

Original Instructions

Installation, Operation & Maintenance Manual

Sentry Spiral Tube Heat Exchangers

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COMPANY WITH
QUALITY SYSTEM
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 **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.

Potential Equipment Hazards (continued)

NOTICE

Cavitation can cause damage and failure of the equipment. Cavitation results whenever 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. The collapsing bubbles generate severe shock waves (i.e. vibrations) which can fatigue and ultimately fracture the tube(s).

Incompatible fluid chemistry can cause corrosion and/or erosion and eventual failure of this equipment. Corrosion and failure can also occur when the equipment is installed in an environment incompatible with the materials of construction of this equipment.

It is the responsibility of the Owner or the Owner'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.

Water containing carbonates, rust, silt, organic matter, or other contaminants can cause fouling, scaling, and/or plugging and eventual failure of the equipment.

⚠ WARNING

To ensure the safety of the operator and the performance of this equipment is not impaired, this equipment shall 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.

Damage to the equipment may occur if a relief valve is omitted.

General Description

Model Number

The model number is engraved or laser marked on the nameplate. See "Spiral Heat Exchanger Model Codes" for a description of the model number system.

Pressure/Temperature Rating

Refer to the nameplate for the pressure and temperature ratings of the heat exchanger (refer to "Spiral Heat Exchanger Model Codes"). The nameplate is located on the front head, except on 7" shells where it is attached to the rear head.

Inspection

Carefully inspect shipping crates or cartons, protective covers and equipment for evidence of damage. Notify carrier if damage is evident.

Storage

Storage in an enclosed and heated warehouse is recommended. If equipment is to be in storage for a period of time exceeding one month, additional steps, such as adding or replacing desiccants, should be taken to prevent corrosion or contamination. The equipment should be inspected thoroughly after storage and prior to installation.

Standard Connections

Standard spiral heat exchangers are provided with inlets and outlets on both shell side and tube side and a shell side vent and drain. Tube side vent and/or drain connections are available as an additional cost option. Tube side connections (inlet and outlet) are the male pipe connections protruding from the heat exchanger.

When a tube side vent (or drain) connection is provided it is located on the end opposite the process connection of one of the tube side manifolds. These units are typically used for vapor/liquid separation applications. Whenever tube side vents or drains are provided, orient the exchanger so that gravity will enhance phase separation.

Heat exchangers are typically connected for counterflow conditions. Counterflow means that the cool fluid flows in the opposite direction to the hot fluid. Counterflow will be obtained by connecting the tube side inlet and the shell side outlet at adjacent connections. Similarly, the tube side outlet and shell side inlet will be side by side.

Application Considerations

Some exchangers manufactured by Sentry will have a data sheet identifying shell and tube side fluids. When a data sheet is not available the Owner or Owner's Agent should consider fluid chemistry, temperatures, pressures, viscosity, and tendency to foul to determine which fluid to connect on the tube side. The design pressure and temperature of either the tube or shell sides of the heat exchanger CANNOT be exceeded. High temperature and/or high pressure or corrosive fluids are typically connected to the tube side. Fluids with high fouling tendencies are typically connected to the shell side to reduce plugging and facilitate cleaning.

System Design Considerations

Consideration should be given to other equipment which may be required for satisfactory operation, such as:

- Relief Valves
- Isolation Valves
- Automatic Drainers and Traps
- Strainers and Filters
- Gauge or Sight Glasses
- Temperature and Pressure Indicators and Alarms
- Process Control Instrumentation and Systems

Vibration

The Spiral Tube Heat Exchanger is designed to provide reliable service for applications involving thermal and hydraulic stresses. In some cases, surge volumes and pulsation dampening should be considered to protect the heat exchanger against operation tending to produce tube vibration.

Installation

Space Provisions

Provide sufficient clearance at cover end for disassembly of cover (bolted models only). Welded models cannot be disassembled.

Foundations

Foundations must be adequate so that the exchanger will not settle and cause the piping to transmit stress or loads to the heat exchanger connections. Foundation bolting should be designed to allow for setting inaccuracies.

Relief Valve

A shellside relief valve should be installed when:

- a. The tube side operating pressure exceeds shell side design pressure.
- b. When steam or other vapor at a pressure higher than the shell side design pressure is reduced using a pressure reducing valve prior to entering the shell.
- c. When the tube side temperature can produce a shell side vapor pressure in excess of shell side design ratings.

