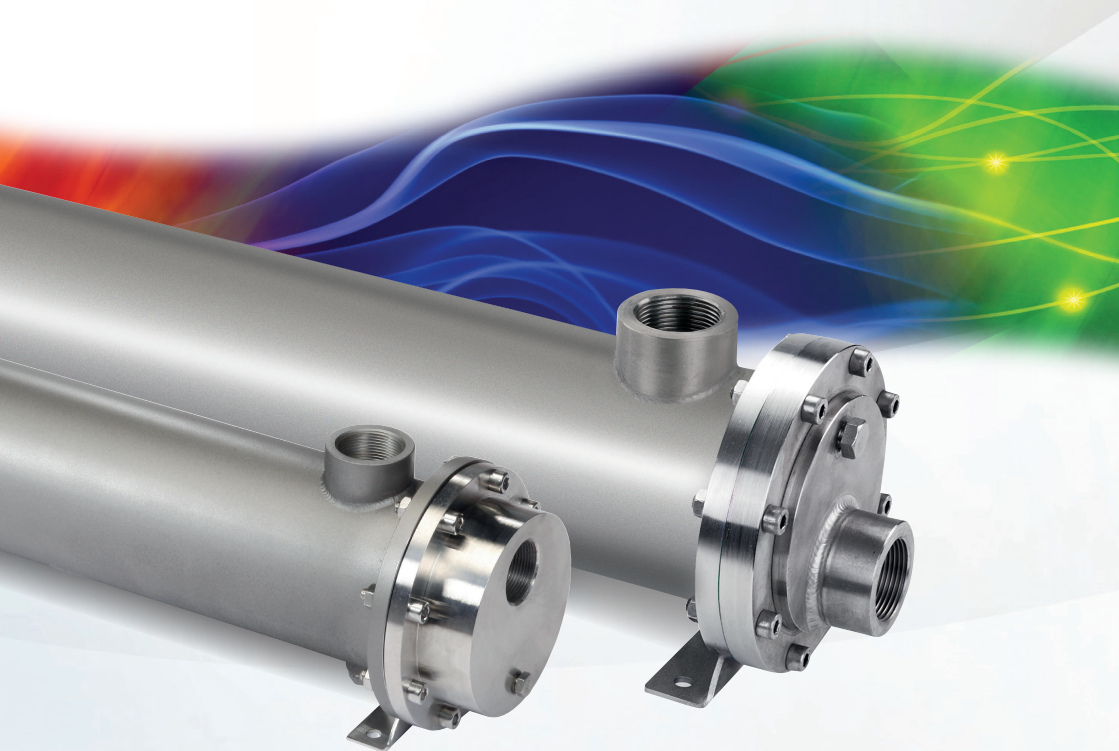


Installation, Operation & Maintenance Guide

STAINLESS STEEL HEAT EXCHANGERS



BOWMAN®
100 YEARS OF HEAT TRANSFER TECHNOLOGY

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Introduction

Thank you for purchasing a high quality Bowman Stainless Steel Heat Exchanger.

Bowman® has been manufacturing heat exchangers for over 100 years and our products are renowned for their quality, heat transfer performance and durability.

Please read this 'Installation, Operation & Maintenance Guide' carefully before installation to ensure your heat exchanger operates efficiently and reliably.

Please keep this guide for future reference to ensure the long term performance of your Bowman heat exchanger.

Should you require advice or assistance, please contact your Bowman stockist or distributor.

Further copies of this 'Installation, Operation & Maintenance Guide' can be downloaded from our web site www.ej-bowman.com

1. Safety

1.1 Hazards when handling the Stainless Steel Heat Exchanger.

BOWMAN® Heat exchangers are constructed to current practice and recognised safety standards. Hazards may still arise from operation, such as:

- Injury of the operator or
- Third parties or
- Damage to the heat exchanger or
- Damage to property and equipment

Any person involved with the installation, commissioning, operation, maintenance or repair of the heat exchanger must be:

- Physically and mentally capable of performing such work
- Appropriately qualified
- Comply completely with the installation instructions

The heat exchanger must only be used for its intended purpose.

In the event of breakdowns which may compromise safety, a qualified person must always be contacted.

1.2 Safety Instructions

The following symbols are used in these operating instructions:



Danger

This symbol indicates an immediate danger to health.

Failure to comply with this instruction may result in severe injury.



Caution

This symbol indicates a possible danger to health.

Failure to comply with this instruction may result in severe injury.



