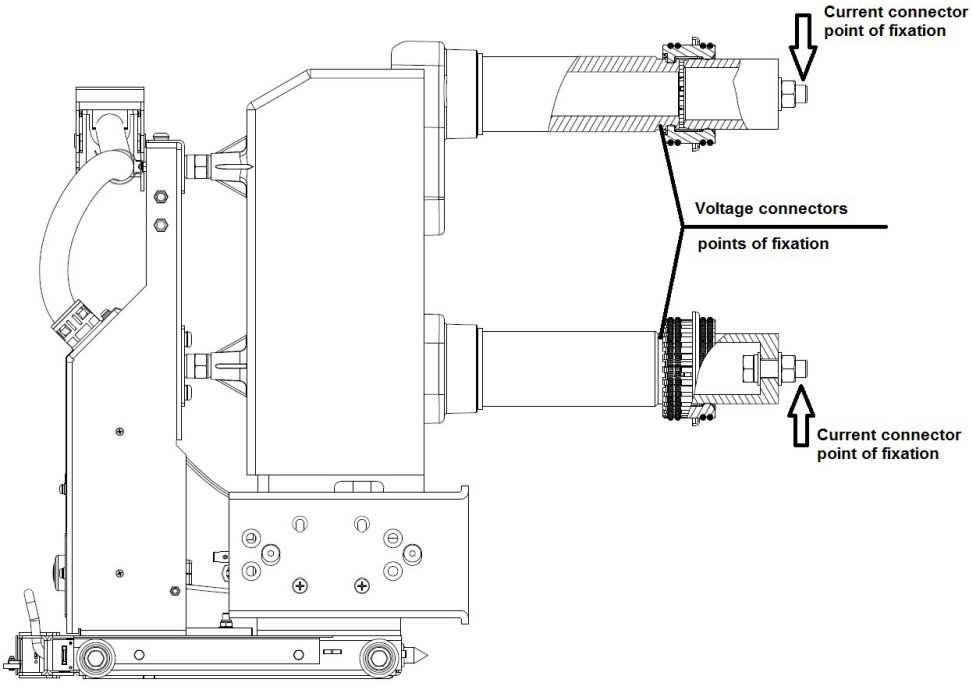
a) VCB15_LD8_16D



b) VCB15_MD1_16D



c) VCB15_HD1_16D



d) VCB25_Shell2_16D

Figure 58

The connection points of the contact resistance meter

Note:

To conveniently attach the current connectors and to prevent damage to the fixed contacts surface, please insert bolts (used for the contacts attachment in the switchgear panel) in the fixed contacts and screw them tightly with nuts. Then use these bolts as points to attach the current connectors.

6. Operation

6.1 Switching

6.1.1 VCB Racking in and out of the Switchgear

To change the VCB position from test to service and vice versa, the DOU plate is equipped with a racking mechanism. To operate it, a handle is used. VCB movement is provided by handle rotation in a clockwise direction for moving to service position and a counterclockwise direction for moving to test position.

Movement is available while the ISM is open.

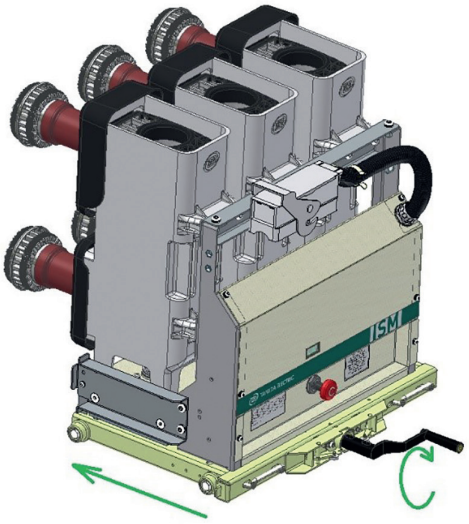


Figure 59
VCB moving in service position

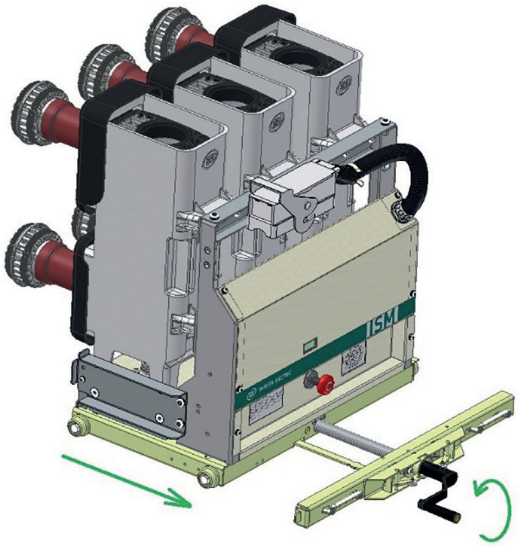


Figure 60
VCB moving in test position

6.1.2 ISM Closing

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

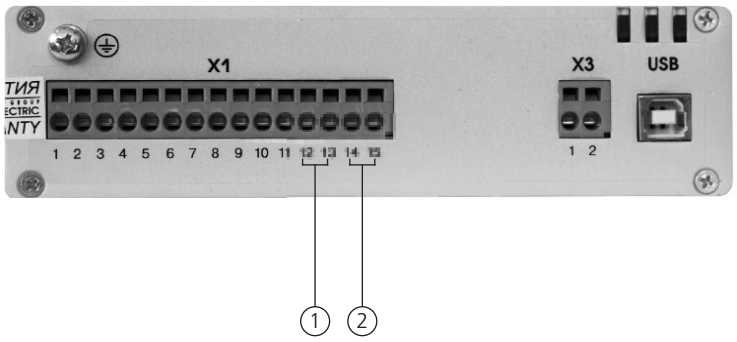
The Close command will be accepted in the following cases.

- CM state is "Ready" (Ready LED flashes green).
- No Trip command is applied.
- Mechanical and electrical interlock is unlocked.

If the "Close" command is applied and held before the CM is in a "Ready" state, the Close command will not be accepted.

If the auxiliary power is not available, the manual generator CBunit_ManGen shall be used to charge the CM capacitors prior to applying the "Close" command to the ISM.

If the manual generator CBunit_ManGen is 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.



1. Close command input
2. Trip command input

Figure 61
CM_16 close and trip inputs

6.1.3 ISM 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 the CM state is "Ready" (Ready LED flashes green), even up to 60 seconds after a loss of auxiliary power supply.

In case 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. Holding "Trip" command will block "Close" command execution.

6.1.4 ISM Emergency Opening

The ISM can also be opened manually. To open the ISM manually, the force should be applied to the manual trip button. See Figure 62 below.

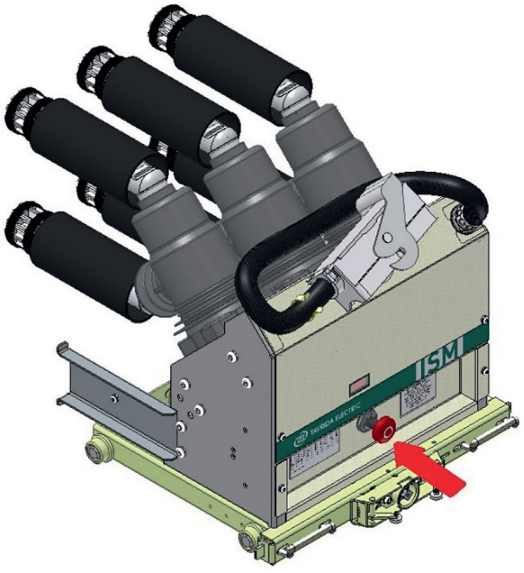


Figure 62
ISM manual trip execution

The button moves the ISM synchronization plate. When the synchronizing plate is moved, a force exceeding the magnetic attraction forces of the ring magnet is applied to the ISM 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.

6.2 Interlocks

The VCB provides all the interlocks required to provide high level of safety and reliability during installation, commissioning and operation.

Standard safety interlocks included:

- The draw-out unit can only be moved if the ISM is open and locked against closing.
- The ISM can only be unlocked and operated if the draw-out unit is exactly in the test or service position.
- The interlocks can only be unlocked and operated if the draw out unit is exactly in the test or service position.

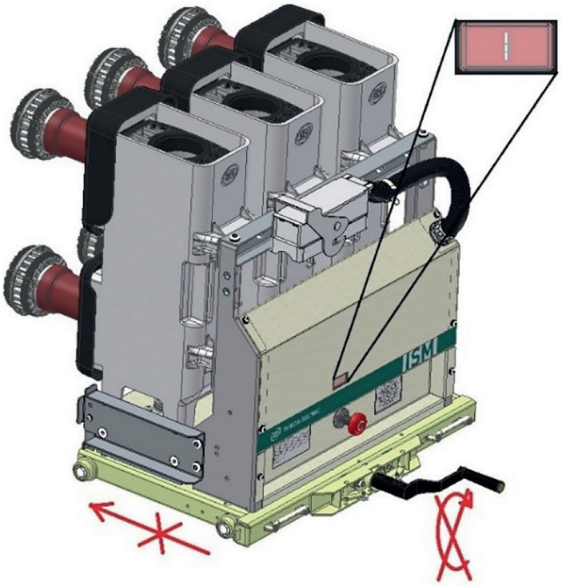


Figure 63

The DOU cannot be moved while the ISM is closed

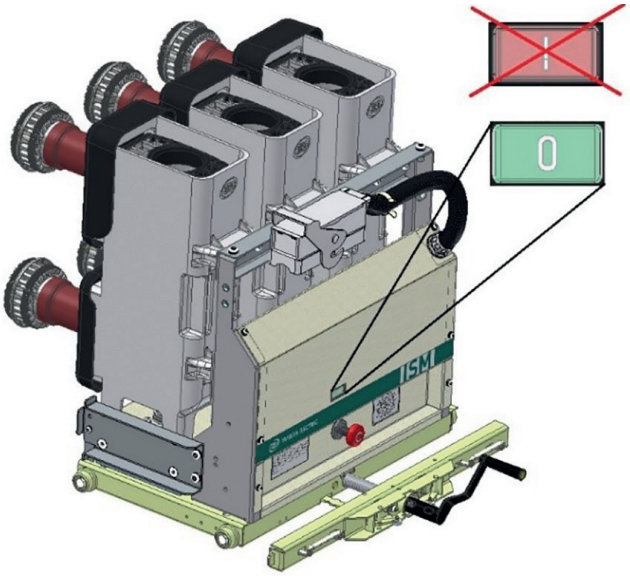


Figure 64

The ISM cannot be closed while the DOU is in the intermediate position

Interlocks related to the draw-out unit located inside the switchgear:

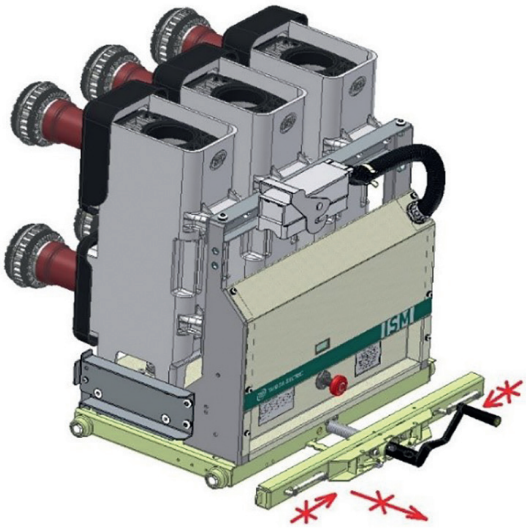


Figure 65

The DOU cannot be removed from Switchgear while DOU not in the test position

- The draw-out unit can only be moved when the earthing switch is open.
- The earthing switch can only be closed when the draw-out unit is in test position.
- The draw-out unit can only be moved to the service position when the Switchgear circuit breaker compartment door is closed.
- The draw-out unit can only be removed from the switchgear when the draw-out unit is in test position.

6.3 Optional Interlocks

Optionally the VCB can be equipped with the following interlocks (in any combination):

- The Interlock preventing VCB auxiliary circuits plug connection to the switchgear if the VCB is not in the test position. The interlock is available when the VCB has plastic auxiliary circuits plug. In case the VCB has IP2X front cover it is already equipped with this interlock;
- The interlock preventing the draw-out unit racking in/out in case locking solenoid is not energized.

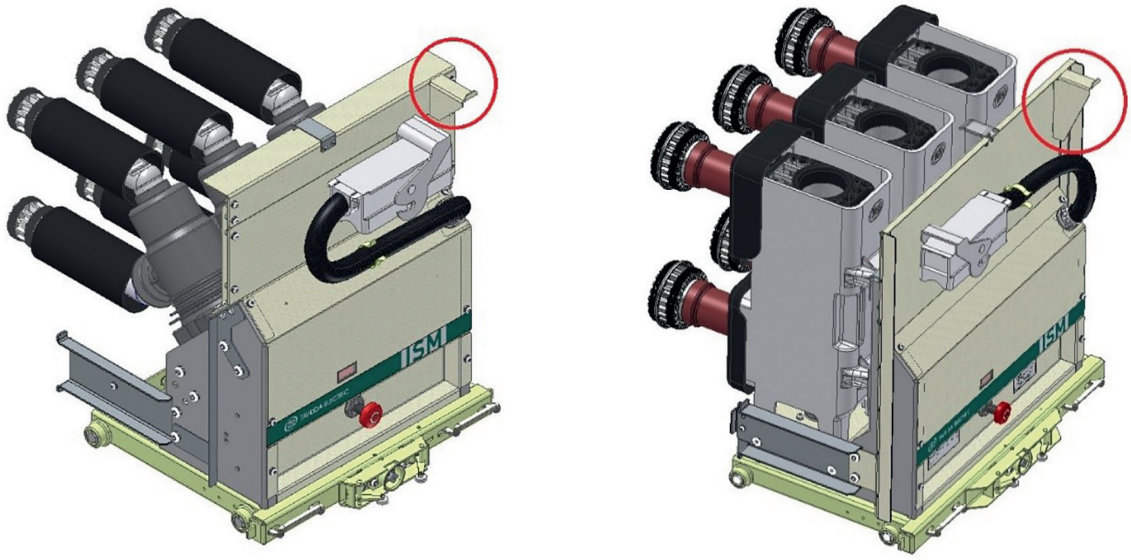


Figure 66

Auxiliary circuits plug interlock

7. Maintenance and Troubleshooting

7.1 Primary Circuits

Under normal operating conditions (see Table 1), the ISM is maintenance-free until it has reached the permissible number of operating cycles.

However, when maintenance is carried out on the complete switchgear, the commissioning tests should be repeated. Check that the VCB is disconnected from all voltage sources before inspecting its insulating parts. The withdrawable VCB should be inspected at least once every 5 years. More frequent inspections (up to one time per six months) are recommended when the VCB works in unfavorable conditions such as dust and moisture. Test results should be treated as given in Table 11.

Table 11 - List of Tests and Check-Ups of the Withdrawable ISM During Maintenance

Operation description	Required tool	Approximate timing
Check for damage, remove any dirt, contamination or moisture.	Dry napless cloth or a napless cloth soaked in alcohol to clean the insulation	5 minutes
Check the moveable contacts condition – absence of any main contacts overheating tracks and damages of silver coating should be ascertained.	Visual check, no tool is required	1 minute
ISM Operation Check		
Perform close and open operation of the ISM. Modules shall be operable, VCB contacts position indicator shall properly work. Otherwise, check the control circuit.	Visual check, no tool is required	1 minute
Perform interlocks check. Interlocks shall work properly.	Visual check, no tool is required	5 minutes
Primary Circuits Insulation Check [1)]		
Observe safety precautions listed in the danger and warning advisories. Construct the proper barrier and warning light system [2)].	Equipment to provide safety in test area	10 minutes
Ground each pole which is not under test	Wires	2 minutes
Apply slowly rising 100% [3)] of test voltage [4)] (50 or 60 Hz) across each pole for one minute [5)]. (ISM is open.)	Power frequency withstand voltage test set	2 minutes
If the pole sustains the test voltage for that period, its vacuum integrity has been verifed [6)].	Power frequency withstand voltage test set	-

1) This test includes not only the vacuum interrupter test, but also the other insulation components tested in parallel with the interrupter. These include the support insulators and the insulated drive links, as well as the insulating (tension) struts between the upper and lower vacuum interrupter supports. If these insulation components are contaminated or defective, the test voltage will not be sustained. If so, clean or replace the affected components and retest.
2) The insulation barriers shall be also installed between the movable contacts of the withdrawable VCB to prevent the discharges appearance in this area - in cases where the VCB is tested separately from the switchgear panel.
3) For test of separate VCB - 100% level of test voltage, for test of switchgear with installed VCB - 80% level of test voltage according to IEC 62271-200.
4) Rated test voltage levels (Ud) are given in Table 1 above.
5) To apply test voltage, the single-core short cables should be used. Application of high-voltage coaxial cables is strictly prohibited. To coordinate the surge impedance between the test set and the VCB, the extra resistor (as shown in Figure 57) shall be used.
6) During testing of vacuum interrupter, self-fading restrikes may appear. In case of restrikes, reduce the voltage slightly until the restrikes disappear (for 10-15 seconds) and then increase again.

Table 11 - List of Tests and Check-Ups of the Withdrawable ISM During Maintenance

Operation description	Required tool	Approximate timing
Repeat actions above to check each pole of the VCB.	Power frequency withstand voltage test set	8 minutes
Close the ISM. Ground each pole not under test.	Wires	1 minute
Apply slowly rising 80% of test voltage [3] (50 or 60 Hz) between a primary conductor of the pole and ground for one minute, repeat test for each pole of VCB.	Power frequency withstand voltage test set	12 minutes
If no disruptive discharge occurs, the insulation system is satisfactory	Power frequency withstand voltage test set	-
After the test, ground all main circuit terminals to dissipate any static charge.	Wires	2 minutes
Primary Circuits Contact Resistance Check [7]		
ISM shall be closed before the test. There should not be any external circuits connected to VCB main terminals that provide parallel circuit with the VCB main circuits, otherwise the tests will be invalid.	Visual check, no tool is required	1 minute
Test equipment shall be connected to VCB main circuits terminals according to Figure 58 to exclude any additional contact resistance and to decrease measurement error. Main contact resistance shall be measured by appropriate equipment at test current not less than 50 A.	Resistance measurement test equipment with test current not less than 50 A	10 minutes
Measured values must not exceed limits specified in Table 1.	Visual check, no tool is required	-

7) If the module has contact resistance which exceeds the specified limit but is less than twice this limit, continuation of use is possible, if actual continuous current does not exceed the following value:

$$Ia < Ir\sqrt{\frac{Rr}{Ra}}$$

where:

Ia, Ra — actual current and corresponding contact resistance,

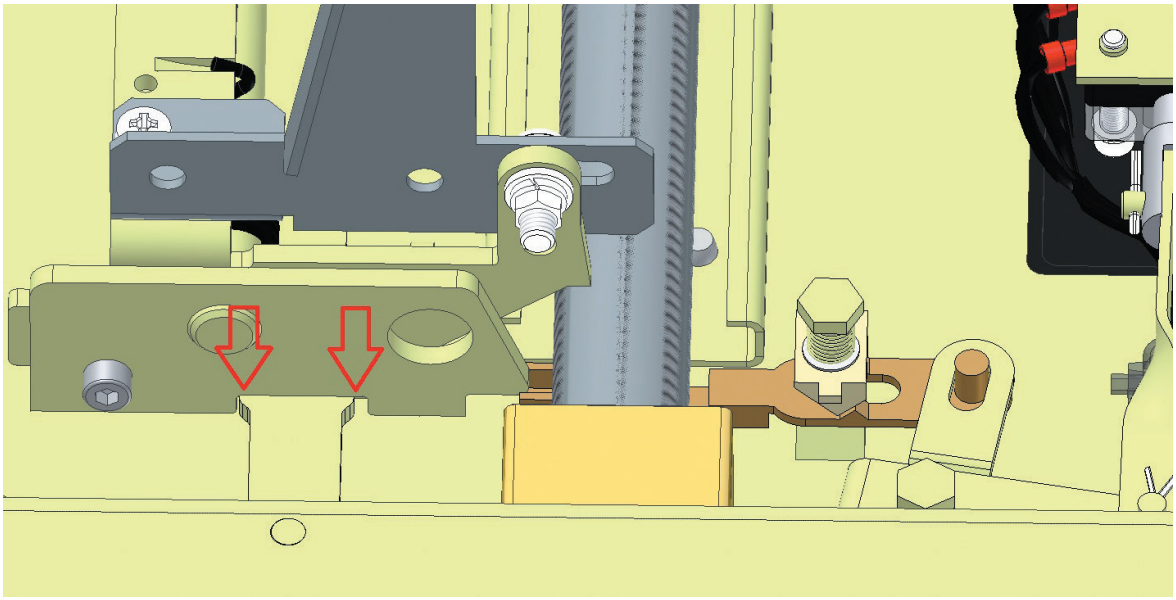
Ir, Rr — rated values (Table 1).

If the contact resistance is at least twice as high as the specified limit, the VCB must be replaced.

Additionally, switchboards can be subjected to extra tests that are specified in corresponding documentation for the switchboards.

DOU Plate Maintenance

Bearing points and sliding surfaces of DOU plate should be lubricated at least once per five years with a thin film of GE Lubricant D6A15A1 (MobilGrease 28, catalog number 193A1751P1). Clean the surfaces to be lubricated with an industry-approved solvent.



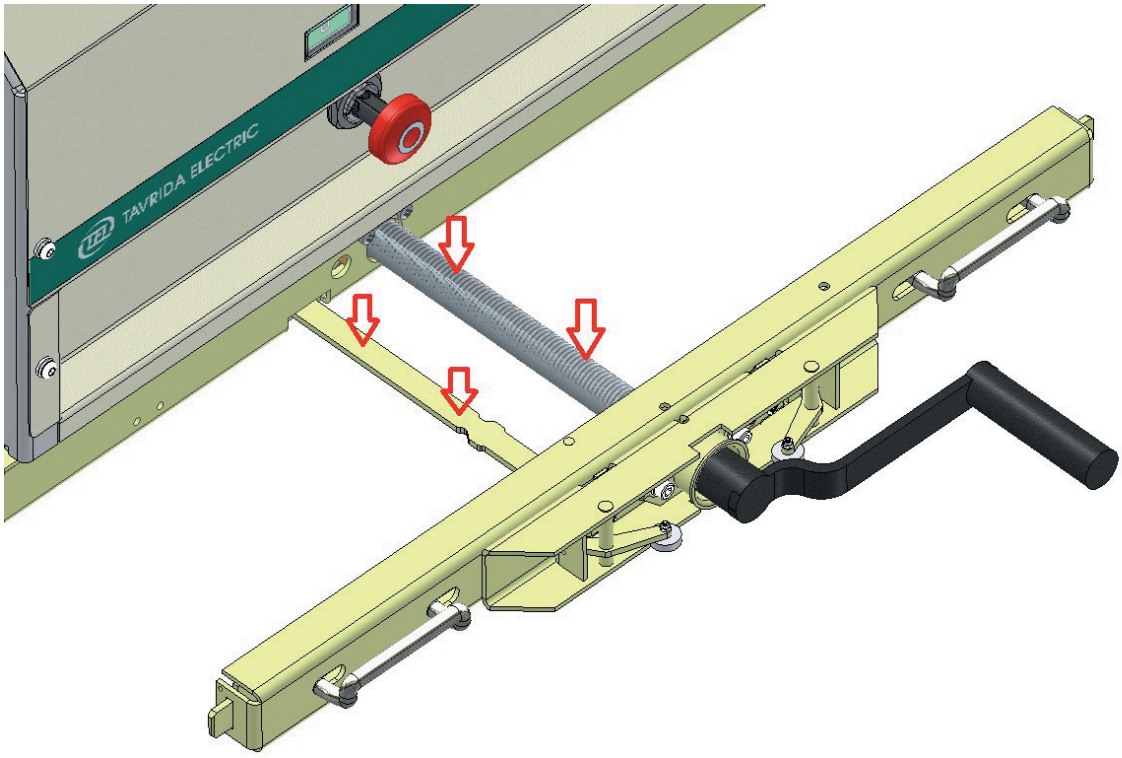


Figure 67
DOU plate lubricated surfaces

Remove all excess lubricant with a clean, lint-free cloth to avoid the accumulation of dirt or dust. Do not lubricate the outside diameters of the DOU plate rollers.

Main Contacts

The fixed contacts in the switchgear panel and the contact surfaces of the ISM movable contacts should be lubricated at least once per five years with a thin film of GE Lubricant D6A15A1 (MobilGrease 28, catalog number 193A1751P1). Clean the surfaces to be lubricated with an industry-approved solvent.

Remove all excess lubricant with a clean, lint-free cloth to avoid accumulation of dirt or dust.

7.2 Secondary Circuits

The CM is inherently maintenance-free. However when maintenance is carried out on the complete switchgear then commissioning tests should be repeated. It is also recommended to conduct regular visual checks of the module housing and insulation of the wires connected to the CM. Test results should be treated as given in the Table 12.

Table 12 - List of Tests and Checkups of the CM During Maintenance

Operation description	Required tool	Approximate timing
Auxiliary Circuits Insulation Check		
Connect all points of the withdrawable VCB secondary circuits with a shorting wire. VCB shall be disconnected from the CM before the test.	Wires	5 minutes
Connect the shorting wire mentioned in previous clause to the high potential lead of the high-voltage tester and ground the circuit breaker housing. Starting with zero volts, gradually increase the test voltage to 1500 V RMS, 50 or 60 Hz. Maintain test voltage for one minute.	Power frequency withstand voltage test set	3 minutes
If no disruptive discharge occurs, the secondary circuits insulation level is satisfactory.	Power frequency withstand voltage test set	-
Disconnect the shorting wire.	Visual check, no tool is required	2 minutes

7.3 Troubleshooting

If during installation, commissioning, operation or maintenance any non-conformity occurs, contact your nearest Tavrida Electric sales representative. The contact data and web site links are listed at the end of this document. In case of non-conformity, any repairs are strictly prohibited without permission from the sales representative.

If you suspect a failure has occurred, perform the checks as mentioned in Table 13 prior to contacting our regional representative.

Table 13 - Typical Failure Symptoms and Methods of Their Elimination

Failure description	Possible reason	Method of elimination
Appearance failure.	Mechanical or arc damage, breach of service conditions.	Replacement of failed component.
Excessive contact resistance of VCB.	VCB internal failure.	Replacement of VCB.
VCB cannot pass power frequency voltage withstand test at 80 % of rated voltage.	VCB internal failure.	Replacement of VCB.

Table 13 - Typical Failure Symptoms and Methods of Their Elimination

Failure description	Possible reason	Method of elimination
ISM cannot perform close/trip operation.	ISM is interlocked.	Check VCB interlocks state and its actuator coil connection with connector CM.
	CM failure.	Check CM LED states.
	VCB internal failure.	Replacement of VCB.
1 blink of CM "Malfunction" LED.	Absence of CM power supply.	Check presence of CM power supply, its polarity and voltage level.
2 blinks of CM "Malfunction" LED.	ISM cannot be closed / tripped.	Check the circuit of ISM actuator coil connection with CM, check state of VCB electrical interlocks.
3 blinks of CM "Malfunction" LED.	ISM actuator coil circuit is interrupted.	Check the circuit of ISM actuator coil connection with CM, check state of VCB electrical interlocks
4 blinks of CM "Malfunction" LED.	Short circuit of ISM actuator coil circuit.	Check the circuit of ISM actuator coil connection with CM, check state of VCB electrical interlocks.
Failure description	Possible reason	Method of elimination
5 blinks of CM "Malfunction" LED.	Manual trip of ISM and ISM is electrically interlocked.	Check the ISM and VCB interlock state
6 blinks of CM "Malfunction" LED.	Overheating of CM.	Stop performing CO operations until the blinks stop if temperature is above the temperature range or move CM into environment with higher temperature if temperature is below the temperature range.
7 blinks of CM "Malfunction" LED.	ISM state is open without command from the CM.	Check the ISM and VCB interlock state.
CM "Malfunction" LED lights continuously.	CM internal failure.	Replacement of CM.
None of CM LEDs lights.	Absence of CM power supply.	Check presence of CM power supply, its polarity and voltage level.
	CM internal failure.	Replacement of CM.

The VCB or CM removal and the installation of the new one should be performed according to chapter 4. The checks and tests after substitution are described in chapter 5.

8. Disposal

All Tavrida Electric vacuum circuit breakers and their components are manufactured from environmentally friendly materials, therefore no special waste disposal is required.

