

Installation and Maintenance Manual

Forbes Marshall Thermodynamic Trap

FMTD76-M

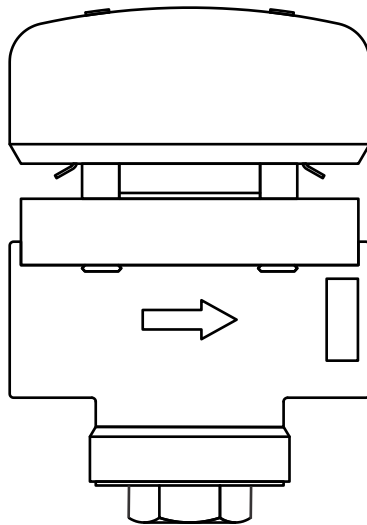


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PLEASE NOTE - Throughout this manual this cautionary symbol is used to describe a potential damage or injury that might occur if the safety considerations are overlooked. This symbol denotes **CAUTION**, **WARNING** or **DANGER**.



1. Preface:

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

Forbes Marshall Thermodynamic Trap [FMTD76-M] Size: DN 15 (½") and DN 20 (¾")

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 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 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, FMTD76-M, is a maintainable high pressure thermodynamic steam trap with integral strainers and a replaceable seat to ease maintenance. It has been specifically designed for main drainage application up to 62 bar g. An insulating cover is fitted as standard to prevent the trap being unduly influenced by excessive heat loss when subjected to low outside temperature, wind, rain etc

3.2 Size and Pipe Connections:

DN 15 and DN 20

Screwed BSPT/NPT and socket weldable ends

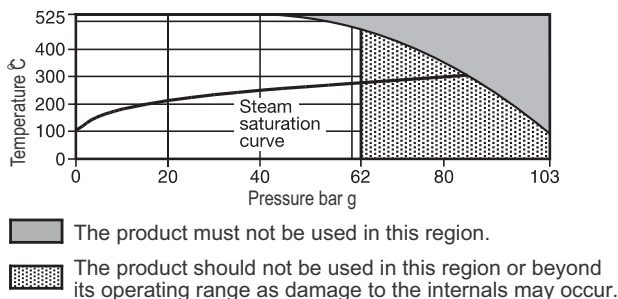
Notes:

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

3.3 Limiting Conditions :

Body designed conditions	ANSI 600
PMA Max. Allowable pressure	103 bar g @ 38°C
TMA Max. allowable temperature	525°C @ 37.2 bar g
Minimum allowable temperature	0°C
PMO Maximum operating pressure for steam service	62 bar g @ 478°C
PMOB Maximum operating back pressure	80% of steam pressure
Minimum operating pressure	1.4 bar g
Designed for a maximum cold hydraulic test pressure of	155 bar g

3.4 Operating Range:



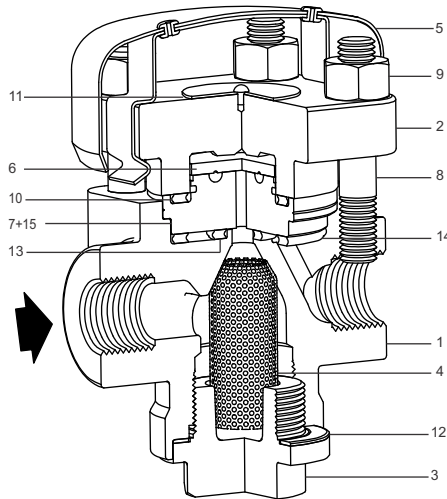


Figure 1 : Forbes Marshall Thermodynamic Trap

Material:

No	Part	Material	Standard
1	Body	Steel	ASTM A 217 GR WC6
2	Cover	Steel	ASTM A 217 GR WC6
3	Strainer cap	Steel	ASTM A 217 GR WC6
4	Strainer screen	Stainless Steel	ASTM 240 GR 316
5	Insulating cover	Aluminum	
6	Disc	Chromium Steel	BS 4659 GR BD 2
7	Seat	Chromium Steel	BS 4659 GR BD 2
8	Cover studs	Steel	ASTM A 193 GR B16
9	Cover nuts	Steel	ASTM A194 GR 8M
10	Cover gasket	Spiral wound SS with exfoliated graphite	
11	Name plate	Stainless steel	ASTM A240 SS 304
12	Strainer cap gasket	Reinforced ex-foliated graphite	
13	Inner seat gasket	Spiral wound SS with exfoliated graphite	
14	Outer seat gasket	Spiral wound SS with exfoliated graphite	
15	Ferrule	Stainless steel	

