Installation manual OI/TSW400–EN

TSW400 series
Thermowells

Safe, tough and reliable thermowells for the Oil & Gas industry

Introduction

The TSW400 Series is a range of thermowells designed to protect temperature sensors in liquid, gas and steam pipelines. The series has hazardous area approvals available, where necessary, and offers thermowells with unique and customized dimensions.

Power and productivity
for a better world™

The Company

We are an established world force in the design and manufacture of measurement products for industrial process control, flow measurement, gas and liquid analysis and environmental applications.

As a part of ABB, a world leader in process automation technology, we offer customers application expertise, service and support worldwide.

We are committed to teamwork, high quality manufacturing, advanced technology and unrivalled service and support.

The quality, accuracy and performance of the Company's products result from over 100 years experience, combined with a continuous program of innovative design and development to incorporate the latest technology.

Contents

1 Safety

1.1 Operator liability

Before using this equipment in corrosive or abrasive environments, or with corrosive or abrasive fluids, the operator must verify that the materials of manufacture are suitable for the application. If requested, ABB will assist in this assessment but will not accept liability for the selection of materials.

Operators must observe all applicable national and plant regulations with regard to installation, testing and repair of this equipment.

1.2 Personnel

This equipment must be installed, commissioned and maintained by trained personnel who are authorized by the plant operator. These personnel must have read and understood this manual and must comply with its instructions.

1.3 Transport and storage

Care must be taken during transportation of the equipment to ensure that it is not damaged. Special care must be taken to avoid excessive vibration and physical shock. The equipment must not be transported or stored in such a way that it becomes contaminated by moisture or other potentially damaging contaminants.

Check the equipment thoroughly after transportation and storage and before installation. Any damage must be reported to the supplier or the shipper before installation.

1.4 Mechanical installation

Mechanical installation must be performed only by authorised and competent personnel. Careful observation of information supplied in this manual is required before commencing installation.

1.5 User guidelines

Correct use includes the following:

- Operation within the technical limit values
- Observing and following the information provided on permissible media (fluids).
- Observing and following the instructions provided in the operating manuals.

The following uses are not permitted:

- Use as a climbing aid (for example, for assembly purposes).
- Use as a support for external loads (for example, as a pipework support).
- Material gain (for example, by overpainting the type plate or welding / soldering on parts).
- Repairs, modifications, supplements or the installation of spare parts. These are permitted only if performed as described in this manual. More extensive work must be approved by ABB – the Company accepts no liability for unauthorized work.

The operating, maintenance and repair conditions described in this manual must be observed. The Company accepts no liability for damage caused by incorrect or unprofessional usage.

2 Available designs

The following designs are available from ABB's standard range of thermowells. However, many organizations have their own standard designs and these can be accommodated by selecting 'other design' and providing a drawing for quotation.

2.1 Flanged

Flanged thermowells are available in three manufacturing options:

Welded with a fillet and groove weld

- fillet and groove welding is perfectly adequate in most circumstances; the weld is designed to be stronger than the required duty pressure.

Welded with a full penetration weld

- full penetration welding provides a stronger weld joint and is specified when absolute assurance of pipe-work integrity is required.

Manufactured from a single piece, shaped forging

- fully forged thermowells are manufactured from a shaped forging formed to closely resemble the final shape of the finished thermowell. This ensures correct granular alignment of all the thermowell components – absolutely vital in ensuring resistance to corrosion cracking.

2.2 Weld-in and threaded

Manufactured from a single piece of high quality material, there is no welding in any of ABB's weld-in or threaded designs.

2.3 Profiles

Three basic profiles are available:

Straight

- the stem diameter is consistent from the root to the tip

Tapered

- the profile tapers from the root to the tip

Stepped

- the lower portion of the thermowell steps to a smaller diameter.

A version of the stepped profile is available in the DIN designs where the step is a taper towards the tip.

2.4 Velocity collars

There are times when thermowell design fails to satisfy ASME PTC19.3 2010 TW criteria. Under these circumstances, it is advisable to shorten the thermowell and change the diameters of the stem root and tip. ABB engineers are available to advise on this. Where the thermowell would become too short, a velocity collar can be used.