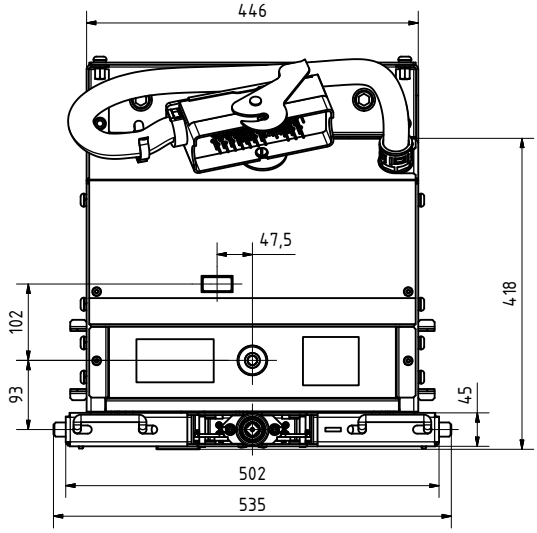
Appendix 1. Withdrawable VCB Package Dimensions

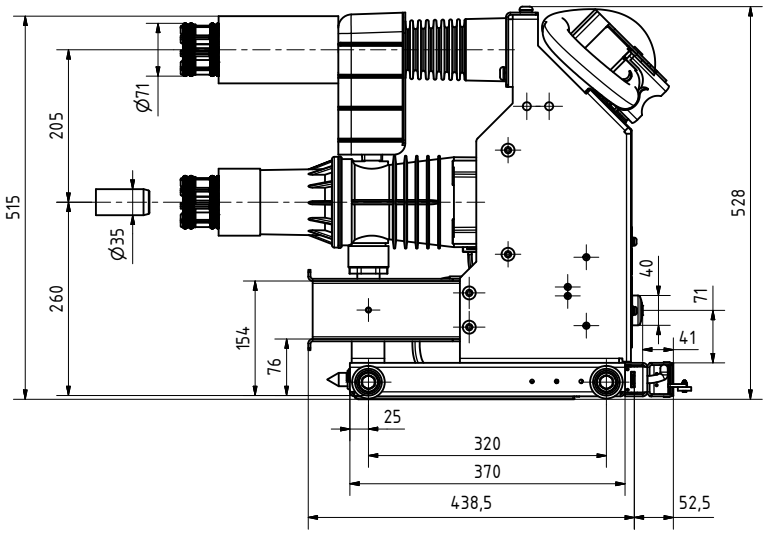
Withdrawable VCB Package Dimensions

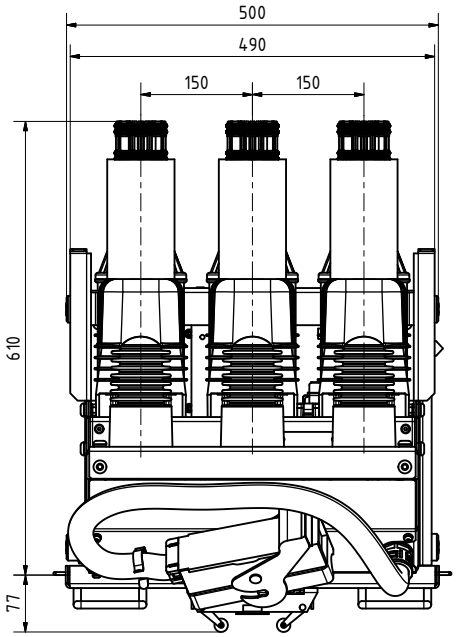
Withdrawable VCB	PCD	Package Dimensions, not more than (LxWxH), mm
VCB15_LD8_16D	150	780x780x937
	210	780x780x937
VCB15_MD1_16D	150	780x780x937
	210	780x780x937
VCB15_HD1_16D	210	780x780x937
	275	1150x990x997
VCB25_Shell2_16D	210	905x805x997
	275	1150x990x997

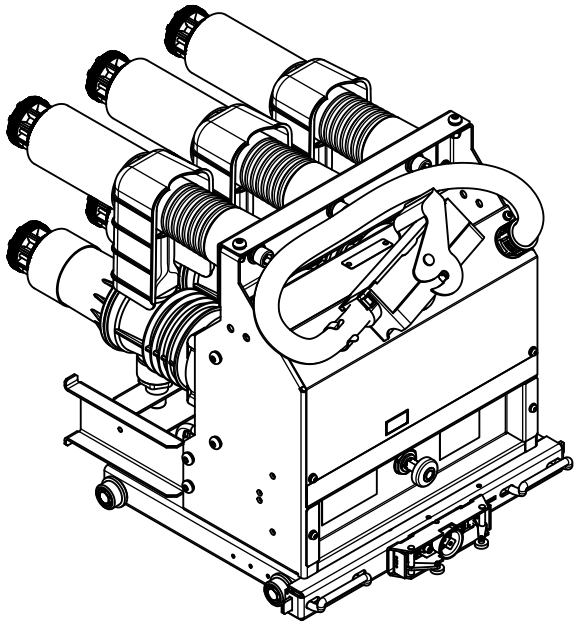
Appendix 2.
Overall Drawings

VCB15_LD8_16D



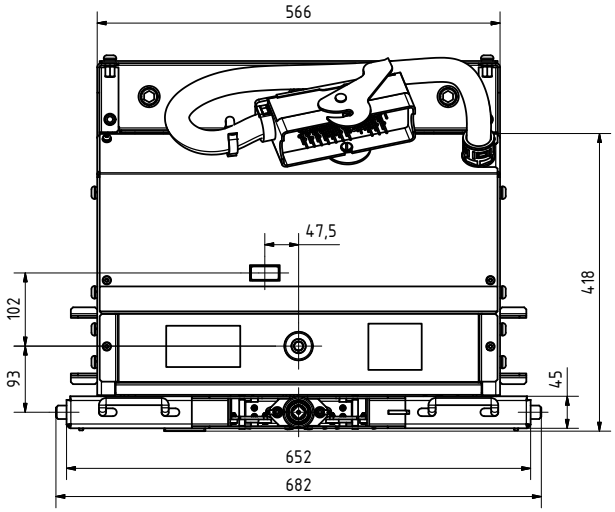


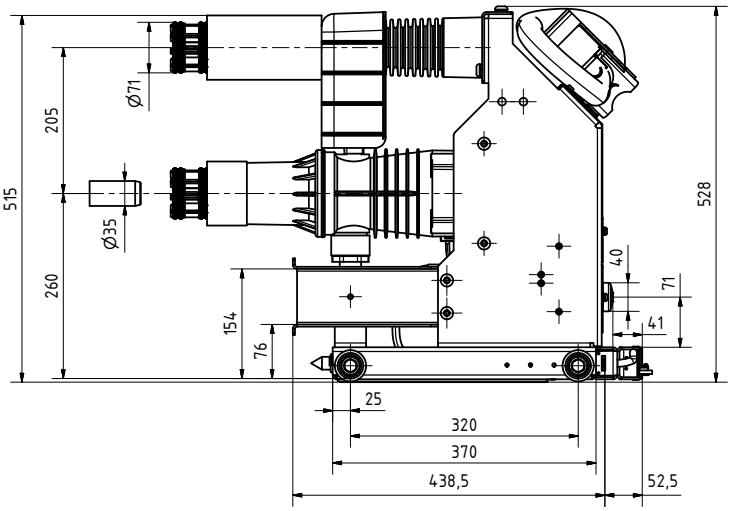


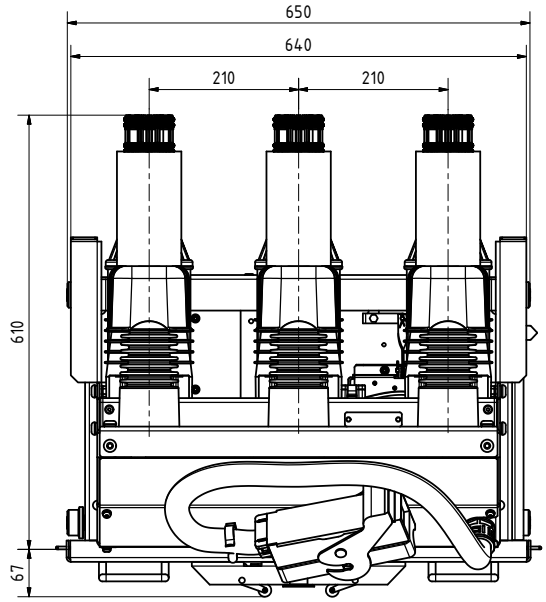


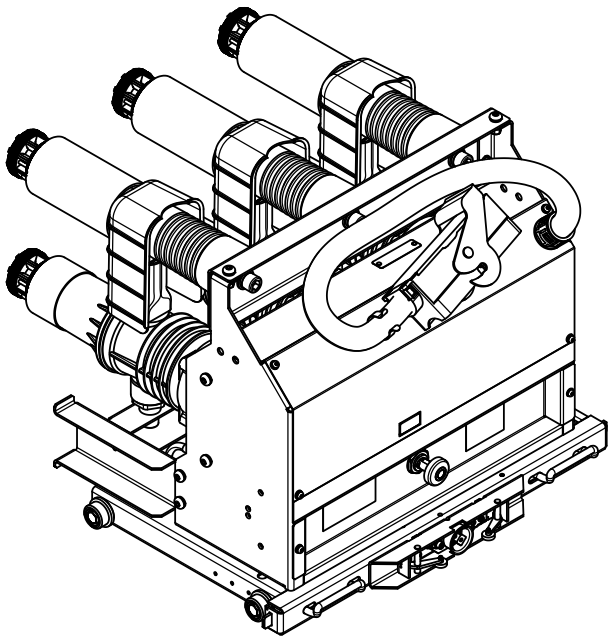
VCB15_LD8_16D
17.5kV, 800 A, PCD: 150 mm,
weight: 70 kg

L_{max} = 687 mm
W_{max} = 535 mm
H_{max} = 528 mm



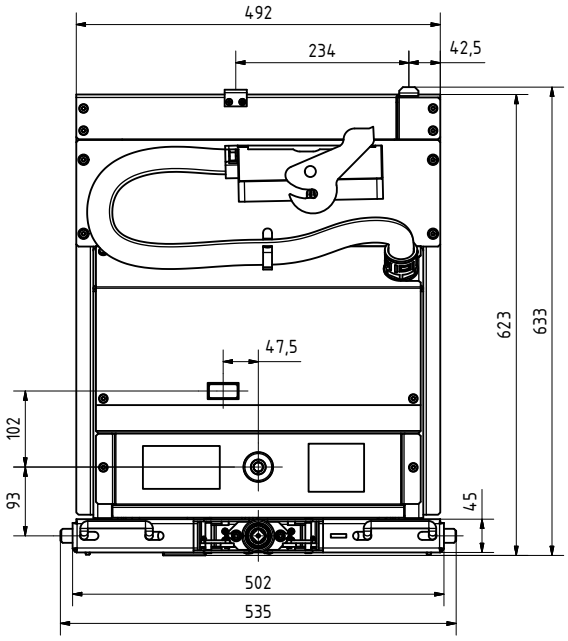


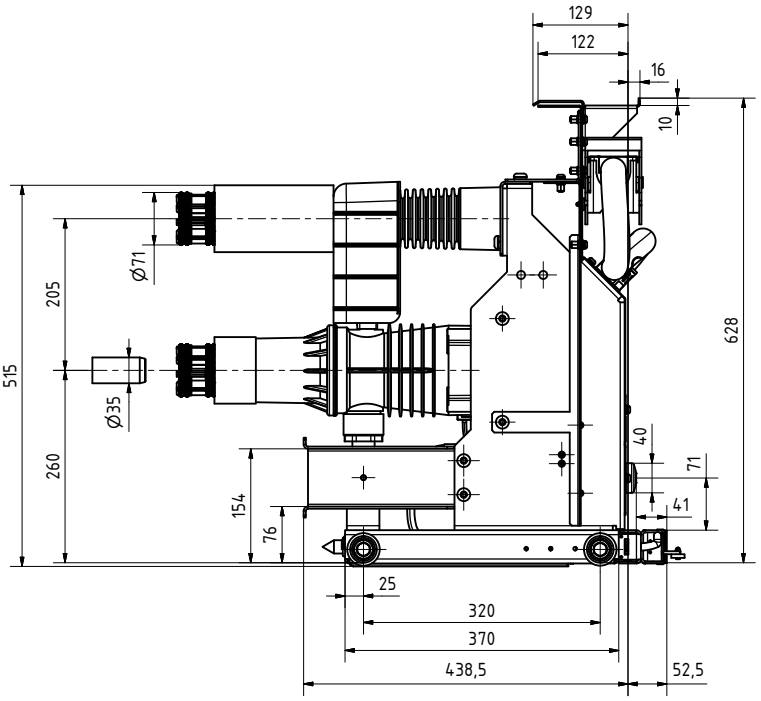


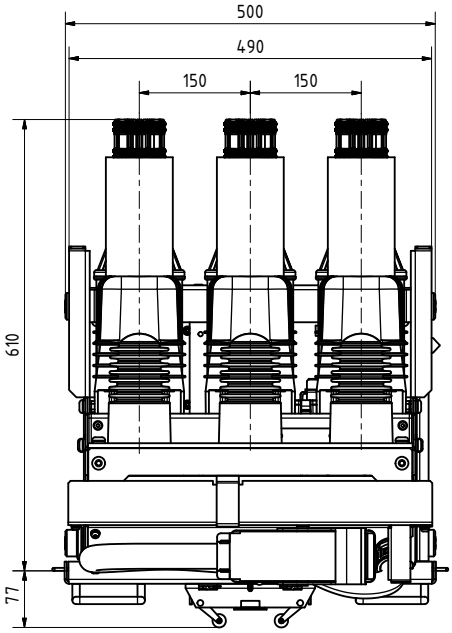


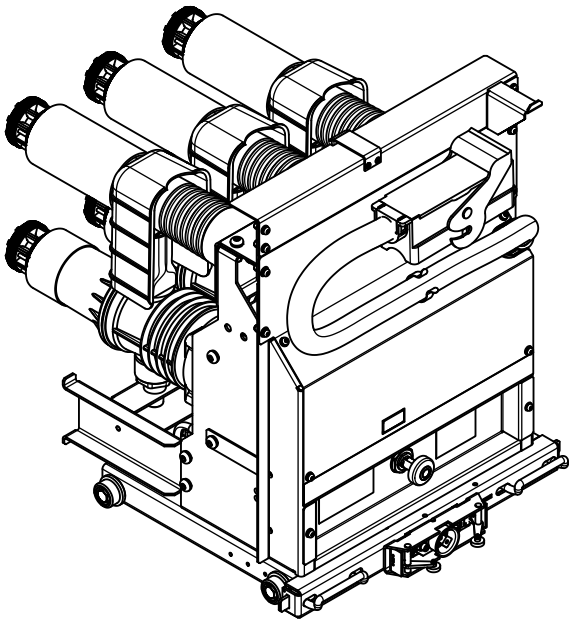
VCB15_LD8_16D
17.5kV, 800 A, PCD: 210 mm,
weight: 76 kg

L_{max} = 677 mm
W_{max} = 682 mm
H_{max} = 528 mm



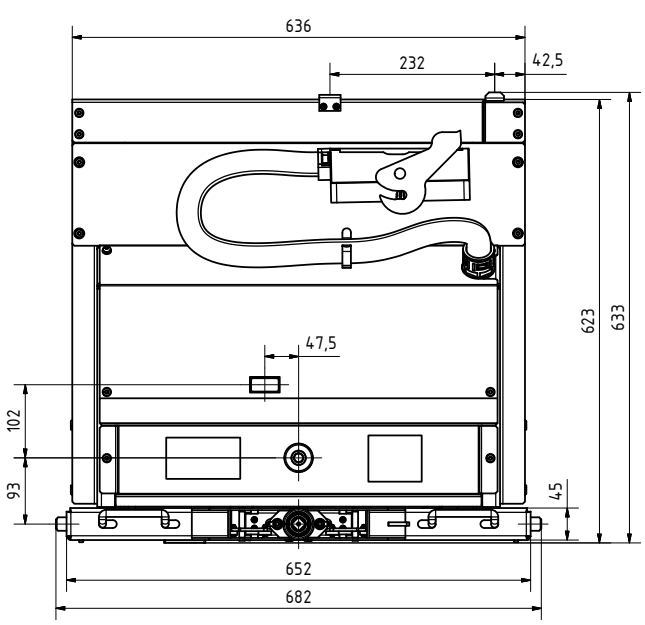


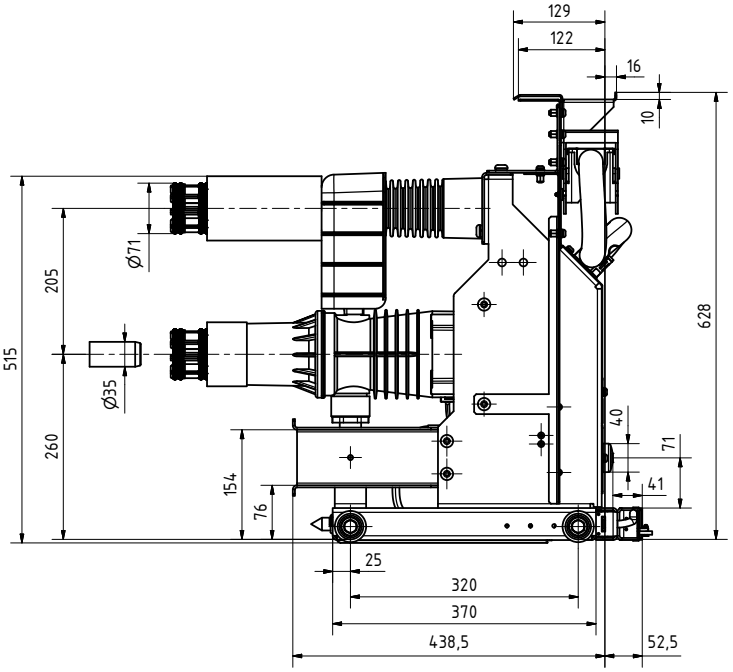


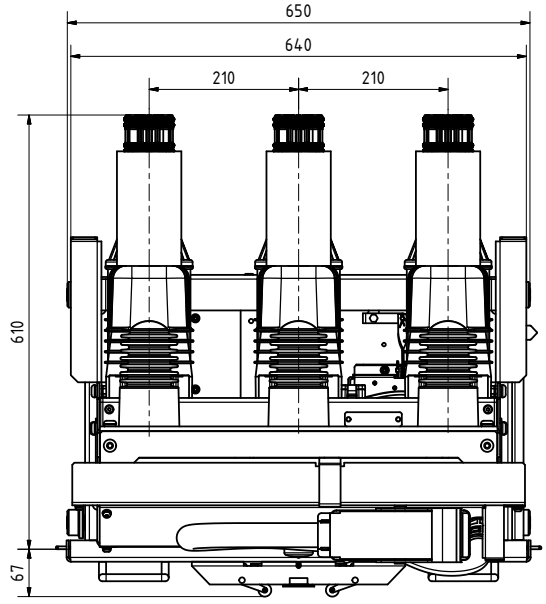


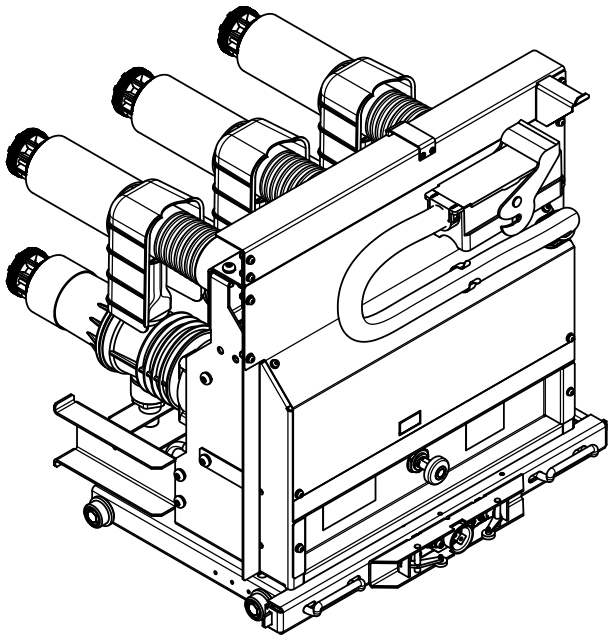
VCB15_LD8_16D
17.5kV, 800 A, PCD: 150 mm, with IP2X front cover,
weight: 74 kg

L_{max} ***= 687 mm***
W_{max} ***= 535 mm***
H_{max} ***= 633 mm***





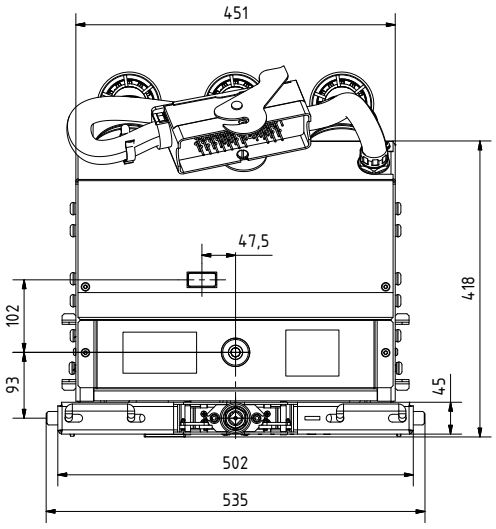


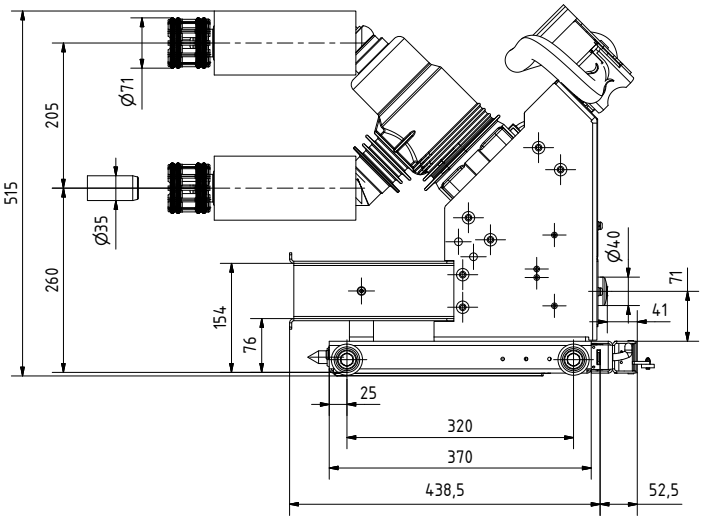


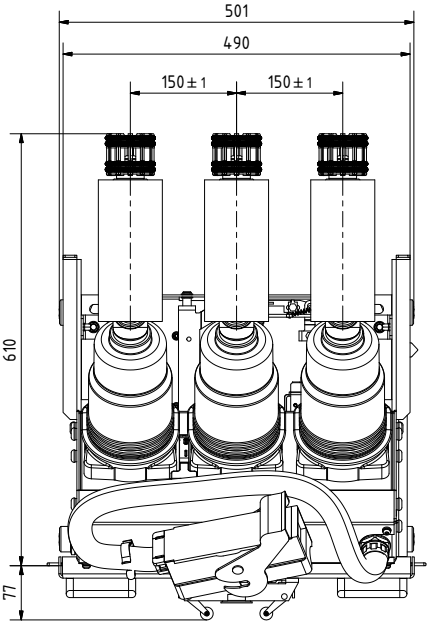
VCB15_LD8_16D
17.5kV, 800 A, PCD: 210 mm, with IP2X front cover, weight: 81 kg

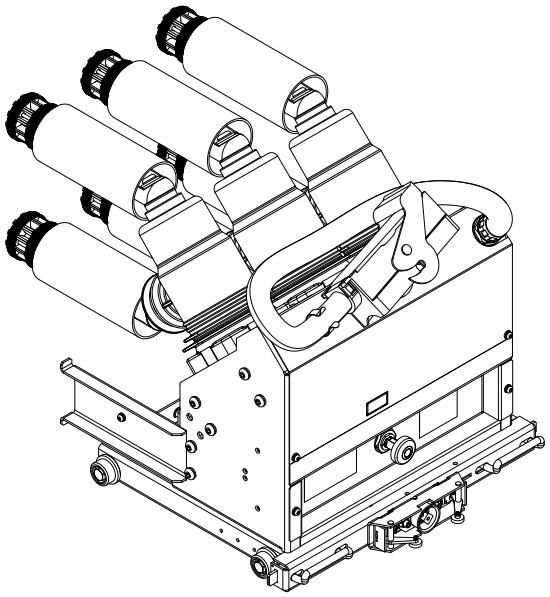
L_{max} = 677 mm
W_{max} = 682 mm
H_{max} = 633 mm

VCB15_MD1_16D



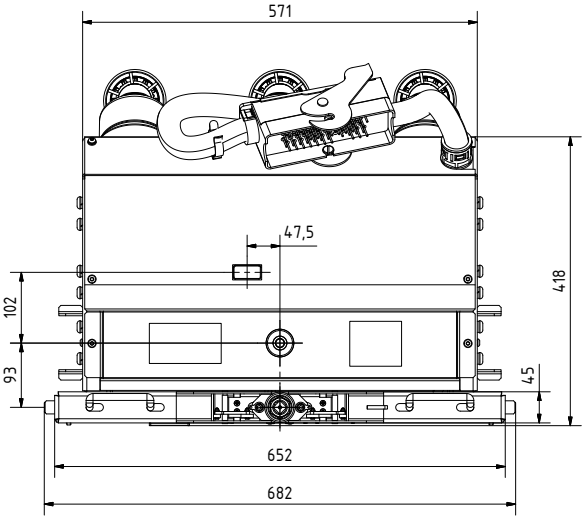


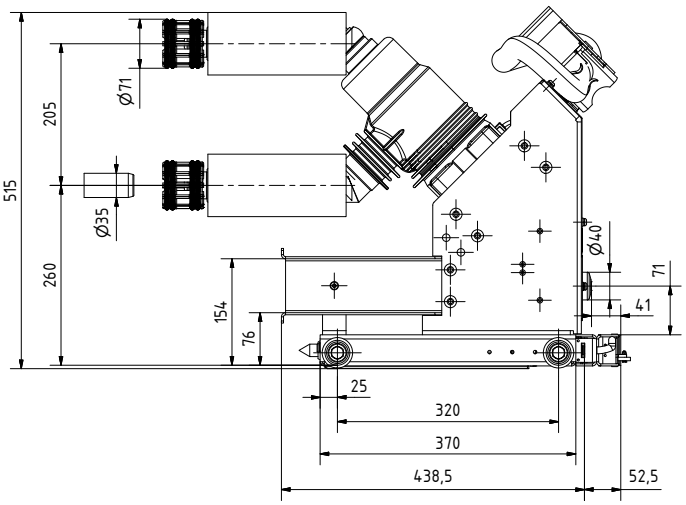


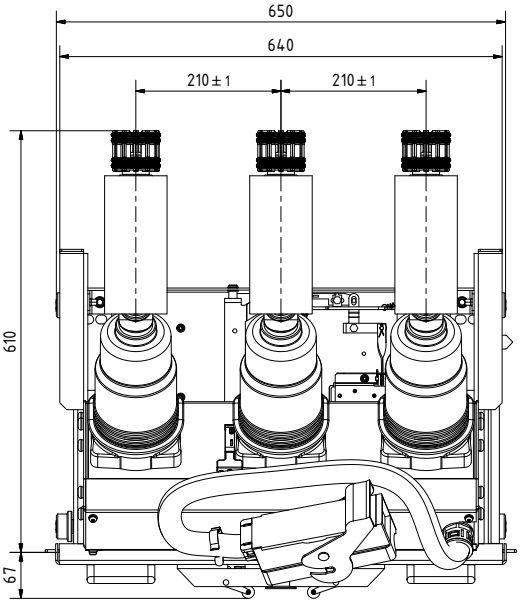


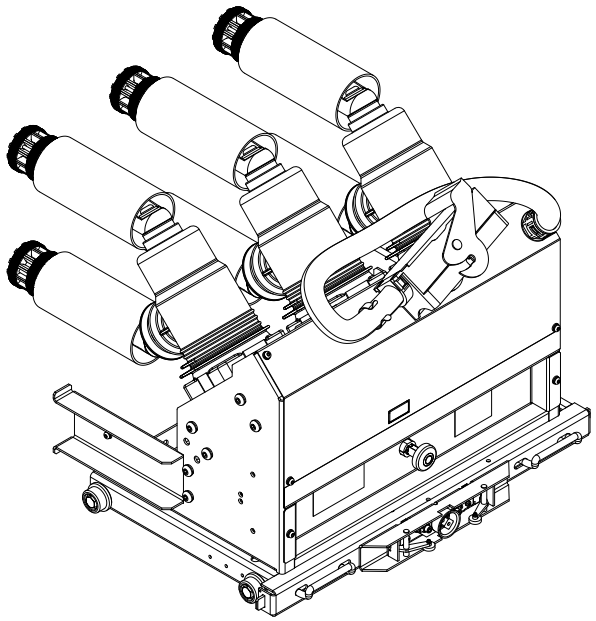
VCB15_MD1_16D
17.5kV, 1250 A, PCD: 150 mm,
weight: 72 kg

L_{max} = 677 mm
W_{max} = 535 mm
H_{max} = 515 mm



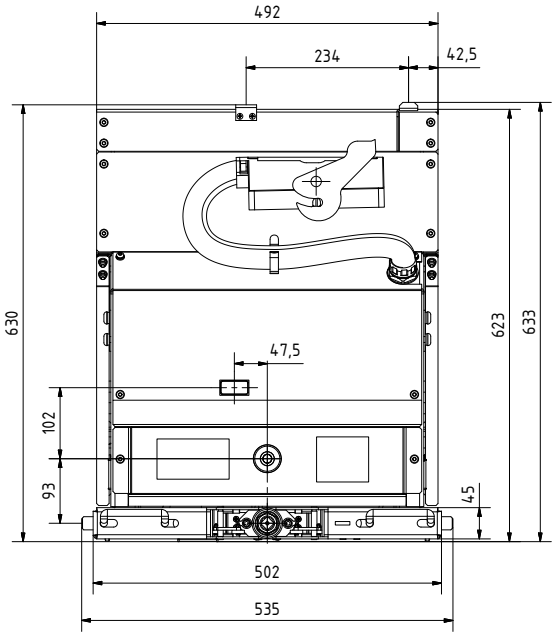


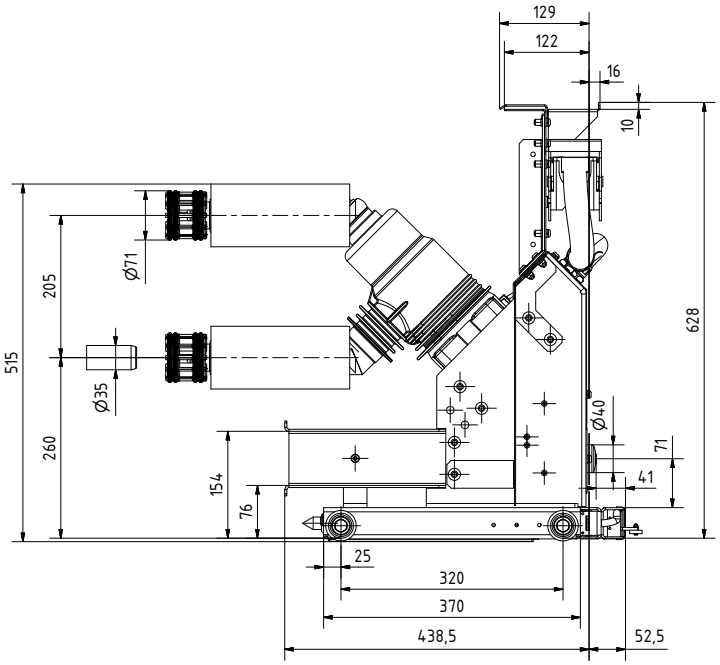


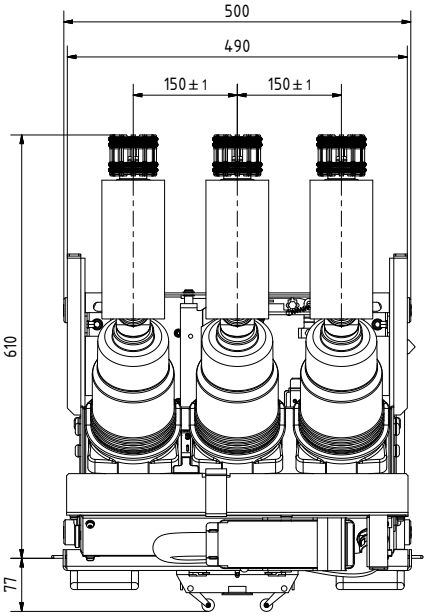


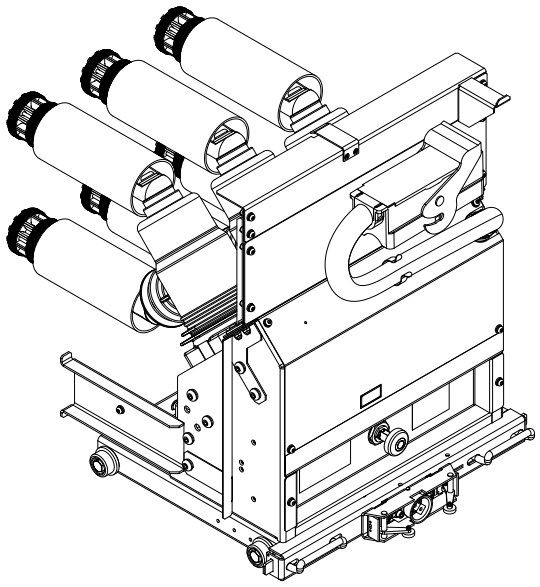
VCB15_MD1_16D
17.5kV, 1250 A, PCD: 210 mm,
weight: 74 kg

