

# Installation and Maintenance Manual

## Bimetallic Steam Trap Series

FMBM54



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**PLEASE NOTE** - Throughout this manual this cautionary symbol is used to describe a potential damage or injury that might occur if the safety considerations are overlooked. This symbol denotes **CAUTION, WARNING or DANGER**.



## **1. Preface :**

This manual is intended for anyone using, commissioning, servicing, or disposing the below. Mentioned products safely and efficiently.

Forbes Marshall Bimetallic Steam Trap (FMBM54)

Size: DN15 ( $\frac{1}{2}$ " ), DN20 ( $\frac{3}{4}$ " ) and DN25 (1")

### **PLEASE NOTE:**

Throughout this manual the following cautionary symbol is used to describe a potential damage or injury that might occur if the safety considerations are overlooked.

## **2. Important Safety Notes :**



Read this section carefully before installing/operating/maintaining the product. The precautions listed in this manual are provided for personnel and equipment safety. furthermore, Forbes Marshall accepts no responsibility for accidents or damage occurring as a result of failure to observe these precautions. Note that the product designed to perform for non-contaminated fluids only. A contamination in the form of chemical, foreign particle etc. can lead to problem with product performance and life of the product.

If these products in compliance with the operating instructions are, properly installed, Commissioned, maintained and installed by qualified personnel (refer Section 2.7) the safety Operations of these products can be guaranteed. General instructions for proper use of tools and safety of equipment's, pipeline and plant construction must also be complied with.

### **2.1 Intended use:**

Check if the product is suitable for intended use/ application by referring to the installation and maintenance instructions, name plates and technical information sheets.

- i) The product is suitable for use as defined in the technical information sheet. In case the need arises to use the product on any other fluid please contact Forbes Marshall the assistance.
- ii) Check for the suitability in conformance to the limiting conditions specified in technical Information sheet of the product.
- iii) The correct installation and direction of fluid flow has to be determined.
- iv) Forbes Marshall products are not intended to resist external stresses, hence necessary precautions to be taken to minimize the same.

## **2.2 Accessibility and Lighting:**

Safe accessibility and working conditions are to be ensured prior to working on the product

## **2.3 Hazardous environment and media:**

The product has to be protected from hazardous environment and check to ensure that no hazardous liquids or gases pass through the product.

## **2.4 Depressurizing of systems and normalizing of temperature:**

Ensure isolation and safety venting of any pressure to the atmospheric pressure. Even if the pressure gauge indicates zero, do not make an assumption that the system has been depressurized.

To avoid danger of burns allow temperature to normalize after isolation.

## **2.5 Tools and consumables:**

Ensure you have appropriate tools and / or consumables available before starting the work. Use of original Forbes Marshall replacement parts is recommended.

## **2.6 Protective clothing:**

Consider for the requirement of any protective clothing for you/ or others in the vicinity for protection against hazards of temperature (high or low), chemicals, radiation, dangers to eyes and face, noise and falling objects

## **2.7 Permits to work:**

All work to be carried out under supervision of a competent person. Training should be imparted to operating personnel on correct usage of product as per Installation and Maintenance instruction. "Permit to work" to be complied with (wherever applicable), in case of absence of this system a responsible person should have complete information and knowledge on what work is going on and where required, arrange to have an assistant with his primary goal and responsibility being safety. "Warning Notices" should be posted wherever necessary

## **2.8 Handling:**

There is a risk of injury if heavy products are handled manually. Analyze the risk and use appropriate handling method by taking into consideration the task, individual, the working environment and the load.

## **2.9 Freezing:**

Provision should be made to protect systems which are not self-draining, against frost damage (in environment where they may be exposed to temperatures below freezing point) to be made.

## **2.10 Product Disposal:**

It is necessary to dispose this product only in accordance with local regulations at the authorized, qualified collecting point specified for equipment's and its parts—Please refer the part details mentioned in the material table of this manual. Please follow all waste disposal guidelines (Management & Handling) as published by local governing authorities in India & abroad

## 2.10 Returning Products :

Customers and Stockist are reminded that, when returning products to Forbes Marshall they must provide information on any hazards and the precautions to be taken due to contamination residues or mechanical damage which may present a health, safety or environmental risk.

This information must be provided in writing including Health and Safety data sheets relating to any substances identified as hazardous or potentially hazardous.

