

Installation and Maintenance Manual

Pressure Powered Pump Package Unit with Insulation Jacket

PPPPU

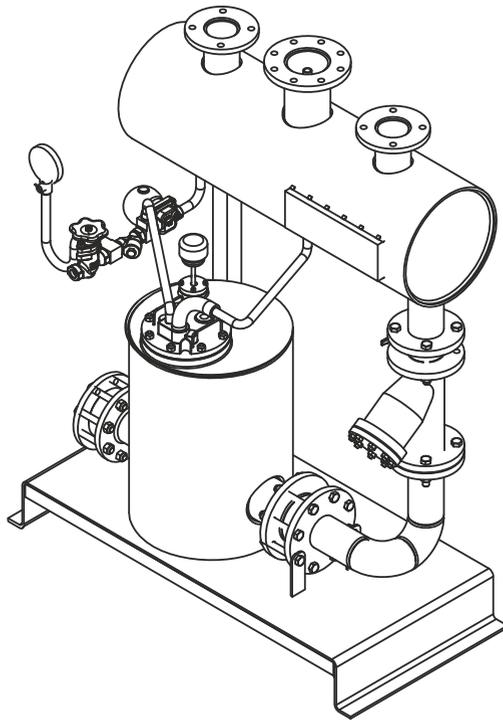


Table of Contents

1.	Preface	1
2.	Important Safety Notes	1
3.	Brief Product Information	3
4.	Product Working Principle.....	10
5.	Installation Guidelines	12
6.	Startup and Commissioning.....	14
7.	Maintenance Guidelines	16
8.	Troubleshooting	19
9.	Available Spares	21
10.	Warranty Period	24

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.

Pressure Pump Insulation Jacket ,[PPPPU]

Size: DN40 (1 ½”), DN50 (2”), DN80 (3”)

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 2.8) 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

1. 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.
2. Check for the suitability in conformance to the limiting conditions specified in technical information sheet of the product.
3. The correct installation and direction of fluid flow has to be determined.
4. 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 liquids or gases in the pipeline:

Contemplate what may have been in the pipe or is in the pipe and also for flammable materials, substances hazardous to health, extremes of temperature.

2.4 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.

2.5 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.

2.6 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.

2.7 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.

2.8 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

2.9 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.

2.10 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.

2.11 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.

2.12 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 Pressure Powered Pump Package Unit, PPPPU, is a positive displacement pump unit operated by steam, compressed air or pressurized gas designed to pump hot condensate.

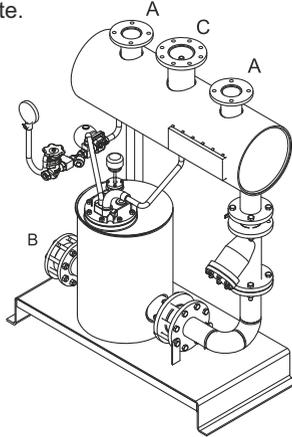


Figure 1 : Pressure Powered Pump Package Unit

3.2 Sizes and Pipe Connections:

Size (DN)	Condensate inlet conn. (A) (DN)	Pump outlet conn. (B) (DN)	Vent conn. (DN)	Empty weight
1-1/2"	2"	2"	4"	540 lbs
2"	2"	3"	4"	772 lbs
3"	3"	3"	4"	870 lbs

SIZE : 1-1/2", 2" and 3" pressure powered pump package unit.

Condensate inlet : vent flanged to class 150

Condensate outlet : use flange provided with pump

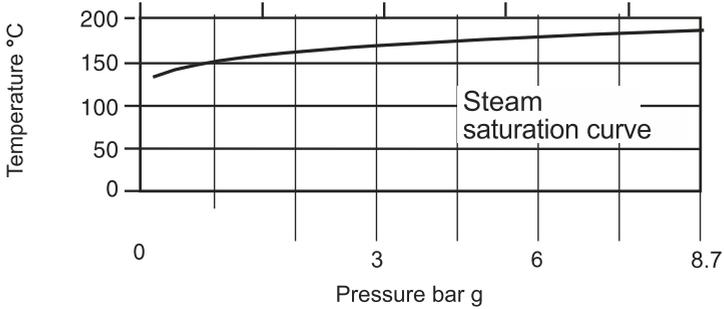
3.3 Limiting Conditions:

PMA Maximum design pressure	126.183 psi
TMA Maximum design temperature	428°F
Operating inlet motive pressure	Steam / Compressed Air / Pressurised gas 43 - 126 psi g (max)
Pump discharge per cycle	66 lb
Steam consumption	6.61 lb of steam per 2204 lb liquid pumped
Air consumption	22 SCF per 2204 lb liquid pumped
Minimum operating temperature	32°F

