Installation, Operation & Maintenance Guide

HEADER TANK HEAT EXCHANGERS
For Engine Jacket Water Cooling

BOWMAN®

100 YEARS OF HEAT TRANSFER TECHNOLOGY

Contents

Introduction

Thank you for purchasing a high quality Bowman heat exchanger.

Bowman® has been manufacturing header tank heat exchangers for over 30 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 header tank 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 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 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® 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 ºC
Cooling Water (secondary side) : 110 ºC
Variants with higher temperature and pressure ratings are available. Please contact the sales team for further details.

1.4 Potential Hazards

Caution

Ensure the maximum permissible operating pressures are not exceeded.

Take Care

NB: Before the heat exchanger is disconnected it must be allowed to cool and be depressurized. The supply and return from the heat exchanger should be isolated to minimise fluid loss.

2. Installation

2.1 Transport / storage

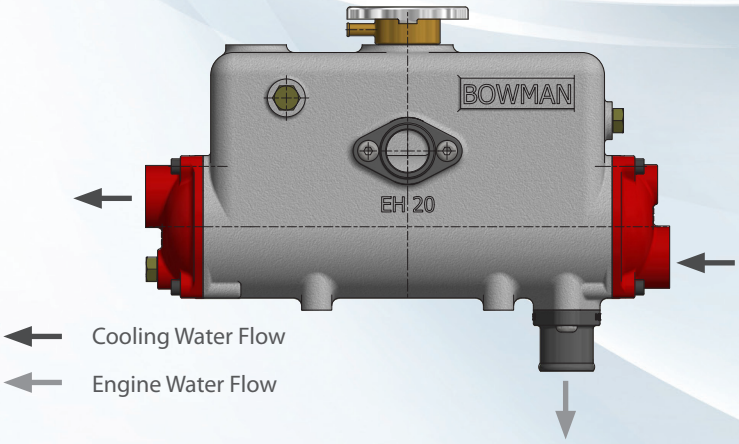
The heat exchanger must be fully drained down prior to transportation. Once drained and fully dry, the heat exchanger must only be stored indoors within a non aggressive atmosphere. The connections should be capped to avoid ingress of dirt and contaminants.

2.2 Fitting

Take Care

Before fitting, the heat exchanger should be checked for visible signs of damage.

The unit should be connected as shown below:



Bowman header tank heat exchangers must always be mounted horizontally and above the engine's cylinder head level.

The engine water circuit should be arranged so that it is self-venting on initial filling.

A by-pass type thermostat should be used and arranged so that only the heat exchanger is by-passed when the engine is cold.

Ensure all other cooling components are positioned in the circuit so that they always receive the full flow of coolant from the engines water pump. These units include water jacketed exhaust manifolds (if fitted), oil coolers, charge air coolers and exhaust gas heat exchangers.

Automotive type thermostats, which simply interrupt the cooling water flow when the engine is cold, are not recommended for use with Bowman header tank heat exchangers.

When operated unattended, it is recommended that an automatic engine shut down system is always installed.

Bowman recommend using an ethylene glycol solution on the engine circuit in the concentration advised by the engine manufacturer for the operating conditions.

Should you intend to use an alternative coolant, please contact our technical sales team.

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 in both circuits.

When fitting the header tank into the pipe work care must be taken to ensure that no debris has been introduced into the header tank.

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

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

Measures should be taken to isolate the header tank from excessive vibration.

Take Care

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 header tank materials. Stainless steel sea water pipes and fittings should not be used adjacent to the header tank.

If the sea water supply is taken from a 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. See point 2.7 for more information.

2.4 Engine Jacket Water Connection

Take Care

All Bowman header tank heat exchangers are supplied with either hose adaptors or blank counter flange plates on the engine water inlet and outlet side, for connecting the engine jacket water to the heat exchanger.

Hose adaptors

Hose adaptors are supplied as standard on the following header tank models:

EH 100 & 200 – these units are supplied with two composite hose adaptors for the water inlet and outlet and come complete with Nitrile 'O' ring seals and M8 socket screws.

