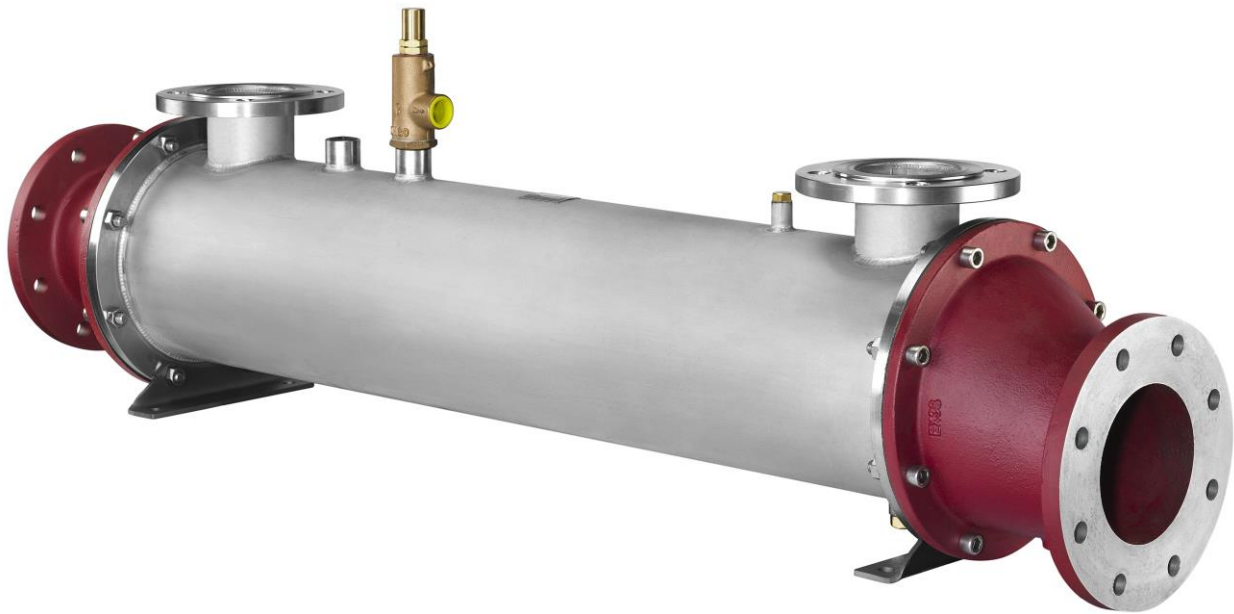


## EXHAUST GAS HEAT EXCHANGERS

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# Installation, Operation & Maintenance Guide

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# Foreword

**BOWMAN**<sup>®</sup> has been manufacturing high quality "Exhaust Gas Heat Exchangers" for over 30 years.

Your **BOWMAN**<sup>®</sup> 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 all future reference to ensure the long lasting performance from your "Exhaust Gas Heat Exchanger".

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# Installation, Operation & Maintenance Guide

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# 1 Safety

## 1.1 Hazards When Handling the Heat Exchanger

**BOWMAN**<sup>®</sup> "Exhaust Gas Heat Exchangers" are constructed with current practice and recognised safety rules. 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
- Be appropriately qualified.
- Comply completely with the installation instructions

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

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

## 1.2 Safety Instructions

The following symbols are used in these operating instructions:



This symbol indicates an **immediate danger** to health.  
*Failure to comply with this instruction may result in severe injury.*



This symbol indicates a **possible danger** to health.  
*Failure to comply with this instruction may result in severe injury.*



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**<sup>®</sup> "Exhaust Gas Heat Exchangers" are only approved for reclaiming heat from waste exhaust gases.

Any other use unless specified by **BOWMAN**<sup>®</sup> is not approved. **BOWMAN**<sup>®</sup> declines all liability for damage associated or arising from such use.

The maximum permissible operating pressures must not exceed:

Gas (tube side)	:	0.5 bar max.
Water (shell side)	:	4.0 bar max.

The maximum permissible operating temperature must not exceed:

Gas (tube side)	:	700°C
Water (shell side)	:	110°C

### European Pressure Equipment Directive

This range of products fall within within Article 3 Paragraph 3 (Sound Engineering Practice) and do not require CE marking.



