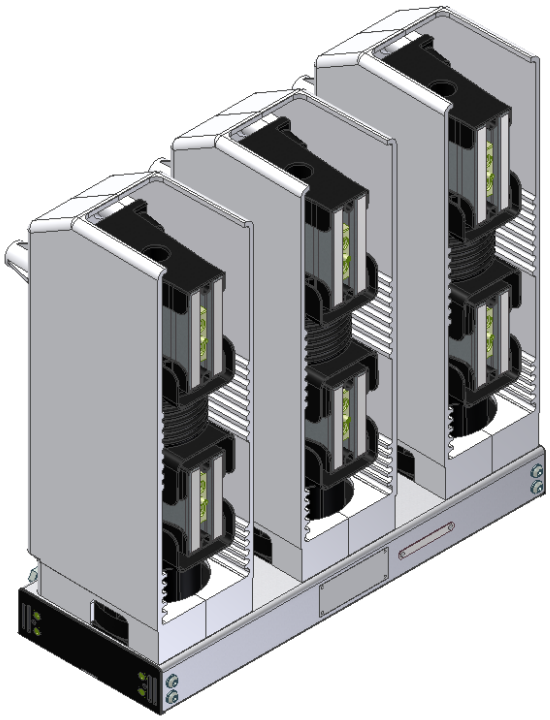
TAVRIDA ELECTRIC



ISM_Shell Series

Indoor Circuit Breaker
5 kV, ...31.5kA, ...2000A
15 KV, ...29kA, ...2000A

Applications Manual MAN5002239

Revision 2

The following installation and operating Instructions contain information necessary for the methods of use, installation, commissioning and operation. It is absolutely necessary for the proper use of the vacuum circuit breakers to read the Installation and Operating Instructions carefully before starting and to adhere to the instructions and the relevant regulations.

Safety first

- Check whether the installation position (distances, spatial separation, and the surroundings) is suitable for the switching devices.

- Installation, operation and maintenance shall only be carried out by trained and experienced personnel who are familiar with the equipment and the electrical safety requirements.

- During installation, commissioning, operation and maintenance of the equipment the relevant legal regulations, accident prevention regulations and the connecting conditions of the electric utilities shall be followed.

- Take note that during operation of the vacuum circuit breakers certain parts are subject to dangerous voltage. Mechanical parts, also remote-controlled, can move quickly. Failure to comply may result in death, severe personal injury or damage to equipment.

- Pay attention to the hazard statements located throughout this manual. 

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

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

For special configurations please contact TAVRIDA ELECTRIC NA.

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Introduction 1

Applicability

This Technical Manual applies to a range of Indoor Circuit Breakers (ISM) manufactured by Tavrida Electric.
The following products are covered by this manual:

ISM15_Shell_2(150)
ISM15_Shell_2(180)
ISM15_Shell_2(210)
ISM15_Shell_2(275)

The model number is shown on the equipment rating plates. If your equipment does not correspond to this number then this manual is not applicable. Please contact your nearest Tavrida Electric office.

Every care has been taken in preparation of this manual. However, please note that not all the details or variations in the equipment or process being described can be covered. Neither is it expected to address all contingencies associated with the installation and operation of this equipment. For any further information please contact your nearest Tavrida Electric office.

Hazard Statements

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

DANGER: Indicates an imminently hazardous situation that, if not avoided, will result in death or serious injury.

WARNING: Indicates a potentially hazardous situation that, if not avoided, could result in death or serious injury.

CAUTION: Indicates a potentially hazardous situation that, if not avoided, could result in personal injury or equipment damage.

Safety Instructions

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

DANGER: Contact with hazardous voltage will cause death or severe personal injury. Contact with Recloser or Control Cubicle terminals should only be undertaken when equipment is isolated from applicable sources of voltage.

WARNING: This equipment is not intended to protect human life. Follow all locally approved safety procedures when installing or operating this equipment. Failure to comply may result in death or severe personaly injury.

WARNING: Before working with equipment descriped in this manual carefully read and understand the contents of this manual. Improper handling, installation, operation or maintenance can result in death, severe personal injury or demage to equipment.

WARNING: Power distribution equipment must be properly selected for the intended operation. It must be installed, used and understand all relevant safety procedures. Failure to comply can result in death, personal injury or equipment damage.

Definitions

The following abbreviations are used in this operating manual:

AR	Automatic reclosing
CM	Control module
CO	Close open cycle
ISM	Indoor switching module
LED	Light emitting diode
MCB	Miniature circuit breaker
NC	Normally closed contact
NO	Normally open contact
PCD	Pole center distance
SCADA	Supervisory control and data aquisition
VCB	Vacuum circuit breaker
VI	Vacuum interrupter

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

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

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

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

Break time
The break time is the time period from the energising of the closing circuit up to the time when the arcs of all the poles are extinguished.

Open-close time (during AR)
Interval of time between the instant when the arcing contacts have separated in all poles and the instant when the contacts touch in the first pole during a reclosing cycle.

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

General

In comparison to conventional circuit breakers, the Tavrida Electric vacuum circuit breakers comprise of two components:
· The ISM (Figure 1)
· The CM for controlling the ISM and monitoring both modules (Figure 2)

Both modules must only be operated together and are meant for indoor installations only. The possibility to choose ISM and CM separately allows any type of switchgear to be easily equipped with regard to its primary and auxiliary circuits.

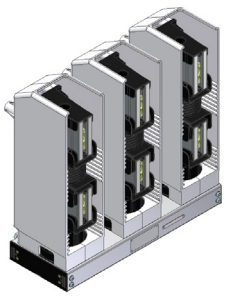


Figure 1

Figure 2

Compact design

Tavrida Electric develops and produces all vital parts of the circuit breakers themselves. The result of intensive inhouse fundamental and material research are extremely compact vacuum interrupter and magnetic actuators. Optimal selection of all components makes these the most compact and light weight vacuum circuit breaker in the world.

Long life

Contact erosion is minimised by use of axial magnetic field. All the switching elements are assembled axially and symmetrically in one straight line. This means that all the mechanical movements are exclusively direct and linear. 30 000 operating cycles can be achieved with rated current without replacing or adjusting any components.

Maintenance free

The ISM is maintenance-free over the expected life of at least 25 years.

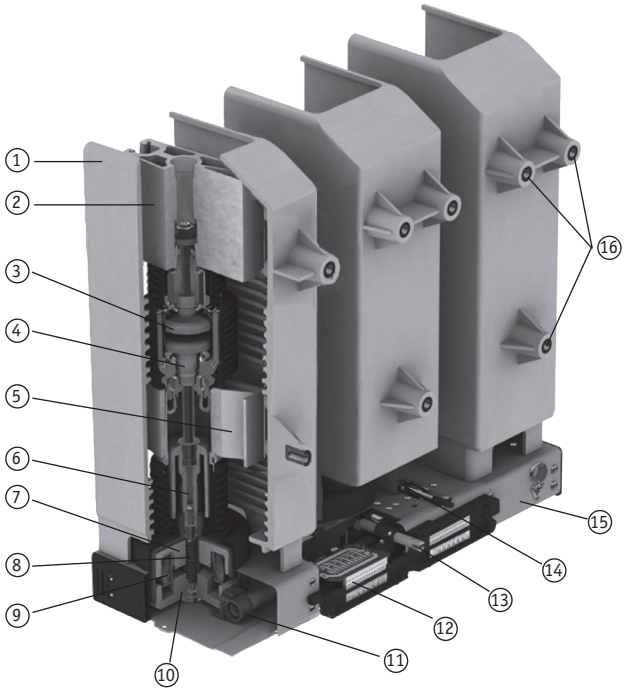
Highest availability

In addition to minimizing the number of failure-critical components, the Tavrida Electric circuit breaker monitors its status continuously. In the unlikely event that a fault occurs in the remaining components of the circuit breaker it is indicated and can be rectified before an unsuccessful switching attempt is made. This clearly leads to higher availability of the electric power supply system.

Design and Method of Operation of the ISM

The ISM vacuum circuit breaker uses three single-coil magnetic actuators, one per pole. The three actuators are mounted in a steel frame and mechanically linked by a synchronizing shaft (Figure 3).

Indoor Switching Module (ISM)



1. Support insulator
2. Upper terminal
3. Vacuum interrupter
4. Movable contact with bellows
5. Lower terminal
6. Pulling insulator
7. Actuator stator
8. Opening and contact pressure springs
9. Actuator coil
10. Actuator armature
11. Synchronizing shaft
12. Auxiliary contacts
13. Interlocking shaft
14. Main contacts position indicator link
15. Frame
16. Fixing points

Figure 3

View into the ISM

Closing

In the open position the contacts are kept open by the force of the opening springs. To close the contacts the coils of the magnetic actuators are excited by a current impulse of the close capacitors of the CM. As a result the contacts close. At the same time the opening springs are compressed. In the close position the contacts are kept closed by means of the magnetic force only. The ISM maintains the closed position without mechanical latching also in case of a failure of the auxiliary power supply (Figure 4).

Opening

To open the contacts a current impulse in the reverse polarity derived from the opening capacitors of the CM is injected in the coils of the magnetic actuators releasing the magnetic holding force. The compressed opening springs and contact pressure springs open the contacts (Figure 4).

Manual-Emergency-Tripping

The ISM can be tripped mechanically without auxiliary power supply (emergency trip). It may be opened manually by means of interlocking shaft rotating counter-clockwise. The interlocking cam of interlocking shaft act on the armature, when then starts to move (refer to chapter “Installation/Primary part/ Interlocking”, page 24). As the air gap increases, the opening springs and contact pressure springs overcome any magnetic holding force and the module opens.

Manual Closing

The ISM can only be closed electrically via the CM. In the case of a failure of auxiliary power supply the contacts can be closed using an alternative auxiliary power supply such as a battery. Mechanical closing is not possible and leads to the destruction of the ISM.

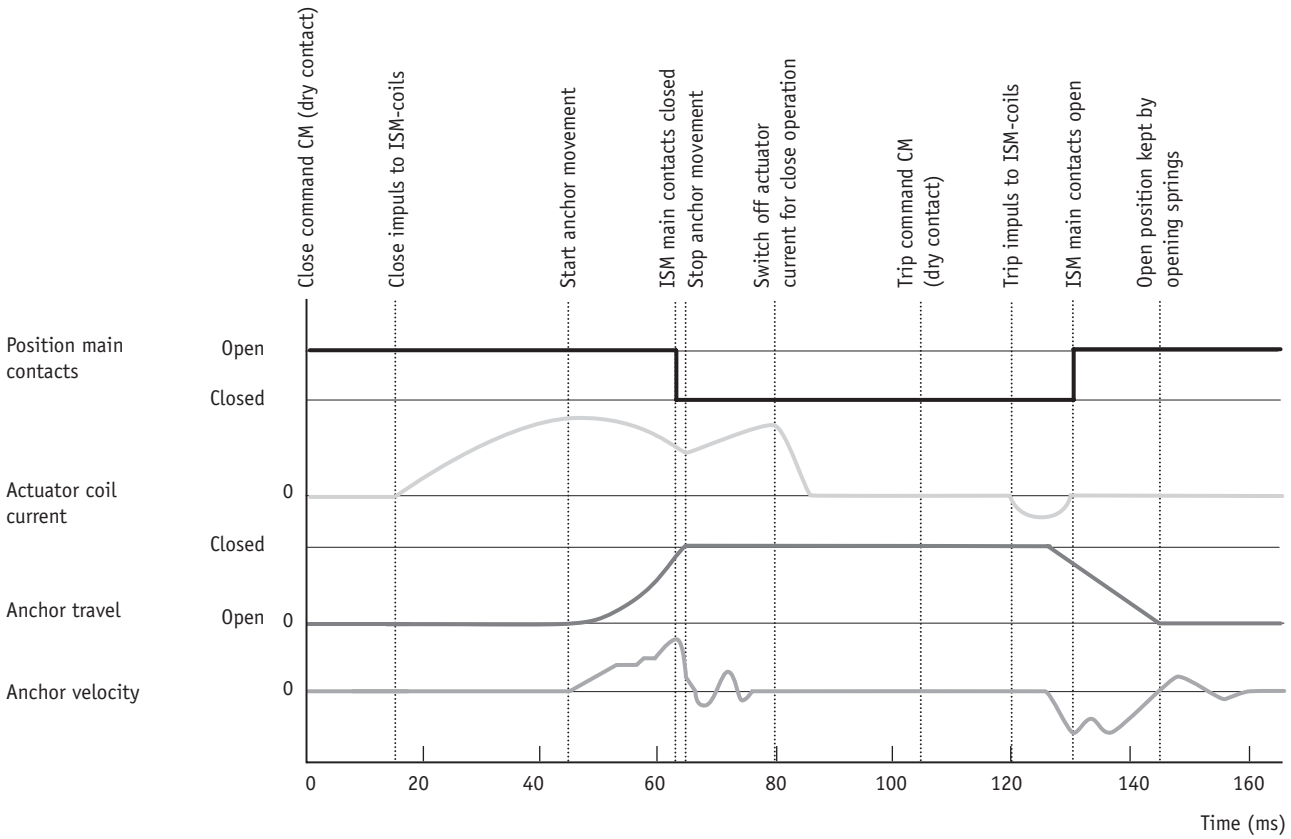


Figure 4

Typical oscillograms of ISM operation

Design and Method of Operation of the CM

The CM is encapsulated in an ABS-housing. It has four holes to fix it on flat surfaces. Terminals, LED indicators and operating elements are placed on the front of CM (Figure 5). The control and monitoring functions are performed by microprocessors. The electrical energy for the tripping and closing is stored in separate capacitors. The capacitors are charged as soon as the CM is connected to the auxiliary power supply.

Control Module (CM)

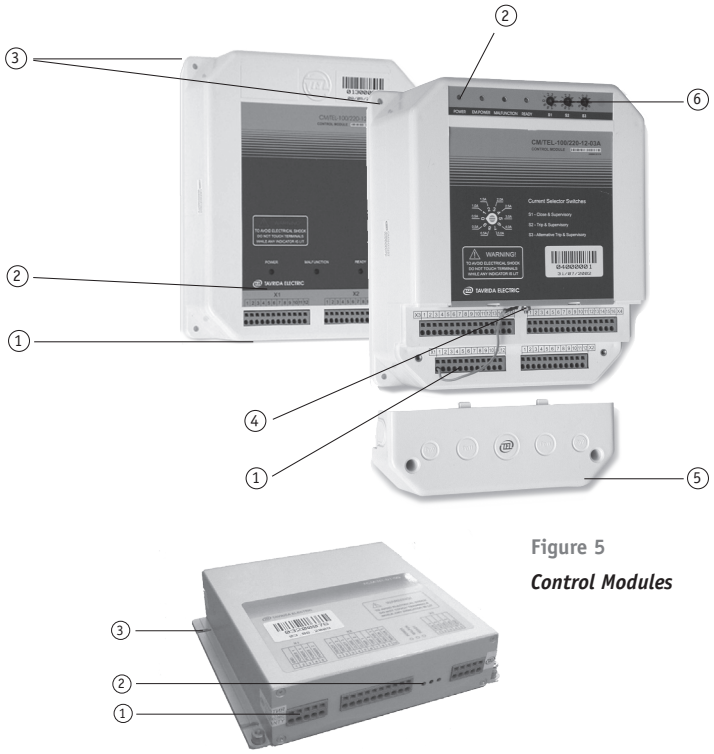


Figure 5

Control Modules

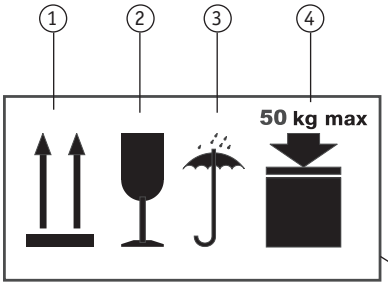
1. Terminals
2. LED indicators
3. Fastening holes
4. Earthing stud
5. Terminals cover
6. Current selector switches

Goods Entry

2

Packing

The following information are provided on the ISM packing cartons (Figure 8):
· Handling symbols for transport and storage of the delivery unit (Figure 6)
· Label 1 for manufacturers´ and product information (Figure 7)
· Label 2 for logistics data (Figure 9)



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

Figure 6
Handling symbols

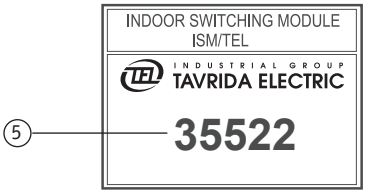


Figure 7
Label 1 for manufacturers´ and product information

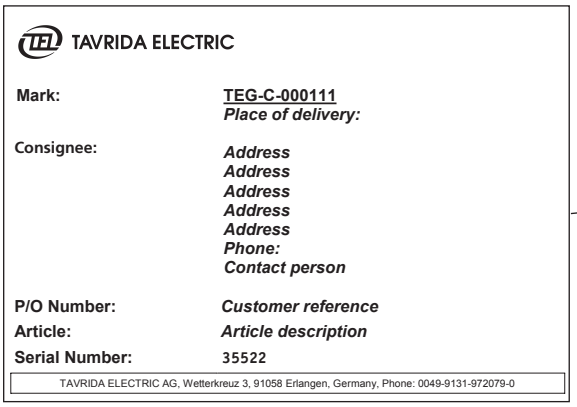


Figure 9
Label 2 Logistics data

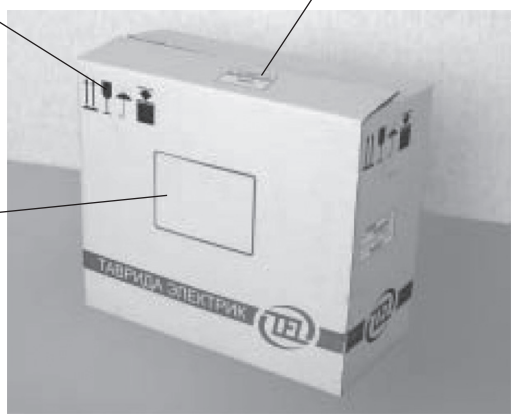
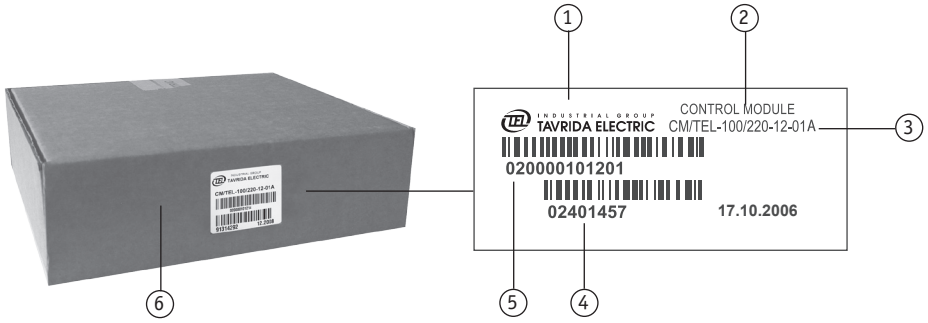


Figure 8
ISM carton package

A label with the following information is fixed on each CM carton package (Figure 10).



1. Manufacturer
2. Product name
3. Type of device
4. Serial number
5. Product code
6. Carton package for CM/TEL...-12-01A (265x220x55 mm)

Figure 10
CM carton package and label

A CM carton package must not have a weight of more than 30 kg applied to it.

Transport

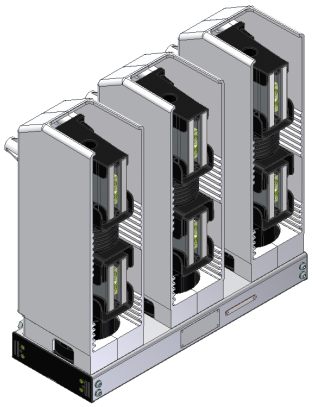
ISM and CM shall be transported in the original packing only. The packed goods shall be handled in accordance with the handling symbols. Loading procedures for ISM packing units shall be carried out only with fork lifts or cranes. If possible the ISM packing unit shall be placed on a palette. Lifting gear must not be attached to the support insulators. During transportation the ISM and CM must not be hit or dropped.