L_{max} = 677 mm
W_{max} = 682 mm
H_{max} = 515 mm



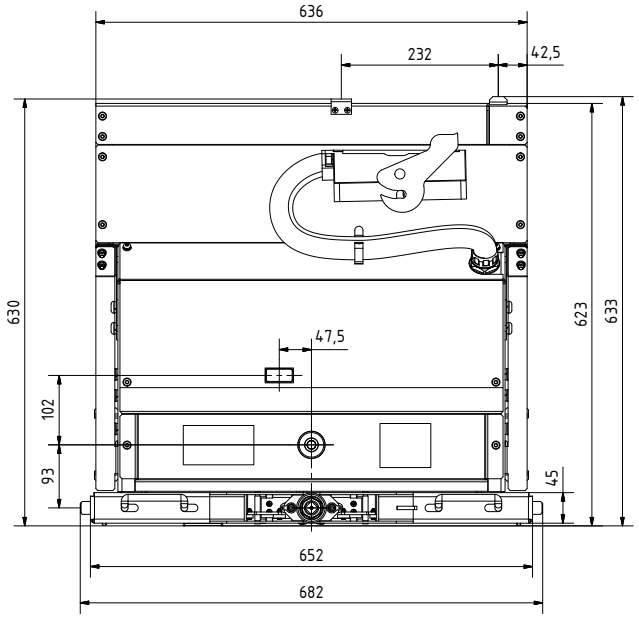


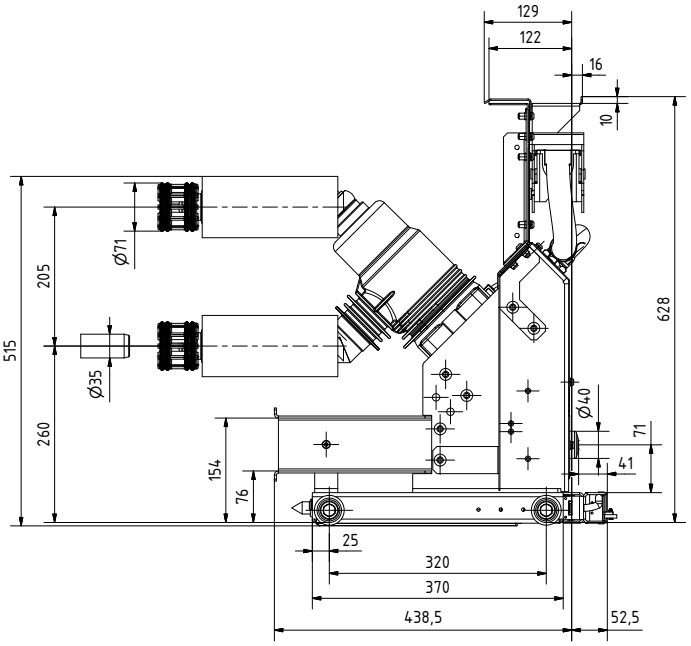


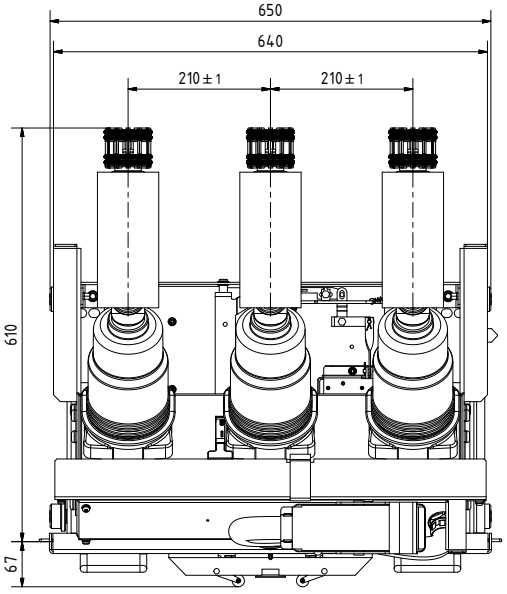


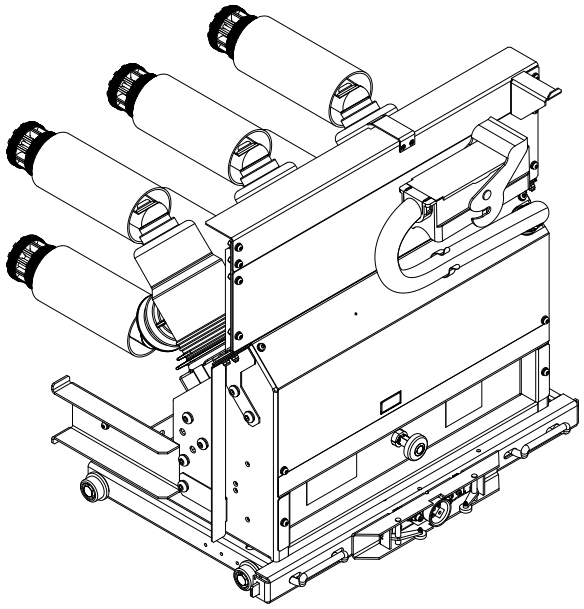
VCB15_MD1_16D
17.5kV, 1250 A, PCD: 150 mm, with IP2X front cover, weight 76 kg

L_{max} = 677 mm
W_{max} = 535 mm
H_{max} = 633 mm





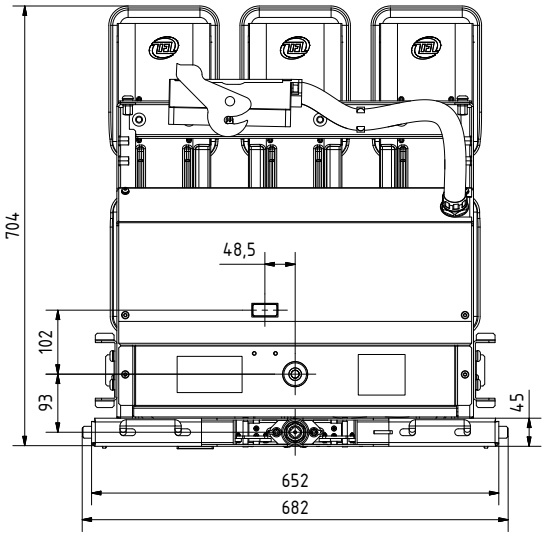


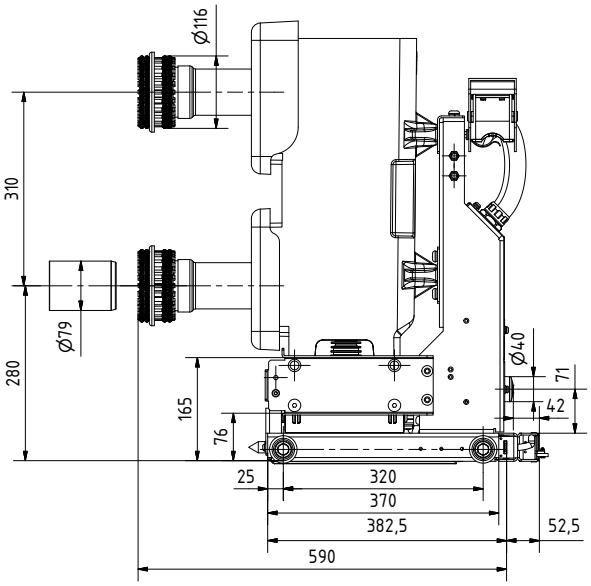


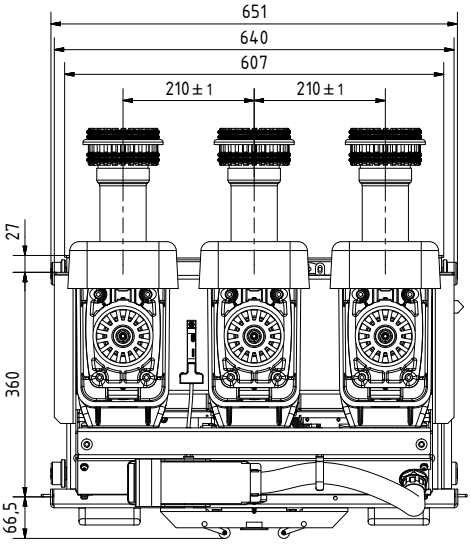
VCB15_MD1_16D
17.5kV, 1250 A, PCD: 210 mm, with IP2X front cover, weight 88 kg

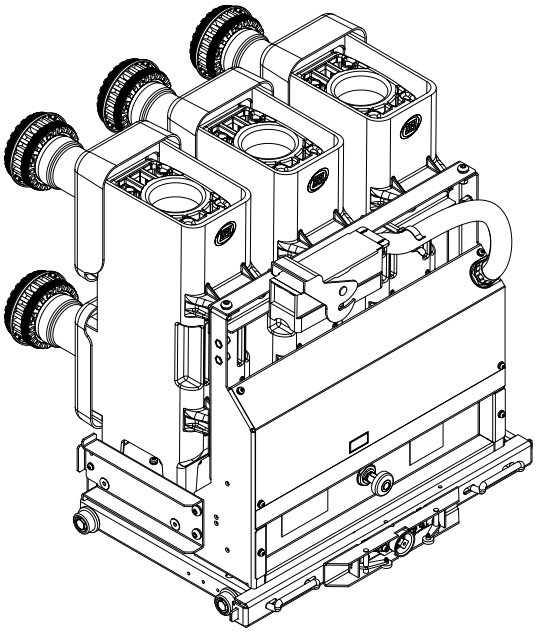
L_{max} = 677 mm
W_{max} = 682 mm
H_{max} = 633 mm

VCB15_HD1_16D



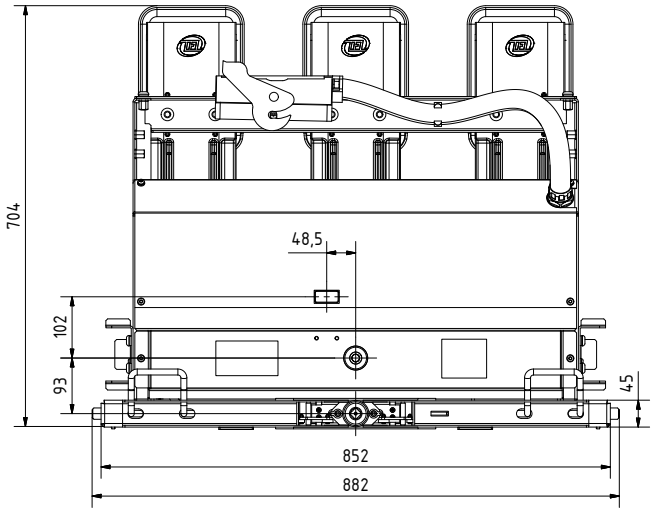


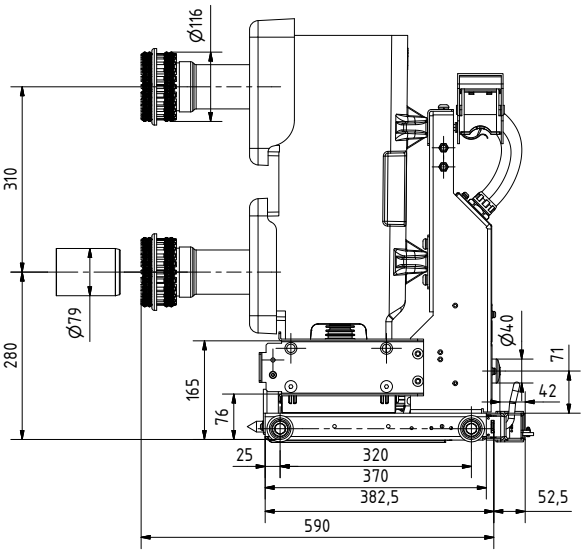


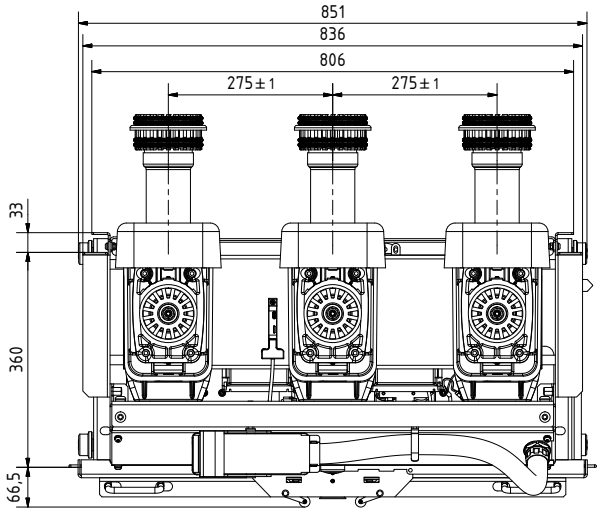


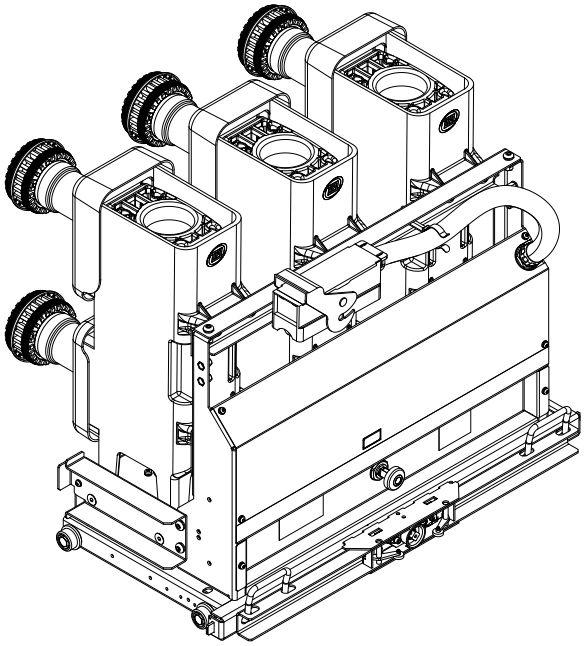
VCB15_HD1_16D
17.5kV, 2500 A, PCD: 210 mm,
weight: 128 kg

L_{max} ***= 656.5 mm***
W_{max} ***= 682 mm***
H_{max} ***= 704 mm***



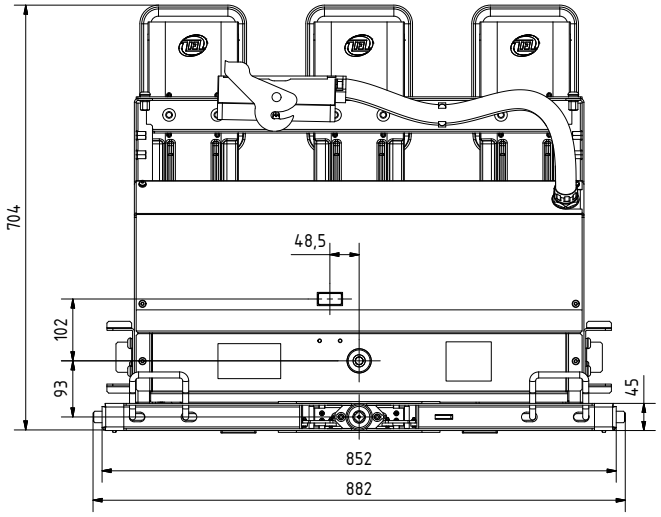


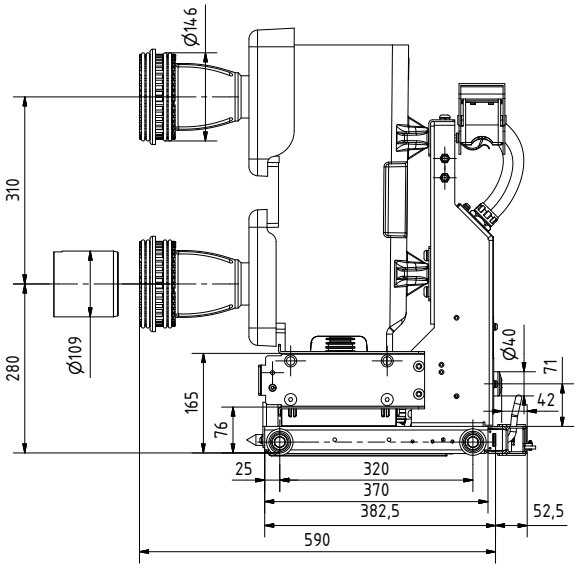


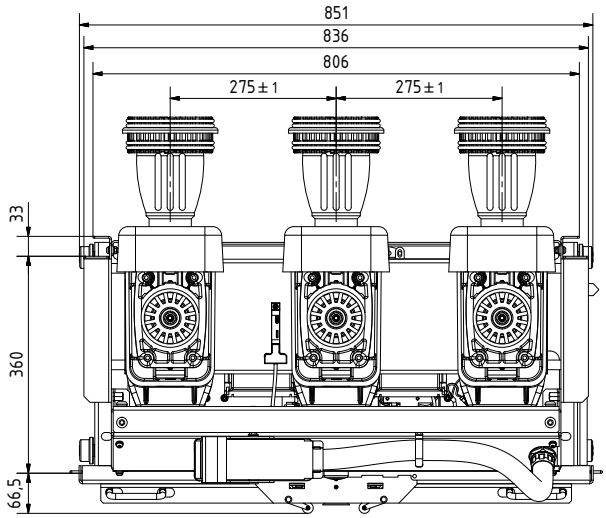


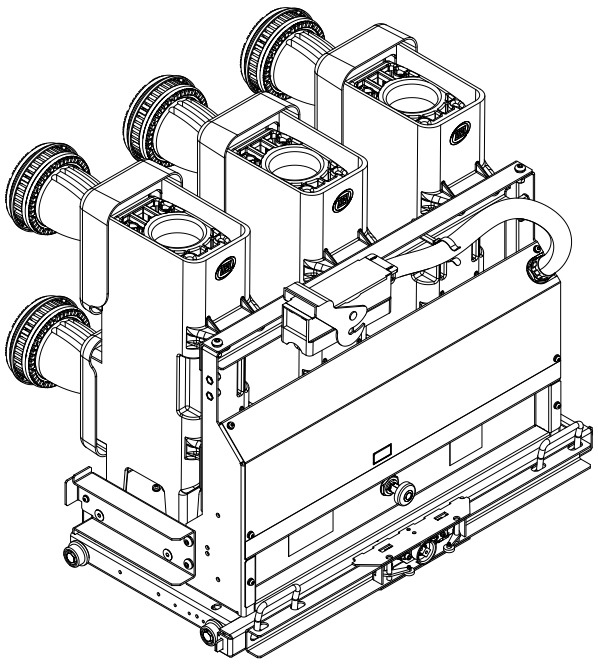
VCB15_HD1_16D
17.5kV, 2500 A, PCD: 275 mm,
weight: 140 kg

L_{max} = 656.5 mm
W_{max} = 882 mm
H_{max} = 704 mm



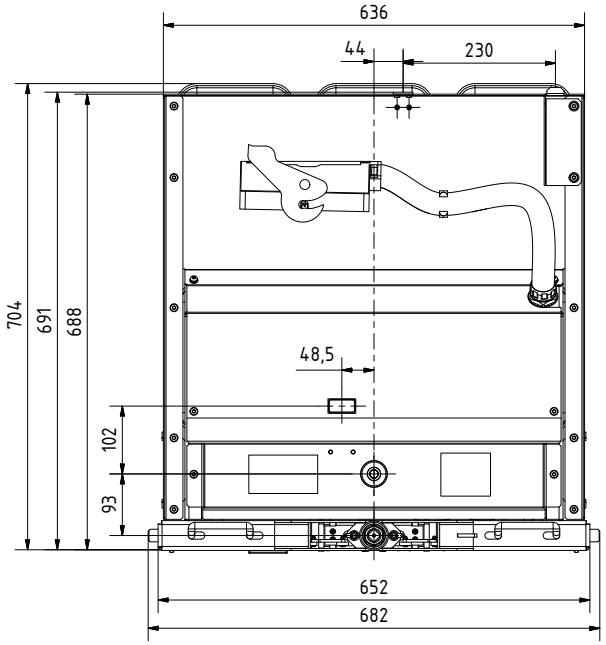


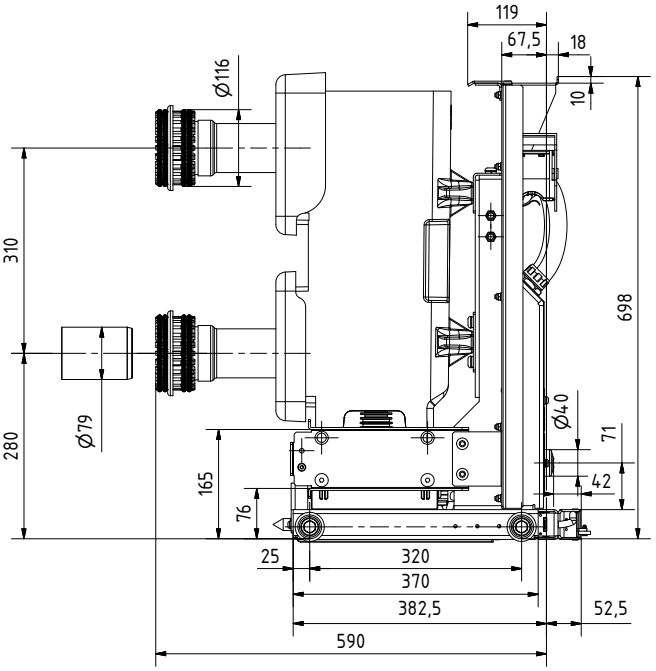


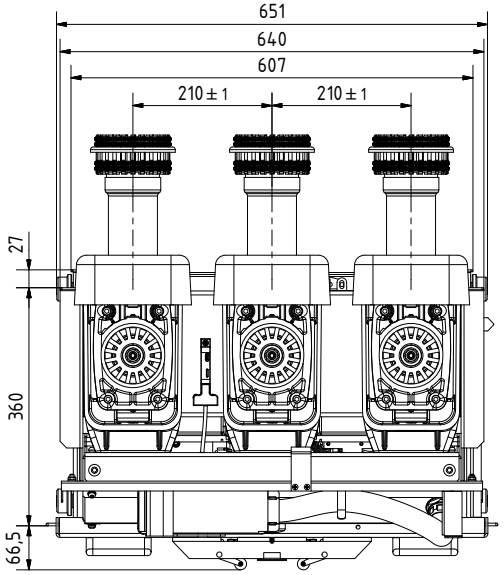


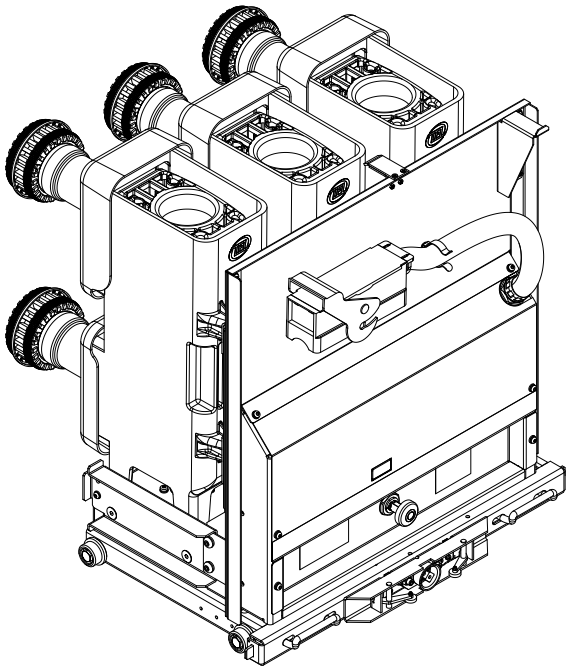
VCB15_HD1_16D
17.5kV, 3150 A, PCD: 275 mm,
weight: 158 kg

L_{max} = 656.5 mm
W_{max} = 882 mm
H_{max} = 704 mm



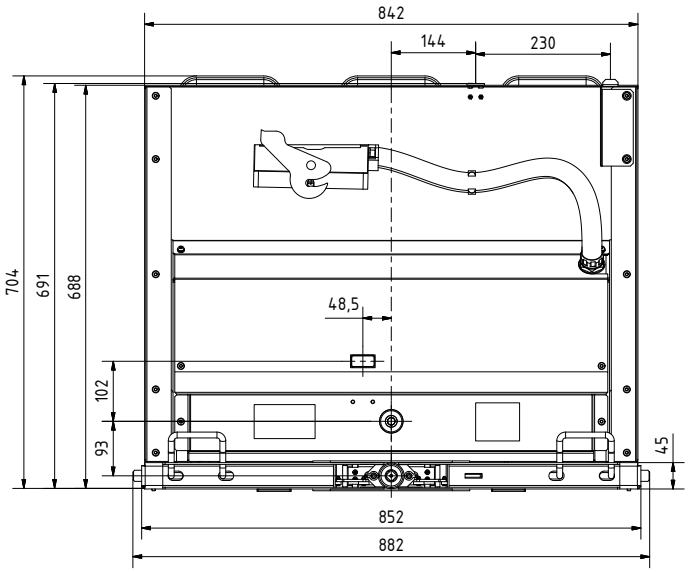


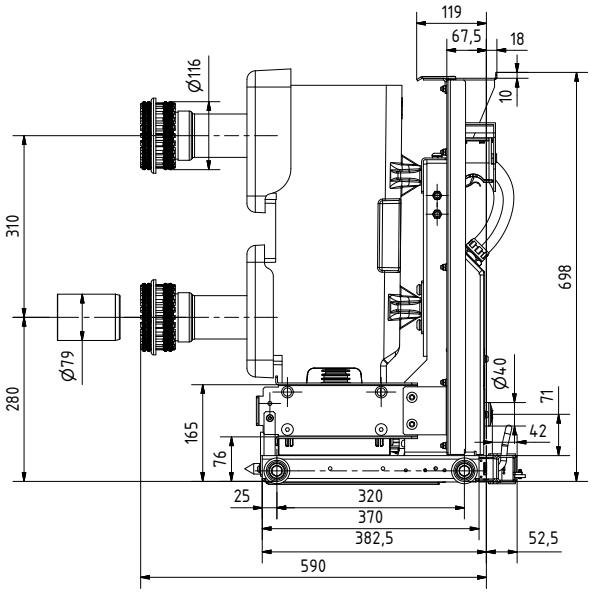


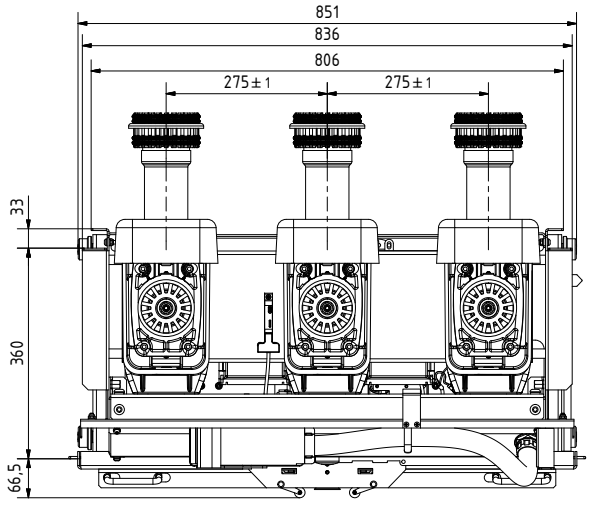


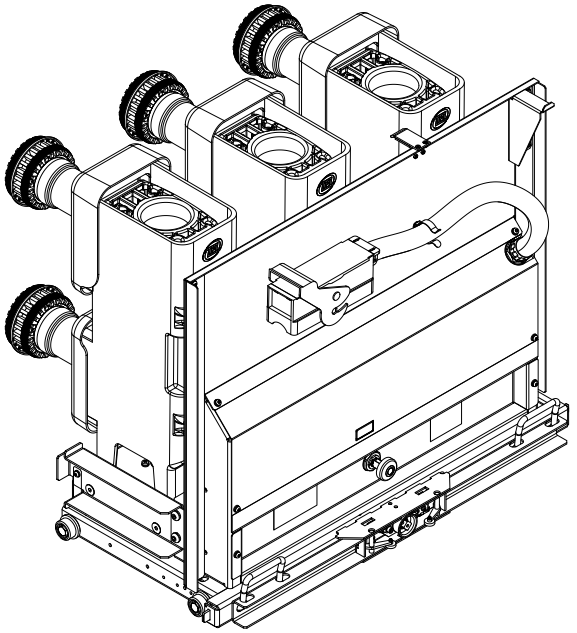
VCB15_HD1_16D
17.5kV, 2500 A, PCD: 210 mm, with IP2X front cover, weight 133 kg