## 1.4 Potential Hazards

The heat exchanger may be damaged or leak if the maximum permissible operating pressure is exceeded.



Connections on the exhaust gas side of the heat exchanger may reach temperatures as high as 700°C



Connections on the cooling water side of the heat exchanger may reach temperatures as high as 110°C

## 1.5 Safety Measures at Installation Site



The heat exchanger should not be used without sufficient cooling water flow through the shell side.

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.



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

## 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.

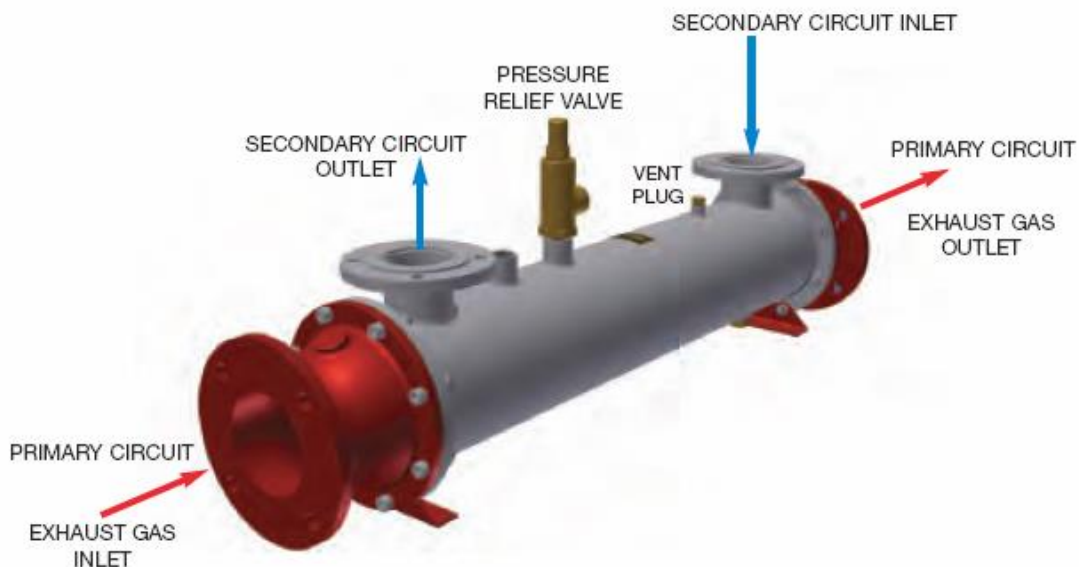
### 2.2 Installation



take care

Before fitting, check the heat exchanger for visible signs of damage.

- a) The heat exchanger must be installed horizontally and levelled accurately, with the primary circuit through the tubes and the secondary circuit over the tubes. The heat exchanger should only be connected in 'counter flow' with the secondary circuit connections always being positioned on top (See schematic diagram below). Alternative installations may also be acceptable; consultation with Bowman should be made prior to installation.
- b) It is very important that the secondary circuit is fully vented via the vent plug fitted in order to prevent any aeration taking place which can cause erosion of the tubes.
- c) If ethylene glycol or any other heat transfer fluid is used in the secondary circuit, adequate mixing should be performed prior to filling of the heat exchanger.
- d) If temperature control sensors are fitted to either the primary or secondary circuits of the heat exchanger, they should be fitted to the inlet circuit and not the outlet circuit in order to provide accurate temperature readings.
- e) The pressure relief valve must not be removed or tampered with.
- f) Water must always be running through the heat exchanger when the engine is running.
- g) No valves are to be incorporated in the circuit which could be accidentally turned off and prevent water flowing through the heat exchanger.
- h) The approach and exit exhaust pipe bore must not be smaller than the heat exchanger connections.
- i) Automatic engine shut down equipment must be fitted.



## 2.3 Connecting the Heat Exchanger



Ensure compliance with water quality and maximum permissible pressure requirements.

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.

See Exhaust Gas Heat Exchanger brochure (available on the Bowman website) for connection details of each model.

