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1 Introduction

This technical document contains detailed descriptions on the safe and proper installation, connection, commissioning and monitoring of the product.

It also includes safety instructions and general information about the product.

This technical document is intended solely for specially trained and authorized personnel.

1.1 Manufacturer

The product is manufactured by:

Messko GmbH

Gewerbegebiet An den Drei Hasen
Messko-Platz 1
61440 Oberursel
Germany

Phone: +49 6171 6398-0
Fax: +49 6171 6398-98
E-mail: messko-info@reinhausen.com
Internet: www.reinhausen.com/messko

Further information on the product and copies of this technical document are available from this address if required.

1.2 Subject to change without notice

The information contained in this technical file comprises the technical specifications approved at the time of printing. Significant modifications will be included in a new edition of the technical file.

The document number and version number of this technical file are shown in the footer.

1.3 Completeness

This technical document is incomplete without the supporting documents.
1 Introduction

The following documents apply to this product:
- Operating instructions
- Test certificate

1.4 Safekeeping

Keep this technical file and all supporting documents ready at hand and accessible for future use at all times.

1.5 Notation conventions

This section contains an overview of the symbols and textual emphasis used.

1.5.1 Hazard communication system

Warnings in this technical file are displayed as follows.

1.5.1.1 Warning relating to section

Warnings relating to sections refer to entire chapters or sections, sub-sections or several paragraphs within this technical file. Warnings relating to sections use the following format:

⚠️ WARNING

Type and source of danger

Consequences

- Action
- Action

1.5.1.2 Embedded warning information

Embedded warnings refer to a particular part within a section. These warnings apply to smaller units of information than the warnings relating to sections. Embedded warnings use the following format:

⚠️ DANGER!

Instruction for avoiding a dangerous situation.
1.5.1.3 Signal words and pictograms

The following signal words are used:

<table>
<thead>
<tr>
<th>Signal word</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>DANGER</td>
<td>Indicates a hazardous situation which, if not avoided, will result in death or serious injury.</td>
</tr>
<tr>
<td>WARNING</td>
<td>Indicates a hazardous situation which, if not avoided, could result in death or serious injury.</td>
</tr>
<tr>
<td>CAUTION</td>
<td>Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.</td>
</tr>
<tr>
<td>NOTICE</td>
<td>Indicates measures to be taken to prevent damage to property.</td>
</tr>
</tbody>
</table>

Table 1: Signal words in warning notices

Pictograms warn of dangers:

<table>
<thead>
<tr>
<th>Pictogram</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>!</td>
<td>Warning of a danger point</td>
</tr>
<tr>
<td>!</td>
<td>Warning of dangerous electrical voltage</td>
</tr>
<tr>
<td>!</td>
<td>Warning of combustible substances</td>
</tr>
</tbody>
</table>
1 Introduction

<table>
<thead>
<tr>
<th>Pictogram</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Warning of a tipping hazard" /></td>
<td>Warning of a tipping hazard</td>
</tr>
<tr>
<td><img src="image" alt="Warning of a hot surface" /></td>
<td>Warning of a hot surface</td>
</tr>
</tbody>
</table>

Table 2: Pictograms used in warning notices

1.5.2 Information system

Information is designed to simplify and improve understanding of particular procedures. In this technical file it is laid out as follows:

Important information.

1.5.3 Instruction system

This technical file contains single-step and multi-step instructions.

Single-step instructions

Instructions which consist of only a single process step are structured as follows:

Aim of action
✓ Requirements (optional).
► Step 1 of 1.
  ⇒ Result of step (optional).
  ⇒ Result of action (optional).

Multi-step instructions

Instructions which consist of several process steps are structured as follows:
1 Introduction

Aim of action
✓ Requirements (optional).

1. Step 1.
   ⇒ Result of step (optional).

2. Step 2.
   ⇒ Result of step (optional).
   ⇒ Result of action (optional).

1.5.4 Typographic conventions

The following typographic conventions are used in this technical file:

<table>
<thead>
<tr>
<th>Typographic convention</th>
<th>Purpose</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>UPPERCASE</td>
<td>Operating controls, switches</td>
<td>ON/OFF</td>
</tr>
<tr>
<td>[Brackets]</td>
<td>PC keyboard</td>
<td>[Ctrl] + [Alt]</td>
</tr>
<tr>
<td><strong>Bold</strong></td>
<td>Software operating controls</td>
<td>Press Continue button</td>
</tr>
<tr>
<td>…&gt;…&gt;…</td>
<td>Menu paths</td>
<td>Parameter &gt; Control parameter</td>
</tr>
<tr>
<td><em>Italics</em></td>
<td>System messages, error messages, signals</td>
<td>Function monitoring alarm triggered</td>
</tr>
<tr>
<td>[► Number of pages].</td>
<td>Cross reference</td>
<td>[► 41].</td>
</tr>
</tbody>
</table>

Table 3: Typographic conventions
2 Safety

This technical document contains detailed descriptions on the safe and proper installation, connection, commissioning and monitoring of the product.

▪ Read this technical document through carefully to familiarize yourself with the product.
▪ This technical document is a part of the product.
▪ Read and observe the safety instructions provided in this chapter in particular.
▪ Observe the warnings in this technical document in order to avoid function-related dangers.
▪ The product is manufactured on the basis of state-of-the-art technology. Nevertheless, risks to life and limb of the user or impairment of the product and other material assets may occur during use due to function-related dangers.

2.1 Intended use

The pressure relief device protects transformers and on-load tap-changers against impermissible pressure increases. At a predefined pressure, the pressure relief device opens, relieves the pressure and closes tightly again once the pressure has been relieved.

The product is designed solely for use in electrical energy systems and facilities. If used as intended and in compliance with the requirements and conditions specified in this technical document and the warning notices in this technical document and attached to the product, the product does not present any danger to persons, property or the environment. This applies throughout the entire service life of the product, from delivery, installation and operation to removal and disposal.

Intended use refers to the following:
▪ Only use the product with the transformer type specified in the order and the associated operating data.
▪ You will find the standard valid for the product and the year of issue on the nameplate.
▪ Operate the product in accordance with this technical document, the agreed-upon delivery conditions and the technical data.
▪ Ensure that any necessary work is only performed by qualified personnel.
2 Safety

- Use the equipment and special tools supplied solely for the intended purpose and in accordance with the specifications of this technical document.
- Only operate the product in industrial areas. Observe the notices in this technical document regarding electromagnetic compatibility and the technical data.

2.2 Fundamental safety instructions

To prevent accidents, disruptions and damage as well as unacceptable adverse effects on the environment, those responsible for transport, installation, operation, maintenance and disposal of the product or parts of the product must ensure the following:

**Personal protective equipment**

Loosely worn or unsuitable clothing increases the danger of becoming trapped or caught up in rotating parts and the danger of getting caught on protruding parts. This results in danger to life and limb.