Minimum Operating back pressure : 58 psi g

Note: For lower operating temperatures consult Forbes Marshall

3.4 Operating Range:



3.5 Standard Accessories:

Condensate recovery meter - 485 (CRM485R)
and insulation jacket

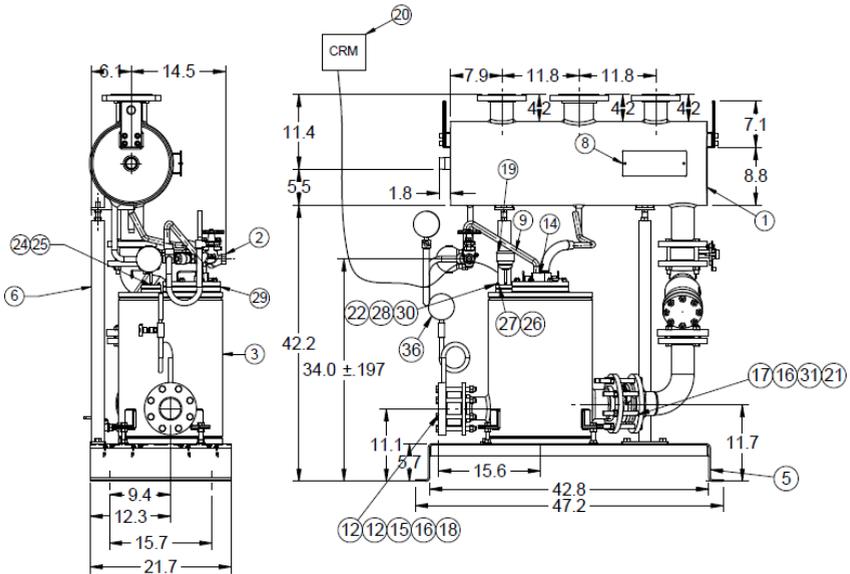
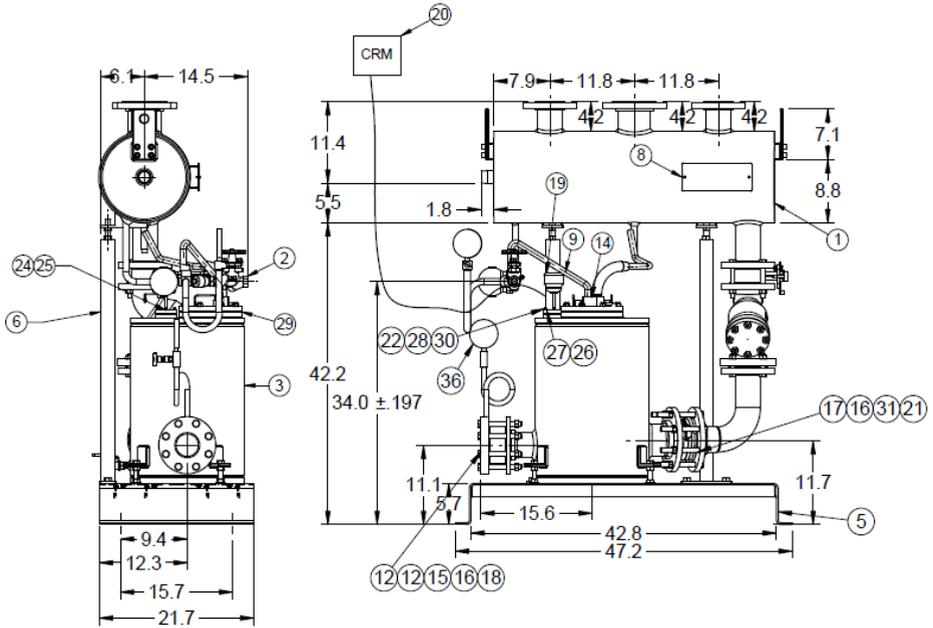


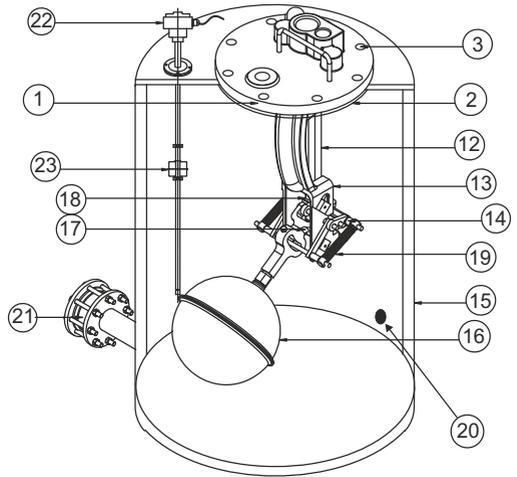
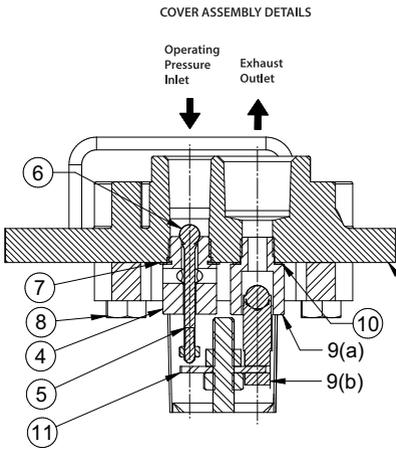
Figure 2 : Detail of Pressure Powered Pump Package Unit with IJ and CRM485R