Take Care

This symbol indicates a possible risk to health.

Failure to comply with this instruction may result in injury or damage to property.



This symbol indicates important information about correct handling of the equipment

Failure to comply with this instruction may cause damage to the heat exchanger and/or its surroundings.

1.3 Approved use



BOWMAN® Stainless Steel Heat Exchangers are only approved for the application stated at enquiry stage. Any other use unless specified by **BOWMAN®** is not approved. **BOWMAN®** declines all liability for damage associated or arising from such use.

The maximum permissible operating pressure must not exceed:

Oil (primary side) : 20 bar max.

Water (secondary side) : 20 bar max.

The maximum permissible operating temperature must not exceed:

Oil (primary side) : 200°C

Cooling Water (secondary side) : 110°C



Caution



Take Care

1.4 Potential Hazards

Ensure the maximum permissible operating pressure on the primary or secondary side of the heat exchanger is not exceeded. The heat exchanger or surrounding equipment may be damaged.

NB: before the heat exchanger is disconnected it must be allowed to cool sufficiently and be depressurized to prevent injury. The supply and returns to the heat exchanger should be isolated to minimise fluid loss.

2. Installation

2.1 Transport / storage

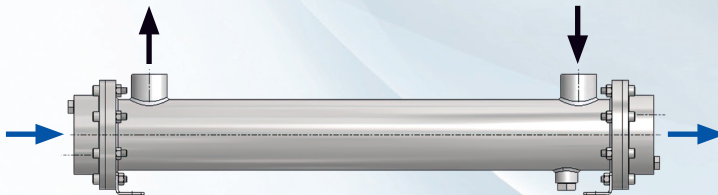
The heat exchanger must be fully drained down prior to transportation. Once drained and fully dry, the heat exchanger must only be stored indoors within a non aggressive atmosphere. The connections should be capped to avoid ingress of dirt and contaminants.



Take Care

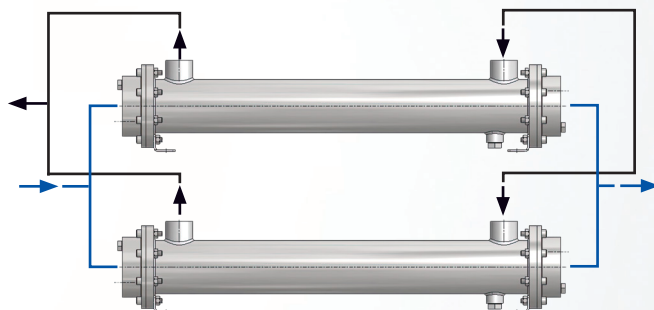
2.2 Fitting

Before fitting, the heat exchanger should be checked for visible signs of damage. The heat exchanger should be positioned horizontally and should be connected in counterflow so that the fluids flow in opposite directions, as shown below:

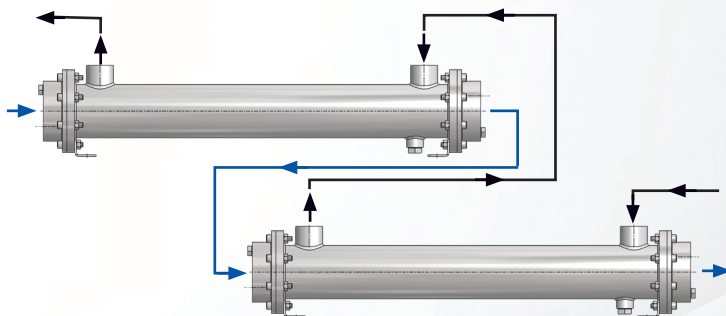


Water →
Oil →

Multiple units can be connected in parallel:



Or in series:



A filter with a maximum permeability of 2.5mm should be used prior to the inlet of each circuit of the heat exchanger. Nothing should be welded to any part of the heat exchanger. Each unit comes complete with mounting brackets. .

2.3 Connecting the heat exchanger



Take Care

Shut off all drainage valves in the flow and return pipes of the primary and secondary circuits.

When fitting the heat exchanger into the pipe work care must be taken to ensure that no debris has been introduced into the primary or secondary circuit of the heat exchanger.



Unsupported lengths of pipework should be avoided so as not to subject the heat exchanger to excessive loads.

Water side pipework diameter should not reduce to less than the connection size within a distance of 1m from the heat exchanger.

Measures should be taken to isolate the heat exchanger from excessive vibration.