- All necessary devices and personal protective equipment required for the specific task, such as a hard hat, safety footwear, etc. must be worn. Observe the "Personal protective equipment" [Section 2.4, Page 14] section.
- Never wear damaged personal protective equipment.
- Never wear rings, necklaces or other jewelry.
- If you have long hair, wear a hairnet.

**Work area**

Untidy and poorly lit work areas can lead to accidents.

- Keep the work area clean and tidy.
- Make sure that the work area is well lit.
- Observe the applicable laws for accident prevention in the relevant country.

**Explosion protection**

Highly flammable or explosive gases, vapors and dusts can cause serious explosions and fire.

- Do not install or operate the product in areas where a risk of explosion is present.
2 Safety

Safety markings
Warning signs and safety information plates are safety markings on the product. They are an important aspect of the safety concept. Safety markings are depicted and described in the chapter "Product description".

▪ Observe all safety markings on the product.
▪ Make sure all safety markings on the product remain intact and legible.
▪ Replace safety markings that are damaged or missing.

Ambient conditions
To ensure reliable and safe operation, the product must only be operated under the ambient conditions specified in the technical data.

▪ Observe the specified operating conditions and requirements for the installation location.

Modifications and conversions
Unauthorized or inappropriate changes to the product may lead to personal injury, material damage and operational faults.

▪ Only modify the product after consultation with Messko GmbH.

Spare parts
Spare parts not approved by Messko GmbH may cause physical injury and damage the product.

▪ Only use spare parts approved by the manufacturer.
▪ Contact Messko GmbH.

Working during operation
You must only operate the product when it is in a sound operational condition. Otherwise it poses a danger to life and limb.

▪ Regularly check the operational reliability of safety equipment.
▪ Perform the inspection tasks described in this technical document regularly.

2.3 Personnel qualification
The person responsible for assembly, commissioning, operation and inspection must ensure that personnel are sufficiently qualified.
2 Safety

Electrically skilled person
The electrically skilled person has a technical qualification and therefore has the required knowledge and experience, and is also conversant with the applicable standards and regulations. The electrically skilled person is also proficient in the following:

▪ Can identify potential dangers independently and is able to avoid them.
▪ Is able to perform work on electrical systems.
▪ Is specially trained for the working environment in which (s)he works.
▪ Must satisfy the requirements of the applicable statutory regulations for accident prevention.

Electrically trained persons
An electrically trained person receives instruction and guidance from an electrically skilled person in relation to the tasks undertaken and the potential dangers in the event of inappropriate handling as well as the protective devices and safety measures. The electrically trained person works exclusively under the guidance and supervision of an electrically skilled person.

Operator
The operator uses and operates the product in line with this technical document. The operating company provides the operator with instruction and training on the specific tasks and the associated potential dangers arising from improper handling.

Technical Service
We strongly recommend having repairs and retrofitting carried out by our Technical Service department. This ensures that all work is performed correctly. If repair work is not carried out by our Technical Service department, please ensure that the personnel who carry out the repairs are trained and authorized to do so by Maschinenfabrik Reinhausen GmbH.

Maschinenfabrik Reinhausen GmbH
Technical Service
P.O. Box 12 03 60
93025 Regensburg
Germany
Phone: +49 941 4090-0
Fax: +49 941 4090-7001
2.4 Personal protective equipment

Personal protective equipment must be worn during work to minimize risks to health.

- Always wear the personal protective equipment required for the job at hand.
- Never wear damaged personal protective equipment.
- Observe information about personal protective equipment provided in the work area.

**Personal protective equipment to be worn at all times**

**Protective clothing**

Close-fitting work clothing with a low tearing strength, with tight sleeves and with no protruding parts. It mainly serves to protect the wearer against being caught by moving machine parts.

**Safety shoes**

To protect against falling heavy objects and slipping on slippery surfaces.

**Special personal protective equipment for particular environments**

**Safety glasses**

To protect the eyes from flying parts and splashing liquids.

**Visor**

To protect the face from flying parts and splashing liquids or other dangerous substances.
## 2 Safety

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hard hat</strong></td>
<td>To protect from falling and flying parts and materials.</td>
</tr>
<tr>
<td><strong>Hearing protection</strong></td>
<td>To protect from hearing damage.</td>
</tr>
<tr>
<td><strong>Protective gloves</strong></td>
<td>To protect from mechanical, thermal, and electrical hazards.</td>
</tr>
</tbody>
</table>
3 Product description

This chapter contains an overview of the design and function of the product.

3.1 Scope of delivery

The following components are included in the delivery:

- MPREC® pressure relief device
- Technical documents
- O-ring 95x3 (only for MPREC® with OD protective cover)
- Mounting seal ring (optional)
- Connecting flange for oil escape opening with internal thread or for welding (optional, and only for MPREC® with OD protective cover)
- Socket connection cable (optional and only for MPREC® with plug connection)

Please note the following:

- Check the shipment for completeness using the shipping documents.
- Leave parts in the packaging and store in a dry area until installation.

3.2 Pressure relief device function description

The pressure relief device with the device flange is mounted tight on the transformer tank or on the on-load tap-changer. If the internal pressure of the transformer or on-load tap-changer exceeds the predefined tripping pressure of the pressure relief device, the spring-loaded valve plate lifts off of its seal seat within a few milliseconds. As a result, the internal pressure is relieved as quickly as possible and the valve plate again closes the pressure relief device tightly.

As an external indication that the valve has tripped, a self-locking signal pin slides out of the housing and, as an option, a semaphore straightens.

Once the pressure falls below the tripping pressure, the valve closes again. The signal pin and the semaphore must be reset in their operating positions manually. The signaling contacts installed as an option are automatically reset.

The pressure relief device is available in 2 versions:

- With sheet-aluminum standard protective cover
- With cast-aluminum OD protective cover (Oil Directed = with directed oil flow)

The construction and function are identical.
3 Product description

The pressure relief device is available with various tripping pressures.

<table>
<thead>
<tr>
<th>Type</th>
<th>Tripping pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>[psi]</td>
</tr>
<tr>
<td>LMPRD 4 psi</td>
<td>4 ± 1</td>
</tr>
<tr>
<td>LMPRD 6 psi</td>
<td>6 ± 1</td>
</tr>
<tr>
<td>LMPRD 8 psi</td>
<td>8 ± 1</td>
</tr>
<tr>
<td>LMPRD 10 psi</td>
<td>10 ± 1</td>
</tr>
<tr>
<td>LMPRD 12 psi</td>
<td>12 ± 1</td>
</tr>
<tr>
<td>LMPRD 15 psi</td>
<td>15 ± 2</td>
</tr>
<tr>
<td>LMPRD 20 psi</td>
<td>20 ± 2</td>
</tr>
<tr>
<td>LMPRD 25 psi</td>
<td>25 ± 2</td>
</tr>
<tr>
<td>LMPRD 30 psi</td>
<td>30 ± 2</td>
</tr>
</tbody>
</table>

Table 4: Pressure range

3.3 Design/versions

The pressure relief device consists of a device flange with valve, spring assembly, signal pin and protective cover; as an option also with 1 or 2 micro-switches and with semaphore.

