Industrial temperature assemblies for high temperature with or without replaceable measuring inserts
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1.1 Intended use

**CAUTION!**
Responsibility for the use of the measurement devices with regard to suitability, intended use and corrosion resistance of the used materials against the measured fluid lies solely with the operator.

**INFORMATION!**
The manufacturer is not liable for any damage resulting from improper use or use for other than the intended purpose.

The high temperature assemblies are used to measure the temperature in industrial applications with temperatures up to 1600°C. The devices are particularly suited for temperature measurement of:
- air
- gases

1.2 Approvals and certifications

1.2.1 CE

Article 1, section 2.1.4 of the Pressure Equipment Directive 97/23/EC does not apply to temperature assemblies for high temperature. For this reason, neither a conformity assessment nor a CE marking is possible. The EC directives applicable to temperature transmitters are contained in the corresponding transmitter documentation.

1.3 Safety instructions from the manufacturer

1.3.1 Copyright and data protection

The contents of this document have been created with great care. Nevertheless, we provide no guarantee that the contents are correct, complete or up-to-date.

The contents and works in this document are subject to copyright. Contributions from third parties are identified as such. Reproduction, processing, dissemination and any type of use beyond what is permitted under copyright requires written authorisation from the respective author and/or the manufacturer.

The manufacturer tries always to observe the copyrights of others, and to draw on works created in-house or works in the public domain.

The collection of personal data (such as names, street addresses or e-mail addresses) in the manufacturer’s documents is always on a voluntary basis whenever possible. Whenever feasible, it is always possible to make use of the offerings and services without providing any personal data.

We draw your attention to the fact that data transmission over the Internet (e.g. when communicating by e-mail) may involve gaps in security. It is not possible to protect such data
completely against access by third parties.

We hereby expressly prohibit the use of the contact data published as part of our duty to publish an imprint for the purpose of sending us any advertising or informational materials that we have not expressly requested.

1.3.2 Disclaimer

The manufacturer will not be liable for any damage of any kind by using its product, including, but not limited to direct, indirect or incidental and consequential damages.

This disclaimer does not apply in case the manufacturer has acted on purpose or with gross negligence. In the event any applicable law does not allow such limitations on implied warranties or the exclusion of limitation of certain damages, you may, if such law applies to you, not be subject to some or all of the above disclaimer, exclusions or limitations.

Any product purchased from the manufacturer is warranted in accordance with the relevant product documentation and our Terms and Conditions of Sale.

The manufacturer reserves the right to alter the content of its documents, including this disclaimer in any way, at any time, for any reason, without prior notification, and will not be liable in any way for possible consequences of such changes.
1.3.3 Product liability and warranty
The operator shall bear responsibility for the suitability of the device for the specific purpose. The manufacturer accepts no liability for the consequences of misuse by the operator. Improper installation or operation of the devices (systems) will cause the warranty to be void. The respective "Standard Terms and Conditions" which form the basis for the sales contract shall also apply.

1.3.4 Information concerning the documentation
To prevent any injury to the user or damage to the device it is essential that you read the information in this document and observe applicable national standards, safety requirements and accident prevention regulations.

If this document is not in your native language and if you have any problems understanding the text, we advise you to contact your local office for assistance. The manufacturer can not accept responsibility for any damage or injury caused by misunderstanding of the information in this document.

This document is provided to help you establish operating conditions, which will permit safe and efficient use of this device. Special considerations and precautions are also described in the document, which appear in the form of icons as shown below.
1.3.5 Warnings and symbols used

Safety warnings are indicated by the following symbols.

**DANGER!**
This warning refers to the immediate danger when working with electricity.

**DANGER!**
This warning refers to the immediate danger of burns caused by heat or hot surfaces.

**DANGER!**
This warning refers to the immediate danger when using this device in a hazardous atmosphere.

**DANGER!**
These warnings must be observed without fail. Even partial disregard of this warning can lead to serious health problems and even death. There is also the risk of seriously damaging the device or parts of the operator’s plant.

**WARNING!**
Disregarding this safety warning, even if only in part, poses the risk of serious health problems. There is also the risk of damaging the device or parts of the operator’s plant.

**CAUTION!**
Disregarding these instructions can result in damage to the device or to parts of the operator’s plant.

**INFORMATION!**
These instructions contain important information for the handling of the device.

**LEGAL NOTICE!**
This note contains information on statutory directives and standards.

- **HANDLING**
  This symbol designates all instructions for actions to be carried out by the operator in the specified sequence.
  - **RESULT**
    This symbol refers to all important consequences of the previous actions.

1.4 Safety instructions for the operator

**WARNING!**
In general, devices from the manufacturer may only be installed, commissioned, operated and maintained by properly trained and authorized personnel. This document is provided to help you establish operating conditions, which will permit safe and efficient use of this device.
2.1 Scope of delivery

INFORMATION!
Inspect the packaging carefully for damages or signs of rough handling. Report damage to the carrier and to the local office of the manufacturer.

INFORMATION!
Do a check of the packing list to make sure that you have all the elements given in the order.

INFORMATION!
Look at the device nameplate to ensure that the device is delivered according to your order.

The manufacturer delivers all industrial high temperature assemblies with the relevant technical documentation. The following table illustrates which temperature assembly is delivered with which documentation (HB = Handbook):

<table>
<thead>
<tr>
<th>Scope of order</th>
<th>HB. for temperature assemblies</th>
<th>HB. for measuring inserts</th>
<th>HB. for transmitters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature assemblies</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TCA-P60</td>
<td>X</td>
<td>X</td>
<td>-</td>
</tr>
<tr>
<td>TCA-P61</td>
<td>X</td>
<td>X</td>
<td>-</td>
</tr>
<tr>
<td>TCA-P62</td>
<td>X</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>TCA-P63</td>
<td>X</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>TCA-P64</td>
<td>X</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>TCA-P65</td>
<td>X</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Temperature assemblies with transmitter</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TCA-P60</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>TCA-P61</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>TCA-P62</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>TCA-P63</td>
<td>X</td>
<td>-</td>
<td>X</td>
</tr>
<tr>
<td>TCA-P64</td>
<td>X</td>
<td>-</td>
<td>X</td>
</tr>
<tr>
<td>TCA-P65</td>
<td>X</td>
<td>-</td>
<td>X</td>
</tr>
</tbody>
</table>
2 Device description

2.2 Design of industrial high temperature assemblies

INFORMATION!
In this documentation, the name “Industrial temperature assembly” refers to temperature assemblies with multipart, welded thermowells as well as those with ceramic thermowells.