Sr. No.	Description	Material	Standard
1	Receiver Pipe	Carbon steel	IS3589
2	Steam Inlet Connection Assembly	Carbon steel	
3	Shell Pipe	Carbon steel	IS3589
4	Condensate Inlet Assembly	Carbon steel	
5	Frame Assembly		IS2062
6	Support Assembly	Structural steel	IS1061/1062
7	Actuator Mechanism Assembly	Carbon steel	
8	Nameplate	stainless steel	SS304
9	½" Steam Inlet Hose 500 Long	stainless steel	SS304
10	1" Exhaust Hose 500 Long	stainless steel	SS304
11	Check Valve Outlet	stainless steel	
12	Table F Flange	Carbon steel	SA516 Gr 70
13	1" BSPT (m) 90 Deg Bend	Carbon steel	A106 GR B
14	½" BSPT Pipe Nipple 100mm Length	Carbon steel	A106 GR B
15	M16 X 120L Hex Head Bolts	Mild Steel	
16	M16 Nut	Mild Steel	
17	Check Valve Gasket	SS304 Exfoliated Graphite	
18	Check Valve Gasket	SS304 Exfoliated Graphite	
19	Reed Sensor Assembly	Stainless Steel	

	Description	Material	Standard
20	Condensate Recovery Meter Unit		
21	Inlet Check Valve	Stainless steel	
22	Reed Sensor Flange		IS2062
23	M16 X 110L Hex Head Bolts	Mild Steel	
24	Stud M12 X 50L	Carbon Steel	EN9
25	Nut M12	Mild Steel	
26	Stud M6 X 35L		ASTMA 193 Gr B7
27	Nut M6		SS304
28	Sensor Mounting Flange		IS2062
29	Mechanism Gasket		Asbestos Free AF154
30	Reed Gasket		SS304 Exfoliated Graphite
31	M 16 X 130L Hex Head Bolts	Mild Steel	
32	Condensate Line Support	Mild Steel	
33	M16 X 70L Hex Head Bolts	Mild Steel	
34*	Ball Valve	Carbon steel	
35	Pressure Gauge Steam	Stainless steel	
36	Pressure Gauge Outlet	Stainless steel	
37	Receiver Nozzles	Carbon steel	IS1239
38	Receiver Flanges	Carbon steel	

* Item not shown in figure



Material

Sr. No.	Description	Material	Standard	Sr. No.	Description	Material	Standard
1	Cover	Cast Iron	IS 210 Gr FG 260	12	Push Rod	Stainless Steel	ASTM A240 SS 304
2	Cover Gasket	Synthetic Fibre	AF154	13	Mechanism	Cast Iron	IS 210 FG 260
3	Stud and Nut M - 12	Carbon Steel	-	14	Mechanism Actuator	Stainless Steel	SS304
4	Inlet Valve Seat	Stainless Steel	ASTM A276 SS 304	15	Body	Carbon Steel	IS 3589
5	Inlet Valve Stem	Stainless Steel Type 304	ASTM A276	16	Float	Stainless Steel	ASTM A240 SS 304
6	Inlet Valve Head	Stainless Steel	-	17	Linkage Mechanism	Stainless Steel	ASTM A351 CF 8
7	Inlet Seat Gasket	Copper	-	18	Push Rod Actuator	Stainless Steel	ASTM A351 CF 8
8	Exhaust Valve	Stainless Steel	ASTM A276 SS 304	19	Spring	Inconel	-
9(a)	Exhaust Valve	Stainless Steel	ASTM A276 SS 304	20	Plug 1/2"BSPT	Forged Steel	ASTM A105
9(b)	Exhaust Valve Head	Stainless Steel	ASTM A276 SS304	21	Check Valve	Stainless Steel	-
10	Exhaust Seat Gasket	Copper	-	22	Flow-temp Sensor	Stainless Steel	-
11	Valve Actuator Disc	Stainless Steel	ASTM A276 SS 304	23	Sensor Float	Stainless Steel	ASTM A240 SS 304

3.6 How to Select and Size:

Select the pump size according to the capacity requirement of the application from the inlet, back pressure and filling head conditions given in the table below.

$$\text{Back pressure (h)} = [\text{H} \times 0.1 \text{ bar g}] + \text{FP bar g} + \text{LP bar g}$$

where H=height to which condensate is to be lifted in mtrs.

FP= Frictional pressure drop of discharge

LP=Line Pressure

3.7 Capacity kg/hr.:

Capacity lbs/hr.