L_{max} = 656.5 mm
W_{max} = 682 mm
H_{max} = 704 mm



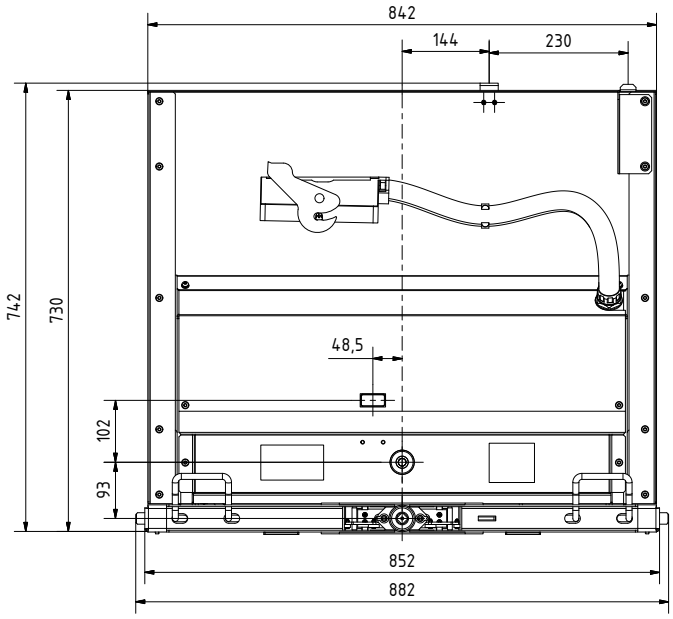


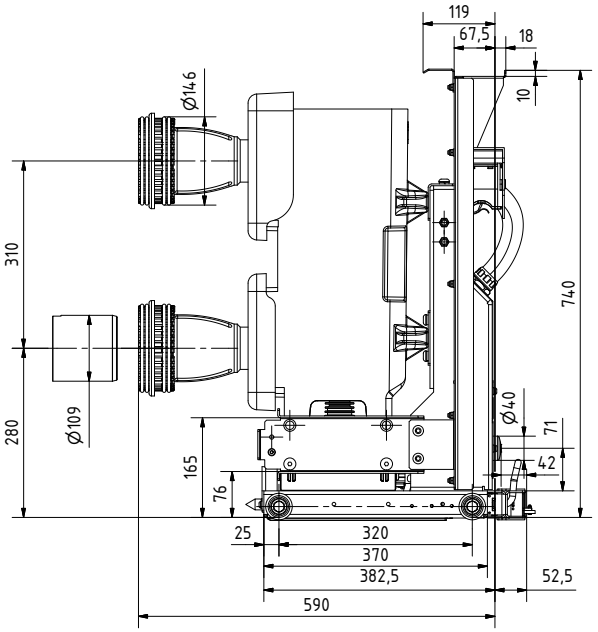


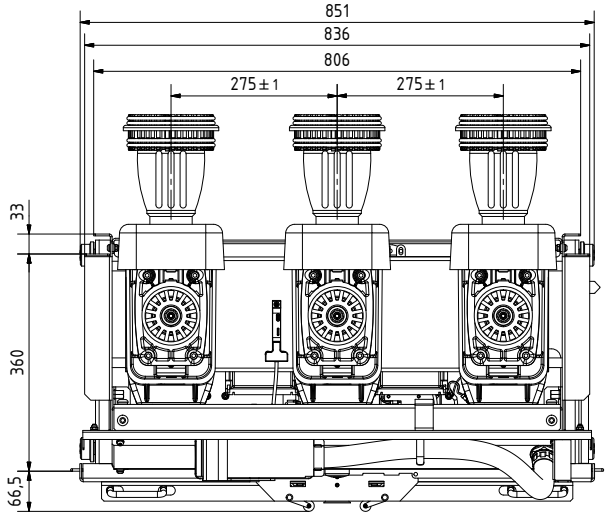


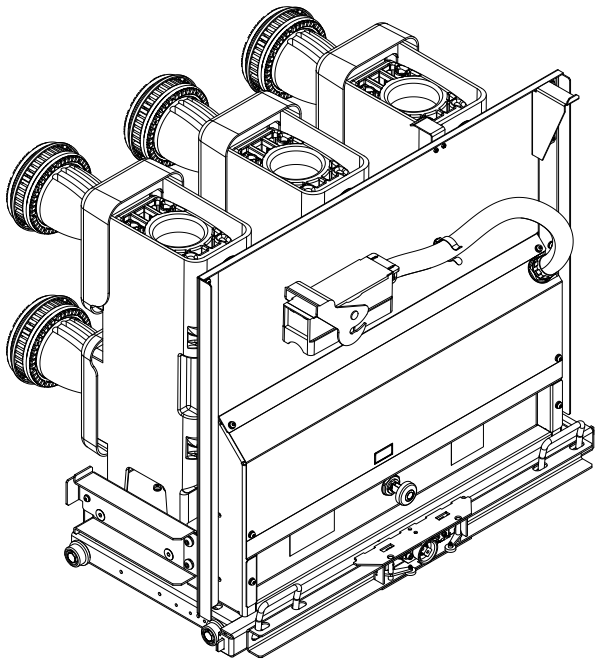
VCB15_HD1_16D
17.5kV, 2500 A, PCD: 275 mm, with IP2X front cover, weight 147 kg

L_{max} = 656.5 mm
W_{max} = 882 mm
H_{max} = 704 mm





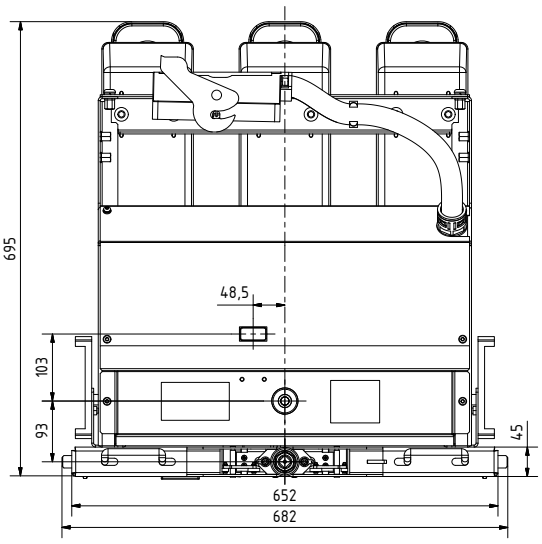


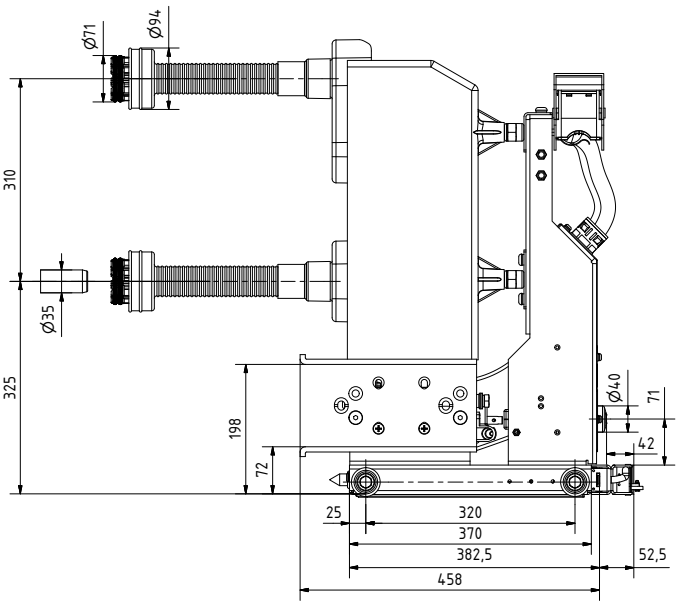


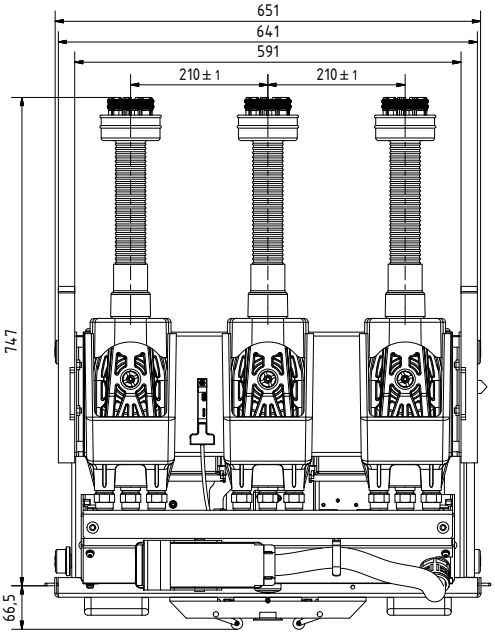
VCB15_HD1_16D
17.5kV, 3150 A, PCD: 275 mm, with IP2X front cover, weight 165 kg

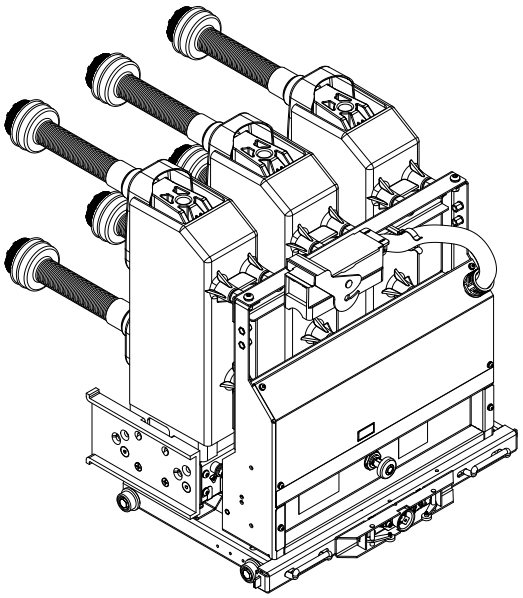
L_{max} = 656.5 mm
W_{max} = 882 mm
H_{max} = 742 mm

VCB25_Shell2_16D



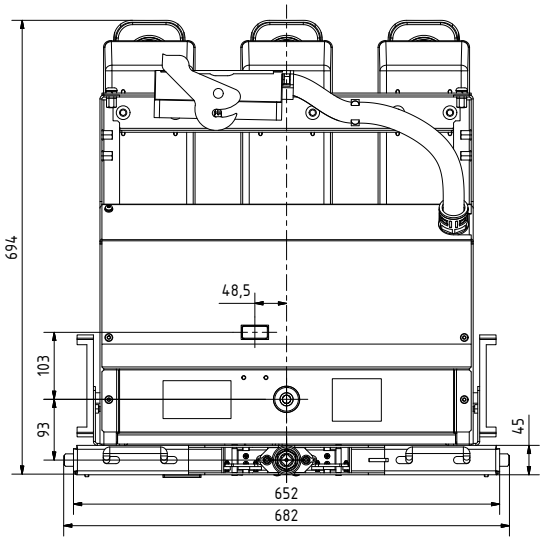


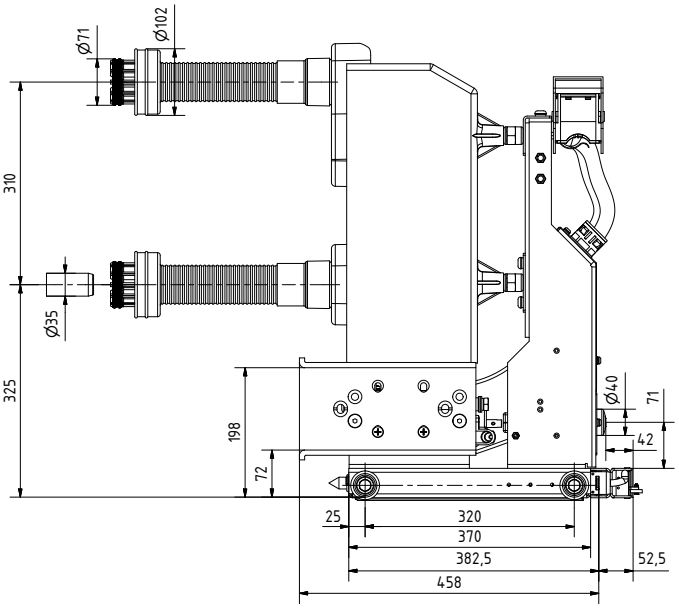


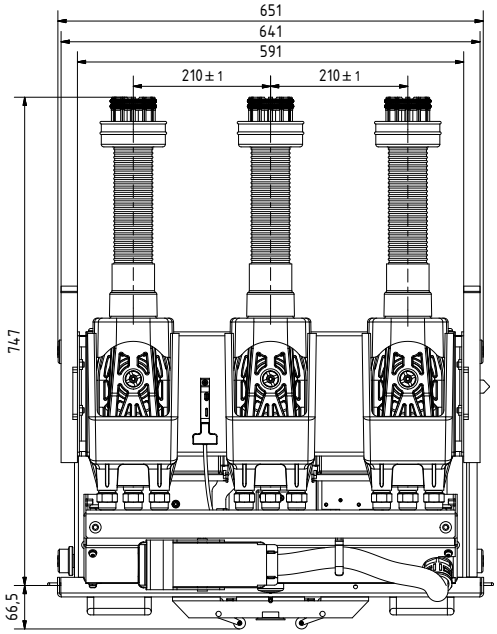


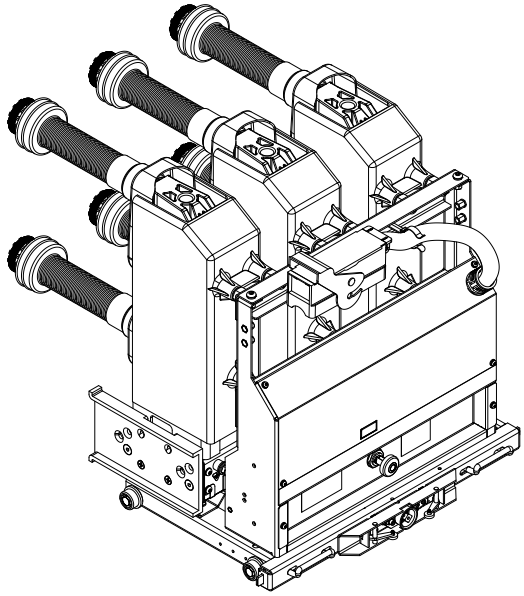
VCB25_Shell2_16D
24kV, 630 A, PCD: 210 mm, 370 mm depth of movable part of cassette, weight: 101 kg

L_{max} = 813.5 mm
W_{max} = 682 mm
H_{max} = 695 mm



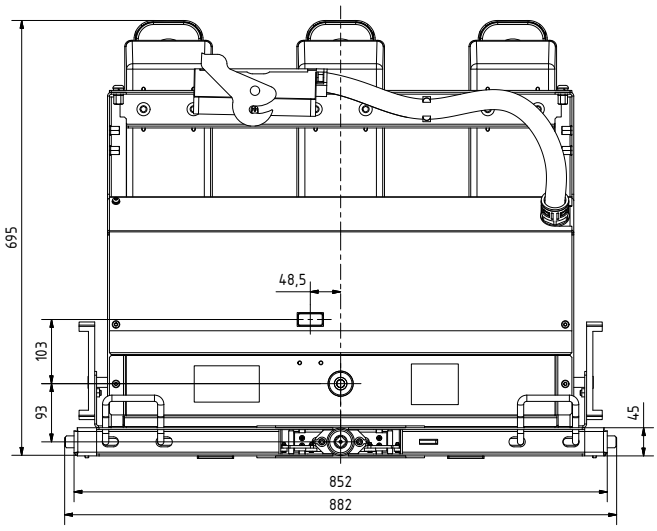


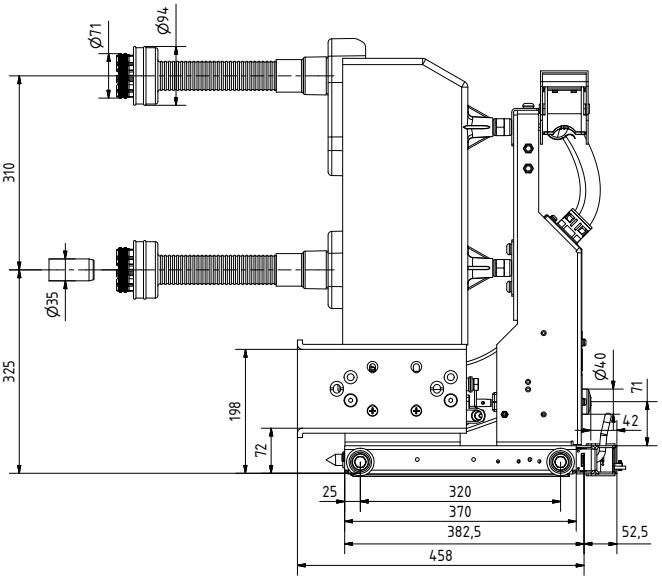


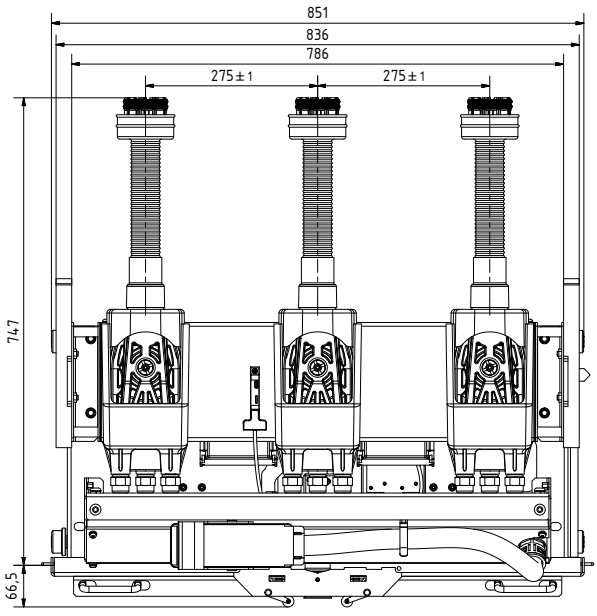


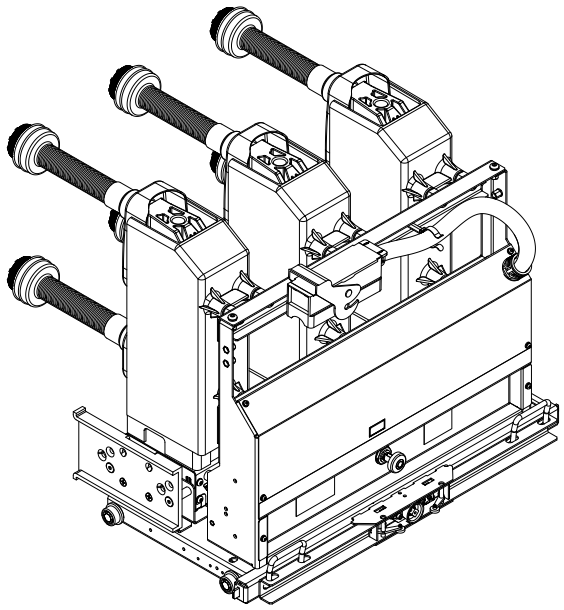
VCB25_Shell2_16D
24kV, 1250 A, PCD: 210 mm, 370 mm depth of movable part of cassette, weight: 112 kg

L_{max} = 813.5 mm
W_{max} = 682 mm
H_{max} = 694 mm



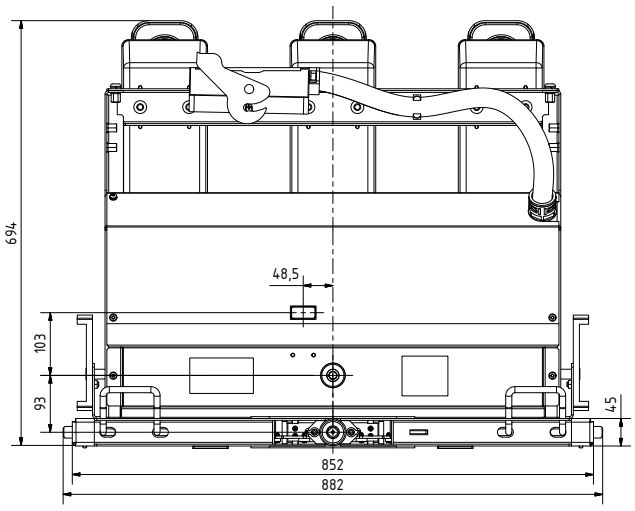


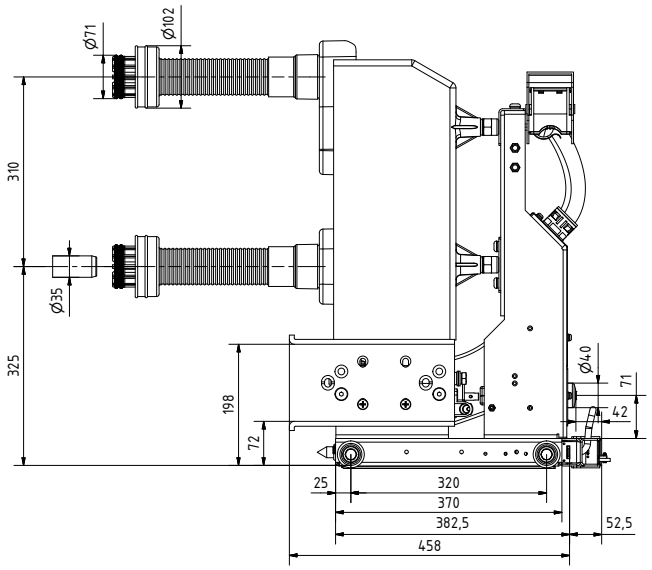


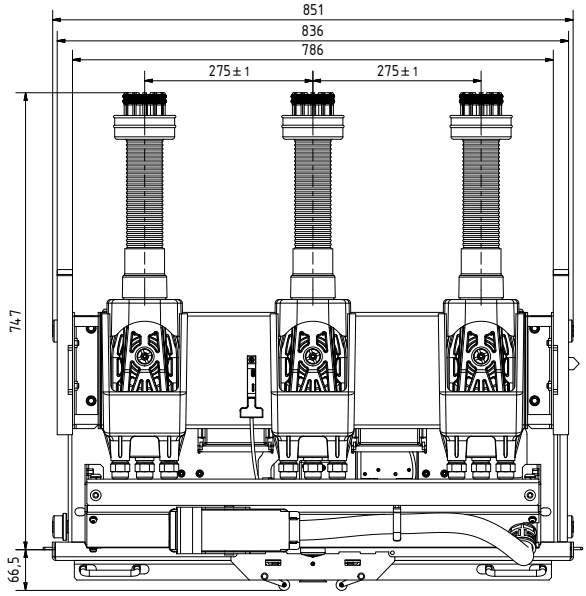


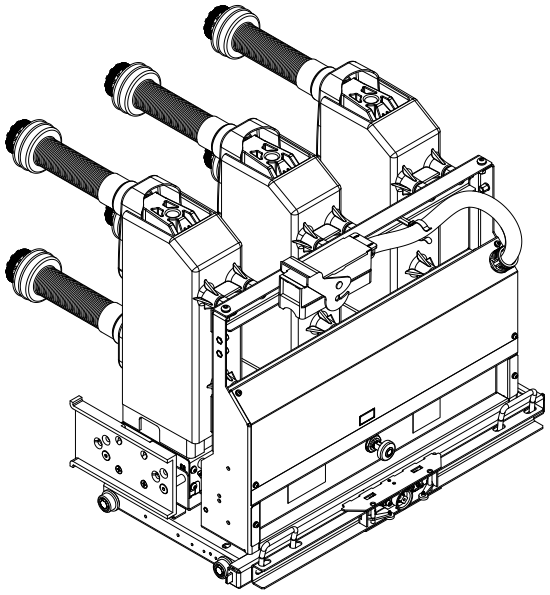
VCB25_Shell2_16D
24kV, 630 A, PCD: 275 mm, 370 mm depth of movable part of cassette, weight: 115 kg

L_{max} = 813.5 mm
W_{max} = 882 mm
H_{max} = 695 mm



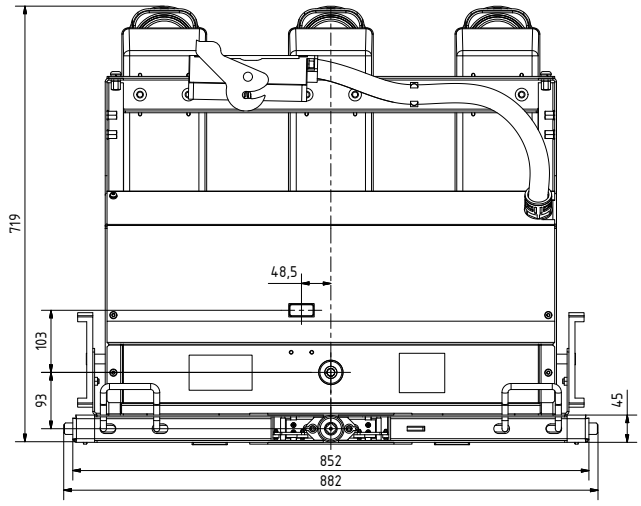


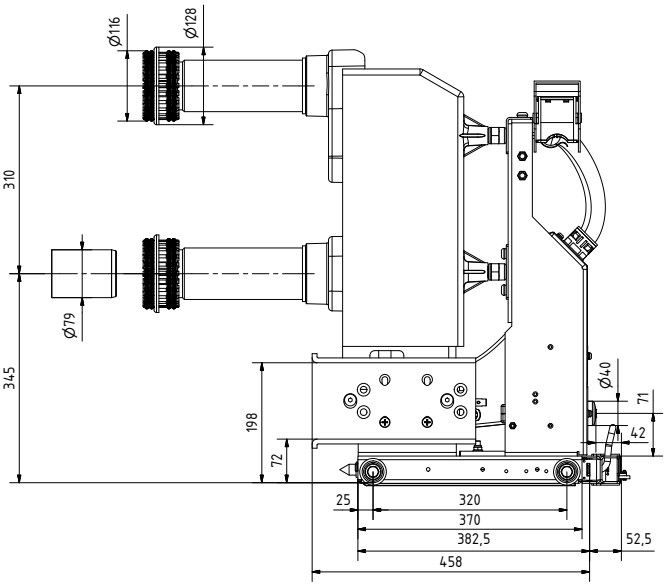


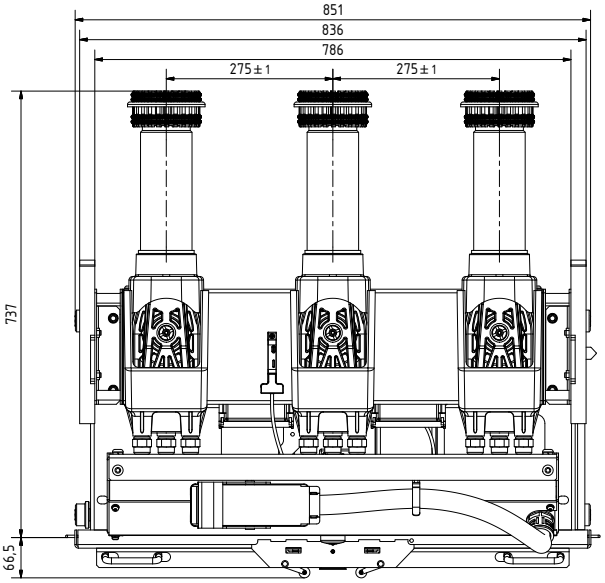


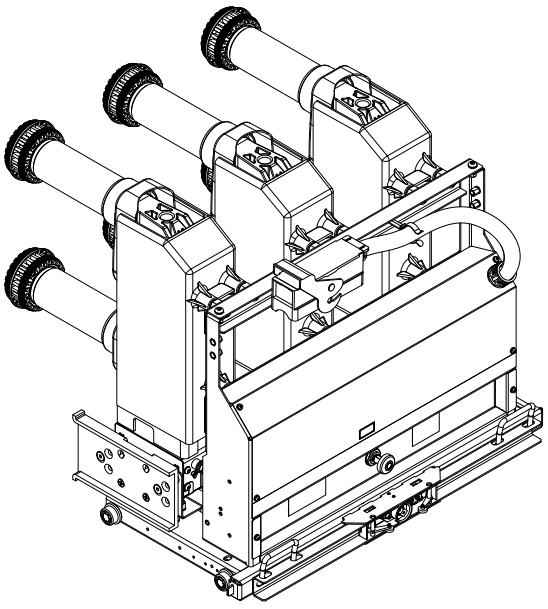
VCB25_Shell2_16D
24kV, 1250 A, PCD: 275 mm, 370 mm depth of movable part of cassette, weight: 126 kg

