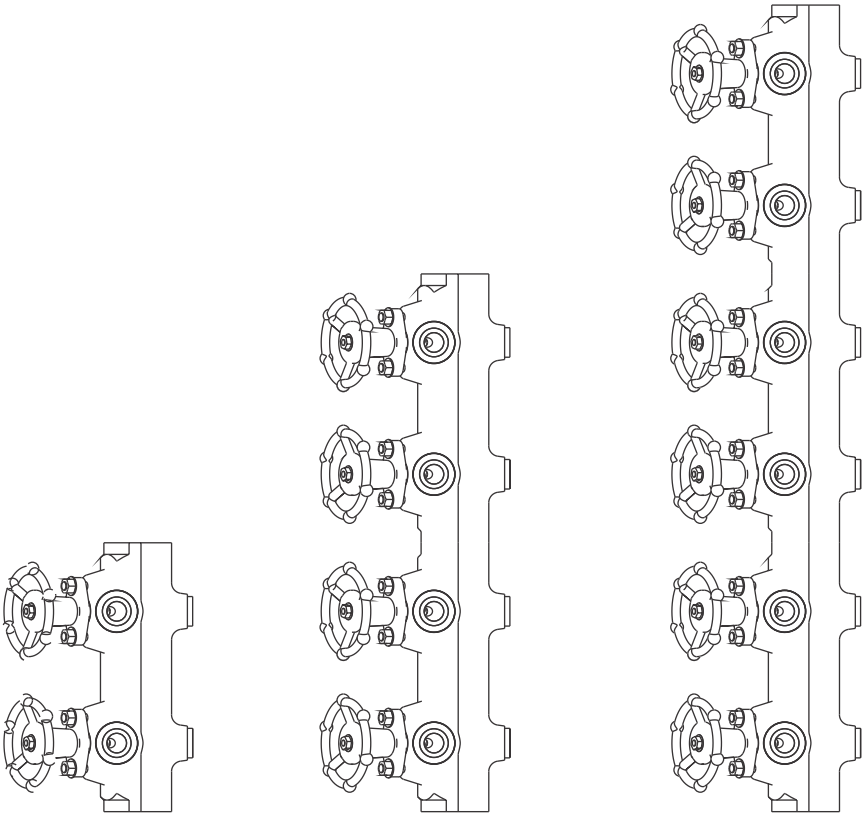
Installation and Maintenance Manual

Forbes Marshall Steam and Condensate Manifold

FMSCM4X, FMSCM8X, FMSCM12X



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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 Steam and Condensate Manifold [FMSCM4X, FMSCM8X, FMSCM12X]

Tracer Line Size: DN 15 (½") / DN 20 (¾")

Main Line Size : DN 25 (1"), DN 40 (1-1/2"), DN 50 (2")

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 Description:

3.1 Description:

The Forbes Marshall Steam and Condensate Manifolds (FMSCM4X, FMSCM8X, FMSCM12X) are forged carbon steel compact manifolds with integral piston type stop valves. They can be used for either steam distribution or condensate collection depending on the way they are installed.

3.2 Available Types, Size and Pipe Connections

FMSCM manifolds are available with 4, 8 or 12 connections with ends,

- flanged to BS 1560 (ANSI) class 150/300 or
- socket weld to ANSI B 16,11 Class 3000 or
- screwed BSPT or NPT

The steam main / condensate return connection is DN 25, DN 40 & DN 50.
The tracer line and drain connections are available as DN 15, DN 20 Flanged screwed BSP, NPT and socket weld to ANSI B 16,11

3.3 Optional Extras:

The following are available at extra cost.

- Mounting kit comprising of studs, spacers and nuts
- Insulation jacket for body and flanges