When installed with recommended filling head above top of pump :-
12". For liquid specific gravity (0.9 to 1)

MOTIVE STEAM				
Pressure (psig)		Capacity (lbs/hr)		
Motive	Back	1½"	2"	3"
125	15	7264	10262	13591
	30	6570	8300	11221
	45	6019	7948	8653
	60	5302	6834	7705
115	15	7187	9789	12853
	30	6371	8069	10042
	45	5456	6603	8311
	60	5181	5831	6504
100	15	7121	9248	12225
	30	6239	7529	9788
	45	5335	6460	7749
	60	4835	5743	6294
90	15	6867	8322	11486
	30	6173	7209	9458
	45	5126	5952	7551
	60	4619	4839	5997
75	15	6625	8168	11133
	30	5809	6735	9127
	45	5049	5523	6768
60	7.5	6823	8565	11993
	15	6250	7518	9833
	30	5247	5963	7088
45	7.5	6548	7804	10373
	15	5666	6482	8102

MOTIVE STEAM				
Pressure (psig)		Capacity (lbs/hr)		
Motive	Back	1½"	2"	3"
90	15	8455	12247	17472
	30	8014	16681	14793
	45	7352	9678	12710
	60	6728	8410	10604
75	15	8267	12092	16976
	30	7837	10582	14242
	45	7220	9105	12048
60	7.5	8609	12323	18574
	15	8113	11861	16645
	30	7606	9965	13459
45	7.5	8675	12555	17824
	15	7959	11299	15620

MOTIVE AIR				
Pressure (bar g)		Capacity (kg/hr)		
Motive	Back	DN 40	DN 50	DN 80
6	0	4055	6360	9645
	1	3835	5555	7925
	2	3635	4845	6710
	3	3335	4390	5765
	4	3055	3815	4810
5	0	4060	6335	9605
	1	3750	5485	7700
	2	3555	4800	6460
	3	3275	4130	5465
4	0	4110	6305	9555
	0.5	3905	5590	8425
	1	3680	5380	7550
	2	3450	4520	6105
3	0	4060	6265	9500
	0.5	3935	5695	8085
	1	3610	5125	7085

3.8 Capacity Multiplying Factors for Other Filling Heads

Filling Head	DN40	DN50	DN80
152	0.7	0.7	0.84
305	1.0	1.0	1.0
610	1.2	1.2	1.08
914	1.35	1.35	1.20

3.9 Capacity Multiplying Factors for Motive Gas Supplies

% Back pressure vs. Motive pressure BP/ MP)

10%	20%	30%	40%	50%	60%	70%	80%	90%
1.04	1.06	1.08	1.10	1.12	1.15	1.18	1.23	1.28

3.10 Example:

Condensate load	1600 kg/hr.
Steam/air pressure available for operating pump	5.0 bar g
Vertical lift from pump to return piping	9 m
Pressure in return piping (piping friction negligible)	1.72 bar g
Filling head on pump	0.3048 mtrs.

Solution:

- 1 Calculate "h", the total lift or back pressure against which the condensate must be pumped.

$$= (9 \text{m} \times 0.1) + 1.72 = 2.62 \text{ bar g}$$
- 2 From capacity table with 5.0 bar g operating inlet pressure and 3.0 bar g back pressure choose a DN 40 pump which has a capacity of 2290 kg/hr

Note from Capacity Factor Charts

A Pump capacity if filling head is 0.610 mtr.

$$= 1.2 \times 2290 = 2748 \text{ kg/hr.}$$

4. Product Working Principle:

Note: For this section refer to Figure 4

A PPPPU unit consists of a receiver (1), Inlet Isolation valve (2), Strainer (3), a body shell (4) containing a float mechanism which operates a set of motive steam / air inlet (5) and exhaust valves (6) and inlet (7) & outlet (8) disc check valves. The steam or air is used as motive media to operate the pump. Condensate comes into the pump receiver (1) from flash vessel or plant condensate header and is allowed to flow in to the pump body (4) having float mechanism by opening the inlet isolation valve (2).

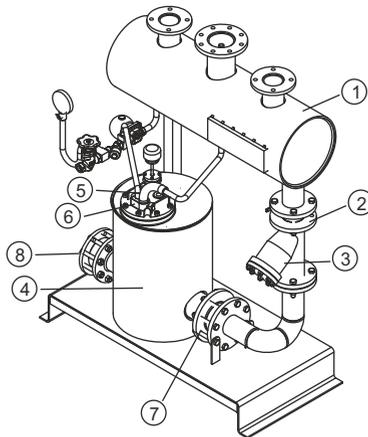


Figure 4: Pressure Powered Pump Package Unit

Note: For this section refer to Figure 3

In the normal position before startup the float is at the lowest position with the motive steam/air valve (5) closed and the exhaust valve (9A) open. When condensate flows by gravity through inlet check valve in to pump body (15), the float (16) will become buoyant and rise.

As the float **(16)** continues to rise, the mechanism link **(17)** is engaged which increases tension in the springs **(19)**. When the float **(16)** has risen to its upper tripping position, the linkage mechanism **(17)** snaps upward over center. The energy in the springs **(19)** is released as the push rod **(18)** is moved upward, to simultaneously open the motive steam inlet valve **(5)** and close the exhaust valve **(9A)**. Steam flow through the inlet valve **(5)** increases the pressure within the body and closes the inlet check valve. When the pressure in the body shell **(15)** exceeds the backpressure in the condensate discharge line, it opens the outlet check valve **(21)** and forces out the condensate in the discharge line.