OPTITEMP high temperature assemblies consist of a thermowell and a connection head. There are versions in which the connection head and the thermowell are thermally decoupled by way of a neck tube.

The thermowell contains either the measuring insert OPTITEMP TC100 or a ceramic measuring insert.

Figure 2-1: Design of a high temperature assembly with thermocouple type k.

1. Connection head lid
2. Measuring insert OPTITEMP TC100
3. Cable gland M20 x 1.5
4. Thermowell/ Support tube
5. Connection head
6. Screw to fasten connection head to the thermowell
Figure 2-2: Design of a high temperature assembly with thermocouple type S.

1. Connection head lid
2. Ceramic measuring insert
3. Cable gland M20 x 1.5
4. Thermowell/Support tube
5. Connection head
6. Screw to fix the connection head to thermowell/ support tube
2.2.2 Types of connection heads

A connection head protects the terminals and the temperature transmitter from environmental effects [e.g. dirt or dust]. All connection heads for high temperature assemblies have a threaded cable gland with the dimensions M20 x 1.5.

There are oil-resistant rubber seals on the covers of all connection heads (can be used up to 100°C / 212°F ambient temperature). All connection heads are available in die-cast aluminium. The surface of these connection heads features a 70µm thick powder coating made of polyester.

**INFORMATION!**
The inside dimensions of the connection heads depicted here comply with DIN 43735.

**INFORMATION!**
The connection head is attached onto the thermowell or support tube using a screw. The cable gland should be facing the desired direction before tightening the screw [using a screwdriver].

Connection heads available

- **BA** (aluminium, IP54)
- **BUZ-T** (aluminium, IP54)
- **BUZ-S** (aluminium, IP54)
- **AA** (aluminium, IP54)
2.2.3 Measuring insert designs and measuring insert length

**INFORMATION!**
The versions, dimensions and other construction features of the measuring inserts are standardised in DIN 43735.

The replaceable measuring insert contains the temperature sensor, with thermocouple. The measuring insert is pushed through the open connection head into the temperature assembly and attached using two spring loaded M4 screws. Depending on the thermocouple type, different measuring inserts are being used. For sensors with type J, K and N, measuring insert OPTITEMP TC 100 is used. For sensors with type B, R and S, a special designed ceramic measuring insert is used.

**INFORMATION!**
Consult the handbook “OPTITEMP TR/TC 100” for more detailed information on the OPTITEMP TC 100 measuring inserts.
One distinguishing dimension of the measuring insert is its length. The length is measured from the bottom edge of the base to the tip of the immersion tube ("a" in the drawing below):

![Figure 2-5: Measuring insert length for TC 100](image)

**INFORMATION!**
Consult the handbook "OPTITEMP TR/TC 100" for more detailed information on the TC100 measuring inserts.

![Figure 2-6: Ceramic measuring insert length](image)

### 2.2.4 Thermowells and Support tubes

The thermowell is designed to prevent external loads (e.g. static pressure, flowing and aggressive media) from damaging the measuring insert. In terms of the material and design, we can distinguish between two types of thermowells:

- Multipart, welded thermowells
- Bar stock thermowells

OPTITEMP TCA-P60 has a multipart welded thermowell made of Kanthal AF/1.4767.

OPTITEMP TCA-P61 has a multipart welded thermowell made of 1.4835/253Ma with an extra thick bar stock tip made of 1.4841/AISI 314 or 1.4835/253Ma.

OPTITEMP TCA-P62 has a multipart welded thermowell made of Kanthal AF/1.4767 or 1.4762.

OPTITEMP TCA-P63 and OPTITEMP TCA-P64 has a ceramic thermowell made of C610 or C799.

OPTITEMP TCA-P65 has a double set of ceramic thermowells made of C799.
INFORMATION!

The dimension "a" denotes the length of the thermowell and "U" the length of the bar stock measuring tip.

Figure 2-7: Thermowells available for TCA-P60, TCA-P61, TCA-P62

1 Thermowell for TCA-P60
2 Thermowell for TCA-P61
3 Thermowell for TCA-P62

INFORMATION!

The dimension "a" denotes the length of the thermowell.
2 DEVICE DESCRIPTION

OPTITEMP TCA HOT

Figure 2-8: Figure 2-5: Thermowells available for TCA-P63, TCA-P64, TCA-P65

1 Thermowell and support tube for TCA-P63
2 Thermowell and support tube for TCA-P64
3 Thermowell and support tube for TCA-P65

<table>
<thead>
<tr>
<th>Thermowell (l/thermowell tip)</th>
<th>Ø [mm]</th>
<th>Wall thickness [mm]</th>
<th>Length a [mm]</th>
<th>U length [mm]</th>
<th>Material</th>
<th>Sensor type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Straight, multipart, welded</td>
<td>15</td>
<td>0.59</td>
<td>1.3</td>
<td>500, 710, 1000, 1400, 2000</td>
<td>-</td>
<td>1.4762/ Kanthal AF</td>
</tr>
<tr>
<td></td>
<td>19</td>
<td>0.75 / 0.87</td>
<td>1.3</td>
<td>500, 710, 1000, 1400, 2000</td>
<td>-</td>
<td>1.4762/ Kanthal AF</td>
</tr>
<tr>
<td></td>
<td>21.3</td>
<td>0.84</td>
<td>7.2*</td>
<td>710, 1000, 1400</td>
<td>200, 300, 500</td>
<td>1.4835/ 253Ma</td>
</tr>
<tr>
<td></td>
<td>21.3</td>
<td>0.84</td>
<td>7.2*</td>
<td>1000, 1400, 2000</td>
<td>200, 300, 500</td>
<td>1.4835/ 253Ma</td>
</tr>
<tr>
<td></td>
<td>22</td>
<td>0.87</td>
<td>2.0</td>
<td>500, 710, 1000, 1400, 2000</td>
<td>-</td>
<td>1.4762</td>
</tr>
</tbody>
</table>
### Table 2-1: * at the measuring tip  
** double thermowell