## 3. Brief Product Description :

### 3.1 Description:

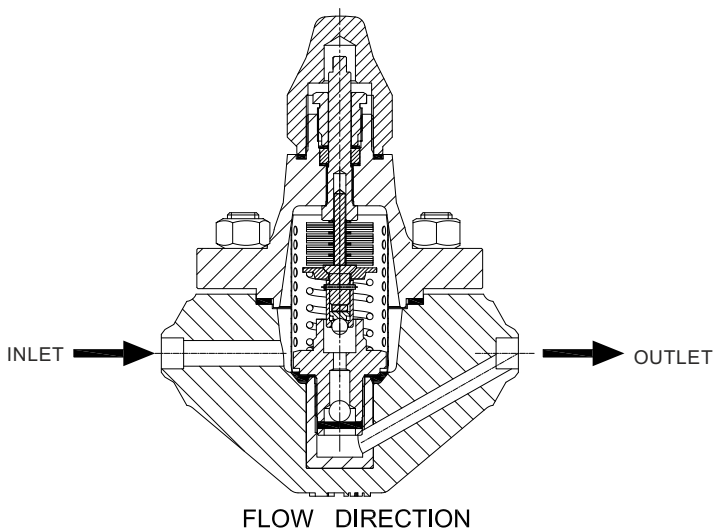
The Forbes Marshall FMBM54 bimetallic steam traps are made of forged Carbon steel, and designed for draining high pressure, high temperature steam lines and processes and can be repaired online. Normally open in the event of failure, they have a built-in strainer screen and an external device for adjusting the condensate discharge temperature.

### 3.2 Size and End Connections :

Size : DN15 ( $\frac{1}{2}$ " ), DN20 ( $\frac{3}{4}$ " ) and DN25 (1")

End Connection : Socket weld to ASME (ANSI) B 16.11  
Butt weld to ASME (ANSI) B 16.25.

\*Note : 1. For FMBM54 - Butt weld end are as per SCH. 80 pipe.



### 3.3 Limiting Conditions:

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Body Design Conditions :

FMBM54: Class 900 to ASME (ANSI) B 16.34

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PMA Maximum Allowable Pressure:

FMBM54 = 153 bar g @ 38°C

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TMA Maximum Allowable Temperature:

FMBM54 = 425°C @ 86 bar g

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Maximum Operating Conditions:

FMBM54 = 45 bar g @ 425°C

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Minimum inlet pressure for satisfactory operation is:

FMBM54= 15 bar g

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Minimum operating temperature: 0°C

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Maximum cold hydraulic test pressure:

FMBM54= For IBR= 90 bar g

For ASME= 229 bar g

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ΔPMX The back pressure for correct operation must not exceed 90% of the upstream pressure

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#### 4. Product Working Principle :

The Forbes Marshall FMBM54 bimetallic steam traps operate on the basis of two opposing forces acting on the valve, an opening force created by the valve opening spring, and a closing force resulting from the condensate temperature acting on the bimetallic elements. They operate with no loss of steam and automatically and quickly drains air, non-condensable gases and large quantities of cold water on start-up.

#### 5. Installation Guidelines :



Note: Before implementing any installations observe the 'Important Safety Notes' in section 2. Referring to the Installation and Maintenance instructions, name-plate and Technical Information Sheet, check that the product is suitable for the intended Installation.

