

R 58®

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Installation and operating instructions for straight thermocouple probes with a metal or ceramic protective tube

1. General notes concerning operation

1.1 Design

Our R7 series thermocouple probes are specifically designed for use in high temperature ranges. The designs are in accordance with or similar to DIN EN 50446 and DIN EN 60584, according to customer requirements and materials used, and are built for a measuring range of room temperature to 1700°C. As standard, our thermocouple probes are equipped with 1, 2, or in special designs with 3 thermocouples.

1.2 Important factors to note

Thermocouple probes should only be installed by trained and authorized staff. Operational safety essentially depends on proper installation. Operational safety essentially depends on proper installation and use. Thermoelements are specially designed for measuring temperatures and only work in connection with specially adapted evaluation units such as regulators, graphical recorders, measurement transducers etc.. Thermoelements are so-called touching sensors. The necessary conduction of the medium / temperature to be measured to the sensor takes place via a touching contact to the medium.

Before starting any work, staff need to have carefully read and understood these instructions. A basic requirement for safe working practice is to make sure you have received all the safety notes and operating instructions as stated in these instructions. In addition the relevant local accident prevention rules apply as well as the general safety provisions outlining where the equipment can be used.

1.3 Limitation of liability

All information and notes in these instructions have been put together taking into account the applicable standards and rules, the state of technical progress as well the findings and experience we have gathered over time. The manufacturer does not assume any liability for damage due to

- non-compliance with these instructions
- usage other than that specified
- usage by staff who have not been trained
- unauthorised modifications
- technical changes
- the use of non-approved spare parts

The actual scope of delivery can differ from the explanations and representations described here in the case of special designs, where the customer has made use of additional ordering options (customized orders) in the case of the latest technical developments (technical changes). The obligations agreed in the supply contract, the general terms and conditions, the manufacturer's delivery conditions and the applicable statutory rules and regulations which apply when the contract is concluded all apply.

1.4 Copyright protection

These instructions are copyrighted and are intended to be used for internal purposes only. Without the written consent of the manufacturer it is prohibited to make these instructions available to third parties, to employ any means or forms of reproduction (this also applies to the reproduction of extracts) and to exploit and/or pass on content. This rule does not apply to content used for internal purposes. Any infringement obligates the user to pay damages. We reserve the right to take further action.

1.5 Customer service

Our customer support team is available to provide technical information. For contact details, please refer to page 1.

In addition, our staff are always interested in finding out new information and user experiences which arise from use of the equipment and which could be of use in improving our products.

2. Installation and operation

2.1 Carrying out tests before installation

Users need to make sure that our R7 series thermocouple probes with ceramic tubes (inside or outside) are handled and transported with great care. In the case of extra long designs, due to the risk of damage to the protective pipe, care should be taken to keep the leverage force on the protective pipe as small as possible when lifting and transporting.

Before installing the thermocouple probe, check for mechanical and/or transport damage.

2.2 Installing the thermocouple probe

The thermocouple probe process connection must correspond with the process connection of the system.

In the case of temperatures $> 500\text{ °C}$, vertical installation is recommended. If this is not possible for technical reasons relating to the process, a horizontally installed protective tube has to be appropriately supported.

Ceramic protective tubes (SR) should not be exposed to mechanical stress (bending and/or impact), or sudden temperature changes (temperature shock). In order to avoid cracks, ceramic protective tubes should only be inserted very slowly or pre-heated in a process. In DIN 43724 (replaced by DIN 50446) the following speeds are recommended for insertion/withdrawal in the hot process:

Protective tubes with a \varnothing of 10 mm - 100 cm/min, in the case of \varnothing 15 mm - 50 cm/min and in the case of \varnothing 24 and 26 mm - 1 cm/min.

Reckmann however recommends that ceramic protection tubes are installed/dismounted significantly more slowly, especially for \varnothing 10 and 15 mm. In addition, in the case of working temperatures of 1200 °C , ceramic protection tubes should only be installed so that they hang vertically.

In order to keep measurement errors through thermal conduction as small as possible, the tip of the probe should be dipped as deep as possible in the medium to be measured.

The recommended minimum insertion depth for thermocouple probes is 6 - 8 times the diameter of the protective tube in fluids and 10 - 15 times the diameter of the protective tube in air/gases.

2.3 Electrical connection

Contact between the thermocouple probe and the assessment electronics may only take place with a compensation or thermocouple conduct corresponding to the thermocouple (in accordance with DIN EN 60584-3).

The following points should be considered when selecting and laying the contact conduct:

- The insulation materials used must be resistant to the thermal, mechanical and chemical stresses which arise at the place of use
- All conductors on the contact points must: feature bare metal (do not use core cable ends with compensation terminals), be free from corrosion, moisture, dirt and be capable of forming perfectly connected electrical contacts
- In order to avoid electromagnetic disturbance, all compensation and thermocouple conductors must be at a distance of 0.5 m and/or run at right angles to the energy conduct. Likewise, electromagnetic disturbance can be avoided through the use of conduct with a static shield and twin stranded wires
- The risk of 'spurious thermal voltage' through the formation of interim elements can be avoided by keeping the temperature of the contact points stable (normal terminals, no thermal material).

2.4 Temperature measuring transducer in the connection head

By using an electronic temperature measuring transducer in the connection head of the thermocouple probe it is possible to greatly reduce the electrical installation effort (no thermal material, 4 - 20 mA Signal is less sensitive to electromagnetic disturbances).

The electrical connection of the measuring transducer must take place in accordance with the enclosed operating instructions published by the measuring transducer manufacturer. With the installation of a head measuring transducer, users must make sure that the temperature of the connection head does not exceed the max. operating temperature of the measuring transducer.

3. Maintenance and testing of the thermocouple probe

3.1 Maintenance recommendations

Users should test the thermocouple probe and the measurement circuit at regular intervals (depending on the respective usage conditions):

- Visual check of the protective tube for mechanical wear and tear / damage caused by chemicals
- A test should be carried out to check temperature deviation by making a comparison with a calibrated comparable element (connection base with a 'verifier' is required)
- A check should be made with regard to soiling/moisture by taking an insulation measurement
- A check should be made for mechanical and chemical changes to the electrical installation and its contact elements (terminal base and connection terminals)

3.2 Initial error analysis

For the functional testing of a temperature measurement circuit, you require a meter with an mV and Ohm measurement range, an insulation meter with a testing voltage of 60 - 100 V DC and a calibrator for mV voltages according to the thermocouple probe signals.

A thermocouple probe is OK if, at room temperature:

- the resistance of the thermocouple is measured (wire $\varnothing > 0.5$ mm) $R < 20 \Omega$. (In the case of a connected conduct, please pay attention to the length and the cross section)
- when heating the measuring tip (by means of a lighter, Bunsen burner or similar) of the thermoelement, the mV – voltage rises slowly corresponding to the thermocouple voltage (simple functional test for thermoelements).

For each of the following types, the standardised thermal voltage (in accordance with DIN EN 60584-1) at 20 °C is:

0.798 mV in the case of type K, 0,525 mV in the case of type N, 0.113 mV in the case of type S, 0.111 mV in the case of type R and -0.003 mV in the case of type B.

- the insulation resistance is $R_{iso} \geq 100 M\Omega$
- when connecting a calibrator instead of the thermocouple probe, users can simply check the connected measurement circuit for functioning and/or interruptions

4. Examples of designs and fixing arrangements