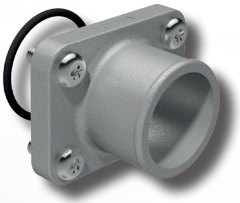
FH 100 & 200 – these units are supplied with one composite hose adaptor for the water inlet (the water outlet being cast into the body of the heat exchanger) together with a Nitrile 'O' ring seal and M10 socket screws.

FH 300 & 400 – these units are supplied with two composite hose adaptors for the water inlet and outlet and come complete with Nitrile 'O' ring seals and M10 socket screws.

GH 200, 300 & 400 – these units are supplied with two cast aluminium hose adaptors for the water inlet and outlet and come complete with Nitrile 'O' ring seals and M12 socket screws.

FH 200 with water inlet hose adaptor.

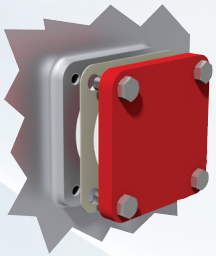
EH & FH composite hose adaptors



GH aluminium hose adaptors

Blank counter flange plates

Bowman KH, JH and PH Header Tank heat exchangers are provided with two blank counter flange plates for the water inlet and outlet, which must be modified by the customer to enable the appropriate connections to be made, to connect the engines jacket water circuit to the heat exchanger.



Blank counter flange plate

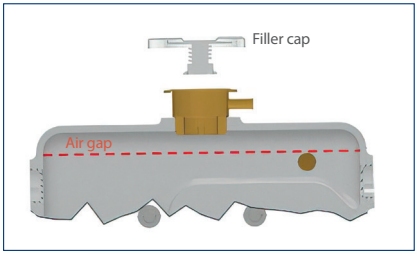
NOTE: for customers wishing to use blank counter flange plates instead of hose adaptors on their EH, FH or GH units, these are available to special order only and at additional cost. Please see the 'Replacement Parts' section of this brochure for ordering details.

2.5 Filling Guideline

You will need to unscrew and remove the filler cap connected to the filler neck. Then, using a handheld torch, check the coolant level within the tank. The coolant level should only be filled up to a level leaving an air gap of around 4 cm from the top of the header. This is to allow for the expansion of hot coolant during operation. For the EH unit, an air gap of 2cm is sufficient.

Once you have checked the coolant level and/or topped up the coolant in the tank, simply replace the filler cap and make sure that it is well sealed. If this is not done, coolant evaporation could increase and subsequently reduce the level of coolant in the heat exchanger.

It is necessary to check the header tank water level regularly around three to four times per year. It should also be part of the annual service.



Type	Typical Engine Suitability		Cooling/Raw Water Volume	Engine Water Volume (full)	Header Tank Capacity
	kW	HP	Litres	Litres	Litres
EH100	40	54	0.45	1.30	0.90
EH200	52	70	0.60	2.20	1.32
FH100	82	110	0.85	3.25	2.08
FH200	115	154	1.10	4.50	2.93
FH300	150	201	1.55	6.55	4.12
FH400	200	270	2.00	9.15	5.70
GH200	240	322	3.10	10.90	6.20
GH300	320	429	3.80	14.85	8.54
GH400	400	540	4.60	18.10	11.20
KH200	450	603	6.30	18.80	13.00
KH300	600	804	7.50	25.60	17.30
KH400	750	1005	9.00	33.50	22.60
JH200	620	831	8.80	27.20	18.60
JH300	820	1100	10.40	36.90	24.80
JH400	1000	1340	12.50	46.30	32.30
PH200	1200	1608	18.60	49.00	34.20
PH300	1500	2010	21.80	64.00	44.60
PH400	1800	2413	25.30	81.00	56.40

Maximum working raw water pressure 16 bar
Maximum working engine water pressure 1 bar (depending on the filler cap rating)
Maximum working temperature 110°C.

