



Installation, Operation and Maintenance Manual

Spiral Tube Heat Exchanger

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WARNING notices as used in this manual apply to hazards or unsafe practices, which could result in personal injury or death.

CAUTION notices apply to hazards or unsafe practices which could result in minor personal injury or property damage.

NOTES highlight procedures and contain information which assists the operator in understanding the information contained in this manual.

WARNING

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

NOTICE

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

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SAFETY PRECAUTIONS

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 or equipment damage.

Use of Hazard Information

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

Definitions



Indicates an imminently hazardous situation, which if not avoided, will result in death or serious injury.



Indicates a potentially hazardous situation, which if not avoided, could result in death or serious injury.



Indicates a potentially hazardous situation, which if not avoided, may result in minor or moderate injury.



CAUTION used without the safety alert symbol indicates a potentially hazardous situation, which if not avoided, may result in property damage.

NOTE

Information that requires special emphasis

SHALL

This word understood to be mandatory

SHOULD

This word understood to be advisory

⚠ WARNING

It is solely the responsibility of the user, through its own analysis and testing, to select products suitable for their specific application requirements, ensure they are properly installed, ensure that they are safely applied, ensure they are properly maintained, and limit their use to their intended purpose.

Improper selection, installation, or use can cause personal injury or property damage.

Sentry does not warrant against erosion and corrosion. Sentry makes no claims regarding suitability for specific use, and provides no warrantee regarding material compatibility of elastomers in specific services.

⚠ 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 damage from occurring.

⚠ WARNING

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 de-pressurized, the contents have been drained and the equipment is cool.

⚠ WARNING

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.

⚠ CAUTION

Freezing of fluids in this equipment can lead to rupture and failure. Take precautions to avoid freezing, such as draining the equipment when out of service or locating the equipment in an environment protected from temperatures below the freeze point of the fluids used.

⚠ CAUTION

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).

⚠ CAUTION

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.

⚠ CAUTION

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 must not be installed or used in any manner other than that which is specified in this manual.

⚠ WARNING

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

⚠ WARNING

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

1.0 General Description

Model Number:	The model number is engraved or laser marked on the nameplate. See Attachment Number 1 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 attachment 1). 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:	<p>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.</p> <p>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.</p> <p>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.</p>
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.

2.0 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. By-pass 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.

3.0 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.

4.0 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.

5.0 Spare Parts List

Bolted shell models only

Standard Gaskets:

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	4-05072N
24"	K	4-05789A
26"	L	4-05072M

