Operating instructions

Surge arrester

Type MVR
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1 About this document
These operating instructions are part of the MVR surge arrester and describe safe and proper use for all phases of operation.
Language of the original operating instructions: German

1.1 Validity
These operating instructions are valid only for the MVR surge arrester.

1.2 Target group
The target group of these operating instructions is professionals in the field of high-voltage technology. The MVR may only be commissioned and maintained by persons instructed in proper use and handling.

2 Safety

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

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Safety Sign]</td>
<td>This is a safety sign. It warns you of the danger of injury and material damage. Follow all measures marked with the safety sign to avoid injuries, death and damage to materials.</td>
</tr>
<tr>
<td>![Warning Sign]</td>
<td>This safety sign warns you of the danger of death or serious injury from electric shocks. Follow all measures marked with the safety sign to avoid injuries and death.</td>
</tr>
</tbody>
</table>

This mark indicates that an action is to be performed.

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

<table>
<thead>
<tr>
<th>Warning word</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>DANGER</td>
<td>Immediate, impending endangerment of your life and health</td>
</tr>
<tr>
<td>WARNING</td>
<td>Possible impending endangerment of your life and health</td>
</tr>
<tr>
<td>CAUTION</td>
<td>Possible impending danger of light injuries or damage to materials</td>
</tr>
</tbody>
</table>

Warnings are structured as follows:

**WARNING WORD!**
The type and source of danger appear here.
Possible consequences, which could occur if the measures are not followed, appear here.
- Measures for avoiding the danger appear here.
2.2 Basic safety precautions

2.2.1 Product safety

The MVR has been constructed using state-of-the-art technology and officially recognised safety-related rules. Danger to life and health of the user or third parties could arise or damage of the MVR and other property could occur while the MVR is in use, however.

- The MVR is only to be used when it is 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 MVR units.

2.2.2 Personnel-related measures

- Train personnel in professional and safe working with high-voltage technology.
- Train and instruct personnel in working on the MVR using the operating instructions.
- Personnel being trained, instructed or provided with general education may only work with the MVR under constant supervision by an experienced high-voltage technology professional.

2.2.3 Organisational measures

- Observe all safety- and danger-related information regarding the MVR.
- 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 professionals may be authorised.
- Clearly assign areas of responsibility for working with the MVR. 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 activities with the MVR.
- Check to 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 MVR is a surge arrester intended for use in low- and medium-voltage applications. Surge arresters protect the insulation of devices against unacceptable over-voltages 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 MVR outside of its intended application range as specified in this document.

3.2 Structure and function

The MVR surge arrester is constructed from one or more non-linear metal-oxide (MO) resistors. These MO resistors have an extremely non-linear resistance property. At the maximum operating voltage of $U_c$, only a small capacitive current will flow in the mA range. With an increase in voltage, the MO resistors enter a highly-conductive 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 non- or slightly-conductive state. The MO arrester converts the energy of the surge into heat, which it transfers to the surrounding air.
The MO-resistor or stack of MO resistors is connected with the terminals. The directly molded PUR housing protects it from all environmental and weather influences. This design has proven to be the best solution in every environment for years.

The MVR is especially suited for overvoltage protection of:
- transformers
- cables and cable sheath
- capacitors
- other low- and medium-voltage apparatuses and systems

The surge arresters MVR 0.44 ... 0.80 K5/K10 are suitable for the use in a.c. and d.c. systems.

The surge arresters MVR 1.0 ... 6.6 G5/G10 are suitable for the use in a.c. systems, only.

