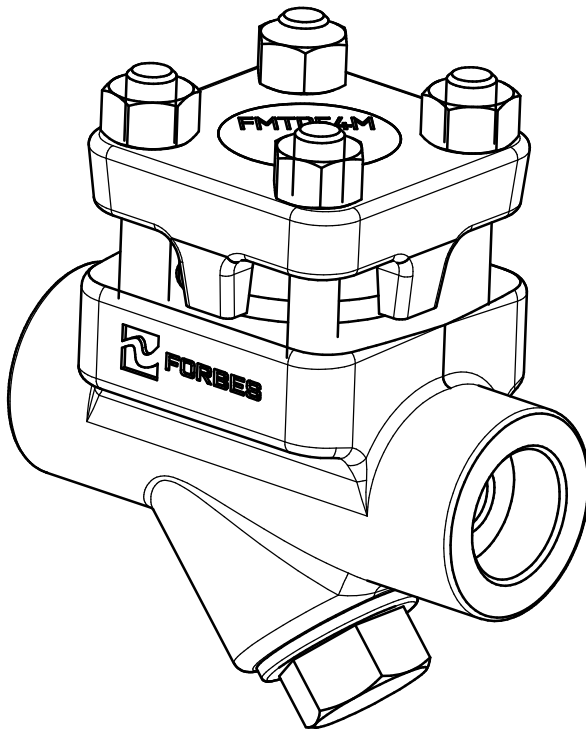


# Installation and Maintenance Manual

## Forbes Marshall Thermodynamic Trap

FMTD54M



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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 Thermodynamic Trap [FMTD54M]**

**Size:** DN 15 (½") , DN 20 (¾") 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 is 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 equipments, 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 for 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

### **2.11 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 Information:

#### 3.1 Description:

The Forbes Marshall Thermodynamic Trap FMTD54M, with inbuilt strainer and Forged carbon steel construction, is best suited for header and mainline drains. Replacable trap internals and built in strainer eases inline maintenance

#### 3.2 Sizes and End Connections:

DN15, DN20 and DN25

Screwed BSPT/NPT/BSP and socket/butt weldable ends

#### Notes:

1. Available with end connections Class 150,300 and 600 (weld on flanges) on request.
2. Available with IBR certificate on request.

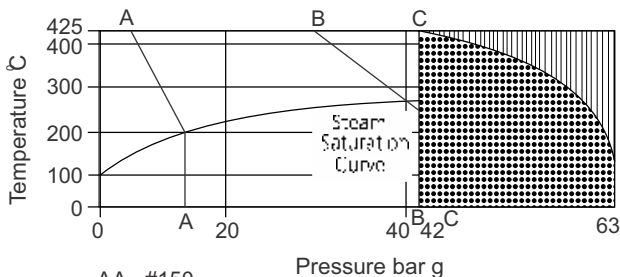
#### 3.3 Limiting Conditions:



|   |                  |
|---|------------------|
| Body design conditions  | PN63             |
| PMA Maximum allowable pressure                                      | 63 bar g @100°C  |
| TMA Maximum allowable temperature                                   | 425°C @ 42 bar g |
| Minimum allowable temperature                                       | 0°C              |
| PMO Maximum operating pressure                                      | 42 bar g         |
| TMO Maximum operating temperature                                   | 425°C @ 42 bar g |
| Minimum operating temperature                                       | 0°C              |
| Minimum operating differential pressure for satisfactory operations | 0.25 bar g       |
| Designed for a maximum cold hydraulic test pressure                 | 95 bar g         |

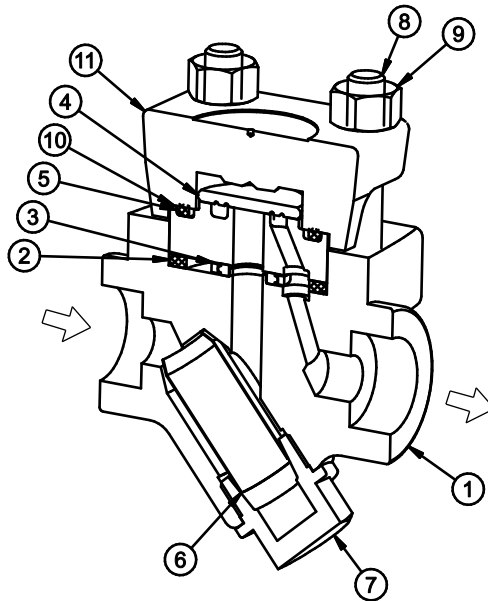
**Note:** for lower operating temperatures consult Forbes Marshall.

