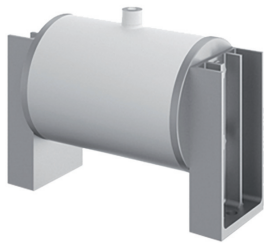


OPERATING INSTRUCTIONS

# Surge arresters

Types POLIM<sup>®</sup> and MWK/MWD



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# 1 About this document

These operating instructions are applicable to the POLIM® and MWK/MWD type surge arresters. These instructions describe the safe and proper use for all phases of operation. Language of the original operating instructions: English

## 1.1 Validity

These operating instructions are valid for all the POLIM® and MWK/MWD type surge arresters, with the exception of the POLIM-D .. PI-2/-3 plug-in type (separable) surge arresters. The operating instructions of POLIM-D .. PI-2/-3 are available in the document 1HC0019085.

Representative samples of the products are shown on the front page.

## 1.2 Target group




The target group of these operating instructions is professionals in the field of high-voltage technology.

Surge arresters may only be commissioned and maintained by persons instructed in the proper use and handling of the surge arresters.

# 2 Safety

## 2.1 Symbols and warnings

Important information and technical notes are emphasised in order to illustrate the correct operation.

Symbol	Meaning
	This is a warning sign. It warns you of the danger of injury or death and/or material damage. Follow all measures marked with such warning signs to avoid injuries, death and damage to materials.
	This sign warns you of the danger of death or serious injury from electric shocks. Follow all measures marked with such warning signs to avoid injuries and/or death.
	This mark indicates that an action is to be performed.

Warning signs in these operating instructions indicate special dangers and list measures for prevention of the danger. There are three levels of warning:

Warning word	Meaning
<b>DANGER</b>	Immediate, impending endangerment of your life and health
<b>WARNING</b>	Possible impending endangerment of your life and health
<b>CAUTION</b>	Possible impending danger of light injuries or damage to materials

Warnings are structured as follows:



### **WARNING WORD!**

**The type and source of the danger are listed here.**

Possible consequences, which could occur if the measures are not followed, are listed here.

► Measures for avoiding the danger are listed here.

## 2.2 Basic safety precautions

### 2.2.1 Product safety

The POLIM® and MWK/MWD type surge arresters have been constructed using state-of-the-art technology and officially recognised safety-related rules. However, while they are in use, danger to life and health of the user or third parties could arise, or damage of the surge arresters and other property could occur.

- ▶ The POLIM® and MWK/MWD type surge arresters are only to be used when they are in technically sound condition, for the intended purpose, and with safety and the possible dangers in mind while observing the operating instructions.
- ▶ Keep the operating instructions intact and fully readable, and store them in such a way that they are accessible to operating personnel at all times.
- ▶ Decommission and replace overloaded or damaged surge arrester units.

### 2.2.2 Personnel-related measures

- ▶ Train personnel in professional and safe working with high-voltage equipment.
- ▶ Train and instruct personnel in working on the POLIM® and MWK/MWD type surge arresters using the operating instructions.
- ▶ Personnel being trained, instructed or just provided with a general education may only work with the POLIM® and MWK/MWD type surge arresters under constant supervision by an experienced high-voltage technology professional.

### 2.2.3 Organisational measures

- ▶ Observe all safety- and danger-related information regarding the POLIM® and MWK/MWD type surge arresters.
- ▶ The safety rules of the owner of the high- and medium-voltage system and all regulations of the respective national safety authorities are to be observed.
- ▶ Only trained and instructed high-voltage technology professionals may be authorised to work independently with the POLIM® and MWK/MWD type surge arresters.
- ▶ Clearly assign areas of responsibility for working with the POLIM® and MWK/MWD type surge arresters. Make them known and adhere to them.
- ▶ Only personnel who have read and understood the operating instructions, especially the „Basic safety precautions“ section, may be allowed to carry out tasks with the POLIM® and MWK/MWD type surge arresters.
- ▶ Ensure that work is being performed in a safety-conscious way with awareness of possible dangers and while observing the operating instructions.