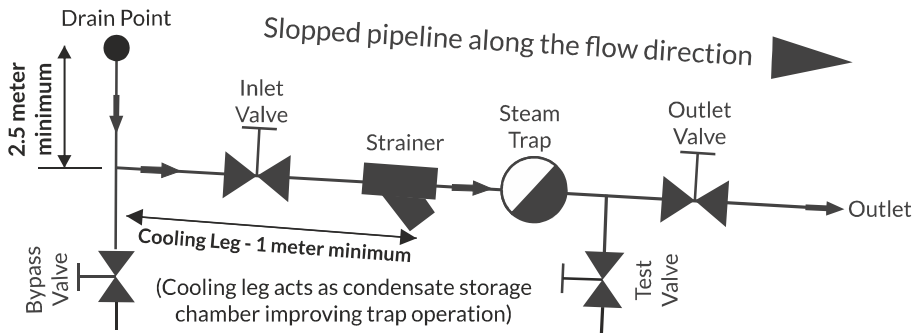


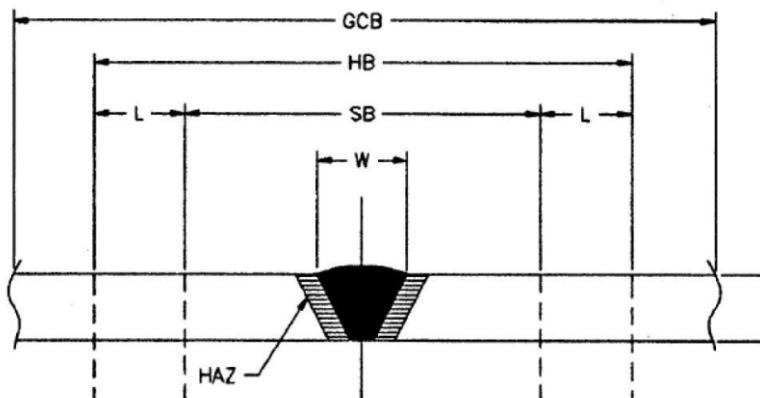
Fig.1 Recommended Installation - Note Pipework to fall in the direction of Flow

Referring to the Installation and Maintenance Instructions, name-plate and Technical Information Sheet, check that the product is suitable for the intended installation:

- A) Check materials, pressure and temperature and their maximum values. If the maximum operating limit of the product is lower than that of the system in which it is being fitted, ensure that a safety device is included in the system to prevent depressurization.
- B) Determine the correct installation situation, the correct direction of fluid flow & ensure that Pipework should have the slope (should be 1:100 minimum) Falling in direction of flow.
- C) Remove protective covers from all connections and protective film from all name-plates, where appropriate, before installation on steam or other high temperature applications.
- D) Install the steam trapping station downstream of the equipment to be drained, ensuring that it is easily accessible for inspection and maintenance.
- E) The preferred position for trap installation is horizontal to achieve optimum performance.
- F) Before installing the trap, ensure all connecting pipework is clean and free of debris.
- G) Mount the steam trap with the arrow on the body pointing in the direction of the flow.
- H) Install the trap 3.5 mtr minimum away from the equipment drain point. This cooling leg acts as a condensate storage chamber improving the trap operation.
- I) The trap and the cooling leg of minimum 1.0 mtr should not be insulated, otherwise the trap performance will be affected.
- J) If there is any possibility of the line freezing, the axis of the bonnets should be installed horizontally. For socket welded traps, observe qualified welding procedures.
- K) Do not use thermal blanket to wrap the entire steam trap during PWHT. Welded unit should not furnace PWHT'd. (Heat generated by these methods destroy bimetal) Only localized Post Weld Heat Treatment of the weld is allowed.



## Welding & Post weld Heat Treatment Instructions : (Reference ASME SEC-IX)



W - Widest width of weld

**HAZ** - Heat Affected zone

SB - Soak band

HB - Heated band

GCB - Gradient control band (Insulation Band)

Pipe Schedule	Pipe Material & Size	Soak Band (mm)	Heated Band (mm)	Gradient Control Band (Insulation Band)	Soaking Temp (°C)	Heating Rate	Cooling Rate	Soak rate
XXS	15-P91	W + T	$SB + 4\sqrt{rT}$	$HB + 4\sqrt{rT}$	730-775	100 °C/Hr		1 Hr / Inch t
	20-P91				730-775			
	25-P91				730-775			
XXS	15-P22				675 (min)			
	20-P22				675 (min)			
	25-P22				675 (min)			
160	15-P91				730-775			
	20-P91				730-775			
	25-P91				730-775			
160	15-P22				675 (min)			
	20-P22				675 (min)			
	25-P22				675 (min)			
80	15-P22				675 (min)			
	20-P22				675 (min)			
	25-P22				675 (min)			

M) The steam trap is factory set at 20°C below steam saturation temperature.

Note : 1) If the trap is to discharge to atmosphere ensure it is to a safe place, the discharging fluid may be at a temperature of 100°C.

2) For more details of welding & post weld heat treatment refer ASME SEC-IX

## **6. Start-up and Commissioning:**

### **6.1 Flushing of lines:**

As part of pre-installation all fluid handling equipment particularly piping should be thoroughly cleaned of scale and the internal debris which accumulates during construction. This is accomplished by blowing or flushing with air, steam, water and other suitable medium.