**PMOB :** Maximum back pressure should not exceed 80% of the inlet pressure under any conditions of operation otherwise the trap may not shut-off

#### 3.4 Operating Range:



-  The Product must not be used in this region.
-  The product should not be used in this region or beyond its operating range as damage may occur to the internal.



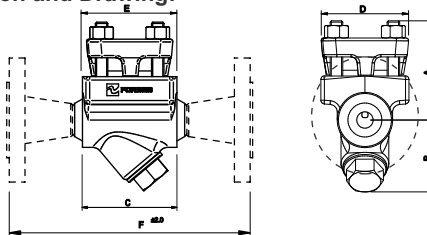
**Figure 1: Forbes Marshall Thermodynamic Trap**

#### Material

| No   | Part              | Material           |
|------|-------------------|--------------------|
| 1.   | Body              | ASTM A105N         |
| 2.   | Outer Seat Gasket | SS304+Graphite     |
| 3.   | Inner seat gasket | SS304+Graphite     |
| 4.   | Disc              | Tool Steel AISI D2 |
| 5.   | Top Cover Gasket  | SS304+Graphite     |
| 6*.  | Screen            | SS304              |
| 7.   | Strainer Cap      | ASTM A105 N        |
| 8.   | Stud              | ASTM A193 B7       |
| 9.   | Nut               | ASTM A194 2H       |
| 10.  | Seat              | Tool Steel D2      |
| 11.  | Top Cover         | ASTM A105N         |
| 12*. | Nameplate         | SS304              |
| 13*. | Rivet             | SS304              |
| 14   | Isotub            | SS304              |

\* Marked not shown in fig.1.

### 3.5 Product Dimension and Drawing:



**Figure 2: Dimensional Drawing of FMTD54M**  
Dimensions (approx.) in mm:

| Size  | A  | B  | C   | D  | E  | F    |      |      | Weight in kg |      |      |      |
|-------|----|----|-----|----|----|------|------|------|--------------|------|------|------|
|       |    |    |     |    |    | #150 | #300 | #600 | *            | #150 | #300 | #600 |
| DN 15 | 79 | 57 | 116 | 68 | 70 | 217  | 227  | 239  | 2.9          | 3.9  | 4.5  | 4.7  |
| DN 20 | 79 | 57 | 116 | 68 | 70 | 227  | 237  | 249  | 2.9          | 4.3  | 5.5  | 5.9  |
| DN 25 | 81 | 60 | 116 | 68 | 70 | 233  | 245  | 259  | 3.0          | 5.0  | 6.0  | 6.6  |

**Note:** \* Weight mentioned is of bare FMTD54M Trap.

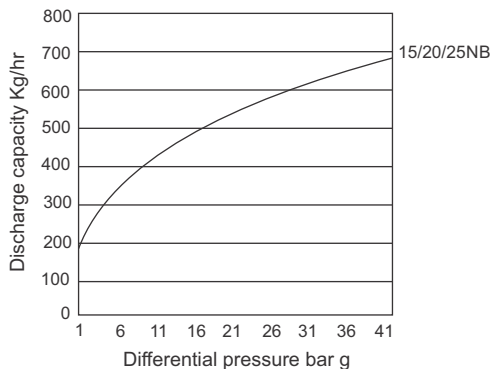
### 3.6 Optional extras:

ISOTUB- An insulating cover which prevents the trap from being unduly influenced by excessive heat loss such as when subjected to low outside temperature, wind, rain etc.