## 3 Description

### 3.1 Intended use

The POLIM® and MWK/MWD type surge arresters are intended for use in high-, medium- and low-voltage applications.

Surge arresters protect the insulation of devices against overvoltages which are caused by lightning or switching operations.

The manufacturer is not liable for resulting damages from further, unintended use. The operator accepts all responsibility for using the POLIM® and MWK/MWD type surge arresters outside of their intended application range as specified in this document or in the respective data sheet.

Note: MWD and POLIM® 4.5 ID surge arresters are designed for indoor use. All other POLIM® and MWK type surge arresters are suitable for use outdoors and indoors.

## 3.2 Structure and function

The POLIM® and MWK/MWD type surge arresters are constructed from metal-oxide (MO) resistors. These MO resistors have an extremely non-linear voltage-current characteristic. At the continuous operating voltage of  $U_c$ , the metal-oxide material acts almost as an insulator and only a small capacitive current will flow, which is in the mA range. With an increase in voltage, the MO resistors enter a low-ohmic state practically without delay. Thus, any further increase in voltage is limited to the specified residual voltage values. After the decline of the overvoltage, the arrester immediately turns back to the high-ohmic state. The surge arrester converts the energy of the surge into heat and transfers it to the surrounding air.

The stack of MO resistors and electrodes is held together with fiberglass-reinforced plastic elements. A directly molded silicone housing protects it against environmental influences.

Surge arresters may optionally be equipped with a disconnecting device. Such a device disconnects automatically the surge arrester from the power network in case of an overload.

## 3.3 Technical data

Performance characteristics, dimensions, weights and installation distances of the POLIM® and MWK/MWD type surge arresters are specified in the data sheets, see:

<https://new.abb.com/high-voltage/surge-arresters/medium-voltage-arresters>

The corresponding dimensional drawings of the products and/or their accessories are available on request.



### 3.3.1 Technical data on the surge arrester

Main characteristic data are partly molded into the silicone housing and partly engraved in the electrodes.

Note: AC surge arresters are not suitable for use in DC applications. DC surge arresters have a D at the end of their name.

Detailed information on this is given in the examples below:

<u>POLIM-D 10-04</u>	①	Type designation
① ② ③	②	$U_c$ in kV
<u>POLIM-C 1.8 ND</u>	③	Housing size
① ② ④ ⑤	④	Housing type designation
<u>POLIM-R 0.14-2ND</u>	⑤	Designation for special housing or DC type (D=DC, other letters refer to the housing, not used if AC and standard housing)
① ② ⑥ ④ ⑤	⑥	1: one MO resistor, 2: two parallel MO resistors
<u>MWK 24 K4</u>	⑦	Position only used in case of special housing (K4, KLL)
① ② ⑦		

Labeling	Meaning
$U_c = \dots$ kV	Continuous operating voltage $U_c$ in $kV_{rms}$ ; DC types: $U_c = U_r$
$U_r = \dots$ kV	Rated voltage $U_r$ in $kV_{rms}$ ; DC types: $U_c = U_r$
$I_n = \dots$ kA	Nominal discharge current $I_n$ in kA
$I_s = \dots$ kA	Rated short-circuit current $I_s$ for 0.2 sec in $kA_{rms}$
HA...	Serial number (8 digits; the 'HA' might be omitted for space reasons), also included in the QR code
20...	Year of manufacture
Class IEC DH (POLIM-D)	Designation of arrester classification
IEEE DIST Class HD (POLIM-D .. R)	
Class IEC SL (POLIM-K, MWK/MWD, POLIM-C AC types)	
Class IEC SL, SM or SH for POLIM-I, -S or -H, respectively	
DC-A/-B/-C	Charge transfer class (DC types only)

### 3.3.2 Application guidelines

The following guidelines apply for the use of surge arresters in medium-voltage systems and in railway applications:

- “Application guidelines Overvoltage protection: Dimensioning, testing and application of metal oxide surge arresters in medium-voltage systems”, document 1HC0075561
- “Application guidelines Overvoltage protection: Dimensioning, testing and application of metal oxide surge arresters in railway facilities”, document 1HC0075573