Note : Item 15 (ferrule) is pressed into item 7 (seat)

3.5 Product Dimension and Drawing:

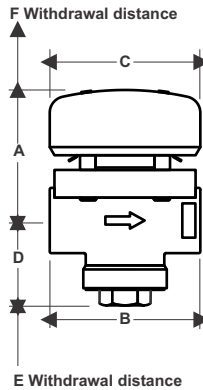
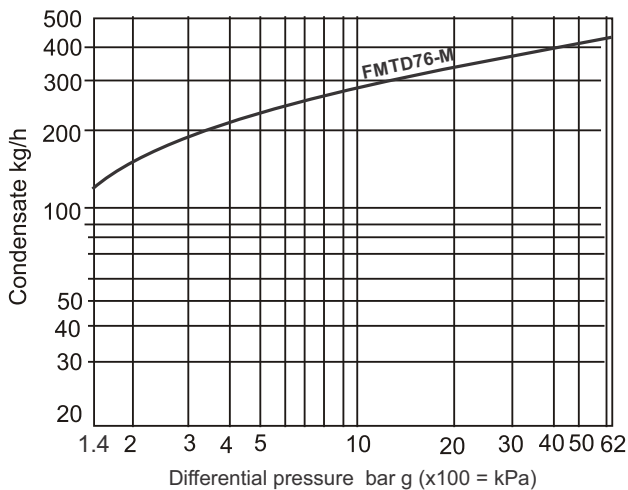


Figure 2 : Dimensional Drawing of FMTD76-M

Dimensions (approx.) in mm and kg

Size	A	B	C	D	E	F	Weight
DN15	80	92	92	52	20	51	2.08
DN20	80	92	92	52	20	51	2.08

3.6 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 [FMTD76-M]:[Refer figure 1]

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 **(4)** in the trap. There is an increase in dynamic pressure of the steam and hot condensate flowing under the disc **(6)** as the velocity of flow increases and consequential drop in static pressure since the total pressure must remain constant, resulting in disc **(6)** being drawn downward to the concentric seat rings **(7)**.
3. As the disc **(6)** is drawn downwards, flash steam passes between the edge of the disc **(6)** and the inner face of the top cover **(2)** of the trap. The flash steam occupies the space in the top surface of the disc **(6)**.
4. The flash steam above the disc **(6)** exerts pressure on the larger area on the top surface area of disc **(6)** overcomes the inlet pressure acting on a smaller area at the bottom of the disc **(6)**. The disc **(6)** snaps shut against the concentric body seat rings **(7)** and prevents further flow.
5. This position of the disc **(6)** continues until the flash steam above the disc **(6)** starts condensing by radiating heat from the top cover **(2)**. Post the condensation of flash steam the pressure acting on top of disc **(6)** 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.

5. Installation Guidelines: [Refer figure 3]



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. Determine the correct installation situation and the direction of fluid flow.
2. Remove protective covers from all connections and protective film from all name – plates, where appropriate, before installation on steam or high temperature applications.
3. Before installing the steam trap flush the inlet drip leg to remove all dirt and oil.
4. The preferred installation is in a horizontal pipe with the nameplate on top. The trap will operate in any position, but the service life may be affected.

Note: When socket weld or butt weld trap is being installed the welding should be carried out to an approved procedure of a recognized standard.

5. Observe the flow direction markings on the trap body. Stop valves should be installed so as to permit the isolation of the trap from both supply and return line pressure. If the steam trap discharges to atmosphere, the discharge should be directed to a safe place.

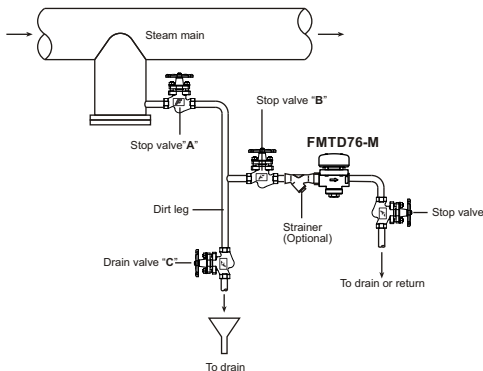
Note: The disc and seating surfaces of these traps have been produced to a high degree of flatness to achieve good shutoff under high pressure conditions. An integral strainer helps prevent dirt and scale from entering the trap. If particles become entrapped between the disc and seat, the high flow velocities can cause rapid wear and erosion. A separate strainer and/or dirt pocket will provide additional protection.

