

Installation and Maintenance Manual

Forbes Marshall Thermodynamic Trap

FMTD722-M

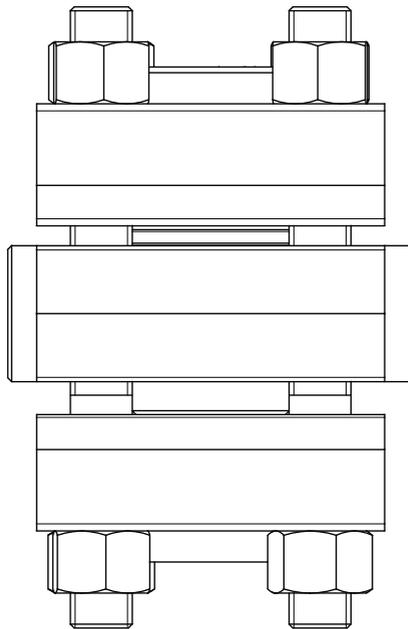


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PLEASE NOTE - Throughout this manual this cautionary symbol is used to describe a potential damage or injury that might occur if the safety considerations are overlooked. This symbol denotes CAUTION, WARNING or DANGER.



1. Preface:

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

Forbes Marshall Thermodynamic Trap [FMTD722-M] Size: DN15 (1/2") and DN20 (3/4").

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 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, FMTD722-M, is a maintainable high pressure thermodynamic steam trap with an integral strainer and a replaceable seat for ease of maintenance. It has low capacity and is specifically designed for superheated applications up to 250 bar g.

3.2 Sizes and Pipeline Connections:

DN 15 and DN 20 butt weld ends to suit schedule 160 pipe.

DN 15 and DN 20 socket weld able ends to ASME (ANSI). B 16.11 Class 6000.

Note : Available with ANSI 600 and ANSI 1500 flanges on request.

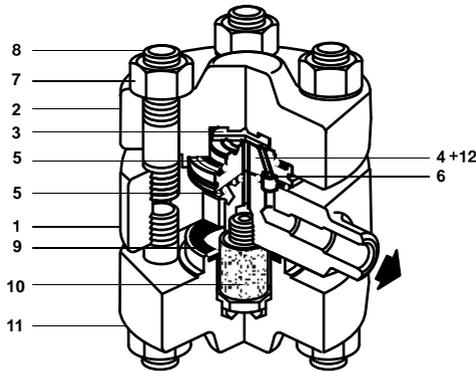


Figure 1 : Forbes Marshall Thermodynamic Trap

Material

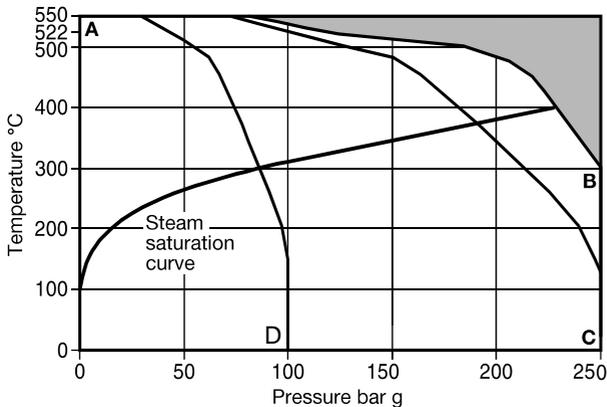
No.	Part	Material	Standard
1	Body	Alloy Steel	ASTM A182F 22
2	Top Cover	Alloy Steel	ASTM A182 F 22
3	Disc	Steel	AISI D2
4	Seat	Steel	AISI D2
5	Top Cover Gasket	Spirally wound SS with exfoliated graphite filler	
6	Inner seat Gasket	SS with exfoliated graphite filler	
7	Cover Nuts	Steel	ASTM A194 Gr. 4
8	Cover Studs	Steel	ASTM A193 Gr. B.16
9	Bottom Cover Gasket	SS with exfoliated graphite filler	
10	Strainer Screen Assembly	Stainless Steel	BS 970 304 515/ sintered stainless
11	Bottom Cover	Alloy Steel	ASTM A182 F22
12	Ferrule	Stainless Steel	

3.3 Limiting Conditions:

Note : if the product is used at pressure above 170 bar kg/cm² we recommend regular inspection of the seat.