Unpacking, Goods Received Control

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

Scope of delivery for the ISM:

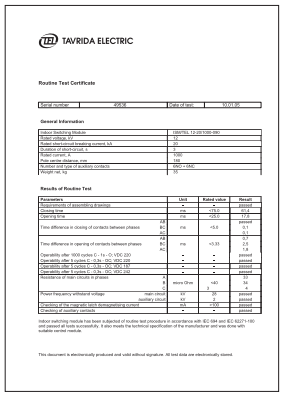
Figure 11



ISM

Screwdriver

Operating manual



Routine test certificate

1x Main contacts position indicator.
Length of flexible link is 1,0 m.
AXCA. 305449.002

Insulating caps optional

6x AXCA . 757559.014, for contact arms with 50mm diameter, lenght of the insulation cap is 176 mm

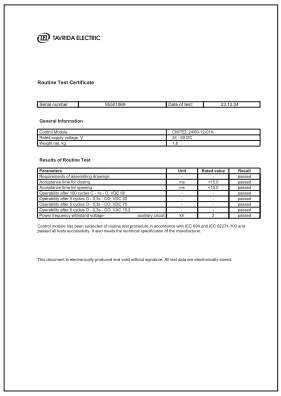
6x AXCA . 757559.015 for contact arms with 74 mm diameter

6x AXCA . 757559.016 for contact arms with 50 mm diameter, lenght of the insulation cap is 203 mm

Scope of delivery for the CM:

CM

Screwdriver



Routine test certificate

Figure 12

Further, the intactness of the devices should be checked visually for:
· Mechanical damage, scratches, discoloration, corrosion
· Damage to the seals (Figures 14, 15)

Any transport damage must be reported immediately to the carrier in writing.
Cases of damage must be photographically documented.

Rating Plate, Seal

Please check that the rating plates of the delivered devices correspond to the data of the order.
The rating plate contains the following informations (Figure 13):

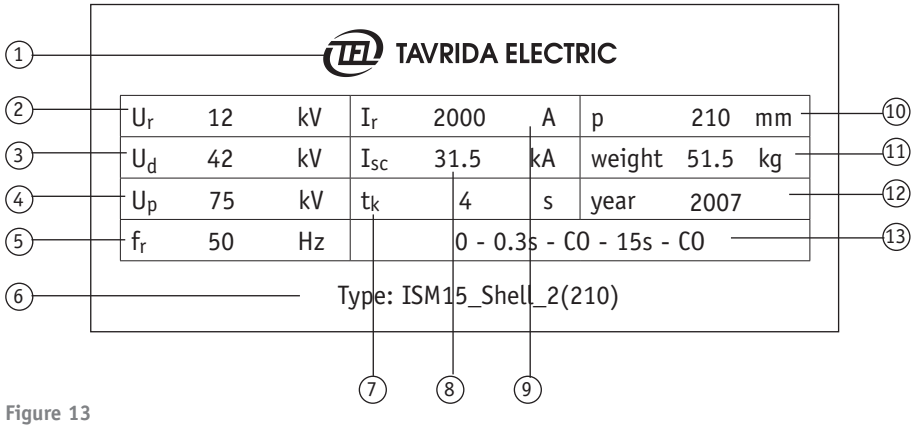


Figure 13
Rating plate

1. Manufacturer
2. Rated voltage U_r
3. Rated power frequency withstand voltage U_d
4. Rated impulse withstand voltage U_p
5. Rated frequency f_r
6. Type of device
7. Rated duration of short circuit t_k
8. Rated-short circuit breaking current I_{sc}
9. Rated current I_r
10. Pole center distance p
11. Weight
12. Year of manufacture
13. Rated operating sequence

Arrangement of the labels (Figures 16, 17):

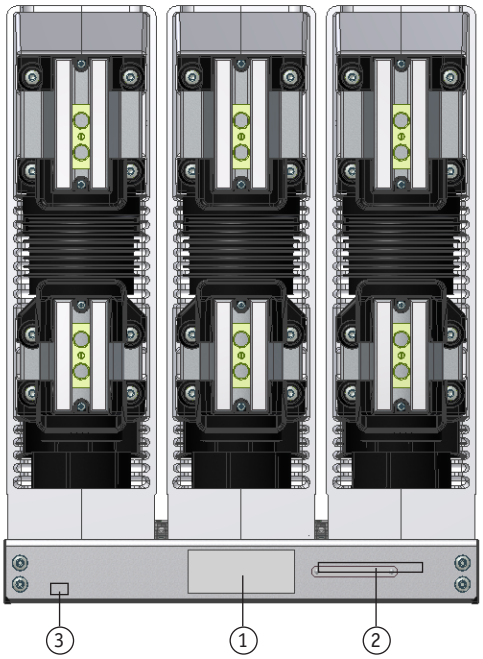


Figure 14

Labelling ISM

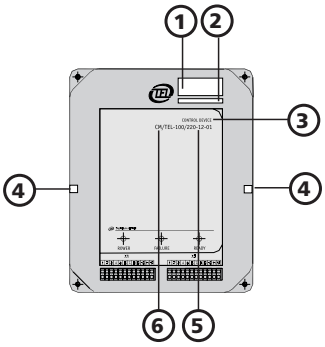


Figure 15

Labelling of the CM_12_1

ISM

1. Rating plate
2. Serial number
3. Seal

CM

1. Serial number
2. Date of manufacture
3. Type description
4. Seal
5. Product code
6. Product name

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

Storage

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

- The ISM is switched off.
- Dessicants must be placed in the packing.
- Storage must be dry, well ventilated and the room temperature should be between - 40°C and + 40°C (IEC694/ DIN VDE 0670 Part 1000).
- If several ISM are stacked a maximum of two layers is permitted.
- If several CM are stacked a maximum of 10 vertical layers is permitted.

If CM are stored longer than one year, the built-in capacitors shall be charged according to the following procedure before putting into operation:

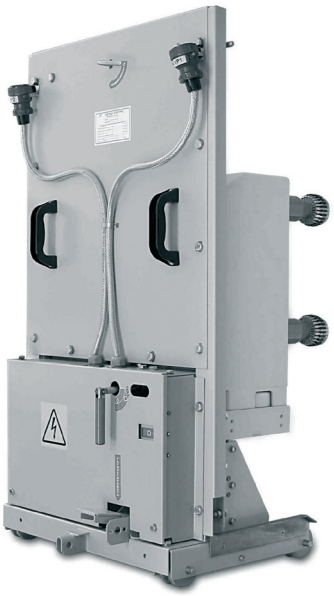
- Switch On auxiliary power supply to CM for 20 seconds.
- Switch Off auxiliary power supply to CM for one minute.
- Repeat the described switching on and off procedure two times.
- Switch On auxiliary power supply to CM for at least 8 hours.

Installation 3

General, Preparation

The following regulations must be adhered to during installation, commissioning and operation:
· IEC 60694/DIN VDE 0101, General specification for high-voltage switchgear and control gear standards.
· VDE 0105, Operation of electrical installations.
· DIN VDE 0141, Earth systems for electrical power installations with nominal voltages above 1 kV.
· All rules for accident prevention applicable in the respective countries.

Figure 16



Vertical installation position of the ISM (draw out type)

The wearing of gloves for handling the parts during installation is recommended.

Insulating material surfaces must be cleaned with clean and dry rags. The contact surfaces of connections must be cleaned before installation. If the contacts have become oxidized during transport or storage then the following sequence must be followed:

· Clean contact surfaces with a rough, dry cloth.
· With hard oxidation, clean with a hard plastic sponge, the upper layer must not be removed.

For ISM fixing and terminal connections steel bolts according to EN ISO 898 class 8.8 (800 N/mm²), nuts according to EN ISO 890 class 8 (880 N/mm²), washers to DIN 125 and conical spring washers to DIN 6796 shall be used.

ISM mounting and connection shall be made with dynamometic wrench only.

Vertical installation position of the ISM (draw out type)

Installation of the ISM

In any switchgear application, the ISM shall be installed with the actuator drive axis vertical (Figure 16). ISM may be installed in position “actuator up”, as well “actuator down” (for all types).

The ISM shall be installed at the place designated for it on a sufficiently stable frame. In order to prevent bending loads at the support insulators the poles must be fixed as shown in figure 17. The torque of all fixing points shall not exceed the values stated in figure 17.

Fixing points

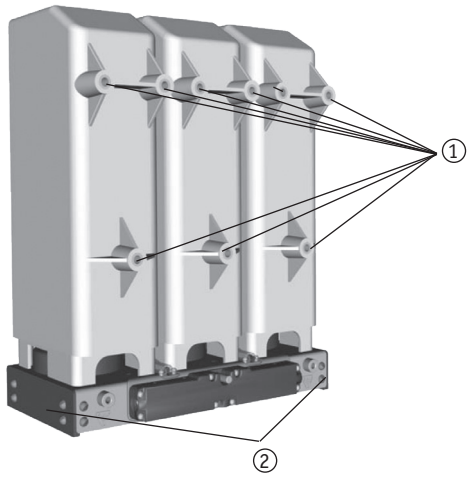


Figure 17

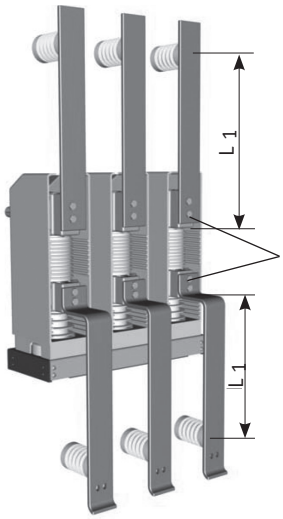
① Nine internal threads for obligatory ISM fixing, which are formed in the module support insulator (M12, maximal torque 40 ± 2 Nm)

② Eight internal threads on the side of frame for obligatory ISM fixing (M8, maximal torque is 10 ± 1 Nm)

Primary terminals connection

Bus bars and cables shall be connected with the primary terminals of ISM mechanically in a stress-free manner. No pressure, tension or torsion shall act on the ISM.

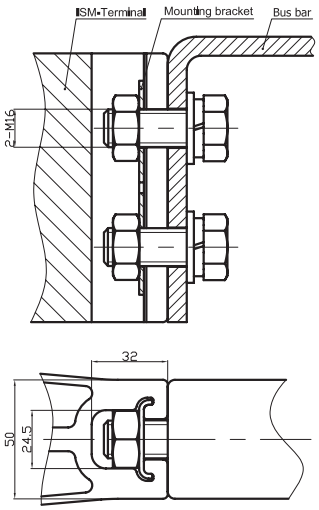
Both contact arms and rectangular bars can be connected to terminals. The level of fastening depends upon external connection. To fasten a contact arm or a bar, nuts or heads of bolts and mounting brackets shall be placed into vertical slots of the terminals, as shown on figures 18, 19, 20.



Each bus bar shall be tightened to terminals with two bolts M16, torque 60Nm.

Figure 18

ISM-terminals with busbars and support insulators.



Detail of standard connection ISM-terminal with busbar using the mounting bracket.

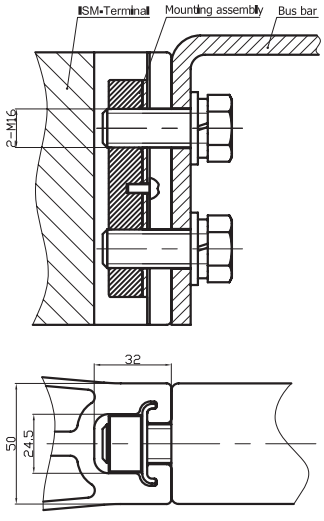


Figure 19

Detail of optional connection ISM-terminal with busbar using the mounting assembly.

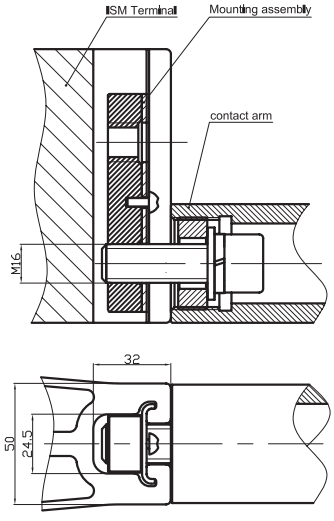


Figure 20

Detail of connection ISM-terminal with contact arm using the mounting assembly.

Additional support insulators

To avoid unacceptable high electrodynamic impact on the ISM, the bus bar connections shall rest on additional supporting insulators (Figure 18). Additional support insulators are necessary, if the length of unsupported busbars is more than specified in the table below.

Module	Short-circuit current, kA		
	20 kA	25 kA	31.5 kA
	L_1, mm		
ISM15_Shell_2(150)	700	450	300
ISM15_Shell_2(210)	980	630	420
ISM15_Shell_2(275)	1200	820	550

Note: Deviation from mounting requirements specified in the present section may lead to permanent damage of the module in short-circuit making current.

Minimum Clearances due to Rated Insulation Voltage

The minimum clearances between the blank phases and to earth shall be according to DIN EN 60071-1, VDE 0101 and VDE 0111 (Figure 21).

Ur	Up	Minimum clearance (L_2)
15 kV	95 kV	120 mm

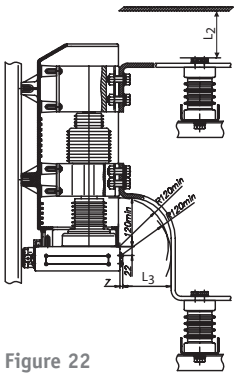


Figure 22

Additional insulating caps for ISM15_ Shell_2(150) and ISM15_Shell_2(180)

Additional insulation of terminals is obligatory for both ISM15_Shell_2(150) and ISM15_Shell_2(180). These shall used for other types of the switching module when air isolating distances between terminals and contacts arms, on the one hand, and earthed metallic frame and enclosure of switchboard, on the other, do not provide dielectric strength required for high-voltage tests.

The total arrangement of additional insulation is shown on figure 22. Terminals are covered with insulating caps. Bare parts of contact arms, i.e. parts not covered with this insulation, shall be imbedded into Raychem-type shrinkable tubes.

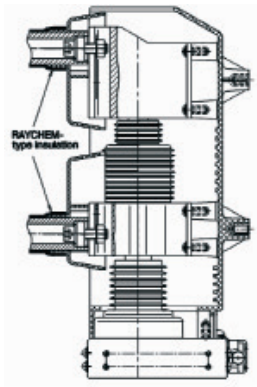


Figure 23

Insulating caps

Minimum clearances from ISM-surfaces to earth

Any switchboard, where switching module is expected to be used shall be designed so as to exceed minimal distances shown on figure 23. Values for terminals covered with insulating caps and Raychem-type tubes are bracketed.

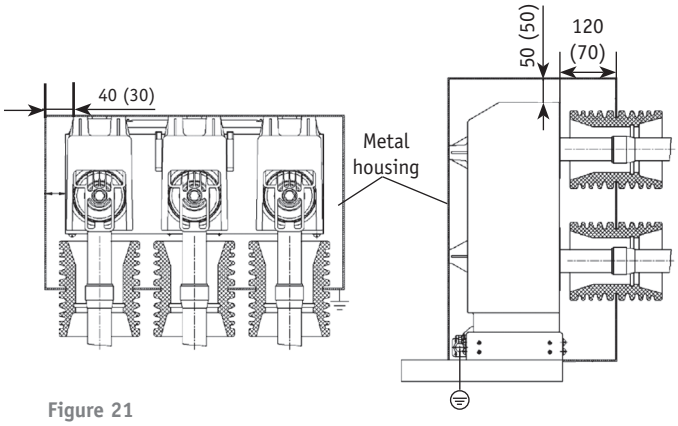


Figure 21

Minimum distances between parts of switching module and earthed metal enclosure of switchboard

Minimum Clearances due to Electromagnetic Influences

The following clearances must be adhered to (Figure 21):

ISM-Type	Short-circuit current, kA		
	20	25	31.5
	L_3, mm		
ISM15_Shell_2	120	150	190

Coordination of Minimum Clearances

In case the minimum clearance L_3 due to 25/31 kA short circuit current exceeds the minimum clearance L_2 due to the rated insulation level, the higher clearance between ISM-frame and adjacent busbars is to be selected.

Heating

The ISM are designed in such a manner that at the rated current specified on the rating plate of the ISM and at 40°C ambient temperature, with free surroundings, no impermissible high temperatures will arise at the hottest spots of the ISM. In order to decide whether for an ISM in the respective panel more intensive heat dissipation or a reduction of the rated current values are required, a temperature rise test according to the relevant standards is recommended.

Protective Earthing

For personnel protection the metal housing of the ISM must be connected according to the applicable regulations, such as DIN VDE 0141, DIN VDE 0151, IEC 6021-2 via the marked two earth screws of the ISM to the earth arrangement of the particular panel. One or both earthing bolts can be used. If two earth connections are used, at each earthing bolt the half total cross section shall be connected. The earth connections can be carried out with cables or flat copper bars. The cross section must be dimensioned such that a worst-case fault current (short circuit) does not cause a weakening of the earth connections (Figure 24).

Reference values for total cross sections of earth connections (copper):

Duration of fault current (1 s)	Max. temperature of earth connection	Cross section earth connection
<10 kA/10 kA	300 °C	35-70 mm²
16 kA	300 °C	70-95 mm²
20 kA	300 °C	70-120 mm²
25 kA	300 °C	95-140 mm²
31.5 kA	300 °C	120-190 mm²

The area around the earth screws shall be cleaned before providing the earth connections. After the occurrence of a short circuit, the proper condition of the protective earthing must be checked.

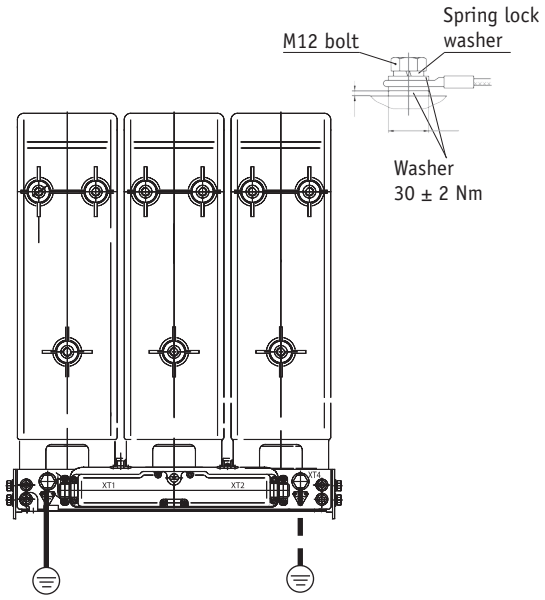


Figure 24

Interlocking

Interlocking mechanism

Interlocking mechanism of the module is based on operation of an interlocking shaft that can be rotated clockwise or counter-clockwise. When the interlocking shaft is rotated clockwise the module becomes acceptable for “close” and “open” operations. Hereinafter this position of the module is called “unlatched”. When the shaft is rotated in reverse direction, i.e. counter-clockwise, the module becomes “open and locked”.

If the module is closed, rotation of the interlocking shaft from “unlatched” to “open and locked” position leads to the manual tripping of the module and afterwards to the mechanical blocking of the actuator.

Working principle of the mechanical interlocking mechanism (Figures 25, 26, 27, 28, 29).

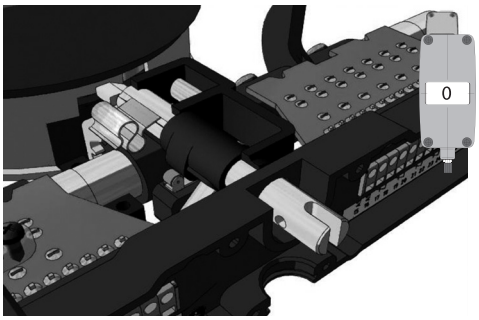


Figure 25

Interlocking shaft in unlatched position. ISM is open.

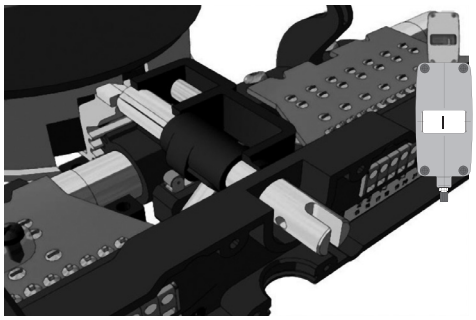


Figure 26

Interlocking shaft in unlatched position. ISM is closed.