### 3.7 Salient Features

1. Forged Carbon steel construction ensures better mechanical properties.
2. The disc and seat, hardened by induction hardening process to about 56 RC can withstand continuous water hammering conditions.
3. Condensate entry below the disc concentric to disc/seat ensures clean and parallel lift to disc with reference to seat, eliminating any localized wear and tear.
4. An inbuilt strainer screen of adequately large area ensures long and trouble free operation.

### 3.8 Capacity Chart:

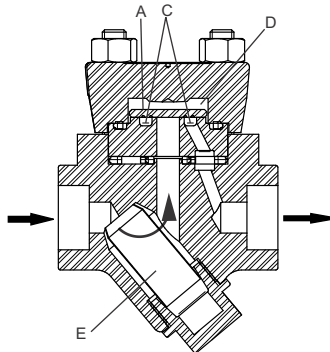


#### 4. Product Working Principle:

The Forbes Marshall thermodynamic trap works on thermodynamic principle using the dynamic effect of flash steam as hot condensate passes through the trap.

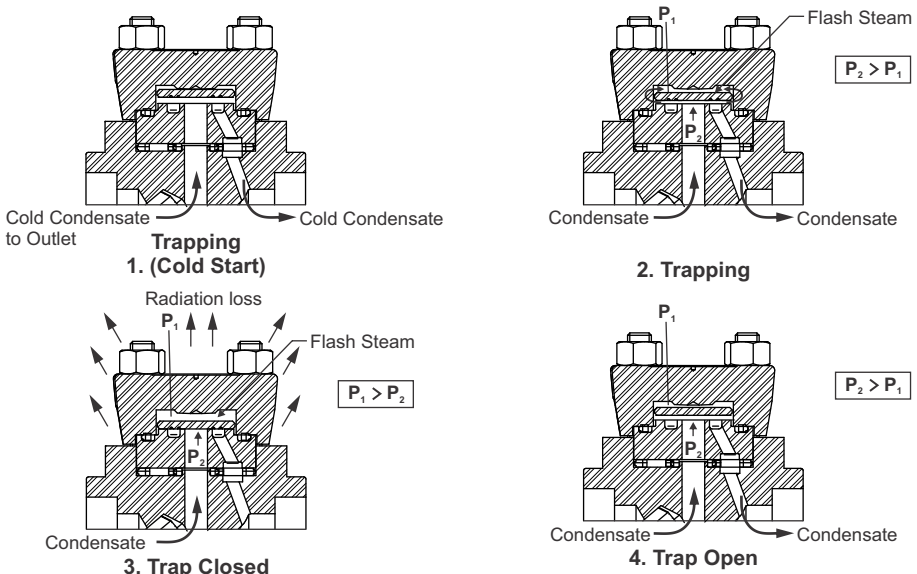
##### 4.1. Operation of Forbes Marshall Thermodynamic Trap : [Refer figure 3]

1. The Forbes Marshall thermodynamic trap operates on thermodynamic principle using the Bernoulli theorem i.e. the total pressure energy (static and dynamic) for a moving fluid is same at all points.
2. Condensate enters the trap through post integral strainer screen (E) in the trap. There is an increase in dynamic pressure of the steam and hot condensate flowing under the disc (A) as the velocity of flow increases and consequential drop in static pressure since the total pressure must remain constant, resulting in disc (A) being drawn downward to the concentric seat rings (C).
3. As the disc (A) is drawn downwards, flash steam passes between the edge of the disc (A) and the inner face of the cap (D) of the trap. The flash steam occupies the space in the top surface of the disc (A).
4. The flash steam above the disc (A) exerts pressure on the larger area on the top surface area of disc (A) overcomes the inlet pressure acting on a smaller area at the bottom of the disc (A). The disc (A) snaps shut against the concentric body seat rings (C) and prevents further flow.
5. This position of the disc (A) continues until the flash steam above the disc (A) starts condensing by radiating heat from the cap (D). Post the condensation of flash steam the pressure acting on top of disc (A) is relieved and the cycle mentioned in points 2,3,4 and 5 is repeated.
6. The Forbes Marshall Thermodynamic Trap has an intermittent discharge pattern. The frequency of which is determinant by the condensate load and ambient temperature.



