BOWMAN®

REG NO FM 38224
BS EN ISO 9001-2008

STAINLESS STEEL HEAT EXCHANGERS

Installation, Operation & Maintenance Guide

Foreword

Dear Customer,

BOWMAN® has been manufacturing high quality stainless steel heat exchangers for over 20 years.

Your **BOWMAN**® Stockist/dealer will be happy to provide you with advice and practical assistance.

Please read these instructions fully and carefully.

Keep the Installation, Operation & Maintenance Guide for future reference to ensure the long lasting performance from the stainless steel heat exchanger.

Installation, Operation & Maintenance Guide

Contents

Chester Street • Birmingham • B6 4AP • United Kingdom
Tel: +44 (0)121 359 5401 • Fax: +44 (0)121 359 7495
Email: info@ejbowman.co.uk • website: www.ejbowman.co.uk

1 Safety

1.1 Hazards when handling the 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 suitably qualified person must always be contacted.

1.2 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)	:	120°C

1.3 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.

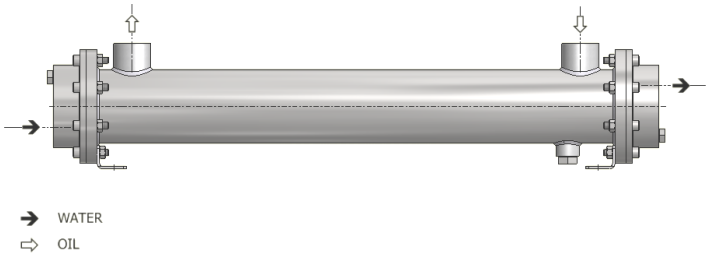
2 Installation

2.1 Transport / storage

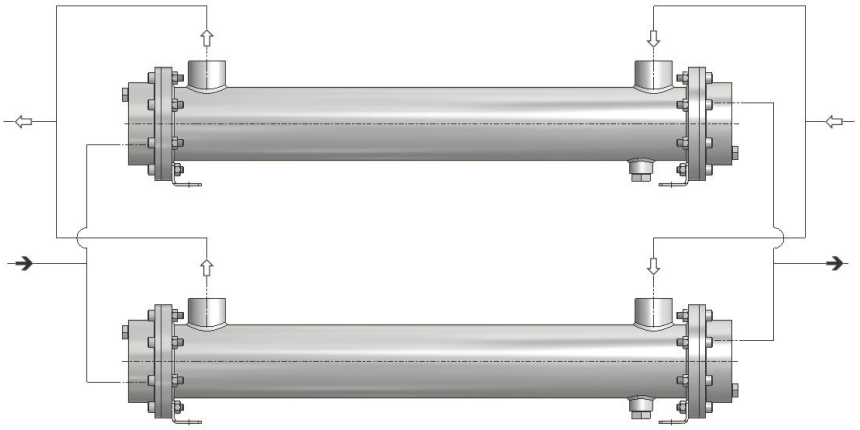
The heat exchanger must be fully drained down prior to transportation. Once drained and fully dry, the heat exchanger must only be stored indoors within a non aggressive atmosphere. The connections should be capped to avoid ingress of dirt and contaminants.

2.2 Fitting

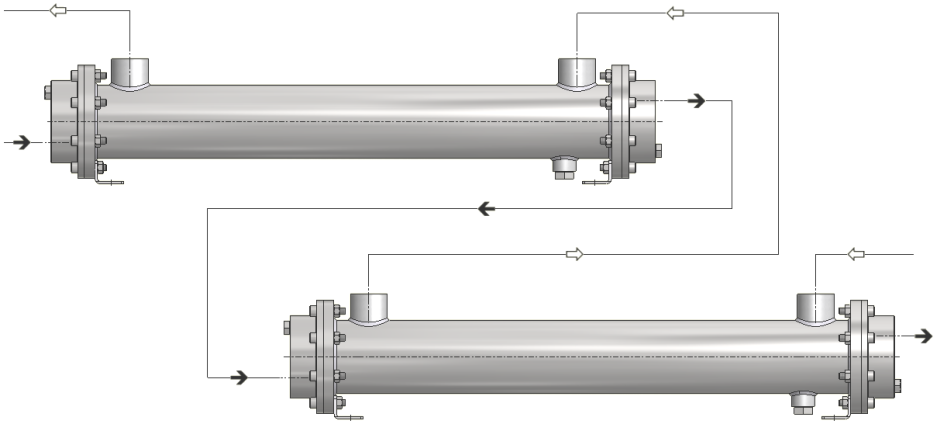
Before fitting, the heat exchanger should be checked for visible signs of damage. The heat exchanger should be positioned horizontally and should be connected in counterflow so that the fluids flow in opposite directions, as shown below:



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 oil cooler. Each unit comes complete with mounting brackets.

2.3 Connecting the heat exchanger

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 oil cooler.

Measures should be taken to isolate the oil cooler 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 oil coolers, the maximum permitted tube side water flow rates are as follows:

SB range	180 l/min.	SE range	755 l/min.
SC range	295 l/min.	SF range	1345 l/min.
SD range	540 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 exchangers 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 1m/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 such time that this document has been fully read and understood.

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

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

Cooling water should be introduced to the heat exchanger 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 maintained for leaks and externally visible damage.

BOWMAN® recommends that the tubestack should be cleaned and inspected annually and the o rings should be renewed at this time.

Removal of the nuts and bolts around the periphery of each end cover will allow the end covers and seals to be removed.

5.3 Cleaning

Any cleaning solutions used must be compatible with stainless steel. This should be confirmed with the chemical's supplier before use.

The chemical solution can be circulated through the heat exchanger or the unit can be submerged in a container filled with cleaning fluid.

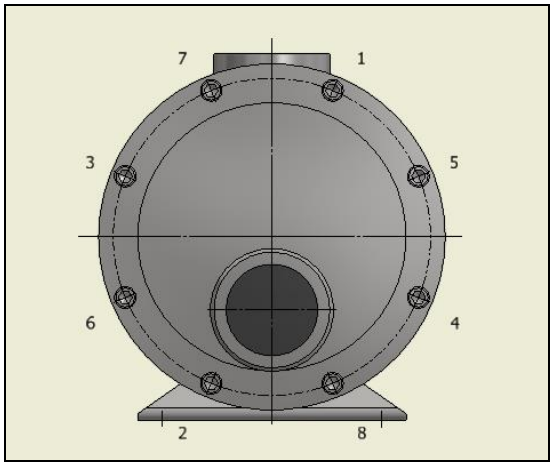
If necessary the fluid should be neutralized after cleaning and the unit should be flushed with fresh water and dried.

Small diameter rods and brushes for tube cleaning are available from companies such as Easy Products www.easyproductsltd.com

Replacement O rings should be fitted and the end cover bolts should be initially hand tightened, then tightened in the sequence and to the torque figures below:

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. Two common types of failure are:

a) Impingement attack (or corrosion/erosion)
This is caused by water containing air bubbles flowing at excessive velocity through the tubes. The impingement of rapidly moving water may lead to a breakdown of the protective passive film built up by the tube 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) Pitting
This problem is caused by very aggressive water in the tubes, especially in partially filled coolers where the water is stagnant. High levels of chlorides in the water will also lead to pitting corrosion. Low water flow rates can create a high temperature rise on the 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 or via download from the website:

www.ejbowman.co.uk

8 Spare Parts

A comprehensive stock of spare parts is always available.

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

9 CE Marking Documentation

Heat exchangers are covered by the Pressure Equipment Directive 97/23/EC which is mandatory for all EU member states. This manual is part of the compliance and points out all essential safety requirements to be observed.

BOWMAN® Stainless Steel Heat Exchangers fall within the Sound Engineering Practice category of the Pressure Equipment Directive 97/23/EC and as such cannot be CE marked.

Bowman products can also be found in the following industries: -

CHP Power Generation

Engine Test House Cooling

Marine Cooling

Swimming Pool Heating

Fishing Industry Cooling

The product range includes: -

Aquatic Heat Exchangers

Calorifiers

Exhaust Gas Heat Exchangers

Hydraulic Oil Coolers

Plate Type Heat Exchangers

Shell & Tube Oil Coolers

Swimming Pool Heat Exchangers