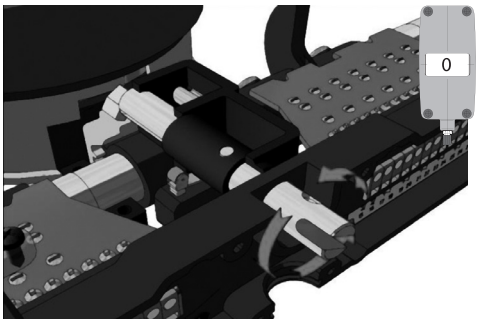


Figure 27

Initial state: ISM is closed. Turn interlocking shaft counter-clockwise to locked position (manual tripping).

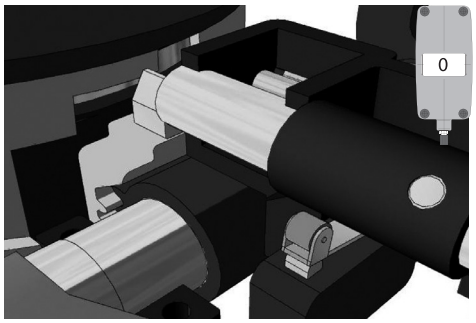


Figure 28

Interlocking shaft in locked position. ISM is open.

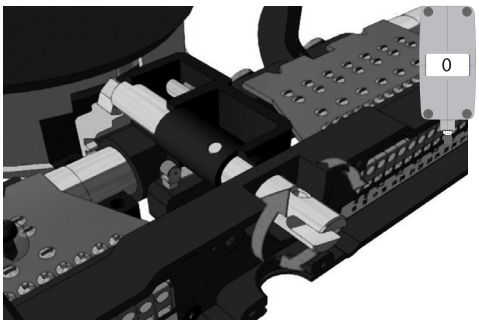


Figure 29

Initial state: ISM is open and locked.
Turn interlocking shaft clockwise to unlatched position.

Mechanical Interlocking

Mechanical interlocking depends on interlocking shaft rotation (refer to figures 25 to 29). The mechanical interface for the connection of mechanical interlocking is placed at the ISM frame between the terminal blocks XT1, XT2 (refer to figure 32). There is a slot on the visible face of the interlocking shaft. If the slot is directed vertically the module is in “unlatched” position. If the slot is directed horizontally the module is in “open and locked” position.

A handle connected directly to interlocking shaft via mating part is recommended. This handle shall be freely rotated up to 90 degrees in both directions. The handle operated by fingers shall be dimensioned so as to provide rotating force in accordance with local standards.

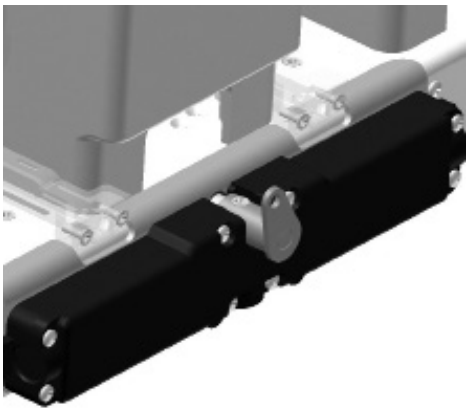


Figure 32

Interlocking shaft with mounted interlocking lever.

Possible tasks of the mechanical interlocking:

· Prevents operation of the disconnectors when switching module is closed (stationary type of switchboard)

· Prevents operation of the truck isolating mechanism when switching module is closed (draw out type)

Design of mechanical interlocking (by example of a draw out unit, figures 30, 31).

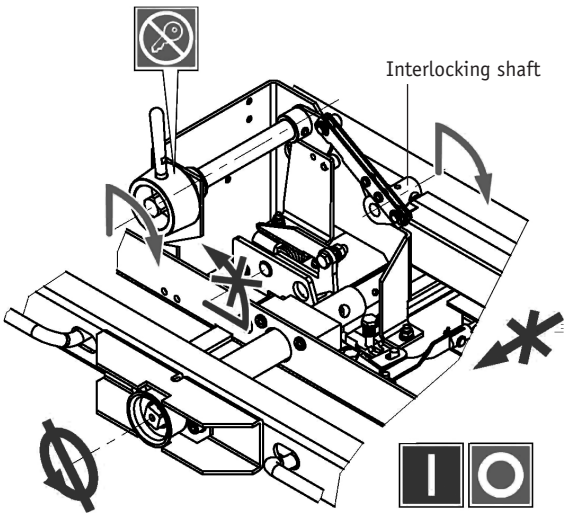


Figure 30

Interlocking shaft is unlatched.
ISM can be opened and closed.

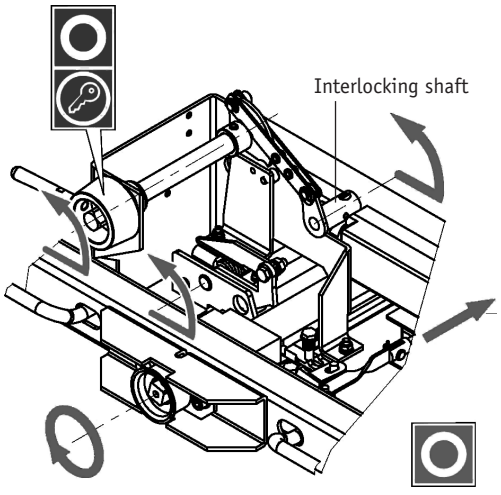


Figure 31

Interlocking shaft is in locked position at opened ISM.

Load capacity of interlocking shaft

Interdependence between torque on the interlocking shaft and turning angle of the shaft when switching module has been previously switched off is presented on figure 33. Peak values of the torque are from 0.56 to 0.84 Nm. When shaft is rotated counter-clockwise the interlocking unit is moved from “Unlatched” position to “Open and locked” one, and otherwise. Operation zone of microswitch S14 when it becomes closed or open in “Unlatched” or “Open and Locked” positions respectively is hatched.

If switching module is closed before rotation of the interlocking shaft and manual trip operation is fulfilled the peak value of the torque can be up to 2Nm.

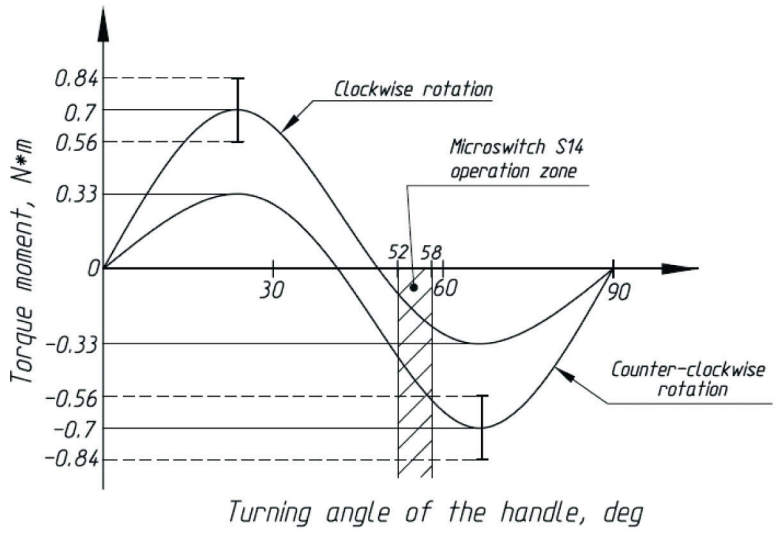


Figure 33

Torque on the interlocking shaft

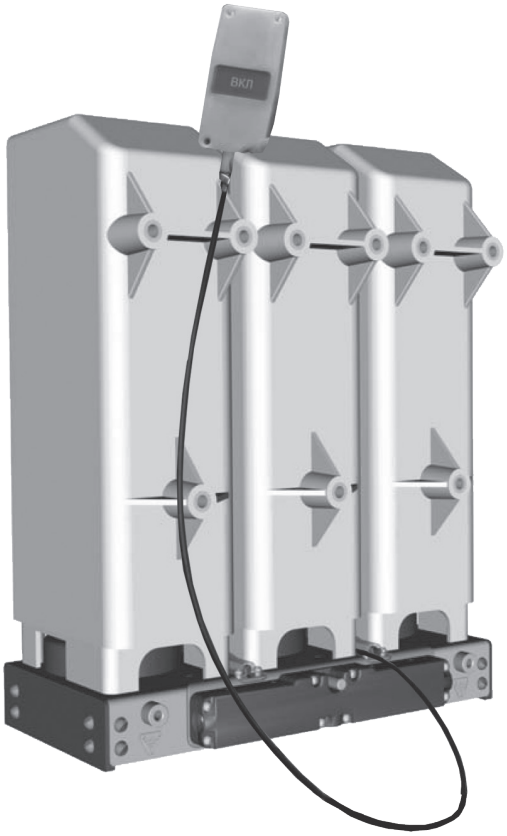
Electrical Interlocking

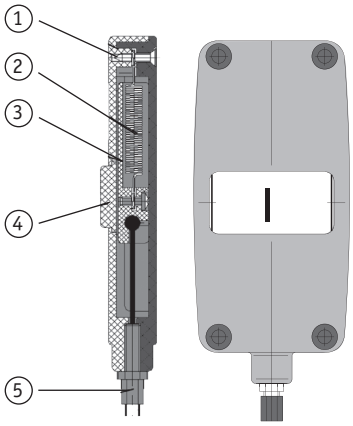
Electrical interlocking is also coupled with the interlocking shaft rotation (refer to chapter “Switching and control functions/Internal electrical interlock”, page 36). If the mechanical interlocking is effective, then the electrical interlocking contact is activated synchronously. Electrical interlocking occurs during first 10 degree of interlocking shaft rotation whereby actuator coils are disconnected from the control module.

Main Contacts Position Indicator

The position indicator works as follows. There are two runners on the synchronizing shaft, any can be chosen to activate movable part of indicator, attached to wire. The movable part has a sticker with two printed symbols, one for Open position of the switching module, the other for Closed one. Connection of control wire to runner is described in “How position indicator can be attached and mounted” in detail.

When switching module comes to Open position the runner pulls the wire and corresponding symbol in inspection window becomes visible (see figure 41). When switching module comes to Close position the spring in the indicator provides reverse movement of the wire and symbol is changed to that one shown on figure 42.





1. Frame
2. Spring
3. Indicator plate
4. Window
5. Adjusting mechanism

Figure 34

Position indicator with flexible link

Indication of ISM-position by indicator plate depending on position of synchronizing shaft trunnion
(Figures 35, 36)

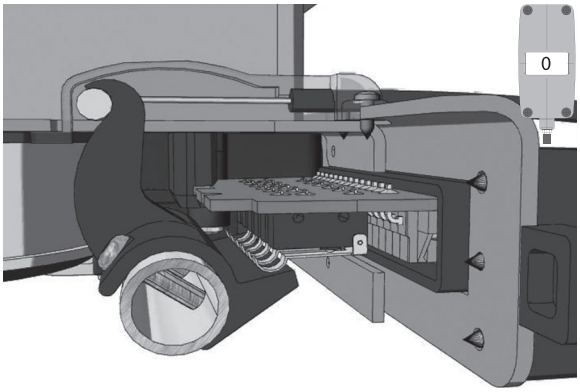


Figure 35

Position of trunnion at opened ISM

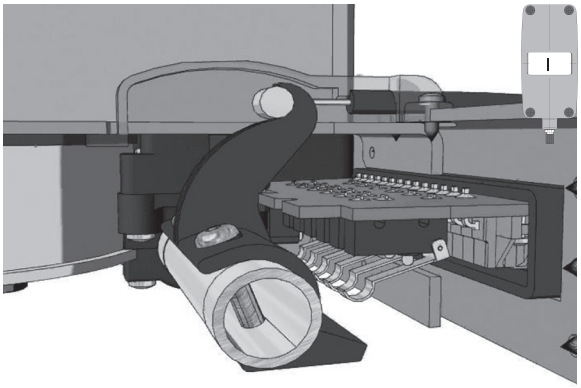


Figure 36

Position of trunnion at closed ISM

Position indicator mounting

Position indicator mounting is shown below step by step. (Figures 37, 38, 39, 40, 41, 42). ISM main contacts shall be in closed position.

Note: Bending radius of the position indicator flexiblel link shall be not less than 40 mm to prevent decreasing performance or even malfunction.

Figure 37

Unscrew the self-tapping screws of transparent cover. Remove the cover.

There are two possibilities (left, right) to connect the flexible link of the position indicator.

Figure 38

Drop the boss of the wire horizontally into slot. Insert end of the sheath into V-shape spring contact. So the wire will be packed in groove between the slot and the spring.

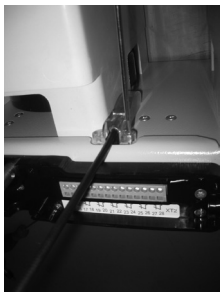


Figure 39

Return the cover to its place and fix it.

Figure 40

Fasten the indicator to front of switchboard and adjust it as shown here for both closed and opened states of the switching module.

Figure 41

Position indicator shows that main contacts are open

Figure 42

Position indicator shows that main contacts are closed

Secondary Connections of the ISM

All ISM have the same terminals (Figure 43). Connected to the terminal blocks XT1 and XT2 are 13 auxiliary switches (6 “NO”- and 7 “NC”-contacts) and the magnetic actuator coils. Cables for terminal blocks XT1 and XT2 can be installed at right, left or bottom side as shown in figure 43.

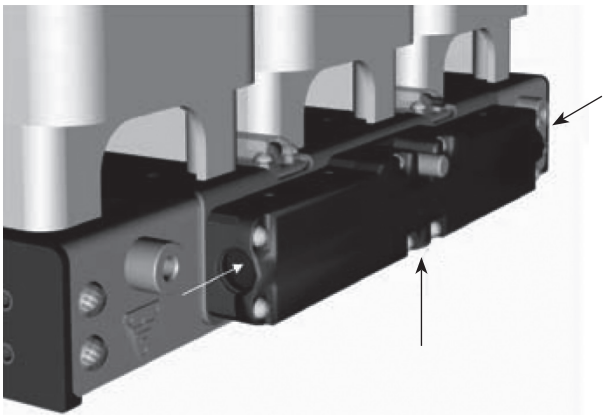
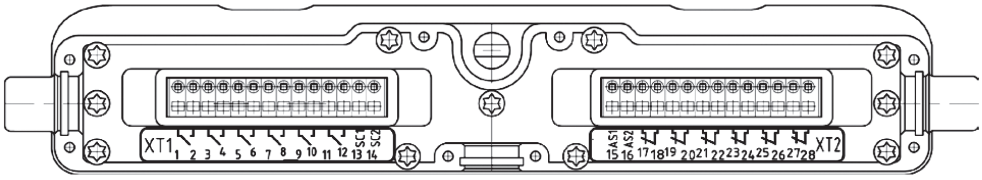


Figure 43
ISM cable entry points



Terminal arrangement ISM

XT1		XT2	
Terminal No.	**Connection**	**Terminal No.**	**Connection**
1	Auxiliary switch S 1 (1)	15	Auxiliary switch S13 (AS1)
2	Auxiliary switch S 1 (4)	16	Auxiliary switch S 13 (AS2)
3	Auxiliary switch S 2 (1)	17	Auxiliary switch S 7 (1)
4	Auxiliary switch S 2 (4)	18	Auxiliary switch S 7(2)
5	Auxiliary switch S 3 (1)	19	Auxiliary switch S 8 (1)
6	Auxiliary switch S 3 (4)	20	Auxiliary switch S 8 (2)
7	Auxiliary switch S 4 (1)	21	Auxiliary switch S 9 (1)
8	Auxiliary switch S 4 (4)	22	Auxiliary switch S 9 (2)
9	Auxiliary switch S 5 (1)	23	Auxiliary switch S 10 (1)
10	Auxiliary switch S 5 (4)	24	Auxiliary switch S 10 (2)
11	Auxiliary switch S 6 (1)	25	Auxiliary switch S 11 (1)
12	Auxiliary switch S 6 (4)	26	Auxiliary switch S 11 (2)
13	Actuator coil (SC1)	27	Auxiliary switch S 12 (1)
14	Actuator coil (SC2)	28	Auxiliary switch S 12 (2)

CM connections

The connections for basic and extended functions of all available CM can be seen from the following terminal arrangements (Figure 46, Figure 47, Figure 48, Figure 49, Figure 50).

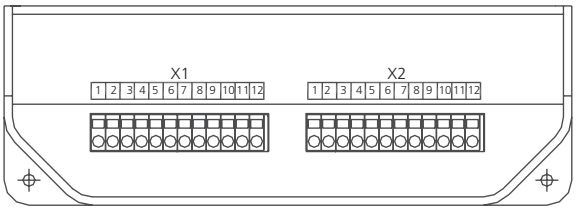


Figure 44

CM_12_1 Terminal arrangement

X1		X2	
Terminal No.	**Connection**	**Terminal No.**	**Connection**
1	Earth	1	Ready (com)
2	Free	2	Ready (NO)
3	Auxiliary power supply ~ (+)	3	Ready (NC)
4	Auxiliary power supply ~ (–)	4	Malfunction (com)
5	Free	5	Malfunction (NC)
6	Free	6	Malfunction (NO)
7	Free	7	Auxiliary switch ISM (AS1)
8	Free	8	Auxiliary switch ISM (AS2)
9	Dry contact “Close”	9	Output actuator coil (SC1)
10	Dry contact “Common”	10	Output actuator coil (SC2)
11	Dry contact “Common”	11	Free
12	Dry contact “Trip”	12	Earth

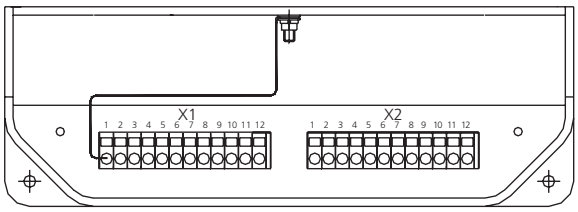


Figure 45

CM_14_1 Terminal arrangement

X1		X2	
Terminal No.	**Connection**	**Terminal No.**	**Connection**
1	Earth, internally used	1	Ready (com)
2	Free	2	Ready (NO)
3	Auxiliary power supply ~ (+)	3	Ready (NC)
4	Auxiliary power supply ~ (–)	4	Malfunction (com)
5	Free	5	Malfunction (NC)
6	Free	6	Malfunction (NO)
7	Free	7	Auxiliary switch ISM (AS1)
8	Free	8	Auxiliary switch ISM (AS2)
9	Dry contact “Close”	9	Output actuator coil (SC1)
10	Dry contact “Common”	10	Output actuator coil (SC2)
11	Dry contact “Common”	11	Free
12	Dry contact “Trip”	12	Earth

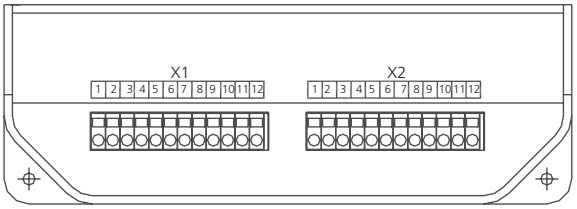


Figure 46

CM_12_2 Terminal arrangement

X1		X2	
Terminal No.	**Connection**	**Terminal No.**	**Connection**
1	Earth, internally used	1	Ready (com)
2	Free	2	Ready (NO)
3	Auxiliary power supply ~ (+)	3	Ready (NC)
4	Auxiliary power supply ~ (–)	4	Malfunction (com)
5	Free	5	Malfunction (NC)
6	Free	6	Malfunction (NO)
7	Free	7	Auxiliary switch ISM (AS1)
8	Free	8	Auxiliary switch ISM (AS2)
9	Dry contact “Close”	9	Output actuator coil (SC1)
10	Dry contact “Common”	10	Output actuator coil (SC2)
11	Dry contact “Common”	11	Free
12	Dry contact “Trip”	12	Earth

X3		X4	
Terminal No.	**Connection**	**Terminal No.**	**Connection**
1	Close command and supervision ~ (+)	1	Ready (com)
2	Close command and supervision ~ (–)	2	Ready (NO)
3	Simulation close coil	3	Free
4	Simulation close coil	4	Free
5	Free	5	Free
6	Trip command and supervision ~ (+)	6	Free
7	Trip command and supervision ~ (–)	7	Free
8	Simulation trip coil 1	8	Free
9	Simulation trip coil 1	9	Free
10	Trip coil 1 supervision	10	Free
11	Free	11	Free
12	Wipe contact trip operation (NO)	12	Free
13	Wipe contact trip operation (NO)	13	Free
14	Free	14	Free
15	Free	15	Free
16	Free	16	Free

