

BOWMAN[®]



REG NO FM 38224
BS EN ISO 9001-2008

HEADER TANK HEAT EXCHANGER



Installation, Operation & Maintenance Guide

Foreword

Dear Customer,

BOWMAN[®] has been manufacturing high quality header tank heat exchangers for over 30 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.

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Installation, Operation & Maintenance Guide

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1 Safety

1.1 Hazards when handling the heat exchanger

BOWMAN® Header tank 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® Header tank heat exchangers are only approved for cooling engine jacket water. 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:

Engine Jacket Water : 1.0 bar max. (Filler cap rating dependant)
Cooling Water (secondary side) : 15 bar max.

Applies to EH-PH three pass threaded connections only – for other versions please contact **BOWMAN**® for guidance.

The maximum permissible operating temperature must not exceed:

Engine Jacket Water : 110 Deg.C

Cooling Water (secondary side) : 110 Deg.C

Variants with higher temperature and pressure ratings are available. Please contact the Sales for further details.

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 oil cooler 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.

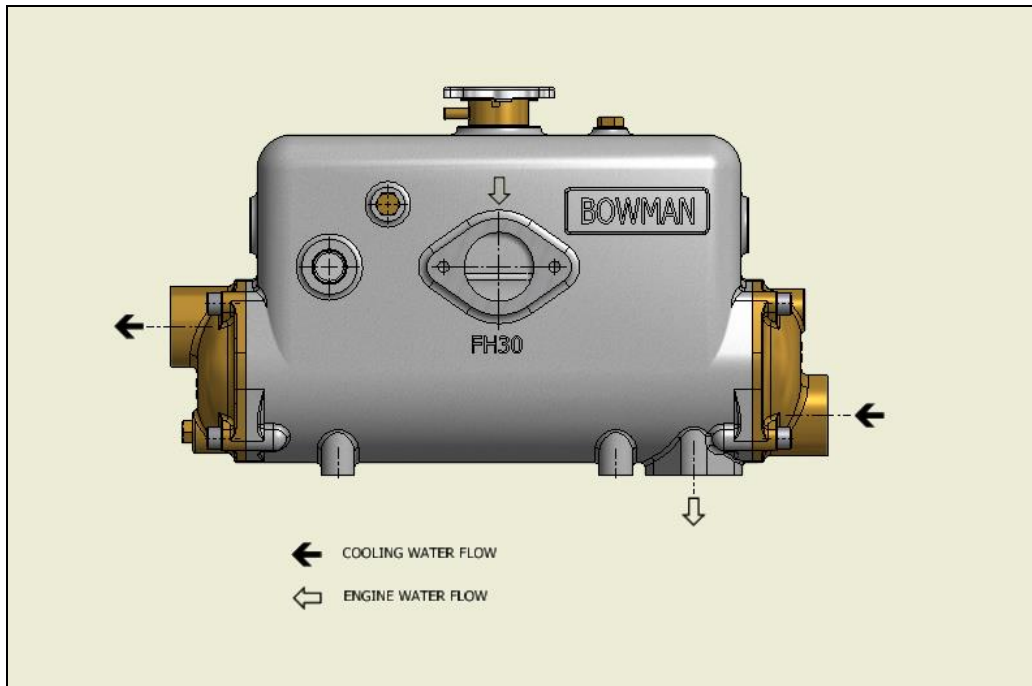
2 Installation

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 header tank should be mounted horizontally and above the cylinder head level and with the engine water circuit arranged so that it self-venting on initial filling. The unit should be connected as shown below:



A by-pass type thermostat should be used and arranged so that only the heat exchanger is by-passed when the engine is cold. All the other components including a water jacketed exhaust manifold if fitted, any oil coolers, charge air coolers and exhaust gas heat exchangers should be positioned in the circuit so that they always receive the full flow of the engine water pump.

Thermostats of the type used on some automotive engines, which simply interrupt the cooling water flow when the engine is cold, are not recommended. For unattended operation, automatic engine shut down equipment should be provided.

A filter with a maximum permeability of 2.5mm should be used prior to the inlet of the cooling water circuit. Nothing should be welded to any part of the header tank. Each unit has threaded holes on its underside to facilitate mounting.

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 header tank heat exchanger from excessive vibration.

Taper fittings are not recommended as these can split the shell and end cover castings 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. Stainless steel sea water pipes and fittings should not be used adjacent to the heat exchanger.