As the condensate level in the pump body **(15)** falls, the float **(16)** is lowered and mechanism link **(17)** is engaged, which again increases the tension in the springs **(19)**. When the float **(16)** reaches the lower tripping position, the linkage mechanism **(17)** snaps downward over center. The energy in the springs **(19)** is released as the push rod **(18)** is moved downward, to simultaneously open the exhaust valve **(9A)** and close the steam inlet valve **(5)**. Steam / air utilized for pumping the condensate gets released through the exhaust valve and this completes one pumping stroke.

When the pressure in the pump body **(15)** has fallen to the same level as the pressure in the inlet pipe, the inlet check valve opens. Condensate will again flow through the check valve to fill the body and begin next 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 that the product is suitable for the intended installation.

Note: For this section refer to Figure 5

1. Ensure that there is no damage in transit. Before installation is done ensure that all steam, air or gas lines are closed. Select correct pipeline sizes as per the pump and connections are available. Level the unit by level bottle.
2. The reservoir has 3 ports, two of them should be connected for condensate inlet (A) and third is used for vent line ©. Most important is that reservoir must be vented to atmosphere. This is to ensure free flow of condensate under gravity to the pump.
3. It is recommended to install PPPPU along with a Forbes Marshall Flash vessel arrangement, if condensate flashing is expected when exposed to atmosphere.
4. Connect the condensate line coming from plant to the flash vessel inlet port. Install strainer (1), single orifice float trap (2) and view glass (3) after the flash vessel and connect condensate outlet line to the pump receiver (6). Install the safety relief valve (4) and pressure gauge (5) at respective locations provided on the flash vessel. Ensure that the pump receiver inlet is at a lower level than the condensate outlet line of flash vessel so the condensate travels by gravity to the pump receiver.
5. Vent line (C) should be piped, unrestricted to safe location in the atmosphere.
6. Connect the motive steam or compressed airline (7) to the motive supply inlet .
7. A pressure gauge (8) is supplied loose along with the pump. Install the same on motive line syphon. Condensate discharge line (B) of pump should be routed to the boiler feed water tank and connect the same to the condensate nozzle of de-aerator head.

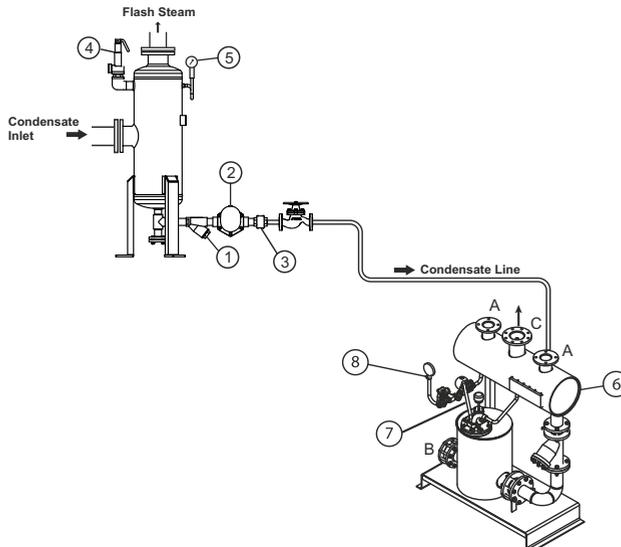


Figure 5: Installation of PPPPU with Forbes Marshall Flash Vessel

5.1 Care to be taken while routing the condensate pump discharge line: (Refer to Fig. 6)

1. The outlet line size should be equal to or more than pump outlet flange size provided with pump.
2. As far as possible, the discharge line should have minimum bends. Ideally the condensate pump discharge line should be lifted immediately after the pump to the maximum elevation in the circuit and then to be connected to feed water tank with a downward slope. This ensures minimum back pressure on the pump .

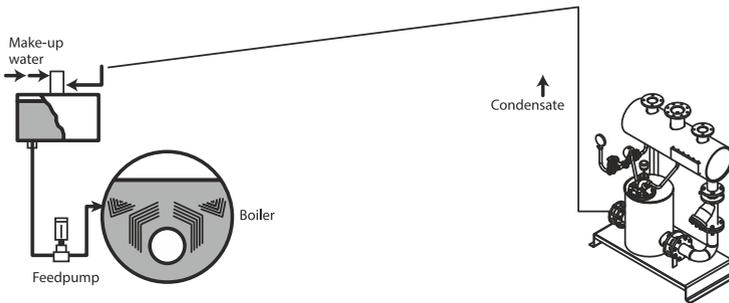


Figure 6 : Routing the condensate line to the Feed Water Tank

5.2 In case more than one condensate pump is connected to a common Condensate line: (Refer to Figure 7)

1. Make sure that NRV supplied with pump is installed with flow direction towards FWT. The NRV size should be equal to the pump outlet line size.
2. If more than one-pump discharge lines are to be connected to a common condensate line, please ensure that the individual line is connected from the top with a non-return valve. The common condensate line should be sized to take care of connected condensate load of all the pumps.