Body design conditions	PN 250
PMA Maximum allowable pressure	250kg/cm ² @ 300°C
TMA Maximum allowable temperature	500°C @ 80 kg/cm ²
Minimum allowable temperature	-29°C
PMO Maximum operating pressure	220 kg/cm ² @ 374°C
TMO Maximum operating temperature	550°C @ 80 kg/cm ²
Minimum operating temperature	0°C
PMOB Maximum operating back pressure should not exceed of 50% the upstream pressure	
Minimum operating differential pressure	8 kg/cm ²
Designed for a maximum cold hydraulic test pressure of	375 kg/cm ²

3.4 Operating Range:



- The product **must not** be used in this region.
A - B Socket weld and Butt weld ends
A - C Flanged to ASME (ANSI) Class 1500
A - D Flanged to ASME (ANSI) Class 600

3.5 Product Dimension and Drawing:

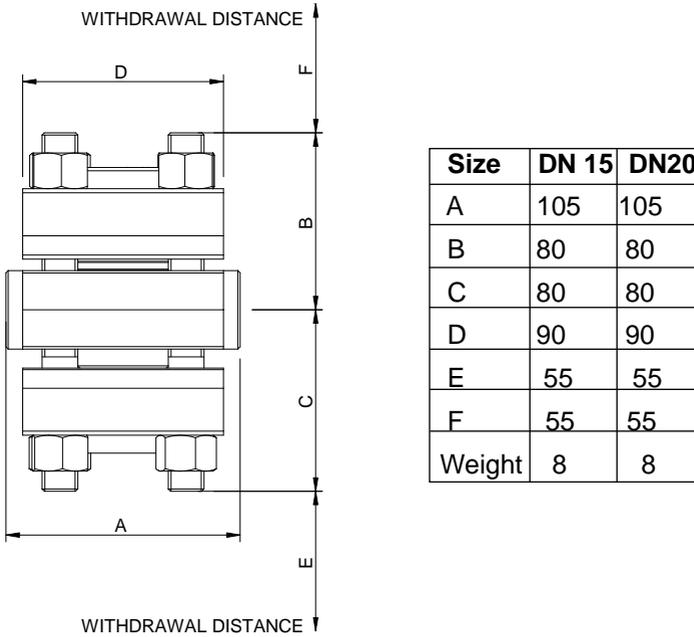
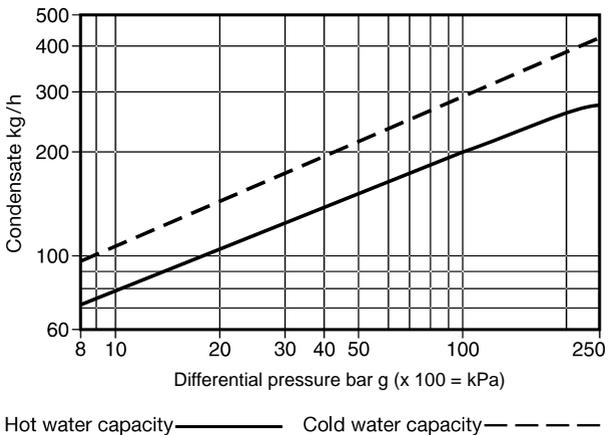


Figure 2 : Dimensional Drawing of FMTD722-M

3.6 Capacity Chart (in accordance with ISO 7842)



4. Product Working Principle:

The Forbes Marshall Thermodynamic Trap [FMTD722-M] 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 [FMTD722-M]: [Refer figure 1]

1. The Forbes Marshall Thermodynamic Trap [FMTD722-M] 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 (10) in the trap. There is an increase in dynamic pressure of the steam and hot condensate flowing under the disc (3) as the velocity of flow increases and consequential drop in static pressure since the total pressure must remain constant, resulting in disc (3) being drawn downward to the concentric seat rings (4).
3. As the disc (3) is drawn downwards, flash steam passes between the edge of the disc (3) 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 (3).
4. The flash steam above the disc (3) exerts pressure on the larger area on the top surface area of disc (3) overcomes the inlet pressure acting on a smaller area at the bottom of the disc (3). The disc (3) snaps shut against the concentric body seat rings (4) and prevents further flow.
5. This position of the disc (3) continues until the flash steam above the disc (3) starts condensing by radiating heat from the top cover (2). Post the condensation of flash steam the pressure acting on top of disc (3) is relieved and the cycle mentioned in points 2, 3, 4 and 5 is repeated.
6. The Forbes Marshall Thermodynamic Trap [FMTD722-M] 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 steam trap will operate in any position, but the service life may be affected.

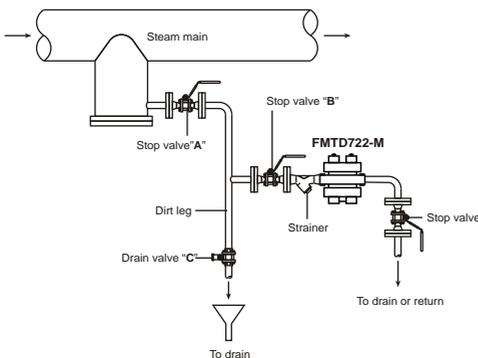
Note: When socket weld or butt weld trap is being installed the welding should be carried out to an approved procedure of a recognized standard.

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).



Alternative layout

Suggested drop leg if the FMTD722-M is located more than 2 m (6 ft) away from the main drop leg.