The design and the designation of the key device components are to be found in the following drawings:

- Pressure relief device with standard protective cover [⇒ Section 3.3.1, Page 18]
- Pressure relief device with OD protective cover [⇒ Section 3.3.2, Page 19] (Oil Directed = with directed oil flow)

The device flange of the pressure relief device is mounted with a mounting seal tight on the counter flange of the transformer tank or the on-load tap-changer cover. A spring assembly presses the valve plate against the seal seat, which consists of one axially aligned and one radially aligned sealing lip. The spring assembly is tensioned between a counter bearing and the device flange with 6 fixing screws.
3 Product description

The signal pin has a cap that can be screwed off so that the protective cover can be removed from the device flange. The signal pin has different colors depending on the type and suitability of the gasket materials for various insulation fluids in the transformer/on-load tap-changer:

- Red (anodized) for mineral oil
- Blue (anodized) for silicone oil, pyranol or similar

The optional micro-switches for the signaling contacts are encapsulated, physically separate from the functioning part of the valve and therefore protected against environmental influences and leaking oil.

3.3.1 Pressure relief device with standard protective cover

The following graphic shows the key parts of the pressure relief device:

![Figure 1: Pressure relief device with standard protective cover](image)

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Device flange</td>
</tr>
<tr>
<td>2</td>
<td>3 housing screws M6x10, wrench size 10</td>
</tr>
<tr>
<td>3</td>
<td>Seal (axial) with sealing lip (radial)</td>
</tr>
<tr>
<td>4</td>
<td>Ground connection (only with plug connection)</td>
</tr>
<tr>
<td>5</td>
<td>Spring assembly</td>
</tr>
<tr>
<td>6</td>
<td>Cable bushing M20x1.5 for cable diameter 8…15 mm; alternatively without, with terminal box, with ANSI plug or with Westinghouse plug</td>
</tr>
</tbody>
</table>
### 3 Product description

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>Cable bushing M20x1.5 on the micro-switch</td>
</tr>
<tr>
<td>8</td>
<td>Protective cover</td>
</tr>
<tr>
<td>9</td>
<td>Signal pin (red for mineral oil, blue for silicon oil)</td>
</tr>
<tr>
<td>10</td>
<td>Signal pin cap</td>
</tr>
<tr>
<td>11</td>
<td>Semaphore (optional)</td>
</tr>
<tr>
<td>12</td>
<td>1 or 2 micro-switches, alternatively without</td>
</tr>
<tr>
<td>13</td>
<td>Counter bearing for spring assembly</td>
</tr>
<tr>
<td>14</td>
<td>6 fixing screws</td>
</tr>
<tr>
<td>15</td>
<td>Valve plate</td>
</tr>
<tr>
<td>16</td>
<td>Mounting seal ring Ø 200 x Ø 178.5 x 4.25 mm [Ø 7.87&quot; x Ø7.03&quot; x 0.17&quot;] (optional)</td>
</tr>
</tbody>
</table>

#### 3.3.2 Pressure relief device with OD protective cover

The OD protective cover has an escape opening for draining the oil in the event of tripping. The escape opening is designed as a flange for closing a pipe in order to enable the directed drainage of the escaping oil. An accompanying o-ring provides a tight seal for the flange connection.
The following graphic shows the key parts of the pressure relief device:

**Figure 2: Pressure relief device with OD protective cover**

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Oil escape opening</td>
</tr>
<tr>
<td>2</td>
<td>Pipe connection with o-ring 95x3 and 3 hexagon screws M12x40 with washer and spring washer, wrench size 19</td>
</tr>
<tr>
<td>3</td>
<td>OD protective cover</td>
</tr>
<tr>
<td>4</td>
<td>4 housing screws M8x100, wrench size 13, max. torque 12 Nm</td>
</tr>
<tr>
<td>5</td>
<td>Signal pin with signal pin cap</td>
</tr>
<tr>
<td>6</td>
<td>1 or 2 micro-switches (optional)</td>
</tr>
<tr>
<td>7</td>
<td>Cable bushing M20x1.5 for cable diameter 8…15 mm; alternatively without, with terminal box, with ANSI plug or with Westinghouse plug</td>
</tr>
<tr>
<td>8</td>
<td>Ground connection (only with version with plug)</td>
</tr>
<tr>
<td>9</td>
<td>Mounting seal ring Ø 200 x Ø 178.5 x 4.25 mm [Ø 7.87&quot; x Ø7.03&quot; x 0.17&quot;] (optional)</td>
</tr>
<tr>
<td>10</td>
<td>O-ring seal between device and protective cover</td>
</tr>
</tbody>
</table>
3.4 Nameplate

The nameplate is on the stand plate for the pressure relief device with standard protective cover, and on the flat surface on the cover for the version with OD protective cover.

Figure 3: Nameplate on the MPREC
4 Packaging, transport and storage

4.1 Purpose

The packaging is designed to protect the packaged product during transport, loading, unloading and during periods of storage in such a way that no detrimental changes occur. The packaging must protect the goods against permitted transport stresses such as vibration, knocks and moisture (rain, snow, condensation).

The packaging also prevents the packaged goods from moving impermissibly within the packaging.

4.2 Suitability, structure and production

The goods are packaged in a sturdy cardboard box or solid wooden crate. These ensure that the shipment is secure when in the intended transportation position and that none of its parts touch the loading surface of the means of transport or touch the ground after unloading.

Inlays inside the box or crate stabilize the goods, preventing impermissible changes of position and protecting them from vibration.

4.3 Markings

The packaging bears a signature with instructions for safe transport and correct storage. The following symbols apply to the shipment of non-hazardous goods. Adherence to these symbols is mandatory.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>☔</td>
<td>Protect against moisture</td>
</tr>
<tr>
<td>⬆️</td>
<td>Top</td>
</tr>
<tr>
<td>🍷</td>
<td>Fragile</td>
</tr>
<tr>
<td>🔴</td>
<td>Attach lifting gear here</td>
</tr>
<tr>
<td>🔵</td>
<td>Center of mass</td>
</tr>
</tbody>
</table>

Table 5: Shipping pictograms

4.4 Transportation, receipt and handling of shipments

In addition to vibrations, jolts must also be expected during transportation. In order to prevent possible damage, avoid dropping, tipping, knocking over and colliding with the product.