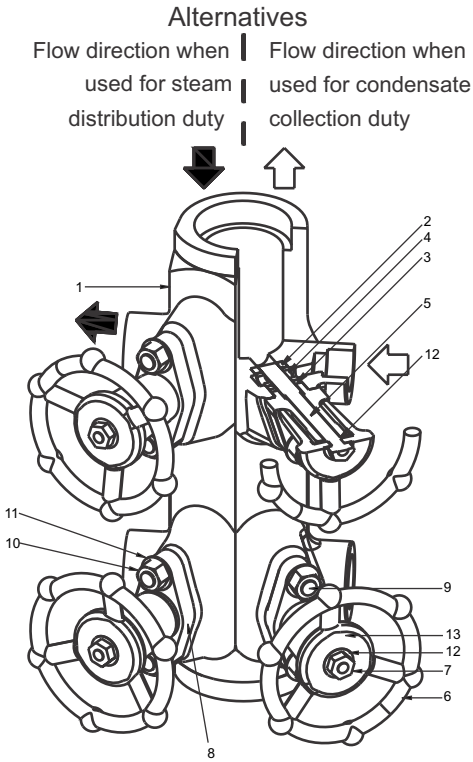


Figure 1: Forbes Marshall Steam and Condensate Manifold

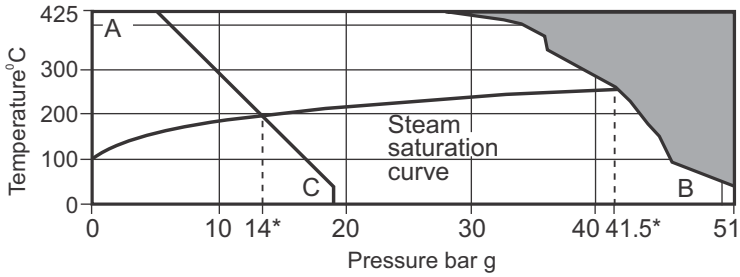
Material

No	Part	Material	Standard
1	Body	Carbon Steel	ASTM A105
2	Lower ring	Graphite and stainless steel	
3	Upper ring	Graphite and stainless steel	
4	Lantern ring	Stainless Steel	ASTM A 276 SS410
5	Piston	Stainless Steel	ASTM A 276 SS316
6	Handwheel	SG Iron / Malleable Iron	
7	Hand wheel nut	Stainless Steel	SS304
8	Bonnet	Carbon steel	ASTM A105
9	Studs	Stainless Steel	ASTM A 193Gr. B7
10	Nuts	Stainless Steel	ASTM A 194Gr. 2H
11	B. washer	Spring Steel	EN 40
12	Washer	Stainless Steel	SS304
13	Name-plate	Stainless Steel	ASTM A 240 SS304

3.4 Limiting Conditions:

Body design conditions		ANSI Class 300 (ISO PN50)
PMA max. allowable pressure		51 bar g @ 38°C
TMA max. allowable temperature		425°C @ 28 bar g
Min. allowable temperature		-29°C
PMO	Max. operating pressure for saturated steam service	Class 150 14 bar g
		Class 300, SWE, BSPT/NPT 41.5 bar g
TMO	Max. operating temperature	Class 150 425°C @ 5.5 bar g
		Class 300 425°C @ 28 bar g
Min. operating temperature		0°C
Max. cold hydraulic test pressure		76 bar g

3.5 Operating Range:



The product must not be used in this region.

* PMO Maximum operating pressure for steam service.

A-B Flanged ANSI Class 300, Screwed and Socket weld.

A-C Flanged ANSI Class 150.

