

# User guide

## THERMOWELL



## Contents

<b>1. GENERAL INFORMATION</b>	<b>3</b>
1.1 INTENDED USE	3
<b>2. INSTALLATION</b>	<b>3</b>
2.1 SCREW-FITTING THERMOWELLS	5
2.2 WELD-FITTING THERMOWELLS	5
2.3 THERMOWELL WITH FLANGE CONNECTION	5
2.4 FOOD PROCESS CONNECTION	6
<b>3. USE LIMITS</b>	<b>7</b>
3.1 VIBRATION FAILURE (RESONANCE)	7
3.2 FATIGUE FAILURE	7
3.3 OVERPRESSURE FAILURE	7
3.4 CORROSION FAILURE	7
3.5 STATIC BENDING FAILURE	7
3.6 OVERTEMPERATURE FAILURE	7
<b>4. WRONG APPLICATION</b>	<b>8</b>
4.1 MODIFICATION OF THE INSTALLATION POINT	8
4.2 INSTALLATION WITH INTERFERENCE COLLAR	8
<b>5. MAINTENANCE AND CLEANING</b>	<b>8</b>
5.1 MAINTENANCE	8
5.2 CLEANING	8
<b>6. DISMANTLING AND DISPOSAL</b>	<b>8</b>
6.1 DISMANTLING	8
6.2 DISPOSAL	8

## 1. General information

The instrument described in this manual has been designed and produced in conformity with the following standards: EN 837-1-2 and ASME B40.1. All components are submitted to severe quality and traceability controls. The quality system management is certified according to the ISO 9001 standard. This manual contains important information about the use and the installation of the gauge in safe conditions. Therefore, it is highly recommended reading the following instructions carefully before use.

*The instrument works in safe conditions when selected and installed correctly in the system and when rules concerning the product as well as the maintenance procedures established by the manufacturer, are respected.*

*Operators in charge with the selection, installation and maintenance of the instrument must be able to recognize the conditions that may negatively affect the instrument ability to work and which may lead to premature failure. Operators must, therefore, be technically qualified and properly trained to carry out the procedures established by the plant regulations.*

**Nuova Fima offers a design and engineering service in order to find the right thermowell dimension according to the system nature.**

**In case of dynamic process Nuova Fima offers and ALWAYS recommends the thermowells verification according to ASME PTC 19.3 TW.**



- The manufacturer disclaims all responsibility in case of damages caused by the improper use of the product and by the non-respect of the instructions reported in this manual.
- Follow carefully the specific safety rules before measuring oxygen pressure, acetylene, inflammable or toxic gas or liquids.
- Disconnect the instruments only after depressurization of the system.
- The process fluid residuals in the disassembled instruments could affect people, the environment and the system. Proper precautions are highly recommended.



- Before installation be sure that the right instrument has been selected following the working conditions and in particular the range, the working temperature and the compatibility between the material used and the process fluid.
- The product warranty is no longer valid in case of non-authorized modifications and of misuse of the product.
- The user is totally responsible for the instrument installation and maintenance.

In order to verify the working and manufacturing features of the instruments read the catalogue sheets in the most up-dated edition available online on [www.nuovafima.com](http://www.nuovafima.com)

### **1.1 Intended use**

Thermowells are used to protect bulbs from the effects of corrosion and of 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 affecting the process

## 2. Installation

Before installation, verify the chemical compatibility between the thermowell and the process medium and its resistance to mechanical stress due to the medium itself.

The non-observance of these recommendations may produce serious damages to the system.

The instrument has to be compatible to the measurement range and the system conditions. During installation thermowells should not receive thermal or mechanical shocks.

Insert the thermowell into the process adapter without forcing or damaging it. The thermowell must not be bent or damaged during mounting. The temperature measuring instrument should be combined with the thermowell using a suitable sealing material in order to prevent humidity from affecting the instrument.

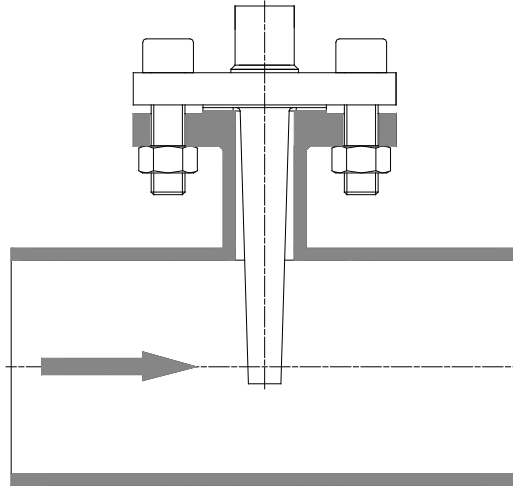
The thermowell tip should be placed beyond the half of the pipe.