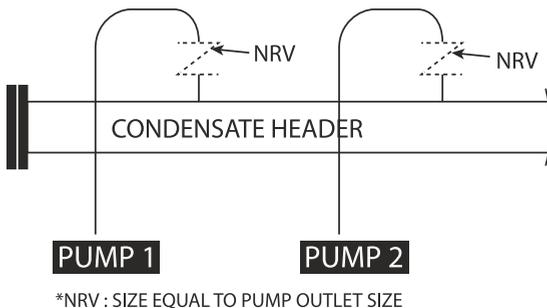


Figure 7: More than one pump connected to common condensate line

6. Startup and Commissioning:

It is recommended to install Forbes Marshall PPPPU along with a Flash vessel arrangement, if condensate flashing is expected when exposed to atmosphere. For trouble free operation of PPPPU, it is important that the single orifice float trap internals, pump internals & check valves are not subjected to dirt or other hard particles.

Therefore, prior to bringing the PPPPU in to operation, please ensure that the entire condensate piping circuit is thoroughly flushed.

6.1 Flushing Procedure in the presence of a Forbes Marshall Flash Vessel (Refer Fig. 8)

1. Open the Forbes Marshall flash vessel drain line and allow the process condensate to flow through the drain till all the foreign particles & contaminated condensate is flushed out and clean condensate can be seen coming out.

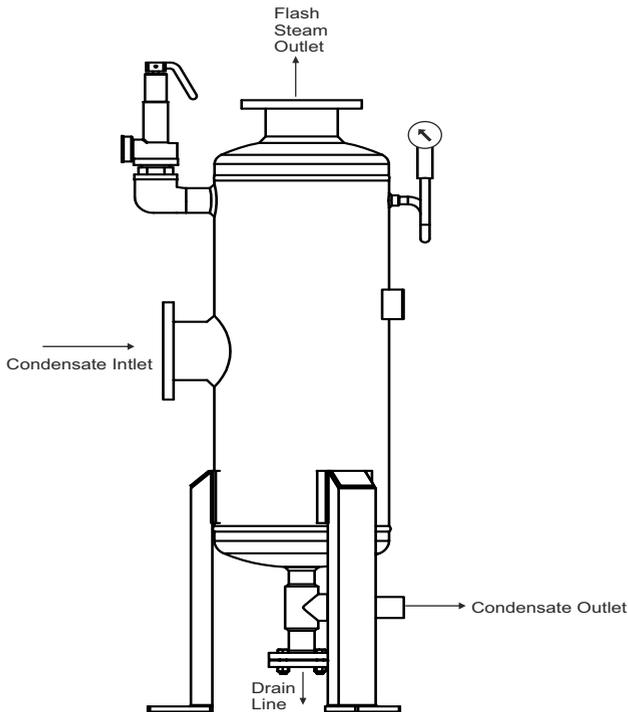


Figure 8 : Flushing procedure of Forbes Marshall flash vessel

6.2 Flushing Procedure in the absence of a Forbes Marshall Flash Vessel (Refer Figure 9)

1. Wherever process condensate is directly connected to pump receiver & Forbes Marshall flash vessel module is not part of PPPPU, open the pump condensate strainer cap (3) & screen to flush the foreign particles and contaminated condensate. Similarly, motive steam / airline (5) should also be flushed by removing strainer cap & screen until we see clean motive media coming out.
2. Once flushing of condensate and motive line is completed, open the motive line isolation valve (6) and ensure that the motive media pressure should not exceed as mentioned on the pump name plate.
3. Make sure that the motive line drain trap (7) is operational.
4. Open the pump condensate isolation valve (2) and allow the condensate to flow to the pump receiver (1) and subsequently to pumping chamber (4).
5. Now the pump should pump periodically.
6. Steam or air utilized for pumping is released with an audible exhaust at the end of each pumping cycle. Observe the condensate return line pressure gauge (8) & ensure that the motive pressure is at least 1.5 to 2 barg more than the back pressure.