**Figure 3 : Forbes Marshall Thermodynamic Trap**





**Figure 3 : Forbes Marshall Thermodynamic Trap**

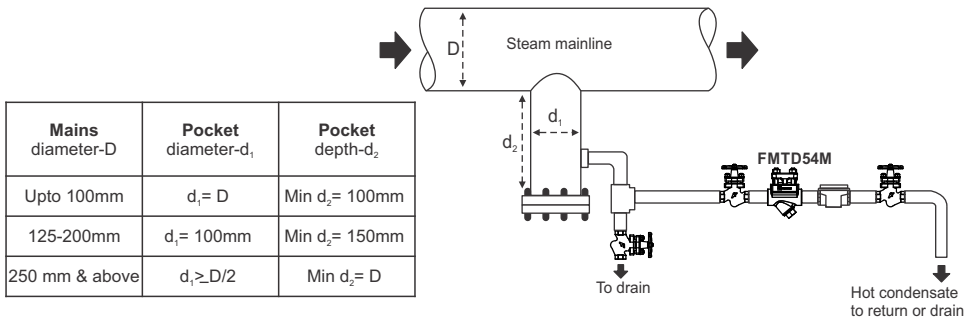
## 5. Installation Guidelines: [Refer figure 4]



**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 the product is suitable for the intended installation.

1. 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.
2. Check materials, line pressure and temperature and their maximum values.
3. Before installation, flush the inlet drip leg to remove all dirt and oil. Ensure to remove all protective seals from the trap.
4. The Forbes Marshall Thermodynamic Trap should be installed in a horizontal plane such that disc movement happens only in vertically up and down directions.
5. The horizontal mainline should be provided with proper collecting pocket as provided by equal Tee should end with a drip leg and at the end of the drip leg Forbes Marshall Thermodynamic Trap should be fitted. Typically recommended drain pocket dimensions relative to steam main pipe sizes are given below.

**Note:** Condensate should not be drained through a small pipe connection at the bottom of mainline.



**Figure 4 : Recommended installation of Forbes Marshall Thermodynamic Trap on mainline**

6. When a socket weld Forbes Marshall Thermodynamic Trap is being installed the welding should be in accordance with an approved weld procedure to a recognized standard.
7. Isolation valves should be installed to allow for safe maintenance and trap replacement.
8. Always open isolation valve slowly until normal operation condition is achieved this will avoid system shocks. Check for leaks and attend if any.

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

2.) For Socket weld / Butt weld end connections coat the weld ends with primer and suitable high temperature paint immediately after welding before corrosion sets in.

## 6. Start-up and Commissioning:

### 6.1. Flushing of lines:

Follow these steps to carry out the flushing.

1. Close the upstream trap isolation valve and open the bypass isolation valve.
2. Let the condensate drain for 10-15 minute or until clear condensate starts coming out, whichever is earlier.
3. Now slowly close the bypass isolation valve and open the upstream trap isolation valve.

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

### 6.2. Commissioning:

After installation or maintenance ensure that the system is fully functioning by confirming condensate is passing through it.

1. After flushing of lines is complete, ensure that bypass isolation valve is closed and upstream trap isolation valve is opened.
2. Check for leaks and attend if any.

## 7. Maintenance Guidelines:



**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 atmosphere. The product should then be allowed to cool. When re-assembling ensure that all joint faces are clean.