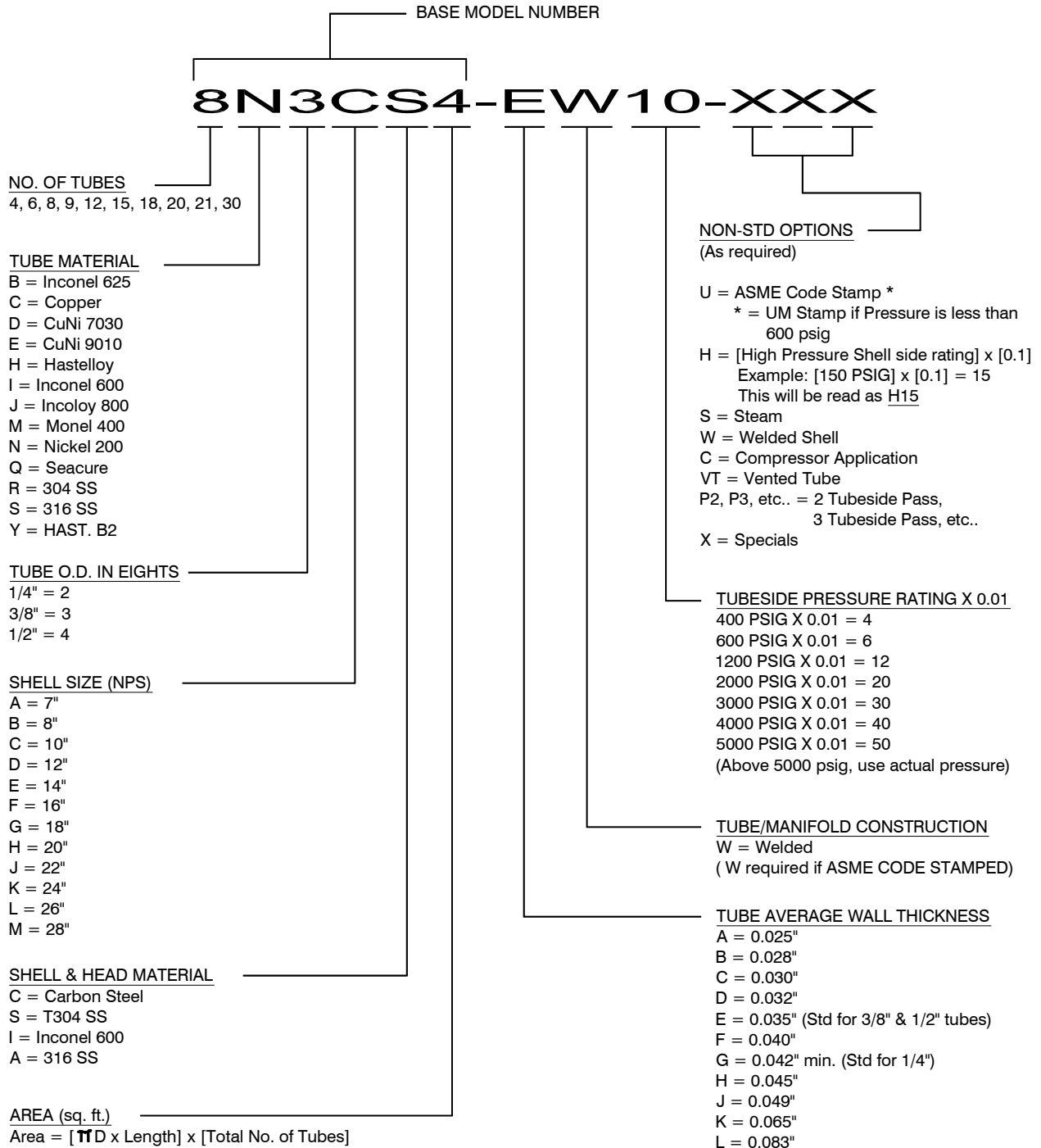
"K" models starting 01/06

- 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.

Attachment 1



Sentry Document No.: 1205059A
 Date: 03/19/03
 Prepared by: JTS
 Approved by: Steve Kraemer
 Revision No.: 0



6.0 Warranty

Seller warrants products manufactured by it and supplied hereunder to be free from defects in materials and workmanship for a period of twelve months from date of shipment. If within such period any such products shall be proved to Seller's satisfaction to be defective, such products shall be repaired or replaced at Seller's option. Seller's obligation and Buyer's exclusive remedy hereunder shall be limited to such repair and replacement and shall be conditioned upon Seller's receiving written notice of any alleged defect within 10 days after its discovery and, at Seller's option, return of such product to Seller, ex-works Sentry's factory.

The foregoing warranties are exclusive and in lieu of all other express and implied warranties except in title, including but not limited to implied warranties of merchantability and fitness for purpose. Seller shall not be subject to any other obligations or liabilities whatsoever with respect to products manufactured or furnished by it, or any undertakings, acts or omissions relating thereto.

Warranty Conditions & Limitations

This Warranty shall not apply to any Sentry product which, in the opinion of Sentry Equipment Corp, has been (a) altered or repaired in a manner affecting the efficiency of performance of the unit or (b) incorrectly installed or operated or (c) damaged in shipment or (d) damaged by flood or fire or (e) if the serial number is missing, altered or defaced.

The owner shall be responsible for maintenance of his equipment. Wear or damage caused by lack of normal maintenance or by misuse of the equipment shall not be considered as defective workmanship and material.

Sentry reserves the right to make product design changes or improvements without notice and without imposing any obligation upon itself to install these changes or improvements on its products previously manufactured.

This warranty is for the sole benefit of the original purchaser and is not transferable unless agreed to in writing by Sentry Equipment Corp.

Receiving Shipments (including loss or damage by transportation)

It is the customer's responsibility to check for missing cartons and sign of damage to cartons. If found, customer should note missing and/or damaged cartons on the delivery receipt and have delivery receipt signed by the representative of the transportation company. If unpacking discloses concealed damage from rough handling, the customer should request a concealed damage inspection from the transportation company.

The Sentry Customer Service Department will aid your organization in any claim proceeding for shortages or damages in shipment, but it is the receiver's responsibility to file claim with the carrier for damage or loss.

Customer Actions For Claims on Products During the Warranty Period

1. Contact the Customer Service Department at Sentry Equipment Corp, Oconomowoc, WI, Telephone: 262-567-7256, to obtain a Return Material Authorization (RMA) number.
2. You will be sent an "RMA" and a "Decontamination Statement" that is required to be filled out and **returned with the equipment**.
3. The following information must appear on the outside of the package:
 - a. RMA number marked on outside of box.
 - b. Decontamination Statement filled out and attached to outside of box.
4. Return defective equipment **FREIGHT PREPAID**. Collect shipments will be refused.
5. The factory will not process warranty claims until the customer has properly accomplished the above items.
6. The Sentry factory may accept the entire claim, a part of the claim, or none of the claim if our inspection of returned parts proves the failure was for reasons other than defective material or factory workmanship.

Important Notes:

1. Sentry will not be responsible for damage incurred during the return shipment.
2. All returns subject to inspection and a \$50.00 evaluation fee.
3. This RMA is not authorization for credit. Credits and/or replacements will be issued upon evaluation of returned goods.
4. RMA is valid for thirty (30) days from issue date.