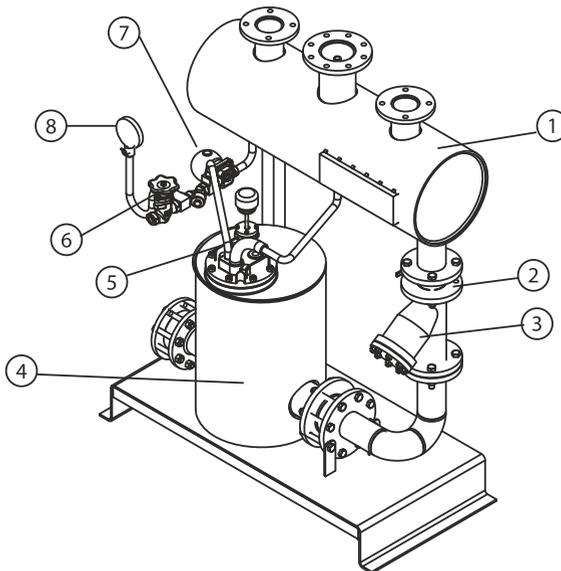


Figure 9 : Flushing procedure of Pressure Powered Pump Package Unit

7. Maintenance Guidelines:

Before undertaking any maintenance on the product it must be isolated from both supply line and return line and any pressure should be allowed to safely normalize to atmosphere. The product should then be allowed to cool. After suitable isolation repairs can be carried out with the product in the line. PPPPU units are designed for trouble free operation. In normal course of action maintenance is not required provided certain care of the system is taken.

7.1 Routine and Preventive Maintenance:

Please refer to the maintenance schedule mentioned in the table below to undertake routine maintenance of the Pressure Powered Pump Package Unit.

NO.	PARAMETERS TO BE CHECKED	FREQUENCY FOR CHECKING VARIOUS PARAMETERS					
		Daily	Weekly	Monthly	Quarterly	Half Yearly	Annually
A	Pressure Powered Pump Package Unit / Flash Vessel						
1	Clean strainer of motive media line			Y			
2	Clean condensate inlet strainer			Y			
3	Visual inspection and cleaning of complete set of internals				Y		
4	Condensate pump chamber draining				Y		
5	Inlet / Exhaust valve leakage testing				Y		
6	Check Valve Cleaning					Y	
7	Operate motive line valve			Y			
8	Operate Condensate inlet valve			Y			
9	Lubrication of piston valves				Y		
10	Pr. Gauge calibration						Y
11	Checking of PPPPU motive pressure	Y					
12	Checking of flash steam pressure in flash vessel	Y					
13	Cleaning of motive line trap internals				Y		
14	Cleaning of steam traps internals				Y		
15	Visual inspection for leakages		Y				
16	Arresting leaks		Y				
17	Checking of float trap SLR setting				Y		
18	Cleaning of strainer between flash vessel and pump			Y			
19	Check air quality(in case motive media is air)		Y				
20	Visual inspection of safety relief valve		Y				
21	Overhauling and cleaning of safety relief valve						Y

7.2 Tool Kit:

To carry out any maintenance of the PPPPU use the tools mentioned in the table below.

Size	Part	Component	Tool used and Size
1½, 2" & 3"	Internal Mechanism Assembly	Motive inlet and exhaust Valve	Open Spanner 1" (A/F)
		Float Mechanism	Open Spanner ¾" (A/F)
		Push Rod and Lock Nut	Open Spanner 11/16" (A/F)
		Bush assembly and stop bolt	Box Spanner 1/2" (A/F)
		Stopper bracket bolt	Box spanner 5/16" (A/F)
		Float Arm Bolt	Open Spanner ¾" (A/F)
		For Split Pin Assembly	Nose Plier
1½, 2" & 3"	External Assembly	Read switch assembly 4 No 1/4" studs; 1/4" X 5/32" nuts	Ring spanner ¾" (A/F)
		Internal assembly cover (1/2" X2")	Open spanner 11/16" / ¾" (A/F)
		Motive inlet and exhaust hose pipe connection	Pipe wrench
1½	Condensate inlet connection	Butterfly valve (1/2" X 3½")	Box spanner 11/16" / ¾"(A/F)
		Strainer assembly (1/2" X 2")	Box spanner 11/16" / ¾" (A/F)
	Condensate return connection	Disc check valve (5/8" X 4")	Box spanner 1" (A/F)
2"	Condensate inlet connection	Butterfly valve (5/8" X 4½")	Box spanner 1" (A/F)
		Strainer assembly (5/8" X 2½")	Box spanner 1" (A/F)
		Disc check valve (5/8" X 5")	Box spanner 1" (A/F)
	Condensate return connection	Disc check valve (5/8" X 5")	Box spanner 1" (A/F)
3"	Condensate inlet connection	Butterfly valve (5/8" X 5")	Box spanner 1" (A/F)
		Strainer assembly (5/8" X 2¾")	Box spanner 1" (A/F)
		Disc check valve (5/8" X 5½")	Box spanner 1" (A/F)
	Condensate return connection	Disc check valve (5/8" X 5½")	Box spanner 1" (A/F)

7.3 Maintenance/Replacement Procedure : (Refer to Figure 3)

For a detailed maintenance/replacement procedure of the pump body internals, please refer to the instructions given in the subsequent sections;

7.3.1 Procedure to Maintain/Replace the whole PPPPU internal assembly:

1. Before carrying out any maintenance, remove all the connections to the pump cover (1). Isolate the pump body by closing the inlet isolation butterfly valve.
2. Unscrew all eight nuts (3) present on the cover (1) and lift the cover and internal mechanism assembly from the pump body (15).
3. Arrange the whole assembly onto the vice such that the internals are placed on top and clamp the cover.
4. Remove the assembly nuts to free the whole assembly from the cover.
5. Remove the old gasket (2), and clean the gasket area. If required replace with a new one.
6. Fit the PPPPU internal assembly onto the cover. Carefully engage the exhaust valve (9A) onto the actuator disc (11) and screw the nuts.
7. Unclamp the cover and insert the whole assembly back inside the pump body (15).
8. Tighten the cover nuts (3).