### 7.1. Routine and preventive maintenance:

Please refer to the maintenance schedule mentioned in the table below to undertake routine maintenance of the Forbes Marshall Thermodynamic Trap.



| No. | Parameters to be checked                                   | Frequency for checking various parameters |       |        |         |           |             |          |
|-----|--|---|-------|--------|---------|-----------|-------------|----------|
|     |  | Immediate                                 | Daily | Weekly | Monthly | Quarterly | Half Yearly | Annually |
| 1   | Test High Pressure steam traps (17.5 bar g and above)      |   | Y     |        |         |           |             |          |
| 2   | Test Medium Pressure steam traps (3.5 bar g to 17.5 bar g) |   |       | Y      |         |           |             |          |
| 3   | Test Low pressure steam traps ( below 3.5 bar g)           |   |       |        | Y       |           |             |          |
| 4   | Repair / Replace steam traps - when testing shows leaks    | Y   |       |        |         |           |             |          |
| 5   | Clean internals / strainer of FMTD54M                      |   |       |        |         | Y         |             |          |
| 6   | Visual Inspection for leakages                             |   |       | Y      |         |           |             |          |
| 7   | Arresting any other leaks                                  | Y   |       |        |         |           |             |          |

### 7.2. Tool Kit:

To carry out maintenance of the Forbes Marshall thermodynamic trap [FMTD54M] refer the tools mentioned in the table below.

| Size        | Component    | Tool used and size       |
|-------------|--------------|--------------------------|
| DN 15/20/25 | Strainer Cap | Open spanner 26 mm (A/F) |
|             | Stud         | Threaded Sleeve          |
|             | Nut          | Open spanner 17 mm (A/F) |

### 7.3. Recommended tightening torques:

| Item No. | Part         |  or  | Torque Range |
|----------|--------------|--|--------------|
| 7        | Strainer Cap | 26mm A/F   | 110 – 130 Nm |
| 8        | Stud         | M10 X 1.5  | 20 – 25 Nm   |
| 9        | Nut          | 17mm A/F   | 45 – 50 Nm   |

**Table 1: Recommended tightening torque**

#### 7.4. Procedure to replace the disc and seat: [Refer figure 5]



**Note:** The top cover gasket (5) contains a thin stainless steel support ring which may cause physical injury if not handled and disposed of carefully.

1. Spring off the insulating cover, unscrew the four nuts (9) and remove the top cover (11).
2. Lift off the disc (26).
3. Remove the top cover gasket (5) and lift out the seat unit (10). Insert screw – driver into the groove for easy removal.
4. Carefully remove the seat gaskets (2 and 3) from the body of the steam trap. Ensure that no damage is caused to the steam trap body (1).
5. Ensure that the gasket contact surface in the body is clean and fit new seat gaskets (2 and 3).
6. Fit new seat unit (10), new cover gasket (5) and new disc (4). Ensure that the disc is fitted with the grooves facing the seat.
7. Replace the top cover (11) ensuring the cover gasket remains in place.
8. Replace the 4 nuts (9). Tighten the nuts diagonally in sequence to a suitable torque of 45 – 40 Nm.

**Note:** The use of a thread lubricant is recommended.

9. After 24 hours check the torque on the top cover nuts (9).
10. Always open the isolation valves slowly and check for leaks.

#### 7.5. Procedure to clean or replace the strainer screen: [Refer Figure 5]

1. Unscrew the strainer cap (7) using the spanner (26mm A / F).
2. Remove the strainer screen (6). Fit a new or cleaned strainer screen into the recess in the strainer cap (7).
3. The strainer cap (7) screwed into the body and tightened to a suitable torque 142 – 158 Nm.

**Note:** The use of a thread lubricant is recommended.

### 7.6. Procedure to replace the cover studs: [Refer Figure 5]

1. After removing old cover studs (8), fit new cover studs.

**Note:** The use of a thread locking compound is recommended.

### 7.7. Steam traps testing:

Following methods can be used to determine the operating condition of a trap and determine if its working properly:

1. Testing traps through visual inspection.
2. Testing traps using temperature gun / equipment
3. Testing traps using sound/ultrasound.
4. Testing traps through online monitoring.