3.6 Product Dimension and Drawing:

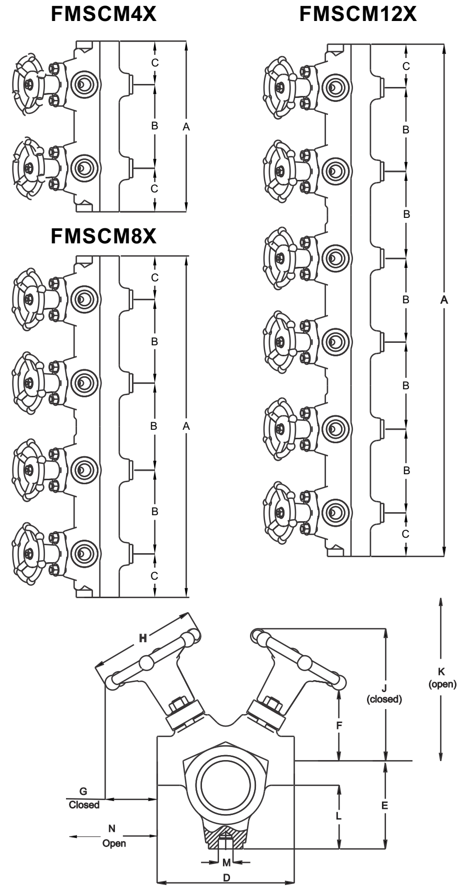


Figure 2: Dimension drawing of FMSCM4X, FMSCM8X, FMSCM12X

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Type	?	B	C	D	E	F	G	H	J	K	L	M	N	Wt (Kg)
FMSCM4X	255	125	65	110	70	78	45	96	110	130	50	M12	55	8.5
FMSCM8X	505	125	65	110	70	78	45	96	110	130	50	M12	55	17
FMSCM12X	755	125	65	110	70	78	45	96	110	130	50	M12	55	25.5
Dimensions (approx.) in mm For Main line size: 50NB														
Type	A	B	C	D	E	F	G	H	J	K	L	M	N	Wt (Kg)
FMSCM4X	255	125	65	126	78	78	45	96	110	130	58	M12	55	12.5
FMSCM8X	505	125	65	126	78	78	45	96	110	130	58	M12	55	21
FMSCM12X	755	125	65	126	78	78	45	96	110	130	58	M12	55	29.5

4. Operation: (Refer to Figure 1)

The integral isolation valve in Forbes Marshall steam and condensate manifold is operated manually by a handwheel (6) it should be either fully open or fully closed. To open the integral isolation valve turn the handwheel (6) in the anticlockwise direction until it stops completely. To close the integral isolation valve turn the handwheel (6) until it stop rotating further.

Note: The piston spindle should be periodically checked to ensure adequate lubrication is present to ensure efficient valve operation. For Lubrication 'Molykote M30' lubricating oil is recommended.

Important Note: Do not use integral isolation valve for throttling which result in excessive wear of internals. Operation of the handwheel (6) should always be by the hand, it is not recommended to use a valve key or F key. If the handwheel (6) is over-tightened, damage of the integral isolation valve internals may occur.

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 the suitable for intended installation.

5.1. Installation of Forbes Marshall Steam and Condensate Manifold:

1. Check materials, pressure and temperature and their maximum values.
2. Installation condition and the direction of fluid flow should be correct.
3. Protection covers from all connections and protective film from all nameplates should be removed before installation on steam or other high temperature applications.

   Note: Lubricate the product before installation as indicated if stored for more than 6 months.

4. **General information: The Forbes Marshall Steam and Condensate Manifold can be** installed in either direction most preferably in vertical position. Ensure that there is sufficient access to the handwheel to allow proper operation. The back is provided with M12 threaded connections for attaching to a supporting structure. For ease of installation it is recommended that spacers are fitted to give the manifold a stand-off of at least 50 mm as shown in fig. 3.

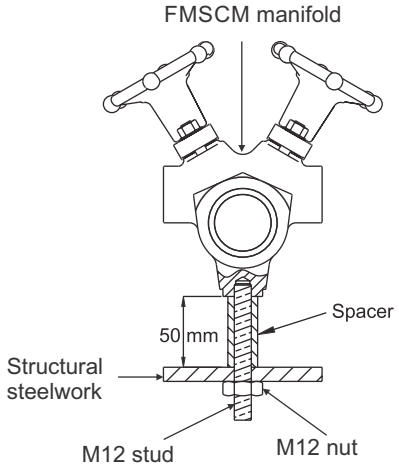

Figure 3: Installation view of Forbes Marshall steam and condensate manifold

5. **Steam distribution duty – The FM steam manifold is installed vertically and when** used for steam distribution, the inlet connection must be at the top. A steam trap must be fitted at the bottom and the discharge can be returned if isolation valve and non-return valve is fitted downstream side of the trap. It is recommended to fit a diffuser at the end of the pipe connection incase the discharge is open to atmosphere.

6. **Condensate distribution duty – The FM condensate manifold is installed vertically** and when used for condensate collection the condensate inlet connection must be at the bottom. The bottom of the FM condensate manifold must have a piston valve for blow down purpose. It is recommended to fit a diffuser at the end of the pipe connection incase the discharge is open to atmosphere.

7. **Pipeline welding – When installing any welding it should be carried out to an** approved procedure of a recognized standard.

8. After installation it is recommended that the FM steam and condensate manifold is insulated to minimise radiation heat losses and to protect personnel from burn risks. This can be done using the optional insulating jacket.

