

Installation and Maintenance Manual

Forbes Marshall Thermodynamic Trap

FMTD64

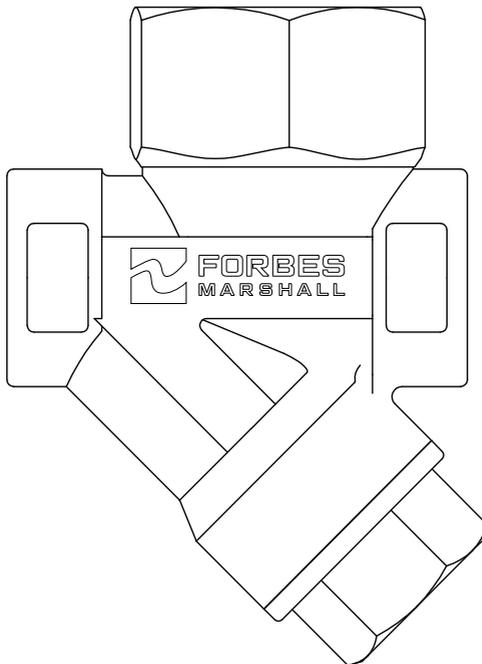


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PLEASE NOTE - Throughout this manual this cautionary symbol is used to describe a potential damage or injury that might occur if the safety considerations are overlooked. This symbol denotes CAUTION, WARNING or DANGER.



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 [FMTD64]

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 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 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 FMTD64, with inbuilt strainer and full stainless steel construction, is best suited for header and mainline drains.

3.2 Sizes and End 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

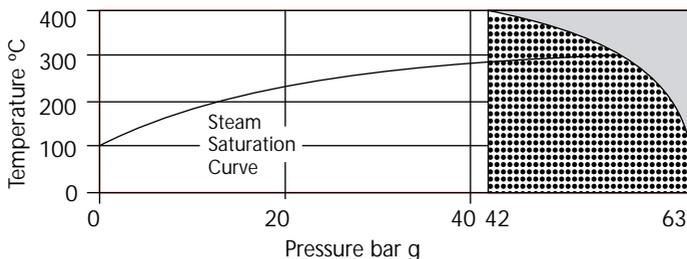
3.3 Limiting Conditions:

Body design conditions	PN63
PMA Maximum allowable pressure	63 bar g @100°C
TMA Maximum allowable temperature	400°C @ 42 bar g
Minimum allowable temperature	0°C
PMO Maximum operating pressure	42 bar g recommended
TMO Maximum operating pressure	400°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 on 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 internals.

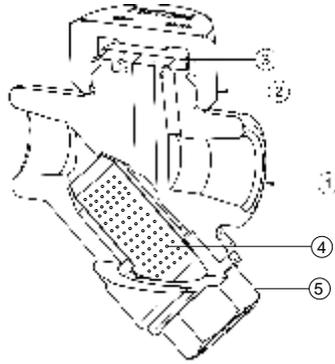


Figure 1: Forbes Marshall Thermodynamic Trap

Material:

Sr. No.	Part	Material	Standard
1	Body	Stainless Steel	ASTM A 743 Gr.-CA 40
2	Cap	Stainless Steel	BS 3146 PART2 ANC2
3	Disc	Stainless Steel	ASTM A 240 SS420
4	Strainer Screen	Stainless Steel Type 304	ASTM A 240
5	Strainer Cap	Stainless Steel	BS 3146 PART2 ANC2

3.5 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.