2.6 Marine installation, recommendations

No heat exchanger manufacturer can guarantee that their 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 coolant pressure should be higher than the sea water pressure, so that in the event of a leak occurring, the engine will not be contaminated.
2. When the cooling system is not being used, the heat exchanger should be isolated from sea water pressure.
3. The sea water outlet pipe from the heat exchanger should have a free run to waste.
4. Stainless steel sea water pipes and fittings should not be used adjacent to the heat exchanger.
5. Important note for marine applications: during commisioning, shutdown and standby periods, if the header tank heat exchanger has not been used over 4-6 day period, it should be drained, cleaned and kept dry. Where this procedure is not possible, drain the stagnant water and refill the heat exchanger with clean sea or fresh water, which should be replaced with oxygenated sea water every 2-3 days to avoid further decomposition.

2.7 Orifice Plates

If the sea water supply is taken from a ship's main, it is important to ensure that the recommended flow cannot be exceeded.

This will normally mean that an orifice plate must be fitted in the pipework at least 1m before the oil cooler, with the orifice size calculated to ensure that the maximum sea water flow rate cannot be exceeded.

The correct orifice diameter can be determined from the table below.

Three Pass Bowman Oil Coolers		Orifice diameter in mm for max. sea water flow									
Oil Cooler Series	Max. Sea water flow l/min	1 bar	2 bar	3 bar	4 bar	5 bar	6 bar	7 bar	8 bar	9 bar	10 bar
EH	50	11	9.5	8.5	8	7.5	7.2	6.8	6.7	6.5	6.3
FH100/200	80	14	12	11	10	9.5	9	8.7	8.4	8.2	8
FH 300/400	110	17	14	13	12	11	10	10	9.8	9.6	9.3
GH	200	23	19	17	16	15	14	14	13	13	13
KH	300	28	23	21	19	18	17	17	16	16	15
JH	400	32	27	24	22	21	20	20	19	18	18
PH	500	41	34	31	28	27	26	25	24	23	23

2.8 Composite end cover water pipe installation

For marine versions supplied with composite end covers, it is recommended that a bonded seal is used in conjunction with the fitting and tightened to the appropriate torque figure given below to ensure sufficient sealing.

Size	Torque (Nm)
EH range (3/4" BSP)	10
FH 100/200 range (1" BSP)	15
FH 300/400 range (1 ¼" BSP)	20
GH range (1 ½" BSP)	25

3. Operation

Take Care

3.1 Maximum water flow rates

The following tables give maximum flow rates through the tube stack for either single, two or three pass configuration, using either sea or fresh water.

Sea Water Application (Maximum 2 m/s)

Single Pass Marine		Two Pass Marine		Three Pass Marine	
Type	Max. Raw water flow l/min	Type	Max. Raw water flow l/min	Type	Max. Raw water flow l/min
EH100-4965-2	180	EH100-4165-2	60	EH100-3401-2	54
EH200-4965-3	180	EH200-4165-3	60	EH200-3401-3	54
FH100-4966-2	270	FH100-4166-2	100	FH100-3182-2	95
FH200-4966-3	270	FH200-4166-3	100	FH200-3182-3	95
FH300-4967-2	375	FH300-4167-2	140	FH300-3282-2	125
FH400-4967-3	375	FH400-4167-3	140	FH400-3282-3	125
GH200-4968-2*	640	GH200-4168-2*	240	GH200-3482-2*	225
GH300-4968-3*	640	GH300-4168-3*	240	GH300-3482-3*	225
GH400-4968-4*	640	GH400-4168-4*	240	GH400-3482-4*	225
KH200-4969-3*	975	KH200-4169-3*	400	KH200-3071-3*	325
KH300-4969-4*	975	KH300-4169-4*	400	KH300-3071-4*	325
KH400-4969-5*	975	KH400-4169-5*	400	KH400-3071-5*	325
JH200-4970-3*	1400	JH200-4170-3*	540	JH200-3335-3*	460
JH300-4970-4*	1400	JH300-4170-4*	540	JH300-3335-4*	460
JH400-4970-5*	1400	JH400-4170-5*	540	JH400-3335-5*	460
PH200-4971-4*	2125	PH200-4171-4*	820	PH200-3073-4*	700
PH300-4971-5*	2125	PH300-4171-5*	820	PH300-3073-5*	700
PH400-4971-6*	2125	PH400-4171-6*	820	PH400-3073-6*	700

*A Murphy Level Switch can be fitted to these units, at extra cost, to indicate low water level conditions.
NOTE: the Murphy Level Switch should be factory fitted and specified when ordering a header tank heat exchanger. Retro-fitting the switch is not recommended.