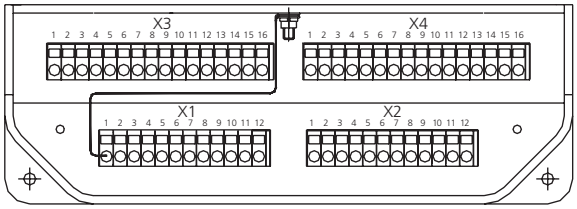


Figure 47

CM_12_3 Terminal arrangement

X1		X2	
Terminal No.	**Connection**	**Terminal No.**	**Connection**
1	Earth, internally used	1	Ready (com)
2	Free	2	Ready (NO)
3	Auxiliary power supply ~ (+)	3	Ready (NC)
4	Auxiliary power supply ~ (–)	4	Malfunction (com)
5	Free	5	Malfunction (NC)
6	Emergency power supply ~ (+)	6	Malfunction (NO)
7	Emergency power supply ~ (–)	7	Auxiliary switch ISM (AS1)
8	Free	8	Auxiliary switch ISM (AS2)
9	Dry contact “Close”	9	Output actuator coil (SC1)
10	Dry contact “Common”	10	Output actuator coil (SC2)
11	Dry contact “Common”	11	Free
12	Dry contact “Trip”	12	Earth

X3		X4	
Terminal No.	**Connection**	**Terminal No.**	**Connection**
1	Close command and supervision ~ (+)	1	Emergency signalling NO-contact
2	Close command and supervision ~ (–)	2	Emergency signalling contact (com)
3	Simulation close coil	3	Emergency signalling NC-contact
4	Simulation close coil	4	Free
5	Free	5	CT-Power supply mode
6	Trip command and supervision ~ (+)	6	CT-Power supply mode
7	Trip command and supervision ~ (–)	7	Free
8	Simulation trip coil 1	8	Trip command and supervision for trip coil 2 from alternative auxiliary power supply
9	Simulation trip coil 1	9	Trip command and supervision for trip coil 2 from alternative auxiliary power supply
10	Trip coil 1 supervision	10	Simulation trip coil 2
11	Free	11	Simulation trip coil 2
12	Emergency signalling NO-contact	12	Free
13	Emergency signalling NO-contact	13	Current transformer input 1
14	Free	14	Current transformer input 1
15	Reset input for emergency-signalling contacts	15	Current transformer input 2
16	Reset input for emergency-signalling contacts	16	Current transformer input 2

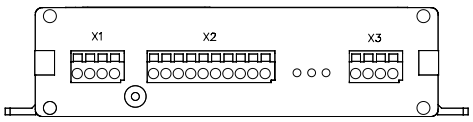


Figure 50

CM_1501_01 Terminal arrangement

X1		X2		X3	
Terminal No.	**Connection**	**Terminal No.**	**Connection**	**Terminal No.**	**Connection**
1	Auxiliary power supply input 1	1	Ready (NO)	1	Auxiliary switch ISM (AS1)
2	Auxiliary power supply input 1	2	Ready (com)	2	Auxiliary switch ISM (AS2)
3	Auxiliary power supply input 2	3	Ready (NC)	3	Output actuator coil (SC1)
4	Auxiliary power supply input 2	4	Dry contact “Close”	4	Output actuator coil (SC2)
		5	Dry contact “Close”		
		6	Dry contact “Trip”		
		7	Dry contact “Trip”		
		8	Ready (NO)		
		9	Ready (com)		
		10	Ready (NC)		

Warning

Power supply voltage can be applied between terminals X1:1,2 and X1:3,4 of CM_1501_01 only. Terminals X1:1, X1:2 short-circuited inside of CM_1501_01, and terminals X1:3, X1:4 also short-circuited inside of module.

Installation of the CM

The installation of the CM is carried out according to the panel design either on the draw out unit or in the low voltage compartment of the switchboard. It must be separated from the high voltage compartment. The CM shall be installed in an earthed mild steel box with a thickness of not less than 1 mm. If interference suppressing filters F/TEL03 and F/TEL04 are applied, then they shall be installed also in the CM-steel box (Figures 45, 46).

The CM can operate in any mounting position. Care must be taken for good access and visibility of the terminals, LEDs and setting elements for operation and maintenance. Basically the ambient conditions as described in chapter “Regulations and ambient conditions”(page 66) shall apply.

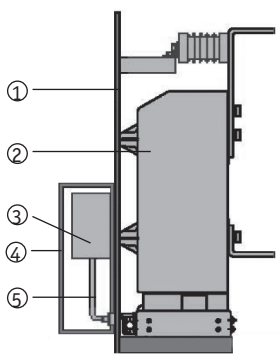


Figure 48

Stationary type installation

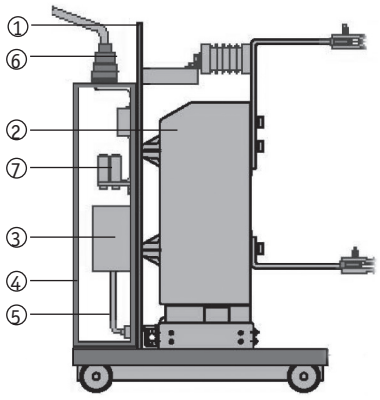


Figure 49

Draw out type installation

① Steel plate > 1 mm thick

② ISM

③ CM

④ Closed steel box > 1 mm thick

⑤ Shielded cable

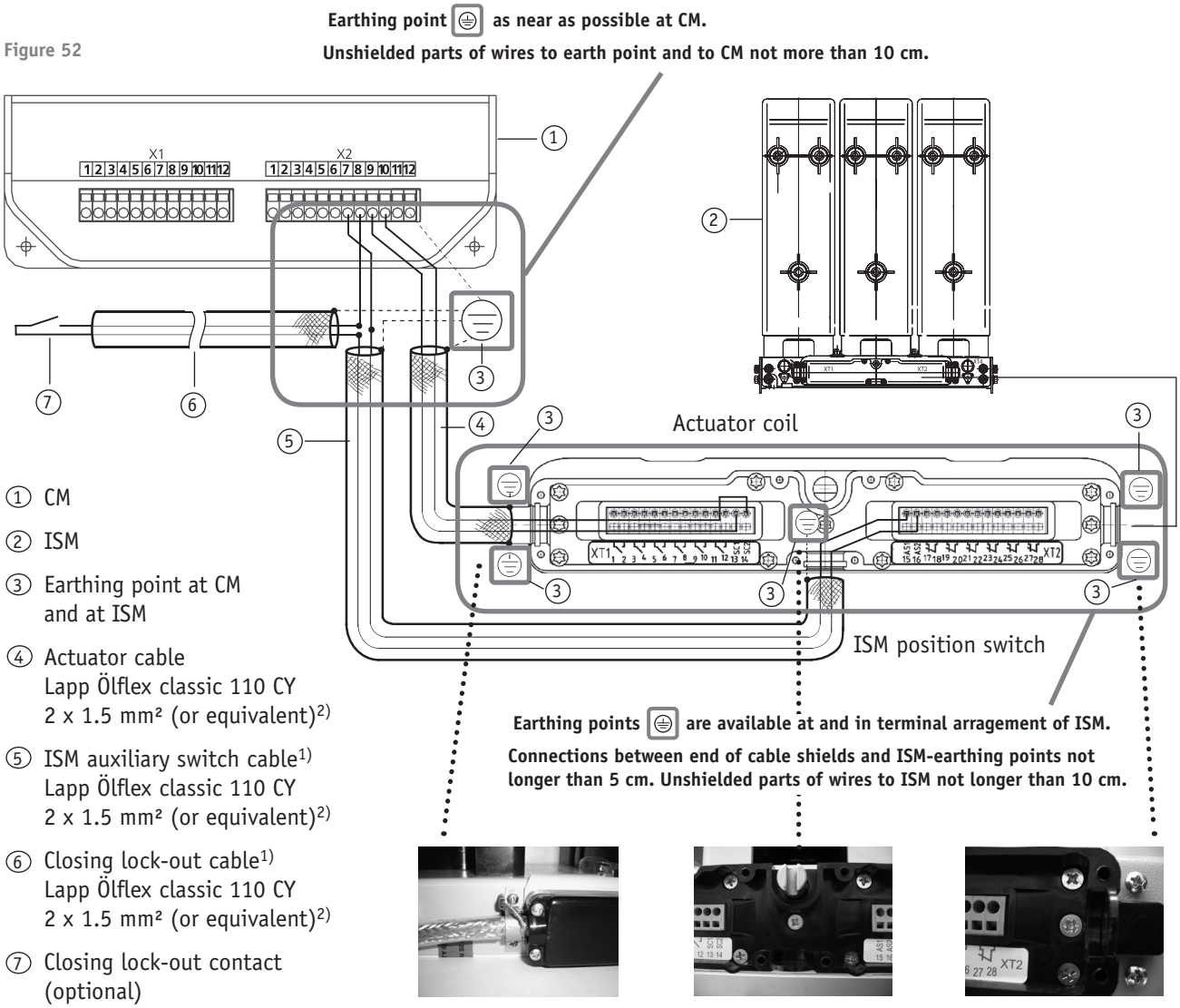
⑥ Secondary circuit plug

⑦ Secondary components

Installation of Secondary Cables between ISM and CM

The installation of secondary cables between ISM and CM shall be performed regarding the subsequent connecting diagram and indications (figure 47). These instructions are required to achieve best possible protection against

Figure 52



① CM

② ISM

③ Earthing point at CM and at ISM

④ Actuator cable
Lapp Ölflex classic 110 CY
2 x 1.5 mm² (or equivalent)[2)]

⑤ ISM auxiliary switch cable[1)]
Lapp Ölflex classic 110 CY
2 x 1.5 mm² (or equivalent)[2)]

⑥ Closing lock-out cable[1)]
Lapp Ölflex classic 110 CY
2 x 1.5 mm² (or equivalent)[2)]

⑦ Closing lock-out contact (optional)

1) For ISM auxiliary switch cable and closing lock-out cable the cross section can be chosen smaller up to 0.5 mm².

2) The degree of coverage of the cable shield shall be not less than 85%.

As a additional measure it is recommended to install the shielded cables between ISM and CM in an earthed metal hose or an enclosed metal duct.

The cables are fixed with a special screwdriver supplied with every ISM and CM (Figure 48). Solid or multi-wire cables with or without sleeves with a cross section of 0.5 to 2.5 mm² can be connected to the terminals. The bare ends of the cables shall be 8 to 9 mm.

1- Insert screwdriver into the rectangular hole and press the contact spring.
2- Insert wire into the corresponding round hole.
3- Remove the screwdriver and pull the wire slightly to check the reliability connection

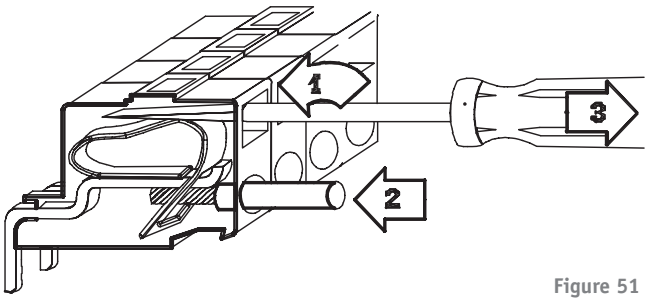


Figure 51

CM Auxiliary Power Supply

To ensure the functionality of the CM, it is recommended to connect the CM to the same auxiliary power supply as the protection relays and control devices. The CM/TEL ...-12-03A can optionally be operated by a 12-30 V DC emergency power supply or by current transformer power supply.

Auxiliary power supply and selection of MCB for CM/TEL...-12-01A, -02A, -03A, CM/TEL...-14-01 and CM_1501_01

(Figure 55)

Technical data of the MCB:

24 V DC :	4A, 1-pole, characteristic B or C
60 V DC :	2A, 2-pole, characteristic B or C
100/220 V AC :	1A, 2-pole, characteristic B or C
100/220 V DC :	1A, 2-pole, characteristic B or C

If the CM is connected with DC voltage please pay attention to the correct polarity.

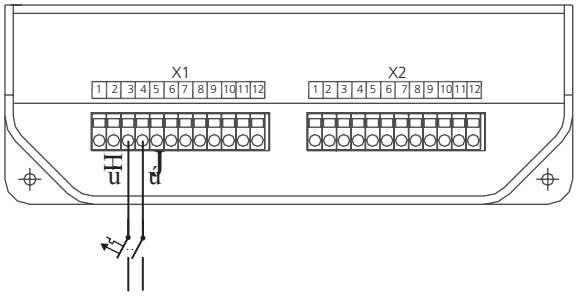


Figure 53

Auxiliary power supply for CM/TEL...-12-01A

Emergency power supply and protection of the CM/TEL...-12--03A

(Figure 56)

Technical data of the MCB:
30 V DC: 4A, 1-pole characteristic B or C

The CM/TEL...-12-03A can be operated simultaneously with the operating and the emergency voltage.
The functions of the CM are limited if it is operated with emergency power supply only.

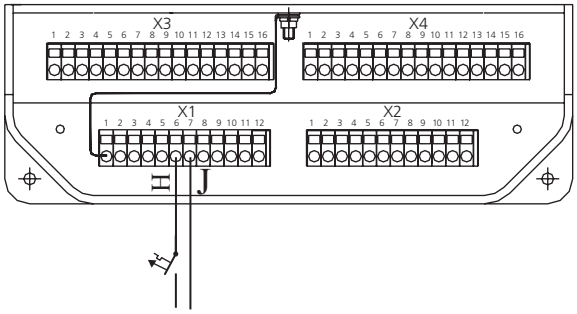


Figure 54

Emergency power supply

Current transformer power supply for CM/TEL...-12-03A

(Figure 57)

Current transformer power supply is recommended when the protection relays are also supplied with current transformer power supply. The CM functions are limited when operating with current transformer power supply.

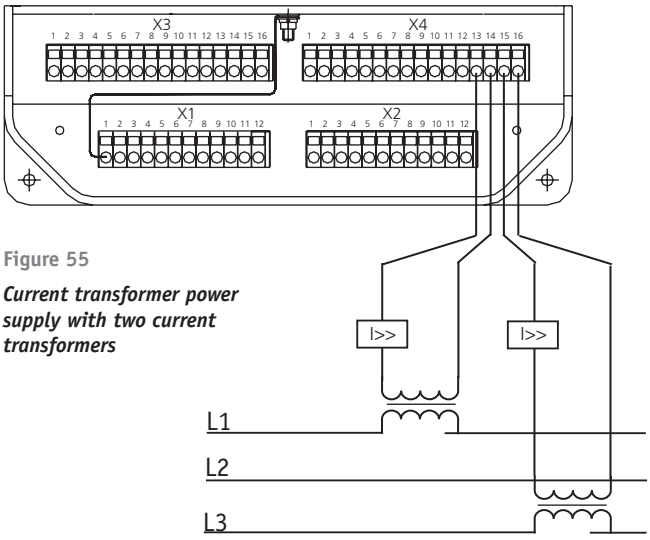


Figure 55

Current transformer power supply with two current transformers

Interference Suppressing Filters (optional)

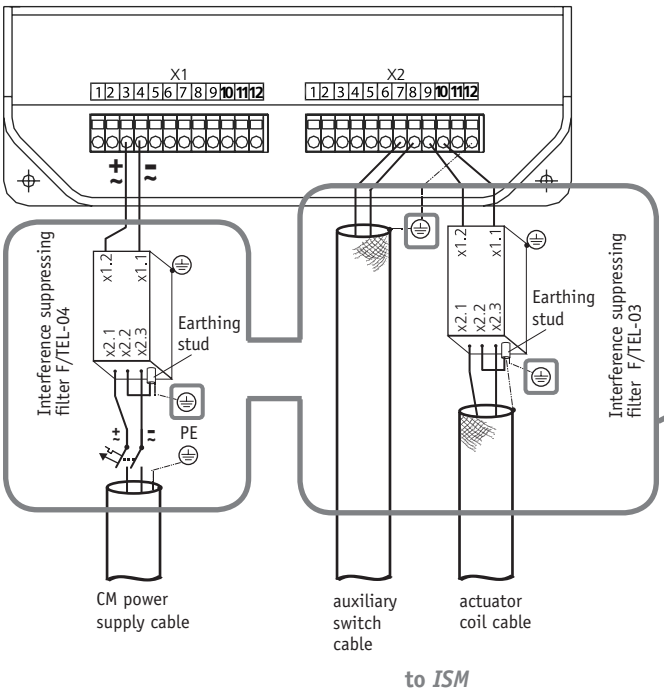
Interference suppressing filters F/TEL-03 and F/TEL-04 shall be installed when CM works under severe electromagnetic conditions and the surge level is higher than the one specified in chapter „Technical data“ page 61.

Recommendation for application of F/TEL-03 and F/TEL-04 in following cases:

Type of load	Rated voltage		
	6 kV	12 kV	up to 24 kV
Motor starting from 500 k VA	-	-	-
Generator starting from 500 k VA	-	-	F/TEL-03, F/TEL-04
Transformers loaded with motors starting from 500 k VA	F/TEL-03, F/TEL-04	F/TEL-03, F/TEL-04	F/TEL-03, F/TEL-04
Electric arc furnace up to 2000 k VA	-	-	F/TEL-03, F/TEL-04
Electric arc furnace starting from 2000 k VA	-	F/TEL-03, F/TEL-04	F/TEL-03, F/TEL-04
Inverter-fed drives starting from 500 k VA	F/TEL-03, F/TEL-04	F/TEL-03, F/TEL-04	F/TEL-03, F/TEL-04

The filter shall be bolted as near to the CM as possible on flat, earthed and good-conducting metal surfaces. Care must be taken that there is an electrical conducting connection between the filter housing and the metal plate. Any existing paint must be removed.

Interference suppressing filters F/TEL-03 and F/TEL-04 for CM/TEL...-12-01A



Earthing points ⏚ as near as possible at CM respectively at filters.

Unshielded parts of wires to earthing point, to filters and to CM not longer than 10 cm.

Figure 56

Switching and Control Functions

Charging of the Capacitors

Closing and trip capacitors of the CM are charged when CM is applied to the auxiliary power supply. The charged closing capacitors correspond with the charged springs of a conventional circuit breaker. After the failure of auxiliary power supply any pending trip or any trip command arriving the CM up to 30s after failure of auxiliary power supply will be executed.

Ready-LED and Ready-Relay Output

While charging the capacitors, the Ready-LED blinks. When the capacitors are charged the Ready-LED is lit continuously and Ready-relay contact X2:1,2 is closed. With blinking or extinguished Ready-LED, the Ready-relay contact X2:1,2 is open. The Ready-relay output, for instance, can be used as release condition for switch control.

Malfunction-LED and Malfunction-Relay Output

If the CM detects an internal or external malfunction, the Malfunction-LED will blink according to the type of malfunction (see chapter: “Signalling”). At the same time the Malfunction-relay contact X2:4,5 will close. In this way a collective CM-Malfunction can be transmitted to an alarm or SCADA system. In case of malfunction the Ready- LED is extinguished and the Ready-relay contact X2:1,2 is opened. The Malfunction-relay contact X2:4,5 is closed, if CM is powered off.

Switching the ISM on and off via the Dry Contact Inputs of the CM

The ISM can only be switched on electrically via the CM. Dry contact inputs are available at all CMs for close and trip operations. Each of these inputs can be connected with one or more parallel-switched dry contacts. Under no circumstances shall external voltage be applied to these inputs as this will destroy the CM.

Internal Electrical Interlock

The opened electrical interlock contact causes in each case a 3-blink malfunction (Refer to chapter “Signalling/Malfunction indication table” page 43).

Electrical Closing Lock-Out (optional)

Close conditions for the ISM, for instance
· Earthing switch OFF
· Disconnector of the panel is in the “on-position”
· Draw out type circuit breaker is in the “service-position”
· Release key switch is in the “operation-position”
· etc.
can be carried out according to the three following variants:

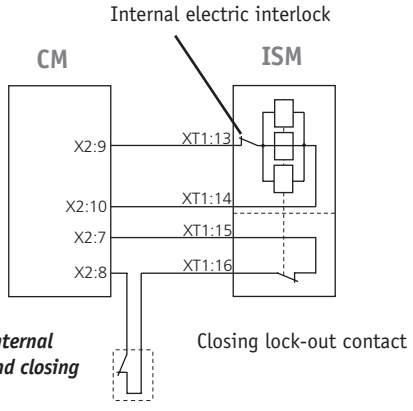


Figure 57

Circuit diagram for internal electrical interlock and closing lock-out.