## 8. Troubleshooting:

If the expected performance is unachievable after installation of the Forbes Marshall thermodynamic trap, check the following points for appropriate corrective measures.

| Failure Mode                                  | Possible Cause                                      | Remedy   |
|---|---|--|
| <b>No condensate is discharged (blocked).</b> | Differential pressure is low.                       | Verify inlet and outlet pressure of the steam trap. Minimum differential pressure required is 0.25 bar g                                   |
|   | Air – Binding problem.                              | Loosen Top Cover and tighten to suitable torque.   |
|   | Steam trap body is hot but no condensate discharge. | To release flash steam locked (trapped) inside the steam trap, pour water on top cover of the steam trap to check it discharge condensate. |
| <b>Steam leakage.</b>                         | Steam Leaking continuously.                         | Ensure bypass valve is fully closed.   |
|   |   | Check installation i.e. Top Cover to be on top and fluid flow direction same as arrow on the steam trap body                               |
|   | Improper installation of the product..              | Check installation i.e. top cover should be on top and fluid flow direction same as arrow on the steam trap body.                          |

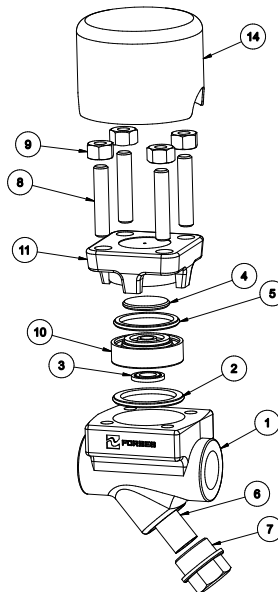
| Failure Mode                               | Possible Cause                                     | Remedy  |
|--|--|---|
| <b>Steam leakage.</b>                      | Foreign material or oil film on disc or body seat. | Clean both disc and body seat, flatness on disc and body seating faces can be improved by lapping individually on flat surface or glass plate. Note: The total amount of metal from body seat face removed should not exceed 0.25mm (0.01").  |
|  | Disc stuck to the top cover.                       | Give a light tap on top of the top cover and check step (inner surface of the top cover) is worn out. If step is worn out replace with new top cover.   |
|  | Back pressure exceeds allowable value.             | Outlet pressure of the steam trap should not exceed 80% of the inlet pressure.  |
| <b>Motor-boating (chattering) of disc.</b> | Scratch on disc or body seat.                      | Check if scratch depth is less than disc and body seating faces flatness can be improved by lapping individually on flat surface or glass plate. If scratch depth is more replace with new body seat. Note: The total amount of metal from body seat face removed should not exceed 0.25mm (0.01"). |
|  | Disc or body seat is worn.                         | Replace with new disc. If body seat is slightly worn it can be refaced by lapping on flat surface or glass plate. If body seat is worn more replace with new body seat. Note: The total amount of metal from body seat face removed should not exceed 0.25mm (0.01").                               |

**Note:** Never attempt to modify the product. When replacing old parts with new parts, use the spare parts listed in Section9.

## 9. Available Spares: [Refer figure 5]

The parts available as spares are shown in heavy outline. Parts drawn in dotted line are not available as spares.

| No. | Spares                            | Part No. | Spares Code                      |
|-----|-----------------------------------|----------|----------------------------------|
| 1   | FMTD54 Top Cover Stud and Nut Set | 8,9      | SPARE-152025CMTD42M/FMTD54M-HKIT |
| 2   | 15NB FMTD54 Seat, Disc            | 10,4     | SPARE-15CMTD42M/FMTD54M-SDKIT    |
| 3   | 20/25NB FMTD54 Seat, Disc         | 10,4     | SPARE-1520CMTD42M/FMTD54M-SDKIT  |
| 4   | FMTD54 Strainer Screen            | 6        | SPARE-152025CMTD42M/FMTD54M-SKIT |
| 5   | FMTD54 Top Cover and Seat Gasket  | 5,2,3    | SPARE-152025CMTD42M/FMTD54M-GKIT |



**Figure 5: Exploded view of FMTD54M Thermodynamic Trap**

### How to Order :

**Example:** 1No. DN15 Forbes Marshall Thermodynamic Trap FMTD54M

### How to Order Spares:

Always order spares by using the description given in the column headed “Available Spare” and stating the size and type of trap.

**Example:** 1No. Strainer Screen for DN15 Forbes Marshall Thermodynamic Trap FMTD54M

## 10. Warranty Period:

As per ordering information and agreements in the contract.



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

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