Taper fittings are not recommended as these can damage the shell and end cover connections if over tightened.

The correct length of fitting should be used as too long a fitting will damage the tubestack.

Pipework materials must be compatible with the heat exchanger materials.



For our heat exchangers, the maximum permitted tube side water flow rates are as follows:

SB range - 180 l/min.

SC range - 295 l/min.

SD range - 540 l/min.

SE range - 755 l/min.

SF range - 1345 l/min.

SG range - 2200 l/min.

No heat exchanger manufacturer can guarantee that his products will have an indefinite life and for this reason, we suggest that the cooling system is designed to minimise any damage caused by a leaking heat exchanger. This can be achieved as follows:

1. The primary circuit pressure should be higher than the secondary cooling water pressure, so that in the event of a leak occurring, the primary circuit will not be contaminated.
2. When the primary circuit system is not being used, the heat exchanger should be isolated from cooling water pressure.

3. Operation

The heat exchanger should be pressurized on the primary circuit (shell) side such that it is at a higher pressure than the secondary circuit (tube) side. This will ensure that if a leak occurs it will be detected by a reduction in the level of the primary circuit fluid rather than it being contaminated. A differential pressure of 2 bar would be sufficient.

It is essential that the following instructions are followed to prevent corrosion/erosion of the heat exchanger:

- a) Always maintain the water pH to within correct levels. The ideal water pH should be kept within 6.5 to 8.0.
- b) Maximum fluid velocity through the heat exchanger of 4.0m/s. If in doubt contact BOWMAN® for guidance.
- c) Minimum water velocity of 1 m/s should be used.
- d) Chloride levels should be kept below 350 ppm
- e) Ensure compliance with water quality and maximum permissible pressure requirements.
- f) Air must be adequately vented from both circuits.
- g) Stagnant water should not be allowed to accumulate in the heat exchanger. If it is not in use for any period of time the water should be drained off.

4. Commissioning



Commissioning of the heat exchanger should not be undertaken until this document has been fully read and understood.



Danger

The primary and secondary circuits of the heat exchanger must be fully closed prior to commissioning.



Take Care

Adequate provision should be made to ensure that correct operating/service equipment along with personal protection equipment (PPE) in accordance with current standards/legislation is used prior to the commencement of any working.

Cooling water should be introduced to the oil cooler prior to the gradual introduction of hot primary circuit fluid.

Both circuits should be vented initially and again when operating temperatures and pressures are reached. The system should be checked for leaks.

5. Maintenance / Repair

5.1 Winter shutdown in areas exposed to frost

Care should be taken to prevent frost damage from a winter shutdown in conditions exposed to frost. We recommend fully draining down the heat exchanger or removing the heat exchanger completely from the installation throughout the duration of the shutdown period unless adequate heat load is applied to the heat exchanger.

5.2 General maintenance

While the unit is in operation, weekly inspection of the heat exchanger and its connections should be made for leaks and externally visible damage.

BOWMAN® recommend that the tubestack should be cleaned and inspected annually and the 'O' rings should be renewed at this time. Removal of the screws around the periphery of each end cover will allow the end covers and 'O' seals to be removed.

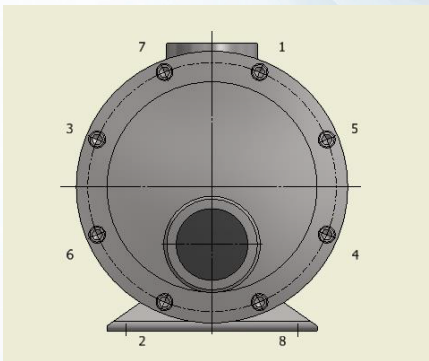
5.3 Stainless Steel Heat Exchanger Cleaning

Whilst we strongly recommend that mechanical and chemical cleaning of the heat exchanger is carried out only by specialised companies, below are some general guidelines that may be useful;

- a) Removal of the end covers allows access to the tube plates.
- b) Wash the tube plates and tubes using a handheld hose or lance. An industrial steam cleaner can be used, if available.
- c) Tube brushes can be used to clean through each tube to aid in removing stubborn deposits. Small diameter rods and brushes for tube cleaning are available from companies such as Rico Industrial Services www.ricoservices.co.uk.
- d) Detergents or chemicals suitable for use with stainless steels can be used, if fouling is severe. Allow time for the detergent or chemical cleaner to work before hosing down with plenty of water.
- e) The tube stack should be flushed through with clean water to remove all traces of cleaning chemicals/detergents. If necessary, the cleaning fluid should be neutralised.
- f) End covers should be refitted after cleaning using new 'O' rings.