3.6 Product Dimension and Drawing:

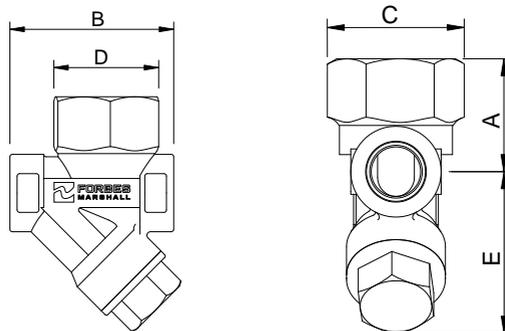
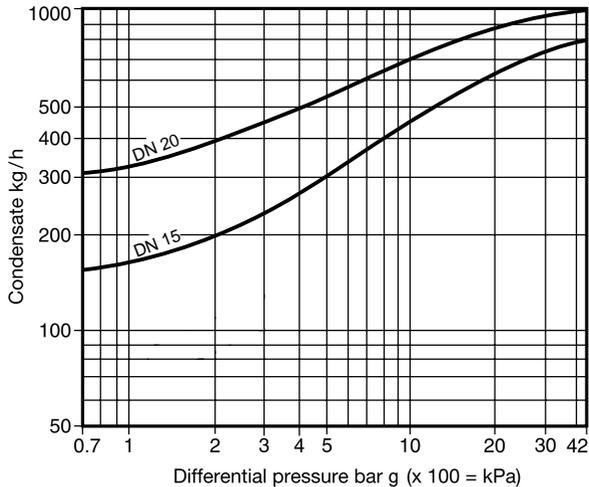


Figure 2: Dimensional Drawing of FMTD64

Dimensions (approx.) in mm:

Size	A	B	C	D	E	Weight
DN 15						
DN 20	42	78	50	44	57	0.8 kg

3.7 Capacity Chart:



3.8 Salient Features

1. Complete stainless steel construction ensures better mechanical and corrosion resistant properties.
2. The disc and seat, hardened by induction hardening process to about 45RC can withstand continuous water hammering conditions.
3. Seat integral part of the body, eliminates leakage-prone joints and gaskets.
4. 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.
5. An inbuilt strainer screen of adequately large area ensures long and trouble free operation.

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 determined by the condensate load and ambient temperature.

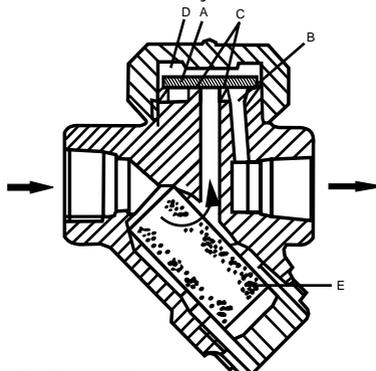


Figure 3 : Forbes Marshall Thermodynamic Trap

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. Check materials, pressure and temperature and their maximum values.
2. Before installation, flush the inlet drip leg to remove all dirt and oil. Ensure to remove all protective seals from the trap.
3. The Forbes Marshall Thermodynamic Trap should be installed in a horizontal plane such that disc movement happens only in vertically up and down directions.
4. 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.

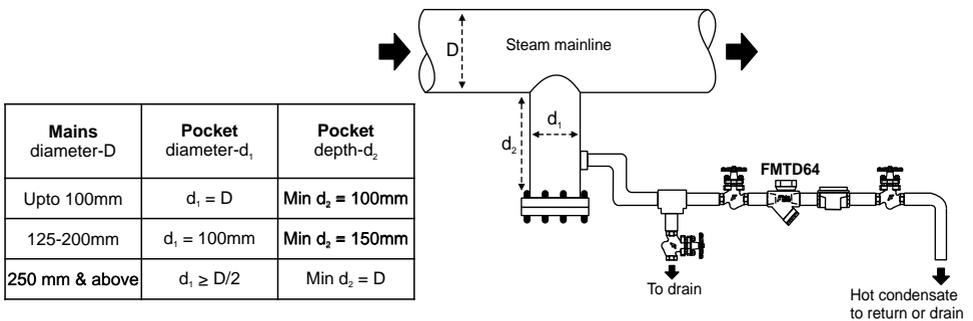


Figure 4 : Recommended installation of Forbes Marshall Thermodynamic Trap on mainline

5. 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.
6. Isolation valves should be installed to allow for safe maintenance and trap replacement.
7. Always open isolation valve slowly until normal operation condition is achieved this will avoid system shocks. Check for leaks and attend if any.

Note: 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.

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 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 FMTD64					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 [FMTD64] refer the tools mentioned in the table below.

