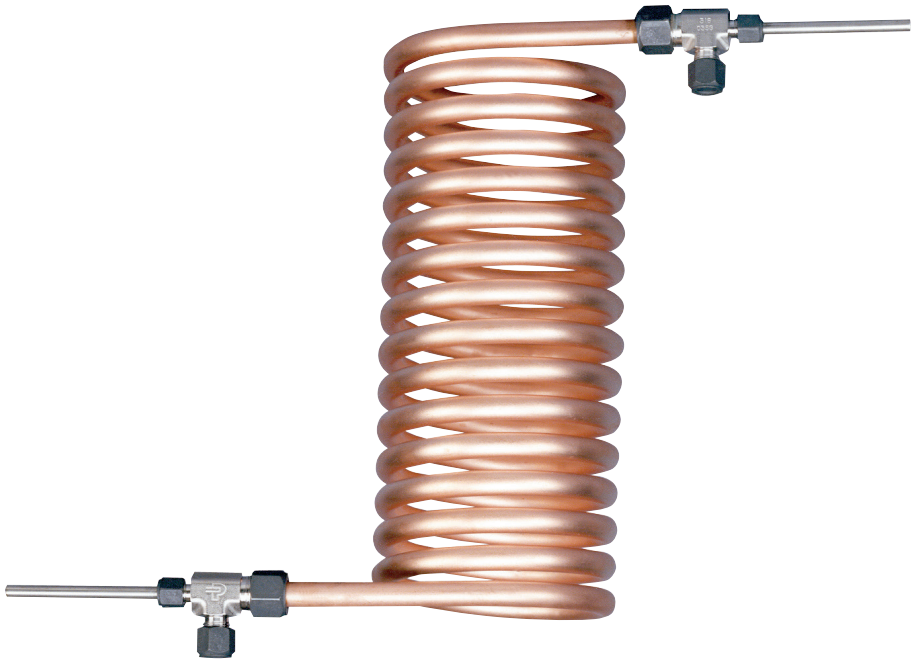


Original Instructions

# Installation, Operation & Maintenance Manual

## Sentry Tube-in-Tube DTC Series Heat Exchangers

S-SW-IOM-00257-5 8-16



COMPANY WITH  
QUALITY SYSTEM  
CERTIFIED BY DNV GL  
= ISO 9001 =

 **SENTRY**

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Do not install, maintain, or operate this equipment without reading, understanding, and following the appropriate Sentry Equipment Corp instructions. Otherwise, injury, damage, or both may result.

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## Note

The information contained in this document is subject to change without notice.

# Safety Information

Please read the entire manual before attempting to unpack, set up, or operate this product. Pay careful attention to all Warnings, Cautions, and Notes. Failure to do so could result in serious personal injury and/or equipment damage.

## Use of Hazard Information

If multiple hazards exist, the signal word corresponding to the greatest hazard shall be used.

### Definitions

#### **DANGER**

**DANGER** indicates a hazardous situation which, if not avoided, will result in death or serious injury.

#### **WARNING**

**WARNING** indicates a hazardous situation which, if not avoided, could result in death or serious injury.

#### **CAUTION**

**CAUTION**, used with the safety alert symbol, indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

#### **NOTICE**

**NOTICE** is used to address practices not related to personal injury.

#### **NOTE**

Information that requires special emphasis.

#### **TIP**

Alternate techniques or clarifying information.

**SHALL:** This word is understood to be mandatory.

**SHOULD:** This word is understood to be advisory.

# General Safety Precautions

## Product Selection, Installation, and Use

### WARNING

Improper selection, installation, or use can cause personal injury or property damage. It is solely the responsibility of users, through their own analysis and testing, to select products suitable for their specific application requirements, ensure they are properly maintained, and limit their use to their intended purpose.

Follow proper local, state, and federal regulations for proper installation and operational requirements.

Always use caution and common sense when working with any chemical. Read the product label and Material Safety Data Sheets (MSDS) carefully and follow the instructions exactly.

## Potential Equipment Hazards

### WARNING

**Hot surfaces!** This equipment may have very hot surfaces. If an operator contacts a hot surface, injury may occur. Use protective clothing to prevent injury. If other equipment comes in contact with a hot surface, damage to the equipment may occur. Ensure the area around this equipment is kept clear to prevent this damage from occurring.

**High pressures!** This equipment may contain fluids at very high pressures. Prior to installing, removing, or maintaining this equipment, ensure that the equipment is isolated from all connecting piping, the equipment is depressurized, the contents have been drained, and the equipment is cool.

**Freezing Temperatures!** This equipment may have very cold surfaces. If an operator contacts a cold surface, injury may occur. Use protective clothing to prevent injury. If other equipment comes in contact with a cold surface, damage to the equipment may occur. Ensure the area around this equipment is kept clear to prevent this damage from occurring.