Unit shown is fitted with the optional Murphy Level Switch.

Fresh water Application (Maximum 3 m/s)

Single Pass Land		Three Pass Land	
Type	Max. Raw water flow l/min	Type	Max. Raw water flow l/min
EH100-4265-2	180	EH100-4065-2	60
EH200-4265-3	180	EH200-4065-3	60
FH100-4266-2	270	FH100-4066-2	100
FH200-4266-3	270	FH200-4066-3	100
FH300-4267-2	375	FH300-4067-2	140
FH400-4267-3	375	FH400-4067-3	140
GH200-4268-2*	640	GH200-4068-2*	240
GH300-4268-3*	640	GH300-4068-3*	240
GH400-4268-4*	640	GH400-4068-4*	240
KH200-4269-3*	975	KH200-4069-3*	400
KH300-4269-4*	975	KH300-4069-4*	400
KH400-4269-5*	975	KH400-4069-5*	400
JH200-4270-3*	1400	JH200-4070-3*	540
JH300-4270-4*	1400	JH300-4070-4*	540
JH400-4270-5*	1400	JH400-4070-5*	540
PH200-4271-4*	2125	PH200-4071-4*	820
PH300-4271-5*	2125	PH300-4071-5*	820
PH400-4271-6*	2125	PH400-4071-6*	820

3.2 Minimum Flow Rates

The following tables give minimum flow rates through the tube stack for either single, two or three pass configuration, using either sea or fresh water.

Type	3-Pass	2-Pass	1-Pass
	Min. Recommended Flow Rates (l/min)	Min. Recommended Flow Rates (l/min)	Min. Recommended Flow Rates (l/min)
EH Range	27	42	84
FH100/200 Range	47	70	140
FH300/400 Range	65	95	190
GH Range	115	170	340
KH Range	160	250	500
JH Range	240	350	700
PH Range	350	530	1060

3.3 General information

It is essential that the following instructions are followed to prevent premature failure of the heat exchanger due to erosion or corrosion.

a) Always maintain the water pH to 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 rise above 7.8, although it is acceptable that sea water pH could vary slightly above this.

b) The table above gives the maximum fluid velocities through the cooler and must not be exceeded. If in doubt contact our technical sales team for guidance.

c) Minimum 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 the water circuit.

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. During commissioning, shutdown and standby periods, if the heat exchanger has not been used over a 4-6 day period, it should be drained, cleaned and kept dry. Where this procedure is not possible, drain the stagnant water and refill the cooler with clean sea or fresh water, which should be replaced with oxygenated sea water every 2-3 days to avoid further decomposition.

4. Commissioning

Commissioning of the heat exchanger should not be undertaken until this document been fully read and understood. Both circuits of the heat exchanger must be closed prior to commissioning.

Danger

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 heat exchanger prior to the gradual introduction of hot coolant. Both circuits should be vented initially and again when operating temperatures and pressures are reached. The system should be checked for leaks.

Take Care

Copper-nickel alloys have a very good resistance to seawater corrosion due to the formation of a thin protective film on the surface of the metal. This film starts to develop over the first few days after the metal has been in contact with clean, oxygenated seawater, and requires a further 3 months to develop fully. This is the most important part of the process to ensure long term corrosion resistance behaviour of copper nickel. The protective surface film of cuprous oxide is indicated by either a brown, greenish brown or blackish brown thin film layer. The process of ensuring that copper alloy receives an effective oxide coating prior to service is known as "conditioning" which is a very important stage for the alloy. Ferrous sulphate can be used if commissioning in clean sea water is not possible. Schedule cleaning may help to reduce the risk possibly with non-metallic brushes. Please refer to Copper Alliance web page for more information: www.copper.org.