An adequate shell side relief valve should be installed in the shell side piping. This valve should be installed near the heat exchanger without any isolation valve between the relief valve and the heat exchanger. When cooling water is flowing through the shell side, and if the shell side piping vents to atmosphere near the heat exchanger, a relief valve would not be required. A tube side relief valve is required when maximum system pressure can exceed the design rating of the tube side of the exchanger.

Piping

The heat exchanger inter-connecting piping and piping supports should be designed such that loads and stresses on the exchanger connections are eliminated. Thermal expansion must be taken into consideration when designing the piping system. Bypass piping and valves should be considered to allow isolation of each side of the heat exchanger for inspection, cleaning, repairs, and replacement.

Provisions for safely venting non-condensable gases from each side of the heat exchanger should be supplied. Drain piping should be designed to assure complete draining. Avoid common drain manifolds. The venting system design should take into account all applicable operator and environmental safety requirements.

Installing Unit

Remove all plugs, shipping covers, desiccant containers, and other protection immediately prior to connecting unit. Avoid unnecessary exposure of internals to contaminants and moisture. Prior to connecting the heat exchanger, ensure that the piping system is clean.

Ensure that the heat exchanger is properly anchored to the foundation or support structure. Anchor bolting should be specified taking into account all loadings and forces and the effects of the environment of the installation.

Operation

Pre-Start Up Orientation

Operating personnel should be familiar with all nameplate data, drawings, specification sheets, and any special instructions prior to start up or operation. The heat exchanger design pressures and temperatures should not be exceeded during start up or operation.

Venting

Prior to operation and if possible to do so safely, the heat exchanger system should be vented of air (non-condensables) to ensure the performance of the exchanger meets specification. Venting should only be done if operator and environmental safety requirements can be met. After completely filled, close all vents.

Start Up

If specific instructions or operating procedures are not provided, the fluid stream closest to ambient temperature should be gradually introduced into the heat exchanger first, followed by the second. Avoid thermally shocking the unit by slowly increasing flow, instead of providing full flow immediately.

During Operation

(Bolted shell models only) Bolting on gasketed or packed joints should be checked periodically to ensure the joint is tight. If tightening is required, a staggered (star) pattern should be used when tightening. Refer to ASME PCC-1 standard "Guidelines for Pressure Boundary Bolted Flange Joint Assembly" for additional guidelines. Periodically verify actual flow rates against design flow rates to avoid subjecting exchanger to excessive velocities.

Excessive vibration or audible noise from a heat exchanger is abnormal. If this occurs, the cause should be investigated immediately. Verify that operating parameters (flows, pressures, temperatures) do not exceed design. If any operating parameter exceeds design, take corrective action immediately to bring any exceeded parameter back within design. Additional corrective actions may require removal of the exchanger from service and inspection.

Water hammer can cause vibration or audible noise in a heat exchanger. Causes of water hammer can be complex and involve quick closing valves and inadequate condensate removal, among other sources. A thorough investigation may be required to determine the source of the water hammer and the appropriate steps to eliminate it.

Shutdown

Shutdown should be accomplished in the reverse order of the start-up procedure. Complete drainage of fluids is essential when freezing or accelerated corrosion is possible during the shutdown time period.

Maintenance

Inspection

Inspect each side of the heat exchanger at regular intervals consistent with operating experience. Scale and other fouling is the most common cause of reduced heat transfer performance and operational life. Partial plugging can cause thermal strains and high local velocities, leading to erosion. Excessive fouling is usually indicated by an increase in pressure drop and/or a reduction in heat transfer performance.

Cleaning

Cleaning of the heat exchanger can be accomplished through chemical or mechanical methods, or a combination of the two. Consultation with a chemical supplier or cleaning consultant is recommended to ensure that the appropriate method and chemistry is selected for the fouling to be removed and the system to be cleaned.

The following maintenance items apply to bolted models only.

Tube Bundle Removal

The coil bundle can be easily damaged. Use cradles, slings, and/or shaped wooden blocks when handling or removing coil bundles. Do not support the bundle weight by an individual tube. Protect all gasket and packing surfaces from accidental damage.

For heavily scaled heat exchangers, disassembly can be made easier by first dissolving the scale. Remove scale by circulating a cleaning solution through the shell side, see "Cleaning" section.

Tube Leak Detection

Leak testing for ruptured and/or corroded tubes can be performed by applying a tubeside test pressure after removing the coil bundle from the shell. A soap bubble test (Snoop) or hydrotest are two methods typically used for leak detection. Prior to any testing, it is essential to verify that all applicable codes and regulations, such as the ASME B&PV Code or safety regulations, are understood and followed.

