



Installation, Operation and Maintenance Manual

Sample Coolers

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SENTRY EQUIPMENT CORP

PO Box 127
Oconomowoc, WI 53066 USA
Phone: 262.567.7256
Fax: 262.567.4523
Email: sales@sentry-equip.com
www.sentry-equip.com

TABLE OF CONTENTS

SAFETY PRECAUTIONS.....iii

1.0 General Description1

2.0 Installation1

3.0 Operation3

4.0 Maintenance5

5.0 Spare Parts List.....5

6.0 Warranty6

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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Sentry Equipment Corp
966 Blue Ribbon Circle North
PO Box 127
Oconomowoc, WI 53066

Phone: 262.567.7256
Fax: 262.567.4523

Normal business hours: 7:00 a.m. to 4:30 p.m. CST (U.S. Central Time), Monday through Friday

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 either tube can lead to rupture of the tube(s) wall and coil failures. 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.

1.0 General Description

A sample cooler is a small shell and coil heat exchanger. The sample to be cooled (or heated) flows through the tube side of the cooler. The cooling fluid, usually water, flows through the shell side of the cooler. A sample cooler is used to cool a sample from a process stream. Because the process stream is usually hot water or steam, sample coolers are used to cool the sample. When high accuracy is desired, the sample must be cooled to exactly 77° F. The cooled sample is then taken to a laboratory for analysis or, in some cases, piped to in-line process instrumentation.

NOTE

Sentry Sample Coolers are exempt from CE marking per Pressure Equipment Directive 97/23/EC. The vessels are below or equal to the limits set forth in Article 3, Sections 1.1, 1.2, 1.3, and section 2 as applicable, and is designed and manufactured in accordance with sound engineering practice. Specifically, the vessels meet the general requirements of the ASME Section VIII, Division 1 Boiler And Pressure Vessel Code. The nameplate will bear the name of Sentry Equipment Corp. and safety instructions will be included per Article 3, Section 3.

2.0 Installation

⚠ 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

If cooling water valves are installed, a relief valve or 3-way valve must be provided (ref. Paragraph 5 below). Damage to the equipment may occur if a relief valve or 3-way valve is omitted.

1. Support the cooler by its bracket(s) (included with the cooler) or by water lines only. Care should be taken to avoid any additional loading on either the tubes or the cooling water piping.
2. The cooling water should be softened and free of chlorides. Any hardness in the cooling water will result in scale build-up on the coil and a loss of heat transfer capacity. Chlorides can cause pitting or stress corrosion in stainless steel. If no source of acceptable cooling water is available, consult **Sentry** for a recommendation.
3. Provide a globe (not gate) valve in the **cooling water outlet line** for throttling purposes. Valve size must be the same as the **cooling water outlet** connection.
4. If isolation of the cooler is desired, provide a gate or ball valve (not globe) in the cooling water inlet line. Valve size must be the same as the **cooling water inlet connection**.
5. Install a relief valve in the cooling water line between the cooler and the outlet or the inlet valve. This protects against excessive shell side pressure in the event of (a) a leak in the high

pressure tubing, 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.

6. A 90° bend or expansion loop must be provided in the hot sample line to the cooler. This allows the tubing to expand and contract with temperature changes without inducing stress at the point where the tube is welded to the cooler head.
7. Mount the cooler either vertically or horizontally (preferably vertical on high temperature lines).
8. 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.
9. 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.

Standard Sample Cooler Connections

Cooler Model	Sample Connections	Cooling Water Connections	
		Inlet	Outlet
TRB 4222	1/4" OD Tube	3/8" FNPT	3/8" FNPT
TSF/TLF 4225	1/4" OD Tube	3/4" FNPT	1/2" FNPT
TSF/TLF 42B5	1/4" OD Tube	3/4" FNPT	1/2" FNPT
TSF/TLF 44B5	1/4" OD Tube	3/4" FNPT	1/2" FNPT
FLF 4225	1/4" OD Tube	3/4" FNPT	3/4" FNPT
FSF/FLF 6225	3/8" OD Tube	3/4" FNPT	3/4" FNPT
FSF/FLF 6222	3/8" OD Tube	3/4" FNPT	3/4" FNPT
FSF/FLF 62B3	3/8" OD Tube	3/4" FNPT	3/4" FNPT
FSF/FLF 64B3	3/8" OD Tube	3/4" FNPT	3/4" FNPT
FXF 6223	3/8" OD Tube	3/4" FNPT	3/4" FNPT
WSW 8222	1/2" OD Tube	1" FNPT	1" FNPT

Note: Contact Sentry for connection information for non-standard coolers.