Should the packaging tip over or fall, damage is to be expected regardless of the weight.
4 Packaging, transport and storage

Every delivered shipment must be checked for the following by the recipient before acceptance (acknowledgment of receipt):

▪ Completeness based on the delivery slip
▪ External damage of any kind.

The checks must take place after unloading, when the box or transport container can be accessed from all sides.

Visible damage

If externally visible transport damage is detected upon receipt of the shipment, proceed as follows:

▪ Immediately record the transport damage found in the shipping documents and have this countersigned by the deliverer.
▪ In the event of severe damage, total loss or high damage costs, immediately notify the sales department at Messko GmbH and the relevant insurance company.
▪ After identifying damage, do not modify the condition of the shipment further and retain the packaging material until an inspection decision has been made by the transport company or the insurance company.
▪ Record the details of the damage on-site immediately with the transport company involved. This is essential for any claim for damages!
▪ If possible, photograph damage to packaging and packaged goods. This also applies to signs of corrosion on the packaged goods due to moisture (rain, snow, condensation) infiltrating the packaging.
▪ Make sure you also check the sealed packaging.

Hidden damage

In the event of damage that is not detected until unpacking after receipt of the shipment (hidden damage), proceed as follows:

▪ Make the party potentially responsible for the damage liable as soon as possible by telephone and in writing, and prepare a damage report.
▪ Observe the time periods applicable to such actions in the respective country. Inquire about these in good time.

With hidden damage, it is very hard to make the transportation company (or other responsible party) liable. Any insurance claims for such damage can be successful only if relevant provisions are expressly included in the insurance terms and conditions.
4 Packaging, transport and storage

4.5 Storage of shipments

When selecting and setting up the storage location, ensure the following:

▪ Store the product and accessories in the original packaging until installation.

▪ Protect stored goods against moisture (rain, flooding, water from melting snow and ice), dirt, pests such as rats, mice, termites etc. and against unauthorized access.

▪ Store crates and boxes on pallets, timber beams or planks as protection against ground moisture and for improved ventilation.

▪ Ensure that the foundation has sufficient load-bearing capacity.

▪ Keep entrance paths clear.

▪ Check the stored goods at regular intervals. Also take appropriate action after storms, heavy rain or snow etc.

4.6 Further transport

Use the original product packaging for further transport.

If you transport the product to the final installation site in a mounted state, observe the following information in order to protect the product against mechanical damage due to external influences.

Transport packaging requirements

▪ Select packaging suitable for the duration of transport or storage, taking the climatic conditions into consideration.

▪ Ensure that the packaging protects the product against transport stress such as shaking, vibrations and impacts.

▪ Ensure that the packaging protects the product against moisture such as rain, snow and condensation.

▪ Ensure that the packaging allows for sufficient air circulation in order to prevent the formation of condensation.
This chapter describes how to mount and connect the device correctly.

The pressure relief device is mounted on a device flange on the transformer tank or on-load tap-changer.

Note the connection diagrams provided.

⚠️ DANGER

Electric shock!

Risk of fatal injury due to electrical voltage. Always observe the following safety regulations when working in or on electrical equipment.

► Disconnect the system.
► Lock the system to prevent an unintentional restart.
► Ensure all poles are de-energized.
► Ground and short-circuit.
► Cover or cordon off adjacent energized parts.

warning

Property damage!

The function of the device will be impaired due to drying. As a result, the transformer will no longer be protected against impermissible pressure increases.

► Ensure that the device is not dried in the oven.
► Only mount the device once the transformer / on-load tap-changer has been dried.

The pressure relief device can be mounted horizontally or vertically.
When mounting the standard version vertically, the stand plate [Section 5.1, Page 27] must face either to the left or right. When mounting the OD version, the oil escape opening [Section 3.3.2, Page 19] must face downwards in order to ensure complete drainage of the oil in the event of tripping.

There must be a clearance of at least 100 mm above or in front of the device, and at least 170 mm with a semaphore. Thus, in the *Alarm* position, the signal pin can be pushed fully out of the housing and the semaphore can fold out completely.
5.1 Mounting pressure relief device with standard protective cover

In order to mount the device, you must open it. Only close it again once mounted.

Figure 5: Mounting pressure relief device with standard protective cover

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3 hexagon screws M6x10, wrench size 10</td>
</tr>
<tr>
<td>2</td>
<td>Ground connection (only with plug connection)</td>
</tr>
<tr>
<td>3</td>
<td>Stand plate</td>
</tr>
<tr>
<td>4</td>
<td>Protective cover</td>
</tr>
<tr>
<td>5</td>
<td>Signal pin, wrench size 12</td>
</tr>
<tr>
<td>6</td>
<td>Signal pin cap, wrench size 32</td>
</tr>
<tr>
<td>7</td>
<td>Clearance above: min. 100 mm [4&quot;] / with semaphore 170 mm [6.7&quot;]</td>
</tr>
</tbody>
</table>
5 Mounting

Opening the device

Prepare for mounting the device as follows:

1. In order that the protective cover can be removed, pull out signal pin (5) and screw off the signal pin cap (6) using 2 open-ended wrenches, wrench size 12 and 32.

2. Unscrew the 2 screws (1), wrench size 10, on the stand plate, and the screw, wrench size 10, on the opposite side of the protective cover.

3. Lift off protective cover (4).

Mounting the device

The dimensions and connection data for mounting are specified in the appendix.

1. Place the mounting seal ring (delivered as an option) under the device, see Dimensions with standard protective cover [► Section 12.1, Page 53].

2. Mount the device onto the counter flange on the transformer / on-load tap-changer by inserting 6 screws M12 or 1/2" (not supplied) through the drill holes in the device flange.

Figure 6: Mounting the device

1 Mounting seal ring Ø 200 x Ø 178.5 x 4.25 mm [Ø 7.87" x Ø7.03" x 0.17"]

2 6 screws M12 or 1/2"
5 Mounting

Closing the device

After mounting, proceed as follows:

1. If the device is equipped with micro-switches for remote transmission of the signals, first connect these micro-switches, see Electrically connecting the pressure relief device [► Section 5.3, Page 35].

2. Place the protective cover onto the pressure relief device such that the drill holes for the fixing screws in the protective cover are aligned with the corresponding threaded holes in the device.

3. To secure the protective cover, screw in the 2 screws, wrench size 10, on the stand plate, and the screw, wrench size 10, on the opposite side, with a maximum torque = 12 Nm.

Establishing operational readiness

1. Screw the signal pin cap, wrench size 32, onto the signal pin, wrench size 12, with max. torque = 8 Nm.

2. Push the signal pin into the device as far as it will go.

3. If the device is equipped with a semaphore, fold this down so that its lower edge is perpendicular to the signal pin.

♫ This ensures that the pressure relief device is visibly in the operating position.
5.2 Mounting pressure relief device with OD protective cover

In order to mount the device, you must open it. Only close it again once mounted.