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

5.2. Available mounting kit sets:

1. FMSCM 4X: A single set comprising of two M12 studs, two M12 nuts and two spacers.
2. FMSCM 8X: A single set comprising of four M12 studs, four M12 nuts & four spacers.
3. FMSCM 12X: A single set comprising of six M12 studs, six M12 nuts and six spacers.

5.3. Typical installation of Forbes Marshall steam and condensate manifold:

5.3.1. Forbes Marshall Steam Manifold:

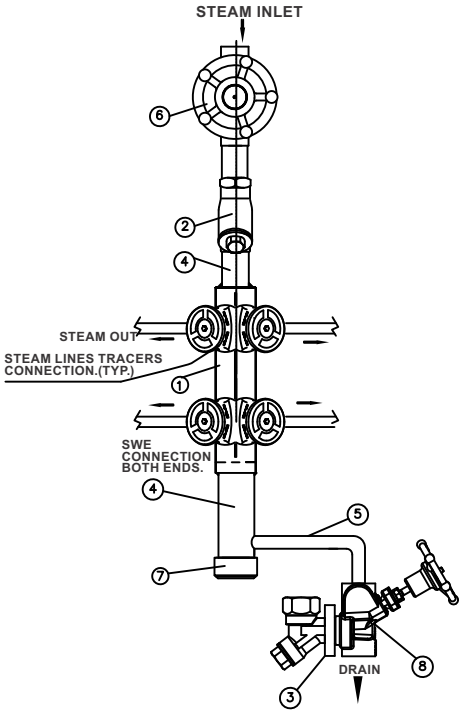

Figure 4: Typical installation of Forbes Marshall Steam Manifold

Part No.	Description
1	Forbes Marshall Steam Manifold
2	Strainer
3	Forbes Marshall universal thermodynamic trap [FMTD64-U]
4	Seamless Pipe SCH 80
5	Seamless Pipe SCH 80
6	Piston Valve
7	Cap SWE
8	Forbes Marshall Pipeline Conncector [FMPC52]

5.3.2. Forbes Marshall Condensate Manifold:

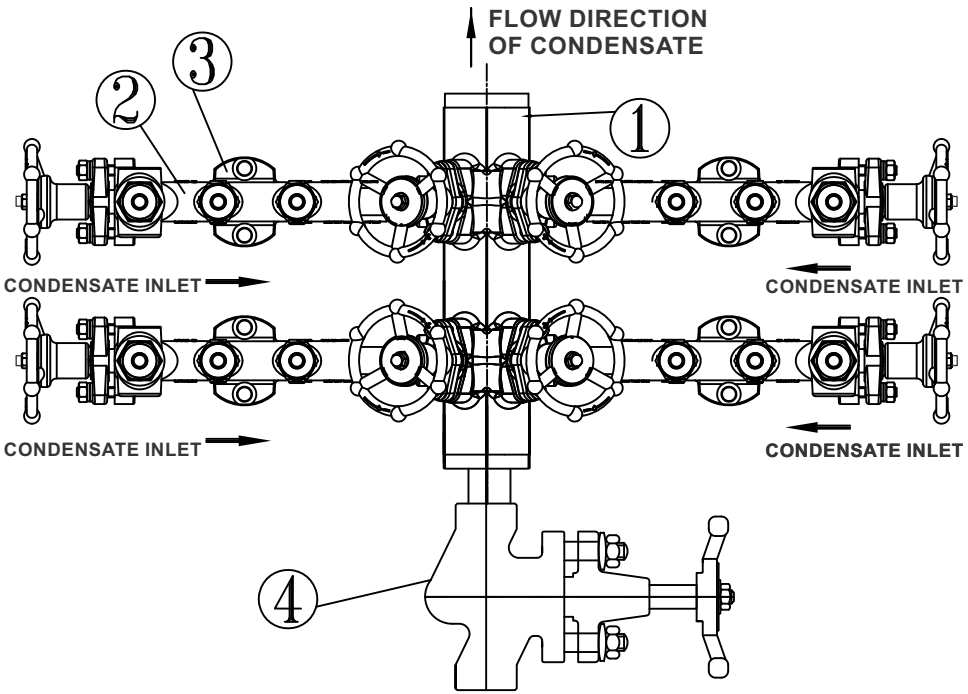

Figure 5: Typical installation of Forbes Marshall Condensate Manifold

Part No.	Description
1	Forbes Marshall Condensate Manifold
2	Forbes Marshall Pipeline Conncector [FMPC53]
3	Forbes Marshall Universal tracer line trap [FMT63-U]
4	Piston Valve

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.