### 3.3.3 Recommended torques and screw-in depths

Thread	Arrester type	Position	Required torque [Nm]	Screw-in depth [mm]	
				min.	max.
<b>Material pairing: steel bolts class 8.8 in aluminum threads of arrester electrodes</b>					
M10	POLIM-H	support on grading ring (if present)	25	10	10
M10	POLIM-H SD	top connection	30	16	16
M10	POLIM-R	top connection	30	16	16
M10	POLIM-X	top connection	30	15	16
M12	MWK/MWD	top & bottom	50	18	23.5
M12	POLIM-C	top connection	50	16	20
M12	POLIM-C	bottom connection	50	16	16
M12	POLIM-C .. LB	top & bottom	30	–	–
M12	POLIM-D/-K/4.5 ID	top connection	50	20	25
M12	POLIM-D/-K	bottom connection	50	20	20
M12	POLIM-D without lug	top connection	50	17	17
M12	POLIM-D without lug	bottom connection	50	12	12
M12	POLIM-I	top & bottom	50	14	14
M12	POLIM-H	top & bottom	50	14	20
M12	POLIM-X	bottom connection	50	18	25
M16	POLIM-I/-S/-H	top connection	100	25	25
M16	POLIM-I/-S/-H	bottom connection	100	25	40
M16	POLIM-X	top connection	100	23	24
M16	POLIM-X	bottom connection	100	23	25
<b>Attachment of a disconnecting device (POLIM-D/-K only)</b>					
M10 & M12	POLIM-D/-K disconnecter	threads at the disconnecting device	20	–	–
<b>Material pairing: steel bolts and steel nuts class 8.8 of some clamping accessories</b>					
M6			10		
M8			25		
M10			50		
M12			75		
M16			160		

### 3.3.4 Behaviour in fire

The silicone housing of POLIM® and MWK/MWD type arresters is self-extinguishing.

## 4 Transporting, unpacking and storage

### 4.1 Transporting

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#### CAUTION!

##### Surge arresters not secured during transportation

Damage to surge arresters that have fallen during transport.

- ▶ Secure the surge arresters against sliding or falling before transportation.
  - ▶ Observe the safety precautions printed on the packaging for proper handling during transportation and storage.
  - ▶ Don't expose the disconnectors or surge arresters equipped with disconnecting devices to temperatures above +60 °C (for exceptions, see specific product documentation).
- 

### 4.2 Unpacking

The surge arresters provided are packaged in sturdy cardboard boxes or wooden crates. If accessories are included in the order, the surge arresters are supplied with accessories installed. If specifically requested, accessories are packaged separately in plastic bags and are either included in the cardboard box or wooden crate or supplied separately in case of large quantities.

The routine test reports for the final electrical inspection are included in the packaging material.

- ▶ After receiving the shipment, compare the order and delivery documents immediately to check for completeness and correctness of the shipment.
- ▶ In case of incompleteness or deviations, inform the supplier and shipper immediately.

Packaging material is one-way unless stated otherwise. It shall be disposed of or recycled according to local regulations.

---



#### WARNING!

##### Damaged surge arresters

Material damage and personal injury due to the installation and commissioning of damaged surge arresters.

- ▶ Do **not** use damaged surge arresters.
  - ▶ Examine shipment immediately to check for damage.
  - ▶ Immediately notify the insurance company, the shipper and the supplier of the damage and create a damage log.
- 

### 4.3 Storage

The original packaging materials can be used for storage.

- ▶ Store the surge arresters in a well-ventilated, clean room.
- ▶ Remove the plastic film to prevent the formation of condensation water.
  - Storage temperature: -40 ... 70 °C
  - Storage temperature for disconnectors or surge arresters equipped with disconnecting devices: -40 ... 60 °C (for exceptions, see specific product documentation).



# 5 Commissioning

## 5.1 Safety



### **DANGER!**

#### **System uses high-voltage**

Electric shock may cause death, serious injury and damage to the system.