## 3 Operation



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

- a) Adequate provision should be made to ensure that in the event of the primary circuit being shutdown, the secondary circuit continues to operate for a period of time to enable the dispersal of residual heat to an acceptable level, preventing damage to the heat exchanger.
- b) Adequate provision should also be made to ensure that the secondary circuit pumps are in continual operation whenever the primary circuit is in operation.
- c) Provision should also be made to ensure that any valves or ancillary equipment associated with either the primary or secondary side of the heat exchanger cannot be accidentally turned off, thereby preventing flow through the heat exchanger.
- d) It is very important that the secondary circuit is fully vented via the vent plug fitted in order to prevent any aeration taking place which can cause erosion of the tubes.
- e) 

Maximum working gas side pressure	0.5 bar
Maximum working water side pressure	4.0 bar
Maximum working gas side temperature	700°C
Maximum working water side temperature	110°C

## 4 Commissioning



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



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.

# 5 Maintenance / Repair



## 5.1 General Maintenance

The heat exchanger should require little attention in service, however if cleaning the tube stack the following notes should be used as a guide. Note new gaskets are required if the end covers are removed.



## 5.2 Exhaust Gas Heat Exchanger Cleaning

- a) Removal of the end covers or access plates, depending on version, allows access to the tube plates.
- b) Wash the tube plates and tubes using a hand held 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 Easy Products, [www.easyproductsltd.com](http://www.easyproductsltd.com)
- 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 or access plates should be refitted after cleaning using new gaskets.

# 6 Warranty

All **BOWMAN**<sup>®</sup> Exhaust Gas Heat Exchangers are guaranteed against manufacturing faults associated with the product for a period of twelve months from the date of invoice.

For full warranty terms, please see the **BOWMAN**<sup>®</sup> Conditions of Sale. A copy of which is available on request or via download from the website.

[www.ejbowman.co.uk](http://www.ejbowman.co.uk)



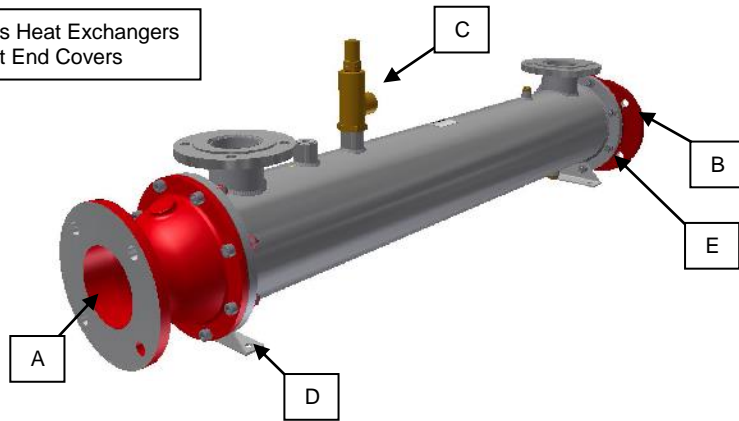
# 7 Performance

Typical examples of exhaust gas heat exchanger performance. The figures below are a general guide only and are not based on any particular natural gas engine. They assume an air/fuel ratio of 10.23 : 1 by volume, a fuel consumption of 0.34m<sup>3</sup>/kWh (measured at 1.013 bar and 15°C) and an exhaust gas temperature of 600°C and a water temperature of 80°C. Figures are based on new and clean conditions.

Type	Typical Engine Power kW	Exhaust Gas Flow kg/min	Exhaust Gas Outlet Temp °C	Heat Recovery kW	Exhaust Gas Pressure Drop kPa
2-25-3737-4	16	1.2	210	9.5	1.6
2-32-3737-5	16	1.2	170	11.5	1.8
3-32-3738-5	32	2.4	210	19	1.5
3-40-3738-6	32	2.4	170	21	1.7
3-60-3738-8	32	2.4	120	23	2.2
4-32-3739-5	60	4.5	210	35	1.3
4-40-3739-6	60	4.5	170	39	1.4
4-60-3739-8	60	4.5	120	43	1.8
5-32-3740-5	90	6.7	210	53	1.2
5-40-3739-6	60	4.5	170	39	1.4
5-60-3740-8	90	6.7	120	65	1.8
6-32-3741-5	140	10.5	210	82	1.3
6-40-3741-6	140	10.5	170	90	1.4
6-60-3741-8	140	10.5	120	101	1.9
8-32-3742-5	250	18.7	210	147	1.3
8-40-3742-6	250	18.7	170	161	1.4
8-60-3742-8	250	18.7	120	181	1.8
10-32-3744-5	400	30	210	236	1.3
10-40-3743-6	400	30	170	256	1.4
10-60-3743-8	400	30	120	288	1.8
12-32-3744-5	600	45	210	353	1.3
12-40-3744-6	600	45	170	388	1.5
12-60-3744-8	600	45	120	425	1.9
15-40-5745-6	950	70	170	604	1.4
15-60-5745-8	950	70	120	670	1.9