![Figure 7: Mounting pressure relief device with OD protective cover](image)

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4 housing screws M8x100, wrench size 13</td>
</tr>
<tr>
<td>2</td>
<td>Protective cover</td>
</tr>
<tr>
<td>3</td>
<td>Signal pin, wrench size 12</td>
</tr>
<tr>
<td>4</td>
<td>Signal pin cap, wrench size 32</td>
</tr>
<tr>
<td>5</td>
<td>Clearance above: min. 100 mm [4&quot;] / with semaphore 170 mm [6.7&quot;]</td>
</tr>
</tbody>
</table>

Opening the device

Prepare for mounting the device as follows:

1. Remove protective cover (2). To do so, pull out signal pin (3) and screw off the signal pin cap (4) using 2 open-ended wrenches, wrench size 12 and 32.
2. Then unscrew the 4 screws (1), wrench size 13, from the protective cover.
3. Lift off the protective cover and place it on a stable surface.
### Mounting the device

1. Place the mounting seal ring (delivered as an option) under the device, see Dimensions with OD protective cover [► Section 12.2, Page 56].

2. Mount the device onto the counter flange on the transformer / on-load tap-changer by inserting 6 screws M12 or 1/2" (not supplied) through the drill holes in the device flange.

![Figure 8: Mounting the device](image)

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mounting seal ring Ø 200 x Ø 178.5 x 4.25 mm [Ø 7.87&quot; x Ø7.03&quot; x 0.17&quot;]</td>
</tr>
<tr>
<td>2</td>
<td>6 screws M12 or 1/2&quot;</td>
</tr>
<tr>
<td>3</td>
<td>Through bar of the device flange</td>
</tr>
</tbody>
</table>

### Closing the device

After mounting, close the device as follows:

1. If the device is equipped with micro-switches for remote transmission of the signals, first connect these micro-switches, see Electrically connecting the pressure relief device [► Section 5.3, Page 35].
5 Mounting

2. **NOTICE!** Protect the o-ring seal between the device and protective cover; therefore, during all intermediate steps, only position the protective cover lightly and do not press down.

![Figure 9: Protecting the o-ring seal](image)

3. Lower the protective cover parallel to the device flange and place lightly on the spring assembly, without pressing the protective cover over the o-ring. When aligning the protective cover, ensure that the through bar of the device flange is vertical under the connection plate of the protective cover. The threaded bolts of the spring assembly must be visible precisely in the center of the oil escape opening.

![Figure 10: Aligning the OD protective cover](image)
4. Insert the 4 housing screws into the intended holes and turn the protective cover gently around its axis until the screws engage in the threads in the counter bearing.

5. **NOTICE!** Do not tilt or jam the protective cover. Tighten the screws slightly crosswise several times to prevent that the protective cover does not tilt or jam whilst it is being lowered.

![Figure 11: Positioning and closing the OD protective cover](image)

6. Then tighten the 4 housing screws in a crosswise sequence up to a maximum torque = 23 Nm.

**NOTICE**

**Malfunction of the pressure relief device!**

The oil escape opening of the pressure relief device is closed with a plastic cap as protection during transport. The pressure relief device will not function with this in place. Therefore, please note the following:

- After mounting the protective cover, remove the plastic cap.
- Never use the plastic cap as a closing cap during operation.
5 Mounting

Mounting oil drainage unit

Figure 12: Mounting oil drainage unit

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3 hexagon screws M12x40 with spring washers and washers (supplied)</td>
</tr>
<tr>
<td>2</td>
<td>Counter flange of the drainage unit, dimensions, see [Section 12.2, Page 56]</td>
</tr>
<tr>
<td>3</td>
<td>Plastic cap as transport lock</td>
</tr>
<tr>
<td>4</td>
<td>O-ring 95x3 (supplied)</td>
</tr>
</tbody>
</table>

- Flange-mount a drainage unit onto the oil escape opening.
- The o-ring as seal and the 3 hexagon screws (wrench size 19) with spring washers and washers are included with the device.
- A suitable connecting flange with internal thread or for welding can be ordered as an option.
Establishing operational readiness

1. Screw the signal pin cap onto the signal pin using 2 open-ended wrenches, wrench size 12 and 32, with max. torque = 8 Nm.

2. Push the signal pin into the device as far as it will go.

3. If the device is equipped with a semaphore, fold this down so that its lower edge is perpendicular to the signal pin. Otherwise the pressure relief device is visually and electrically in the tripped position.

   This ensures that the pressure relief device is visibly in the operating position.

5.3 Electrically connecting the pressure relief device

**WARNING**

Danger of death or severe injury!

Danger of death or severe injury due to improper electrical connection of the pressure relief device.

- When the pressure relief device trips, the transformer must be immediately de-energized by the circuit breaker.

- Ensure that the pressure relief device’s signaling contact is correctly looped into the tripping circuit of the transformer circuit breaker.
5 Mounting

Connecting the micro-switches (optional)

There are a variety of versions for connecting the optionally installed micro-switches:

- Cable screw connections [► Section 5.3.1, Page 36]
- Terminal box [► Section 5.3.2, Page 38]
- Plug (ANSI or Westinghouse) [► Section 5.3.3, Page 39]

Each micro-switch is designed as an electrically isolated normally open and normally closed contact.

5.3.1 Connecting cable screw connections

![Diagram](image)

Figure 14: Connecting micro-switches in the pressure relief device with standard protective cover

| 1 Micro-switch 1 | 2 Micro-switch 2 (if not installed, the outer cable screw connection is replaced with a dummy plug) |
Figure 15: Connecting micro-switches in the pressure relief device with OD protective cover

1. Micro-switch 1
2. Micro-switch 2 (if not installed, the outer cable screw connection is replaced with a dummy plug)

► Open standard protective cover [► Section 5.1, Page 27].

⇒ The micro-switch(es) is (are) located on the counter bearing of the spring assembly.

► Alternative: Open OD protective cover [► Section 5.2, Page 30].

⇒ The micro-switch(es) is (are) located on the inside of the protective cover. Therefore, lay the protective cover on a stable surface with the opening facing upwards for connecting the cables.

1. Remove the 4 cover bolts of the micro-switch housing and remove the cover (crosshead screwdriver).

2. Remove an amount of sheathing from the double-insulated cable (cable diameter 8...15 mm) appropriate for the wiring, strip off 7 mm of insulation from the individual wire and cap off with ferrules.