Caution. A velocity collar relies on an interference fit between the thermowell collar and the mounting branch. The interference fit is the responsibility of the installation team. Although ABB can advise on the procedure, ABB cannot be held responsible for incorrect fitting of velocity collars.

3 Installation

3.1 General

Warning. Before installing a thermowell, ensure that the pipeline is depressurized and isolated. Failure to do so can create hazards to the operators and result in damage to equipment.

When installing a thermowell, the best practice is to position the tip in the middle third of the pipeline – see Fig. 3.1. This is less important when installing a thermowell in a heavily lagged pipeline.

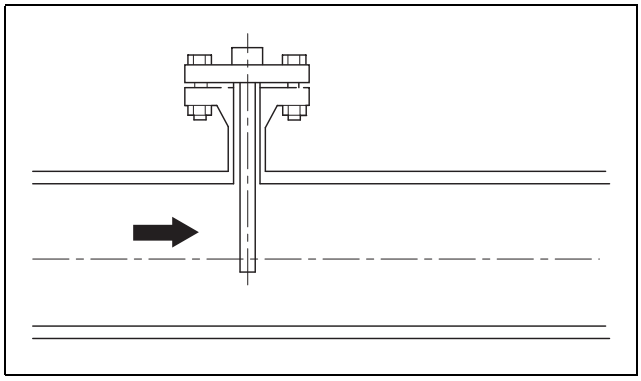

Fig. 3.1 Preferred installation position

To prevent seal failure and process fluid leakage when fitting thermowells to the plant, it is important to ensure that welded parts are sufficiently strong enough, the correct nuts, bolts, studs and gaskets are used and that threads are tightened appropriately.

3.2 Thermal conduction errors

In order to obtain the most accurate readings it is important to know where potential for error exists. Heat conduction along a thermowell can produce a significant offset in the temperature experienced at the sensor. To avoid this, the thermowell must be 6 to 8 times longer than its tip diameter for use in liquids and 10 to 15 times longer than its tip diameter for gases.

This can be problematic in small-bore pipelines so install the thermowell as shown in Fig. 3.2.

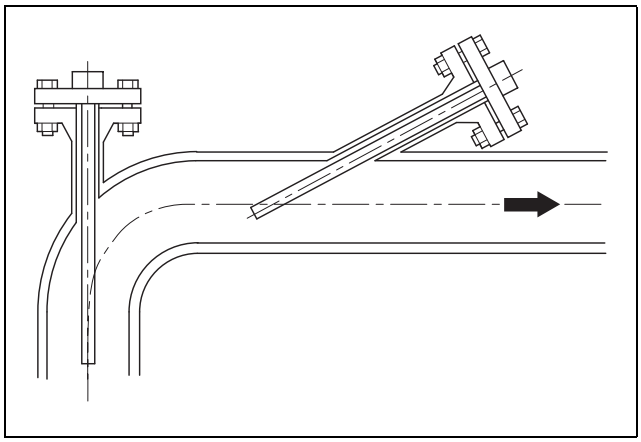

Fig. 3.2 Installation in small-bore pipelines

3.3 Using existing thermowells in changed process conditions

When an existing thermowell is to be used in a modified process conditions, ensure it is suitable for the new service. Pay particular attention to the following:

- Corrosion and erosion resistance
- Temperature limitations
- Process connection rating and condition
- Wake frequency

3.4 Thermowells with velocity collars

Velocity collars are used to change the resonance frequency of a thermowell by shortening the unsupported length of its stem. To ensure correct operation of a thermowell fitted with a velocity collar, a good fit between the collar and wall of the fitting is essential. Therefore, machining the standoff to achieve a tight sliding fit between the standoff wall and velocity collar is required. Contact ABB for advice if there are any doubts regarding acceptable tolerances.

3.5 Socket-weld and weld-in thermowells

- Remove all packaging and check that the thermowell is clean and free of damage and debris.
- Check the thermowell's tag number and ensure it is correct for thermowell for the location and that the material is suitable for welding.
- Insert the stem of the thermowell carefully into the bore.
- Weld the thermowell in place ensuring that suitable welding material has been used and that the welder is suitably qualified.