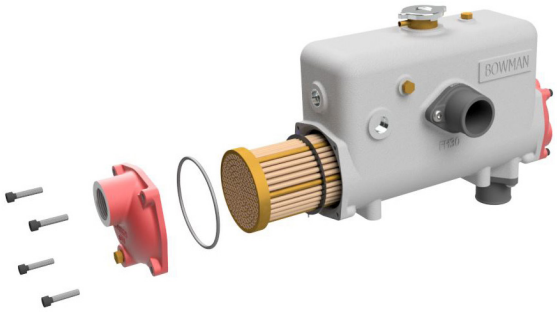
5. Maintenance / Repair

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 draining down the heat exchanger or removing it completely from the installation for the duration of the shutdown period.

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 seals to be removed. The tubestack can then be withdrawn from either end of the body.



5.3 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) **IMPORTANT:** Ensure all engine coolant and cooling water is drained from the heat exchanger **before** removing the end covers.

b) Removing the end covers allows access to the tube stack, which can be removed from the body.

c) Wash the tube plates and tubes using a hand held hose or lance. An industrial steam cleaner can also be used if available.

d) Tube brushes can be used to clean through each tube to aid removing stubborn deposits. Small diameter rods and brushes for tube cleaning are available from companies such as Rico Industrial Services www.ricoservices.co.uk

e) Detergents or chemicals suitable for use with the tube material* can be used if fouling is severe. Allow time for the detergent or chemical cleaner to work, before hosing down with plenty of water. **Please refer to the spare parts list for details of the tube materials.*

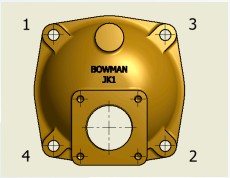
f) The tube stack should be flushed through with clean water to remove all traces of cleaning chemicals/detergents. If necessary, the cleaning fluid should be neutralised.

g) **When refitting the end covers after cleaning, new 'O' seals must be used**

5.4 End cover screw tightening sequence


Take Care

End covers must be refitted in their original orientation and tightened to the torque figures below.



Cooler Series	Screw Size	Torque (Nm)	Cooler Series	Screw Size	Torque (Nm)
EH	M6	8	KH	M12	54
FH100/200	M8	22	JH	M16	95
FH300/400	M8	22	PH	M16	130
GH	M10	37			

6. Potential Service Issues

6.1 Tube failures

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

a) Impingement attack (or erosion corrosion)

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 coolant rises	Film, scale or restrictions on the inside of the tubes	The complete heat exchanger should be thoroughly cleaned
Coolant 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 either directly from E J Bowman (Birmingham) Limited, Chester Street, Birmingham, B6 4AP, UK, or your local stockist who supplied the product.

8. Titanium Tube Stacks

Titanium is the ultimate 'fit and forget' solution for any application where super aggressive water conditions exist, including salt water, or contaminated / mineral rich fresh water. It resists chemical attack indefinitely and also eliminates the possibility of 'galvanic reaction' between dissimilar materials – often the cause of premature failure in certain operating conditions.

Bowman can now offer titanium tube stacks as an option for many of our header tank heat exchangers, providing a highly durable, long life solution for the most demanding applications.

All titanium tube stacks benefit from a full 10 year guarantee and, as a further advantage, they also offer the ability to operate at higher flow rates compared to standard cupro-nickel, without the risk of tube erosion.

GUARANTEED

10

YEARS

Full 10 year guarantee on all titanium material in contact with cooling water.

9. Spare Parts List

A comprehensive stock of spare parts is always available. Details are given in the Header Tank Heat Exchangers brochure which can be downloaded from:
www.ej-bowman.com/downloads
Please contact our sales department for price and availability or nearest stockist.

10. CE/UKCA Marking

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® Header Tank 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.

11. 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 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 a sacrificial element protecting the header tank. The Royal Navy has often used this technique and when the black iron pipework corrodes, it is simply replaced with a fresh piece.

We do know that some manufacturers of header tanks, mostly those that are copies of better known products, often fit zinc anodes with copper nickel alloys in error.

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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