Variant 1 - In the CM close command circuit (e.g. use of the dry contact input X1:9, X1:10)
Variant 2 - In the ISM auxiliary switch circuit (between CM/X2:8 and ISM/XT1:16), Figure 51
Variant 3 - In the close command circuit (e.g. use of the dry contact input X1:9, X1:10) and in the ISM position switch circuit (between CM/X2:8 and ISM/XT1:16)

If despite effective electrical closing lock-out a close attempt is made, the Malfunction LED will blink 2 times (see malfunction indication table, page 44). The reason for the malfunction must be eliminated to abolish the electrical closing lock-out and to activate the close readiness.

ISM Forced Trip by an Undervoltage Relay

In case the ISM shall trip because the auxiliary power supply voltage drops below the minimum value an additional under voltage relay is requested (not part of the scope of supply). The trip contact of the under voltage relay shall be integrated into the dry contact trip command circuit. If the CM was ready for operation before the voltage dropped below the minimum value, tripping of the ISM is possible within 30 s after the voltage dropped below the minimum level (Figure 52).

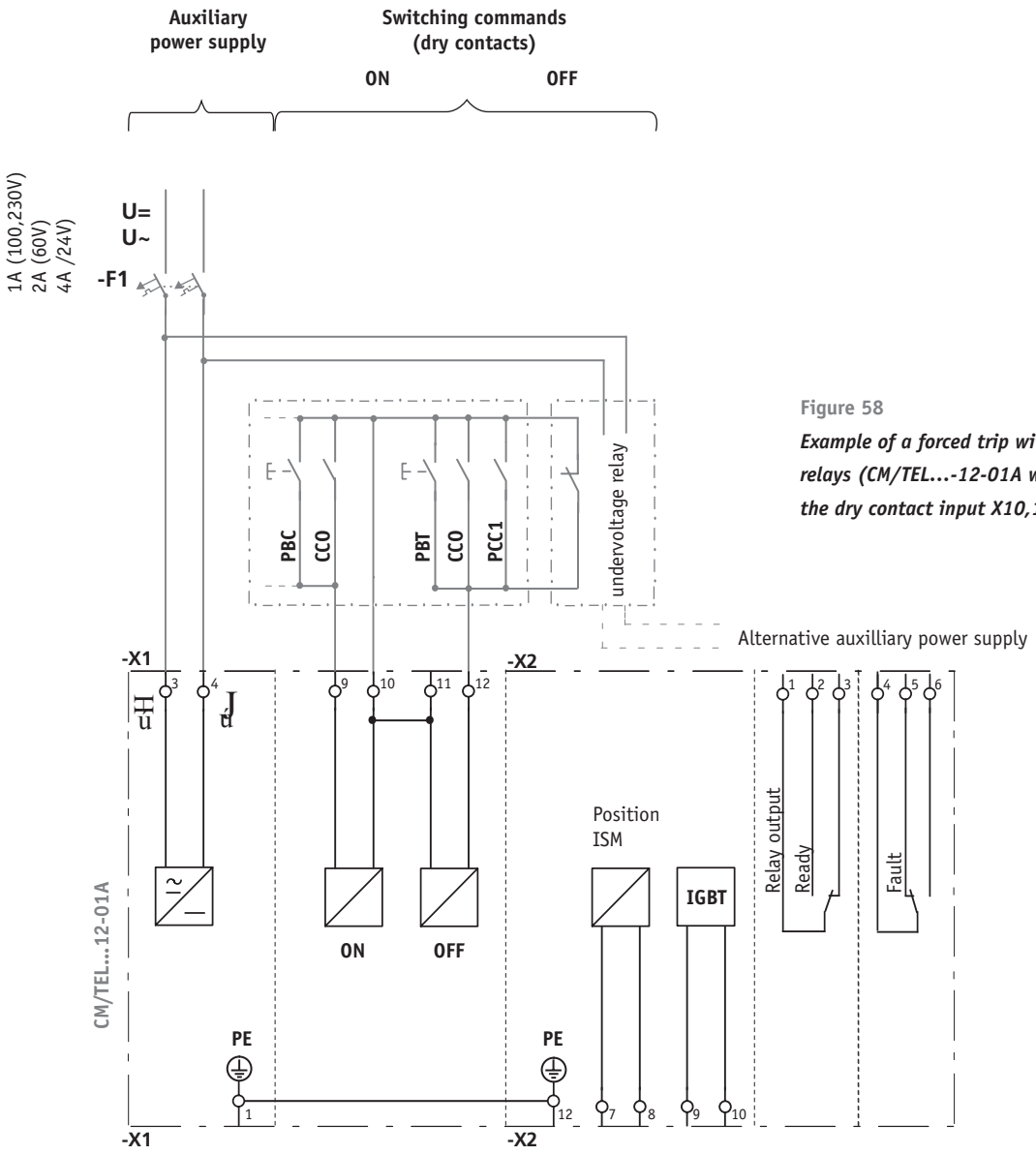


Figure 58
Example of a forced trip with undervoltage relays (CM/TEL...-12-01A with the use of the dry contact input X10,12)

Antipumping Duty

For close and trip inputs the following rule is applicable: During close operation, if a trip instruction is received before the close instruction becomes passive then the close instruction will be blocked. For the next close operation the close instruction must be reapplied after the trip instruction has become passive (Figure 53).

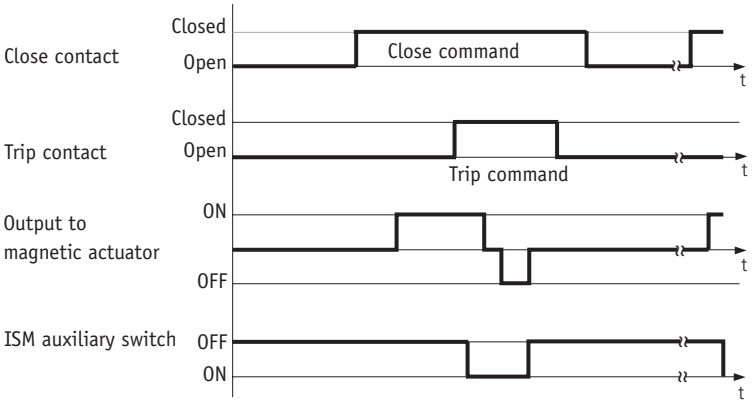


Figure 59

Blocking Duty

For close and trip inputs the following rule is applicable: If a close instruction is received whilst a trip instruction remains active then the close instruction is blocked. For the next close operation the close instruction must be reapplied after the trip instruction has become passive (Figure 54).

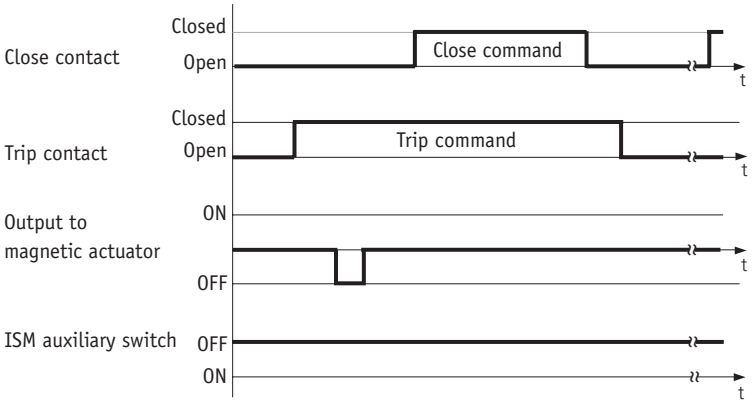


Figure 60

Combined Blocking and Antipumping Duty

A close command during a pending trip command is not executed (blocking duty) even it is pending longer than the trip command (antipumping duty) (Figure 55).

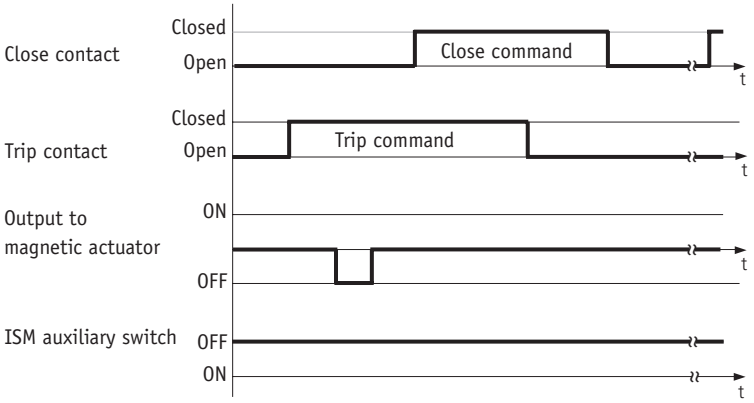


Figure 61

Output to Magnetic Actuator and Input for ISM Position Indication

The cables between the ISM and CM and the coils of the magnetic actuator are monitored permanently (see malfunction indication table, page 44). Internally at the inputs X2:7,8 of the CM 230 V DC is applied for the ISM auxiliary switch S13.

Commissioning, Maintenance

General

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

Caution Danger!

Insofar as installation, commissioning or retrofit is carried out on energized equipment, the relevant safety regulations must be adhered to (e.g. the 5 safety rules to DIN VDE 0105/078.3 Part 1 Point 9).

When designing and mounting a panel for the first time an acceptance of the equipment must be carried out together with Tavrida Electric in order to ensure the installation conditions.

The ISM must always be tested and operated together with the CM. Individual testing is not possible and may lead to the destruction of the ISM.

Commissioning Primary Part

Tests at end of installation shall include at least:

- Operating conditions of ISM shall comply with requirements of the rating plate.
- Check for damage, remove dirt
- Unsupported busbar length according to page 21, 22
- Fixing points according to page 21
- Bolts and torques to pages 20, 21, 23
- Minimum clearances due to rated insulation voltage according to page 22
- Minimum clearances due to electromagnetic influence according to page 23
- Protective earthing according to page 23
- Free air circulation at ISM

Testing the rated insulation level to IEC 6094 and VDE 06701 Part 1000:

- For 15 kV ISM the rated power frequency test voltage is 36 kV (42 kV according to the Chinese Standard GB 1984-2003)

Commissioning Secondary Part

Preparation before testing the functionality shall include at least:

- Installation of CM according to page 30.
- 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 according to selected CM-type.
- Polarity of auxiliary power supply and selection of MCB according to page 32.
- Connection between CM and ISM acccording to pages 29, 30, 31, 32, 59, 60.
- Selection and connection of interference suppressing filters according to pages 33, 60.
- Checking that all secondary connections have been pulled up tight.

Operating test

While testing the functionality, at first the ISM must be separated from high voltage.

· Turn on the CM auxiliary power supply and check the following operating indications:
  - The POWER LED must light up immediately.
  - The READY LED must blink during charging of capacitors and light up continuously within 15 s after switching on. The READY relay contact (X2:1,2) must close within 15 s.
  - The READY relay contact (X2:1,2) must close within 15 s.
  - The MALFUNCTION LED must not light up.
· Check of all basic and extended functions (if any) according to the chapters “Switching and Control Functions” and “Signalling”.

Caution Danger!

· During operation both CM-actuator voltage (on CM X2:9,10 and ISM XT2:13,14) and internal auxiliary voltage for ISM auxiliary switch S13 (on CM X2:7,8 and ISM XT2:15,16) amounts to approximately 230 V DC.
· After switching off the CM, there is still a voltage at the terminals of the capacitors. Only after the MALFUNCTION LED is extinguished the voltage has dropped to a safe value.

In the factory the magnetic actuator coils are connected and tested according to the existing circuit diagram. If the actuator coil is connected with reversed polarity it is possible that the first operations cannot be performed successfully. This is no failure of the ISM and after a few switching operations this possible effect disappeared permanently (unless the polarity is changed again).

After above listed functionality tests were performed succesfully the ISM can be tested under high voltage and with load connected.

Maintenance

Under normal operating conditions (see chapter “Regulations and ambient conditions, Ambient conditions”, page 65) the ISM is maintenance free for a period of at least 25 years or until it has reached the permissible number of operating cycles. Nevertheless the surface of the ISM must be kept clean. Deposits of any kind must be removed.

Non-Conformity

If during installation, commissioning, operation or maintenance any non-conformity occurs, action shall be taken in accordance with the non-conformity report on pages 74, 75.

Signalling 6

LED Indicators and Dry Contacts

Functionality	Results	LED indicators				Dry contacts			
		CM_12_1..2..3			CM_14_1	CM_12_1..2..3			CM_14_1
Switch on auxiliary power supply	Power supply On	•	•	•	•				
Switch on emergency power supply	Emergency power supply On			•					
CM is ready to carry-out control commands	Operational readiness	•	•	•	•	•	•	•	•
ISM close operation	Wipe contact close operation						•		
ISM trip operation	Wipe contact trip operation						•		
Unsupervised ISM trip operation	Emergency signalling contacts							•	
Malfunction CM or ISM	Malfunction	•	•	•	•	•	•	•	•

Functionality	Results	LED indicators	Dry contacts
		CM_1501_01	
Switch on auxiliary power supply	Power supply On	•	
Switch on emergency power supply	Emergency power supply On		
CM is ready to carry-out control commands	Operational readiness	•	•
ISM close operation	Wipe contact close operation		
ISM trip operation	Wipe contact trip operation		
Unsupervised ISM trip operation	Emergency signalling contacts		
Malfunction CM or ISM	Malfunction	•	•

LED indicators are situated at the front side of the CM (Figure 65, Figure 66).

Figure 62
Operating and malfunction indications for CM_12_1

Figure 63
Operating and malfunction indications for CM_12_3

Malfunction Indication Table

The self-monitoring system inside the CM detects eventual malfunctions and report them via the MALFUNCTION LED with various blink signals. The meaning of the blink codes and the variations per type of malfunction are shown in the following table.

Error group	Malfunction LED blinks	Function, type of malfunction	Description of malfunction variants	Recommendation for malfunction elimination	Affected CM
External error	1 blink signal, then 1.5 s pause, periodic (about 4 min for CM/TEL...-12 series, about 10 min for CM/TEL...-14-01)	The power supply has failed for >1.5 s (> 3.5 s for CM/TEL...-14-01) or has been out-side the operating range.	The operating range of the power supply of the CM, depending on the type of voltage, its value and switch command, is between 65-70% and 125% (Trip commands) and 80-125% (Close commands) of the nominal voltage. With continuous failure of the power supply, the blink signals continue until the capacitors are unloaded.	- Switch on MCB - Check for cable break - Check terminal connections	All CM
	2 blink signals, then 1.5 s pause, periodic	The Close or Trip-command of the CM is carried out but the corresponding ISM position signal is missing.	**Malfunction variant 1:** The Close command of the CM is carried out by the ISM. The normally open ISM auxiliary switch S13 has been bridged already due to a malfunction before the Close command was given (despite the existing malfunction, the ISM can be switched off again by the CM. This deletes the malfunction indication although the malfunction still exists).	- Check for short circuit in the cable - Check for short circuited terminals - Check ISM position switch S13	All CM
			Malfunction variant 2: The Trip command of the CM is carried out by the ISM. The normally closed ISM auxiliary switch S13 has been interrupted due to a malfunction (the ISM can only be placed in the close position after the malfunction has been eliminated).	- Check for cable break - Check terminal connections - Check ISM position switch S13	
		The Close command of the CM is not carried out as the ISM is electrically locked in OFF position.	**Malfunction variant 3:** The Close command of the CM is not carried out by the ISM as the closing lock-out contact in ISM S13 auxiliary switch circuit is open. The malfunction indication has been purposely taken into account.	Closing of the ISM is only possible if closing lock-out contact is closed.	
		The Close or Trip command of the CM is not carried out by the ISM as the ISM is mechanically locked in the particular position.	**Malfunction variant 4:** The Close command of the CM is not carried out by the ISM as it is mechanically locked in the OFF position.	Delete malfunction with Trip command. The ISM can only be closed when the mechanical lock has been removed.	
			Malfunction variant 5: The Trip command of the CM is not carried out by the ISM as it is mechanically locked in the ON position.	Remove the mechanical lock of the ISM.	

Error group	Malfunction LED blinks	Function, type of malfunction	Description of malfunction variants	Recommendation for malfunction elimination	Affected CM
External error	3 blink signals, then 1.5 s pause, periodic	The magnetic actuator coil circuit is interrupted.	**Malfunction variant 1:** Possible causes: cable break, loose terminal connections, defect magnetic actuator coils.	- Check for cable break - Check terminal connections	All CM
		CM-internal malfunction.	**Malfunction variant 2:** CM-defect.	- CM must be replaced	
	4 blink signals, then 1.5 s pause, periodic	The magnetic actuator coil circuit is short circuited.	Possible causes: Short circuited cable strands, short circuited terminal connections.	- Check for short circuit in the cable - Check for short circuited terminals	All CM
	5 blink signals, then 1.5 s pause, periodic	without CM command, the ISM trips.	**Malfunction variant 1:** Mechanical emergency trip.	Delete the malfunction indication with the CM Trip command.	All CM
		ISM is closed, a trip is simulated.	**Malfunction variant 2:** The ISM was properly closed by the CM and the close position feedback exists. Then a malfunction occurres in the ISM auxiliary switch S13 circuit in which the normally open switch S13 is bridged (the ISM can still be tripped again via the CM despite the existing malfunction. This deletes the malfunction indication but the cause of the indication is still there).	- Check for short circuit in the cable - Check for short circuited terminals - Check ISM position switch S13	
Internal error	17 or more blink signals, then 1.5 s pause, periodic	Various internal malfunction of the CM.		- CM must be replaced	All CM

Explanatory notes to malfunction indications and operational readiness

- If the ISM is in OFF position and malfunction indications exist, ISM can be closed only after all malfunctions have been eliminated.
- If several malfunctions appear at the same time malfunctions regarding the magnetic actuator are indicated with priority otherwise the last malfunction that occurred.
- Usually failures need to be fixed to stop malfunction indication.
  During several malfunction variants of 2- or 5- blink failures, the malfunction indication will disappear with a trip CM command.
- In case of internal CM failures please contact your nearest Tavrida Electric partner.

Special Applications: Fast Switching

Fast Transfer Switching

Sensitive loads in industrial processes are often configured with a secondary primary feed from the utility for backup and reserve power. For sectors such as oil & gas, slow transfer times from traditional switching solutions result in motor stoppages and lost production time while processes are brought back on-line.

The high closing and opening speeds of the ISM15_Shell_2 series allow for a packaged solution. The VCB_FTS system is comprised of specially selected ISM15_Shell_2 breakers, control modules with a faster command recognition speed, and optional automatic transfer relays.

Transfer speed can be delineated by two transition types:

1. Closed transition - the backup power line is connected by closing the breaker before the main line is interrupted (make before break).

2. Open transition - the backup power line is connect by closing the breaker after the main line is interrupted (break before make).

The timing of the system can therefore be broken down by the following table, using the Schweitzer Engineering SEL-451 relay as an example of total timing calculation:

Product Parameters	Designation	Response Time
ISM15_Shell_2 opening time (including CM)	Topen	12 ms
ISM15_Shell_2 interrupting time (including CM)	Tinterrupt	20 ms
ISM15_Shell_2 closing time (including CM)	Tclose	26 ms
SEL-451 open phase detection logic trip time	Tsel451	10 ms
Closed transition with SEL-451 open phase detection logic trip time	Tsel451 + Tclose	36 ms
Open transition with SEL-451 open phase detection logic trip time	Tsel451 + Tclose + Topen	48 ms

Arc Flash Mitigation

A high concern for the electrical industry are incidents of arc flash, whereby a fault is initiated that causes damage to the equipment or serious injury to operators. These faults can be caused by many factors such as poor maintenance, equipment failure, or operator error.

In recognition of this many relay manufacturers have produced arc detection features. These generally include the standard relay functions plus an instantaneous trip driven by arc-detecting fiber optic cables within switchgear cubicles.

The purpose of these relays is to interrupt the arc fault through instant tripping of upstream devices. The faster the arc is suppressed, the lower the energy output and therefore less damage to equipment plus improved operator safety.

Tavrida ISM_Shell_2 series breakers unique high speed opening characteristics allow for a packaged solution. The VCB_FAS system is comprised of specially selected ISM15_Shell_2 breakers, control modules with a faster command recognition speed, and optional arc mitigation relays.