Follow these steps to carry out the flushing.

1. Close the isolation valve and open the bypass isolation valve.
2. Drain the condensate until clear condensate starts coming out, whichever is earlier.
3. Now slowly close the bypass isolation valve and open the trap isolation valve.

Note: For a detailed procedure on flushing of lines please visit Forbes Marshall website.

### **6.2 Commissioning Procedure for Forbes Marshall Bimetallic Steam Traps :**

1. At start up Open inlet isolation valve (approx 25%) slowly & in gradual way to avoid system shocks for building pressure inside the trap. Wait for some time.
2. Once the trap get pressurized, open the inlet isolation valve completely in gradual way.
- 3 . Allow the trap to operate for several minutes & review the operation to ensure it is correct .

Strictly follow above procedure for system safety & correct functioning of trap

Note: During commissioning, the valve may need resetting to take account of any operating conditions.

\* **Important Note** : After the trap has been in service at normal operating pressure & temperature for 24 hours, it is essential that the cover nuts are re - tighten ( see Table 1 for recommended tightening torques). This will ensure correct compression of gaskets under service condition.

## 7. Maintenance





**Safety Note :** Before undertaking any maintenance of the product it must be isolated from both supply line and return line and ensure pressure is normalized to all atmosphere. The product should then be allowed to cool. When re-assembling ensure that joint faces are clean.

These traps are installed in high pressure steam lines. Personnel doing the adjustment work should wear heavy gloves, long sleeve shirt, and other safety equipment designed to protect the wearer (goggles, face shield, etc.) in the event of a leak.

The equipment needed to proceed with any maintenance programme is listed in Table 1. FMBM54, have an external adjustment screw, which permits the ushing of the trap seat and the setting of the discharge temperature of the condensate in the inlet line allowing optimum performance to be achieved.

**Table 1 Recommended tightening torques**

Item part			 or mm 	N m
8	Valve Seat		36 A/F	120-132
12	Gland nut		21 A/F	25
5	Cover nut	FMBM54	24 A/F	120
			22 A/F	70-77
3	Blind nut	FMBM54	29A/F	80-88

Note : It is recommended that new gaskets and spares are used whenever maintenance is undertaken.

## 7.1 Procedure to Flush the Trap :

This procedure should be performed once every six months.

**To clean the steam trap during operation, it is advisable to close the steam inlet valve before turning the adjustment screw, and proceed as follows (in a closed return system, close the discharge line and open the test valve):**

- Remove the blind nut (3) and loosen the Adjustment screw(13) by turning clockwise.  
Note: Adjustment screw have left hand threads.
- Loose the adjustment screw a few turns, clockwise. This completely disengages the valve from the valve seat (8).
- Open the steam inlet valve slightly. This causes a strong purging action, which removes any impurities that may have been deposited in the steam trap.
- Turn the adjustment screw anticlockwise until the valve comes into contact with the valve seat (8).  
Turn through a further ¼ turn anticlockwise. (Refer Laser marking on Gland nut & Adjustment screw)
- Replace blind nut gasket (14) and tighten to the recommended torque as specified in Table 1.
- Shut the test valve and open the outlet isolation valve and check for leaks.
- Allow the trap to operate for several minutes and review the operation to ensure it is correct.

## 7.2 Condensate discharge temperature setting

- This procedure is the same as that given in Section 7.1, the discharge temperature may be adjusted as follows :
- To reduce by 10°C (50°F) (more subcooling), turn the screw anticlockwise ¼ turn.
- To increase by 10°C (50°F) (less subcooling), turn the screw clockwise ¼ turn.
- **Allow trap operation and condensate temperature to stabilize between adjustments. Continue adjusting until satisfactory operation is obtained.**

## 7.3 Trap Checking

In a closed return system, a test tee (see Figure 1) and valve must be used to observe trap operation. The trap should modulate the condensate discharge depending on inlet temperature and pressure.