<table>
<thead>
<tr>
<th>Thermowell/thermowell tip</th>
<th>Ø [mm]</th>
<th>Wall thickness [mm]</th>
<th>Length a [mm]</th>
<th>U length [mm]</th>
<th>Material</th>
<th>Sensor type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ceramic thermowell</td>
<td>10</td>
<td>0.39</td>
<td>1.5</td>
<td>180, 255, 355, 500, 710, 1000</td>
<td>-</td>
<td>C610</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td>0.59</td>
<td>2.0</td>
<td>500, 710, 1000, 1400, 2000</td>
<td>-</td>
<td>C610</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>0.39</td>
<td>2.0</td>
<td>180, 255, 355, 500, 710, 1000</td>
<td>-</td>
<td>C799</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td>0.59</td>
<td>2.5</td>
<td>500, 710, 1000, 1400, 2000</td>
<td>-</td>
<td>C799</td>
</tr>
<tr>
<td>24x3 / 15x2.5**</td>
<td>0.94 / 0.95**</td>
<td>3.0 / 2.5**</td>
<td>500, 710, 1000, 1400, 2000</td>
<td>-</td>
<td>C799</td>
<td>TCA-P65</td>
</tr>
</tbody>
</table>
2.2.5 Support tubes

The support tube is the part covering the ceramic thermowell at the upper end. Its purpose is to create a robust design for process connection and mounting of the connection head. The support tube is available in material 1.4404 / 316L for TCA-P63, TCA-P64 and in material 1.4571 / 316Ti for TCA-P65. It is fixed to the thermowell by a heat-resistant ceramic compound.

**INFORMATION!**

Support tubes is only applicable for the products TCA-P63, TCA-P64 and TCA-P65.
2.2.6 Types of temperature transmitters

Electrical temperature assemblies have just one, weak, interference-prone output signal. If this signal has to travel a great distance or if a standard signal of 4...20 mA is required, use of a temperature transmitter is recommended:

**INFORMATION!**

The manufacturer cannot make any general statement as to the distance from which the use of a temperature transmitter is necessary as it depends on the specific interference associated with the installation site. The operator alone is responsible for this decision.

There are two types of temperature transmitters:

- **Head-mounted transmitter:** Located on the measuring insert and thus in the connection head of the temperature assembly during operation, recognisable by the "C" in the product name (e.g. TT 10 C)
- **Rail-mounted transmitter:** Located in the control cabinet or field housing, recognisable by the "R" in the product name (e.g. TT 10 R); they are usually used when the temperature in the connection head does not allow for the use of a head-mounted transmitter

![Figure 2-9: Example of a head-mounted transmitter](image-url)
Head-mounted and rail-mounted transmitters both convert the temperature sensor’s small signal into a standardised output signal of 4...20 mA, not susceptible to interference, or into a digital signal. The output signal depends on the type of temperature transmitter. The following three 2-wire technology options are currently available:

- 4...20 mA
- 4...20 mA with HART®
- Profibus-PA

You can configure almost any temperature transmitter using a PC and a computer program. The only exception is the TT 10 C/R version, whose measuring ranges must be set using solder bridges. The following temperature transmitters are currently available:

<table>
<thead>
<tr>
<th>Available in both head-mounted and rail-mounted version</th>
<th>Only available in rail-mounted version</th>
</tr>
</thead>
<tbody>
<tr>
<td>TT 10 C/R (analogue, standard, 4...20 mA)</td>
<td>TT 31 R (3-wire circuit, 0/4...20 mA, outputs: 0/1...5 VDC, 0/2...10 VDC)</td>
</tr>
<tr>
<td>TT 30 C/R (digital, 4...20 mA, standard)</td>
<td>TT 32 R (4-wire circuit, 0/4...20 mA, outputs: 0/1...5 VDC, 0/2...10 VDC)</td>
</tr>
<tr>
<td>TT 40 C/R (digital, 4...20 mA, precise)</td>
<td>TT 50 C/R (digital, 4...20 mA, HART®)</td>
</tr>
<tr>
<td>TT 51 C/R (digital, 4...20 mA, HART®, SIL2)</td>
<td>TT 60 C/R (digital, Profibus-PA)</td>
</tr>
</tbody>
</table>

**INFORMATION!**
Consult the relevant transmitter handbook for more detailed information on the temperature transmitters.
2.3 Process connections and areas of application

2.3.1 Sliding flange

The sliding flange is used when connecting high temperature assemblies to applications with weld-in connection. The sliding flange is made of cast steel with black powder lacquer coating and the counter flange is made of lacquered steel 1.0401.

Figure 2-11: Installing a high temperature assembly with a sliding flange and counter flange

1 Thermowell and support tube
2 Sliding flange
3 Counter flange
4 Application wall

CAUTION!
Do not clamp the temperature assembly directly on the ceramic thermowell, the ceramic will break or crack.
2.3.2 Compression fitting

The compression fitting is used when connecting a high temperature assembly to applications with screw-in. The compression fitting is made of zinc-plated steel 1.0715 and has a ceramic sealing.

Figure 2-12: Installing a high temperature assembly with a compression fitting

1. Thermowell and support tube
2. Compression fitting
3. Application wall

CAUTION!
Do not clamp the temperature assembly directly on the ceramic thermowell, it risks to break or crack.
2.4 Overview of available versions

**INFORMATION!**
The beginning of the product name refers to the type of sensor in the measuring insert:

- **TCA**: Temperature assembly with thermocouple

**TCA-P60**
Temperature assembly with thermowell of Kanthal

**TCA-P61**
Temperature assembly with thermowell of Kanthal or Chrome steel with bar stock tip

**TCA-P62**
Temperature assembly with thermowell of Kanthal or Chrome steel

**TCA-P63**
Temperature assembly with support tube and ceramic thermowell

**TCA-P64**
Temperature assembly with support tube and ceramic thermowell

**TCA-P65**
Temperature assembly with support tube and double ceramic thermowells
2.5 Nameplate

**INFORMATION!**  
Look at the device nameplate to ensure that the device is delivered according to your order.

The nameplate is located on the connection head, it measures 70 mm x 18 mm / 2.76 x 0.71":

![Sample nameplate](image)

**Figure 2-13: Sample nameplate (OPTITEMP TCA-P64)**

1. Manufacturer  
2. Production site  
3. Manufacturing year  
4. Type of temperature assembly  
5. Measuring insert specification  
6. Manufacturer’s website  
7. Note that the handbook is available for download from the manufacturer’s website.  
8. Type code  
9. Individual serial number  
10. Order number  
11. Production order number  
12. Space for transmitter information

**INFORMATION!**  
For a customer-specific TAG No., the manufacturer can print out a separate label if required.

If the temperature assembly has a transmitter, this information is found on the right side of the nameplate.
3.1 General notes on installation

**CAUTION!**
Installation, assembly, start-up and maintenance may only be performed by appropriately trained personnel. The regional occupational health and safety directives must always be observed.