The timing of the system can be broken down by the following table, using the SEL-751 relay as an example of total timing calculation:

Product Parameters	Designation	Response Time
ISM15_Shell_2 opening time (including CM)	Topen	12 ms
ISM15_Shell_2 interrupting time (including CM)	Tinterrupt	20 ms
ISM15_Shell_2 closing time (including CM)	Tclose	26 ms
SEL-751 arc flash detection time	Tsel751	4 ms
Interruption time after arc initiation	Tsel751 + Tinterrupt	24.3 ms

Type	VCB15_Shell2_FTS (150...210...275) VCB15_Shell2_FAS (150...210...275)
Rated data	
Rated voltage (U_r)	15 kV
Rated current (I_r)	to 2000 [1] A
Rated power frequency withstand voltage (U_d)	36 kV
Rated lightning impulse withstand voltage (peak) (U_p)	95 [2] kV
Rated short-circuit breaking current (I_{sc})	to 25 kA @ 15 kV to 28 kA @ 5 kV
Rated peak withstand current (I_p)	to 80 kA
Rated short-time withstand current (I_k)	to 31.5 kA
Rated duration of short circuit (t_k)	4 s
Rated frequency (f_r)	50/60 Hz
Switching performance	
Mechanical life [4] (CO-cycles)	30 000
Operating cycles [4], rated current (CO-cycles)	30 000
Operating cycles [4], rated–short circuit breaking current (O-operations)	50
Closing time [3]	22 ms
Opening time [3], not more than	12 ms
Break time [3], not more than	20.3 ms
Rated operating sequence (CM_1501_01(12))	O-0.3s-CO-10s-CO
Standards	
Design class with regard to severity of service conditions in accordance with IEC 60932	Class 1
Standards	IEC 62271-100 GB 1984-2003 ANS C37.09
Mechanical vibration withstand capability according to IEC 60271, IEC 60068	Class 4M4

Note

[1] In open air

[2] For ISM15_Shell_2(150..180) with additional insulation caps for contact terminals only

[3] In combination with CM_1501_01(4)

[4] See Figure 64

Product Line

8

Indoor switching modules (ISM)

Type	Rated Voltage	Rated Short Circuit	Rated Continuous Current	Pole Center Distance
ISM15_Shell_2(150)	15 kV	31.5 kA (5 kV) 29 kA (15 kV)	2000 A	150 mm
ISM15_Shell_2(180)	15 kV	31.5 kA (5 kV) 29 kA (15 kV)	2000 A	180 mm
ISM15_Shell_2(210)	15 kV	31.5 kA (5 kV) 29 kA (15 kV)	2000 A	210 mm
ISM15_Shell_2(275)	15 kV	31.5 kA (5 kV) 29 kA (15 kV)	2000 A	275 mm

Control modules (CM12, CM14 Series)

Type	Former Product Code	Rated Voltage	General Functionality
CM_12_1(60)	CM/TEL-24/60-12-01A	24 - 60 VDC	Basic functionality
CM_12_1(220)	CM/TEL-100/220-12-01A	100 - 270 VAC / VDC	
CM_12_2(60)	CM/TEL-24/60-12-02A	24 - 60 VDC	Basic functionality + additional supervised close / trip circuits, wipe signals
CM_12_2(220)	CM/TEL-100/220-12-02A	100 - 270 VAC / VDC	
CM_12_3(60)	CM/TEL-24/60-12-03A	24 - 60 VDC	Basic functionality + additional supervised close / trip circuits, emergency power supply, CT power supply
CM_12_3(220)	CM/TEL-100/220-12-03A	100 - 270 VAC / VDC	
CM_14_1(60)	CM/TEL-24/60-14-01A	24 - 60 VDC	Basic functionality + reclosing
CM_14_1(220)	CM/TEL-100/220-14-01A	100 - 270 VAC / VDC	

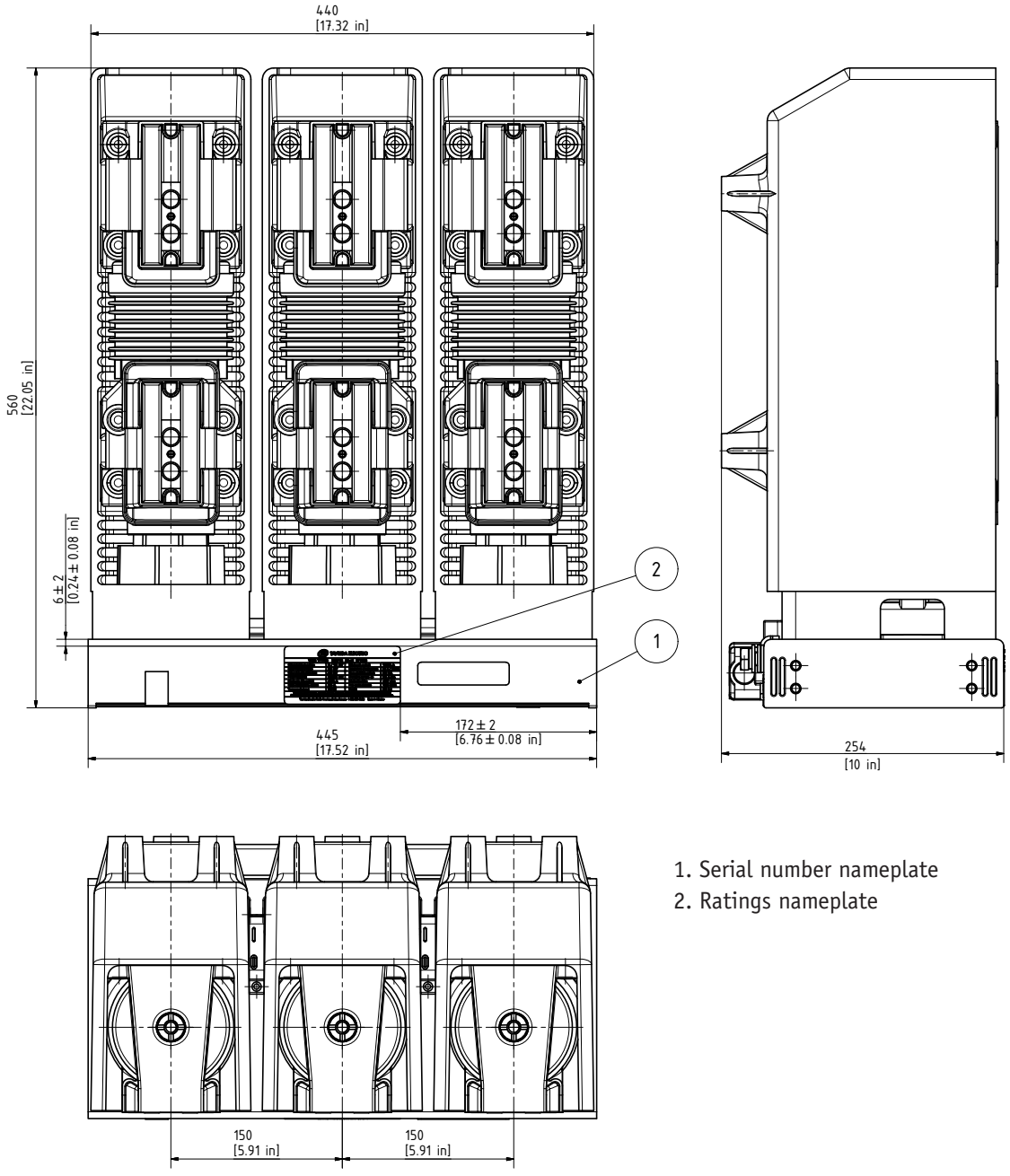
Control modules (CM15 Series)

Type	Former Product Code	Rated Voltage	General Functionality
CM_1501_01(12)	N/A	100 - 270 VAC / VDC	Basic functionality, 12 ms trip delay time
CM_1501_01(4)	N/A	100 - 270 VAC / VDC	Basic functionality, 4 ms trip delay time[1)]

Dimensions and Weights

9

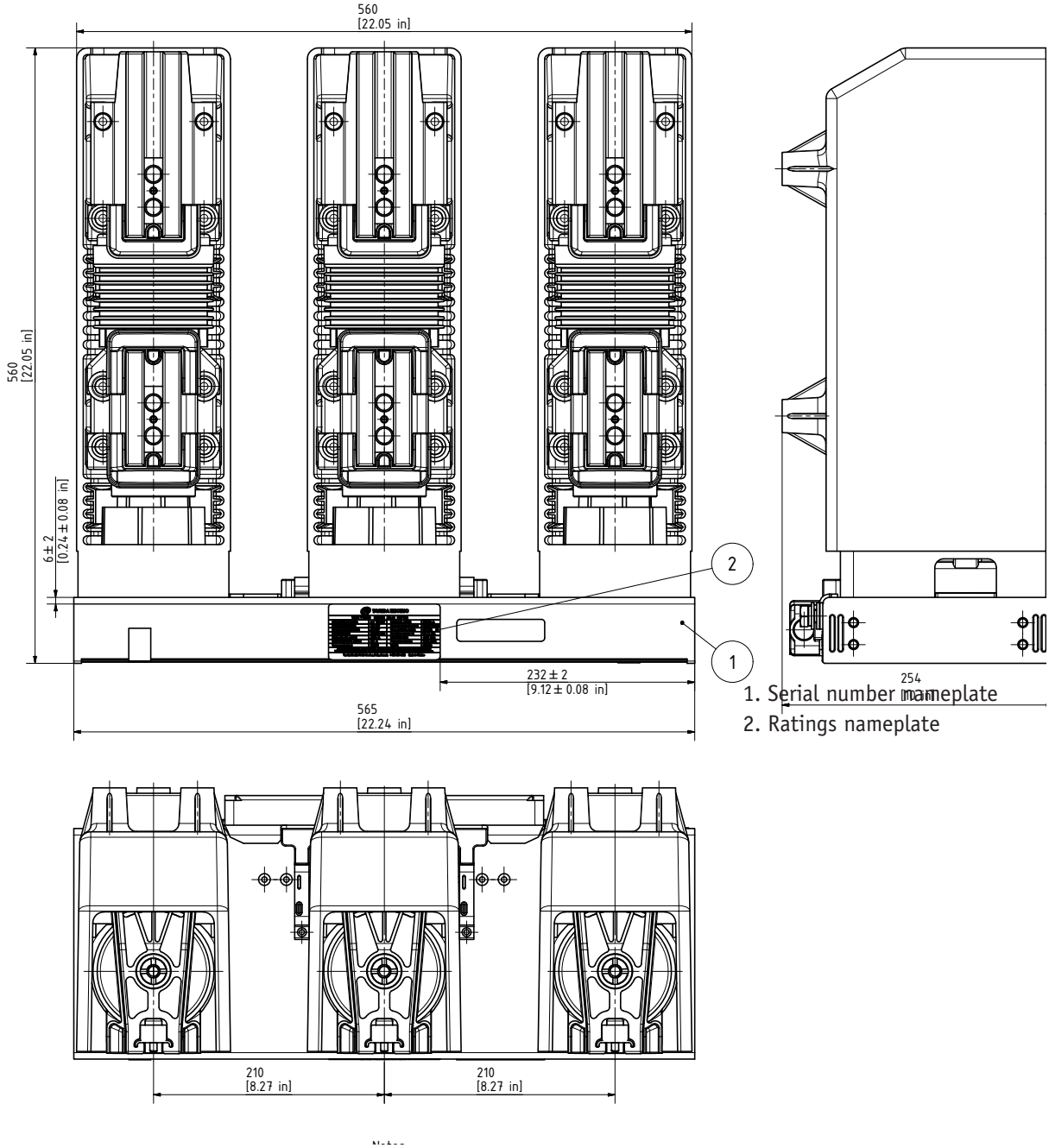
Dimensions and Weights of the ISM



1. Serial number nameplate
2. Ratings nameplate

5 / 15 kV VCB, PCD 150 mm, Weight: 51

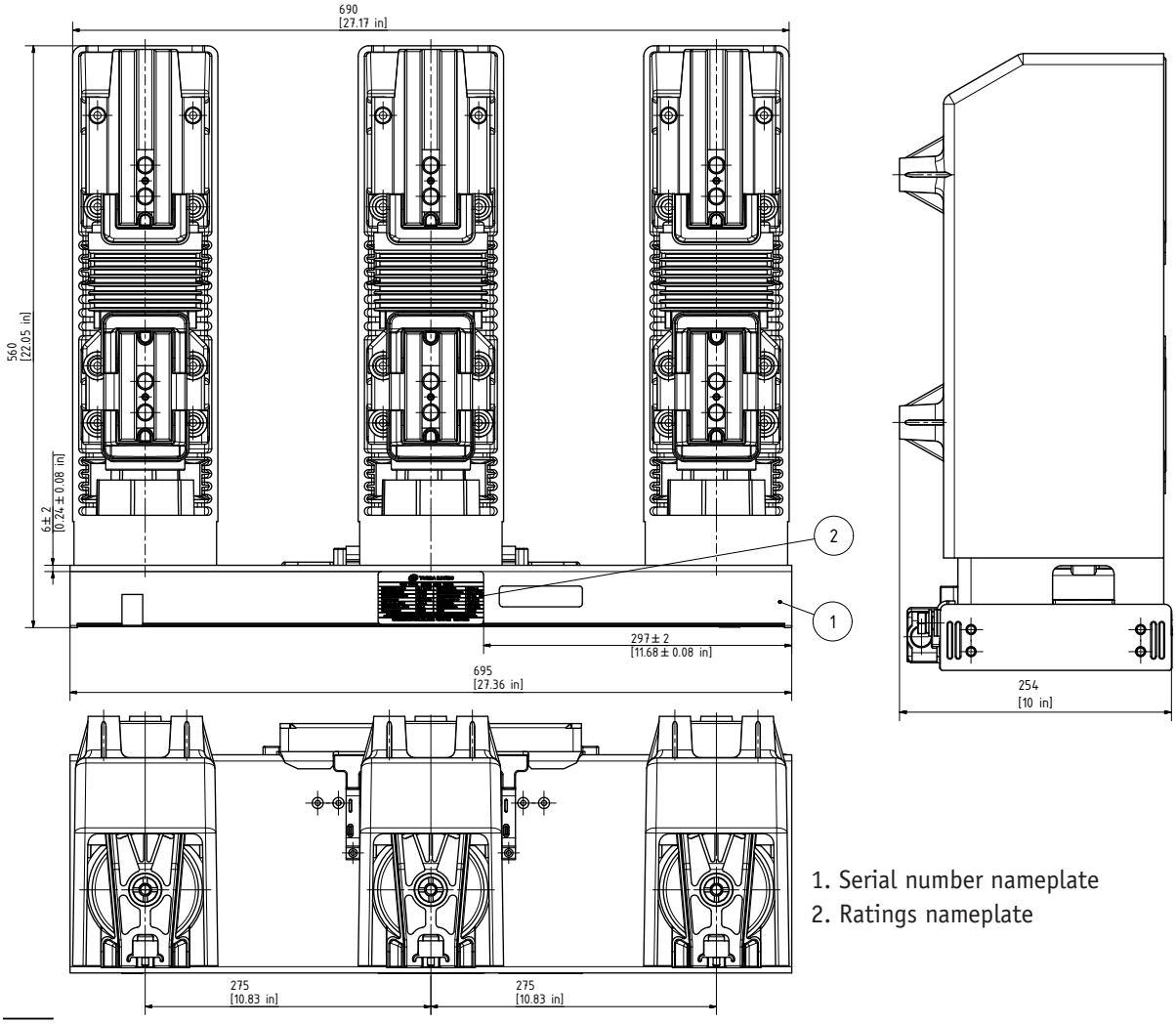
ISM15_Shell_2(150)



1. Serial number nameplate
2. Ratings nameplate

5 / 15 kV VCB, PCD 210 mm, Weight: 48

ISM15_Shell_2(210)

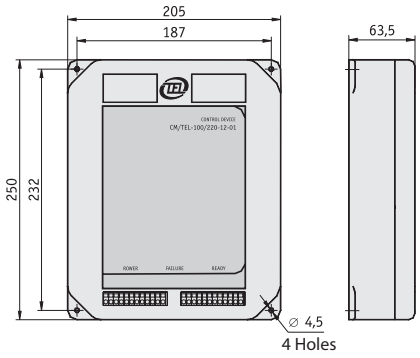


1. Serial number nameplate
2. Ratings nameplate

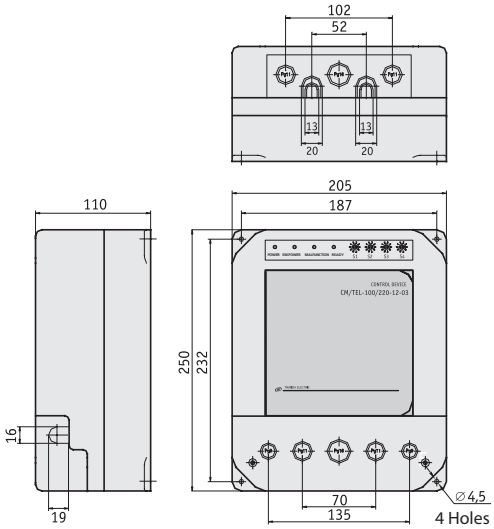
5 / 15 kV VCB, PCD 275 mm, Weight: 54.5

ISM15_Shell_2(275)

Dimensions and Weights of the CM

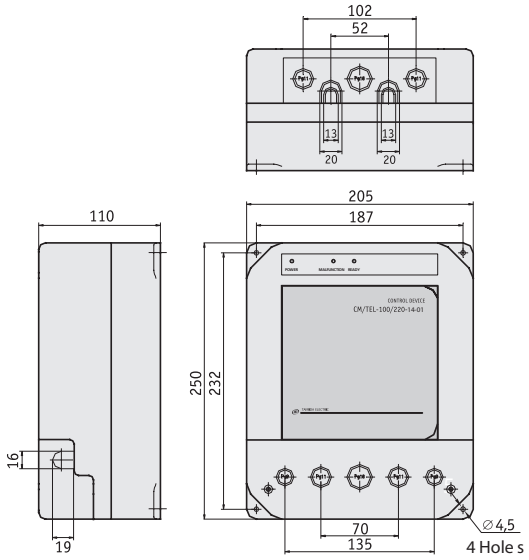


CM_12_1
Weight: 1.8 kg
CM_12_1(60)
CM_12_1(220)

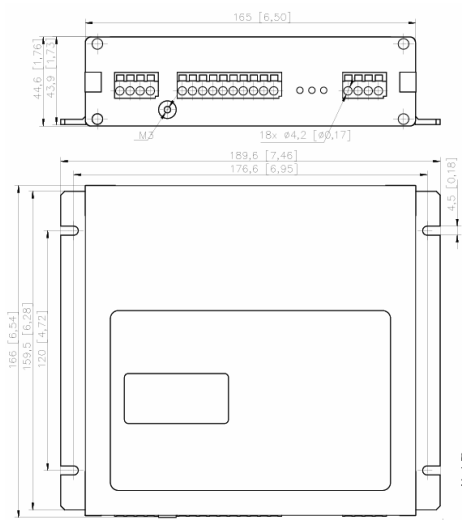


CM_12_2
Weight: 2.8 kg
CM_12_2(60)
CM_12_2(220)

CM_12_3
Weight: 3.2 kg
CM_12_3(60)
CM_12_3(220)

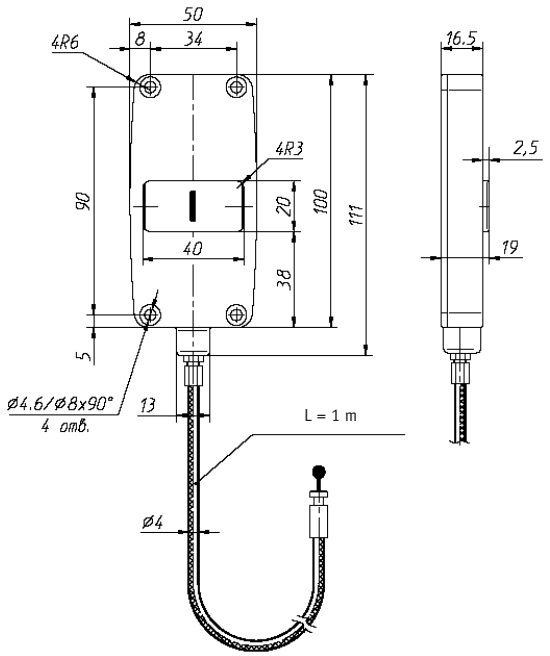


CM_14_1
Weight: 3 kg
CM_14_1(60)
CM_14_1(220)