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.

6.1.1. Forbes Marshall Steam Manifold: [Refer figure 4]

1. Close the piston valve (6) and integral isolation valves of steam manifold (1).
2. Ensure the piston valve (6) is closed, open the strainer cap of the strainer (2) and trap bypass valve (DV1) of the FM Pipeline Connector [FMPC52]
3. Drain the fluid for atleast 10 -15 minutes or until clear fluid start coming out, whichever is earlier.
4. Close the piston valve (6) slowly ensure no steam is passing through the strainer (2). Refit the strainer cap in strainer (2) and close the trap bypass valve (DV1) of the FM Pipeline Connector [FMPC52]
5. Open the piston valve (6) and integral isolation valves of steam manifold (1).

6.1.2. Forbes Marshall Condensate Manifold: [Refer figure 5]

1. Close the integral isolation valves of FM condensate manifold (1).
2. Open the piston valve (4) and drain the condensate for atleast 10 -15 minute or till clear condensate start coming out, whichever is earlier.
3. Close the piston valve (4) and open the integral isolation valves of FM condensate manifold (1).

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 fluid is passing through it.

1. After flushing of lines is complete, ensure the trap bypass valve of FM Pipeline connector [FMPC52] is closed and integral isolation valve of FM steam manifold is opened, similarly for FM condensate manifold ensure piston valve is closed and integral isolation valve of condensate manifold is opened respectively.
2. Checks 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. Once completed open the product slowly and check for leaks.

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 steam and condensate manifold.

SR. NO.	PARAMETERS TO BE CHECKED	FREQUENCY FOR CHECKING VARIOUS PARAMETERS					
	FM STEAM AND CONDENSATE MANIFOLD	Daily	Weekly	Monthly	Quarterly	Half yearly	Annually
1	Manually Operate the valve			Y			
2	Lubrication of piston type isolation valve				Y		
3	Visual inspection and cleaning of threads				Y		
4	To clear dirt or muck from condensate manifold through downstream piston valve.		Y				
	To clear dirt or muck from steam manifold through trap by-pass valve (DV1) in FMPC52.						

7.2. Tool Kit:

To carry out maintenance of the FM manifold refer the tools mentioned in the table below.

Sizes	Component	Tool used & size
DN 15 /20	M8 Studs	Stud Runner M8 x 1.25
	Handwheel nut	Box spanner 10 mm (A/F)
	Bonnet nut	Box spanner 13mm (A/F)
	Sealing stack	Insertor tool (Available as spares)
	Sealing stack	Extractor tool (Available as spares)

7.3. Recommended tightening torques:

Part No.	Component	or mm		Torque
7	Handwheel Nut	10 A/F	M6	0.1 Nm
10	Bonnet Nut	14/F	M8	9 -10 Nm

Table 1: Recommended tightening torques

7.4. Procedure to service: [Refer Fig. 1]

Note: The graphite stem sealing stacks (item 2 and 3) contain thin stainless support stacks which may cause physical injury if not handled and disposed of carefully.

1. **Hot Tightening: After steam and condensate manifold is put into service (8 to 12** hours) or after a change of sealing stacks (2 and 3), verify the bonnet nuts (10) should be tightened to the recommended torque with the valve in the closed position.

   Note:Never tighten nuts when valve is in open condition.

2. Ensure the bonnet (8) is driven down straight during tightening and that care is taken with the handwheel (6) operation. This operation is to be repeated should any trace of leakage develop.
3. If perfect sealing cannot be achieved in this way, repack the valve following the procedure below. A small diameter hole evident in the bonnet (8) is primarily to prevent pressurization within the bonnet (8), but is useful for observing leaks past the upper sealing stack (3) and for lubrication of the piston (5) when the valve is closed..