L_{max} = 813.5 mm
W_{max} = 882 mm
H_{max} = 694 mm



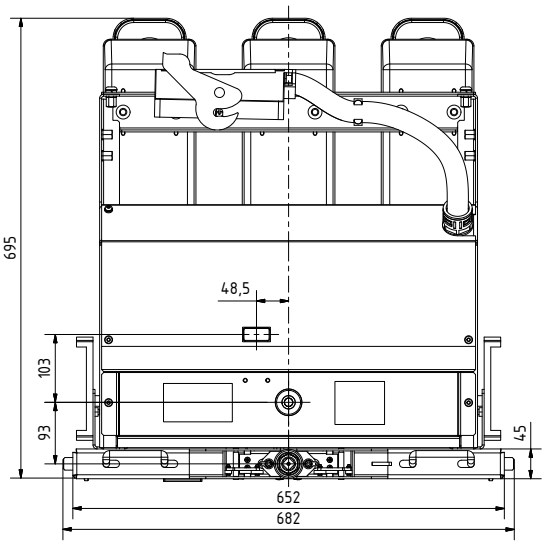


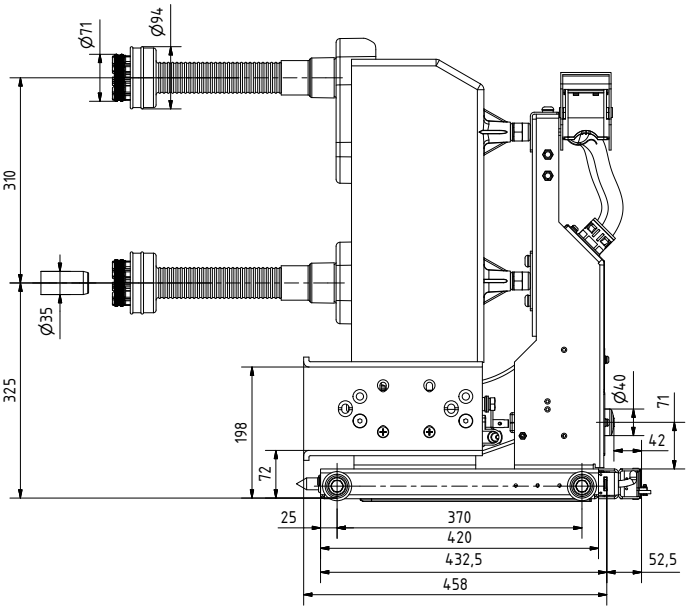


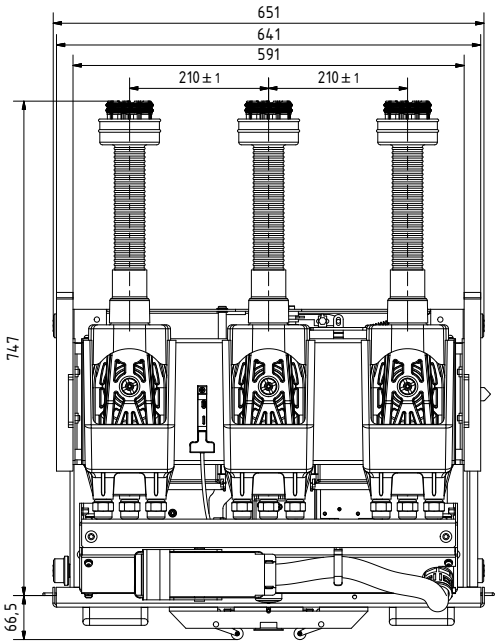


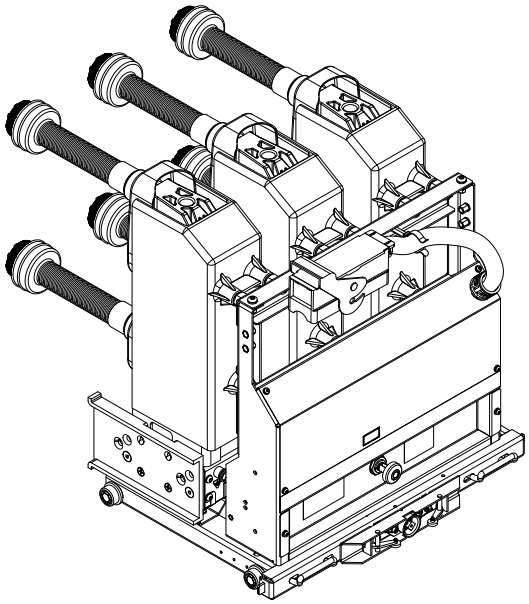
VCB25_Shell2_16D
24kV, 2500 A, PCD: 275 mm, 370 mm depth of movable part of cassette, weight: 180 kg

L_{max} = 803.5 mm
W_{max} = 882 mm
H_{max} = 719 mm



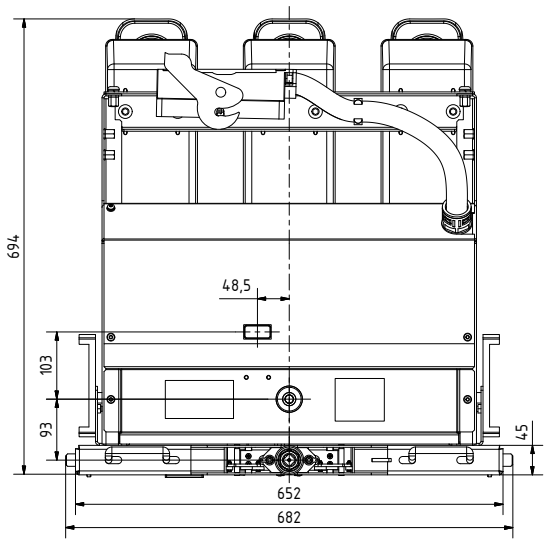


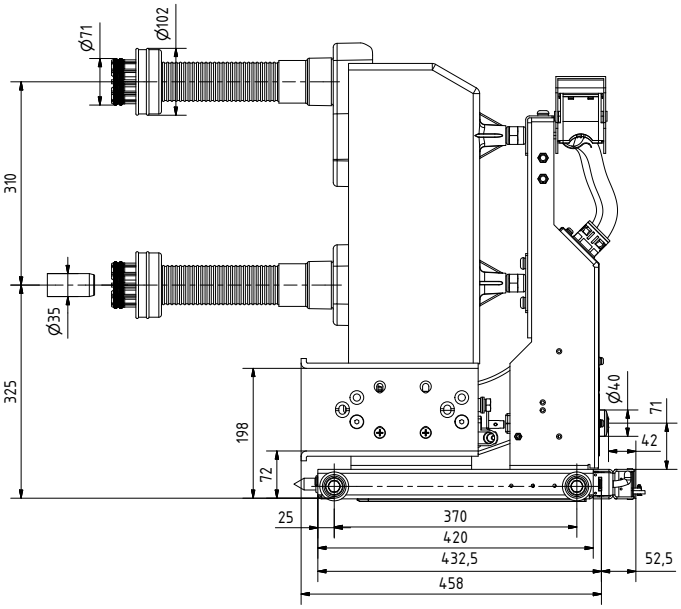


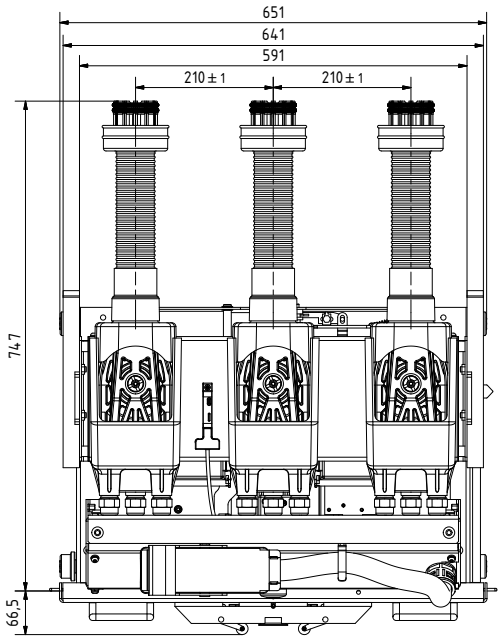


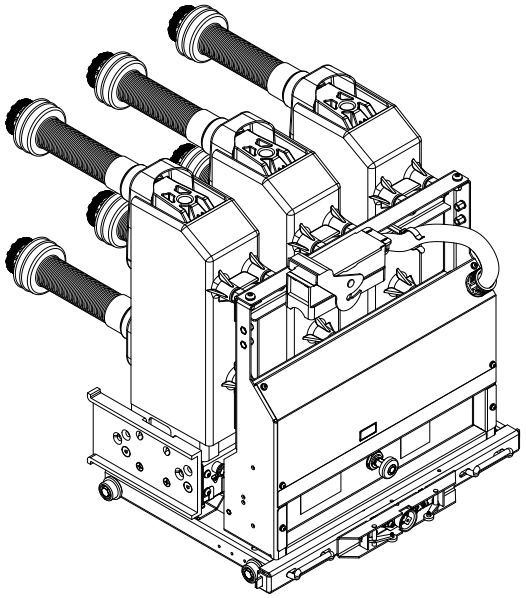
VCB25_Shell2_16D
24kV, 630 A, PCD: 210 mm, 420 mm depth of movable part of cassette, weight: 102 kg

L_{max} *= 813.5 mm*
W_{max} *= 682 mm*
H_{max} *= 695 mm*



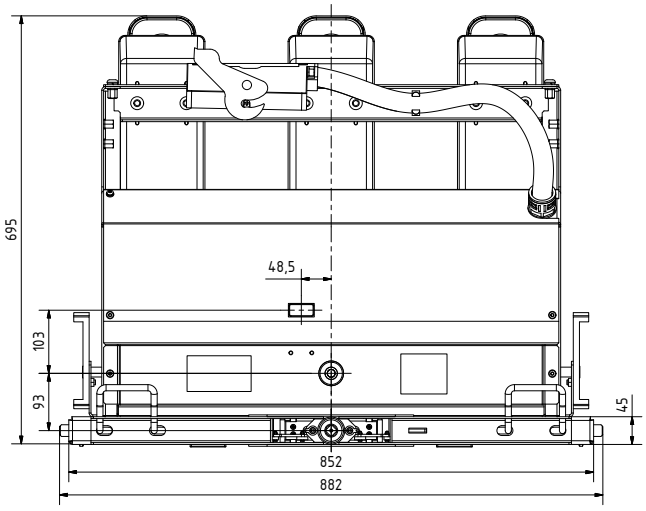


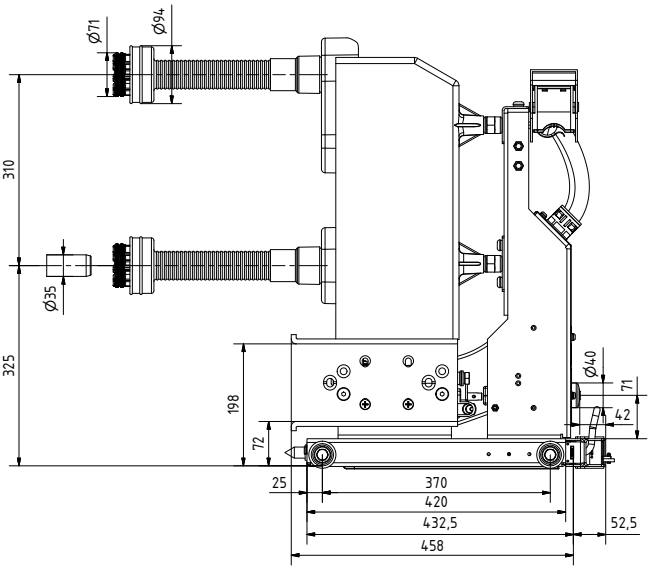


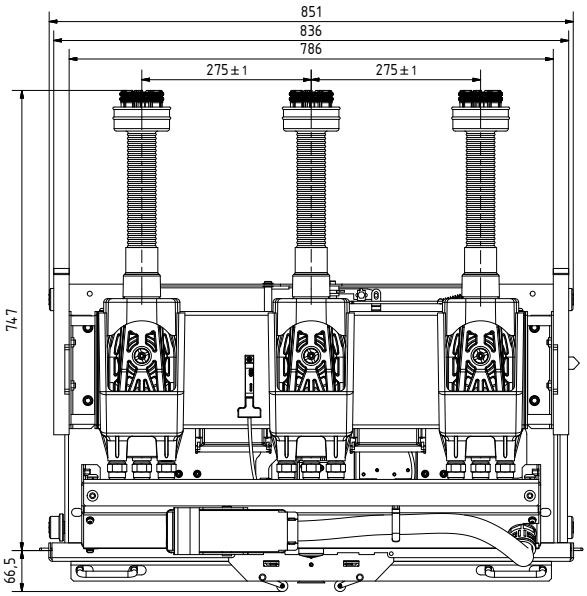


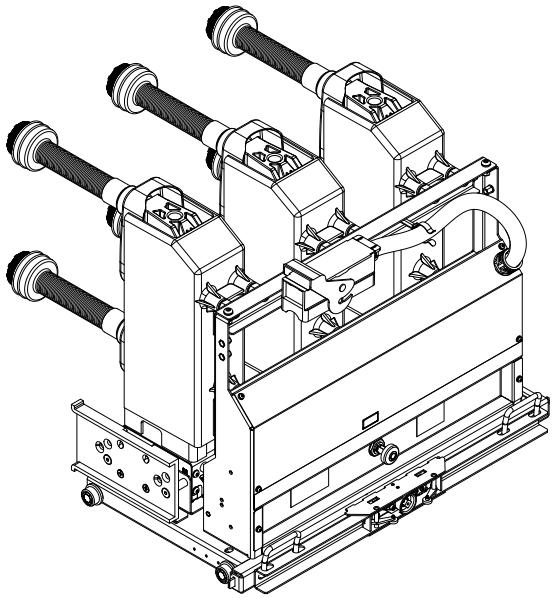
VCB25_Shell2_16D
24kV, 1250 A, PCD: 210 mm, 420 mm depth of movable part of cassette,
weight: 113 kg

L_{max} = 813.5 mm
W_{max} = 682 mm
H_{max} = 694 mm



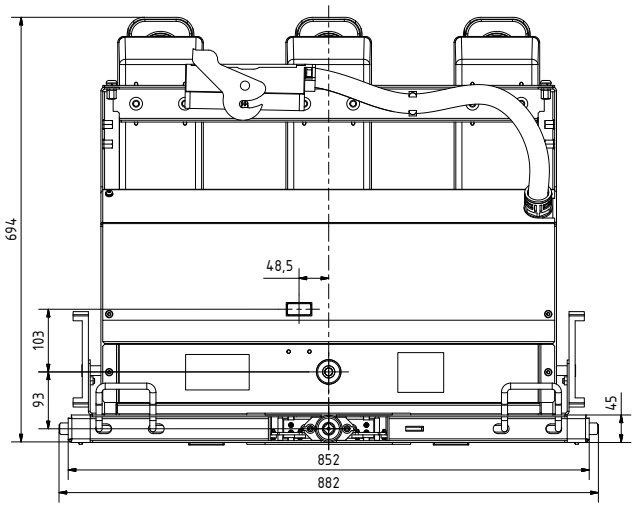


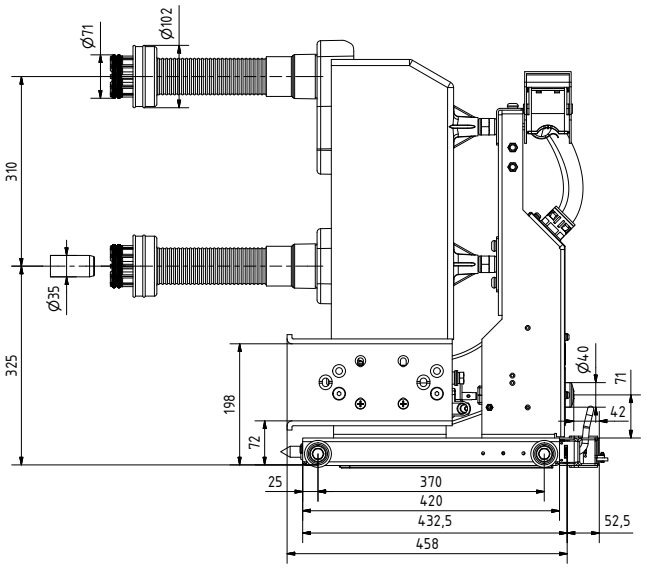


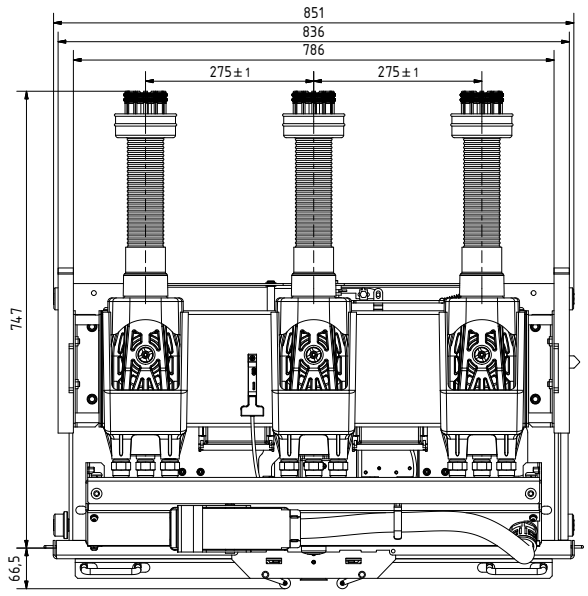


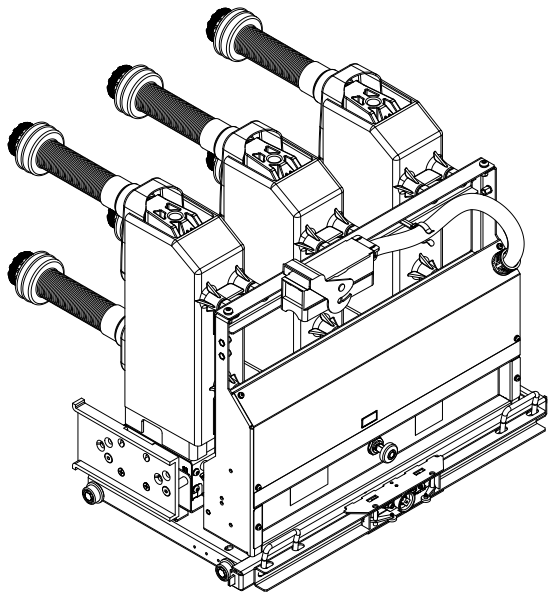
VCB25_Shell2_16D
24kV, 630 A, PCD: 275 mm, 420 mm depth of movable part of cassette, weight: 117 kg

L_{max} = 813.5 mm
W_{max} = 882 mm
H_{max} = 695 mm



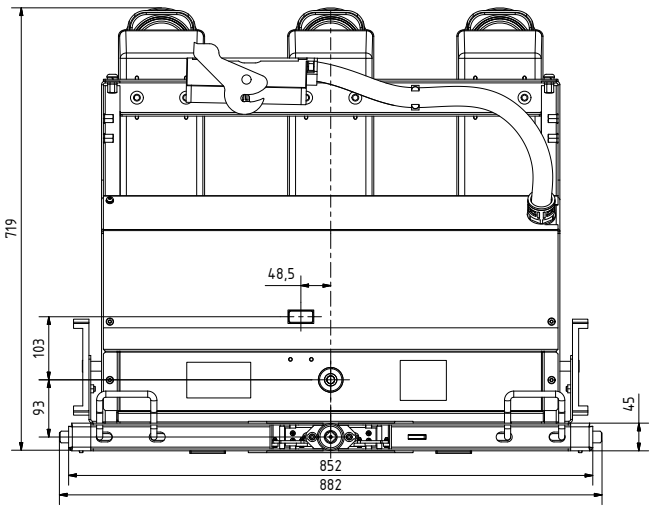


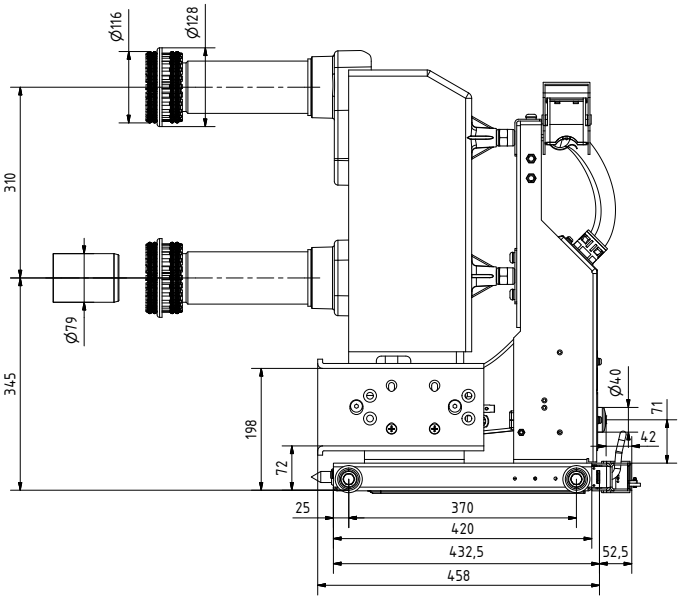


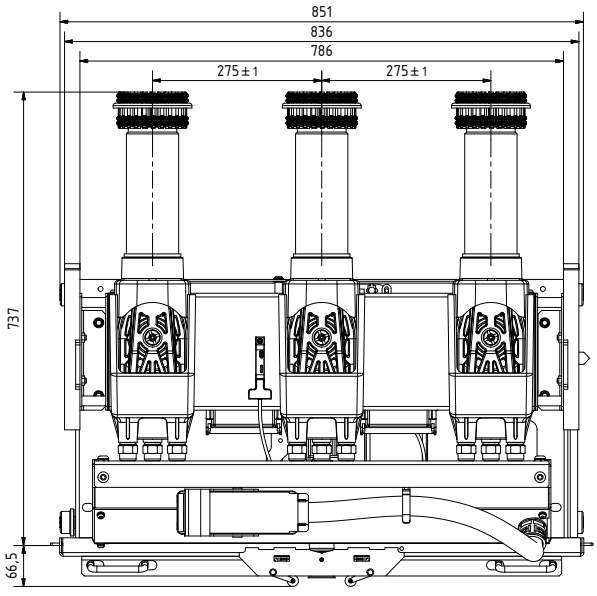


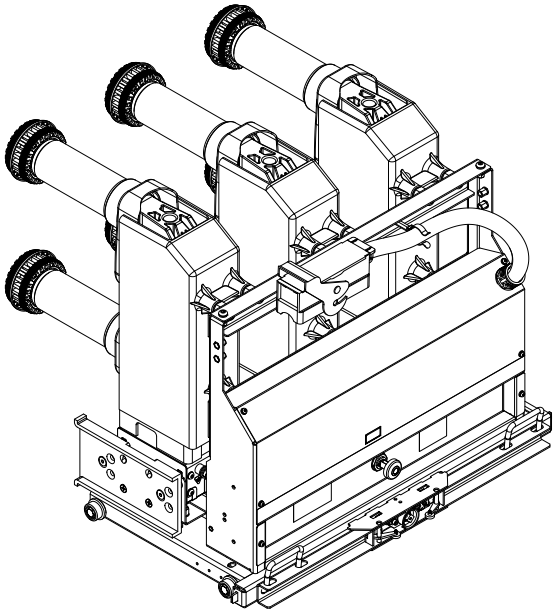
VCB25_Shell2_16D
24kV, 1250 A, PCD: 275 mm, 420 mm depth of movable part of cassette,
weight: 128 kg

L_{max} = 813.5 mm
W_{max} = 882 mm
H_{max} = 694 mm



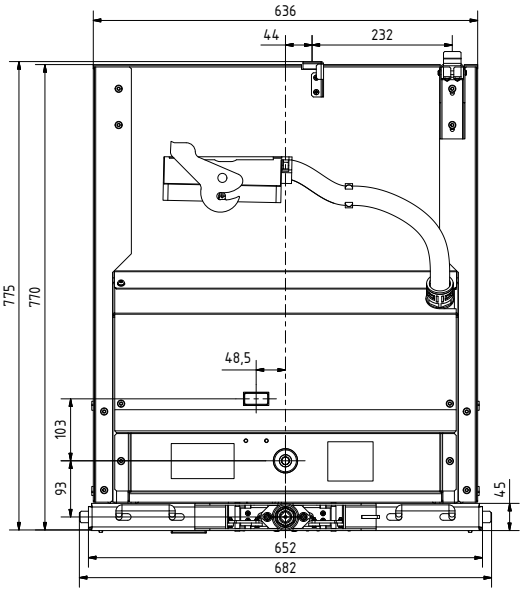


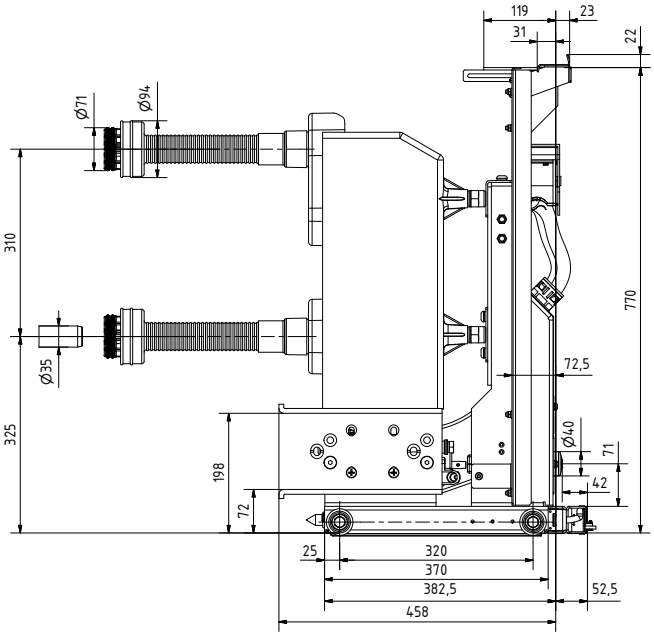


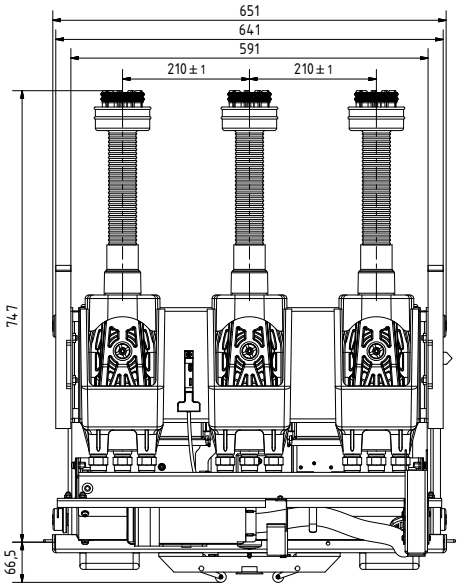


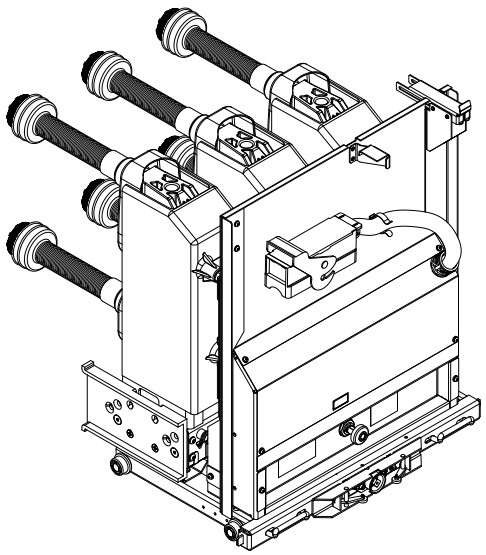
VCB25_Shell2_16D
24kV, 2500 A, PCD: 275 mm, 420 mm depth of movable part of cassette, weight: 163 kg

L_{max} = 803.5 mm
W_{max} = 882 mm
H_{max} = 719 mm



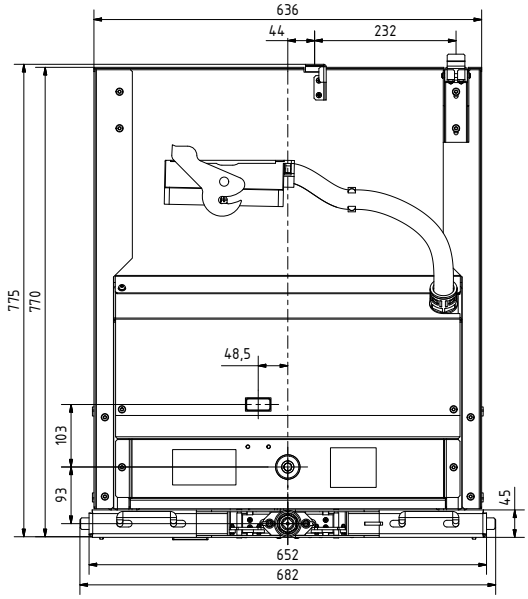


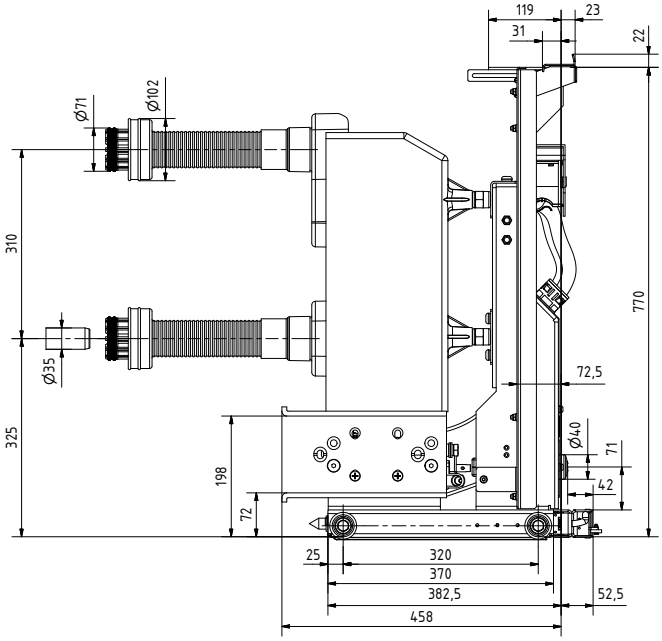


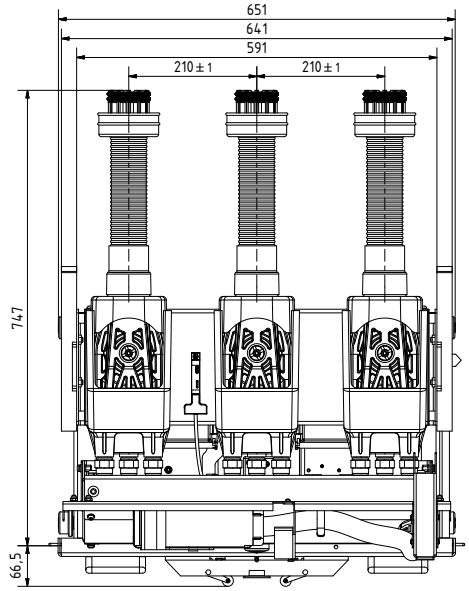


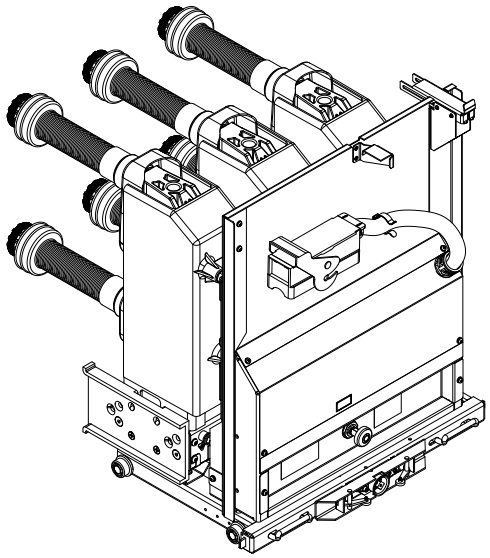
VCB25_Shell2_16D
24kV, 630 A, PCD: 210 mm, 370 mm depth of movable part of cassette, with IP2X front cover, weight: 109 kg

