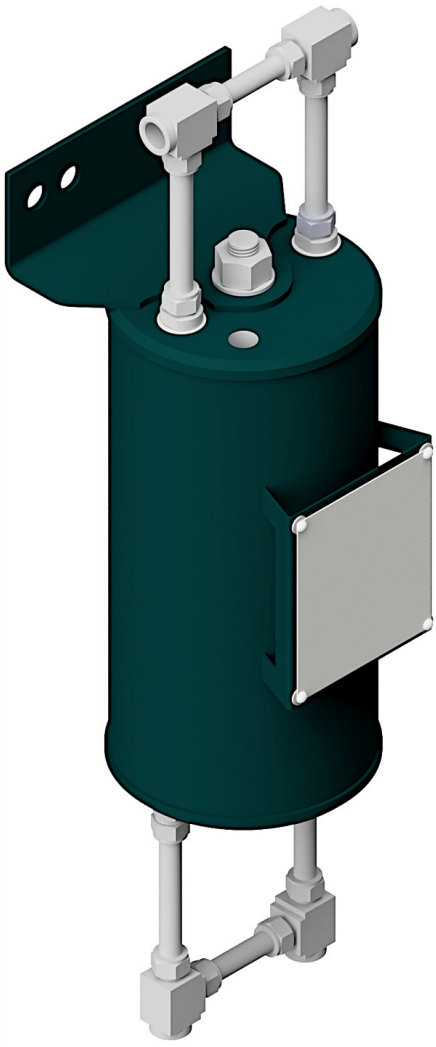
FLOWSERVE

USER INSTRUCTIONS

Installation
Operation
Maintenance

682M and 682H Seal Coolers



Experience In Motion

1. Introduction

1.1 About this manual

This manual is intended to ensure the safe installation and effective operation of the 682M and 682H seal coolers. It is highly recommended that all applicable personnel review and follow the guidance provided by this instruction.

Note: As hazardous conditions can result from planned as well as unforeseen circumstances, pressurized equipment shall always be operated with caution. Before installation, equipment should always be fully inspected including, but not limited to checking for:

- Any possible damage due to transport or storage
- Cleanliness, required before operation
- Existence of an affixed nameplate with correct inspection markings and design/test conditions clearly annotated

1.2. How to use this manual

Only trained and qualified personnel should install or operate the equipment. Refer to section 2.3 for safe product operation. Inexperienced personnel should only work on this system under the supervision of a qualified person.

Before using this manual, make sure you have fully read and understand the safety section. Pay special attention to section 5, which describes the system in detail.

When system maintenance is performed, ensure that maintenance procedures are followed, paying close attention to the alerts and safety icons.

1.3. Other supplied documentation

The assembly drawing is included with the cooler.

1.4. Conformity with Standards and Directives

The 682M and 682H Seal Cooler conforms to the following standards and directives:

- ASME BPVC Section VIII Div. 1
- ASME B31.3
- Pressure Equipment Directive (PED) 2014/68/EU
- API Standard 682

1.5. Use of Alerts and Icons

The manual “Notes”, “Cautions”, and “Warnings” alert you of important information and/or hazardous situations.

CAUTION
The equipment, product or surrounding area can be damaged if the “caution” is not obeyed.

WARNING
Personnel can be (seriously) injured, or the equipment can be seriously damaged if the “warning” is not obeyed.

More specific icons are also used, depending on the type of hazard.

2. Safety

2.1. Hazards associated with the 682M and 682H Seal Cooler

The following hazards can be present in the system:

- High pressure
- Dangerous or Toxic chemicals
- High Temperatures (hot surfaces)
- Dangerous moving parts (during installation)

Notes:

• Cooling fluid at sufficient flow and pressure is required for efficient heat removal from process or barrier fluid.

WARNING
HIGH PRESSURE: The cooling fluid section of the cooler is not protected against overpressure. If the supply and return lines are closed, a cooling line could burst. If there is a possibility of the coolant pressure exceeding the cooler design pressure, a pressure relief valve shall be installed in the cooling line to prevent over pressurization.