## 7.4 Procedure for Disassembly and Service : (Refer Figure 2)

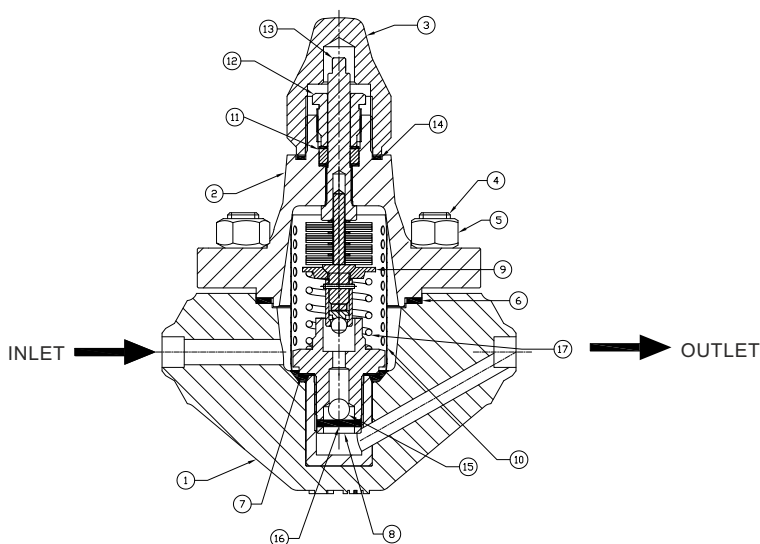


Fig. 2

1. Shut the trap inlet and outlet valves, vent the pressure and allow the trap to cool sufficiently to prevent possible injury from hot surfaces.
2. Remove the blind nut (3).
3. Remove the cover nuts (5) and the cover (2).
4. Remove the strainer screen (10) and clean or replace.
5. Note: The valve and bimetallic element assembly (9) is assembled loosely. Carefully lift these as one piece from the body (1). Take the necessary precautions to ensure that the bimetal element arrangement should not be disturbed. Inspect the valve head for wear.
6. Remove the spring (17).
7. Remove the valve seat (8) with a 36 mm A / F pipe wrench. Inspect the valve seating surface and the check valve seat for wear.
8. Remove the NRV ball (15) and Dowell pin (16) and inspect for wear.
9. Clean all gasket surfaces and remove dirt /scale from the trap internals with a wire brush or equivalent. Be careful not to damage the sealing surfaces.
10. Blow out the trap inlet piping and clean the upstream strainer if applicable.
11. The spare kit consists of the bimetallic assembly kit (9), valve seat gasket (7) cover gasket (6), blind nut gasket (14), strainer screen (10), valve seat (8), NRV ball (15) and Dowell pin (16).

## 7.5 Reassembly : Refer to Figure 2

1. Use a high temperature thread lubricant/Anti-seize on the valve seat (8), adjustment screw threads and gasket seating surfaces.
  2. Place the NRV ball & Dowell pin (15 & 16) into seat (8) & position them properly in body (1) Put the valve seat gasket (7) in place and thread the valve seat (8) into the body (1). Tighten to the recommended torque as specified, in Table 1.
  3. Install the Spring (17).
  4. Install the bimetallic element assembly (9).
  5. Slip the strainer screen (10) over the bimetallic element assembly with the rounded end uppermost.
  6. Install the cover gasket (6).
  7. Before cover installation ensure Adjustment screw in cover should be at its top most position.
  8. Install the cover (2). Note: Ensure that the Stem of the bimetallic assembly kit(9) fits into the adjustment screw guide hole when coverput into its position.
  9. Install the cover nuts (5) using the high temperature thread lubricant and tighten to the recommended torque (see Table 1).
  10. To adjust for cold conditions (to be done on a trap without inlet or outlet pressure):
    - Turn the adjustment screw anticlockwise to bring the valve in contact with the valve seat (Close position) Do not tighten.
    - Again using the adjustment screw, open the valve (off the valve seat) by the number of clockwise turns specified in Table 2 for the appropriate type trap. This method approximates factory settings.
  11. The steam trap is factory set at 20°C below steam saturation temperature
  12. Tighten the locking gland nut (12) if leak observed through cover glands.
- Install the blind nut and gasket ( 3 and 14 ) and torque as specified in Table 1

## 8. TROUBLE SHOOTING

If the expected performance is unachievable after installation of the Bimetallic steam trap check the following points for appropriate corrective measures.