6. Access for removal of the integral strainer screen should be provided.
7. The insulating cover may be removed to facilitate installation, but it must be replaced before the steam trap is put into service.

Note: If the steam trap is to discharge to atmosphere ensure it is to a safe place, the discharging fluid may be at a temperature of 100°C (212°F).



For socket weld / butt weld end connections coat the welded ends with primer and suitable high temperature paint immediately after welding before corrosion sets in.



Alternative layout

Suggested drop leg if the FMTD76-M is located more than 2 m (6 ft) away from the main drop leg.

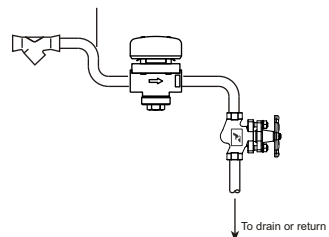


Figure 3: Installation of FMTD76-M on Mainline

6. Start-up and Commissioning:

6.1 Flushing of lines: [Refer figure 3]

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 stop valve (B) and open the drain valve (C).
2. Let the condensate drain for 10-15 minutes or till clear condensate starts coming out, whichever is earlier.
3. Now slowly close the drain valve (C)and open the stop vavle (B).

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

6.2 Commissioning: [Refer figure 3]

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 drain valve (C) is closed and stop valve (B) is opened.
2. Check for leaks and attend if any.

6.3 Commissioning with particular reference to venting air: [Refer Figure 3]

With high pressure systems, initial start – up can take several hours (or days) to bring the system to normal operating pressure and temperature. Even if the steam trap has been replaced with another steam trap while the main system has remained running, it may still be necessary to vent air from the drop leg. If the steam trap is some distance from Stop Valve 'A', it could be possible to air lock the pipework between valve 'A' and the steam trap (i.e. the steam trap closes to air and does not readily allow steam to enter the pipework). To overcome this on start up the following procedure should be adopted. With stop valve 'B' closed, drain valve 'C' open, slowly and partially open stop valve 'A'. This will discharge the air, condensate and any pipe debris. Valve 'C' should be fully closed, and valves 'A' and 'B' slowly opened to the fully open position. When the steam trap is more than 2m (6 ft) away from the vertical drain leg, a suitable drop leg at the inlet of the steam trap can improve its servidlife by ensuring that the steam trap does not see a mixture of steam and condensate.

Important Note:

After the steam trap has been in service at normal operating pressure and temperature for 24 hours, it is essential that the cover nuts are retightened (see table 1 for the recommended tightening torques). This will ensure the correct compression of the gasket under service conditions.

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 [FMTD76-M].

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	Repair / Replace steam traps - when testing shows leaks	Y						
4	Clean internals / strainer of FMTD76-M					Y		
5	Visual Inspection for leakages			Y				
6	Arresting any other leaks	Y						

7.2 Tool Kit:

To carry out maintenance of the Forbes Marshall Thermodynamic Trap [FMTD76-M] refer the tools mentioned in the table below.

Size	Component	Tool used and size
DN 15/20	Strainer cap	Box spanner 32mm (A/F)
	Cover Studs	Stud Runner M10 X 1.5
	Cover Nuts	Box spanner 17mm (A/F)

7.3. Recommended tightening torques:



Item No.	Part	 or mm		Torque Range
3	Strainer Cap	32 A/F		142 -158 Nm
8	Cover Studs		M10 X1.5	20 -25 Nm
9	Cover Nuts	17 A/F		45 -50 Nm

Table 1 Recommended Tightening Torques

7.4. Procedure to service the trap: [Refer figure 1]



Note: The cover gasket 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 (5), unscrew the four nuts (9) and remove the top cover (2).
2. Lift the disc (6). Remove the cover gasket (10) and lift out the seat unit (7). The use of 2 screwdrivers inserted into the grooves may ease removal. Ensure that the location ferrule (15) is also removed.
3. Carefully remove the seat gaskets (13+14) from the body of the trap. Ensure that no damage is caused to the trap body.
4. Ensure that the gasket contact surface in the body is clean and fit new seat gaskets (13 + 14).
5. Fit the new seat unit (7) ensuring that the location ferrule (15) is firmly located in the body.
6. Fit the new cover gasket (10) and fit new disc (6). Ensure that the disc is fitted the grooves facing the seat.
7. Replace the top cover (2) ensuring the cover gasket remains in place.
8. Replace the four nuts (9). Tighten the nuts diagonally in sequence to a recommended torque of 45-50 Nm.