Size	Component	Tool used and size
DN 15/20	Cap	Box spanner 42 mm (A/F)
	Strainer Cap	Box spanner 26 mm (A/F)

7.3. Recommended tightening torques:

Item	Component	Torque Range
2	Cap	180 - 200 Nm
5	Strainer Cap	170- 190 Nm

Table 1: Recommended tightening torque

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

1. Remove the Isotub if fitted and unscrew the main bore cap (2) using a spanner. Do not use a pipe wrench which may cause distortion of the main bore cap (2).
2. Any minor or major damage / scratch on the seating surface of the disc (3) or body seat (1) will cause the steam trap to pass steam. Since the disc is less hardened than the body seat (1), fine particle passing through the steam trap (along with the condensate) could damage the disc (1). This damage will be in the form of scratches on the disc (1) surface area. If the scratch depth is not much this can be cured by lapping the disc (3) and the steam trap can be made functional. If the body seat(1) is slightly worn out it can be refaced by lapping individual on a glass surface plate. The amount of material to be removed by lapping should not exceed 0.25mm (0.01").

Lapping Procedure:

- a) Requirement: Emery paper, glass surface, lapping paste and oil.
- b) First, lap the disc (3) on a piece of emery paper (grade 220) to eliminate scratches on the disc (3) and to prepare the surface for further fine lapping.
- c) Apply the lapping paste and oil on to the glass surface and rotate the disc (3) in the shape of the numeric "8" (Eight).
- d) Lapping should be done till all scratches on the disc (3) disappear.

Note: If the scratches on the disc (3) are not curable then the disc (3) should be replaced.

3. When re-assembling main bore cap (2), the disc (3) is normally placed in position with the grooved side in contact with the body seating face (1). No gasket is required but high temperature anti-seize grease should be applied to the threads. Tighten the main bore cap (2) to the recommended torque as mention in Table 1.

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

1. Unscrew the strainer cap (5) using the spanner, withdraw strainer screen (4) and clean or if damaged replace with new one.
2. To re-assemble, insert the strainer screen (4) in the strainer cap (5), then screw strainer cap (5) into the place with recommended torque as mention in Table 1.
3. No gasket is required but a finer smear of Molybdenum Disulphide grease should be applied to the threads.

7.6. 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
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 strainer 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 0.25 bar g
	Air – Binding problem.	Loosen cap 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 cap of the steam trap to check it discharge condensate.
Steam leakage.	Steam Leaking continuously.	Ensure bypass valve is fully closed.
		Check installation i.e. cap to 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 cap.	Give a light tap on top of the cap and check if step (inner surface of the cap) 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.

Failure Mode	Possible Cause	Remedy
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 steam trap. 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 part, use the spare parts listed in section 9.

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.

Product	SPARE TYPE	SPARE CONSIST OF	SPARE SPECIFICATION	SPARE CODE
FMTD64	SCREEN AND DISC KIT	SCREEN AND DISC (PACK OF 5 EACH)	DN15	SPARE-15FMTD64-SDKIT
	SCREEN AND DISC KIT	SCREEN AND DISC (PACK OF 5 EACH)	DN20	SPARE-20FMTD64-SDKIT
	ISOTUB KIT	ISOTUB (PACK OF 1)	DN15/20	SPARE-1520FMTD64-ISTBKIT

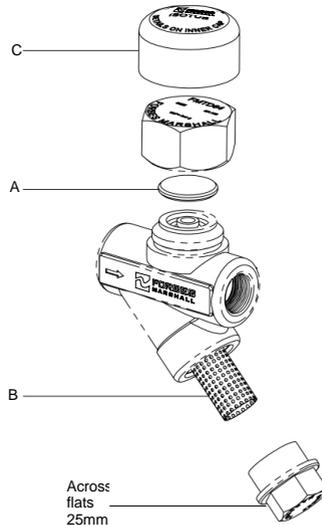


Figure 5: Parts Available as spares (Heavy outline) for FMTD64

How to Order :

Example: 1No. DN15 Forbes Marshall Thermodynamic Trap FMTD64

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 FMTD64

10. Warranty Period:

As per ordering information and agreements in the contract.

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