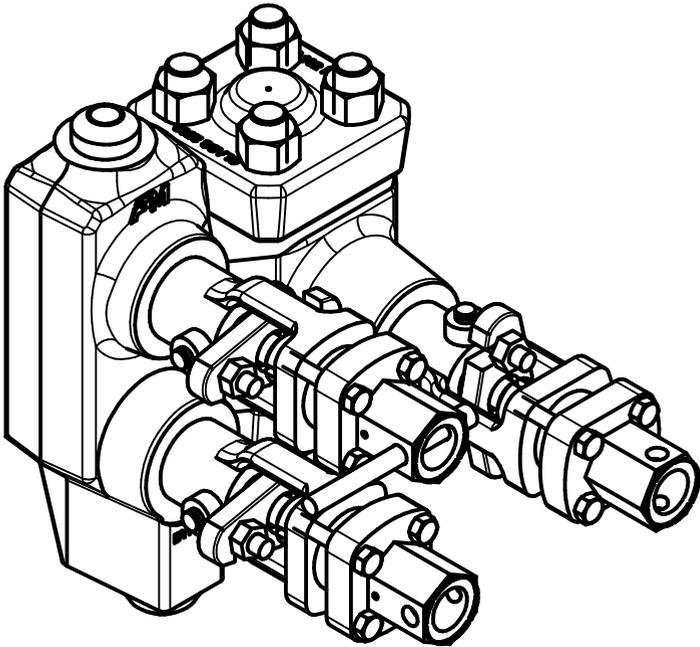


# Installation and Maintenance Manual

## Compact Module Thermodynamic Version (Dv1 and DV2)

CMTD250M



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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.

### **Compact Module – Thermodynamic Trap – (DV1 & DV2) [CMTD250M]**

**Size : DN 15 (1/2”), DN 20 (3/4”) and DN25 (1”)**

#### **PLEASE NOTE:**

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



This symbol denotes **CAUTION, WARNING** or **DANGER**

## 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 Compact Module - Thermodynamic Trap, CMTD250M is designed with an inbuilt inlet isolation valve, bypass valve and trap vent valve for very high pressure steam applications up to 220 bar g @ 374°C. Replaceable trap internals and inbuilt strainer ease online maintenance.

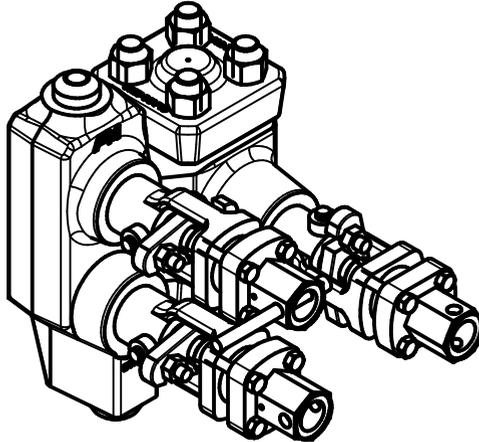


Figure 1: Compact Module – Thermodynamic Trap [CMTD250M]

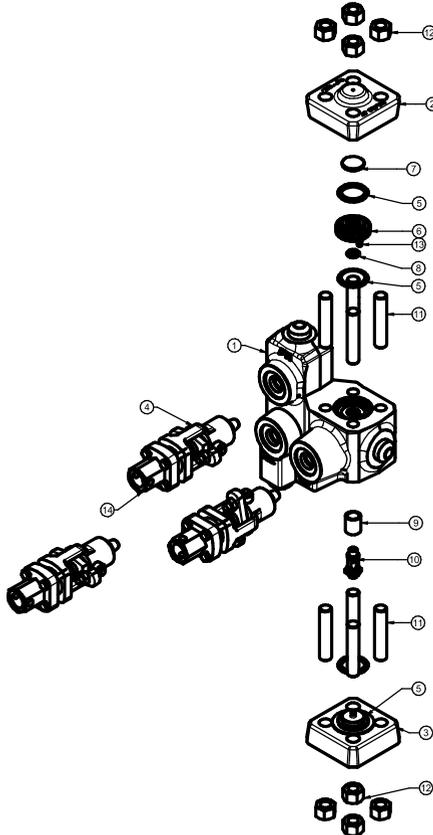
#### 3.2 Available sizes and pipe connections:

INLET (BWE)	OUTLET (BWE)	BYPASS (BWE)	VENT (SWE)
DN25	DN25	DN25	DN25
DN20	DN20	DN20	DN20
DN15	DN15	DN15	DN15

**Note: Available with IBR Certificate.**

#### 3.3 Limiting conditions:

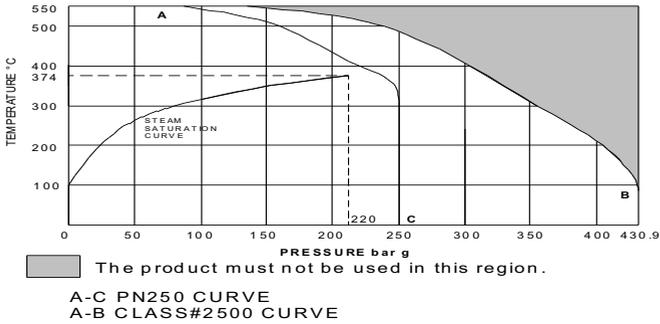
Body design condition	ASME Class #2500
PMA, max allowable pressure	430.9 bar g @ 38 °C
TMA, max allowable temperature	550 °C @ 130.3 bar g
PMO, max operating pressure	220 bar g @ 374 °C
TMO, max operating temperature	550°C @ 125 bar g
Min. allowable temperature	0°C
Max. operating back pressure	80% of upstream pressure
Cold hydraulic test pressure	330 bar g (as per IBR)



**Figure 2: Exploded View of CMTD250M**

NO.	DESCRIPTION	MATERIAL
1.	MODULE BOD	ASTM A182 F22 Cl3
2.	TOP COVER	ASTM A182 F22 Cl3
3.	BOTTOM COVER	ASTM A182 F22 Cl3
4.	BONNET	ASTM A182 F22 Cl3
5.	SPIRAL WOUND GASKET	SS EXFOLIA TED GRAPHITE
6.	SEAT	STEEL BS EN ISO 4957
7.	DISC	STEEL BS EN ISO 4957
8.	SPIRAL WOUND GASKET	SS EXFOLIATED GRAPHITE
9.	SPOOL PIECE	ASTM A276 SS304
10.	SCREEN ASSEMBLY	SINTERED STAINLESS STEEL
11.	STUD	ASTM A193 Gr. B16
12.	NUT	ASTM A194 Gr. 7
13.	FERRULE	ASTM A276 SS304
14.	VALVE KEY	STEEL

### 3.4 Operation Range:



### 3.5 Product Dimension and Drawing:

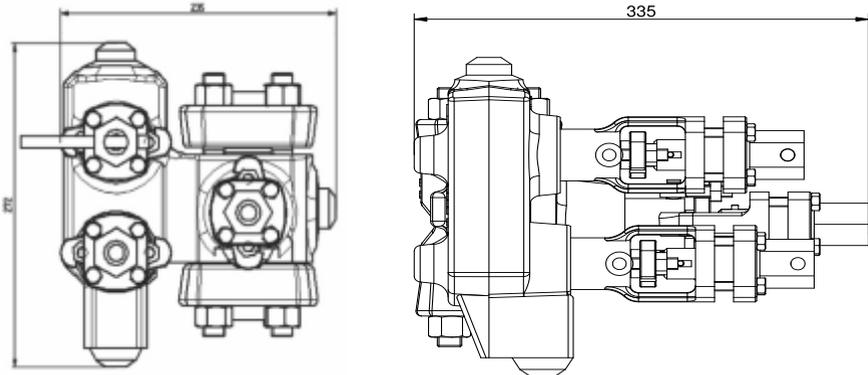
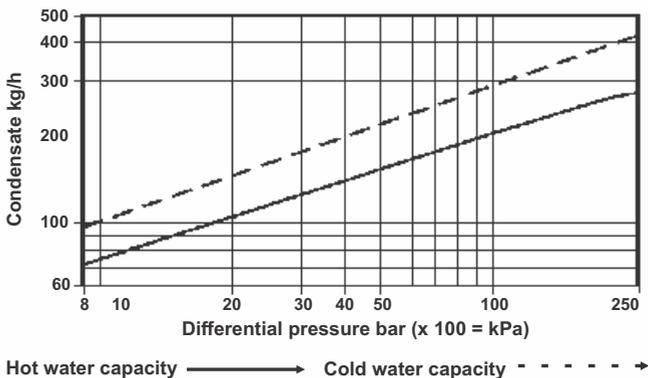