### NOTICE

Freezing of fluids in tube can lead to rupture of the tube wall and coil failures. Take precautions to avoid freezing, such as draining the equipment when out of service or installing the equipment in an environment protected from temperatures below the freezing point of the fluids used.

## Cavitation

### NOTICE

Cavitation can cause damage and failure of equipment.

Cavitation results when localized boiling occurs on the surface of a coil. Vapor bubbles form on the coil surface and are swept into the main stream of the fluid where they immediately condense and collapse. Collapsing bubbles generate severe shock waves (i.e., vibrations) which can fatigue and ultimately fracture the tube(s).

Cavitation can be avoided by considering the following:

1. Cavitation is caused by:
  - a. Coolant flow rate is too low; fluid overheats to its boiling point.
  - b. Coolant operating pressure is too low; fluid boils at a low temperature.
2. Cavitation can be prevented by:
  - a. Adjusting coolant and inner tube flow rates.
  - b. Increasing coolant pressure as high as possible — 50 psig (3 barg) minimum recommended for water.
3. If you hear vibration or rattling noises from the equipment, take corrective action immediately:
  - a. Coolant inlet valve is fully open.
  - b. Coolant flow is per design condition.
  - c. Coolant pressure is as high as possible.
  - d. Inner tube fluid flow is reduced, if necessary.
  - e. Increase coolant flow (always throttle at the coolant outlet). If the coolant is water, the outlet temperature should not be allowed to exceed 140°F (60°C).

## Stress Corrosion Cracking

### NOTICE

Incompatible fluid chemistry can cause corrosion and/or erosion and eventual failure of the equipment. Corrosion and failure can also occur when the equipment is installed in an environment incompatible with the materials of the equipment. It is the responsibility of the Purchaser or the Purchaser's Agent to ensure the materials of construction of the equipment are suitable for the fluid chemistry and environment where the equipment is to be used.

A source of corrosion to be considered in stainless steel is stress corrosion cracking. Stress corrosion cracking (SCC) in stainless steel is a complex phenomenon. If coolant being used is water, the limits noted below must be met to avoid premature tube failure. Adequate coolant flow combined with proper material selection (e.g., Inconel 625) will substantially extend the life of the sample cooler tube. Although material selection is critical, it may not eliminate problems.

Failure due to stress corrosion cracking can be minimized by:

1. Verifying the fluid chemistries and selecting the alternative materials of construction.
2. Reducing the operating temperatures by increasing the coolant flow rate.

<b>Maximum Acceptable Chloride Levels in Cooling Water for 316 Stainless Steel (assuming low levels* of dissolved oxygen)</b>	
<b>Sample Temperature</b>	<b>Cooling Water Chloride Concentration</b>
77 - 356°F (25 - 180°C)	250 ppm
356 - 554°F (180 - 290°C)	100 ppm
554 - 1022°F (290 - 550°C)	25 ppm

\*approximately 0.1 ppm or below

### **⚠ WARNING**

To ensure the safety of the operator and the performance of this equipment is not impaired, this equipment must not be installed or used in any manner other than that which is specified in this manual.

Prior to installing, removing or maintaining this equipment, ensure that the equipment is isolated from all connecting piping, the equipment is depressurized, the contents have been drained and the equipment is cool.

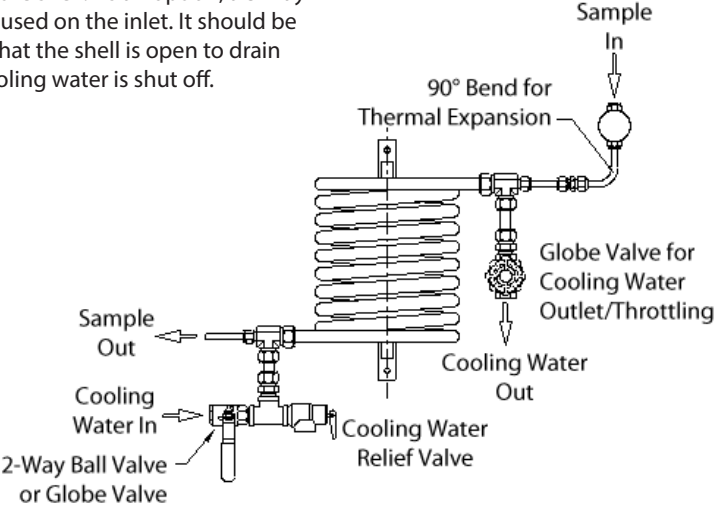
## **General Description**

Sentry® Tube-in-Tube DTC heat exchangers are spirally wound, full counter flow heat exchangers well suited for a variety of applications where low flow rates of high temperature and/or high pressure fluids need cooling or heating.