**INFORMATION!**
Inspect the packaging carefully for damages or signs of rough handling. Report damage to the carrier and to the local office of the manufacturer.

**INFORMATION!**
Do a check of the packing list to make sure that you have all the elements given in the order.

**INFORMATION!**
Look at the device nameplate to ensure that the device is delivered according to your order.

**INFORMATION!**
Assembly materials and tools are not part of the delivery. Use the assembly materials and tools in compliance with the applicable occupational health and safety directives.

3.2 Storage

**CAUTION!**
Always store high temperature assemblies in a dry place protected from dust, preferably in its original packaging. The permissible range for storage temperatures is -40...+70°C / -40...+176°F.

3.3 Transport

**CAUTION!**
Always transport high temperature assemblies in their original packaging. Do not expose the devices to moisture or vibration during transport. The information that applies to storage also applies to transport.

3.4 Possible installations

Gas-tight ceramic materials are generally sensitive to large changes in temperature as it might burst. It is therefore recommend to heat the thermowell before installation and to gradually immerse it into the process.

To protect the temperature assembly from mechanical stress and from bending at high temperatures, the temperature assembly should be installed in a vertical position. If vertical position is not possible, please consult the supplier before installing the temperature assembly in another position.
3.4.1 Gas-tight installation

To achieve gas-tightness up to 1 bar, the temperature assembly must be installed using a compression fitting or a sliding flange.

**INFORMATION!**

When installing temperature assemblies with ceramic thermowells, the compression fitting should be clamped on to the support tube. This means that the transition between the ceramic thermowell and the support tube is not separated from the process. For that reason, gas-tightness up to 1 bar can not be guaranteed when using compression fitting together with ceramic thermowells.

3.5 Load limits

The load limits of industrial temperature assemblies depend on several factors:

- Dimensions and design of the thermowell (especially the insertion length and diameter)
- Thermowell material
- Mechanical conditions the thermowell is subject to due to the measured medium [pressure, temperature, radiation]
- Vibration load
4.1 Safety instructions

**DANGER!**
All work on the electrical connections may only be carried out with the power disconnected. Take note of the voltage data on the nameplate!

**DANGER!**
Observe the national regulations for electrical installations!

**WARNING!**
Observe without fail the local occupational health and safety regulations. Any work done on the electrical components of the measuring device may only be carried out by properly trained specialists.

**INFORMATION!**
Look at the device nameplate to ensure that the device is delivered according to your order.

4.2 Grounding

**DANGER!**
The thermowells on the high temperature assemblies are grounded via the process connection. For ceramic thermowells the process connection must be on the support tube to ensure grounding.

4.3 Protection category

The IP protection category of a high temperature assemblies depends on the type of connection and the cable gland used. For all high temperature assemblies applies category IP54.

4.4 Power supply

**INFORMATION!**
Assembly materials and tools are not part of the delivery. Use the assembly materials and tools in compliance with the applicable occupational health and safety directives.

For more detailed information on supplying these components with power, consult the product-specific manuals.
5.1 Start-up

**CAUTION!**
Double check the following things prior to starting up a high temperature assembly in order to avoid measuring errors as well as damage to or the destruction of the temperature assembly:

- Ensure that the thermowells have been properly installed according to the manufacturer’s instructions.
- Ensure that the process connection has been successfully tested for leaks.
- Ensure that the measuring insert sits firmly on the bottom of the thermowell.
- Ensure that the measuring insert has been properly electrically connected according to the manufacturer’s instructions (refer to measuring insert handbook).

5.2 Normal operation

During the course of normal operation, it is not necessary to make any adjustments to the temperature assembly, measuring insert, temperature transmitter or temperature indicator.

**WARNING!**
Never touch the thermowell, neck tube or connection head in operation without protective gloves! These components can become very hot during operation and cause burns.

5.3 Faults and damage: reason and remedies

**INFORMATION!**
The most probable cause of a fault is the measuring insert itself and its electronic components (see the handbook for measuring inserts, subsection “Faults: Reasons and Remedies”). The following issues come into question here:

- Short circuit or open circuit
- Insulation resistance too low
- Ageing
- Wrong thermocouple wire or compensating line
- Wrong polarisation of thermocouple or compensation cable

In addition, the following faults and damage may occur:

**Liquid on the process connection**
A damaged or incorrect seal can lead to a leak at the process connection. Should this occur, replace the seal and ensure that the new one meets the individual requirements of the measuring point (pressure, temperature, chemically aggressive media). It is the sole responsibility of the operator of the device to select the right seal.
Temperature indication too high or too low
When reference measurements result in an incorrect temperature indication, the following causes come into question:

- Heat radiation from heaters in oven, reflector shirm.
- Severe heat transfer caused by too short insertion length of thermowell or measuring insert: the temperature assembly indicates a temperature that is too low when it is above the ambient temperature and one that is too high when it is below the ambient temperature.
- Severe heat transfer via the process connection, the pipeline or the tank wall due to a lack of insulation.
- Ageing of thermocouples. Calibrate / compensate or replace
- Incorrect thermowell dimensions (diameter, wall thickness).
- Wrong polarization during the installation, switch polarization to right polarization.

To keep the heat transfer to a minimum, either increase the insertion length of the temperature assembly or improve the insulation of the measuring point.

Slow response to changes in temperature
If the measuring insert is not resting firmly on the bottom of the thermowell, the response to any changes in temperature may be slowed. So, ensure that the measuring insert touches the bottom of the thermowell using the spring-loaded mounting.

Damage to the thermowell and penetrating liquid/ gases
If the thermowell is not sufficiently resistant to chemically aggressive media, corrosion may occur and the measured medium may penetrate.

Breaks or tears
It is possible for breaks or tears to occur due to the force of the media flowing against the thermowell. Superimposition of the two causes or a combination of insufficient mechanical and chemical resistance is also possible. The following are starting points for troubleshooting:

- Selection of a thermowell with different dimensions
- Change in neck tube length at critical head resonances
- Selection of a different installation site
- For ceramic thermowells ensure the process connection is connected to the support tube
6.1 Replacing the electronics

When it comes to high temperature assemblies, it is only possible to replace an electronic component if there is a temperature transmitter. Consult the handbook for the temperature transmitter or, if applicable, the head-mounted display to learn what you need to take into consideration when replacing the electronics.