3.3 Technical data

The technical data, dimensions, weights and installation distances are specified in the following documents:
- surge arresters MVR 0.44 ... 0.80 K5 in the pamphlet 1HC0076311
- surge arresters MVR 0.44 ... 0.80 K10 in the pamphlet 1HC0093989
- surge arresters MVR 1.0 ... 6.6 G5 in the pamphlet 1HC0093990
- surge arresters MVR 1.0 ... 6.6 G10 in the pamphlet 1HC0093991

3.3.1 Technical data on the surge arrester

The rating plate molded in PUR for MVR 0.44 ... 0.80 K5/K10 contains the following data:

<table>
<thead>
<tr>
<th>Data</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>MVR ... K..</td>
<td>Type designation</td>
</tr>
<tr>
<td>K5 for $I_n = 5$ kA</td>
<td></td>
</tr>
<tr>
<td>K10 for $I_n = 10$ kA</td>
<td></td>
</tr>
<tr>
<td>... V AC</td>
<td>Maximum permissible continuous operating voltage $U_c$ for a.c. applications</td>
</tr>
<tr>
<td>... V DC</td>
<td>Maximum permissible continuous operating voltage $U_c$ for d.c. applications</td>
</tr>
<tr>
<td>20xx</td>
<td>Year of manufacture</td>
</tr>
</tbody>
</table>

The rating plate molded in PUR for MVR 1 ... 6.6 G5/G10 contains the following data:

<table>
<thead>
<tr>
<th>Data</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>MVR ... G..</td>
<td>Type designation</td>
</tr>
<tr>
<td>G5 for $I_n = 5$ kA</td>
<td></td>
</tr>
<tr>
<td>G10 for $I_n = 10$ kA</td>
<td></td>
</tr>
<tr>
<td>$U_c$ ... kV</td>
<td>Maximum permissible continuous operating voltage $U_c$ for a.c. applications</td>
</tr>
<tr>
<td>$U_r$ ... kV</td>
<td>Rated voltage $U_r$ for a.c. applications</td>
</tr>
<tr>
<td>$I_n$ ... kA</td>
<td>Nominal discharge current $I_n$</td>
</tr>
<tr>
<td>123456</td>
<td>Identification number (optional)</td>
</tr>
<tr>
<td>20xx</td>
<td>Year of manufacture</td>
</tr>
</tbody>
</table>

3.3.2 Application guidelines

The following guidelines apply for the use of MVR surge arresters:
- „Application guidelines - Overvoltage protection“ Dimensioning, testing and application of metal-oxide surge arresters in medium voltage systems, pamphlet 1HC0075561

3.3.3 Behaviour in fire

The PUR housing of the surge arrester is not self-extinguishing.
4 Transportation, Unpacking and Storage

4.1 Transportation

**CAUTION!**

**Improper handling during transportation.**
Damage to surge arresters due to improper handling.
- Observe safety precautions printed on the packaging for proper handling during transportation and storage.
- Secure surge arresters against falling before transportation.

4.2 Unpacking

The surge arresters provided are packaged in stable cardboard boxes or wooden crates.
The routine test report for the final electrical inspection is included in the packaging material.
- After receiving the shipment, compare the order and delivery documents immediately to check for completeness and accuracy of the shipment. In case of incompleteness or deviations, inform the supplier and shipper immediately.

**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.
- Notify the insurance company, the shipper and the supplier of the damage immediately and create a damage log.

4.3 Storage

The original packaging materials can be used for storage.
- Store surge arresters in a well-ventilated, clean room.
- Remove plastic film to prevent the formation of condensation water.
- Storage temperature: -40 ... +60°C
5 Commissioning

5.1 Safety

DANGER!
System uses high voltage.
Death, serious bodily harm and damage to the switching gear may result from an electric shock.

- Allow only authorised professionals to perform work on the surge arrester.
- Observe the safety rules of EN 50110-1 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 deenergised.
  - Earth the system and short-circuit it.
  - Cover or cordon off neighbouring energised parts.

5.2 Electrical check before commissioning

Each surge arrester is tested by the manufacturer. Additional electrical testing before commissioning is not necessary.

5.3 Installation location and protective distance

DANGER!
Danger of fire and injury with overloading of the surge arrester.
Danger of injury from bursting plastic and flying (housing) parts.

- Mount the surge arrester with a suitable cover or in a safe distance.
- Ignition of flammable materials by an arc and flying burning parts.
- Do not store flammable materials near the surge arrester.
- When working near the surge arrester, do not wear easily flammable clothing.

Surge arresters only protect medium-voltage and low-voltage apparatuses when they are located within the protective distance. The protective distance is only a few meters.