L_{max} = 813.5 mm
W_{max} = 682 mm
H_{max} = 792 mm



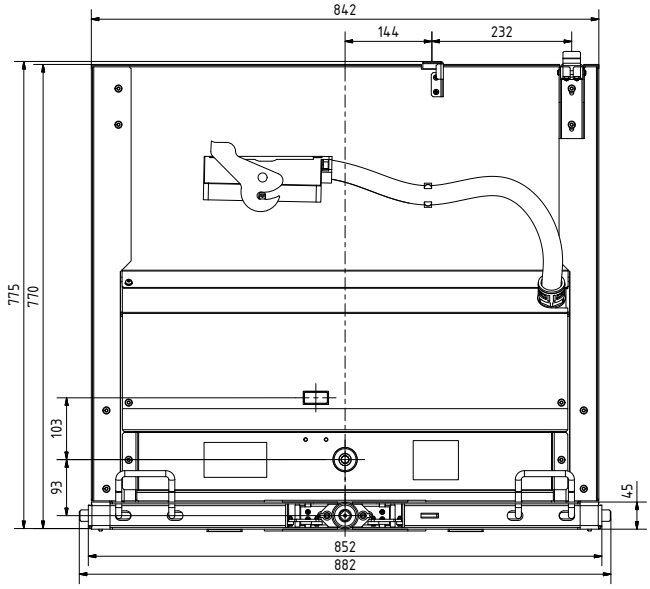


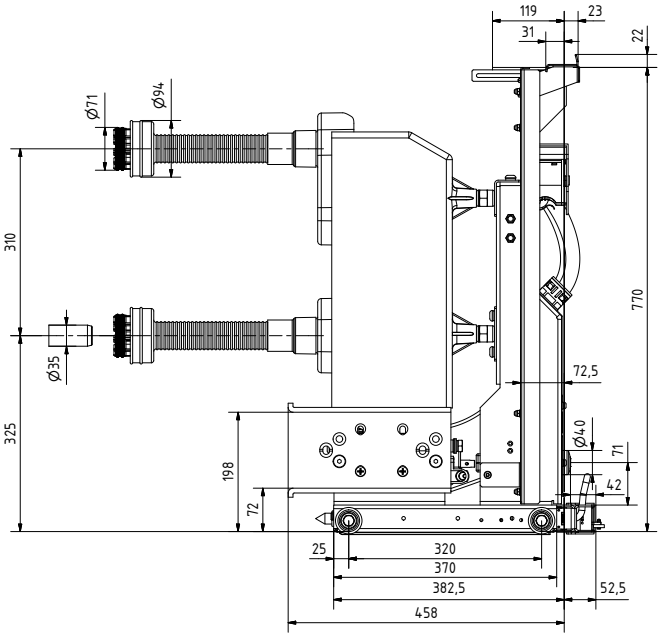


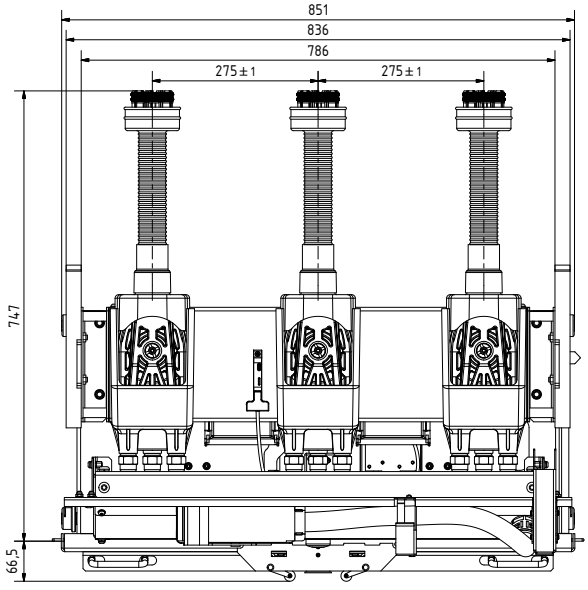


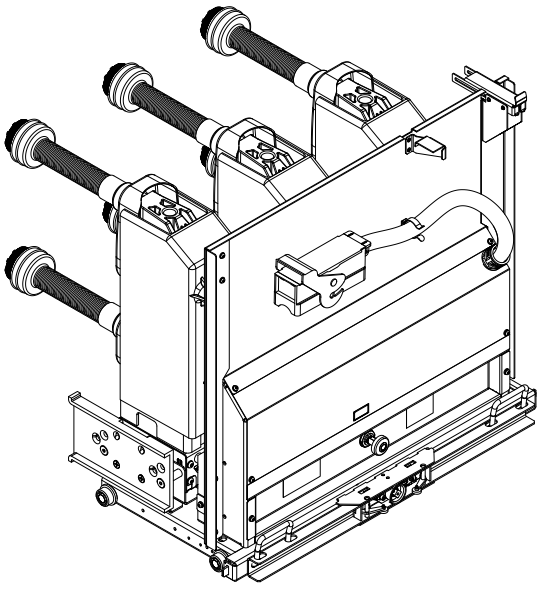
VCB25_Shell2_16D
24kV, 1250 A, PCD: 210 mm, 370 mm depth of movable part of cassette, with IP2X front cover, weight: 120 kg

L_{max} = 813.5 mm
W_{max} = 682 mm
H_{max} = 792 mm



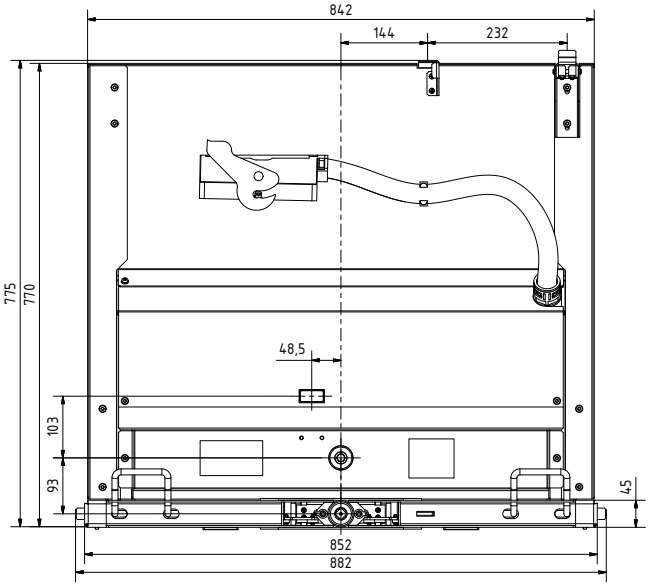


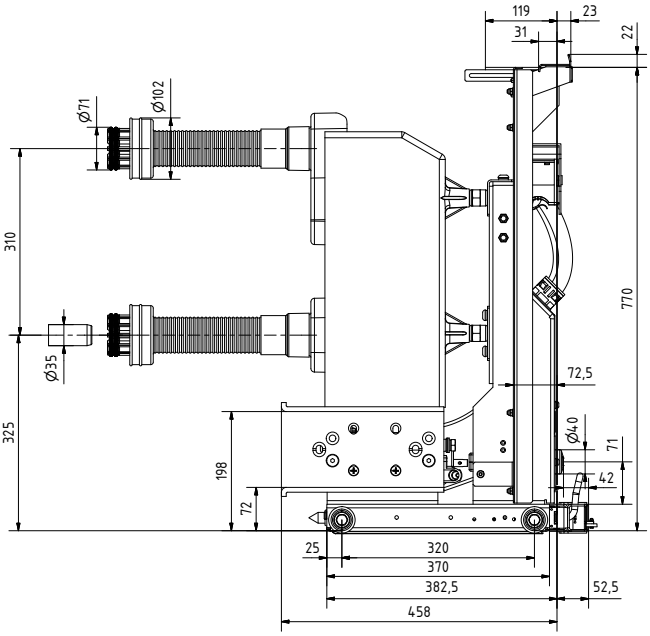


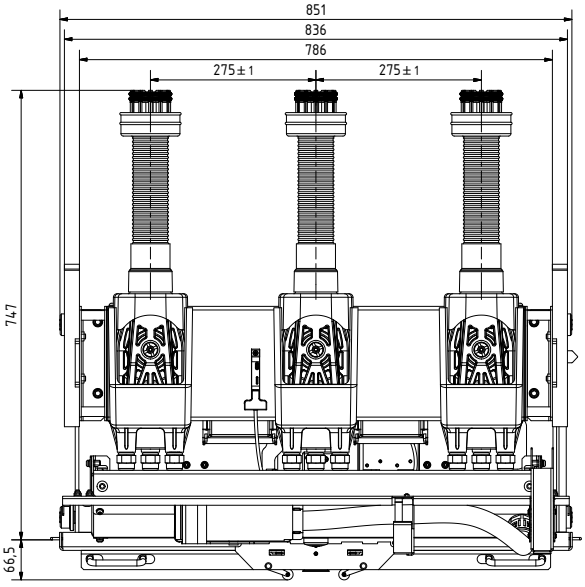


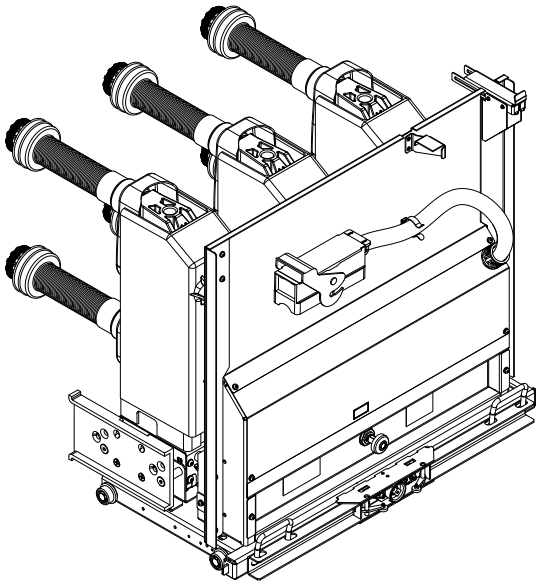
VCB25_Shell2_16D
24kV, 630 A, PCD: 275 mm, 370 mm depth of movable part of cassette, with IP2X front cover, weight: 124 kg

L_{max} = 813.5 mm
W_{max} = 882 mm
H_{max} = 792 mm



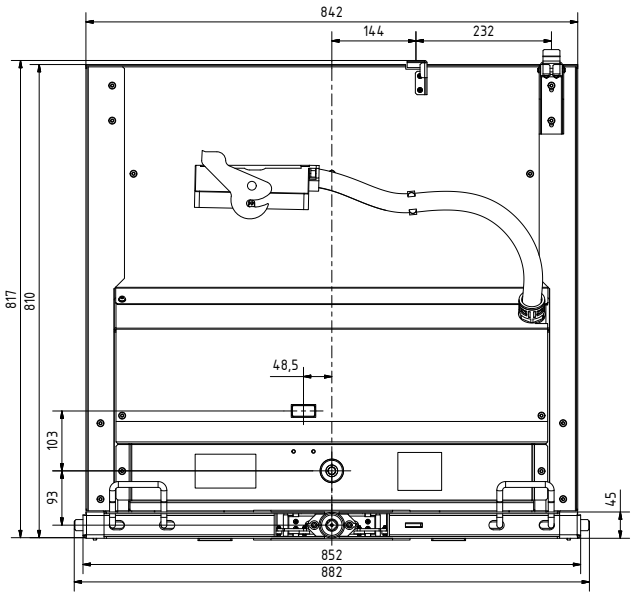


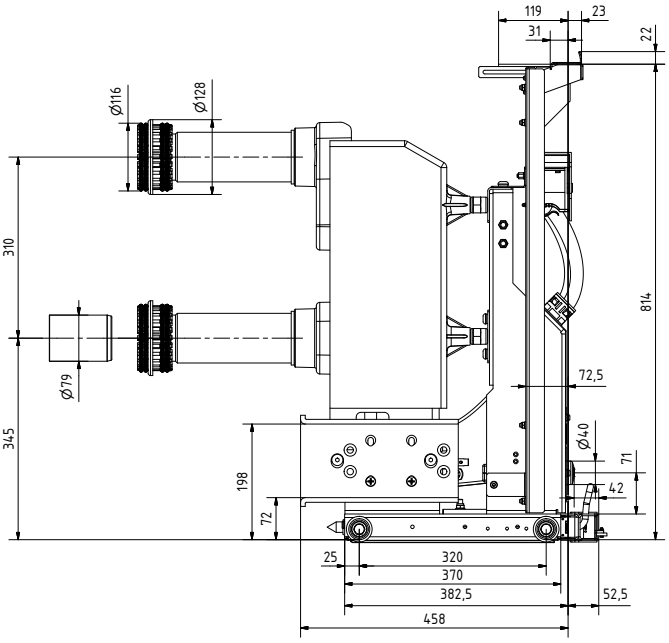


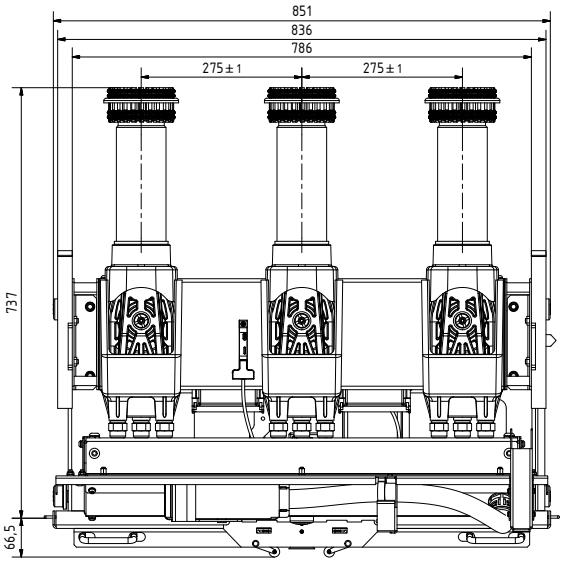


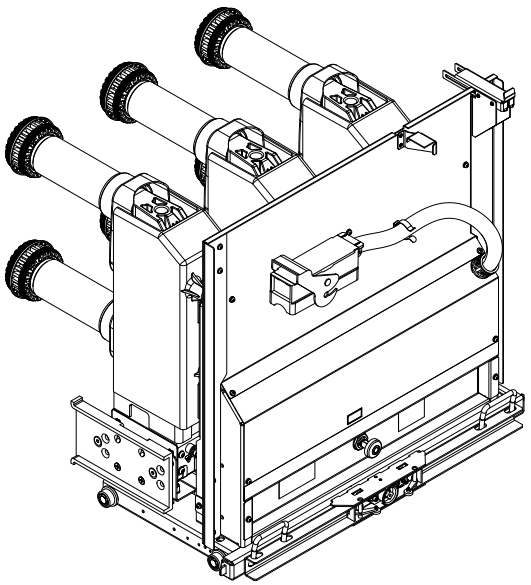
VCB25_Shell2_16D
24kV, 1250 A, PCD: 275 mm, 370 mm depth of movable part of cassette, with IP2X front cover, weight: 135 kg

L_{max} = 813.5 mm
W_{max} = 882 mm
H_{max} = 792 mm



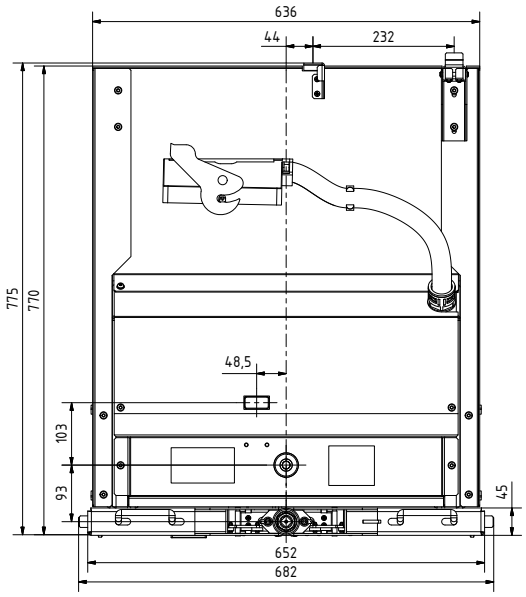


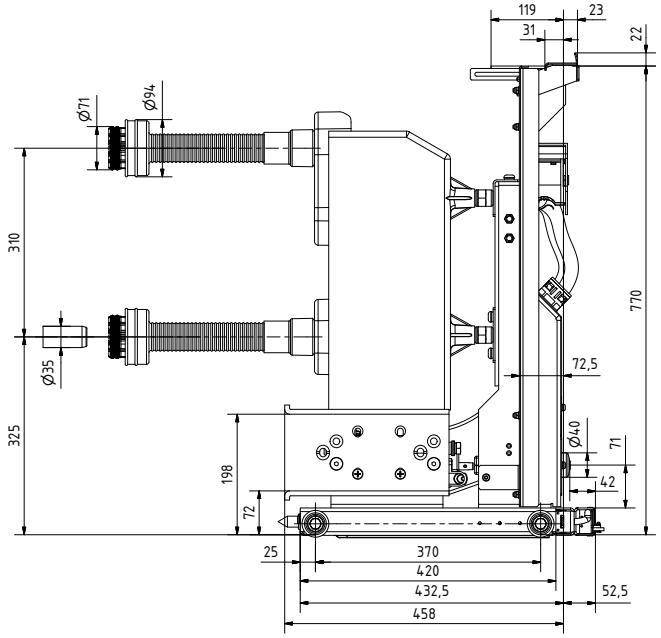


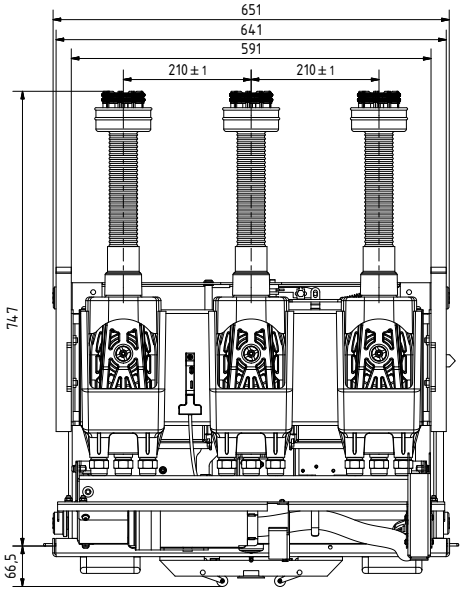


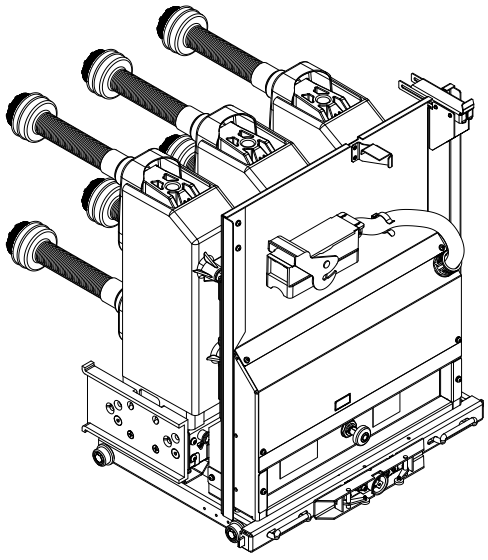
VCB25_Shell2_16D
24kV, 2500 A, PCD: 275 mm, 370 mm depth of movable part of cassette, with IP2X front cover, weight: 190 kg

L_{max} = 803.5 mm
W_{max} = 882 mm
H_{max} = 836 mm



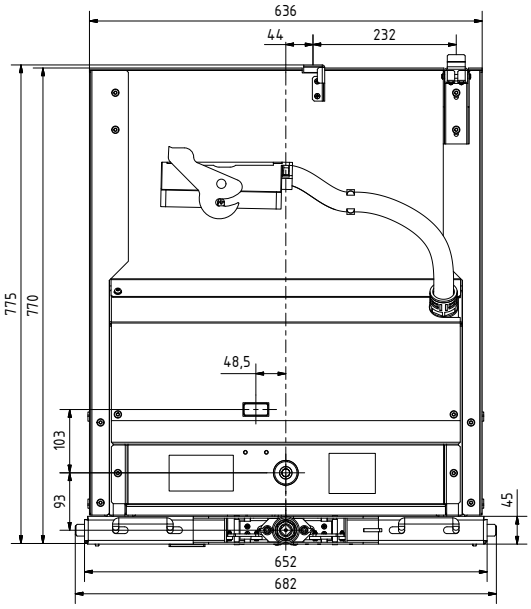


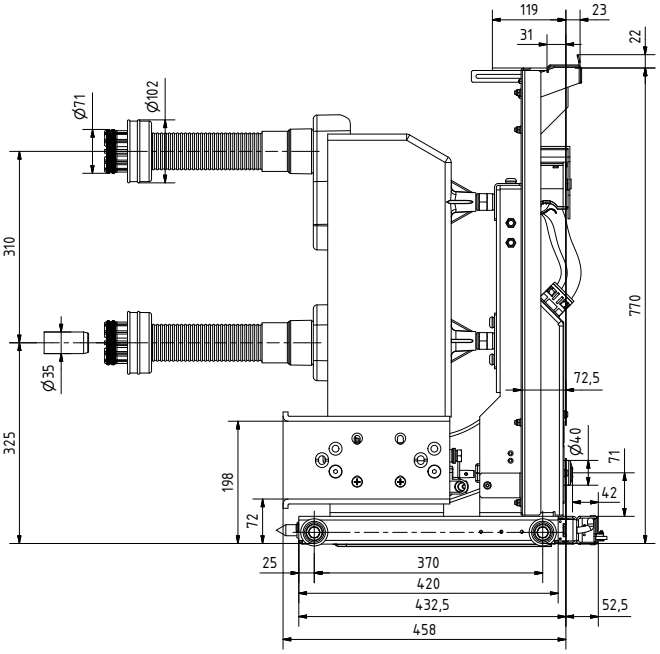


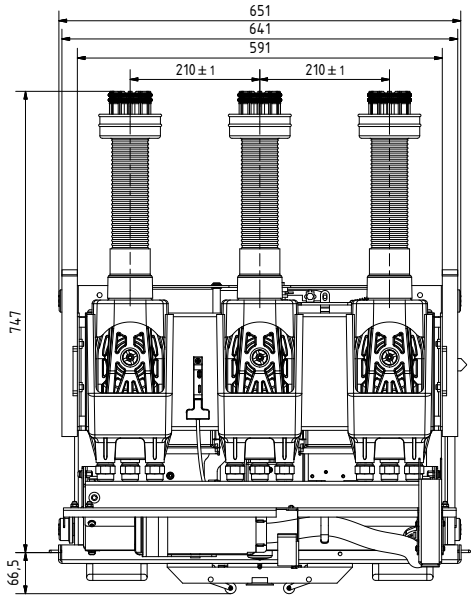


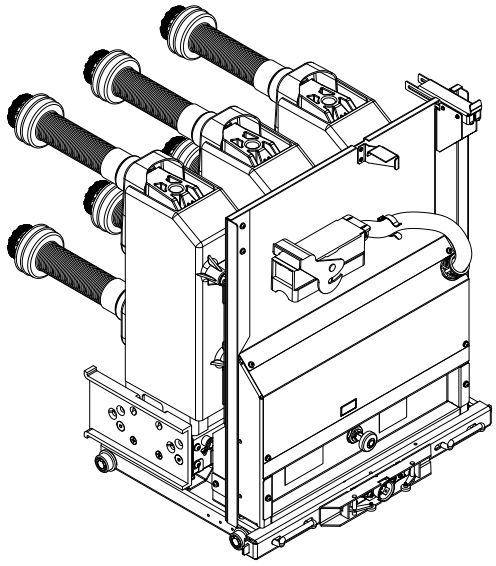
VCB25_Shell2_16D
24kV, 630 A, PCD: 210 mm, 420 mm depth of movable part of cassette, with IP2X front cover, weight: 110 kg

L_{max} = 813.5 mm
W_{max} = 682 mm
H_{max} = 792 mm



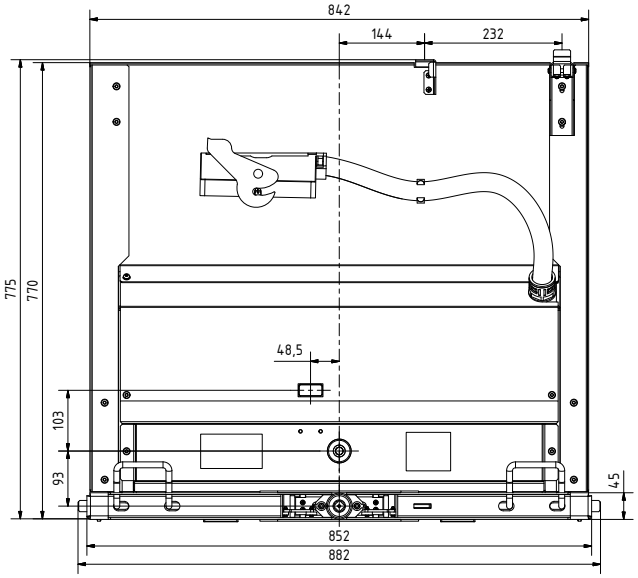


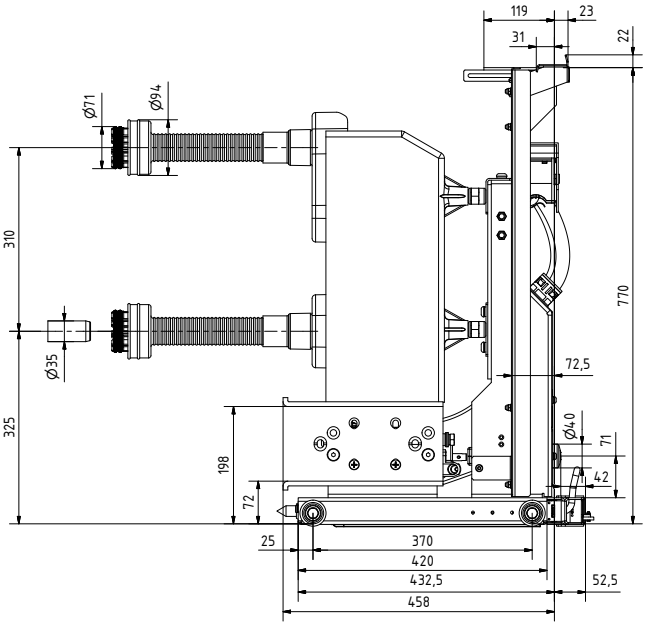


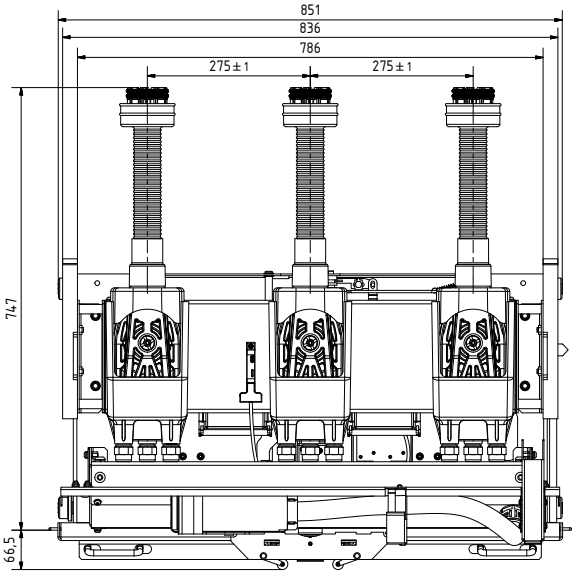


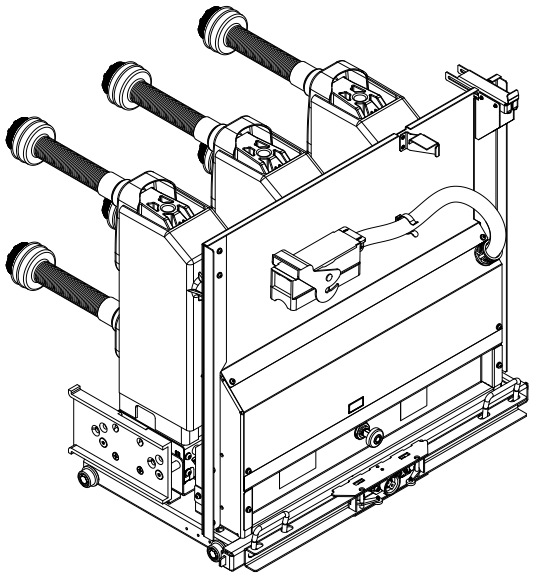
VCB25_Shell2_16D
24kV, 1250 A, PCD: 210 mm, 420 mm depth of movable part of cassette, with IP2X front cover, weight: 121 kg