3.0 Operation

Start-up and Operation

1. Fully open all cooling water valves before introducing sample to the cooler. Verify that minimum required cooling water flow is occurring. If cooling water is untreated, its temperature rise should not exceed 30°F (17°C) in order to minimize scaling. Be sure that the outlet temperature does not exceed 140°F (60°C).
2. When necessary, throttle cooling water flow by partially closing the globe valve on the cooling water outlet line. Any valve on the cooling water inlet line must always be fully open during operation.



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



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).

Cavitation can be avoided by considering the following:

1. Cavitation is caused by:
 - a) The coolant flow rate is too low, such that the fluid is overheated to its boiling point.
 - b) The sample flow rate is too high, causing the coolant to overheat to its boiling point.
 - c) The coolant operating pressure is too low, such that the fluid can boil at a low temperature.
2. Cavitation can be prevented by:
 - a) Adjusting the coolant and sample flow rates.
 - b) Increasing the 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) Reduce sample flow rate.
 - e) Excessive coolant flow rate can cause vibration of the coil due the effects of vortex shedding, leading to coil failure. Reduce coolant flow rate to design condition. The coolant outlet temperature should not exceed 140 °F. Reduce sample flow rate as necessary to achieve coolant flow and temperature limitations.
 - f) Coolant flow rate is throttled using the outlet valve only, not the inlet. This ensures that the coolant is at the higher pressure.



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 steels 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.

1. Failure due to Stress Corrosion Cracking can be minimized by:
 - a) Verifying the fluid chemistries and selecting the alternative materials of construction.
 - b) Reducing the operating temperatures by increasing the coolant flow rate.

Maximum Acceptable Chloride Levels in Cooling water for 316 stainless steel, assuming low levels* of dissolved oxygen

<u>Sample Temperature</u>	<u>Cooling Water Chloride Concentration</u>
25 - 180 °C	250 ppm
180 - 290 °C	100 ppm
290 - 550 °C	25 ppm
* approximately 0.1 ppm or below	

4.0 Maintenance

Disassembly and Reassembly

1. For heavily scaled coolers, disassembly is made easier by first dissolving the scale. Remove scale by circulating an inhibited sulfamic acid cleaning solution through the cooling water side.
2. Replace used gaskets with new ones. After reassembly, pressurize shell and visually inspect for water leaks. Replace gaskets showing visible leaks. Keep spare shell gaskets on hand for this need.
3. During reassembly tighten the bolts only enough so that shell side leaking does not occur. T Series coolers require approximately 35 ft-lbs torque. F Series coolers require approximately 45 ft-lbs torque. Over-tightening can cause gasket failure.

5.0 Spare Parts List

COOLER MODEL	QTY REQ'D	GASKET P/N**	BRACKET P/N*
FF SERIES COOLERS (FLF,FSF,FXF)	1	2-03800A	2-00165B
TF SERIES COOLERS (TLF, TSF)	1	2-03800B	2-04297A
TRB COOLERS	2	2-00602B	COOLERS WITH SERIAL #S 06700016A0279 AND UP USE P/N 2-04297A. SERAIL #S 06700016A0278 AND DOWN USE P/N 2-04297B
TEB COOLERS	2	2-00602B	COOLERS WITH SERIAL #S 06700016B0031 AND UP USE P/N 2-04297A. SERAIL #S 06700016B0030 AND DOWN USE P/N 2-04297B
FB SERIES COOLERS & TB SERIES COOLERS		CONTACT SENTRY EQUIP. CORP	PARTS AND SERVICE DEPT. FOR CURRENT OPTIONS.

* BRACKET QUANTITY VARIES UPON COOLER SET-UP.

**GASKETS ARE NON-ASBESTOS MATERIAL

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.