User guide for thermowells

E-03.20

The Rüeger thermowells are designed and produced as per standards: ASME PTC 19.3 TW 2016, ASME B16.5 e ASME B31.1.

Our sensors and thermometers operate in safe conditions if correctly selected and installed in the system and when these operating instructions and the maintenance procedures of the manufacturer are respected.
The operators must therefore be technically qualified and trained, for proper installation and maintenance of the instruments.
In case of high velocity fluids flow Rüeger always recommends and offers the possibility to optimize the thermowells according to ASME PTC 19.3 TW 2016.

Functionality

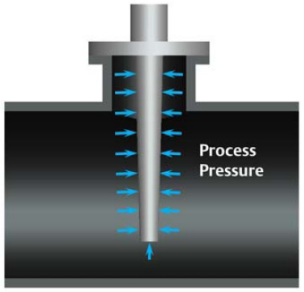
Thermowells are used to protect bulbs from the effects of corrosion and process fluid flow, due to the high speed at which the process fluid flows, and to enable the thermometer to be interchanged, recalibrated, or replaced, without stopping the process.

Installation

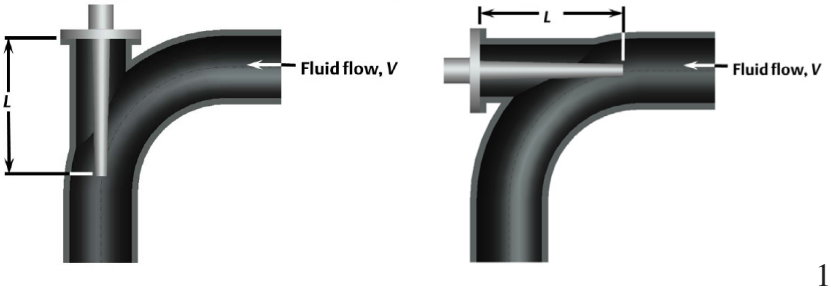
Before installation verify the chemical compatibility between the thermowell selected and the process medium and its endurance to mechanical stress due to the medium itself.
The instrument has to be compatible with respect to the measurement range and the system conditions. During installation thermowells should not be subjected to thermal shocks or mechanical impacts.
Insert the thermowell into the process adapter without forcing or damaging it. The thermowell must not be bent or altered during mounting. It is recommended to mount the temperature measuring instrument into the thermowell using a suitable sealing material in order to avoid humidity ingress.
Generally the tip of the thermowell should be placed in the middle third of the pipe, though the position may differ in special cases.
It must be ensured that the measuring element sensing part, (thermoresistances, thermocouples, bi-metal or gas thermometers) is completely exposed to the medium.
If as a result of a small pipe diameter, this cannot be ensured, a pipe extension can be inserted around the measuring point.

Three mounting positions in the system are possible. These are independent from the process connection type:

Vertical installation



Elbow installation



Screwed thermowells

When using a parallel threads, a suitable seal should be used when mounting. Tapered threads can be sealed directly on the thread. For the correct tightness it is recommended to apply a PTFE tape on the male parallel thread compatible with the process temperature (200C°max).
This is not allowed on tapered threads.

Welded thermowells

Weld-in thermowells can be mounted into the process directly or by using a welded socket. Make sure that the weld seam is clean and that suitable equipment is used.

Flanged thermowells

The flange dimensions of the thermowell must be compatible those of the mating flange on the process side. The seals used must be suitable to the process and chemically compatible.
In case of process high flow rate the correct tightening torques and suitable tools (spanners) should be used for installation. The use of spanners is recommended in order to resist the vibrations and bending stress caused by the process medium flow rate.

Use limits

The main thermowell failure cases are listed below.
In order to find out correctly the instrument's working limits contact Rüeger technical assistance department will take care to calculate the correct thermowell dimensions according to ASME PTC 19.3 TW 2016.

The tests which have been carried out are:

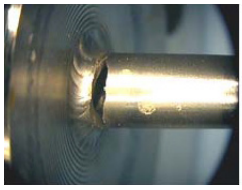
a) Resonance test
b) Fatigue test
c) Bending test
d) Maximum pressure test
e) Minimum temperature test

Vibration rupture (Resonance)

In case of high velocity fluids flow in which the process medium flow rate is high the thermowell could vibrate.
This is because of oscillations that can subsequently develop in the process medium caused by the turbulent nature of the vortex. The vortex which can be detached from the fluid flow surrounding the thermowell.
When the vibration frequency of the fluid movement coincides with the natural one of the thermowell we can say that the thermowell is in resonance. At this state the movement range due to bending increases seriously as well as the bending stress causing a tension level to the thermowell which is higher than the maximum limit allowed for the material. In this way the thermowell is damaged where tensions are higher that is in the thermowell constraint point. In this case there is the risk of leakage which could affect the outer parts of the process. It is necessary to install the thermowell far from the resonance area, or when the process type does not allow that, replace it with a thermowell designed with a shorter immersion length or an antivibration collar.

Fatigue rupture

In case of high velocity fluids flow the thermowell is subject to stress. In fact the dynamic properties of the medium make the thermowell ocsillate cyclically causing a mechanical stress to it. After repeated cycles the thermowell could break because of the widening of a crack which usually create nearby the welding between the flange and the thermowell body in the constraint point where tension due to fatigue (and bending) is higher.




So it is necessary to establish if the resulting dynamic tensions are lower than those supported by the material maximum fatigue limit. If they are not, replace the thermowell installing one whose dimensions can support the current dynamic stress.

Overpressure rupture

In case of pressure peak due to a system malfunction the thermowell could be subject to a higher pressure value compared to the maximum tolerable limit. In this case the thermowell hydrostatic tightness cannot be guaranteed. If the thermowell is not able to tolerate such a pressure value. It is then necessary to replace it with another one whose dimensions are suitable to the oscillations produced by the maximum current pressure.

Corrosion rupture

In case of particularly aggressive process medium the thermowell material and welded parts could be eroded. That is why it is necessary to choose the most suitable material matched to the process medium in order to ensure a properly functioning thermowell.

Static-bending rupture

If the thermowell is subject to a fluid flow it tends to bend depending on the flow rate velocity. Therefore it is necessary to prevent this by choosing the right thermowell dimensions.

Overtemperature rupture

In case the process temperature is higher than the maximum allowed temperature with respect to the thermowell material, the established security standards are no longer ensured; the mechanical thermowell properties slightly decrease when the temperature exceeds the maximum limit. Therefore it is necessary to select a material suitable to the process temperature range in order to prevent any damage to the system.

Wrong application

In case of damage caused by using the product contrary to its intended use the guarantee will be no longer valid. Below is a list of the main uses incorrect.

Modification of the installation point

Do not use the thermowell in a different system area other than that specified in the order. By modifying the process characteristics of the thermowell the working range could be reduced or even the thermowell could be rendered unusable. In case of any system characteristics modification the thermowell verification according to ASME PTC 19.3 TW 2016 won't be valid anymore.

Maintenance

Generally thermowells are maintenance-free. A visual check at regular intervals of the thermowell is recommended in order to detect leaks or damages. Make sure that the seal is in perfect condition. Repairs should only be carried out by the manufacturer or, following prior consultation, by correspondingly qualified skilled personnel.

Cleaning

Wash and clean the dismounted instrument before returning it, in order to protect staff and the environment from exposure to residual media.

Dismounting and disposal

Residual media on dismounted thermowells can result in a risk to persons, the environment and equipment. Take sufficient precautionary measures.

Modifications reserved

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