3. Open the cable screw connections M20x1.5 (wrench size 24) on the outer cable bushing and on the micro-switch housing.

4. Pull the cable ends loosely through the outer and inner cable screw connections.

5. **NOTICE!** Do not kink the braided leads! Connect the signal lines and protective conductor to the 4 clamping screws in loose arcs in accordance with the connection diagram.
5 Mounting

6. First tighten the inner cable screw connection hand-tight, and then the outer cable screw connection, and ensure that the cables and braided leads remain loose and without tension, and that they are not twisted.

7. Tighten all cable screw connections with max. torque = 5.0 Nm.

8. Close the cover of the micro-switch housing using the 4 cover bolts with a max. torque = 2.0 Nm.

9. Replace the protective cover.

5.3.2 Connecting the cable to the terminal box

To connect the device to the terminal box, proceed as follows:

1. Undo the 4 screws in the cover of the terminal box using a crosshead screwdriver.

2. Remove the sheathing of the cable to be connected, strip off approx. 7 mm of insulation from the braided leads and cap off with ferrules.

3. Open the cable screw connection M25x1.5 (for cables Ø 13–20 mm) (wrench size 32) and pull the cable through.

4. **NOTICE!** Do not kink the braided leads! Connect the signal lines and protective conductor to the labeled terminal strip in loose arcs in accordance with the connection diagram.
5. Close the cable screw connection with max. torque = 6.7 Nm.

6. If present, proceed in the same way for the second cable screw connection.

7. Close the cover of the terminal box.

5.3.3 Connecting the plug connector (ANSI or Westinghouse)

Before connecting the device, check that the socket connection cable matches the plug on the device. Then proceed as follows:

1. Connect the protective conductor between the grounding screw below the plug connection (wrench size 10, max. torque = 5 Nm) and the housing of the transformer or on-load tap-changer.

2. Remove the sheathing of the free end of the socket connection cable, strip off approx. 7 mm of insulation from the braided leads and cap off with ferrules.

3. Lay the socket connection cable between the device and control box and connect the braided leads in the control box in accordance with the pin assignment.

<table>
<thead>
<tr>
<th>1</th>
<th>1 Micro-switch</th>
<th>2</th>
<th>2 Micro-switches</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wire colors of the supplied cable:</td>
<td>Pin 1: black</td>
<td>Pin 1: black</td>
<td>Pin 4: orange</td>
</tr>
<tr>
<td>Pin 2: red</td>
<td>Pin 2: red</td>
<td>Pin 5: yellow</td>
<td></td>
</tr>
<tr>
<td>Pin 3: blue</td>
<td>Pin 3: blue</td>
<td>Pin 6: brown</td>
<td></td>
</tr>
</tbody>
</table>
5 Mounting

Figure 18: Pin assignment of the Westinghouse socket connection cable in plan view

<table>
<thead>
<tr>
<th>1 1 Micro-switch</th>
<th>2 2 Micro-switches</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wire colors of the supplied cable:</td>
<td>Pin 1: black</td>
</tr>
<tr>
<td>Pin 4: green</td>
<td>Pin 5: blue</td>
</tr>
<tr>
<td>Pin 6: white</td>
<td>Pin 6: orange</td>
</tr>
</tbody>
</table>

4. Attach the socket of the connection cable to the plug of the pressure relief device.

5. Hold the connection cable tightly and tighten the socket housing clockwise as far as it will go. The connection cable must not be twisted during this operation.
Check that the protective relay is functioning correctly before commissioning the transformer / on-load tap-changer. You will find a description of the function test in the following.

A case where one micro-switch of the pressure relief device is wired to the tripping circuit of the circuit breaker that de-energizes the transformer in the event of an error is used as an example.

If you have connected the micro-switches to another device, check the response to the change in switch position on that device (steps 6, 9 and 11).

1. Fully de-energize the transformer, lock to prevent it from being switched back on, and ensure that it is de-energized.

2. Ground and short-circuit the transformer on the high-voltage side and low-voltage side. Ensure that the grounding for work is not removed during testing.

3. **WARNING!** If the micro-switches also trip the fire extinguishing unit in the event of an error, deactivate the fire extinguishing unit prior to the function test. Otherwise, the unintended tripping of the fire extinguishing unit can lead to death due to asphyxiation. Check the signal transmission in accordance with the fire extinguishing unit operating instructions or contact the manufacturer.

4. Pull the signal pin out of the housing into the position *alarm* to actuate the micro-switches, see [Section 7.1, Page 43].

5. Leave the transformer's danger zone.

6. Ensure that the transformer's circuit breaker cannot be closed.
   - Passive protection test

7. Push the signal pin of the pressure relief device into the housing to return the micro-switches to the *operation* position.

8. Leave the transformer's danger zone.

9. Close the transformer's circuit breaker with disconnecting switches open and the transformer grounded on all sides.

10. Pull the signal pin out of the housing into the position *alarm* to actuate the micro-switches.

11. Check whether the transformer's circuit breaker has tripped.
   - Active protection test

12. Return the signal pin of the pressure relief device to the *operation* position.
6 Commissioning

13. If the fire extinguishing unit was deactivated prior to the test, recommission this in accordance with the manufacturer operating instructions.

⇒ Once this function test has been performed, the transformer / on-load tap-changer can be commissioned.
The following section describes how you can monitor and restore the operating state of the device.

### 7.1 Pressure relief device operating state

The operating state of the pressure relief device can be determined externally from the position of the signal pin and from the position of the semaphore (optional):

<table>
<thead>
<tr>
<th></th>
<th>Operation</th>
<th>Alarm – pressure relief device has tripped</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 19: Operating positions of the signal pin and the semaphore (optional)
7 Operation

If the pressure relief device has tripped, the signal pin remains in the *alarm* position even when the pressure in the transformer / on-load tap-changer has normalized again. If the micro-switches inside the housing are connected, a signal is sent simultaneously to the control room.

► Once the cause has been eliminated, push the signal pin (and the semaphore) back down **manually**.

If the signal pin is in the *operation* position, the pressure relief device has not tripped mechanically. If a micro-switch has, nevertheless, issued a signal, the error can lie in the tripping circuit, see Tripping circuit malfunction [► Section 9.1, Page 47].

7.2 Venting the pressure relief device

When mounted vertically, no gas collects below the valve plate. Venting is therefore not necessary.

When mounted horizontally, venting the pressure relief device is only necessary if this is recommended by the transformer / on-load tap-changer manufacturer.

⚠️ **WARNING**

**Danger of explosion!**

Explosive gases in the pressure relief device, in the transformer or under the on-load tap-changer head cover can blow out or explode and thus lead to death or serious injury.

► Ensure that there are no ignition sources such as naked flames, hot surfaces or sparks (e.g. caused by the build-up of static charge) in the immediate surroundings and that none occur.

► De-energize all auxiliary circuits (e.g tap-change supervisory device, pressure relief device, pressure monitoring device) before opening the pressure relief device.