6.2 Cleaning and maintenance

As a rule, the high temperature assemblies require no cleaning or maintenance. However, depending on the conditions of use and the thermal and mechanical load, they can age.

As a result of the ageing process, the characteristics ("characteristic curve") can change. That means that the relationship between the thermovoltage and the temperature changes. In this case, calibration shows whether any deviations in measurement values are still within permissible tolerances.

6.3 Spare parts availability

The manufacturer adheres to the basic principle that functionally adequate spare parts for each device or each important accessory part will be kept available for a period of 3 years after delivery of the last production run for the device.

This regulation only applies to spare parts which are subject to wear and tear under normal operating conditions.

6.4 Availability of services

The manufacturer offers a range of services to support the customer after expiration of the warranty. These include repair, maintenance, technical support and training.

INFORMATION!
For more precise information, please contact your local sales office.
6.5 Returning the device to the manufacturer

6.5.1 General information

This device has been carefully manufactured and tested. If installed and operated in accordance with these operating instructions, it will rarely present any problems.

**CAUTION!**

Should you nevertheless need to return a device for inspection or repair, please pay strict attention to the following points:

- Due to statutory regulations on environmental protection and safeguarding the health and safety of the personnel, the manufacturer may only handle, test and repair returned devices that have been in contact with products without risk to personnel and environment.
- This means that the manufacturer can only service this device if it is accompanied by the following certificate (see next section) confirming that the device is safe to handle.

**CAUTION!**

If the device has been operated with toxic, caustic, flammable or water-endangering products, you are kindly requested:

- to check and ensure, if necessary by rinsing or neutralising, that all cavities are free from such dangerous substances,
- to enclose a certificate with the device confirming that is safe to handle and stating the product used.
6.5.2 Form (for copying) to accompany a returned device

CAUTION!
To avoid any risk for our service personnel, this form has to be accessible from outside of the packaging with the returned device.

<table>
<thead>
<tr>
<th>Company:</th>
<th>Address:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Department:</td>
<td>Name:</td>
</tr>
<tr>
<td>Tel. no.:</td>
<td>Fax no. and/or Email address:</td>
</tr>
<tr>
<td>Manufacturer’s order no. or serial no.:</td>
<td></td>
</tr>
</tbody>
</table>

The device has been operated with the following medium:

This medium is:
- radioactive
- water-hazardous
- toxic
- caustic
- flammable

We checked that all cavities in the device are free from such substances.
We have flushed out and neutralized all cavities in the device.

We hereby confirm that there is no risk to persons or the environment through any residual media contained in the device when it is returned.

Date: Signature: Stamp:

6.6 Disposal

CAUTION!
Disposal must be carried out in accordance with legislation applicable in your country.

Separate collection of WEEE (Waste Electrical and Electronic Equipment) in the European Union:

According to the directive 2012/19/EU, the monitoring and control instruments marked with the WEEE symbol and reaching their end-of-life must not be disposed of with other waste. The user must dispose of the WEEE to a designated collection point for the recycling of WEEE or send them back to our local organisation or authorised representative.
7.1 Measuring principle

All of the temperature assemblies described here belong to the class known as “contact temperature assemblies”. Unlike “radiation temperature assemblies”, these temperature assemblies come into direct contact with the medium whose temperature they are to measure.

The measuring principle are described in the following subsection.

7.1.1 Thermocouples

The thermocouple features two electric conductors made from different metals, connected at one end. Each free end is connected to a compensation cable which is then connected to a millivolt meter. This circuitry forms a “thermal circuit”. The point at which the two electric conductors connect is called the measuring point and the point at which the compensation cables connect to the conductors of the millivolt meter is called the cold junction.

If the measuring point of this thermal circuit is heated up, a small electrical voltage (thermal voltage) can be measured. If, however, the measuring point and the cold junction are at the same temperature, no thermoelectric voltage is generated. The degree of thermoelectric voltage, also known as electromotive force (EMF), depends on the thermocouple material and the extent of the temperature difference between the measuring point and the cold junction. It can be measured using the millivolt meter with no auxiliary power.

Simply put, the thermocouple behaves like a battery, the voltage of which also increases as the temperature rises.

INFORMATION!

The characteristic curves and tolerances of commercially available thermocouples are standardised in IEC 60584.

Figure 7-1: Thermocouple measuring circuit, schematic.

- Measuring point t1 (hot junction)
- Thermocouple
- Transition junction t2
- Compensation cable / extension cable
- Reference junction t3 (cold junction)
- Copper conductor
- Voltage meter Uth

\[ U_h = f(t_1 - t_3) \]
### 7.2 Technical data tables

**INFORMATION!**
- The following data is provided for general applications. If you require data that is more relevant to your specific application, please contact us or your local sales office.
- Additional information (certificates, special tools, software,...) and complete product documentation can be downloaded free of charge from the website (Downloadcenter).

#### Measuring system

<table>
<thead>
<tr>
<th>Application range</th>
<th>Measuring the temperature of air and gases in industrial processes with high temperature.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring principle</td>
<td>Contact temperature assembly</td>
</tr>
<tr>
<td>Measured value</td>
<td>Temperature</td>
</tr>
</tbody>
</table>

#### Design

<table>
<thead>
<tr>
<th>Modular design</th>
<th>High temperature assemblies consist of several components:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>- Measuring insert with temperature sensor</td>
</tr>
<tr>
<td></td>
<td>- Transmitter (either integrated with temperature assembly or remote)</td>
</tr>
<tr>
<td></td>
<td>- Connection head</td>
</tr>
<tr>
<td></td>
<td>- Separate neck tube</td>
</tr>
<tr>
<td></td>
<td>- Thermowell</td>
</tr>
<tr>
<td>Signal converter</td>
<td>In-head transmitter or rail-mount transmitter.</td>
</tr>
<tr>
<td>Sensor</td>
<td>Type “J”, “K”, “N” or “S” thermocouple with a characteristic according to DIN EN 60584. Type “B” and “R” can be ordered on request.</td>
</tr>
<tr>
<td>Measuring range</td>
<td>Refer to &quot;Operating conditions&quot;.</td>
</tr>
</tbody>
</table>
**Measuring accuracy**