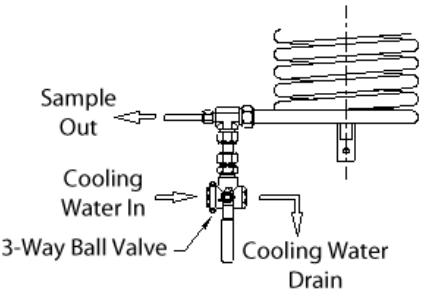
## **Installation**

1. Do not rotate cooling water connections (terminal tee). Rotating cooling water connections may result in leakage.
2. Attach the DTC unit either vertically or horizontally (preferably vertical on high temperature lines) to a suitable surface using the DTC's bracket. A wall, mounting plate or pipe is acceptable.
3. Provide a globe (not gate) valve in the coolant outlet line for throttling purposes. Valve size must be at least the same as coolant outlet connection.
4. If isolation of the DTC unit is desired, provide a gate or ball valve (not globe) in the coolant inlet line. Valve size must be at least the same as coolant inlet connection. If a coolant inlet valve is installed, a relief valve or 3-way valve must be provided per paragraph 8 below.

5. Installation of a sample flow control valve in the sample line after the cooler is recommended. The valve should be a multi-turn type to allow for more precise flow control. The valve should be specified in accordance with the operating pressure and temperature of the sample.
6. Installation of a sample flow isolation valve in the sample line prior to the cooler is recommended. The valve should be specified in accordance with the operating pressure and temperature of the sample.
7. Install coolant tubing to compression fitting on DTC unit. Connect inner tube fluid to plain end tube by means of fittings or welding, as appropriate. A 90° bend or expansion loop is recommended. Inner tube inlet and outlet valves and other components should be selected based on the individual application of the DTC unit. Use good engineering practice. Consult factory for recommendations.
8. A relief valve should be installed in the coolant line between the DTC unit and the outlet or the inlet valve. This protects against excessive outer tube side pressure in the event of (a) a leak in the inner tube, or (b) an operator turning on the hot sample flow with both cooling water isolation valves closed, thus boiling the coolant and pressurizing the shell. As an option, a 3-way valve can be used on the inlet. It should be oriented so that the shell is open to drain when the cooling water is shut off.



OR ...



## Operation

Fully open all coolant valves. Verify that minimum required coolant flow is occurring. If using water as a coolant and it is untreated, its temperature rise should not exceed 30°F (17°C) so as to minimize scaling. Be sure that the outlet temperature does not exceed 140°F (60°C).

When necessary, throttle coolant flow by partially closing the globe valve on the coolant outlet line. Any valve on the coolant water inlet line must always be fully open.

## Maintenance

The DTC has minimal maintenance needs. When used in applications where scaling and fouling occur, a periodic chemical cleaning is recommended to ensure the performance of the DTC is maintained. Consult with a qualified chemical cleaning consultant prior to attempting a cleaning operation.

## Spare Parts List

The DTC has no spare parts.



# Standard Warranty

Sentry Equipment Corp (“Seller”) warrants products manufactured by it and supplied hereunder (“Products”) to be free from defects in workmanship and, to the extent materials are selected by Seller, to be free from defects in materials, in each case for a period as defined in the table below:

Brand	Product Line	Warranty Period
Sentry®	<ul style="list-style-type: none"><li>▪ Steam &amp; Water Sampling Products and Systems</li><li>▪ Solid &amp; Powder Sampling Products and Systems</li><li>▪ Gas Sampling Products and Systems</li><li>▪ Liquid &amp; Slurry Sampling Products and Systems</li><li>▪ Pipeline Integrity Products</li></ul>	Eighteen months from date of shipment or twelve months from startup (whichever occurs first)
Waters Equipment	Steam & Water Sampling Products and Systems	Twelve months from date of shipment

To view the full warranty, go to [www.sentry-equip.com/warranty](http://www.sentry-equip.com/warranty).

# Customer Support

With proven sampling expertise since 1924, Sentry products and services provide business operations the critical insights to optimize process control and product quality. We deliver true representative sampling and analysis techniques to customers around the globe, empowering them to accurately monitor and measure processes for improved production efficiency, output, and safety. Standing behind our commitments, we are determined to tackle any application, anywhere.

We know that running an efficient operation isn't easy. It requires thorough, careful analysis of controlled, real-time data achieved through reliable, accurate, and repeatable process monitoring and measuring. By effectively conditioning, sampling, and measuring gas, liquid, slurry, powder, solids, steam, or water within their production environments, our customers obtain the critical insights they need to control and optimize their processes.

Yet, controlling your processes also means reliable customer support throughout the life cycle of your equipment.

- Customer Service—General information, warranty claims, order management.
- Installation Service—For systems that require specialized expertise upon installation.
- Technical Support—Troubleshooting, training, and technical manuals.
- Field Service & Retrofits—When a problem needs immediate attention.
- Replacements Parts & Consumables—Order your replacement parts and consumables.
- Sentry ProShield Services—Select from four ProShield Guardian service plans providing different levels of support to protect your large system investments with regularly scheduled maintenance.

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