2.2. General Safety

When installing, operating and maintaining this system, safety of personnel should be a top priority. As such:

- Obey applicable safety laws and regulations
- Read and understand this manual
- Follow the installation, operation, and maintenance procedures
- Wear Personal Protective Equipment (PPE) as required and applicable
- Take proper precautions and follow all plant requirements for handling hazardous materials

2.3. Trained and Qualified Personnel

Qualified personnel are people who have been authorized by those responsible for the safety of the plant to perform the necessary work, and who can recognize and avoid possible dangers. The following aspects determine the qualification of personnel:

- Appropriate training
- Relevant experience
- Knowledge of relevant standards and specifications
- Knowledge of accident prevention techniques and regulations
- Knowledge of plant regulations and operating conditions

2.4. Personal Protective Equipment (PPE)

When operating or maintaining this system, make sure you wear the appropriate Personal Protective Equipment (PPE), including: protective clothing, gloves, safety shoes, safety glasses, hearing protection, etc.

WARNING	
	HOT SURFACES: The system and surrounding surfaces might be hot. Take care when touching components. Wear the appropriate Personal Protection Equipment (PPE), according to plant regulations.

3. Environmental Considerations

CAUTION	
	You are required by law to dispose of waste products and end of life equipment according to local regulations.

3.1. Disposing of Waste Products

Any waste products resulting from the use or maintenance of the system must be disposed of according to local environment laws and regulations.

3.2. End of Life Equipment

WARNING	
	DANGER CHEMICALS: Dangerous chemical might be released during removal of the system. Wear PPE. Follow all safety regulations and plant regulations.

WARNING	
	HIGH PRESSURE: High pressure might be stored in the system. Before removing or re-installing the system, make sure the entire system has been de-pressurized (and drained if required).

Dispose of end of life equipment following local environment laws and regulations.

4. Transportation and Storage Requirements

The following requirements apply to the 682M and 682H seal cooler and all related equipment:

Transport and storage criteria	Requirements
Transportation	The cooler must be transported and stored in the unopened, original shipping box.
Suspect damaged during transportation	Inspect coolers that have been dropped or have been subjected to impacts during transport to confirm that they are operational before installation.
Warehouse requirements	The warehouse must be dry and dust free.
Long-term storage	After a storage period of 1 year, inspect the cooler before installation.
Preserving installed systems	The preserving medium prevents damage to the installed system or mechanical seal (i.e. preventing fouling or chemical attack). contact Flowserve if you are unsure which preserving medium to use.

5. Design Overview

5.1. Description

The 682M and 682H Seal Coolers are shell and tube heat exchangers used to lower the temperature of single and dual mechanical seals. The medium to be cooled is on the tube side while the cooling fluid passes through the shell. The coolers are factory configured for series or parallel flow through the tube. Use this guide to properly apply and operate either flow pattern.

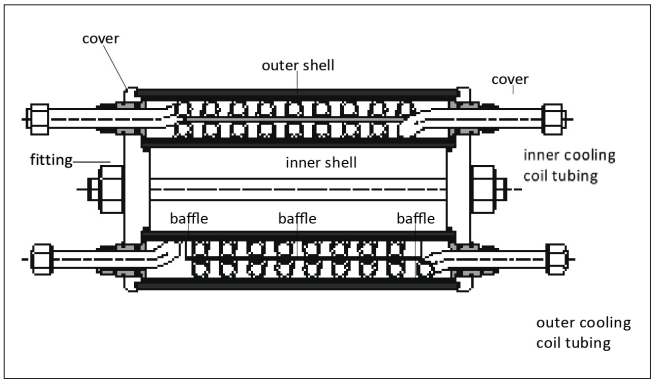


Figure 1: 682H Cooler Cross Section View

Note: External tubing that configures series or parallel flow is not shown.

Note: The images of parts shown in these instructions may differ visually from the actual parts due to manufacturing processes that do not affect the part function or quality. Refer to specific product drawing for connection and dimensional details.

The 682M Seal Cooler is provided with one intermediate baffle to achieve seal cooling at a lower cost, while the 682H Seal Cooler has three baffles (inner, intermediate and outer) to maximize heat transfer, optimizing seal cooling.