Figure 3 : Dimensional Drawing of CMTD250M

### 3.6 Capacity Chart:



#### **4. Product Working Principle:**

CMTD250M is a compact trap module comprising of a thermodynamic steam trap (which uses a disc to control the release of condensate and to trap steam), upstream isolation valve (to protect the trap), trap depressurization or vent valve (to depressurize the trap before removing the covers for maintenance) and a bypass valve before the trap (to bypass the flow during maintenance of the trap).

During operation, the upstream isolation valve (inlet valve) is kept fully open while the bypass and trap vent valves are tightly shut. The condensate is discharged through the trap.

The paragraph below explains the trap operation.

The trap cycles open and close to discharge condensate close to steam temperature and closes tight between discharges. The disc, which is the only moving part, rises and falls in response to dynamic forces produced by the partial re-evaporation (flashing) of hot condensate.

Cool condensate, air and other non-condensable gases enter the trap through the central orifice, lift the disc, and are discharged through the outlet orifice. When the condensate approaches steam temperature, a portion of it flashes as it enters the trap.

The flash steam passes at high velocity over the underside of the disc and collects in the control chamber above. The resulting pressure imbalance forces the disc downward onto the seating surfaces, stopping the flow. The trap remains tightly closed until the loss of heat through the trap body lowers the control chamber pressure, allowing the inlet pressure to raise the disc and repeats the cycle.

## 5. Installation Guidelines:

**Note: Before implementing any installations observe the 'Important Safety Notes' in Section 2. Referring to the installation and maintenance instructions, name – plate and technical information sheet check the product is suitable for the intended installation.**

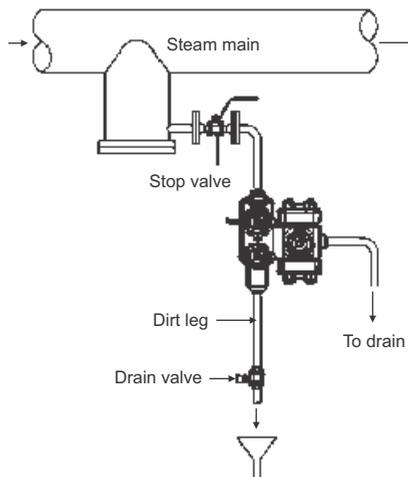
1. Check materials, pressure and temperature and their maximum values. If the maximum operating limit of the product is lower than that of the system, in which it is being fitted, ensure that a safety device is included in the system to prevent over pressurization.
2. Determine the correct installation situation and the direction of fluid flow.
3. Remove protective covers from all connections and protective film from all name-plates, where appropriate, before installation on steam or other high temperature applications.
4. Ensure CMTD250M is properly supported. M12 tappings are given on the rear side of the body for mounting.

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

5. Observe the flow direction markings on the rear side of the trap body. If the 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 shut-off 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. Ensure proper access for removal of the integral strainer screen below the bottom cover. Provide sufficient space above trap assembly for removal of top cover during maintenance.