- ▶ Allow only authorised professionals to perform work on the surge arrester.
- ▶ Observe the safety rules of EN 50110-1 or equivalent local standards on the “Operation of Electrical Installations” before working on the system:
  - Disconnect the system from the power supply.
  - Secure the system against being switched on again.
  - Ensure that the system is de-energised.
  - Ground the system and short-circuit it.
  - Cover or cordon off neighbouring energised parts.

## 5.2 Electrical checking before commissioning

Each POLIM® and MWK/MWD surge arrester is tested by the manufacturer. The log of the electrical test is included with the packaging.

Additional electrical testing before commissioning is not necessary.

## 5.3 Installation location and protective distance



### **DANGER!**

#### **Danger of fire and injury due to arc and ejected parts when electrically overloading the surge arrester and when the disconnecting device, if installed, is disconnecting the surge arrester**

Ignition of flammable materials by an arc or ejected hot parts

- ▶ Do not store flammable materials near the surge arrester.
- ▶ When working near a surge arrester, do not wear easily flammable clothing.

Surge arresters only protect high-voltage apparatuses when they are located within the protective distance, as defined in the surge arrester application guidelines (see chapter 3.3.2 above).

- ▶ Always mount surge arresters as close as possible to the apparatus to be protected within the protective distance. The length of the connection cables is decisive here.
- ▶ If in doubt, calculate the protective distance according to the formulas in the surge arrester application guidelines (see chapter 3.3.2 above).

Additionally, for surge arresters equipped with disconnecting devices, the following applies:

- ▶ Use surge arresters equipped with a disconnecting device in outdoor installations only.
- ▶ Use the disconnecting device with the intended surge arrester only. The disconnecting devices are different for each surge arrester type.
- ▶ Ensure that a safe insulating distance will be created and maintained between the connection lead and the disconnecting device in case of disconnection.



## 5.4 Mounting

### 5.4.1 System voltage

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#### **WARNING!**

##### **Surge arrester connected to the system during insulation tests**

The test voltage applied to the equipment during insulation tests may damage the surge arrester.

- ▶ Disconnect surge arrester from the system during insulation tests.
- 



#### **CAUTION!**

##### **Incorrect system voltage or technical data**

Damage to the system and the surge arrester. The test voltage applied to the equipment during insulation tests may damage the surge arrester.

- ▶ Do not use surge arresters intended for AC systems in DC systems.
  - ▶ Consult the manufacturer for the application of surge arresters intended for DC systems in AC systems.
  - ▶ Observe the “Application guidelines” as mentioned in chapter 3.3.2 above.
  - ▶ Before mounting, ensure that the characteristic data on the surge arrester matches the requirements of the power system.
  - ▶ Ensure that the system voltage applied at the terminals of the arrester does not exceed the continuous operating voltage  $U_c$  of the surge arrester.
- 

### 5.4.2 Connections

The top end is generally intended for connection to the high-voltage and the foot end/floor plate is generally to be connected to the system ground.

The base or foundation for the surge arrester must be flat, clean and suitable for the loads that arise.

The following parts made of stainless or galvanised steel are to be provided by the customer depending on the application:

- Bolts
- Foundation bolts
- Nuts
- Bolt locks
- Any required balancing washers

The ordered mounting accessory is already mounted to the surge arrester in most cases. If the mounting accessory has been ordered and delivered separately, it must be mounted according to the enclosed instruction, data sheet or dimension drawing.

The use of a counter tool at the same electrode is advised when accessories are tightened to the top or bottom connection.

Furthermore, it is recommended to use a flexible connection on one terminal of the surge arrester to minimise mechanical stress on the active part.

Careful consideration of the potential consequences associated with the installation of a surge arrester as a supporting post is necessary.

#### **Surge arrester without disconnecting device**

- ▶ Ensure selection of suitable material pairs.
- ▶ Connect the earth conductor to the ground terminal of the surge arrester.
- ▶ Connect the high-voltage conductor to the high-voltage terminal of the surge arrester.
- ▶ Observe the recommended torques and the screw-in depths (see chapter 3.3.3).
- ▶ When tightening a bolt, the torque must be countered by a spanner at the same terminal to minimise torque or bending forces on the surge arrester.
- ▶ Carefully clean the contact surfaces before mounting and lubricate with acid-free contact grease.