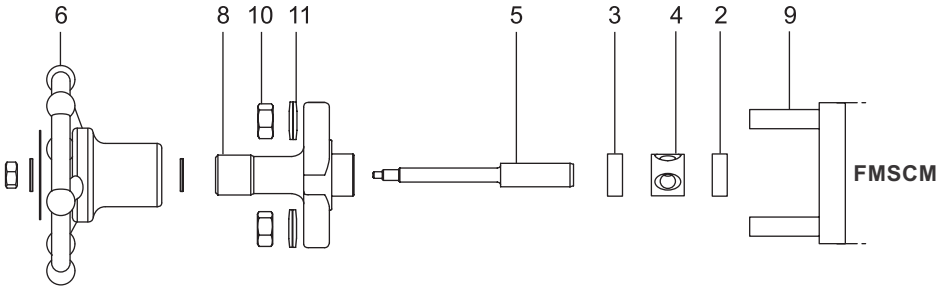

Figure 6: View showing valve internals OF FMSCM manifold

7.5. Procedure to Dismantle the integral isolation valve: [Refer Figure 6]

1. Turn the handwheel (6) to fully open the valve.
2. Remove the nuts (10) and washers (11) from the studs (9).
3. Carefully turn the handwheel in the closing direction to lift the bonnet (8).
4. Rotate the bonnet (8) to ensure that the flange bolt holes are misaligned with the studs (9).
5. Turn the handwheel (6) in the opening direction to release the piston (5) from the sealing stack (2 and 3) and so release the piston / bonnet sub-assembly from the body.
6. Examine the piston (5) for signs of scoring, corrosion etc., which may affect perfect tightness of the valve.
7. Check other parts for wear / damage and replace if necessary

7.6. Procedure to Repack the integral isolation valve: [Refer Figure 6 and 7]

1. With the valve dismantled, insert the valve internals with extractor tool through the two sealing stack (2 and 3) and the spacer (4).
2. Firmly tap to ensure that the tool bottoms out in the bore and with a quarter turn of the handle carefully remove the two sealing stack (2 and 3) and the spacer (4).
3. Thoroughly clean the sealing stack housing and all the internals.
4. Fit new lower sealing stack (2), spacer (4) and new upper sealing stack (3) using Insertor tool. Use mallet to apply light strokes on insertor tool ensuring they fit perfectly.

   Note: The lower sealing stack (2) and upper sealing stack (3) are the same.
5. Apply a thin layer of graphite based grease to threads only (not to internals and stem piston).

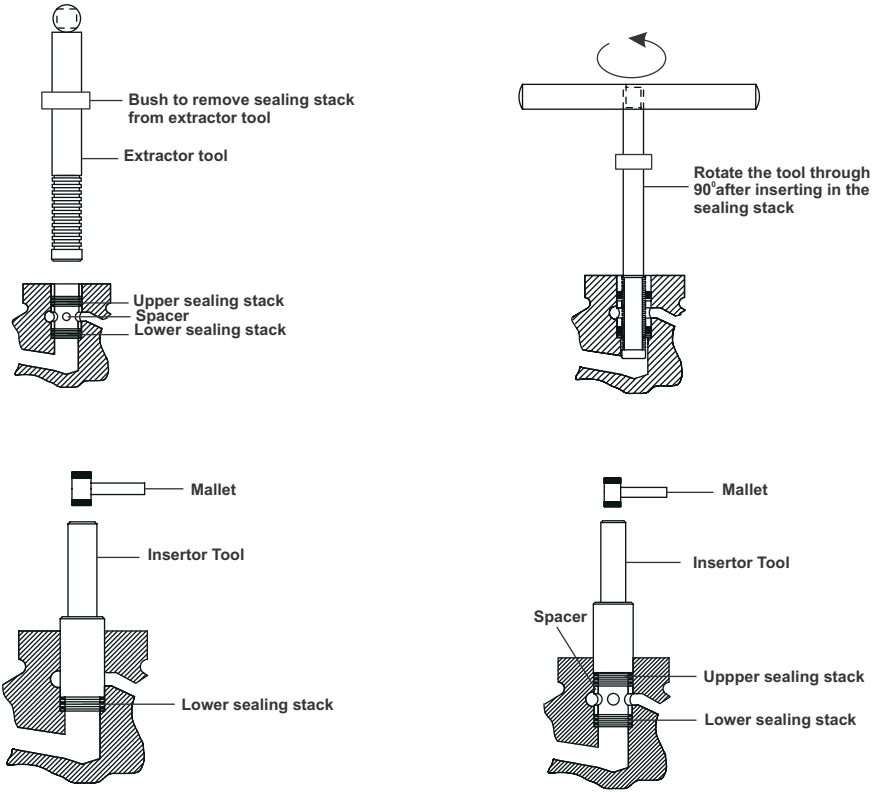

Figure 7: View showing extractor tool and insertor tool.