If the sea water supply is taken from the ships main, ensure that the recommended flow rate cannot be exceeded. This will normally mean that an orifice plate must be fitted in the pipe work at least 1m before the cooler with the orifice size calculated to ensure that the maximum sea water flow rate cannot be exceeded. If these precautions are not taken, it is possible that the sea water flow rate through the cooler may be several times the recommended maximum which will lead to rapid failure.

For our header tank heat exchangers, the maximum permitted cooling water flow rates are stated in the header tank brochure available to download from the Bowman website. The maximum cooling water flow rate varies and is dependent on the cooling water used (fresh water or sea water) and how many passes the water makes on the tube side (single pass, two pass or three pass).

2.4 Notes on zinc anodes

The use of zinc anodes in heat exchangers has been employed for some years, generally by manufacturers using admiralty brass tube or its variants. The purpose of the zinc anode, or zinc pencil as it is sometimes called, is to prevent dezincification of the brass alloy tubes. As such zinc anode acts sacrificially in favour of the tube.

There are a number of American and European manufacturers that use these anodes in their products. Bowman, do not fit zinc anodes as the tubes used in the construction of our heat exchangers are of copper nickel alloy and as such do not require a zinc anode. It is possible that if this anode is fitted it can actually destroy the copper oxide film built up by the tube as a natural defence which can allow the tube material to be attacked.

It is usual with the copper nickel alloys to use an iron anode which allows an iron oxide film to build up inside the tube which breaks down as a sacrificial element reducing the possibility of corrosion to the heat exchanger. In Bowman designs it is not practical to fit iron anodes as their size has to be very generous. Therefore as an alternative a piece of black iron pipework can be placed before the heat exchanger which in itself acts as sacrificial element protecting the cooler. The Royal Navy has often used this technique and when the black iron pipework corrodes, it is simply replace with a fresh piece.

We do know that some manufacturers of heat exchangers, mostly those providing copies of the better known products, often fit zinc anodes incorrectly with copper nickel alloys in error.

3 Operation

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 7.4 to 7.6. On no account should it fall below 7.2 or above 7.8.
- b) Maximum fluid velocity through the tube side of 2m/s for sea water (maximum sea water flow rates are detailed in the Header tank brochure) or 3m/s for fresh water must not be exceeded. If in doubt contact **BOWMAN®** for guidance.
- c) Minimum tube side water velocity of 1m/s should be used.
- d) Ensure compliance with water quality and maximum permissible pressure requirements.
- e) Air must be adequately vented from both circuits.
- f) 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.

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 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® recommend that the tubestack should be cleaned and inspected annually and the O ring seals should be renewed at this time.

Removal of the screws around the periphery of each end cover will allow the end covers and seals to be removed. The tubestack can then be withdrawn from either end of the body.

5.2 Cleaning

Any cleaning solutions used must be compatible with the heat exchanger materials. 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 disassembled and the tubestack submerged in a container filled with cleaning fluid.

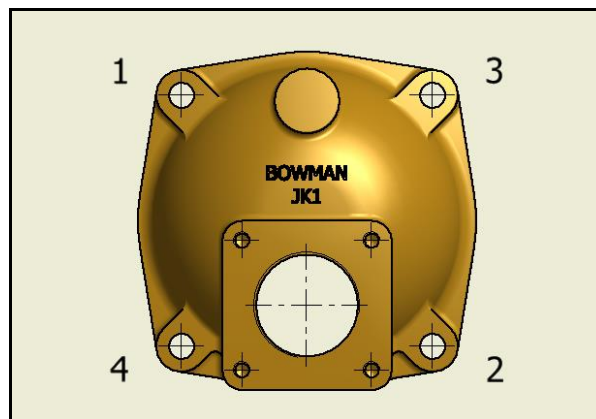
If necessary the fluid should be neutralized after cleaning and the unit should be flushed with fresh water and dried.

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 be 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)
EH	M6	8	KH	M12	54
FH	M8	22	JH	M16	95
GH	M10	37	PH	M16	130

5.3 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 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) 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	Tube scaling or build up 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 engine water rises	Film, scale or restrictions on the inside of the tubes	The complete heat exchanger should be thoroughly cleaned
Engine water 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**[®] Header tank 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[®] Header Tank 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

Stainless Steel Heat Exchangers

Swimming Pool Heat Exchangers