## Surge arrester with disconnecting device



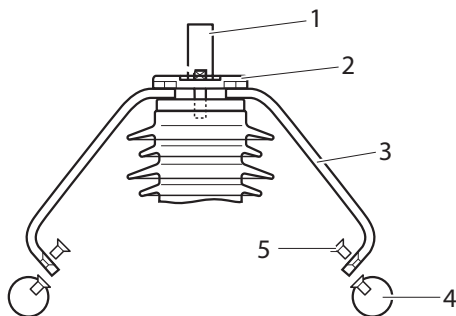
### DANGER!

#### Tripping of disconnecting device

Risk of injury due to inappropriate handling.

- ▶ Do not expose the disconnecting device to temperatures above 60 °C (for exceptions, see specific product documentation).
  - ▶ Never try to open the disconnecting device.
  - ▶ Do not connect any voltage/energy source to the terminals of the disconnecting device.
- 
- ▶ Mount the insulating bracket at vertical surface (wall, column, tower).
  - ▶ Use a flexible connection between disconnecter and earth.
  - ▶ Connect the earth conductor to the stud of the disconnecting device.

### 5.4.3 Mounting grading ring (POLIM-I, -S, -H only)



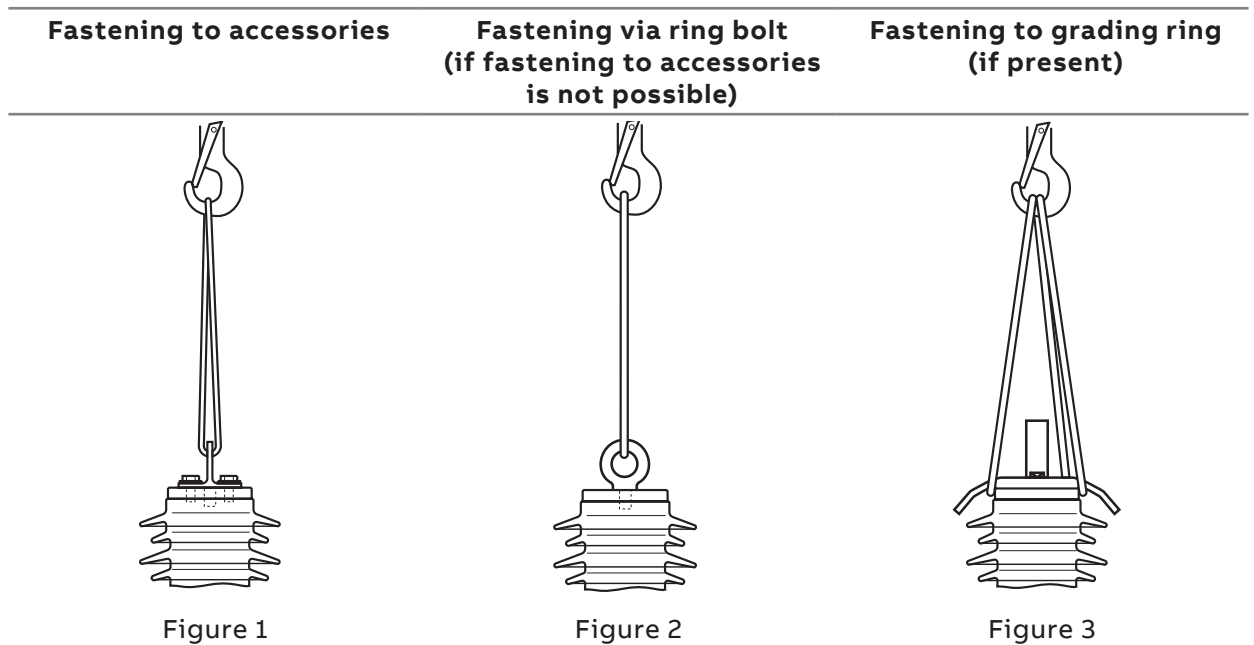
- 1 Connection bolt
- 2 Cover
- 3 Support
- 4 Grading ring
- 5 Countersunk screw

If your surge arrester has a grading ring, you must mount the grading ring.