Oil Cooler Series	Bolt Size	Torque (Nm)	Oil Cooler Series	Bolt Size	Torque (Nm)
SB	M8	17.0	SE	M10	33.0
SC	M8	17.0	SF	M12	57.0
SD	M10	33.0	SG	M12	57.0

5.4 End cover bolt tightening sequence



End covers must be refitted in the correct orientation to ensure correct performance.

6. Potential Service Issues

6.1 Tube failures

The majority of problems facing a heat exchanger are those of corrosion or erosion on the water side. Three common types of failure are:

a) Impingement attack (or corrosion / erosion)

This is caused by water containing air bubbles flowing at high speed through the tubes. The impingement of rapidly moving water may lead to a breakdown of the protective copper oxide film on the tubes thus allowing corrosion/erosion. This is worse with water containing sand or grit. The effect of these conditions would be pockmarking and pinholing of the tubes.

b) Oxide corrosion

This is caused by water containing organic matter such as that found in polluted estuaries. Usually this water produces hydrogen sulphide, which is very corrosive and can cause failure of the tubes, particularly if excessive water flows are used.

c) Pitting

This problem is caused by very aggressive sea water in the tubes, especially in partially filled coolers where the sea water is stagnant. Low sea water flow rates can create a high temperature rise on the sea water side. Under these conditions deposits may build or settle in the tube, allowing pitting corrosion to take place under the deposits.

This is only a brief introduction to corrosion problems. The subject is complex and the purpose of these notes is to outline in very general terms what may occur under extreme conditions.

6.2 Fault finding

Symptoms	Possible Causes	Remedy
Increase in temperature on shell side or excessive pressure loss	Oil sludging, tube scaling or build up of both resulting in an insulating film covering the tubes	The complete heat exchanger should be thoroughly cleaned
Pressure loss is as expected, but the temperature of the oil rises	Film, scale or restrictions on the inside of the tubes	The complete heat exchanger should be thoroughly cleaned
Oil leaking into the cooling water circuit or vice versa	Split or perforated tubes	Tubes should be blocked with hard wooden plugs as a temporary measure & the tubestack replaced asap
Inadequate performance	Flow rates too low Unit connected in parallel flow	Check flow rates & increase if necessary Reconnect in counterflow as per section 2.2

7. Warranty

All **BOWMAN**® Stainless Steel Heat Exchangers are guaranteed against manufacturing and material defects for a period of twelve months from the date of delivery.

BOWMAN® should be contacted immediately if a unit is received damaged. No attempt should be made to repair a faulty unit as this will invalidate the warranty.

For full warranty terms, please see the **BOWMAN**® Conditions of Sale. A copy of which is available on request either directly from EJ Bowman (Birmingham) Limited, Chester Street, Birmingham B6 4AP, UK or your local stockist who supplied the product.

8. Spare Parts List

A comprehensive stock of spare parts is always available.

Please contact our sales department for price and availability or your nearest stockist.

9. UKCA / CE Marking Documentation

Heat exchangers placed in EU markets are covered by the Pressure Equipment Directive (PED) 2014/68/EU regulations. From 1st January 2021, any heat exchangers placed in the UK market must follow Pressure Equipment (Safety) Regulations 2016 which replaces the PED.

Any heat exchangers operating at above 0.5 bar(g) have to be assessed under the rules and currently will fall into Sound Engineering Practice or Categories I to IV depending on the hazard classification of what is inside the unit and its internal capacity.

BOWMAN® Stainless Steel Heat Exchangers fall within the Sound Engineering Practice and as such should not be CE or UKCA marked.

This manual consists of all essential safety requirements to be observed according to the stated regulations.

This page has been left blank for recording heat exchanger service and maintenance information.

Bowman heat transfer solutions

Bowman heat exchangers and oil coolers can be found in Active Fire Protection Systems, Automotive Testing, Combined Heat & Power, Hydraulic Systems, Marine Engineering, plus Mining Equipment and Machinery, in a range that includes:



Exhaust Gas
Heat Exchangers



Hydraulic Oil Coolers



Swimming Pool
Heat Exchangers



Stainless Steel
Heat Exchangers



Header Tank
Heat Exchangers



Plate Heat
Exchangers



Engine Oil Coolers



Transmission Oil Coolers



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