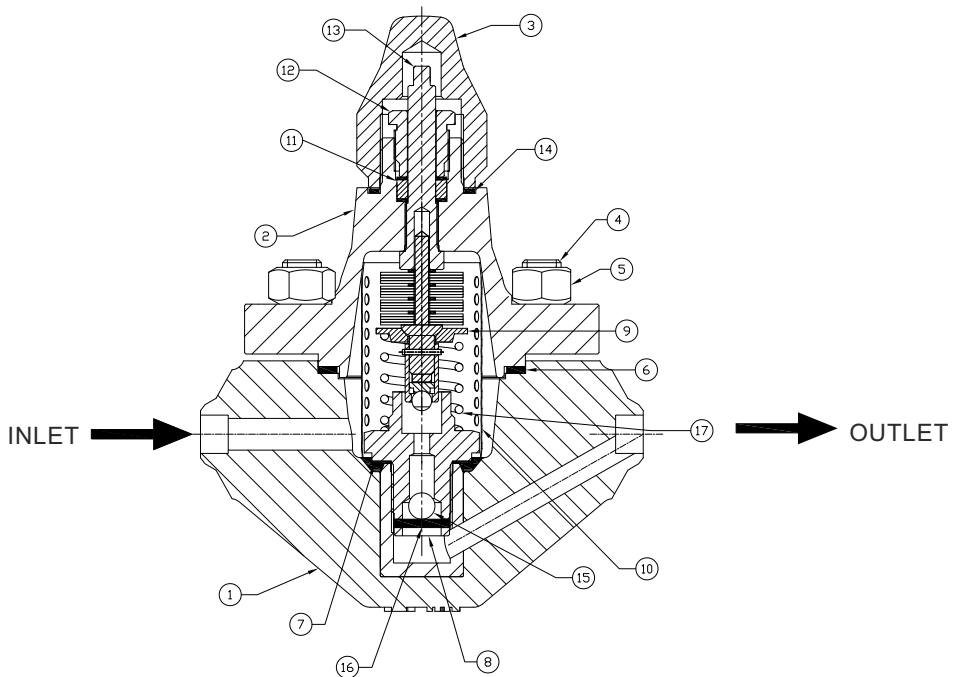
Failure Mode	Possible Cause	Remedy
No condensate discharge (Blocked)	Either Inlet or outlet valve is close.	Make sure inlet and outlet valves are open.
	External Strainer Screen is clogged with rust or scale.	Flush external strainer screen or dismantle and clean the screen
	Trap Strainer Screen is clogged with rust or scale.	Clean Strainer Screen if screen rusted replace with new one
	Valve seat clogged with dirt.	Follow 'Procedure to Flush the Trap' (See Section 7.1).
	Bimetallic element improperly adjusted.	Adjust as described under 'Condensate discharge temperature setting'(See Section 7.2).
	Internals	Dismantle and inspect internals. See 'Disassembly and service' (See Section 6.4).
	Improper Installation	Check installation fluid flow direction same as arrow on the Nameplate or Trap Body.
Steam leakage or blowing from the outlet	Dirt on valve seat surface.	Follow 'Procedure to Flush the Trap' See Section 7.1).
	Bimetallic element improperly adjusted.	Adjust as described under ' Condensate discharge temperature setting' (See Section 7.2).
	Worn valve seat	Dismantle, inspect and replace if necessary. Note: The seat and bimetallic element set must be replaced as a matched pair.
	Backpressure too high	Downstream system must be corrected.
Steam leaks from body & cover joint	Improper Tightening torque on cover nut & blind nut.	Tighten to the proper torque as mention in table 1.
	Cover gasket or blind nut gasket deterioration ordamage	Replace with new gasket.

## 9. AVAILABLE SPARES

The spare parts available are detailed in the table below. No other parts are supplied as spares.

### Available Spares

Bimetallic assembly kit	6, 7, 8, 9, 10, 15, 16
Strainer screen	10
Gasket set	6, 7, 14





### How to order:

Always order spares by using the description given in the column above headed "Available Spares", and stating the size and type of bimetallic steam trap.

### For Spare codes refer below table:

Spare Part Code	Description
SPARE-152025FMBM-GKIT	
SPARE-152025FMBM-SGKIT	
SPARE-152025FMBM58/78-INTKIT	
SPARE-152025FMBM510/710-INTKIT	
SPARE-152025FMBM715-INTKIT	
SPARE-152025FMBM721-INTKIT	

## **10. WARRANTY PERIOD**

As per ordering information and agreements in the contract.

**Notes :**



[www.forbesmarshall.com](http://www.forbesmarshall.com)

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