- Always mount surge arresters as close as possible to the apparatus to be protected within the protective distance. The length of the connecting cables are decisive here.
- In cases of doubt, calculate the protective distance according to the formulas in the „Application guidelines“.
5.4 Mounting

5.4.1 System voltage

**CAUTION!**

**Damage to the surge arrester during insulation test.**
The surge arrester may be overloaded (damaged) if it is mounted during the insulation test of the system.
- Disconnect surge arrester from switchgear during insulation tests.

**CAUTION!**

**Incorrect system voltage.**
Damage to the switching gear and the surge arrester.
- Do not use surge arresters MVR 1.0 … 6.6 G5/G10 intended for a.c. systems in d.c. systems.
- Observe the „Application guidelines“ from ABB Switzerland Ltd.
- Before mounting, ensure that the characteristic data on the rating plate of 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 maximum permissible continuous operating voltage of the surge arrester.

5.4.2 Installation position

**CAUTION!**

**Deposits on the undersides of sheds.**
Conductivity of deposits hinders protective function of the MVR 1.0 … 6.6 G5/G10.
- Always mount surge arresters in such a way that the sheds point downward.

MVR 0.44 … 0.8 K5/K10 can be mounted in each position.

5.4.3 Minimum distances between surge arresters and earth

- Observe national regulations and the rules of the system owner regarding minimum permissible distances between the surge arresters and the earth.
- Mount the surge arrester with a suitable cover or in a safe distance.

5.4.4 Connections

The following materials made of stainless or galvanised steel are to be provided by the customer:
- bolts
- nuts
- washers
- bolt locks

The design of the surge arrester MVR is symmetrical.
- Connect one terminal of the surge arrester with earth.
- Connect the high voltage connection with the other terminal of the surge arrester. Use a stranded cable.
- Carefully clean contact surfaces before mounting and lubricate with acid-free contact grease.
- Ensure selection of suitable material pairs
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 with acid-free contact grease.
- Observe recommended minimum diameters:
  - Copper dia. 20 mm²
  - Aluminum dia. 40 mm²
6 Maintenance, Upkeep

6.1 Safety

DANGER!
System uses high voltage.
Death, serious bodily harm and damage to the switching gear may result from an electric shock.

- Allow only authorised professionals to perform work on the surge arrester.
- Observe the safety rules of EN 50110-1 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 deenergised.
  - Earth the system and short-circuit it.
  - Cover or cordon off neighbouring energised parts.

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

6.2 Replacement after overloading

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

CAUTION!
Damage to the surge arrester.
Damaged surge arresters no longer protect the switchgear.

- Check the surge arresters visually on a regular basis to ensure that they are in sound condition.
- Replace damaged surge arresters.

- Keep a small percentage of installed surge arresters in reserve.
MVR surge arresters are environmentally-friendly products which must be disposed of based on the respective applicable regional regulations in an environmentally-friendly manner. The materials should be given up for recycling.

Constituent components are:
- PUR for the external insulation
- terminals and other parts made of steel or aluminium
- metal-oxide varistors

**PUR (polyurethane)**

PUR can break down into CO₂ and NOₓ, thus uncovering the encased metal-oxide varistors.

**Metal-oxide varistors**

The metal-oxide varistors are sintered ceramics consisting of about 90% of ZnO. The following additions are also contained within:
- percent by weight between 1 and 4%: Bi₂O₃ and Sb₂O₃, which are considered to be dangerous substances according to EU ordinances
- percent by weight between 0.1 and 1%: NiO and Cr₂O₃, which are considered poisonous and dangerous materials pursuant to EU guideline 91/689/EEC

Metal-oxide varistors are coated with a thin glass coating containing lead-oxide (<0.1% of the weight of the metal-oxide varistor).

The substances are ligated as a mixed oxide in metal-oxide varistors. A wash-out test in accordance with an EPA specification (Federal Register/vol. 45, No 98 /Rules and regulations) has shown that the sintered metal-oxide varistors can be disposed of as industrial waste without infringing on EEC guidelines.

No danger to personal health or the environment is present during normal operation.
For more information please contact:

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[www.abb.com/arrestersonline](http://www.abb.com/arrestersonline)

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