**Figure 4: Typical installation of CMTD250M**

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

## **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 this step to carry out flushing of lines.

1. Close the upstream isolation valve and open the trap bypass valve respectively
2. Drain the condensate 10-15 minutes or until clear condensate starts coming out, whichever is earlier.

**Note: Trap bypass valve (DV1) should be used to remove muck or dirt and not for welding fluxes and metal burrs. 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 fluid is passing through it.

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

### **6.3. Commissioning with particular reference to venting air:**

With high pressure systems, initial start-up can take several hours to bring the system to normal operating pressure and temperature. Even if the trap has replaced another trap while the main system has remained running, it may still be necessary to vent air from the drip leg. If the trap is at some distance from stop valve, it could be possible that air gets locked in the pipework between valve and the CMTD250M (i.e. the 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 closed, drain valve open, slowly and partially open stop valve. This will discharge the air, condensate and any pipe debris. Valve should be fully closed, and valves and slowly opened to the fully open position.

#### **Important note:**

After the trap has been in service at normal operating pressure and temperature for 24 hours, it is essential that the cover nuts are re-tightened (see Table 2 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 and gaskets replace with new ones.

### 7.1 Routine and Preventive Maintenance:

Please refer to the maintenance schedule mentioned in the table below to undertake routine maintenance of the trap.

Sr. No.	Parameters to be check	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 CMTD250M					Y		
4	Lubrication of upstream and downstream isolation valve					Y		
5	Visual Inspection for leakages			Y				
6	Arresting any other leaks	Y						
7	Isolation Valve for CMTD250M				Y			

### 7.2 Tool Kit:

To carry out maintenance of the Single Orifice Float Trap [SOFT510] refer the tools mentioned in the table below.

Size	Component	Tool used and size
DN 15/20/25	Cover Nut	Box spanner 27 mm (A/F)
	Cover Stud	Stud Runner M18 X 1.5

### 7.3 Recommended tightening torques:

Item	Component	Torque Range
11	Cover Stud	90 – 100 Nm
12	Cover Nut	180 – 200 Nm

**Table 1: Recommended tightening torque**

#### 7.4 Procedure to fit the disc and seat: [Refer figure 2]

1. Unscrew the four nuts (12) and remove the top cover (2).
2. Lift off the disc (7).
3. Remove gasket (5) and lift out the seat unit (6) Insert screwdriver into the groove for easy removal. Ensure that ferrule (13) is also removed.
4. Carefully remove the gaskets (5 + 8) from the body of the trap. Ensure that no damage is caused to the trap body (especially serrations).
5. Ensure that the gasket contact surface in the body is clean and fit new gaskets (5+8).
6. Fit a new seat unit (6) ensuring that ferrule (13) is firmly located in the body.
7. Fit a new gasket (5) and a new disc (7). Ensure that the disc is fitted with the grooves facing the seat.
8. Place the top cover (2) back in position ensuring the cover gasket remains in place.
9. Tighten the nuts (12) diagonally in sequence to a recommended torque. (Refer table 2).

**Note: The use of a thread lubricant (Loctite 767) is recommended.**

After 24 hours check the torque on the top cover nuts (12) and refer table 2.

#### 7.5 Procedure to clean or replace the strainer screen: [Refer Figure 3]

1. Access to the strainer screen can be obtained by removing the bottom cover(3). Use spanner 27 A/F for unscrewing the nuts.
2. Remove the strainer screen assembly (9 +10) using a spanner 22A/F and replace with a new one.
3. Put a new gasket (5) and place the cover (3) back to its position.
4. Tighten the nuts (12) diagonally in sequence to a recommended torque. (refer table 2).