<table>
<thead>
<tr>
<th>Reference conditions</th>
<th>Ambient temperature: +23°C / +73.4°F (fluctuations due to air pressure and density have no impact on measuring accuracy.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum measuring error</td>
<td>More detailed information in the subsection “Measurement Error” (also in the “Technical Data” section). The maximum measurement error is in accordance with tolerance class 1 acc. to DIN EN 60584.</td>
</tr>
</tbody>
</table>

**Operating conditions**

<table>
<thead>
<tr>
<th>Load limits</th>
<th>The load limits depend on several factors (e.g. dimensions, design and material of thermowell). Other information can be found in the “Installation” section or in separate subsections of section “Technical data”.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td></td>
</tr>
<tr>
<td>Process temperature</td>
<td>up to +1600°C / +2912°F, depending on measuring insert, design and material.</td>
</tr>
</tbody>
</table>
| Ambient temperature | Connection head without transmitter: -40...+100°C / -40...+212°F  
Connection head with transmitter: -40...+85°C / -40...+185°F |
| Storage temperature | -40...+70°C / -40...+158°F at 40...60% relative humidity. |

**Other conditions**

| Protection categories | IP 54 |

**Installation conditions**

| Insertion angle | Vertically |

**Materials**

| Thermowells | Multipart, welded:  
1.4767 / Kanthal AF  
1.4841  
1.4762  
Ceramic:  
Ceramic C610  
Ceramic C799 |
|-------------|-------------------------------------------------------------------------------------------------------------------|
| Support tube | 1.4404 / AISI 316 L  
1.4571 / 316 Ti |
| Connection heads | Aluminium (powder coated) |
| Measuring inserts | Mineral insulated sheathed cable, sheath material Inconel 600®  
Mounted in ceramic insulators, C799 |

**Process connections and connection head thread**

<table>
<thead>
<tr>
<th>Plug-in temperature assembly</th>
<th>Mounted using sliding flange or compression fitting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connection head</td>
<td>Assembly hole: Ø15.3, Ø22.3, Ø32.5 mm</td>
</tr>
</tbody>
</table>
7 TECHNICAL DATA

Electrical connections

<table>
<thead>
<tr>
<th>Power supply</th>
<th>Only necessary when using a temperature transmitter and depends on transmitter type (typically 24 VDC).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power consumption</td>
<td>Only when using a temperature transmitter (typically 550 mW).</td>
</tr>
<tr>
<td>Cable entry (connection head)</td>
<td>Cable entry thread according to DIN: M20 x 1.5 mm</td>
</tr>
<tr>
<td>Current output</td>
<td></td>
</tr>
<tr>
<td>Output range</td>
<td>Exists only when using a temperature transmitter and depends on transmitter type (typically 4...20 mA, HART®, Profibus-PA).</td>
</tr>
<tr>
<td>Error signal</td>
<td>Exists only when using a temperature transmitter. According to NAMUR NE 43, selectable: upper value ≥ 21.0 mA, lower value ≤ 3.6 mA, the factory default is the upper value.</td>
</tr>
<tr>
<td>Load</td>
<td>Relevant only when using a temperature transmitter and then dependent on transmitter type (typically 250 Ω).</td>
</tr>
</tbody>
</table>

Other electrical characteristics

| Galvanic isolation | Relevant only when using a temperature transmitter (see transmitter handbook). |
| Time constant | More detailed information can be found in the subsection "Response times" of the section "Technical data". |

Approvals and certificates

| Electromagnetic compatibility | See handbook for temperature transmitter used. |
| Functional safety | SIL2 with temperature transmitter TT51 C/R |
7.3 Dimensions

7.3.1 Cable gland

Figure 7-2: Cable gland

1. Cable gland
2. Process connection (inner diameter)

<table>
<thead>
<tr>
<th>Connection head</th>
<th>Process connection</th>
<th>Cable gland</th>
</tr>
</thead>
<tbody>
<tr>
<td>BA</td>
<td>Ø15.3</td>
<td>M20 x 1.5 mm</td>
</tr>
<tr>
<td>BUZ-T</td>
<td>Ø15.3 or Ø22.3</td>
<td>M20 x 1.5 mm</td>
</tr>
<tr>
<td>BUZ-S</td>
<td>Ø15.3</td>
<td>M20 x 1.5 mm</td>
</tr>
<tr>
<td>AA</td>
<td>Ø22.3 or Ø32.5</td>
<td>M20 x 1.5 mm</td>
</tr>
</tbody>
</table>
7.3.2 Support tubes

The dimensions for the support tubes given in this subsection are standard lengths. Longer support tube may sometimes be necessary if the ambient temperature is too high and could damage the connection head or the electronic components inside. Always consult the supplier for the right length.

<table>
<thead>
<tr>
<th>&quot;c&quot; [neck tube length] [mm]</th>
<th>&quot;b&quot; [diameter] [&quot;]</th>
</tr>
</thead>
<tbody>
<tr>
<td>80</td>
<td>3.15</td>
</tr>
<tr>
<td>150</td>
<td>5.90</td>
</tr>
<tr>
<td>200</td>
<td>7.87</td>
</tr>
<tr>
<td>15</td>
<td>0.59</td>
</tr>
<tr>
<td>22</td>
<td>0.87</td>
</tr>
<tr>
<td>32</td>
<td>1.26</td>
</tr>
</tbody>
</table>
7.3.3 Lengths of thermowells

The dimensions for the thermowells and measuring inserts given in this subsection are standard lengths. Upon request the manufacturer can supply devices with other dimensions.