The measuring element sensing part which is placed inside the thermowell, (thermocouples, bi-metal or inert gas thermometers) must be perfectly in contact with the medium.

If this procedure is not possible because the pipe diameter is too small, the pipe diameter can be increased in the measuring point area.

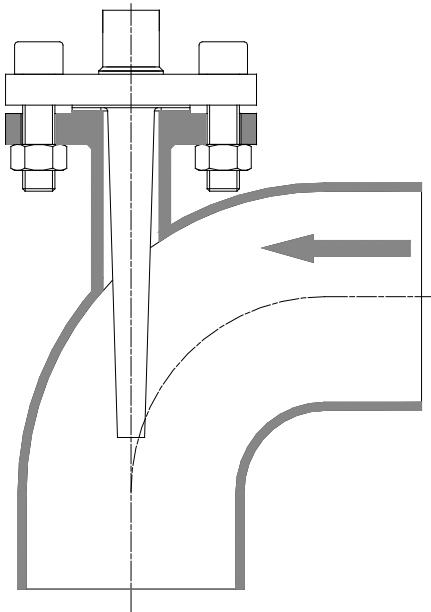
Three thermowell mounting positions are possible in the system, whatever the process connection type:

## 1. Right-angled position with respect to the flow

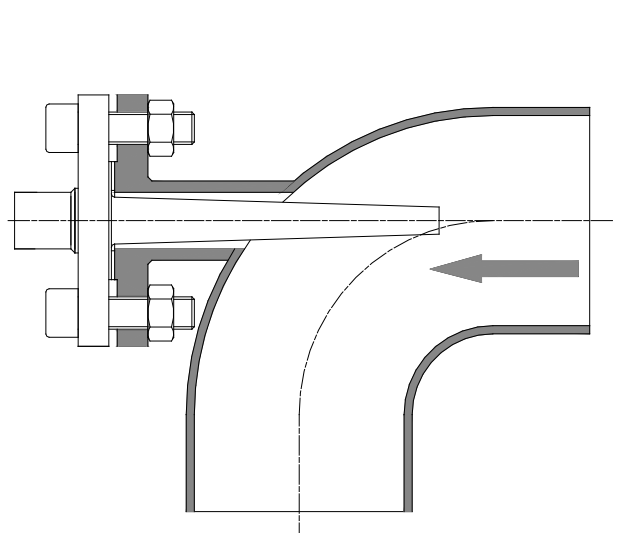


## 2. Tilted position with respect to the flow:

a. Upstream



b. Downstream



The insertion length and the diameter of the thermowell should be established according to the process conditions especially on the medium flow rate.

## 2.1 Screw-fitting thermowells

When mounting a parallel threads, a suitable seal should be used. Tapered threads can be sealed directly on the thread. For a correct tightness a PTFE tape on the male thread compatible with the process temperature (200C° max) is recommended.