6. Product Specification

6.1. The Standard Materials for both Seal Coolers are shown in the following table:

Component	682M Seal Cooler	682H Seal Cooler
O-rings	Fluoroelastomer	
Tubing	316 Stainless Steel	
Fittings	316 Stainless Steel	
Inner and Outer Shells	SA-106 Grade B CS	SA-312 TP316/316L SS
Top and Bottom Covers	SA-516 Grade 70 CS	SA-240 316/316L SS
Baffles	(One) 316 Stainless Steel	(Three) 316 Stainless Steel
Stud	SA-193 Grade B7, Zn Plated	
Nuts	SA-194 Grade 2H, Zn Plated	

6.2. Technical Data:

Cooling Coil Tube OD	19 mm (0.750 inch)
Cooling Coil Tube Wall Thickness	2.4 mm (0.095 inch)
Effective Cooling Area	0.51 m^2 (5.50 ft^2)
Shell (Coolant) Flow Rate	24.6 to 75.7 l / min (6.5 to 20 GPM)
Tube (Product) Flow Rate	7.6 to 37.9 l / min (2 to 10 GPM)
Unit Weight (Empty)	62.1 kg (137 lbs)
Maximum Temperature (Tube Side)	371°C (700°F)
Maximum Temperature (Shell Side)	150 °C (302 °F)
Max. Working Pressure (Tube Side)	255 bar @ 371°C (3700 psi @ 700°F)
Max. Working Pressure (Shell Side)	682M: 15.8 bar @ 150°C (230 psi @ 302°F) 682H: 17.9 bar @ 150°C (260 psi @ 302°F)

6.3. Seal Cooler 682M and 682H Product Offerings:

Process Connection	Coolant Connection	Configuration	682M P/N	682H P/N	Optional Certification
¾" Tube	¾-14 NPT	Basic[1]	682MBTN0000	682HBTN0000	PED[3]
¾" Tube	¾-14 NPT	Series	682MSTN0000	682HSTN0000	ASME[2], PED[3]
¾" Tube	¾-14 NPT	Parallel	682MPTN0000	682HPTN0000	ASME[2], PED[3]
¾-14 NPT	¾-14 NPT	Series	682MSNN0000	682HSNN0000	ASME[2], PED[3]
¾-14 NPT	¾-14 NPT	Parallel	682MPNN0000	682HPNN0000	ASME[2], PED[3]
¾" 600# RF Sch. 80	¾-14 NPT	Series	682MSFN0600	682HSFN0600	ASME[2], PED[3]
¾" 600# RF Sch. 80	¾-14 NPT	Parallel	682MPFN0600	682HPFN0600	ASME[2], PED[3]
¾" 600# RF Sch. 80	¾" 300# RF Sch. 80	Series	682MSFF0600	682HSFF0600	ASME[2], PED[3]
¾" 600# RF Sch. 80	¾" 300# RF Sch. 80	Parallel	682MPFF0600	682HPFF0600	ASME[2], PED[3]

*1 The 682*BTN cooler versions are for Flowserve systems internal use only (see page 4)*

1 Add suffix -U to part number for ASME U-Stamp (Example: 682MSTN0000-U)

1 Add suffix -P to part number for PED Certification (Example: 682HSNN0000-P)

7. Installation

Before installing the cooler, inspect all components for damage. If any of the components are damaged, you should report this to your local Flowserve representative.

Position the 682M and 682H seal cooler as close to the seal as possible. Make sure there is sufficient room for:

- Evacuation of the plant in case of an emergency (do not block walkways and emergency exits).
- Safe operation and maintenance of the system.

WARNING	
	CRUSH HAZARD. Possible injury and/or trapped limbs. Take care to avoid being trapped or crushed between heavy, moving objects.

7.1. Primary API Piping Plans

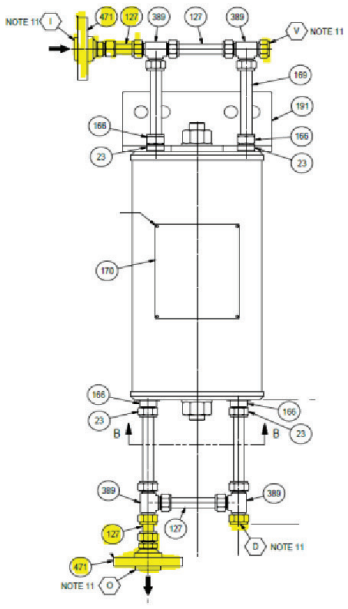
API Plan 21 provides cooling to the seal by flowing pump discharge fluid through a control orifice and into the seal cooler before entering the seal chamber. This piping plan is targeted for clean high temperature fluids and hot water above 176°F (80°C) to improve vapor pressure margin, meet secondary seal element temperature limits, reduce coking, and improve fluid lubricity. Refer to figure 2 in following page.