L_{max} = 813.5 mm
W_{max} = 682 mm
H_{max} = 792 mm



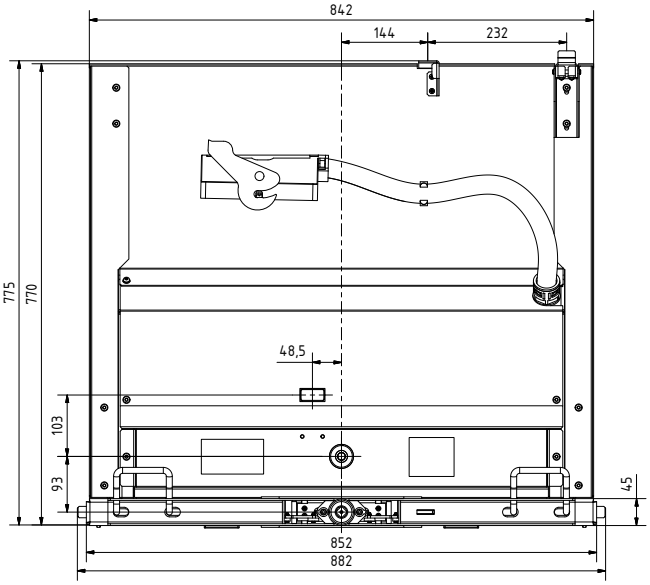


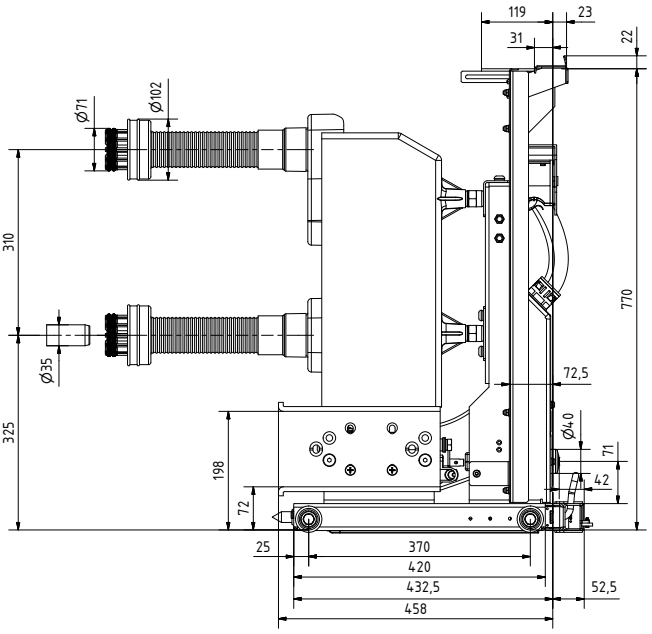


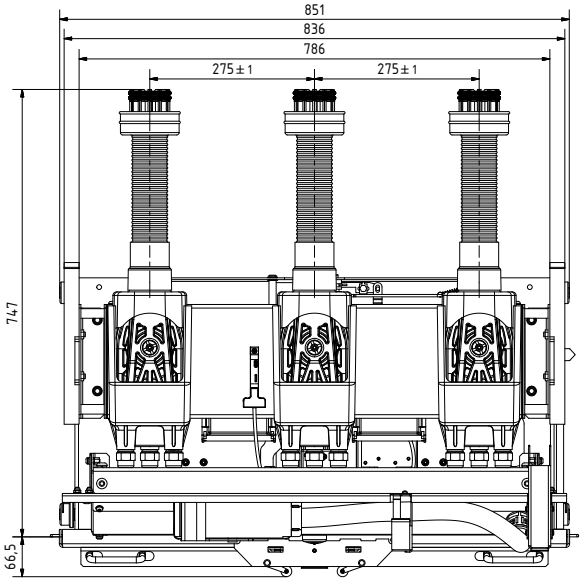


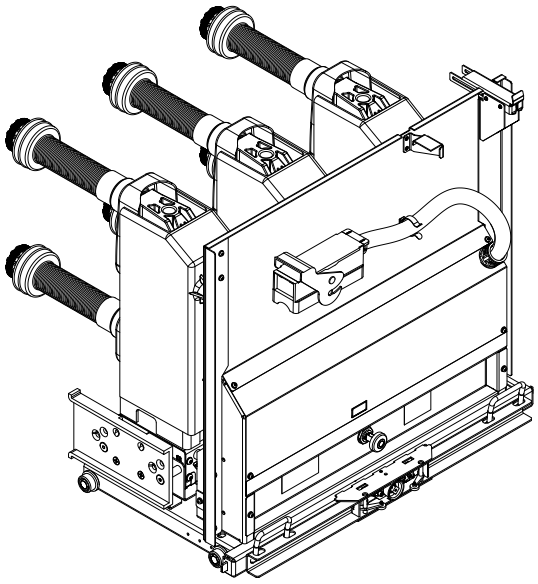
VCB25_Shell2_16D
24kV, 630 A, PCD: 275 mm, 420 mm depth of movable part of cassette, with IP2X front cover, weight: 126 kg

L_{max} = 813.5 mm
W_{max} = 882 mm
H_{max} = 792 mm



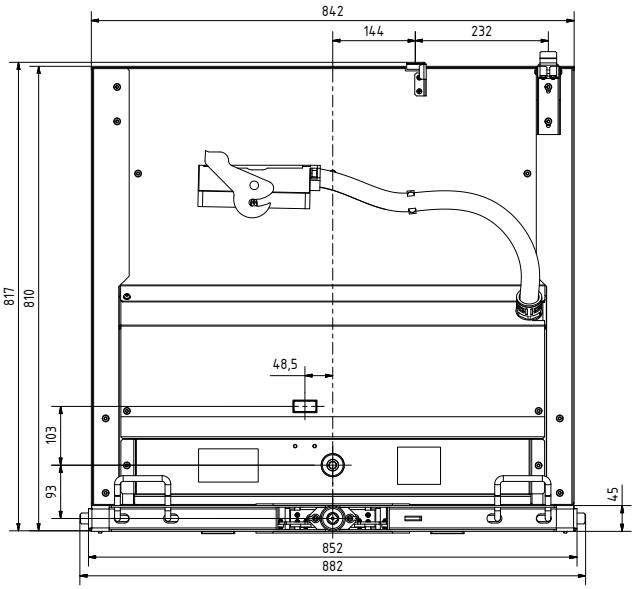


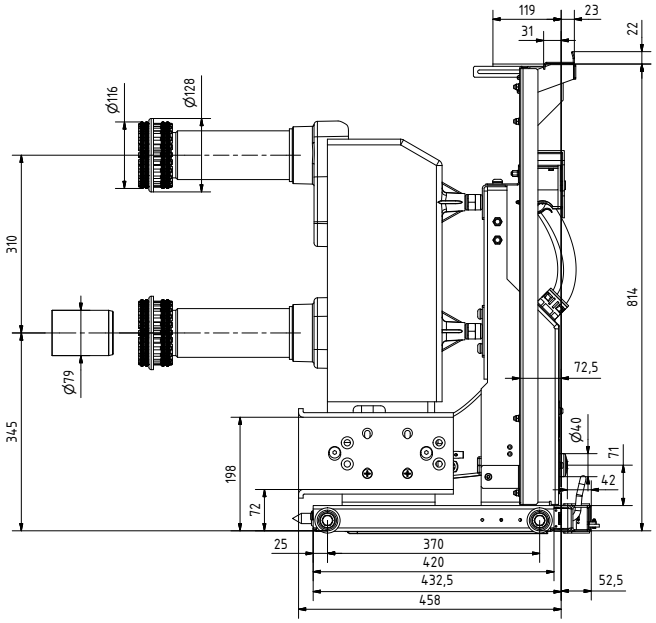


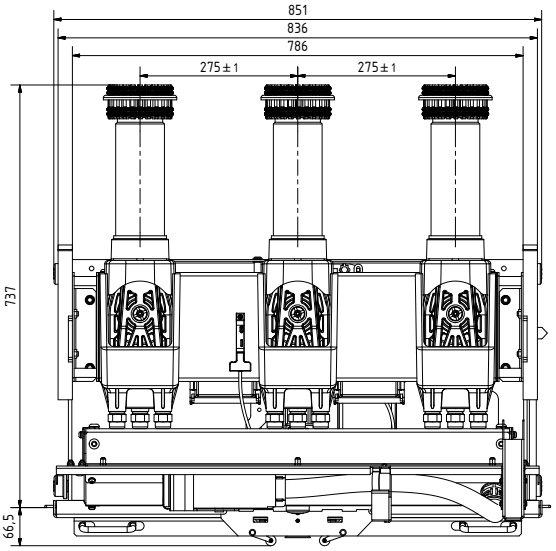


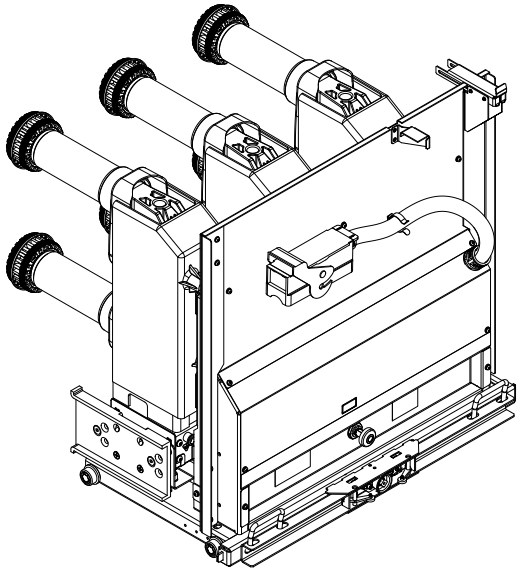
VCB25_Shell2_16D
24kV, 1250 A, PCD: 275 mm, 420 mm depth of movable part of cassette, with IP2X front cover, weight: 137 kg

L_{max} = 813.5 mm
W_{max} = 882 mm
H_{max} = 792 mm





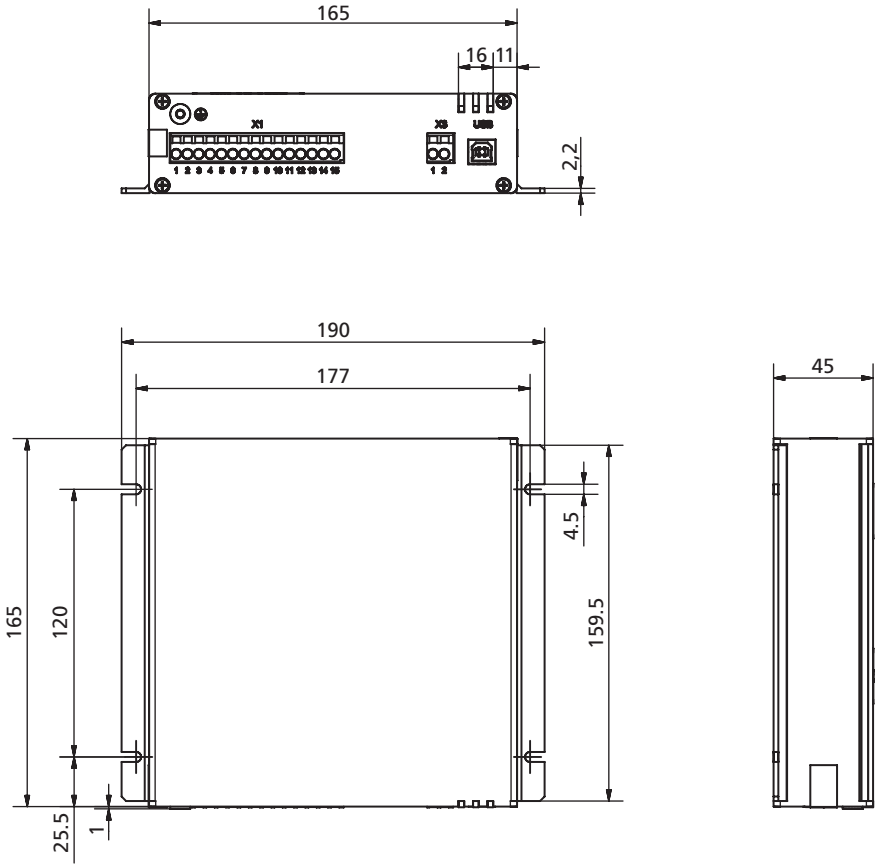




VCB25_Shell2_16D
24kV, 2500 A, PCD: 275 mm, 420 mm depth of movable part of cassette, with IP2X front cover, weight: 173 kg