**This procedure is not allowed on tapered threads.**

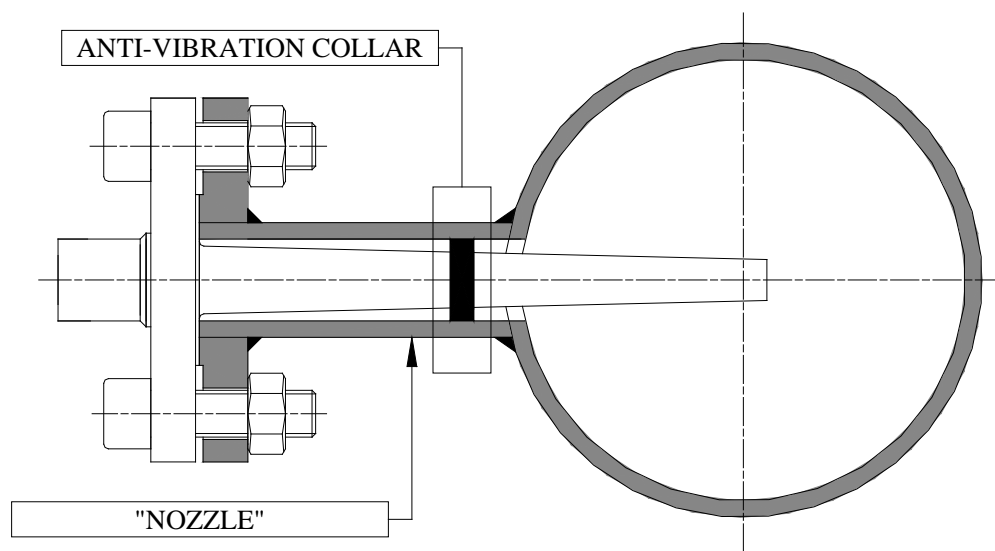
## 2.2 Weld-fitting thermowells

Weld-in thermowells can be mounted into the process directly (pipe or vessel wall) or by using a welded socket. Make sure that the weld seam is clean and that a suitable equipment is employed. If necessary, the weld seams should be heat treated.

## 2.3 Thermowell with flange connection

The thermowell flange dimensions should match with the mating flange on the process side. Seals should 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.



The interception collar should match with the internal diameter of the nozzle in order to allow a proper operation. The collar shifts the thermowell constraint point towards the stem in order to reduce the flow rate impact.

**According to ASME PTC 19.3 TW standard the interference collar thermowells are not recommended and they are not included in the above mentioned directive.**

NUOVA FIMA ensures a proper endurance of these instruments only if correctly installed. Therefore, a lightly forced coupling between the external collar diameter and the internal diameter has to be applied.

The procedure required to obtain a correct coupling is described as follows:

### Design:

- 1) The external collar diameter should be more than 0,15mm with respect to the internal bore diameter where the thermowell is installed.
- 2) Install the interference collar as close as possible to the nozzle and the pipe.

## Interference collar thermowell installation

**WARNING: A lightly forced coupling between the collar and the nozzle bore is essential for a correct operation. On the contrary if the thermowell does not fit perfectly the instrument might not work properly**

- 1) Gradually install the thermowell into the nozzle. If the thermowell fits well no other operation is necessary. If it doesn't, slowly rotate the thermowell until it reaches the required position.
- 2) If the thermowell does not fit, remove it carefully and reduce the external collar diameter gradually by 0,05mm at a time. Then verify the nozzle fitting manually. Repeat this procedure until a lightly forced manual coupling of the thermowell in the nozzle is obtained. If the interference affects the collar just partially, that nozzle portion only has to be reduced.

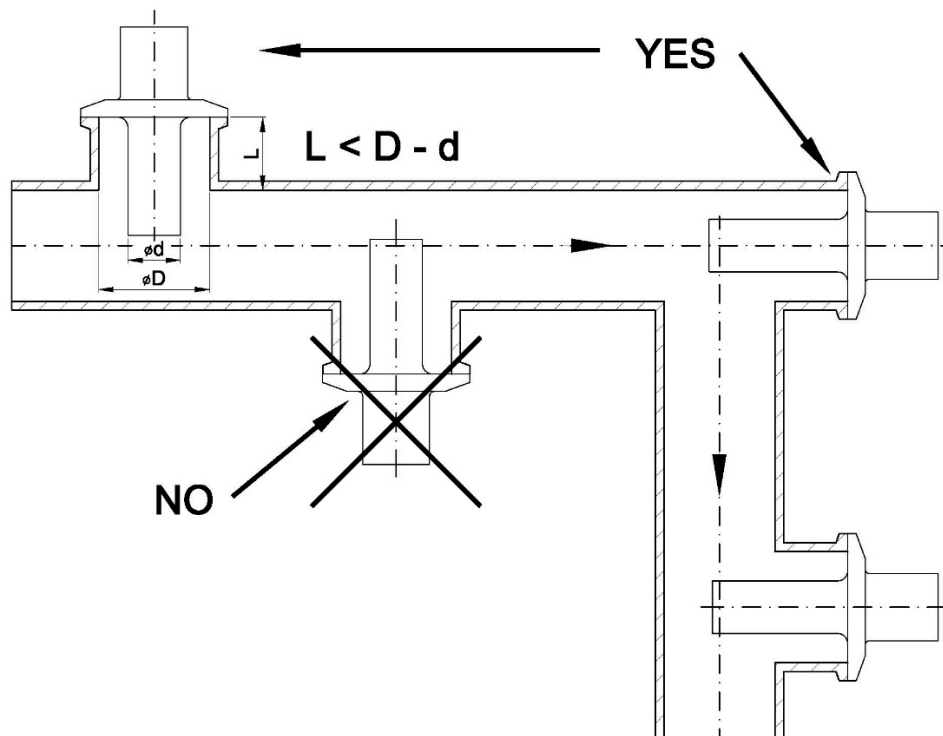
**WARNING: the collar only reduces the vibrations effects caused by the process medium. Vibrations affecting the pipe and/or the nozzle together with those produced by the process medium could affect the overall structure of the thermowell**

## 2.4 Food process connection

Normally, the mounting devices such as rings, clamps, nuts, flanges, seals and O-rings are not included in the supply and not described in this manual. Seals and O-rings must be selected among those approved for the food industry.