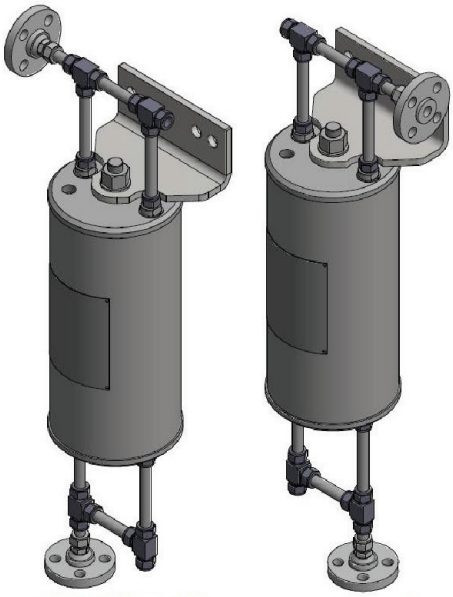
API Plan 23 cools the seal chamber fluid by using a pumping device to circulate the seal chamber fluid through a seal cooler and back to the seal chamber. The circulated fluid is isolated from the pump impeller area by a throat bushing so that the seal cooler needs to cool a limited volume of fluid in the seal chamber heated by the seal faces and heat soak from the process side. This piping arrangement is the plan of choice for clean hot water services, particularly above 176°F (80°C) where water has low lubricity, and many clean hot hydrocarbons to improve vapor pressure margin. Refer to figure 3 in following page.

API Plan 53C cools the clean external barrier fluid pressurized by a piston accumulator, to supply adequate liquid to the barrier fluid seal chamber.

7.2. Configuring Flow Direction of Process Fluid

The 682M and 682H Coolers are assembled with the process fluid flowing from the left side of the cooler to the right side. The flow direction can be customized to flow from the right side of the cooler to the left side, by loosening the flange fitting connections (highlighted in yellow in figure 2) and reversing the tube assembly orientation, as shown in figure 2.





Standard Construction (Product on Left Hand Side See Note 11)

Optional Construction (Product on Right Hand Side See Note 11)

[11] Product on Left Hand Side. For Right Hand Side, Reverse Flanges Item 471 Location.