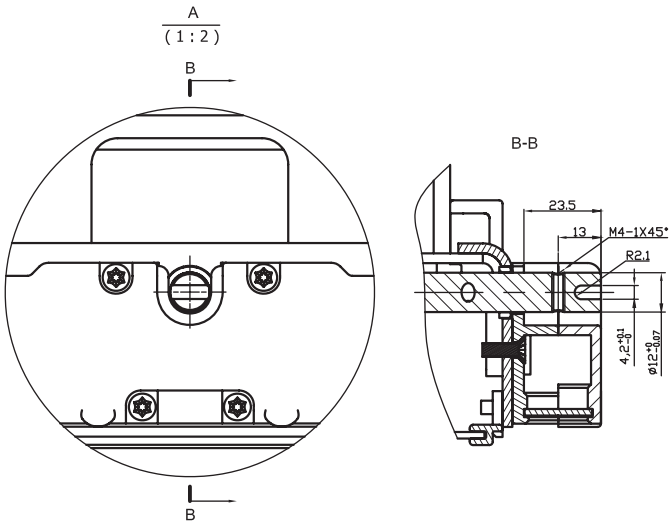


CM_1501_01
Weight: 1.5 kg
CM_1501_01(12)
CM_1501_01(4)

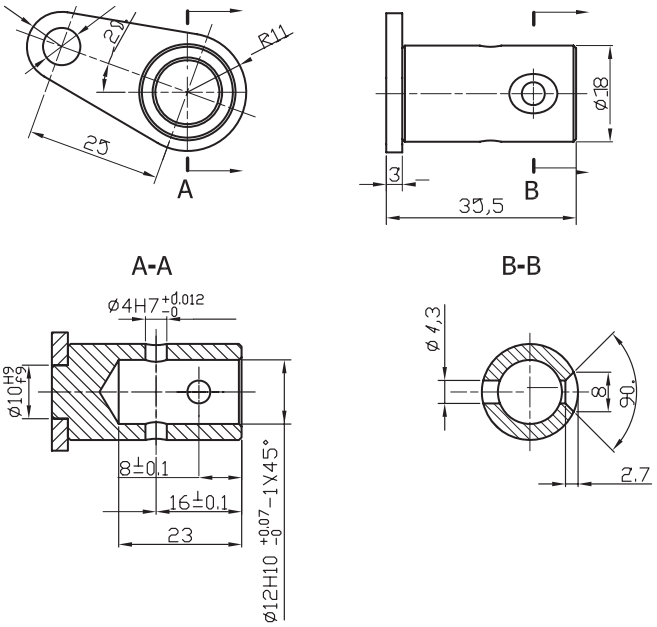
Dimensions of the Position Indicator



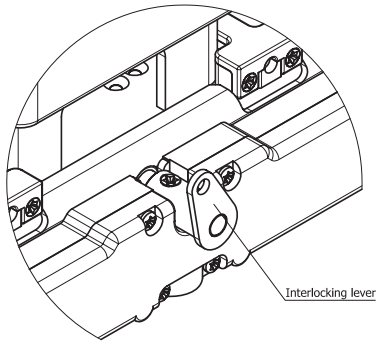
Dimensions of Mating Part for Interlocking Shaft



Dimensions of interlocking shaft



Mating part with interlocking lever

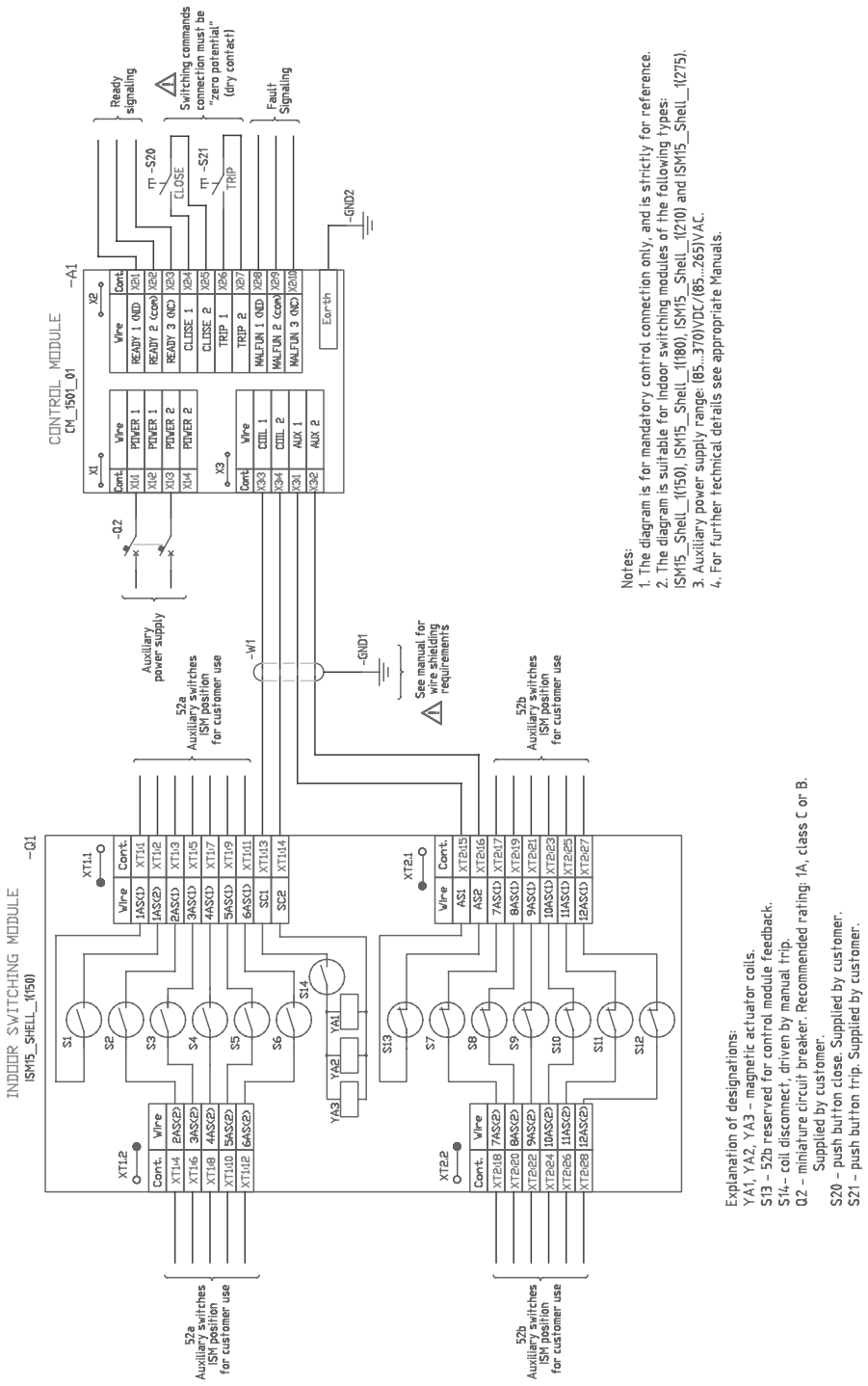


Interlocking shaft with mounted interlocking lever

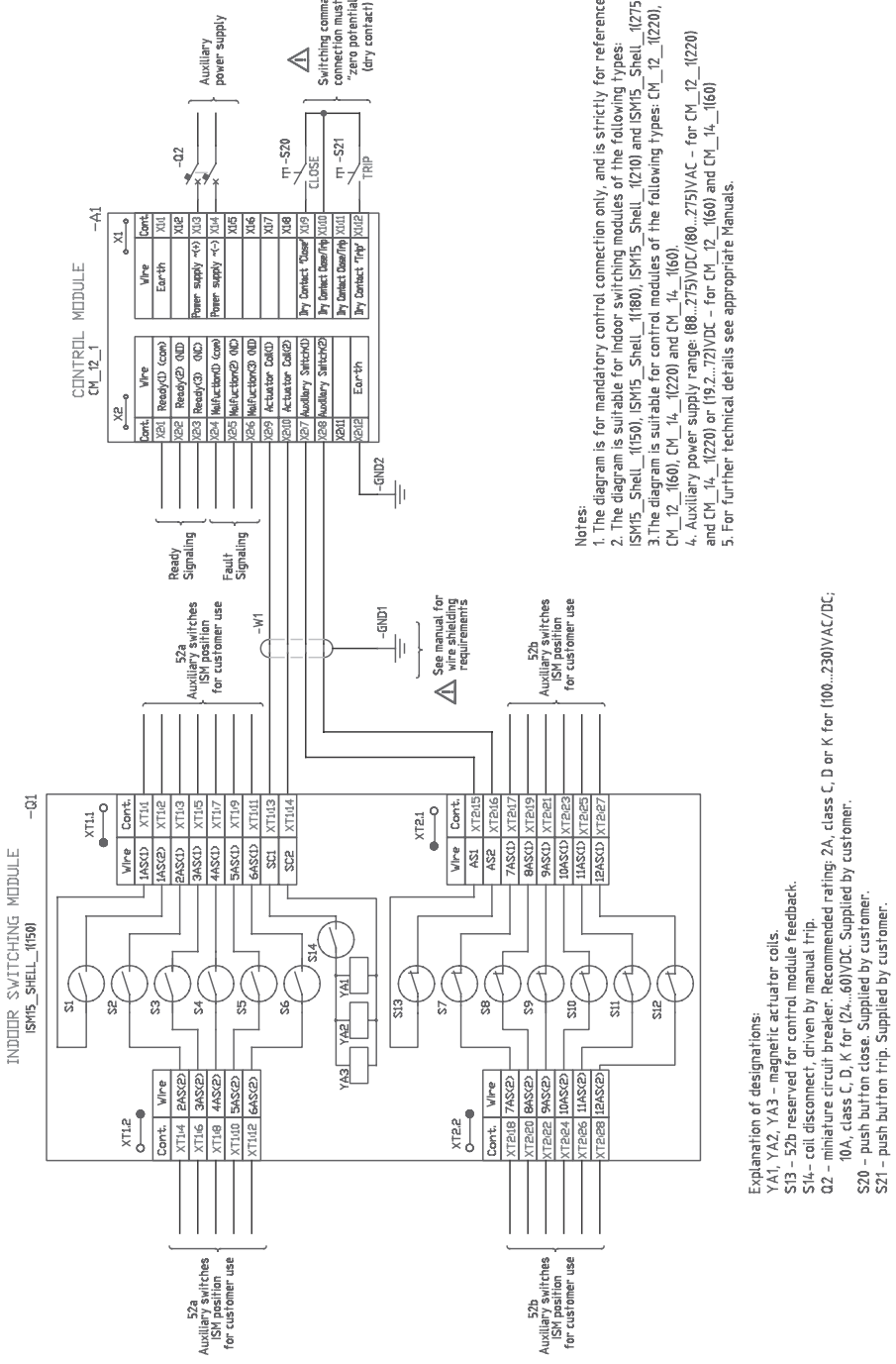
10

Circuit Diagrams

ISM15_Shell_2 with CM_1501_01



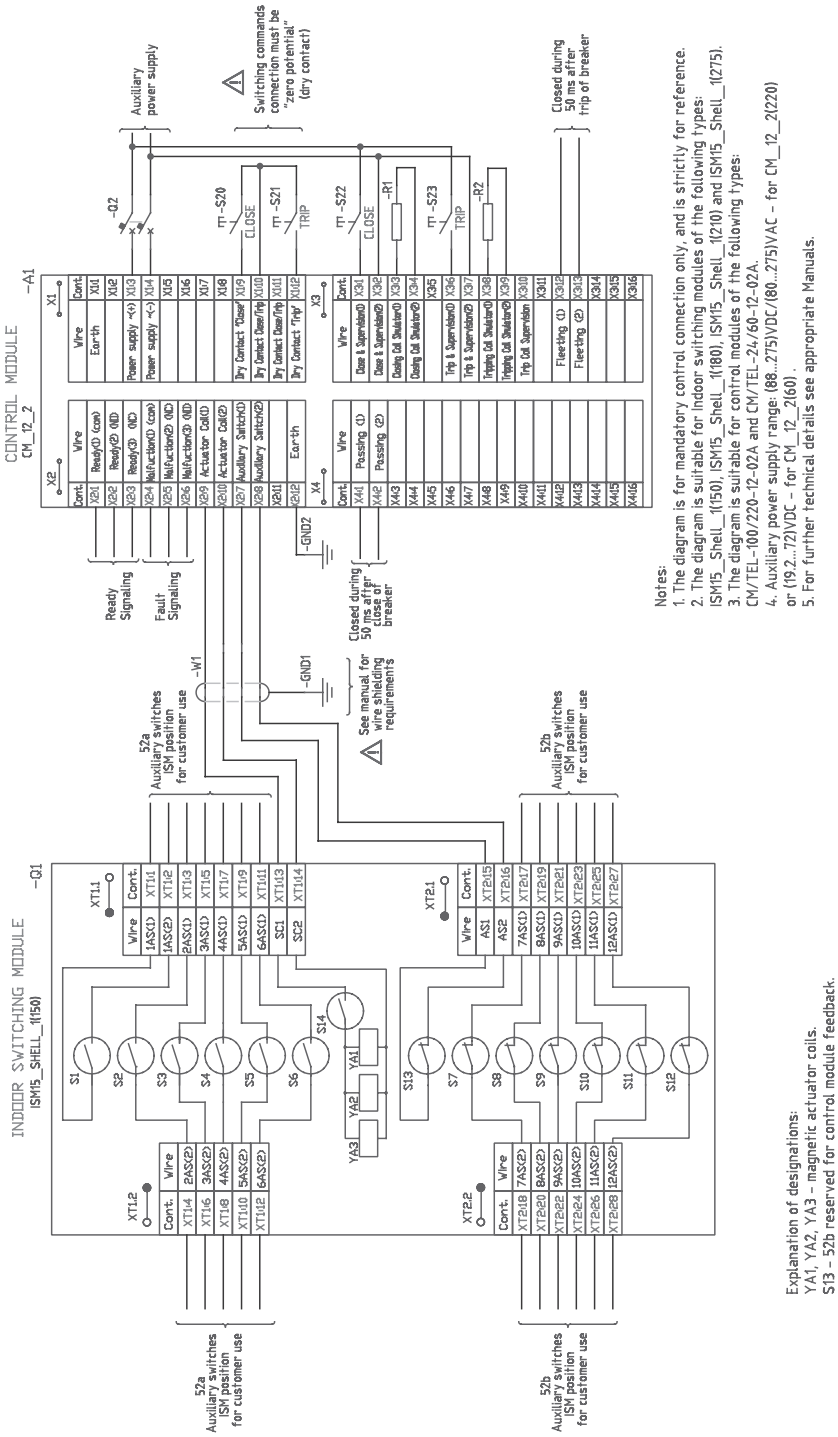
ISM15_Shell_2 with CM_12_1



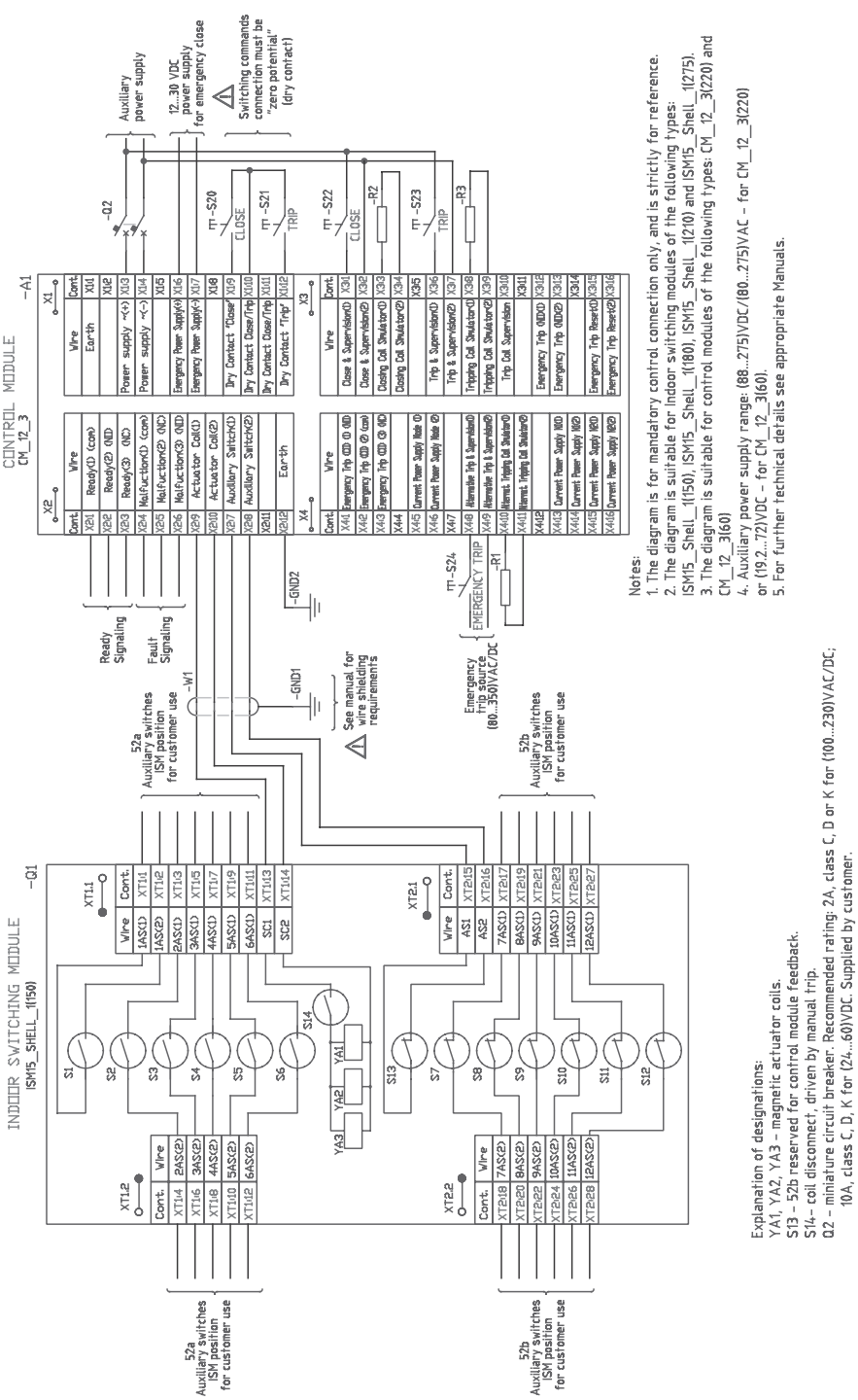
Notes:
1. The diagram is for mandatory control connection only, and is strictly for reference.
2. The diagram is suitable for indoor switching modules of the following types: ISM15_Shell__1(150), ISM15_Shell__1(210) and ISM15_Shell__1(275).
3.The diagram is suitable for control modules of the following types: CM_12_1(220), CM_12_1(60), CM_14_1(220) and CM_14_1(60).
4. Auxiliary power supply range: (88...275)VDC/(80...275)VAC - for CM_12_1(220) and CM_14_1(220) or (19.2...72)VDC - for CM_12_1(60) and CM_14_1(60)
5. For further technical details see appropriate Manuals.

Explanation of designations:
YA1, YA2, YA3 – magnetic actuator coils.
S13 – 52b reserved for control module feedback.
S14– coil disconnect, driven by manual trip.
Q2 – miniature circuit breaker. Recommended rating: 2A, class C, D or K for (100...230)VAC/DC; 10A, class C, D, K for (24...60)VDC. Supplied by customer.
S20 – push button close. Supplied by customer.
S21 – push button trip. Supplied by customer.