Temperature assemblies with high temperature stainless steel thermowells

<table>
<thead>
<tr>
<th>TCA-P60</th>
<th>Insertion length “a”</th>
<th>Measuring insert length</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>[mm]</td>
<td>[“]</td>
</tr>
<tr>
<td>500</td>
<td>525</td>
<td>19.7</td>
</tr>
<tr>
<td>710</td>
<td>735</td>
<td>28</td>
</tr>
<tr>
<td>1000</td>
<td>1025</td>
<td>39.4</td>
</tr>
<tr>
<td>1400</td>
<td>1425</td>
<td>55.1</td>
</tr>
<tr>
<td>2000</td>
<td>2025</td>
<td>78.7</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TCA-P61</th>
<th>Insertion length “a”</th>
<th>Measuring insert length</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>[mm]</td>
<td>[“]</td>
</tr>
<tr>
<td>1000 [U=200/300/500]</td>
<td>1050 [7.9/11.8/19.7]</td>
<td>39.4</td>
</tr>
<tr>
<td>1400 [U=200/300/500]</td>
<td>1450 [7.9/11.8/19.7]</td>
<td>55.1</td>
</tr>
<tr>
<td>2000 [U=500]</td>
<td>2050 [19.7]</td>
<td>78.7</td>
</tr>
</tbody>
</table>
### TECHNICAL DATA

#### TCA-P62

<table>
<thead>
<tr>
<th>Insertion length “a” [mm]</th>
<th>Measuring insert length [mm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>500</td>
<td>19.7</td>
</tr>
<tr>
<td>540</td>
<td>21.3</td>
</tr>
<tr>
<td>710</td>
<td>28</td>
</tr>
<tr>
<td>750</td>
<td>29.5</td>
</tr>
<tr>
<td>1000</td>
<td>39.4</td>
</tr>
<tr>
<td>1040</td>
<td>40.9</td>
</tr>
<tr>
<td>1400</td>
<td>55.1</td>
</tr>
<tr>
<td>1440</td>
<td>56.7</td>
</tr>
<tr>
<td>2000</td>
<td>78.7</td>
</tr>
<tr>
<td>2040</td>
<td>80.3</td>
</tr>
</tbody>
</table>
Temperature assemblies with ceramic thermowell

![Diagram of temperature assemblies with ceramic thermowell]

1. TCA-P63
2. TCA-P64
3. TCA-P65

<table>
<thead>
<tr>
<th>TCA-P63</th>
<th>Insertion length &quot;a&quot;</th>
<th>Measuring insert length type K, N</th>
<th>Measuring insert length type S</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>[mm]</td>
<td>[°]</td>
<td>[mm]</td>
</tr>
<tr>
<td>180</td>
<td>180</td>
<td>7.1</td>
<td>205</td>
</tr>
<tr>
<td>250</td>
<td>250</td>
<td>9.8</td>
<td>275</td>
</tr>
<tr>
<td>355</td>
<td>355</td>
<td>14</td>
<td>380</td>
</tr>
<tr>
<td>500</td>
<td>500</td>
<td>19.7</td>
<td>525</td>
</tr>
<tr>
<td>710</td>
<td>710</td>
<td>28</td>
<td>735</td>
</tr>
<tr>
<td>1000</td>
<td>1000</td>
<td>39.8</td>
<td>1025</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TCA-P64</th>
<th>Insertion length &quot;a&quot;</th>
<th>Measuring insert length type K, N</th>
<th>Measuring insert length type S</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>[mm]</td>
<td>[°]</td>
<td>[mm]</td>
</tr>
<tr>
<td>500</td>
<td>500</td>
<td>19.7</td>
<td>540</td>
</tr>
<tr>
<td>710</td>
<td>710</td>
<td>28</td>
<td>750</td>
</tr>
<tr>
<td>1000</td>
<td>1000</td>
<td>39.8</td>
<td>1040</td>
</tr>
<tr>
<td>1400</td>
<td>1400</td>
<td>55.1</td>
<td>1440</td>
</tr>
<tr>
<td>2000</td>
<td>2000</td>
<td>78.7</td>
<td>2040</td>
</tr>
</tbody>
</table>
### TCA-P65

<table>
<thead>
<tr>
<th>Insertion length “a”</th>
<th>Measuring insert length type S</th>
</tr>
</thead>
<tbody>
<tr>
<td>[mm]</td>
<td>[&quot;]</td>
</tr>
<tr>
<td>500</td>
<td>19.7</td>
</tr>
<tr>
<td>710</td>
<td>28</td>
</tr>
<tr>
<td>1000</td>
<td>39.8</td>
</tr>
<tr>
<td>1400</td>
<td>55.1</td>
</tr>
<tr>
<td>2000</td>
<td>78.7</td>
</tr>
</tbody>
</table>

**INFORMATION!**
- Tolerances of all thermowell and insertion lengths: ± 1 mm / 0.04”
- Tolerances between measuring insert and thermowell lengths: +3 mm, -0 mm / +0.08", -0"
7.3.4 Sliding flange

<table>
<thead>
<tr>
<th>Tube Ø</th>
<th>da [mm]</th>
<th>b [mm]</th>
<th>c [°]</th>
<th>d [mm]</th>
<th>e [°]</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>35</td>
<td>1.38</td>
<td>55</td>
<td>2.17</td>
<td>73</td>
</tr>
<tr>
<td>21/2</td>
<td>40</td>
<td>1.57</td>
<td>70</td>
<td>2.76</td>
<td>90</td>
</tr>
<tr>
<td>32</td>
<td>50</td>
<td>1.97</td>
<td>70</td>
<td>2.76</td>
<td>90</td>
</tr>
</tbody>
</table>
7.3.5 Compression fitting

<table>
<thead>
<tr>
<th>Ød</th>
<th>Øa</th>
<th>b</th>
<th>c</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>[mm]</td>
<td>[°]</td>
<td>[mm]</td>
</tr>
<tr>
<td>G1/2</td>
<td>15</td>
<td>0.59</td>
<td>50</td>
</tr>
<tr>
<td>G3/4</td>
<td>15</td>
<td>0.59</td>
<td>60</td>
</tr>
<tr>
<td></td>
<td>19</td>
<td>0.75</td>
<td>70</td>
</tr>
<tr>
<td>G1&quot;</td>
<td>15</td>
<td>0.59</td>
<td>70</td>
</tr>
<tr>
<td></td>
<td>21/22</td>
<td>0.83/0.87</td>
<td>70</td>
</tr>
</tbody>
</table>
7.4 Measuring accuracy

The measuring accuracy depends largely on the following factors:

- The version of the measuring insert (type of sensor, type of circuit, measuring range).
- The correct dimensions (diameter, wall thickness) and insertion length of the thermowell for good thermal coupling to the process temperature (insufficient insertion depth often results in measurement errors).
- The type of temperature transmitter used.

**INFORMATION!**
Please consult the appropriate handbook for further information regarding the accuracy of the measuring inserts and the temperature transmitters.