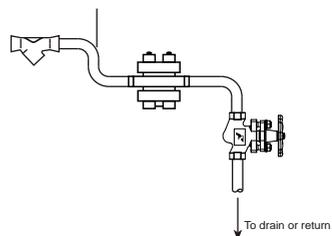


Figure 3 : Installation FMTD722-M on mainline

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 valve (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.

6.2. 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 service life 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 Procedure:



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 preventive maintenance:

Please refer to the maintenance schedule mentioned in the table below to undertake routine maintenance of the Forbes Marshall Thermodynamic Trap [FMTD722-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	Repair / Replace steam traps - when testing shows leaks	Y						
3	Clean internals / strainer of FMTD722-M					Y		
4	Visual Inspection for leakages			Y				
5	Arresting any other leaks	Y						

7.2. Tool Kit:

To carry out maintenance of the Forbes Marshall Thermodynamic Trap [FMTD722-M] refer the tools mentioned in the table below.

Size	Component	Tool used and size
DN 15/20	Cover Nuts	Box spanner 24mm (A/F)
	Cover Studs	Stud Runner M16 X 2
	Strainer screen assembly	Box spanner 22mm (A/F)

7.3. Recommended tightening torques:

Item No.	Part	 or 	mm	Torque Range
3	Spool	22 A/F		25 - 35 Nm
8	Stud		M16 X 2	85 - 90 Nm
9	Nut	23 A/F	M16	160 – 180 Nm

Table 1 Recommended Tightening Torques:

7.4. Procedure to fit the disc and seat: [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. Remove top cover (2) by unscrewing the four cover nuts (7).
2. Lift off the disc (3).
3. Lift out the seat (4). The use of 2 screwdrivers inserted into the groove may ease removal. Ensure that the location ferrule (12) is also removed.
4. Carefully remove the seat gaskets (5 and 6) from the body (1) of the trap. Ensure that no damage is caused to the trap body (1).
5. Ensure that the gasket contact surface in the body (1) is clean and fit new seat gaskets (5 and 6).
6. Fit the new seat (4) ensuring that the location ferrule (12) is firmly located in the body (1).
7. Fit the new seat gasket (5) making sure that the gasket faces are perfectly clean and fit a new disc (3). Ensure that the disc (3) is fitted with the grooves facing the seat (4).
8. Reassemble the top cover (2).
9. Retighten the cover nuts (7) to the recommended tightening torques (Refer table 1).
10. After 24 hours in service, and when reassembling, the nuts should be tightened in a diagonally opposite sequence.
11. Open the isolation valves slowly until normal operating conditions are achieved.
12. Check for leaks and if any attend.

7.4. Procedure to clean or replace the strainer: [Refer figure 1]

1. Access to the strainer screen can be obtained by removing the bottom cover (11) by unscrewing the four nuts (7) that are securing it in place.
2. Remove the strainer screen (10).
3. Fit the new or cleaned strainer screen (10) into the recess on the underside of the cover.
4. A new gasket (9) should be fitted and the cover refitted.
5. Retighten the cover nuts (7) to the recommended tightening torques. (Refer Table 1).
6. After 24 hours in service, and when reassembling, the nuts should be tightened in a diagonally opposite sequence.
7. Open the isolation valves slowly until normal operating conditions are achieved.
8. Checks for leaks and operating conditions.

7.5. Procedure to replace the cover studs:

After removing old cover studs, fit new cover studs until the studs bottom out. The use of a thread lubricant is recommended.

7.6. 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	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 8 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.
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 of the 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 50% of the inlet pressure.
Motor-boating (chattering) of disc.	Scratch on disc or body seat.	Check if scratch depth is less then 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 part with new, use the spare parts listed in Section 9.

9. Available Spares:

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

Spares	Part No.	Spare Code
Set of Cover Studs & Nuts	8 and 7 (Pack of 8)	SPARE-1520FMTD722M-SNKIT
Strainer Screen and Gasket	10 and 9	SPARE-1520FMTD722M-SGKIT
Set of Gaskets	5 (2 nos) , 6, 9 (Pack of 3)	SPARE-1520FMTD722M-GKIT
Set of Internals	3, 5 (2 No.), 6, 9, 10 , 4+12	SPARE-1520FMTD722M-INTKIT

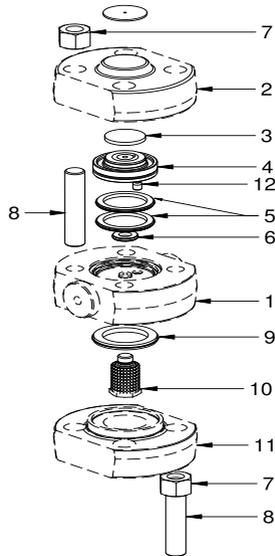


Figure 4: Parts available as spares (Heavy Outline) for FMTD722-M

How to Order:

Example : 1 No. Forbes Marshall Thermodynamic Trap, FMTD722-M, with maintainable seat, butt weld ends to suit schedule 160 pipe.

10 Warranty Period:

As per ordering information and agreements in the contract.

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