Gasket Replacement

It is recommended that the body gasket be replaced whenever a unit is unbolted and/or disassembled. Replacement gaskets should be centered on the flange. When tightening the flange bolting, a staggered (star) pattern should be used to assure leak proof joints. After re-assembly, pressurize shell and visually inspect for leaks. Refer to ASME PCC-1 standard "Guidelines for Pressure Boundary Bolted Flange Joint Assembly" for additional guidelines. Tighten bolting or replace gaskets to eliminate visible leaks. It is recommended that spare shell gaskets be kept on hand. See the "Spare Parts List" for replacement gasket part numbers.

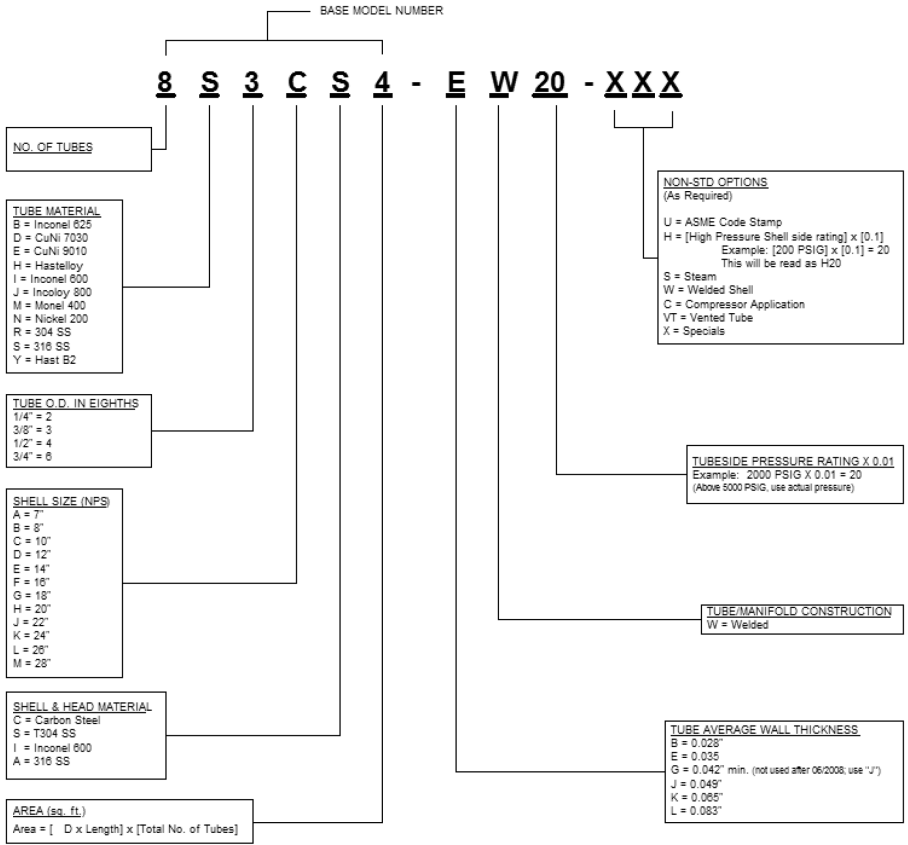
Spare Parts List

Standard Gaskets (bolted shell models only)

Shell Size	Model # Shell Code	Gasket Part Number
7"	A	4-05072A
10"	C	4-05072B
12"	D	4-05072C
16"	F	4-05072D
18"	G	4-05072G
20"	H	4-05072J
22"	J	4-05072L
24"	K	4-05798A
26"	L	4-05072M

1. The shell code is the second letter from the left side of the model number stamped on the heat exchanger nameplate. For example: Model 8S2CS4-GW12 is a "C" size, or 10" shell.
2. Standard gasket material is Klingersil C4401. Gaskets are non-asbestos material.
3. Spiral Heat Exchangers may have been specified with special gaskets. Contact Sentry to confirm replacement gasket part number.
4. For "K" models manufactured prior to January 2006, use gasket part number 4-05072N.

Spiral Heat Exchanger Model Codes



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">▪ Steam & Water Sampling Products and Systems▪ Solid & Powder Sampling Products and Systems▪ Gas Sampling Products and Systems▪ Liquid & Slurry Sampling Products and Systems▪ Pipeline Integrity Products	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.

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.

To learn more, go to www.sentry-equip.com/support.

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