**Tolerances according to IEC 60584-2**

<table>
<thead>
<tr>
<th>Thermocouple</th>
<th>Temperature range °C</th>
<th>Tolerances</th>
</tr>
</thead>
<tbody>
<tr>
<td>J (Fe-CuNi)</td>
<td>-40 to +375</td>
<td>±1.5 °C</td>
</tr>
<tr>
<td></td>
<td>+375 to +750</td>
<td>±0.4 % 1)</td>
</tr>
<tr>
<td>K (NiCr-NiAl)</td>
<td>-40 to +375</td>
<td>±1.5 °C</td>
</tr>
<tr>
<td></td>
<td>+375 to +1000</td>
<td>±0.4 % 1)</td>
</tr>
<tr>
<td>N (NiCrSi-NiSi)</td>
<td>-40 to +375</td>
<td>±1.5 °C</td>
</tr>
<tr>
<td></td>
<td>+375 to +1000</td>
<td>±0.4 % 1)</td>
</tr>
<tr>
<td>T (Cu-CuNi)</td>
<td>-40 to +125</td>
<td>±0.5 °C</td>
</tr>
<tr>
<td></td>
<td>+125 to +350</td>
<td>±0.4 % 1)</td>
</tr>
<tr>
<td>E (NiCr-CuNi)</td>
<td>-40 to +375</td>
<td>±1.5 °C</td>
</tr>
<tr>
<td></td>
<td>+375 to +800</td>
<td>±0.4 % 1)</td>
</tr>
<tr>
<td>R (Pt13Rh-Pt)</td>
<td>0 to +1100</td>
<td>±1.0 °C</td>
</tr>
<tr>
<td></td>
<td>+1100 to +1600</td>
<td>±(1+0.003(t-1100)) °C</td>
</tr>
<tr>
<td>S (Pt10Rh-Pt)</td>
<td>0 to +1100</td>
<td>±1.0 °C</td>
</tr>
<tr>
<td></td>
<td>+1100 to +1600</td>
<td>±(1+0.003(t-1100)) °C</td>
</tr>
<tr>
<td>B (Pt30Rh-Pt6Rh)</td>
<td>+600 to +1700</td>
<td>0.25 % 1)</td>
</tr>
<tr>
<td></td>
<td>class 2</td>
<td>class 2</td>
</tr>
</tbody>
</table>

*Table 7-1: 1) of temperature reading*
With the exception of the TT 60 C/R version, all of the temperature transmitters generate an analogue output signal. For this reason, the following table indicates the measuring accuracy of most of the transmitters as a percentage of the measuring range:

<table>
<thead>
<tr>
<th>Type of temperature transmitter</th>
<th>Typical accuracy [% of the measuring range or °K]</th>
</tr>
</thead>
<tbody>
<tr>
<td>TT 10 C/R (analogue, standard, 4...20 mA)</td>
<td>± 0.5% to ± 1.0%</td>
</tr>
<tr>
<td>TT 30 C/R (digital, 4...20 mA, standard)</td>
<td>± 0.10%</td>
</tr>
<tr>
<td>TT 31 R (3-wire-circuit, 4...20 mA)</td>
<td>± 0.10%</td>
</tr>
<tr>
<td>TT 32 R (4-wire circuit, 0/4...20 mA; 0/2...10 VDC)</td>
<td>± 0.10%</td>
</tr>
<tr>
<td>TT 40 C/R (digital, 4...20 mA, precise)</td>
<td>± 0.05%</td>
</tr>
<tr>
<td>TT 50 C/R (digital, 4...20 mA, HART®)</td>
<td>± 0.10%</td>
</tr>
<tr>
<td>TT 51 C/R (digital, 4...20 mA, HART®, SIL2)</td>
<td>± 0.05%</td>
</tr>
<tr>
<td>TT 60 C/R (digital, Profinet-PA)</td>
<td>± 0.10°K</td>
</tr>
</tbody>
</table>
7.5 Permissible temperatures

7.5.1 Connection head

<table>
<thead>
<tr>
<th>Temperature transmitter</th>
<th>Material</th>
<th>Temperature range</th>
<th>Maximum temperature limiting component</th>
</tr>
</thead>
<tbody>
<tr>
<td>without</td>
<td>Coated aluminum</td>
<td>-40...+100°C / -40...+212°F</td>
<td>Gasket of connection head cover and cable gland</td>
</tr>
<tr>
<td>with</td>
<td>Coated aluminum</td>
<td>-40...+85°C / -40...+185°F</td>
<td>Temperature transmitter</td>
</tr>
</tbody>
</table>

7.5.2 Thermowells and measuring inserts

The temperatures specified in the following tables are valid only for thermowells and measuring inserts that do not project into flowing media or media under pressure. The maximum permissible temperature is reduced under load.

**INFORMATION!**
The manufacturer can provide an optional strength calculation for a fee.

**Thermowells**

<table>
<thead>
<tr>
<th>Type of thermowell</th>
<th>Material</th>
<th>Max. temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multipart</td>
<td>1.4767 / Kanthal AF</td>
<td>+1150°C / +2102°F</td>
</tr>
<tr>
<td></td>
<td>1.4835 / 253 Ma</td>
<td>+1100°C / +2102°F</td>
</tr>
<tr>
<td></td>
<td>1.4762 / Chrome steel</td>
<td>+1150°C / +2102°F</td>
</tr>
<tr>
<td></td>
<td>1.4841 / AlSi 314 / Chrome steel</td>
<td>+1125°C / +2057°F</td>
</tr>
<tr>
<td>Ceramic</td>
<td>C410 / Ceramic</td>
<td>+1600°C / +2912°F</td>
</tr>
<tr>
<td></td>
<td>C799 / Ceramic</td>
<td>+1800°C / +3272°F</td>
</tr>
</tbody>
</table>

**Measuring inserts**

<table>
<thead>
<tr>
<th>Type of sensor</th>
<th>Cable jacket material</th>
<th>Max. temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>TCA-P60 to TCA-P64</td>
<td>Inconel® 600 / 2.4816</td>
<td>+1100°C / +1832°F</td>
</tr>
<tr>
<td>TCA-P63 to TCA-P65</td>
<td>C799 / Ceramic</td>
<td>+1600°C / +2912°F</td>
</tr>
</tbody>
</table>
KROHNE – Process instrumentation and measurement solutions

- Flow
- Level
- Temperature
- Pressure
- Process Analysis
- Services

Head Office KROHNE Messtechnik GmbH
Ludwig-Krohne-Str. 5
47058 Duisburg (Germany)
Tel.: +49 203 301 0
Fax: +49 203 301 10389
info@krohne.com

The current list of all KROHNE contacts and addresses can be found at:
www.krohne.com