L_{max} = 803.5 mm
W_{max} = 882 mm
H_{max} = 836 mm

Dimensions of Control Module

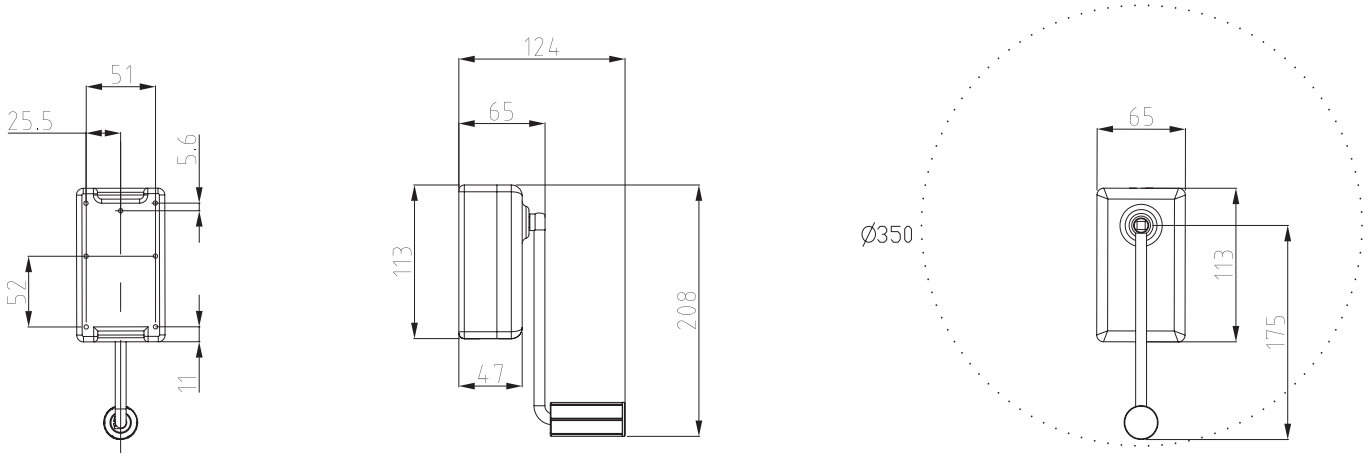


CM_16_1(Par1_Par2_Par3_Par4_Par5)
Weight: 1 kg

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

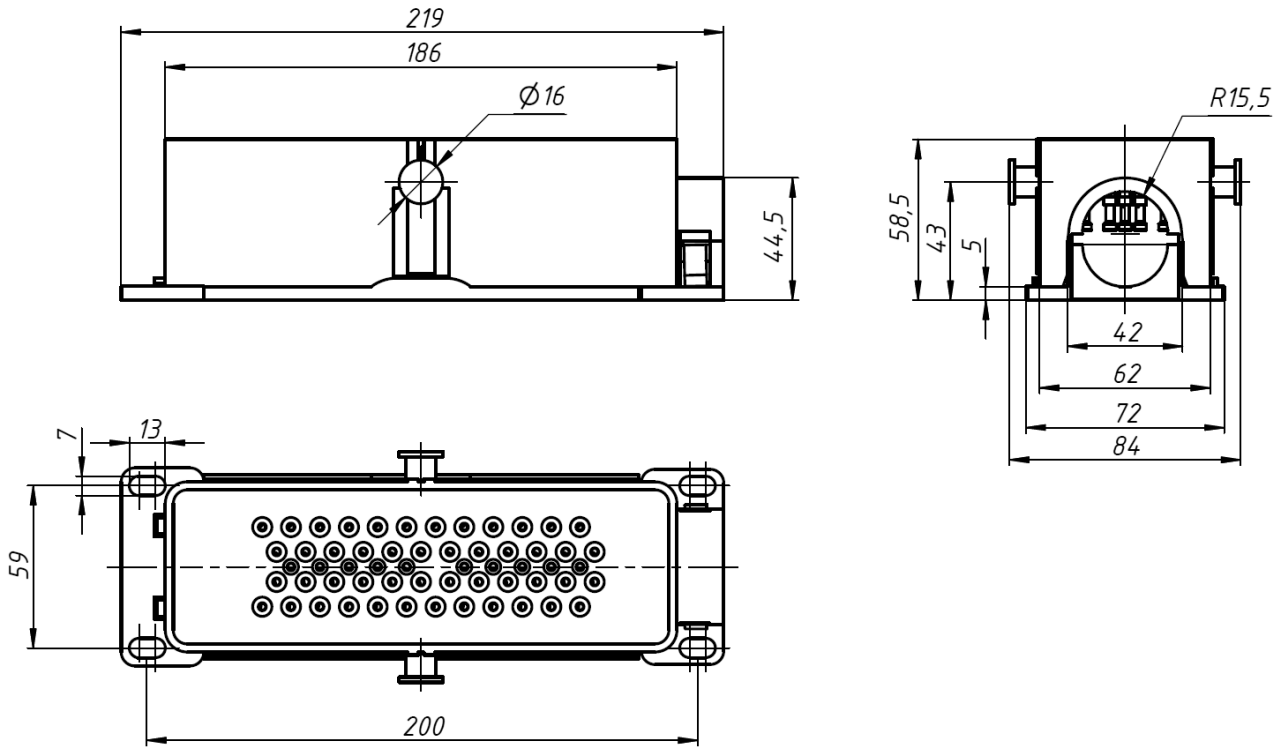
Dimensions of the Accessories

Dimensions of Manual Generator

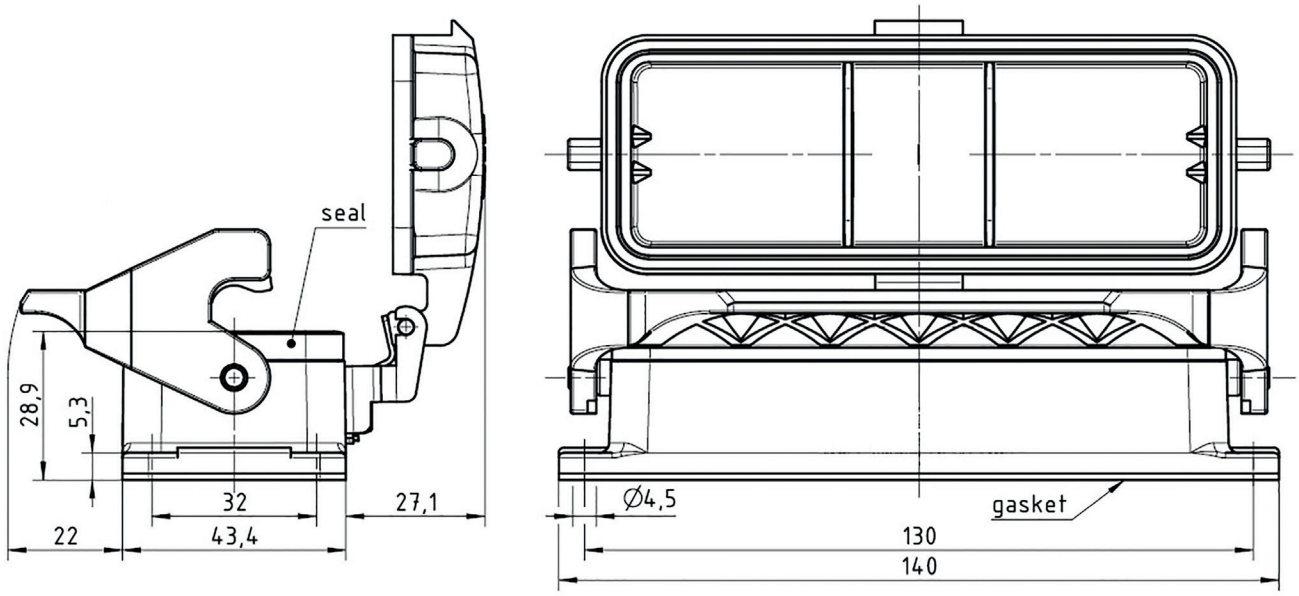


CBunit_ManGen_1, CBunit_ ManGen_2
Control wiring plastic plug counterpart

Control Wiring Plug Counterparts

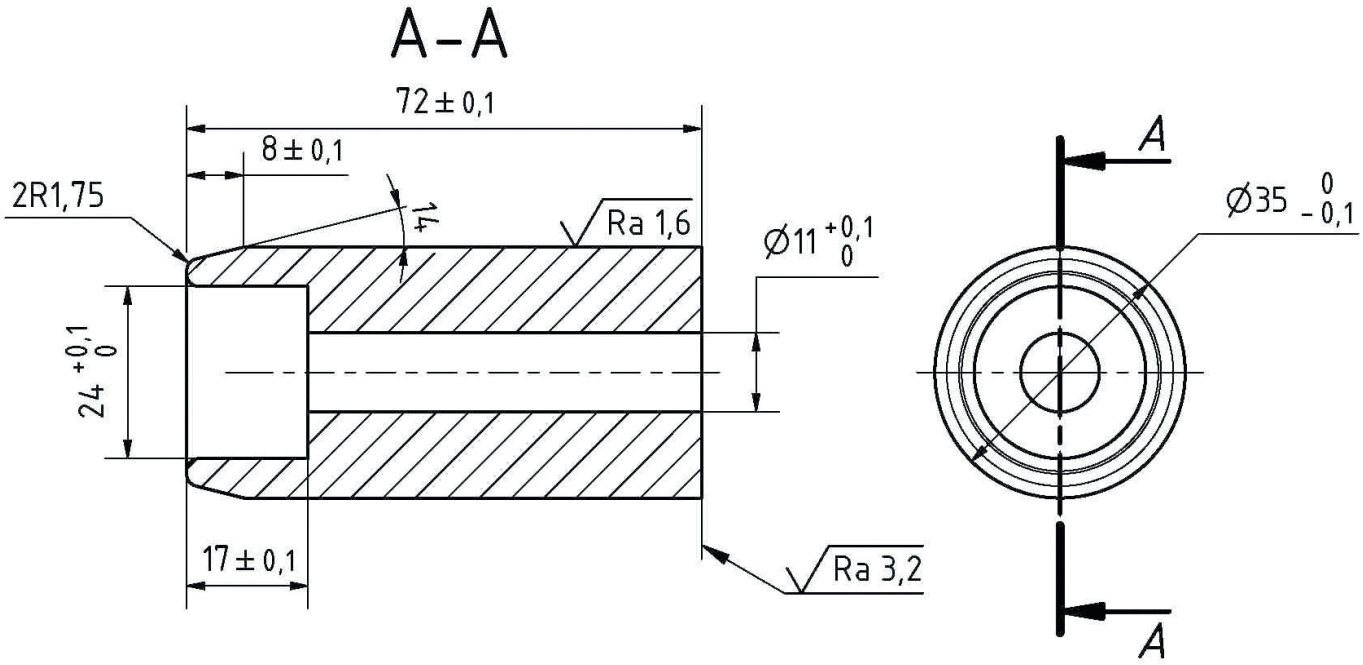


Control wiring plastic plug counterpart

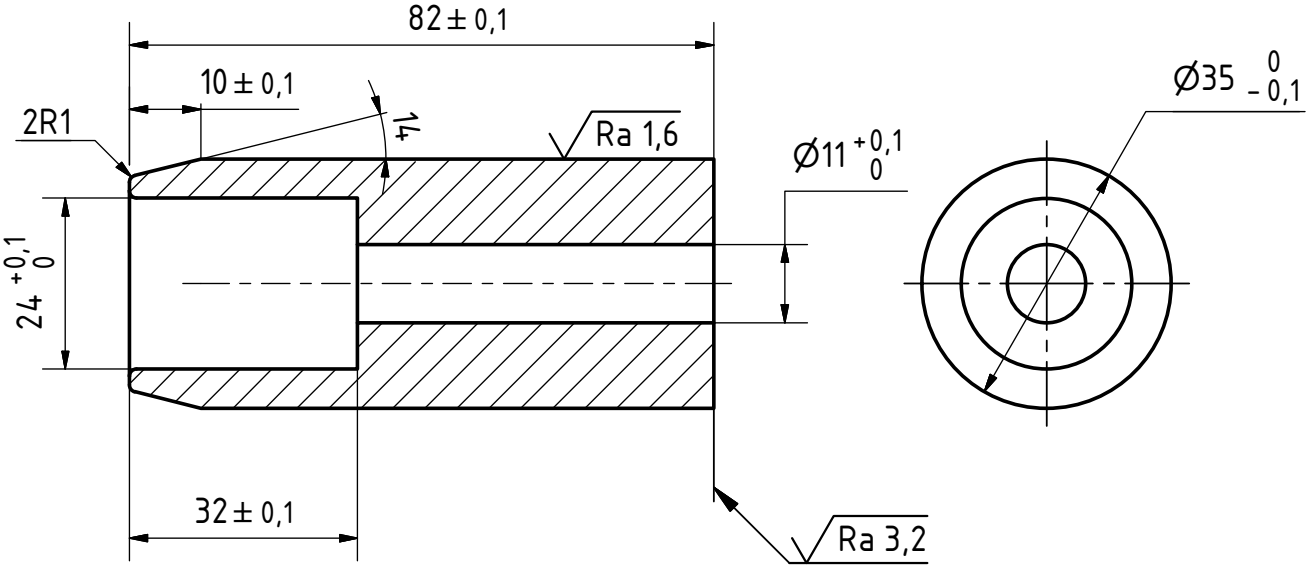


Control wiring metal plug counterpart

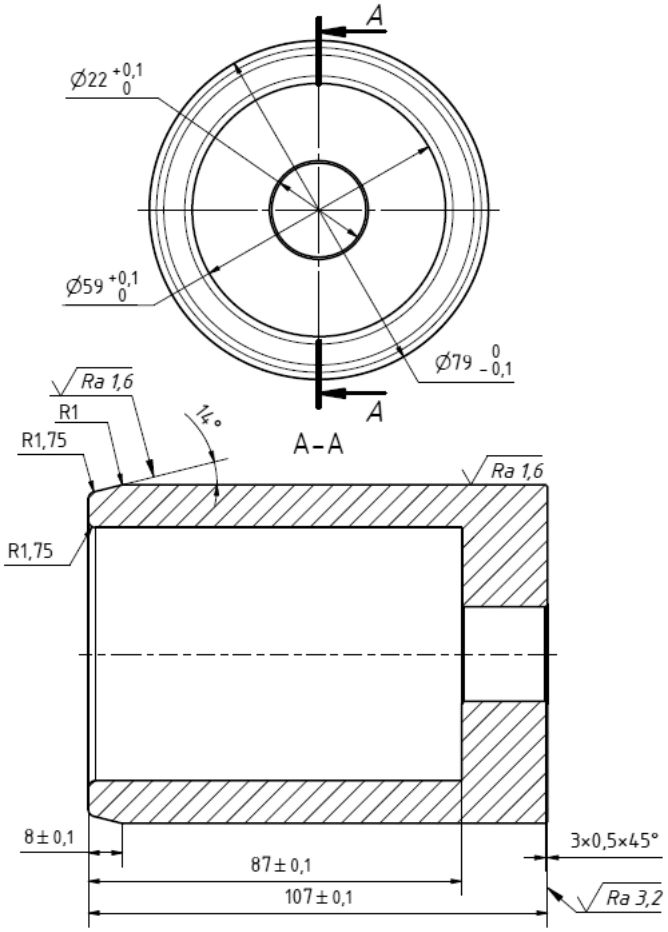
Switchgear Fixed Contact Counterparts



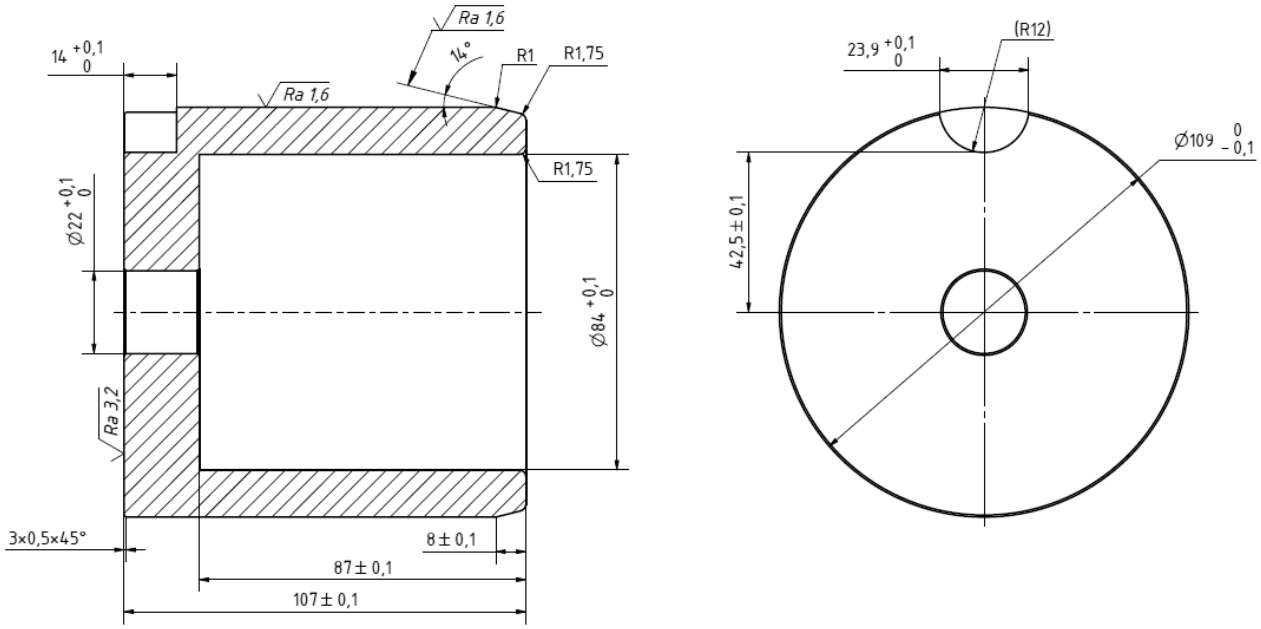
17,5 kV, 1250 A fixed contact



24 kV, 1250 A fixed contact



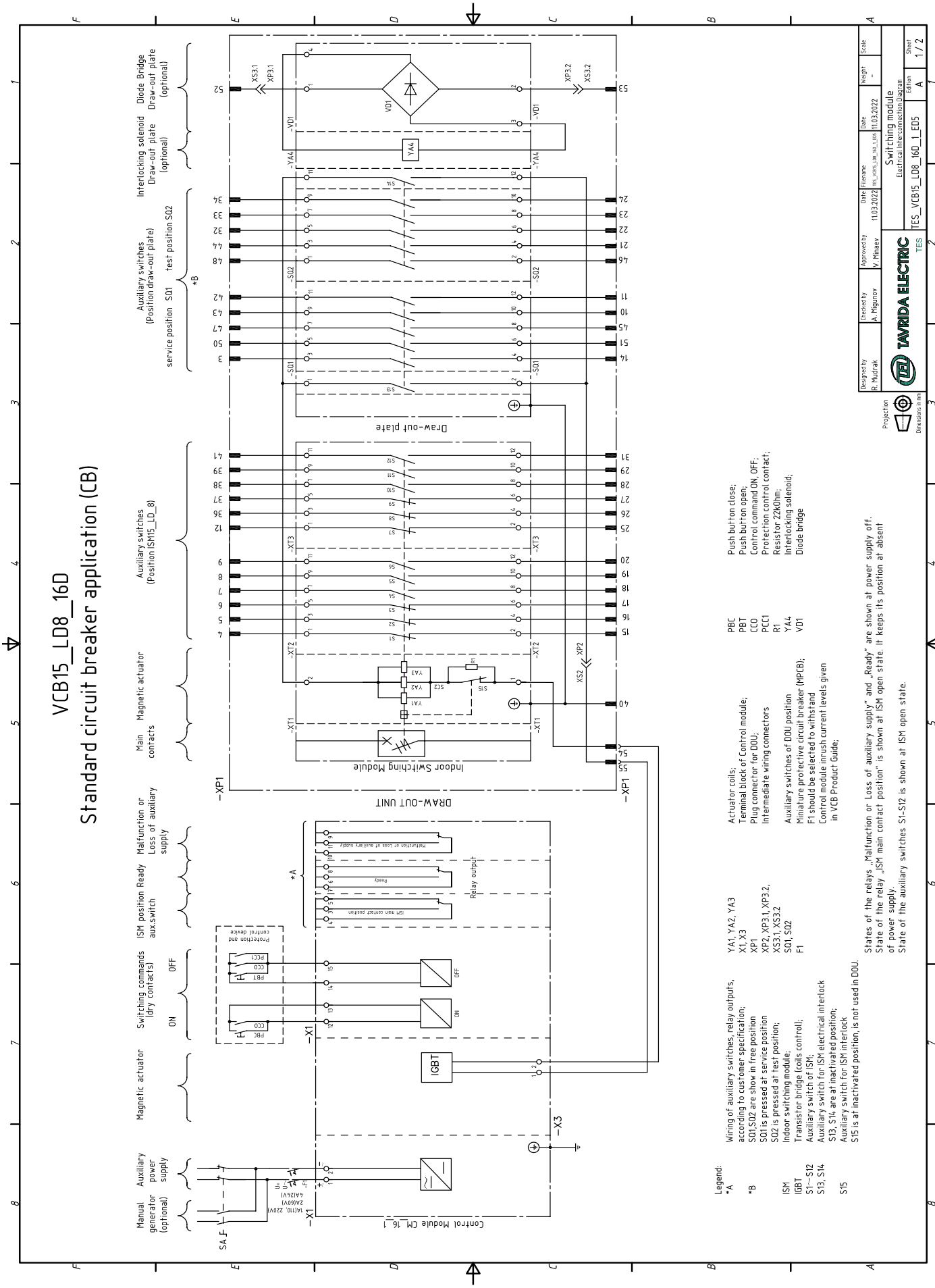
2000 A fixed contact



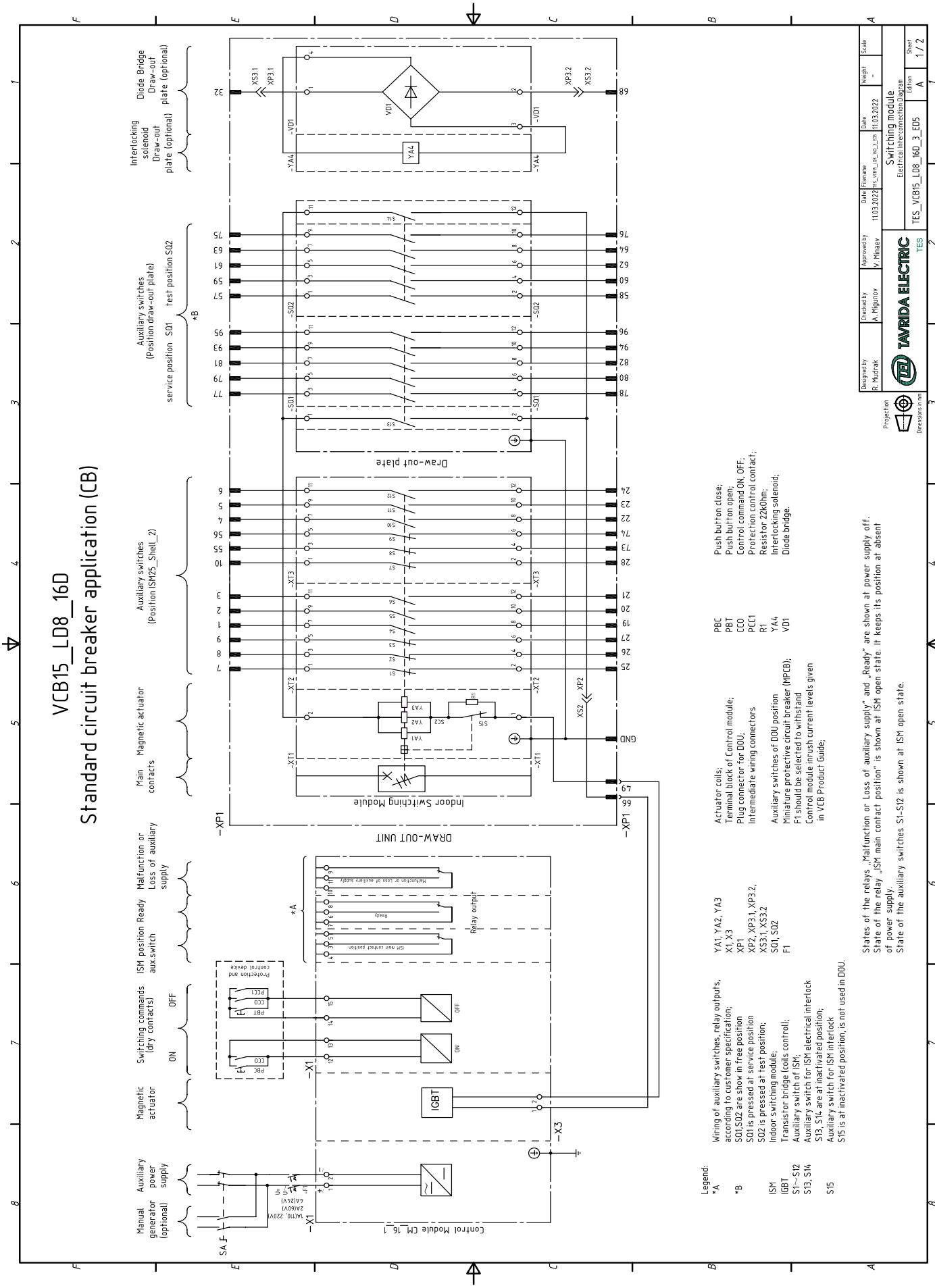
3150 A fixed contact

Appendix 3.
Secondary Schemes

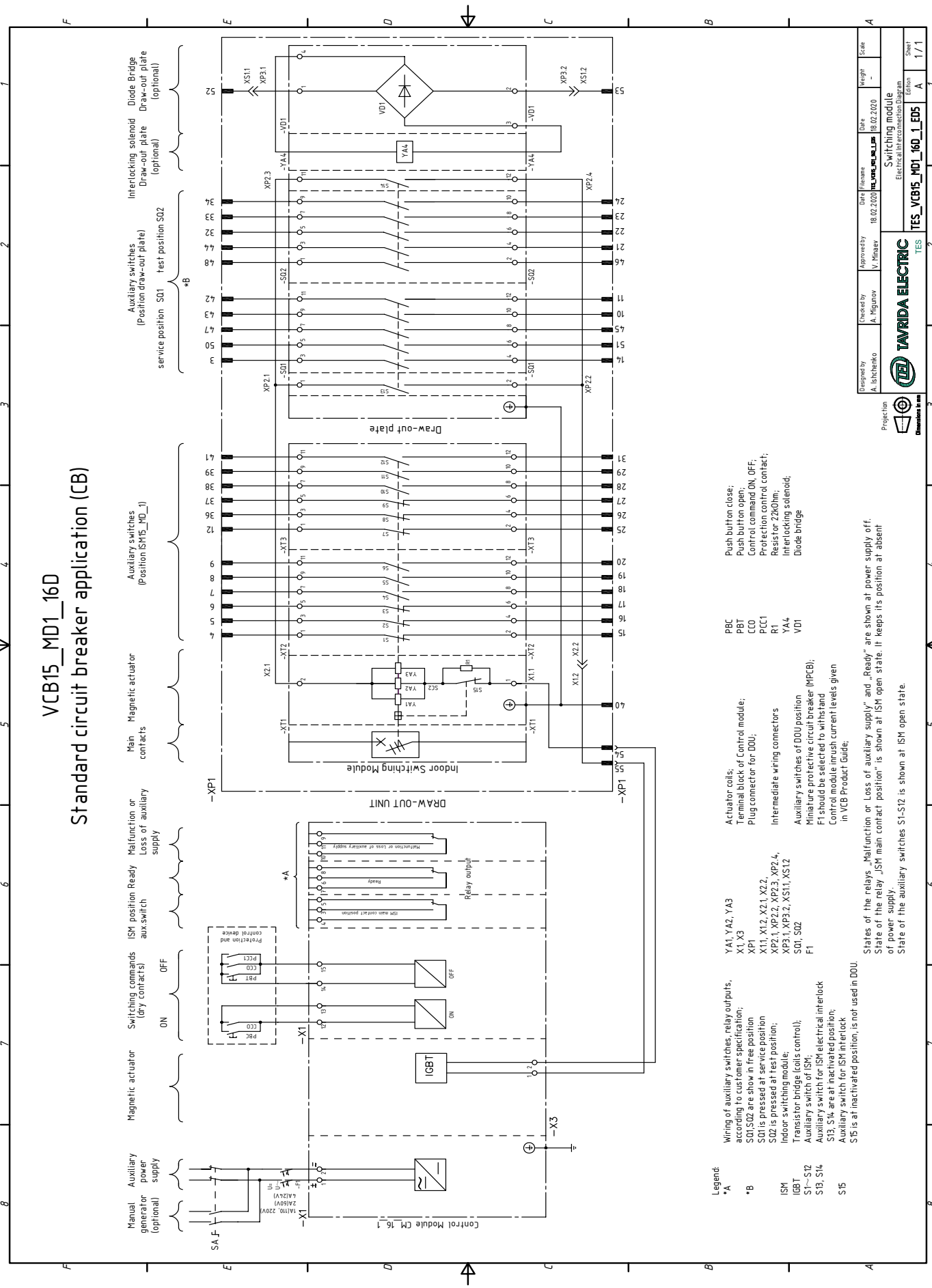
VCB15_LD8_16D with Plastic Plug



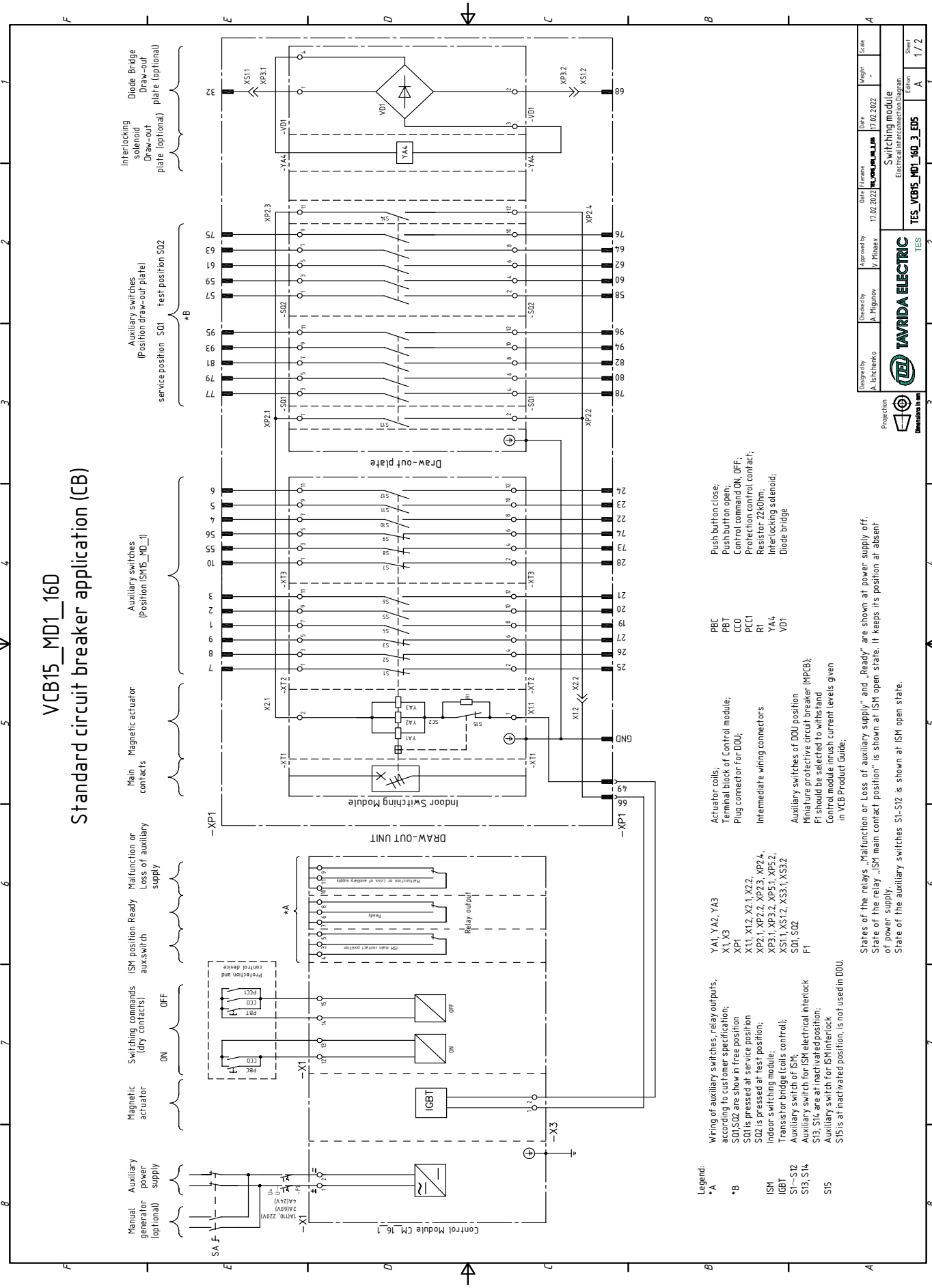
VCB15_LD8_16D with Metal Plug



VCB15_MD1_16D with Plastic Plug



VCB15_MD1_16D with Metal Plug



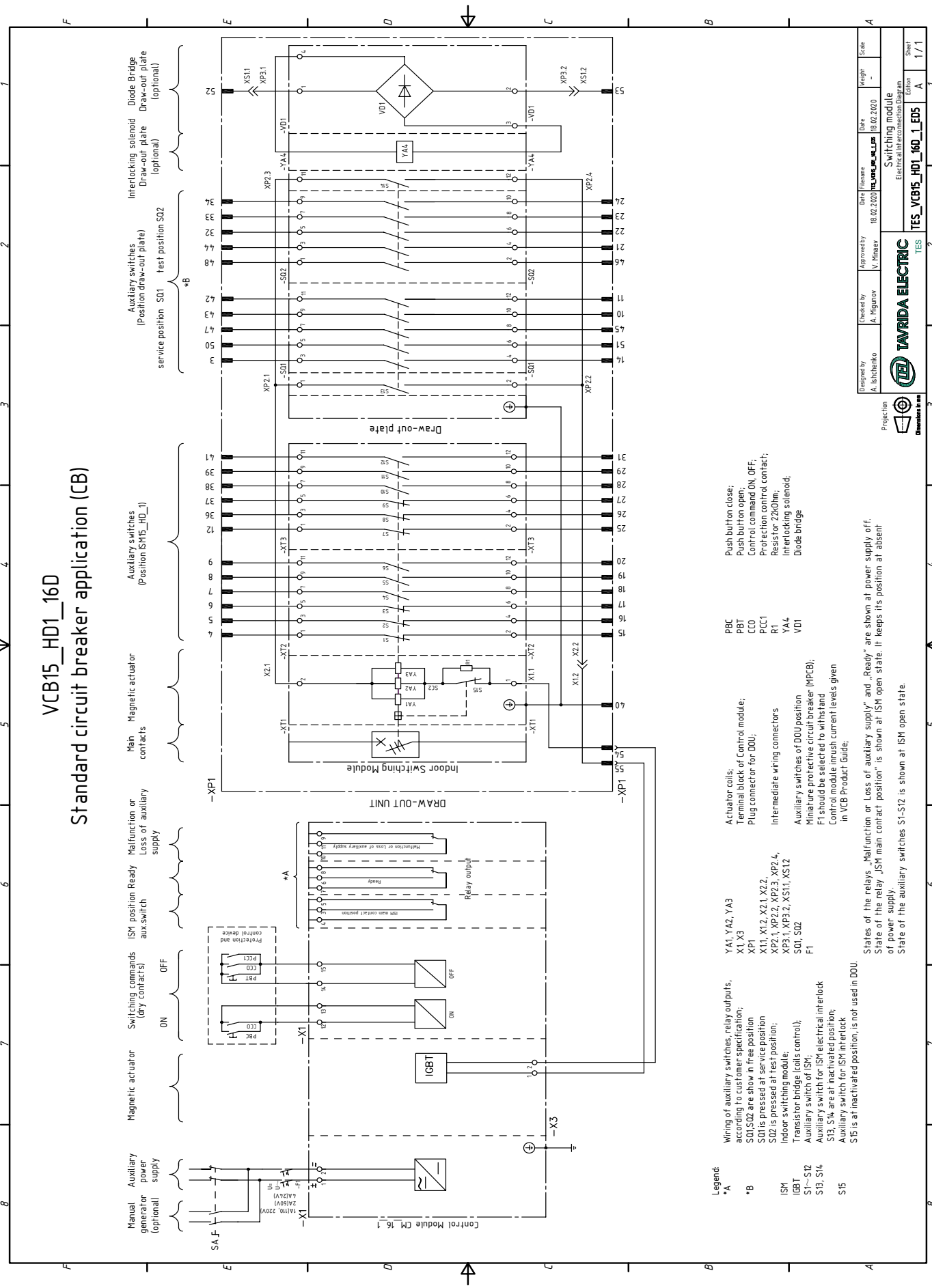
Legend:

*A	Wiring of auxiliary switches, relay outputs, according to customer specification;	YA1, YA2, YA3	Actuator coils;
*B	SQ1,SQ2 are show in free position	X1, X3	Terminal block of Control module;
	SQ1 is pressed at service position	XP1	Plug connector for DOU;
	SQ2 is pressed at test position;	X11, X11.2, X2.1, X2.2,	
	Indoor switching module;	XP2.1, XP2.2, XP2.3, XP2.4,	Intermediate wiring connectors
ISM	Transistor bridge (coils control);	XP3.1, XP3.2, XP5.1, XP5.2,	
IGBT	Auxiliary switch of ISM;	XS11, XS12, XS3.1, XS3.2	Auxiliary switches of DOU position
S1—S12	Auxiliary switch for ISM electrical interlock	SQ1, SQ2	Miniature protective circuit breaker (MPCB);
S13, S14	S13, S14 are at inactivated position;	F1	F1 should be selected to withstand
	Auxiliary switch for ISM interlock		Control module inrush current levels given
S15	S15 is at inactivated position, is not used in DOU.		in VCB Product Guide;

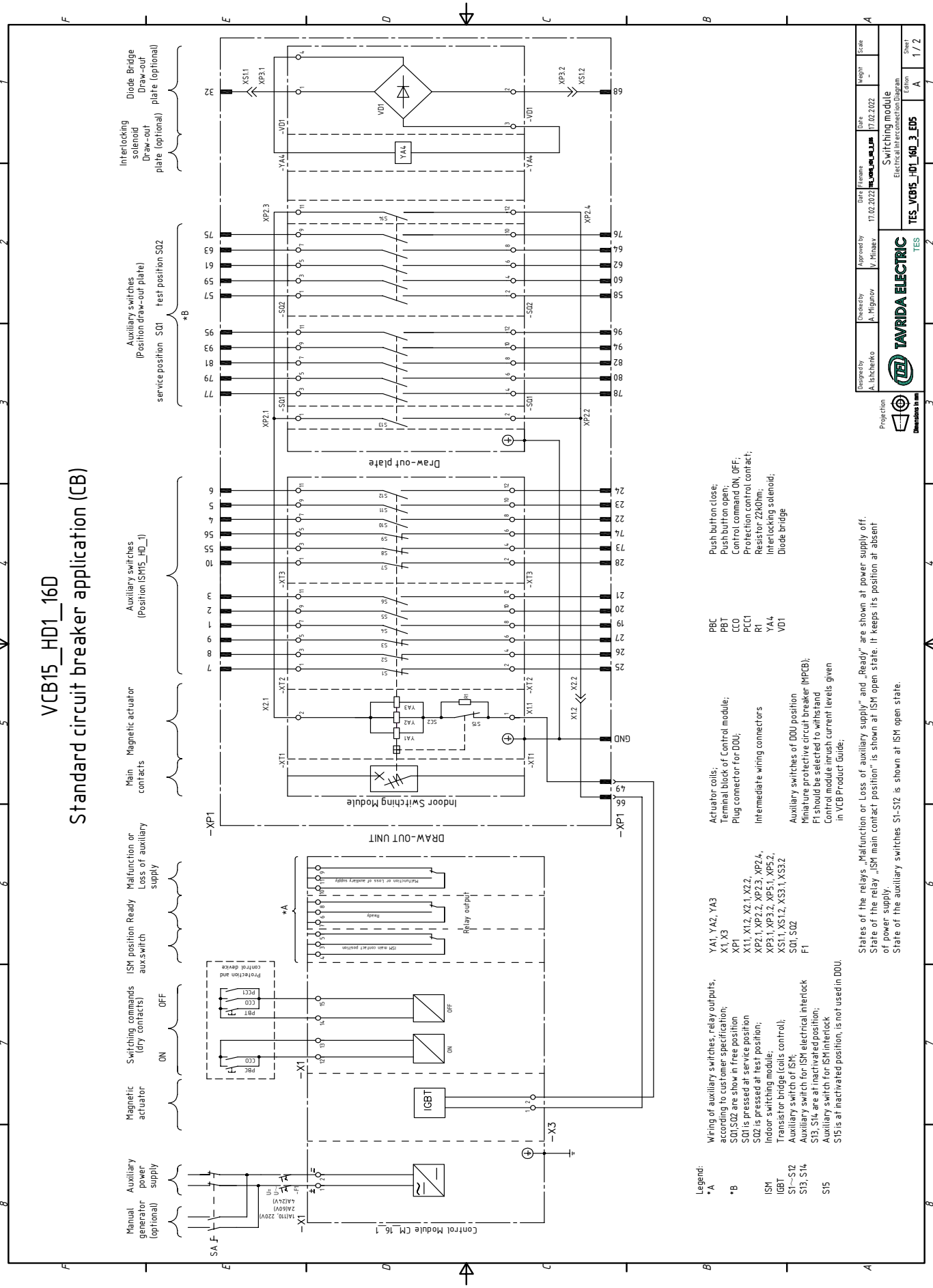
PBC	Push button close;		
PBT	Push button open;		
CCO	Control command ON, OFF;		
PCC1	Protection control contact;		
R1	Resistor 22kOhm;		
YA4	Interlocking solenoid;		
VD1	Diode bridge		

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.
State of the auxiliary switches S1-S12 is shown at ISM open state.

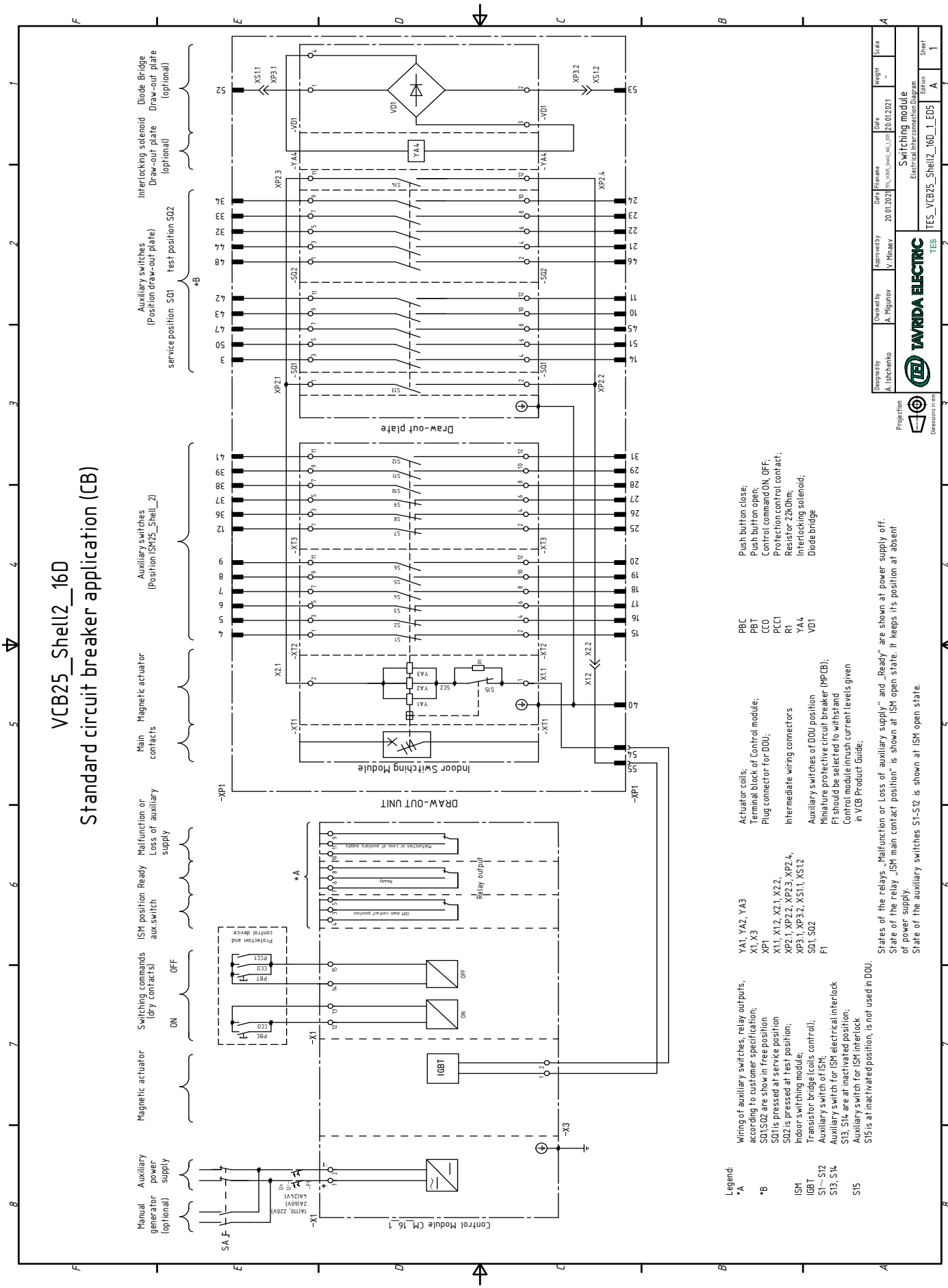
VCB15_HD1_16D with Plastic Plug



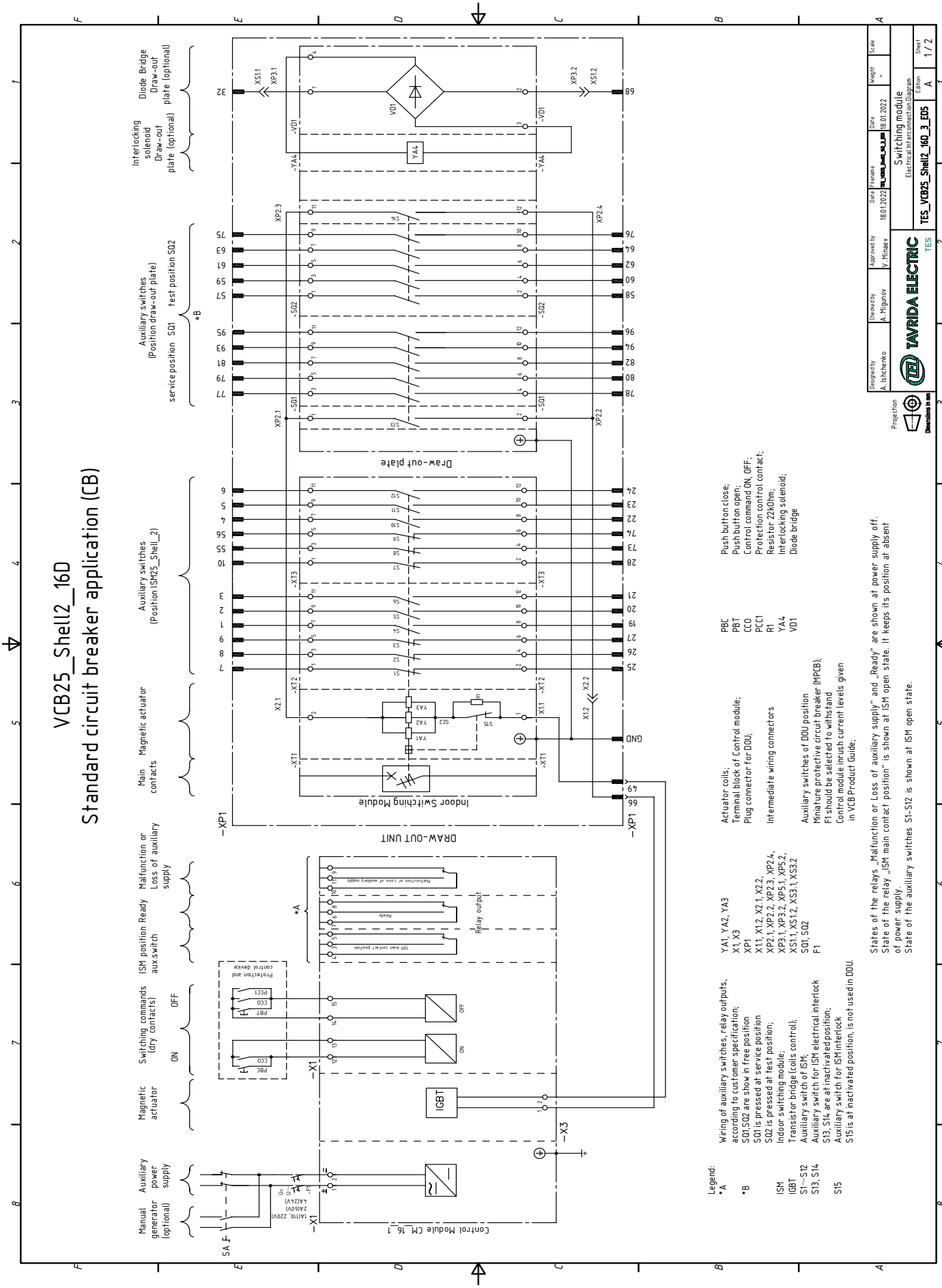
VCB15_HD1_16D with Metal Plug



VCB25_Shell2_16D with Plastic Plug



VCB25_Shell2_16D with Metal Plug



List of Changes

Documents version	Change Date	Scope of change	Reason of change	Version author
1	16.10.2018	Document creation	Products development	may
2	21.02.2019	Mistypes correction; withdrawable ISM lifting provision elaboration	Document elaboration	may
3	16.10.2019	Change of VCB, ISM and CM classification.	Product range change	may
4	29.10.2019	CBmount_CM_1 was added	Product range change	may
5	21.05.2020	Adding of the new options	Product range change	may
6	12.08.2022	Adding of VCB15_LD8_16D and VCB25_Shell2_16D	Product range chang	may mariy

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