► Do not operate any electrical devices during the work (e.g. risk of sparks from impact wrench).

To vent the pressure relief device after filling the transformer / on-load tap-changer, proceed as follows:

1. Refer to the transformer / on-load tap-changer operating instructions and only vent the pressure relief device if recommended by the transformer / on-load tap-changer manufacturer.
2. Remove the protective cover of the pressure relief device see **Opening the device** with standard protective cover [► Section 5.1, Page 27] or with OD protective cover [► Section 5.2, Page 30].

3. Carefully open the vent screw a few turns using a wrench of wrench size 10 or a screwdriver without unscrewing it completely.

4. As soon as oil begins to escape, tighten the screw again with max. torque = 12 Nm.

5. Then continue with **Closing the device** with standard protective cover [► Section 5.1, Page 27] or with OD protective cover [► Section 5.2, Page 30].

⇒ This ensures that the pressure relief device is again ready for operation.
8 Maintenance and inspection

Maintenance
The product is maintenance-free.

Inspection
Depending on the conditions of use of the device and the national regulations in the respective country of use, the transformer manufacturers can specify different inspection intervals.

► Observe the inspection intervals defined in CIGRE Publication No. 445 "Guide for Transformer Maintenance" or the inspection intervals specified by the transformer manufacturer.

The following checks are necessary for each transformer inspection:

▪ Visual inspection for leakages, corrosion and damage
▪ Function test; see Commissioning [► Section 6, Page 41]

In addition, the following checks are necessary during every second transformer inspection:

▪ Visual inspection for leakages, corrosion and damage under the cover

► To do so, remove the cover; see [► Section 5.1, Page 27]. (For OD cover only: First remove the pipe connection of the oil escape opening; see [► Section 5.2, Page 30].)

▪ Visual inspection of the compression spring
▪ Visual inspection of the flange
▪ Visual inspection of the switches

In the event of questions or irregularities, contact the Technical Service department:

Maschinenfabrik Reinhausen GmbH
MR Service & Complaint
Falkensteinstrasse 8
93059 Regensburg, Germany
E-mail: service@reinhausen.com or complaint@reinhausen.com
This chapter describes how to eliminate simple operating faults.

9.1 Testing the tripping circuit and reason for tripping

If the signal pin is in the operation position, the pressure relief device has not tripped. If a micro-switch has, nevertheless, issued a signal, the error can lie in the tripping circuit.

► In this case, check whether the signals in the tripping circuit are being reliably transmitted.

If the signal pin is in the alarm position, the pressure relief device has tripped. In this case, clarify the following questions and, if necessary, contact the transformer / on-load tap-changer manufacturer in order that further measures can be introduced.

▪ Has oil escaped from the pressure relief device?
▪ Was the transformer subjected to a mechanical load?
▪ How large was the load on the transformer at the instant of tripping?
▪ Was the on-load tap-changer moved immediately before or during tripping?
▪ Did any other protective devices respond at the instant of tripping?
▪ Were switching operations being carried out in the grid at the instant of tripping?
▪ Were overvoltages registered at the instant of tripping?
▪ How high is the static pressure on the pressure relief device (height difference between the oil level in the expansion tank and in the pressure relief device)?

► Once all potential errors have been remedied, push the signal pin back into the device, otherwise any further tripping of the valve cannot be displayed.
10 Disposal

Observe the national disposal regulations in the country of use.
## 11 Technical data

<table>
<thead>
<tr>
<th>Operating conditions</th>
<th>MESSKO® MPREC®</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site of operation</td>
<td>Indoors and outdoors, tropicalized</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>Ambient temperature: -50°C...+80°C (mechanical version only) -40°C...+80°C (version with micro-switches) Oil temperature: -30°C...+120°C</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>-50°C...+80°C</td>
</tr>
<tr>
<td>Degree of protection (terminal box, cable screw connections, micro-switches)</td>
<td>IP65 in accordance with IEC 60529 IP66 in accordance with IEC 60529 available as an option for: ▪ Standard protective cover with cable screw connection ▪ OD protective cover with cable screw connection ▪ OD protective cover with terminal box</td>
</tr>
<tr>
<td>Contamination level</td>
<td>3</td>
</tr>
<tr>
<td>Overvoltage category</td>
<td>III; external protection: miniature circuit breaker maximum 16 A, C characteristic</td>
</tr>
</tbody>
</table>

### Materials

<table>
<thead>
<tr>
<th>All parts</th>
<th>Weather resistant and transformer-oil resistant; all external parts UV resistant Offshore version: all external parts also seawater resistant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Device flange</td>
<td>Seawater-proof aluminum casting</td>
</tr>
<tr>
<td>Standard protective cover</td>
<td>Seawater-proof aluminum with powder coating RAL 7033 or RAL 7038</td>
</tr>
</tbody>
</table>
### Materials

<table>
<thead>
<tr>
<th>OD protective cover</th>
<th>Seawater-proof aluminum casting with powder coating RAL 7033 or RAL 7038; sealing lip in the valve plate included in the scope of delivery, see [Section 3.3.1, Page 18]</th>
</tr>
</thead>
</table>

Offshore version available as an option:
- Screws in V4A in accordance with DIN 931/933
- Degree of protection: IP65 or IP66 in accordance with IEC/EN 60529
- Cable screw connections in accordance with EN 60423, ISO 965
- Lacquer coating C5-M in accordance with IEC 12944, IEC 20340

<table>
<thead>
<tr>
<th>Valve plate</th>
<th>Stainless steel</th>
</tr>
</thead>
</table>

| Gasket materials | NBR for mineral oil  
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Viton for alternative insulating fluids</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Springs</th>
<th>Spring steel in accordance with EN 10270-1 SH, compression springs with configuration-specific parts painting (in German: KTL) for identification and as corrosion protection</th>
</tr>
</thead>
</table>

| Signal pin | Seawater-proof aluminum; anodized  
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Red for standard sealing lip (NBR); blue for Viton</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Vent screw</th>
<th>Self-securing; stainless steel; wrench size 10</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Semaphore</th>
<th>Optional; corrosion-resistant steel with powder coating RAL 1026, luminous yellow; (not suitable for offshore applications)</th>
</tr>
</thead>
</table>

### Dimensions

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>MESSKO® MPREC®</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Fastening</th>
<th>Ø 235 mm [Ø 9.25&quot;] bolt circle of the 6 holes Ø 15.5 mm [Ø 0.61&quot;]</th>
</tr>
</thead>
</table>

| Protective cover | Ø 291 mm [Ø 11.46"] standard protective cover  
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ø 295 mm [Ø 11.61&quot;] OD protective cover</td>
</tr>
</tbody>
</table>

| Oil escape opening | Only for version with OD protective cover:  
|--------------------|------------------------------------------------------------------------------------------------|
|                    | Ø 90 mm [3.54"] with o-ring 95x3; bolt circle of the 3 holes Ø 120 mm [Ø 4.72"]  
|                    | Connecting flange (available as an option) with internal thread G3 1/4" or for welding |
## 11 Technical data