**Note: The use of a thread lubricant (Loctite 767) is recommended.**

#### 7.6 Procedure to replace the cover studs: [Refer Figure 3]

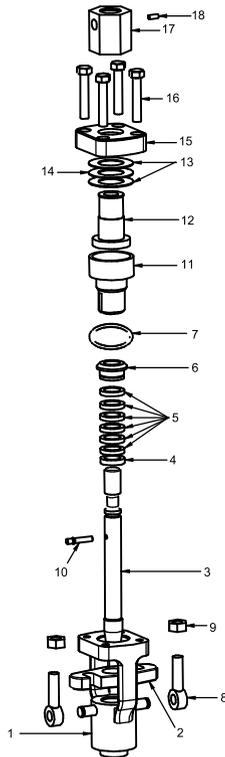
After removing old cover studs (11), fit new cover studs until the studs bottom out. Ensure that the side of the stud with lesser no. of threads engages in the body tapped holes.

**Note : The use of a thread lubricating compound (Loctite 767) is recommended . (Refer table 2 for torque values)**

#### 7.7 Dismantling the Bonnet Assemblies: (Refer figure 5)

1. Loosen the grub screw (18) from the valve key (17) and remove the valve key.
2. Unscrew allen screws (16) and remove cover (15).
3. Unscrew and remove yoke bush (12) along with needle roller bearing (14) and thrust washers(13)Note: Left Hand threads.
4. Loosen and remove gland nut (9) and washer.
5. Tilt thrust ring (7) and push it through the gland flange each tilted in opposite direction.
6. Remove thrust ring (7) and stuffing box (6).
7. Remove spindle (3), packing rings (5) and bottom ring (4) from the body- use suitable tool for this.
8. Replace the worn out parts and reassemble.

9. Prevent damage to gland packing. Unless instructed otherwise, the parts listed below have to be lubricated with Molykote 30 grease before assembly
10. Threaded nuts, bolts and studs as well as their contact surfaces and other threaded parts not in contact with the process medium.
11. Needle bearing.
12. Clean the valve unit before lubrication.



**Figure 5: Exploded View of Bonnet Assembly**

### 7.8 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 Compact Module –ThermodynamicTrap [CMTD250M],check the following for appropriate corrective measures.

Failure Mode	Possible Cause	Remedy
<b>No Condensate is discharged (blocked).</b>	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.
	No condensate discharge	Ensure Upstream &downstream isolation valves are fully open.
	Seize of the isolation valve	Lubricate the valve frequently with *Molykote M30 oil.
	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>	Check trap bypass valve (Dv1) and trap vent valve (Dv2) is open or partial closed.	Ensure Bypass valve (DV1) and Trap Vent Valve (DV2) is fully closed.
	Improper installation of the product	Check installation i.e .top cover to be on top and fluid flow direction same as arrow on the steam tap body
	Stem-piston is damaged or corroded.	Check scouring, corrosion have occur on Stem Piston of upstream valve, Bypass Valve (DV1) and trap vent valve (Dv2). If damaged replace with new stem piston and lubricate stempiston with *Molykote M30 oil
	Sealing stack is worn-out.	Check Sealing Stack of upstream isolation valve, Bypass valve (DV1) and trap vent valve (DV2)are damage or worn. If worn-out replace with new sealing stack and Hex nut should be tight with proper torque.
	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 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 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 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:**

Always order spares part by using the description and Spare Code No. given below & stating size

Sr. No.	Spares	Spare Code
1.	DN 15/20 CMTD250M FASTNER KIT	SPARE-CMTD250M-FKIT
2.	DN 15/20 CMTD250M GLAND PACKING KIT	SPARE-CMTD250M-GKIT
3.	DN 15/20 CMTD250M SPINDLE BUSHING KIT	SPARE-CMTD250M-SBKIT
4.	DN15/20 CMTD250M SPARE SEAT AND DISC KIT	SPARE-CMTD250M-SDKIT

**How to Order:**

**Example: 1 No. of Compact Module - Thermodynamic Trap (DV1 & Dv2), CMTD250M, DN 25 butt weldable end connection, IBR.**

**10. Warranty Period:**

As per ordering information and agreements in the contract.



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