- ▶ Ensure that the surge arrester cannot topple over.
- ▶ Place the grading ring (4) over the surge arrester with the mounting holes towards the top.
- ▶ Screw out the connection bolt (1) approx. 11 mm with a fork wrench.
- ▶ Lift the cover (2) slightly.
- ▶ Place the three supports (3) of the grading ring into the intended cut-outs between cover (2) and surge arrester.
- ▶ Screw in the connection bolt (1) with a fork wrench, but do not tighten it yet.
- ▶ Screw the grading ring (4) onto the supports with countersunk screws M10 (5).
- ▶ Tighten the connection bolt (1) to a torque of 100 Nm.
- ▶ Tighten the countersunk screws (5) at the grading ring to a torque of 25 Nm.

#### 5.4.4 Transportation during mounting

Depending on weight and installation location of the surge arrester, a crane may be necessary for mounting. The crane ropes can be fastened in the following ways, depending on the surge arrester model:



##### Fastening to accessories

- ▶ Hook the rope as shown in Figure 1.

##### Fastening via ring bolt

- ▶ Remove top accessories from surge arrester.
- ▶ Screw the ring bolt into threaded hole M16x25.
- ▶ Hook the rope as shown in Figure 2.

##### Fastening to grading ring

- ▶ Hook the three ropes in the three supports of the grading ring and the hook of the crane as shown in Figure 3.

#### 5.4.5 Installation position

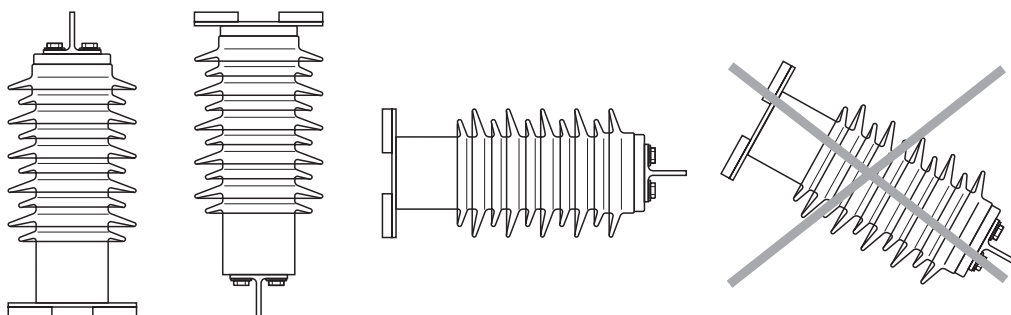


##### CAUTION!

##### Deposits on the undersides of sheds

Conductivity of deposits hinders protective function of the POLIM® and MWK/MWD type surge arresters.

- ▶ Always mount surge arresters in a way that the sheds point downward.



The top and bottom connections could be either ground or high-voltage terminals as long as the sheds point downwards. In case of doubt please consult ABB.

## 5.4.6 Distances between surge arresters and earth

The recommended distances between the surge arresters and the earth are specified on the data sheets supplied with the quotation or order confirmation. The values are based on calculations for unfavourable conditions and include safety margins.

- ▶ Observe national regulations and the rules of the system owner.

### Surge arrester with disconnecting device

- ▶ Ensure that the mounting position of a surge arrester equipped with a disconnecting device is such that a disconnected earth wire can swing freely and in this case no flash over will occur between the bottom connection and earth.

## 5.4.7 Earthed installation

If no surge arrester monitoring devices such as surge counters and/or milliammeters were supplied, the POLIM® and MWK/MWD type surge arresters are to be mounted earthed.

- ▶ Bolt surge arresters directly to the earthed frame or foundation. Use the centering washers (if supplied) when fixing the mounting plate.
- ▶ Connect the earth connection of the surge arrester to its base plate tap.