Note: The use of a thread lubricant is recommended also replace the insulating cover (5).

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

7.5 Procedure to clean or replace the strainer screen: [Refer figure 1]

Note: On older models the strainer was a 0.8 mm perforated screen. Newer models use a 100 mesh screen to provide improved screening. The screens are interchangeable.

1. Screwed and socket weld connections. (Figure 4)
2. Accesses to the strainer screen can be obtained by removing strainer cap (3).
3. Remove the strainer screen (4).
4. Fit a new or cleaned strainer screen into the recess in the cap (3).
5. A new gasket (12) should be fitted and the cap (3) screwed into the body and tightened to the recommended torque.

Note: The use of a thread lubricant is recommended.

7.6 Procedure to replace the cover studs: [Refer Figure 1]

Screwed and socket weld connections (Figure 4).

After removing the old cover studs (8), fit new cover studs until the studs bottom out.

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 it's 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 steam trap, check the following points for appropriate corrective measures.

Failure Mode	Possible Cause	Remedy
No condensate is discharged (blocked).	Inlet drip leg or strainer screen is clogged with rust or scale.	Flush inline drip leg and clean strainer screen. If screen is rusted, replace with new strainer screen.
	Differential pressure is low.	Verify inlet and outlet pressure of the steam trap. Minimum differential pressure required is 1.4 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 the top cover of the steam trap to check it discharge condensate.
Steam leakage.	Steam leaking continuously.	Ensure Bypass valve is fully closed.
		Check installation i.e. top cover should be on top and fluid flow direction same as arrow on the steam trap body.
	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 cover and check if step (inner surface of the top cover) is worn out. If step is worn out replace with new steam trap.
	Back pressure exceeds allowable value.	Outlet pressure of the steam trap should not exceed 80% of the inlet pressure.
Motor-boating (chattering) of disc.	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 disc. 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 one, use the spare parts listed in section 9.

9. Available Spares: [Refer figure 4]

The spare parts available are shown in heavy outline. Parts drawn in broken line are not supplied as spares.

Sr.No.	SPARE PART	SPARE CONSIST OF	PART No.	SPARE CODE
1	GASKET KIT	SEAT(INNER /OUTER), BODY & STRAINER CAP GASKET (PACK OF 3 NOS. EACH)	12	SPARE-1520FMTD76M- GKIT
2	REPAIR KIT	SEAT-1 NO. ,DISC - 1 NO. , SEAT GASKETS- 2 NO'S,SCREEN- 1NO.,BODY & STRAINER GASKET 1 NO.	4	SPARE-1520FMTD76M- RPRKIT
3	SEAT AND DISC KIT	SEAT - 1NO. , DISC 1NO., SEAT GASKETS - 2 NO'S AND COVER GASKET -1 NO'S	6,7,10,13, 14,15	SPARE-1520FMTD76M- INTKIT
4	ISOTUB KIT	ISOTUB (PACK OF 1)	5	SPARE-1520FMTD76M- ISTBKIT
5	STUD AND NUT KIT	SET OF COVER STUDS AND NUTS (PACK OF 4 EACH)	8,9	SPARE-1520FMTD76M- SNKIT

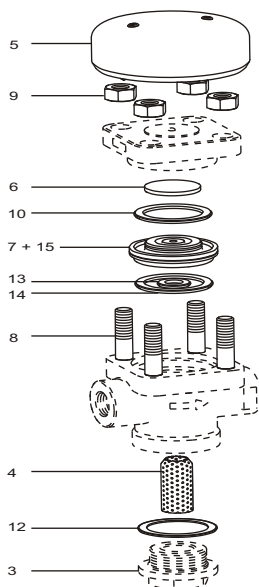


Figure 4: Parts available as spares (Heavy Outline) for FMTD76-M Screwed and socket weld

How To Order:

Example : DN 15 Forbes Marshall thermodynamic trap FMTD76-M with integral strainer with screwed BSPT connections.

How to Order Spares:

Always order spares by using the description given in the column headed “Available Spares”.

Example : 1 No. strainer for Forbes Marshall thermodynamic trap FMTD76-M.

10. Warranty Period:

As per ordering information and agreements in the contract.



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