7.7. Procedure to reassemble the integral isolation valve: (Refer fig. 6)

1. Take the piston / bonnet sub-assemblyand turn the handwheel (6) in the opening direction up to the stop.
2. Insert piston (5) into the upper sealing ring and push it down until it is possible to fit washers (11) and screw nuts (10) onto the studs (9) and then hand tighten.
3. Shut the valve fully, ensuring that the bonnet (8) is driven down straight, gradually tighten the nuts to the recommended torque (refer Table 1).
4. If any insulation was present then refit it again.

7.8. Lubrication procedure for integral isolation valve:

Clean the valve unit before lubrication. For lubrication use *Molykote M30 lubricating oil. Lubricate piston through the hole provided in the bonnet and bonnet threading on quarterly basis.

Note: *Molykote M30 lubricating oil is not available please use equivalent lubricating oi with specification as mention in Table no.2.

8. Troubleshooting:

If the expected performance is unachievable after installation of the Forbes Marshall steam and condensate manifold, check the following points for appropriate corrective measures.

Failure Mode	Possible Cause	Remedy
Inadequate flow rate at outlet.	The integral isolation valve is not completely open.	Ensure the integral isolation valve is completely open.
Fluid leakage from end connection.	End connection is not tight.	Tighten the end connection with proper torque for flange end and tighten the screwed end manifold.
Fluid Leakage from bonnet and body of the integral isolation valve.	Sealing stack worn out.	If any leakage is observed in integral piston type isolation valve through bonnet hole, first close the valve till handwheel touches bonnet and then tighten all the nuts equally half or one turn until leakage stops. (Refer table 1 for recommended tightening torques) **Note: Never tighten nuts when valve is in open condition.** If leakage does not stop dismantle the valve, check if sealing stack is worn-out. If worn-out replace with new set of sealing stack.
	Piston is damaged or corroded of the integral isolation valve.	Check if piston is damaged due to scouring, corrosion of the integral isolation valve. If damaged replace with new piston kit.
Excessive force is required to turn the handwheel.	Seizing of the integral isolation valve.	Lubricate the valve using *Molykote M30 lubricating oil on quarterly basis spindle through the hole provided in the bonnet and bonnet threading on quarterly basis.

Note: Never attempt to modify the product. When replacing old parts with new parts, use the spare parts listed in Section 9.

*Molykote M30 lubricating oil is not available please use equivalent lubricating oil with specification as mention in table 2.

Specification of Molykote M30			
Colour			Black
Composition			Synthetic oil Molybdenum disulphide
Density	**Density at 20°C (68°F) (Standard - DIN 51 757)**		1.0 g/ml
Viscosity	**Base oil viscosity at 40°C (104°F) (Standard - DIN 51 562)**		120 mm3/s
Temperature	**Service temperature range**		Oil lubrication up to +200°C (397°F)
			Dry lubrication up to +450°C (842°F)
Load –carrying capacity, wear protection.	**Four-ball tester (VKA)**	**Weld Load (Standard – DIN 51 562 pt.2)**	2000 N
		Wear scar under 800 N (Standard – DIN 51 350 pt.3)	1.02 mm
		Almen-Wieland machine OK load.	20000 N
Storage life			1 years.

Table 2: Specification of Molykote M30

9. Available Spares:

The spare parts available are detailed below. For ease of replacement an extractor tool and insertor tool are available for removing and replacing the sealing stack respectively

Spares	Part No.	Spare Code
Sealing stack set (spare set of 10 rings)	2,3	FGS2036525
Extractor tool and Insertor tool	Refer figure 7	FGS2036526

How to Order:
Example : 1 No. Forbes Marshall steam distribution and condensate collection manifold FMSCM8X in forged carbon steel body with integral piston valves having 8 x DN 20 socket weld connections to ANSI B 16.11 Class 3000.

How to Order Spares:
Always order spares by using the description given in the column headed “Available Spares” and state the type and size of manifold.
Example: Sealing ring set for an integral piston valve on a forged manifold SCM DN 15 socket weld.

10. Warranty Period:

As per ordering information and agreements in the contract.

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