ISM15_Shell_2 with CM_12_2



ISM15_Shell_2 with CM_12_3



11

Technical Data

Indoor Switching Modules (ISM)

Type	ISM15_Shell_2 (150...210...275)
Rated data	
Rated voltage (U_r)	15 kV
Rated current (I_r)	to 2000 [1] A
Rated power frequency withstand voltage (U_d)	36 (42) [6] kV
Rated lightning impulse withstand voltage (peak) (U_p)	95 [2] kV
Rated short-circuit breaking current (I_{sc})	to 29 kA @ 15 kV to 31.5 kA @ 5 kV
Rated peak withstand current (I_p)	to 80 kA
Rated short-time withstand current (I_k)	to 31.5 kA
Rated duration of short circuit (t_k)	4 s
Rated frequency (f_r)	50/60 Hz
Switching performance	
Mechanical life [4] (CO-cycles)	30 000
Operating cycles [4], rated current (CO-cycles)	30 000
Operating cycles [4], rated–short circuit breaking current (O-operations)	50
Closing time [3]	32 ms
Opening time [3], not more than	20 ms
Break time [3], not more than	28 ms
Rated operating sequence (CM_1501_01(12))	O-0.3s-CO-10s-CO
Standards	
Design class with regard to severity of service conditions in accordance with IEC 60932	Class 1
Standards	IEC 62271-100 GB 1984-2003 ANS C37.09
Mechanical vibration withstand capability according to IEC 60271, IEC 60068	Class 4M4
Other data	
Resistance of main circuit	< 22 µOhm
Weight (depending on PCD) for ISM	49 ... 51 kg
Type of driving mechanism	Monostable magnetic actuator
Design, switching capacity of auxiliary contacts	
Number of available auxiliary contacts for three-phase ISM	6 NO + 6 NC
Rated power frequency test voltage	2 kV
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	5 A
Maximum current for 30 V DC, inductive load (t=20 ms)	3 A
Maximum current for 50 V DC, ohmic load	1 A
Maximum current for 50 V DC, inductive load (t=20 ms)	1 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	5 A
Maximum current for 125 V AC, inductive load (cosj =0,3)	5 A
Maximum current for 250 V AC, ohmic load	5 A
Maximum current for 250 V AC, inductive load (cosj =0,3)	5 A

Control Modules (CM)

Type	CM_12_1...2...3	CM_14_1	CM_15_1
Type of operation			
Rated operating sequence	O-0.3s-CO-15s-CO	O-0.1s-CO-1s-CO-1s-CO	O-0.1s-CO-10s-CO-10s-CO
Maximum CO operating cycles per hour	100	60	100
Auxiliary power supply 24/60			
Auxiliary power supply	24 V DC to 60 V DC		N/A
Operating range (80-125%)	19.2 V DC to 75 V DC		N/A
Auxiliary power supply 100/220			
Auxiliary power supply	110 V DC to 220 V DC		85 V DC to 370 V DC
Operating range (80-125%)	88 V DC to 275 V DC for close operations		
Operating range (70-125%)	77 V DC to 275 V DC for trip operations		
Auxiliary power supply	100 V AC to 220 V AC		
Operating range (80-125%)	80 V AC to 275 V AC for close operations		85 V AC to 265 V AC
Operating range (65-125%)	65 V AC to 275 V AC for trip operations		
Power consumption			
Charging the close and trip capacitors	≤50 W/70 VA		≤20 W/25 VA
Permanent power consumption (standby)	≤10 W/15 VA	≤5 W	≤5 W/8 VA
Reaction times			
Preparation time for the operation of the CM after switching on the auxiliary power supply, not more than	15 s	90 s	15 s
Preparation time for the close operation of the CM after a previous close operation, at most	9 s	1 s	10 s
Preparation time for the trip operation of the CM after switching on the auxiliary power supply , not more than	0.5 s		
Trip capability after failure of the auxiliary power supply, at least	30 s	5 s	60 s
Preparation time for the close operation of CM after switching on the emergency power supply, not more than (CM/TEL...12-03A)	50 s	N/A	N/A
Electric strength			
Power-frequency withstand voltage, 1 min (to IEC 60 255-5)	2 kV		
Lightning impulse withstand voltage, 1.2 μs/ 50 μs/ 0.5 J (according to IEC 60 255-5)	5 kV		
Insulation resistance at 1000 V DC at most 1 min at 2000 V DC (according to IEC 60 255-5)	> 5 MOhm		

Note

[1] In open air

[2] For ISM15_Shell_2(150) with additional insulation caps for contact terminals only

[3] In combination with the associated CM control unit CM_1501_01(12)

[4] See Figure 57

[5] The information in brackets refer to the national Chinese standards GB 1984-2003 and refers to an installation altitude of maximum 1000 m

	CM_12_2

Wipe contact outputs (CM/TEL...-12-02A)

Close wipe contact (X4: 1, 2)	
Delay time from closing the main ISM contact (opening the ISM auxiliary switch S13) up to closing the close wipe contact	25 ± 5 ms
Closing time of the close wipe contact (close wipe signal length)	50 ± 5 ms
Trip wipe contact (X3: 12, 13)	
Delay time from opening the main ISM contact (closing the ISM auxiliary switch S13) up to closing to trip wipe contact	25 ± 5 ms
Closing time of the trip wipe contact (trip wipe signal length)	50 ± 5 ms

	CM_12_2...3
Inputs for potential-loaded close and trip commands (X3: 1, 2, 3, 4 and X3 : 6, 7, 8, 9) and alternative potential-loaded trip command inputs (X4: 8, 9, 10, 11) as well as supervision of these switching command circuits	
Voltage range (close, trip)	20,4 - 275 V AC or DC
Rated current IN setting with external resistances and selection switches	0.5/ 1/ 1.5/ 2/ 2.5/ 3/ 4/ 5 A
Minimum trip command current	0.65 x I_N
Minimum close command current	0.8 x I_N
Maximum sustained supervision current	0.3 x IN but not more than 0.2 A
Control command (close or trip) acceptance time	25 ± 5 ms
Input resistance in the low impedance mode	Equal to the external resistor
Input resistance in the high impedance mode, not less than	500 kOhm

	CM_12_3
Input for supervision of the trip coil (X3: 10)	
Resistance in the low impedance mode	Equal to the external resistor
Resistance in the high impedance mode, not less than	500 kOhm
Reset input for emergency signalling contacts (X3: 15, 16)	
Voltage range	20.4 - 275 V AC/DC
Resistance	36 ± 15% kOhm
Emergency power supply (X1: 6, 7)	
Voltage range	12-30 V DC
Power consumption while charging the close capacitors for close operation	35 W
Standby power input	15 W
Preparation time for the close operation of the CM after switching on the emergency power supply, not more than	50 s

	CM_12_3
Input for CT power supply	
Operating current range	2-300 A
Power consumption per phase during charging trip capacitors	
- at 2 A	5 VA
- at 5 A	12 VA
- at 10 A	25 VA
- at 30 A	120 VA
- at 300 A	8 kVA
Preparation time for trip operation (charging of the trip capacitor [1]), not more than	
- at 2 A	1000 ms
- at 5 A	400 ms
- at 10 A	150 ms
- at 30 A	110 ms
- at 300 A	100 ms
Current carrying capacity, not less	
- at 5 A	∞
- at 10 A	100 s
- at 30 A	10 s
- at 150 A	1 s
- at 300 A	0.1 s

Life cycle of ISM

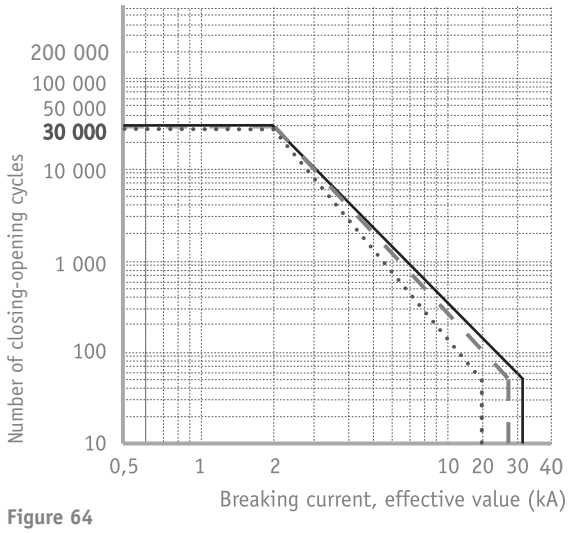


Figure 64

ISM15_Shell_2 at 20kA breaking current
ISM15_Shell_2 at 25kA breaking current
ISM15_Shell_2 at 31.5kA breaking current

Life cycle of CM close and trip capacitors

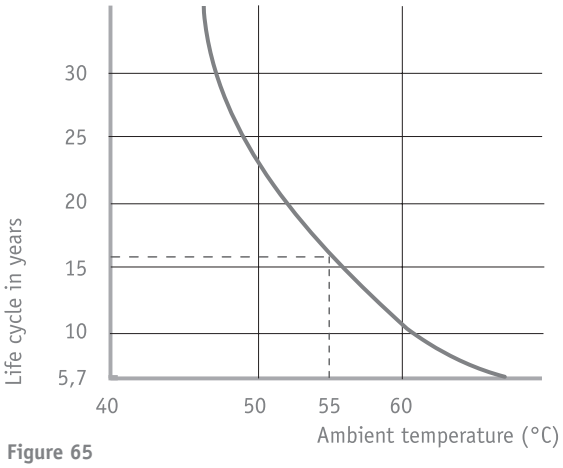


Figure 65

12

Regulations and Ambient Conditions

Regulations

The ISM complies with the following standards:

· DIN VDE 0670, Teil 1000	Germany
· IEC 60056	International standard
· IEC 62271-100, -200	International standard
· IEC 60 694	International standard
· GB 1984-2003	China
· GOST 687-78	Russian Federation
· ANSI C37.09	North America
· ANSI C37.09a	North America

CE The EMC Directive 89/336/EEC.
The Low Voltage Directive 73/23/EEC.

Highest value ambient temperature	+ 55 °C
Average temperature over 24 hours	+ 35 °C
Lowest ambient temperature	- 40 °C
Relative humidity in 24 hours	max 98%
Relative humidity over 1 month	max 90%
Average water vapour pressure over 24 hours	max 2.2 kPa
Average water vapour pressure over 1 month	max 1.8 kPa

Installation altitude

Up to an installation altitude of 1000 m above sea level, the acceptance need not take the dielectric strength of the air into account. Above 1000 m, 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 (Figure 59).

Example:

Installation altitude:	2500 m
Operating voltage:	12 kV
Rated power frequency withstand voltage:	28 kV
Rated impulse withstand voltage	75 kV
Ka factor from diagram	1.2

At sea level the installation must resist the following test voltage values:

Corrected rated power frequency withstand voltage: 28 kV x 1.2 = 33.6 kV
Corrected rated impulse withstand voltage: 75 kV x 1.2 = 90 kV

Please coordinate the necessarily actions with Tavrida Electric AG.

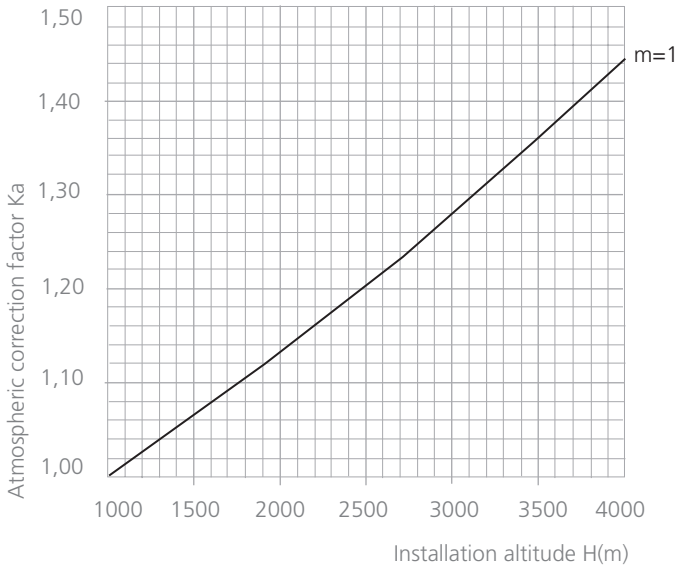


Figure 66

Correction factor (Ka) for installation altitude (H) m = 1 correction curve for the rated power frequency withstand voltage and rated lightning impulse voltage.

13

Legal Information

Warranty

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

a) … the warranty period having run out during the period of storage with the customer.
b) … 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 voltages.

Quality Regulations

All manufacturing facilities of the company have been certified by KEMA in the Netherlands and comply with (DIN EN) ISO 9001:2000.

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

- 1000 C-O cycles
- Insulation strength of the primary and auxiliary circuits at operating frequency
- Measurement of the resistance of the main circuit
- All test results are automatically stored

KEMA

CERTIFICATE

Number: 75954

The management system of:

Industrial Group Tavrida Electric
Moscow, Russian Federation
Sevastopol, Ukraine

including the implementation meets the requirements of the standard:

ISO 9001:2000

Scope:
the general management, design, projecting, testing, production, sales, retrofitting and service of indoor and outdoor medium voltage switchgear, vacuum circuit breakers, surge arresters, low voltage vacuum circuit breakers (max. 1kV) and retrofit kits and control devices for switchgear, including components parts for this equipment, in the organisations as listed in the addendum

The file that forms the basis of this certificate:
75954-QUA

This certificate is valid until: January 1, 2010

Issued for the first time: February 1, 1998

KEMA Quality B.V.

ir. P.J.J.G. Nabuurs
Managing Director

A.J.M. van Outheusden
Certification Manager

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KEMA Quality B.V. Utrechtseweg 310, 6812 AR Arnhem P.O. Box 5185, 6802 ED Arnhem The Netherlands
T +31 26 3 56 20 00 F +31 26 3 52 58 00 customer@kema.com www.kema.com Registered Arnhem 09085396
Experience you can trust.

Complaints and Transport Damage

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

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

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

Environmental Friendliness

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

Non-Conformity Report

In order to be able to exchange or repair the device, we kindly ask you to fill the accompanied “Non-conformity report” and send it to our regional representative or directly to us.

Please note:
Your request can only be fulfilled if the accompanying report is properly filled out and includes the name and address as well as a copy of the invoice.
For queries please contact your Tavrida Electric partner.

TAVRIDA ELECTRIC NA

Service Department
1105 Cliveden Avenue
Delta, BC, Canada
V3M 6G9

Phone: (604)-540-6600
Fax: (604)-540-6604
E-Mail: info@tavrida-na.com
Web: www.tavrida-na.com

Liability

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

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

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TAVRIDA ELECTRIC NA

Service Department
1105 Cliveden Avenue
Delta, BC, Canada
V3M 6G9
E-Mail: info@tavrida-na.com
Web: www.tavrida-na.com

NON-CONFORMITY REPORT

From:		**To:**	**TAVRIDA ELECTRIC NA** Service Department
Address:		Address:	1105 Cliveden Avenue
			Delta, BC
Name:			
Phone:		Phone:	604-540-6600
Fax:		Fax:	604-540-6604
E-Mail:		E-Mail:	info@tavrida-na.com

Type designation ISM	Serial No.:
Type designation CM	Serial No.:
Date when non-conformity was noticed:	Date of commissioning:
When did the non-conformity occur: ○ Incoming inspection ○ Installation/Commissioning ○ Service	Place of installation of CM/TEL: ○ Low voltage compartment of panel ○ High voltage compartment of panel ○ Separate control cubicle ○ Draw-out unit

Does your installation comply with the requirements of the Technical Manual:	
Primary Part (ISM): ○ Operating conditions of ISM comply with technical data specified in Technical Manual ○ Unsupported busbar length (page 21) ○ Fixing points (page 21) ○ Bolts and torques (pages 20, 21, 23) ○ Minimum clearances due to rated insulation voltage (page 22) ○ Minimum clearances due to electromagnetic influence (page 23) ○ Protective earthing (page 23)	Secondary part (CM): ○ Installation of CM (page 30) ○ Type of voltage and voltage level according to selected CM-type ○ Polarity of auxiliary power supply and selection of MCB (page 32) ○ Connection between CM and ISM (pages 33, 59, 60) ○ Selection and connection of interference suppressing filters (pages 33, 60)

Description of non-conformity:

How many blinks occured on Malfunction-LED of CM?

○ 1x ○ 2x ○ 3x ○ 4x ○ 5x ___ If other, how many blinks ○ No blink signal ○ Undefined signal

Did you investigate the reason of malfunction blink signal with the help of malfunction indication table (page 44) ?

○ Yes ○ No

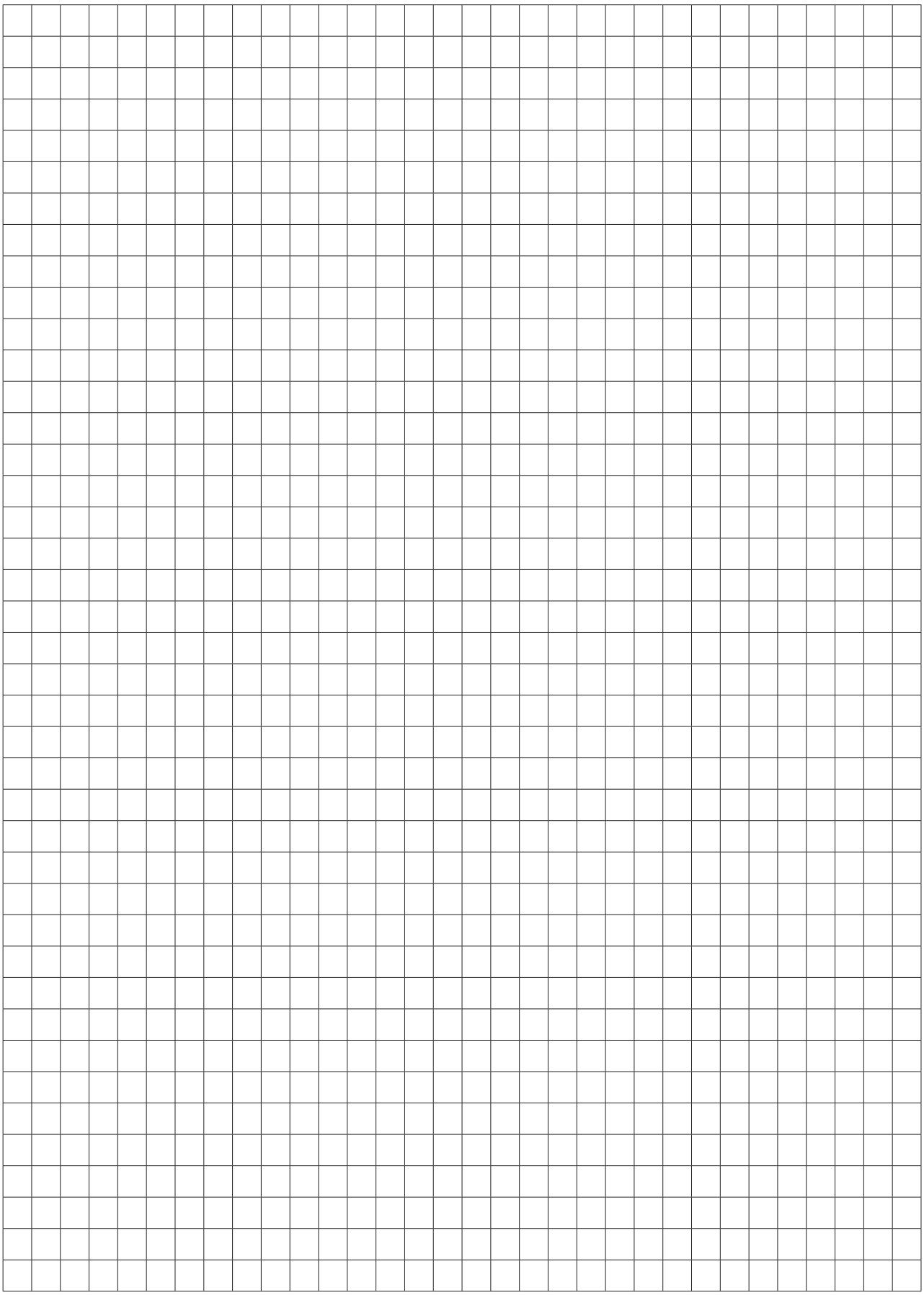
Non-conformity report issued by:

Date:	Name:	Signature:

Your warranty claim can only be handled if this non-conformity report is filled in completely including your name and address.

Date: _____

Date: _____



Date: _____

TAVRIDA ELECTRIC

Tavrida Electric North America

Tavrida Electric North America Ltd.
1105 Cliveden Avenue,
Delta, BC, Canada
V3M6G9
Phone: (604)-540-6600
Fax: (604)-540-6604
E-Mail: info@tavrida-na.com
Web: www.tavrida-na.com