Figure 2: Configuring Process Fluid Flow Direction

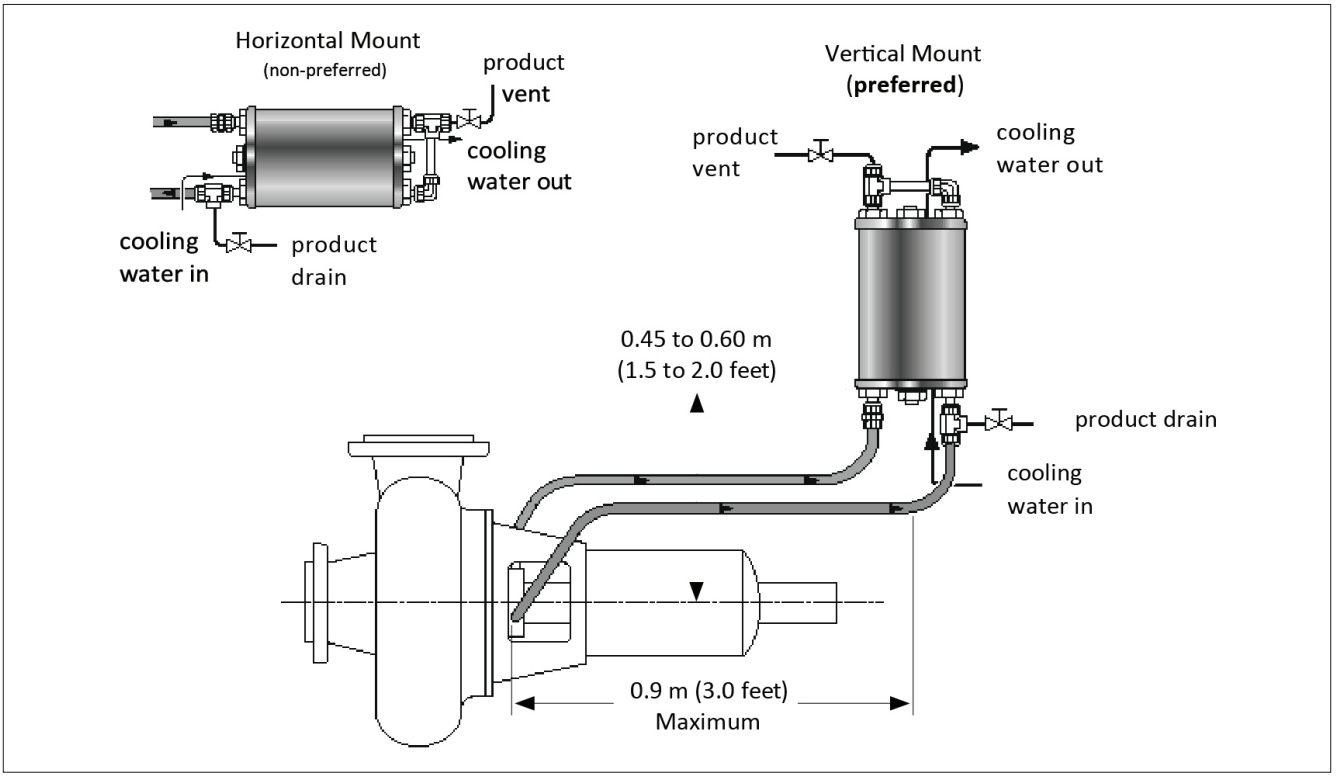


Figure 3: Series Tube Flow Piping

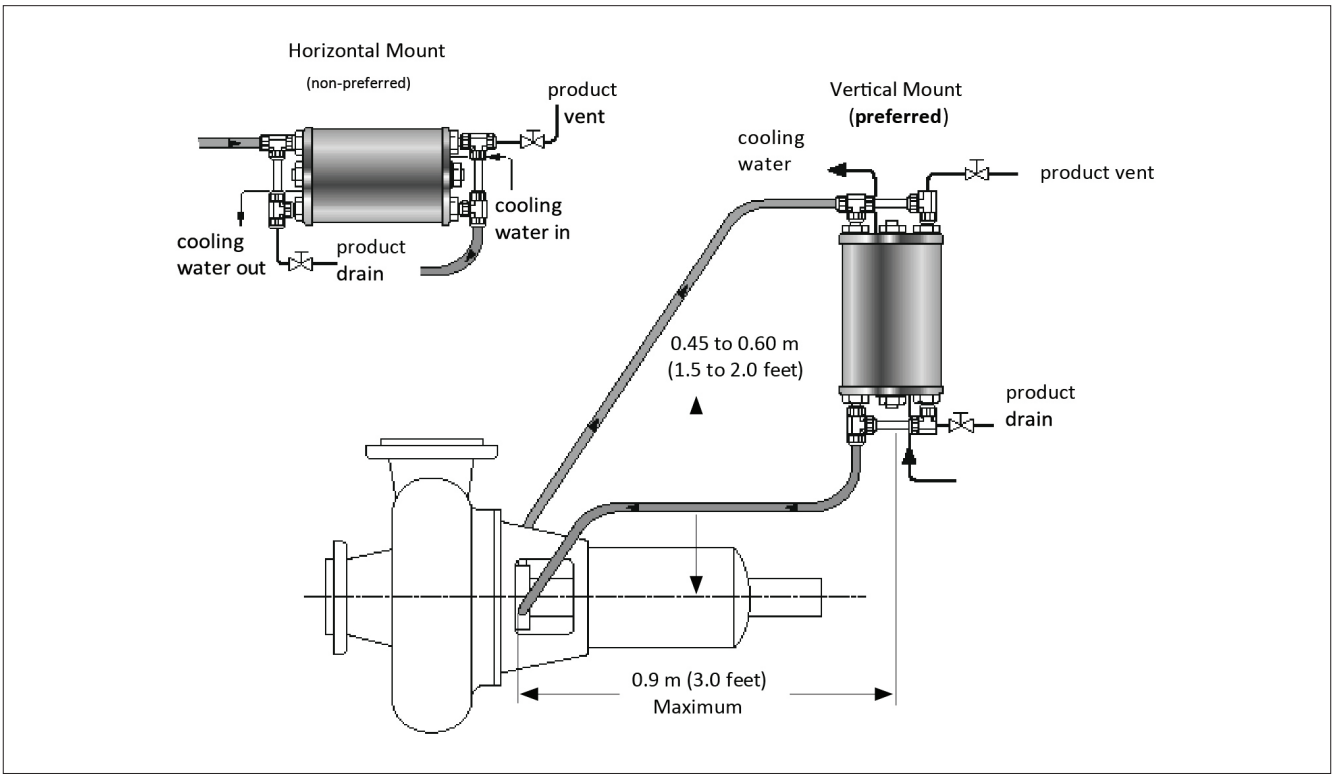


Figure 4: Parallel Tube Flow Piping

7.3. Vertical or Horizontal Mounting

It is strongly recommended that the 682M and 682H Seal Coolers be mounted in a vertical position to ensure proper cooling efficiencies and simplify maintenance requirements.