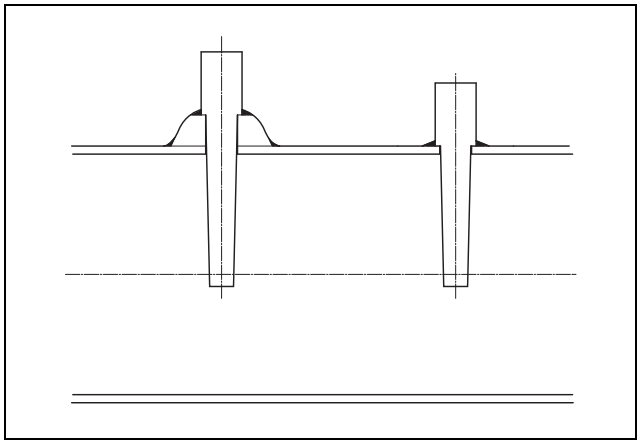

Fig. 3.3 Installed socket-weld and weld-in thermowells

3.6 Flanged and Van Stone thermowells

- Remove all packaging and check that the thermowell is clean and free of damage and debris.
- Check the thermowell's tag number and ensure it is the correct thermowell for the location and that the flange rating is the same as the mounting flange.
- Position the gasket on the mounting flange ensuring it does not protrude into the bore.
- Insert the thermowell stem carefully through the mounting flange until the thermowell flange contacts the gasket.
- Fit the bolts and tighten them evenly hand tight
- Determine the maximum tightening torque according to relevant flange specifications and tighten each bolt incrementally first to 30% of maximum torque then to 60% and finally to the maximum torque.

3.7 Screw-in thermowells

- Remove all packaging and check that the thermowell is clean and free of damage and debris.
- Check the thermowell's tag number and ensure it is the correct thermowell for the location.
- Check that the thermowell's thread matches the thread of the socket.
- Apply a suitable sealant to the threads.
- Insert the thermowell carefully into the bore and tighten finger tight.
- Tightened fully to the correct torque figure for the thread type and size.

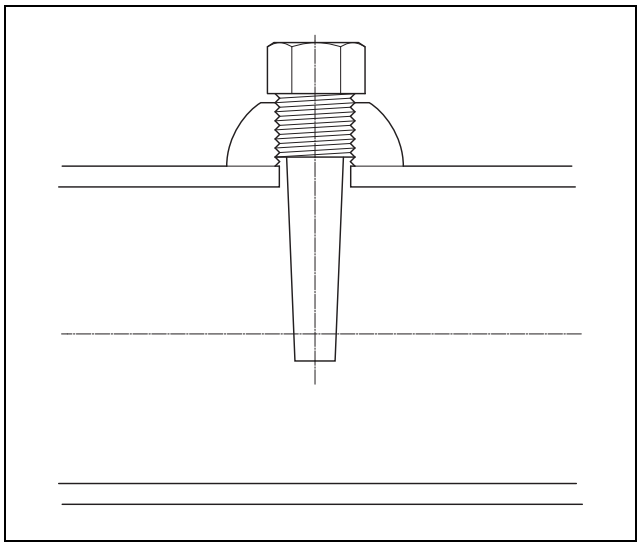

Fig. 3.4 Installed Screw-in thermowell

4 Commissioning

4.1 General

When the thermowell is installed, fill the pipeline, making constant checks for leaks or damage. Gradually bring the pipeline up to normal operating pressure, again checking for leaks or damage. If any leaks or damage are detected, depressurize the pipeline and repair as necessary observing all local health and safety and environmental requirements.

5 Operation and maintenance

5.1 Removing the thermowell

Warning. Always observe plant safety regulations. Before removing the thermowell, ensure the pipeline is depressurized and isolated.

5.1.1 Flanged connection

- Loosen the flange securing bolts and / or nuts and partially separate the flanges.
- Remove the bolts and carefully remove the thermowell, complete with gaskets.

5.1.2 Screw-in connection

- Carefully unscrew the thermowell from the line.

5.2 Examination

The frequency of examination depends on the abrasive or corrosive nature of the fluid, for example

- Steam – annually
- Clean fluid – 2 or 3 years

In the case of a new process or plant, examine the meter during each routine maintenance period until the wear of each installation, relative to others, can be assessed.

5.3 Reassembly

Reassemble the thermowell as detailed in Section 3. page 6.