### Earthed installation of POLIM 4.5 ID

The POLIM®4.5 ID surge arrester is to be mounted earthed.

- ▶ Mount the metallic side bars of the surge arresters directly to the earthed frame.
- ▶ Connect both side bars of the surge arrester to earth.
- ▶ Use flexible connection and connect the high-voltage connection with the top terminal of the surge arrester.
- ▶ Observe recommended torques (see chapter 3.3.3 above).
- ▶ Carefully clean contact surfaces before mounting and lubricate them with acid-free contact grease.
- ▶ Ensure selection of suitable material pairs.

## 5.4.8 Insulated installation

If surge arrester monitoring devices such as surge counters and/or milliammeters were supplied, the POLIM® and MWK/MWD type surge arresters are to be mounted insulated.

- ▶ Mount surge arresters with the included loose insulators made of cast resin on the earthed frame or foundation according to the dimensional drawing.
- ▶ Mount monitoring devices according to the respective mounting instructions.

### Monitoring devices with analogue display

Monitoring devices with analogue display are connected in series to the surge arrester between the base plate and the ground connection.

- ▶ Attach the cable connector of the monitoring devices to the base plate tap of the surge arrester.
- ▶ Select a cable or conductor for the connector cable with the same diameter and material as used for the earth connection.
- ▶ Connect the earth connection to the earth tap of the monitoring devices.

### Digital monitoring devices

Installation of digital monitoring devices is described in their respective operating instructions.

## 5.5 Earthing

- ▶ Observe national regulations and the requirements of the system owner.
- ▶ Connect surge arresters to the system ground via the shortest path. Carefully clean contact surfaces before mounting and lubricate them with acid-free contact grease.
- ▶ Ensure selection of suitable material pairs.
- ▶ Observe recommended cross-sections:

Surge arrester type	Recommended cross-section for copper [mm <sup>2</sup> ]	Recommended cross-section for aluminum [mm <sup>2</sup> ]
MWK/MWD, POLIM-C..N, -C..ND, -C..LB	35	70
POLIM-R POLIM-D	70	95
POLIM-C..HD POLIM-H..ND, -H..SD	70	120
POLIM-I POLIM-X POLIM 4.5 ID	95	150
POLIM-K POLIM-S	120	240
POLIM-H..N		

### Surge arrester with disconnecting device

- ▶ Ensure that a surge arrester equipped with a disconnecting device meets the following requirements:
  - The disconnecter must be connected to earth with a flexible connection.
  - One side of the earth wire must be connected to the disconnecting device, the other side must be connected to the earth near the mounting position of the insulating bracket.
  - In case of disconnection, ensure that the disconnected earth wire can swing freely and that no flash over will occur between the bottom connection and earth (see chapter 5.4.6).

## 6 Maintenance

The surge arresters do not contain wearing parts and are therefore maintenance-free. Replacement parts are not needed.

We recommend to check the surge arresters visually on a regular basis for damages and the clamps of surge arrester terminals for loose connections.

### 6.1 Safety



#### **DANGER!**

#### **System uses high-voltage**

Electric shock may cause death, serious injury and damage to the system.

- ▶ Allow only authorised professionals to perform work on the surge arrester.
- ▶ Observe the safety rules of EN 50110-1 or equivalent local standards on the “Operation of Electrical Installations” before working on the system:
  - Disconnect the system from the power supply.
  - Secure the system against being switched on again.
  - Ensure that the system is de-energised.
  - Ground the system and short-circuit it.
  - Cover or cordon off neighbouring energised parts.

## 6.2 Cleaning in case of heavy pollution

Thanks to the hydrophobicity of the silicone housing, normal pollution does not affect the insulation capacity of the housing. In case of excessive pollution (heavy deposit layer) the surge arrester should be de-energised and then cleaned (see chapter 6.1 for safety precautions).