Even though the 682M and 682H Seal Coolers can provide cooling capabilities when mounted horizontally, it is much more advantageous to mount them vertically, given that the cooling coil winds gradually for optimum heat transfer, fluid liquid drainage and gas venting.

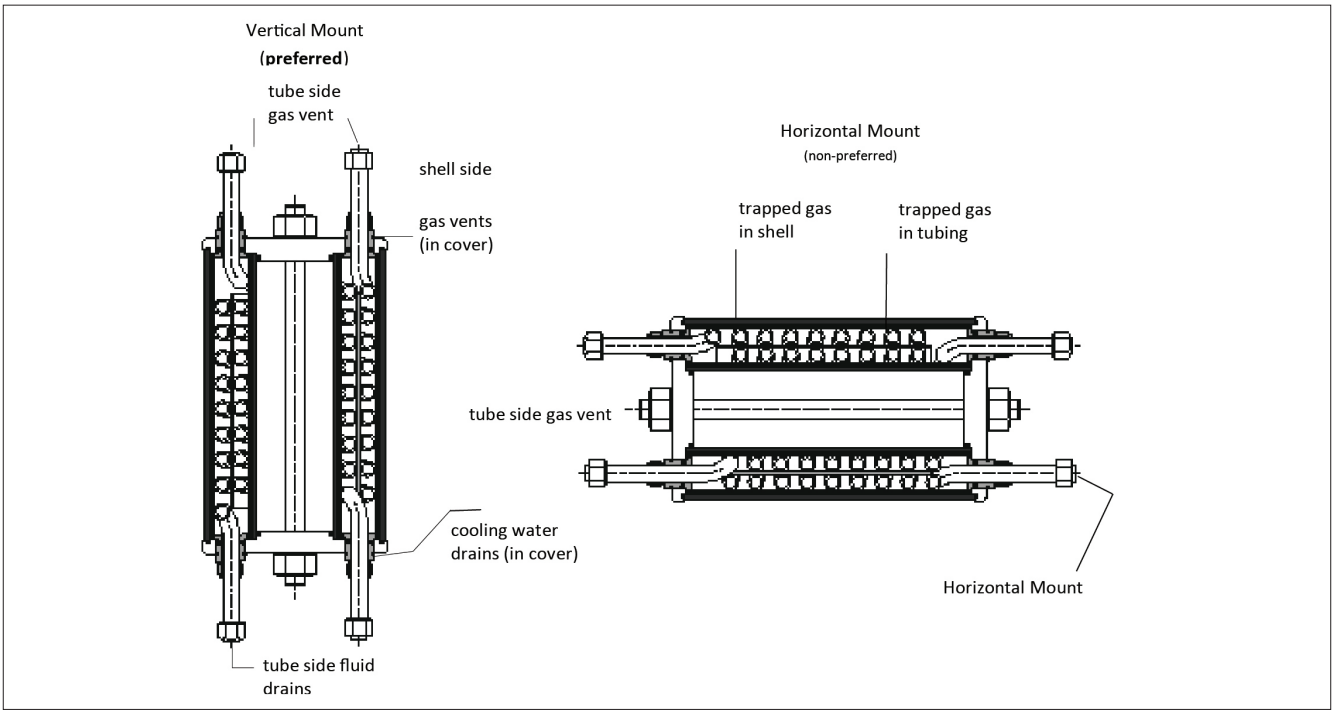


Figure 5: Cooler Mounting

In a horizontal position, it is much more difficult to totally drain both the sealing and cooling fluids. The sealing fluid becomes trapped within the lower turns of the cooling coil and the shell side cooling water becomes trapped below the lowest drainage point. The seal cooler needs to be removed and positioned vertically to achieve total drainage. It is also much more difficult to vent gas/air from a horizontal installation because the gas/air can become trapped within the upper turns of the cooling coil. A series of flush and bleed steps can be necessary to remove trapped gases.