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>MESSKO® MPREC®</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height (in tripped state)</td>
<td>Max. 234.5 mm [9.23&quot;] standard protective cover without semaphore</td>
</tr>
<tr>
<td></td>
<td>Max. 340 mm [13.39&quot;] standard protective cover with semaphore</td>
</tr>
<tr>
<td></td>
<td>Max. 246 mm [9.96&quot;] OD protective cover without semaphore</td>
</tr>
<tr>
<td></td>
<td>Max. 342 mm [13.46&quot;] OD protective cover with semaphore</td>
</tr>
<tr>
<td>Mounting seal ring</td>
<td>Available as an option; Ø 200 mm x Ø 178.5 mm x 4.25 mm [Ø 7.87&quot; x Ø 7.03&quot; x 0.17&quot;]</td>
</tr>
<tr>
<td>Connection cable length for plug version</td>
<td>1,219 mm [48&quot;]; 1,829 mm [72&quot;]; 2,134 mm [84&quot;]; 2,438 mm [96’’]; 3,658 mm [144’’]; 4,572 mm [180’’]; 5,004 mm [197’’]; 5,080 mm [200’’]; 6,096 mm [240’’]; 7,620 mm [300’’]; 9,144 mm [360’’]; 10,000 mm [394’’]; 11,990 mm [472’’]; 15,010 mm [591’’]; 20,110 mm [792’’]</td>
</tr>
<tr>
<td>Weight</td>
<td>Approx. 6 kg with standard protective cover</td>
</tr>
<tr>
<td></td>
<td>Approx. 11 kg with OD protective cover</td>
</tr>
<tr>
<td>Operating pressure</td>
<td>See table above [Section 3.2, Page 16]</td>
</tr>
<tr>
<td>Micro-switches</td>
<td>MESSKO® MPREC®</td>
</tr>
<tr>
<td>Contacts</td>
<td>1 x NO contact (normally open), 1 x NC contact (normally closed) per micro-switch</td>
</tr>
<tr>
<td></td>
<td>Special version: Micro-switch 2 x NO contacts (normally open)</td>
</tr>
<tr>
<td>Housing material</td>
<td>Seawater-proof aluminum</td>
</tr>
<tr>
<td>Rated operating voltage: $U_e = 240$ V</td>
<td></td>
</tr>
<tr>
<td>Limit switch (standard equipment)</td>
<td>Utilization category AC-15; 240 V / 3 A in accordance with IEC 60947-5-1</td>
</tr>
<tr>
<td></td>
<td>Conventional thermal current: $I_{th,e} = 10$ A</td>
</tr>
<tr>
<td>Limit switch with gold-plated contacts</td>
<td>Utilization category AC-15; 240 V / 3 A in accordance with IEC 60947-5-1</td>
</tr>
<tr>
<td></td>
<td>Conventional thermal current: $I_{th,e} = 10$ A</td>
</tr>
<tr>
<td>Limit switch with 2 x NO contacts</td>
<td>Utilization category AC-15; 240 V / 1.5 A in accordance with IEC 60947-5-1</td>
</tr>
<tr>
<td></td>
<td>Conventional thermal current: $I_{th,e} = 5$ A</td>
</tr>
<tr>
<td>Rated insulation voltage</td>
<td>AC: 2,500 V / 1 min</td>
</tr>
</tbody>
</table>
## 11 Technical data

### Connection via cable screw connections

<table>
<thead>
<tr>
<th>Connection terminals</th>
<th>Single-wire: 0.5...2.5 mm², AWG 20-10; braided leads with ferrule: 0.5...1.5 mm², AWG 20-15</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cable screw connections</td>
<td>IP65: M20x1.5 for cable diameters 8...15 mm; connection cable not included in delivery</td>
</tr>
<tr>
<td></td>
<td>IP66 and offshore applications: M20x1.5 for cable diameters 5...14 mm; connection cable not included in delivery</td>
</tr>
<tr>
<td>Degree of protection</td>
<td>IP65 (IP66 as an option) in accordance with IEC 60529 for enclosed device</td>
</tr>
</tbody>
</table>

### Connection at terminal box

<table>
<thead>
<tr>
<th>Connection terminals</th>
<th>Single-wire: 1...4 mm², AWG 18-8; braided leads with ferrule: 0.5...2.5 mm², AWG 20-10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cable glands</td>
<td>IP65: M25x1.5 for cable diameters 13...20 mm</td>
</tr>
<tr>
<td></td>
<td>IP66: M25x1.5 for cable diameters 11...20 mm</td>
</tr>
<tr>
<td></td>
<td>Offshore version: M25x1.5 for cable diameters 9...17 mm, stainless steel</td>
</tr>
<tr>
<td></td>
<td>If only 1 cable screw connection, dummy plug as replacement for second</td>
</tr>
<tr>
<td>Degree of protection</td>
<td>IP65 (IP66 as an option) in accordance with IEC 60529 for enclosed device</td>
</tr>
</tbody>
</table>

### Connection at plug

#### ANSI plug

<table>
<thead>
<tr>
<th>Connection cable</th>
<th>ANSI socket connection cable AWG 16, SOOW, 600 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Degree of protection</td>
<td>IP65 in accordance with IEC 60529 for enclosed device</td>
</tr>
</tbody>
</table>

#### Westinghouse plug

<table>
<thead>
<tr>
<th>Connection cable</th>
<th>Westinghouse socket connection cable AWG 16, SOOW, 600 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Degree of protection</td>
<td>IP65 in accordance with IEC 60529 for enclosed device</td>
</tr>
</tbody>
</table>
12.1 Dimensions with standard protective cover

Figure 21: MPREC with standard protective cover – view from below
Figure 22: Side view with signal positions

1 Alarm position  
2 Operation position  
3 Mounting seal ring
Figure 23: Connection options for the micro-switches; detail: venting

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Terminal box</td>
</tr>
<tr>
<td>2</td>
<td>Vent screw</td>
</tr>
<tr>
<td>3</td>
<td>Connection via cable screw connection (gland)</td>
</tr>
<tr>
<td>4</td>
<td>ANSI plug</td>
</tr>
</tbody>
</table>
12 Appendix

12.2 Dimensions with OD protective cover

Figure 24: Side view with signal positions

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Alarm position</td>
</tr>
<tr>
<td>2</td>
<td>Operation position</td>
</tr>
</tbody>
</table>
Figure 25: View from below and from the side in the OPERATION position

1 Dimensions in the alarm position
342 mm [13.47"]

2 Dimensions in the alarm position
246 mm [9.69"]