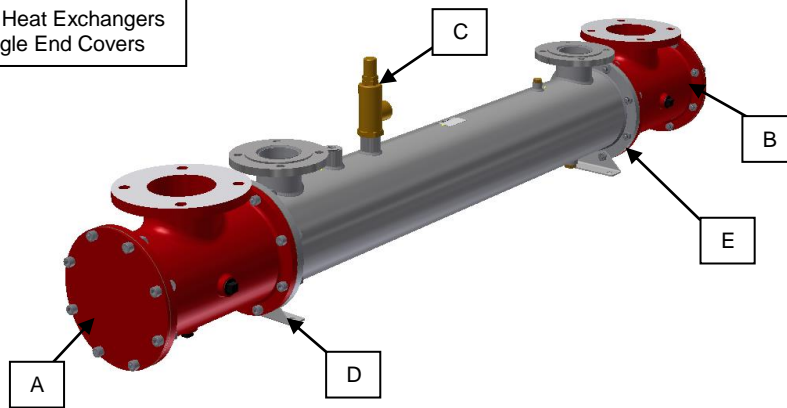
## 8 Spare Parts List

Exhaust Gas Heat Exchangers  
with Straight End Covers



Type	Inlet End Cover A	Outlet End Cover B	Pressure Relief Valve C	Mounting Foot D	End Cover Gasket E
2-3737	EX002-3757CI	EX032-4057CI	4028	4476	3787
3-3738	EX003-3758CI	EX033-4058CI	4028	4477	3788
4-3739	EX004-3759CI	EX034-4059CI	4028	4478	3789
5-3740	EX005-3760CI	EX035-4060CI	3795	4479	3790
6-3741	EX006-3761CI	EX036-4061CI	3795	4480	3791
8-3742	EX008-3762CI	EX038-4062CI	3795	4481	3792
10-3743	EX010-3763CI	EX040-4063CI	3795	4482	3793
12-3744	EX012-3902CI	EX042-4064CI	3795	4483	3862
15-5745	EX043-5757CI	EX044-5758CI	3795	4484	5759

Exhaust Gas Heat Exchangers  
with Right Angle End Covers



Type	Inlet End Cover A	Outlet End Cover B	Pressure Relief Valve C	Mounting Foot D	End Cover Gasket E
2-5837	EX062-5334CI	EX062-5334CI	4028	4476	3787
3-5838	EX063-5335CI	EX063-5335CI	4028	4477	3788
4-5839	EX064-5336CI	EX064-5336CI	4028	4478	3789
5-5840	EX065-5337CI	EX065-5337CI	3795	4479	3790
6-5841	EX066-4982CI	EX066-4982CI	3795	4480	3791
8-5842	EX067-4984CI	EX067-4984CI	3795	4481	3792
10-5843	EX068-4987CI	EX068-4987CI	3795	4482	3793
12-5844	EX069-5338CI	EX069-5338CI	3795	4483	3862
15-5845	EX070-5339CI	EX070-5339CI	3795	4484	5759

## **Exhaust Gas Heat Exchanger webpage: -**

<http://www.ejbowman.co.uk/products/ExhaustGasHeatExchangers.htm>

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

**Hydraulic Cooling**

**Engine Test House Cooling**

**Mining Industry**

**Marine Cooling**

**Swimming Pool & Spa Industry**

**Fishing Industry Cooling**

## **The product range includes: -**

**Marine Heat Exchangers**

**Header Tank Heat Exchangers**

**Swimming Pool Heat Exchangers**

**Charge Air Coolers**

**Stainless Steel Heat Exchangers**

**Inline Plate Type Heat Exchangers**

**Fuel Coolers**

**Shell & Tube Heat Exchangers**

**Titanium Heat Exchangers**

**Aftercoolers**

**Aquatic Heat Exchangers**

**Non-Storage Calorifiers**