The presence of trapped gas/air is more critical when using a Plan 23 seal flush. Trapped gases that become entrained in the sealing fluid can reduce the seal cooler efficiency and flow in the seal flush circuit. This can ultimately cause the seal to overheat and fail due to insufficient lubrication. Mounting the seal cooler vertically is thus preferred, as the thermosyphon effect helps alleviate gas-related detrimental conditions.

8. Operation

Always operate the 682M and 682H Seal Coolers within the temperature and pressure limits shown on the assembly drawing / product nameplate.

When installing, ensure that the seal cooler, piping, and vent locations provide complete venting of gas (including air) from both the process and coolant sides of the cooler. This requires the vents to be located at the highest point in each system.

Before start-up, ensure that all piping is properly attached to the appropriate connections for both the process and coolant to prevent fluid leaks and achieve expected cooler performance. Ensure that all the gas (including air) is vented from both the coil and shell systems to maximize system efficiency and prevent a vapor lock condition.

At start-up, ensure that the flush fluid flow and coolant fluid flow are set and stabilized at the prescribed flow rates determined for the application.

Do not allow the coolant fluid flow rate to drop below minimum flow rate. Lower flow rates promote fouling which reduces the seal cooler heat transfer capabilities. See table 1 for coolant flow rates.

Cooler Characteristic	Flow Rate
Minimum Coolant Flow	24.6 L/m [6.5 GPM]
Maximum Coolant Flow	75.7 L/m [20 GPM]

Table 1: Coolant Flow Rates

Seal cooler performance should be periodically validated. Baseline temperatures should be gathered soon after equipment commissioning and compared with temperature data collected periodically over the operational life of the cooler.

Changes in temperature differential, unaccompanied by process flow or temperature change can be a sign of tube fouling and should be investigated.

9. Maintenance Recommendations

The 682M and 682H seal cooler may only be disconnected by qualified personnel, in accordance with local regulations, the safety standards of the user and in accordance with the users operating procedures.

Before disconnecting the equipment, verify that:

- The equipment is at ambient temperature
- The equipment is not pressurized
- The equipment is drained

Process fluid may remain in tubes, therefore, site regulations for liquid removal shall be followed.

WARNING	
	DANGER CHEMICALS: Dangerous chemical might be released during removal of the system. Wear PPE. Follow all safety regulations and plant regulations.

9.1. Remove the seal cooler from service.

WARNING	
	HOT STEAM: The pressurized steam, cooler and surrounding surfaces might be hot. Take care when touching components. Wear the appropriate Personal Protection Equipment (PPE), according to plant regulations

Under no circumstances should the seal cooler be maintained while it still contains any hazardous materials or when the internal pressure is above atmospheric pressure. The equipment must be brought to atmospheric pressure by venting it to a safe location, before opening.

9.2. Remove all end fittings connected to the lengths of tubing protruding from each end of the cooler. Fitting ferrules and nuts cannot be removed from the primary lengths of protruding tube and should be remain in place. Do not remove the fittings directly adjacent to the tube cover. Be sure to retain all fittings and mark them appropriately. This will minimize the likelihood of fitting leaks upon reassembly.

9.3. Remove the center bolt.

9.4 **682M:** Remove two snap rings located between the coil fittings and the top cover.

682H: Remove four snap rings located between the coil fittings and the top and bottom covers.

9.5 **682M:** Carefully pry the bottom cover from the main cooler body. Extract the Cooler internal subassembly completely from the main cooler body. Take care not to use too much force, which can result in coil stretch.

682H: Carefully pry each end cover from the main cooler body. A short piece of pipe(150 to 200 mm, 6 to 8 inches) screwed into the shell side inlet or outlet offers an adequate amount of leverage. Take care not to use too much force, which can result in coil stretch. The outer and inner shells can now be removed, exposing the coiled tubing.

9.6 **682M:** Proceed to step 9.7.

682H: Remove the sheet metal baffles located at the tube body OD and ID. Orientation is important and should be recorded.

9.7 Clean the shell and coils taking care not to damage either.

9.8 Inspect all components for damage or corrosion and replace as needed. Secondary sealing components such as O-rings should always be replaced.

9.9 Reassemble the unit in reverse of disassembly. Center bolt torque required is 135 to 203 N-m (100 to 150 ft_lb). All fittings should be reassembled to the manufacturer's specifications.

9.10 Leak testing is recommended after assembly. Refer to end user specifications or procedures. Alternately, individual units can be returned to Flowserve for refurbishment and testing.

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