6 Specification – physical

6.1 Material specifications

ABB can manufacture thermowells from almost any commercially available material. If the material required is not in the following list, contact ABB for advice.

- **316/ 316L stainless steel**
  the most commonly used material for thermowells combining excellent corrosion resistance with good strength and availability.
- **316Ti stainless steel**
  an enhanced version of 316 – a small amount of titanium is added to help stabilize the material at temperatures over 800 °C (1472 °F).
- **321 stainless steel**
  offers similar properties to 316 and 316Ti but is more suitable for operation at higher temperatures.
- **Hastelloy C-276**
  a material favored for chloride atmospheres and processes. 300 series stainless steels are not recommended for use in high chloride and low oxygen environments.
- **Inconel 600**
  a high nickel alloy containing chromium – suitable for use at high temperatures and in both oxidizing and reducing atmospheres.
- **Monel 400**
  a high nickel alloy containing copper – highly resistant to corrosion in a wide variety of environments.
- **Duplex**
  a stainless steel designed specifically for use in salt water environments where it offers excellent corrosion resistance.
- **Super duplex**
  a variant of duplex steel that includes a small amount of copper – preferred over duplex for its enhanced high temperature properties.

Note. ABB are unable to specify a particular material for a process plant as this requires detailed process knowledge. However, ABB can discuss the implications of such choices on speed of delivery and cost. In addition, ABB welding engineers are available to advise on welding procedures for all materials.

6.2 Additional material specifications

Materials for use in 'sour' environments (environments containing high concentrations of hydrogen sulphide) normally demand material that complies with the NACE standard. ABB can comply fully with all these requirements.

Certain countries require that materials conform to particular requirements (for example, the NORSOK standard for materials for use in the North Sea).

6.2.1 ASME PTC 19.3 2010 TW stress calculations

The only published international code for the evaluation of the stresses placed on thermowells in service. ABB engineers can perform a calculation to the ASME code on request. Certification is supplied when requested.

Notes

Products and customer support

Automation Systems
For the following industries:
- Chemical & Pharmaceutical
- Food & Beverage
- Manufacturing
- Metals and Minerals
- Oil, Gas & Petrochemical
- Pulp and Paper

Drives and Motors
- AC and DC Drives, AC and DC Machines, AC Motors to 1kV
- Drive Systems
- Force Measurement
- Servo Drives

Controllers & Recorders
- Single and Multi-loop Controllers
- Circular Chart and Strip Chart Recorders
- Paperless Recorders
- Process Indicators

Flexible Automation
- Industrial Robots and Robot Systems

Flow Measurement
- Electromagnetic Flowmeters
- Mass Flowmeters
- Turbine Flowmeters
- Wedge Flow Elements

Marine Systems & Turbochargers
- Electrical Systems
- Marine Equipment
- Offshore Retrofit and Refurbishment

Process Analytics
- Process Gas Analysis
- Systems Integration

Transmitters
- Pressure
- Temperature
- Level
- Interface Modules

Valves, Actuators and Positioners
- Control Valves
- Actuators
- Positioners

Water, Gas & Industrial Analytics Instrumentation
- pH, Conductivity and Dissolved Oxygen Transmitters and Sensors
- Ammonia, Nitrate, Phosphate, Silica, Sodium, Chloride, Fluoride, Dissolved Oxygen and Hydrazine Analyzers
- Zirconia Oxygen Analyzers, Katharometers, Hydrogen Purity and Purge-gas Monitors, Thermal Conductivity

Customer support
We provide a comprehensive after sales service via a Worldwide Service Organization. Contact one of the following offices for details on your nearest Service and Repair Centre.

UK
ABB Limited
Tel: +44 (0)1946 830611
Fax: +44 (0)1946 832661

USA
ABB Inc.
Tel: +1 215 674 6000
Fax: +1 215 674 7183

Client Warranty
Prior to installation, the equipment referred to in this manual must be stored in a clean, dry environment, in accordance with the Company's published specification. Periodic checks must be made on the equipment's condition. In the event of a failure under warranty, the following documentation must be provided as substantiation:
- A listing evidencing process operation and alarm logs at time of failure.
- Copies of all storage, installation, operating and maintenance records relating to the alleged faulty unit.

Contact us

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OI/TSW400–EN 08.2012

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