### **Instruments marked as 3-A**

Instruments provided with a DIN11851 connection should be installed using special seals such as those supplied by Siersema Componenten System (S.K.S.) B. V. or seals type ASEPTO-STAR k-flex produced by Kieselmann GmbH. In the picture below shows how to install it correctly in order to assure a proper functioning and cleanliness of the instrument. Improper installation may produce residual media which could speed the corrosion process and affect a proper cleaning procedure.



## 3. Use limits

The main thermowell failure cases are listed below.

In order to find out the instrument working limits please contact the Nuova Fima technical assistance department to calculate the correct thermowell dimensions according to **ASME PTC 19.3 TW**.

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

### **3.1 Vibration failure (Resonance)**

When the medium flow velocity is significant, the thermowell might vibrate. This happens because the high velocity of the process medium could affect the thermowell which is also affected by vortices that are produced by the fluid flow. 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 stage, the thermowell moves a lot therefore it is seriously stressed far more than the stress limit allowed for the material and it is seriously damaged in the point of maximum tension. This is when a leakage is very likely to happen affecting the external parts of the process.

It is necessary to install the thermowell far from the resonance area. When the process type does not allow that, replacing it with a thermowell designed with a shorter immersion length or an antivibration collar is recommended.

### **3.2 Fatigue failure**

In case of dynamic process, the thermowell undergoes to stress. In fact, the dynamic properties of the medium make the thermowell oscillate cyclically causing a mechanical stress to it. After several cycles a damage may develop due to the crack which may widen progressively and which usually develops close to the welding point between the thread and the thermowell body in the point of maximum fatigue and bending.

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, the thermowell should be replaced with one whose dimensions can support the current dynamic stress.

### **3.3 Overpressure failure**

In case of pressure peak due to a system malfunction the thermowell could receive a higher-pressure value compared to the maximum accepted limit. In this case the thermowell hydrostatic tightness cannot be guaranteed. If the thermowell is not able to tolerate such a pressure value it should be replaced with one whose dimensions are suitable to the oscillations produced by the maximum current pressure.

### **3.4 Corrosion failure**

In case of a particularly aggressive process medium the thermowell material and welded parts could be eroded. Therefore, the most suitable thermowell material to the process medium should be chosen in order to ensure the thermowell to work properly.

### **3.5 Static bending failure**

If the thermowell is affected by a fluid flow it tends to bend depending on the flow rate velocity. This may be prevented by choosing the right thermowell dimensions.

### **3.6 Overtemperature failure**

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 decrease slightly 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.

## 4. Wrong application

In case of damage caused by using the product contrary to its intended use the guarantee will be no longer valid. Please find a list of the main product misuses below.

### **4.1 Modification of the installation point**

The thermowell should not be installed in a different system area other than the one specified in the order. By modifying the process parameters, the thermowell working range could be reduced or even the thermowell could become unusable. **In case of any system characteristics modification the thermowell verification according to ASME PTC 19.3 TW is no longer valid.**

### **4.2 Installation with interference collar**

If an interference collar is required during the thermowell installation, a slack between the nozzle diameter and the collar itself should be prevented. For further information about the correct installation of interference collars, refer to paragraph 2.3 of this use instructions manual.

## 5. Maintenance and cleaning

### **5.1 Maintenance**

Thermowells are usually maintenance-free. A constant visual check 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, by qualified skilled personnel prior consultation.

### **5.2 Cleaning**

Wash and clean the dismantled instrument before return in order to protect the operators and the environment from exposure to residual media.

## 6. Dismantling and disposal

Residual media on dismantled thermowells may affect people, the environment and the system. Proper precautions should be taken.

### **6.1 Dismantling**



Before dismantling, the instrument should cool down. During the dismantling procedure, dangerous hot fluid under pressure may escape.

The system must be depressurised before dismantling thermowells.

### **6.2 Disposal**

Incorrect disposal may affect the environment. Disposal of instruments, components and packaging materials must be performed according to environment protection and waste national disposal regulations.