### CAUTION!

#### Solvents and abrasive equipment

Damage to the silicone housing

- ▶ Do not use cleaning agents containing solvents other than isopropanol.
- ▶ Do not use abrasive equipment for cleaning.
- ▶ Do not use silicone grease or silicone oil after cleaning.
- ▶ Do not immerse the entire surge arrester into a cleaning bath.
- ▶ Clean the surge arresters either with:
  - Warm water and soft, lint-free cloths,
  - Water spray with a maximum pressure of 400 kPa,
  - Soft, lint-free cloths moistened with isopropanol (isopropyl alcohol).
- ▶ Clean the entire silicone surface.

## 6.3 Replacement after overloading or damages caused by animals

Overloading during operation can lead to damaging (e.g. traces of fire, fractures) of the surge arrester from arcs.

Minimal animal bites on the sheds of the silicone housing (e.g. by birds, martens, mice etc.) do not impair the functioning of the surge arrester. However, heavy bites do reduce the insulation capacity of the silicone housing.



### CAUTION!

#### Damage to the surge arrester

Damaged surge arresters no longer protect the equipment.

- ▶ Check the surge arresters visually on a regular basis to ensure that they are in sound condition.
  - ▶ Replace damaged surge arresters.
  - ▶ Replace the surge arresters when the disconnecting device has operated.
- 
- ▶ Keep a small quantity of surge arresters in reserve.

## 6.4 Disconnecting device

The disconnecting device, if installed, does not need any maintenance.



### DANGER!

#### Tripping of disconnecting device

Risk of injury due to inappropriate handling.

- ▶ Do not expose the disconnecting device to temperatures above 60 °C (for exceptions, see specific product documentation).
- ▶ Never try to open the disconnecting device.
- ▶ Do not connect any voltage/energy source to the terminals of the disconnecting device.

# 7 Disposal

POLIM® and MWK/MWD type surge arresters are environmentally-friendly products. They must be disposed of in accordance with regional environmental regulations. Their materials are suitable for recycling.

Constituent components are:

- Silicone rubber (not halogenated) for the external insulation
- Terminals and other parts made of aluminium
- Metal-oxide resistors
- Fibreglass-reinforced plastic lugs
- Steel mounting hardware

## **Silicone rubber (not halogenated)**

The silicone rubber can decompose into  $\text{SiO}_2$  and  $\text{CO}_2$ , thus uncovering the encased metal-oxide resistors.

## **Metal-oxide resistors**

The metal-oxide resistors are sintered ceramic bodies composed mainly of ZnO (90%). In accordance with the rules of the European Union for hazardous substances, with reference to the Regulation (EC) 1272/2008 on classification, labeling and packaging of substances and mixtures, and the Directive 2008/98/EC on waste, the following other substances are present in the metal-oxide resistors:

- $\text{Bi}_2\text{O}_3$  >1% by weight
- $\text{Sb}_2\text{O}_3$ ,  $\text{Co}_2\text{O}_3$ , NiO,  $\text{Cr}_2\text{O}_3$  >0.1% by weight

After the sinter production process, these oxides are part of a new composition within the ZnO-resistor ceramic bulk material, which is chemically bonded. No exposition occurs. In addition, the metal-oxide resistors are coated with a thin glass layer (<0.1% by weight) containing PbO.

A leaching test, according to the Council Decision of 19 December 2002 and directive 1999/31/EC on acceptance of waste at landfills, has therefore been performed. The test is much more arduous than reality since the test is performed with material in ground form. Despite this, all substances listed in the Council Decision of 19 December 2002, except Pb, fulfilled the criteria for inert non-hazardous waste. It is very likely that a test performed on metal-oxide resistor blocks, parted but not ground, would fulfil the criteria for inert non-hazardous waste for all substances.

No danger to personal health or to the environment is present if disposed of properly.

## **Constituent components of the disconnecting device**

- Terminals and metallic parts made of aluminium
- Enclosure made of thermoset material
- Small propellant charge

If the disconnecting device has not been damaged it can be assumed that the small propellant charge had not been tripped. In this case, the disconnecting device must be disposed of as hazardous waste according to the local laws and regulations. Do not open the disconnecting device.

Tripped disconnecting devices can be recycled or disposed of as non-hazardous waste.



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