7.3.2 Procedure to Maintain/Replace float assembly:

1. Follow steps 1 to 3 of section 7.3.1
2. Unscrew the float **(16)** from the float arm using appropriate spanner.
3. Screw the new float using Loctite 272 adhesive onto the threads.
4. Insert the whole assembly inside the pump body as described in steps 7 and 8 of section 7.3.1

7.3.3 Procedure to Maintain/Replace Exhaust valve seat & head assembly:

1. Unscrew all eight nuts **(3)** present on the cover **(1)** and lift the cover and mechanism assembly from the pump body **(15)**.
2. Arrange the whole assembly onto the vice such that the internals are placed on top and clamp the cover.
3. Remove the assembly nuts to free the whole assembly from the cover.
4. If required, remove the old gasket **(2)**, and clean the gasket area before replacing with a new one.
5. Unscrew the Exhaust valve head **(9B)**.
6. Clean the metal gasket and replace if required.
7. Fit the exhaust valve head and seat.
8. Now fit the PPPPU internal assembly onto the cover. Carefully engage the exhaust valve onto the actuator disc **(11)** and screw the nuts.
9. Unclamp the cover and insert the whole assembly back inside the pump body. While reinstalling the cover.
10. Tighten the cover nuts **(3)**.

7.3.4 Procedure to Maintain/Replace Inlet valve seat and head assembly:

1. Follow steps 1 through to 4 of section 7.3.3
2. Unscrew the Inlet valve head **(6)**.
3. Clean the metal gasket and replace if required.
4. Fit the inlet valve head and seat.
5. Now fit the PPPPU internal assembly onto the cover **(1)**. Carefully engage the exhaust valve **(9A)** onto the actuator disc **(11)** and screw the nuts.
6. Unclamp the cover and insert the whole assembly back inside the pump body **(15)**. While reinstalling the cover.
7. Tighten the cover nuts **(3)**.

7.3.5 Procedure to Maintain/Replace the springs:

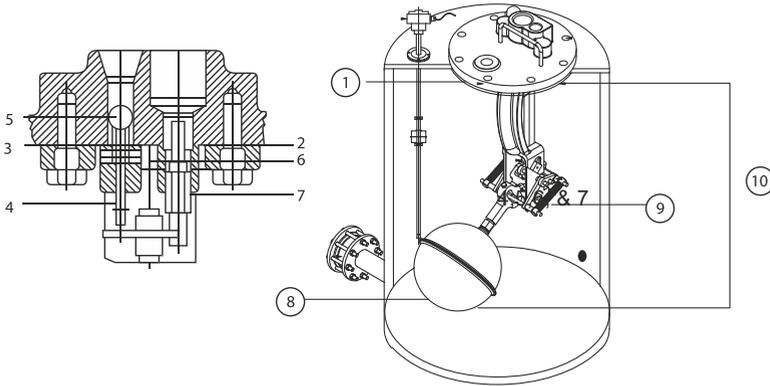
1. Unscrew all eight nuts **(3)** present on the cover **(1)** and lift the cover and mechanism assembly from the pump body **(15)**.
2. Arrange the whole assembly onto the vice such that the internals are placed on top and clamp the cover.
3. Remove the split pins.
4. Remove the washer and the springs **(19)** from the linkage mechanism **(17)**
5. Clean the springs **(19)** and replace if required.
6. Put the washer and split pins back
7. Reassemble the whole mechanism following steps 7 and 8 of section 7.3.1

8. Troubleshooting:

If the expected performance is unachievable after installation of the Pressure Powered Pump PacakageUnit, check the following points for appropriate corrective measures.

Failure Mode	Possible Cause	Remedy
Pump stops working	a) Motive supply closed	a) Open valves to supply motive pressure to pump
	b) Motive line strainer choked	b) Clean the strainer
	c) Condensate inlet line closed	c) Open condensate inlet valve and allow condensate to flow in pumping chamber.
	d) Condensate line strainer choked	d) Clean the strainer
	e) Condensate discharge line closed	e) Open all discharge line valves to allow free discharge from pump to destination.
	f) Motive pressure insufficient to overcome back pressure	f) Check motive and back pressure. Adjust motive pressure to 2barg more than total back pressure.
	g) Float punctured	g) Replace the float.
	h) Check the direction of the Check Valve	h) Correct it if found wrong.
	i) Steam coming out continuously from exhaust line	i) It means motive steam inlet valve is leaking- open the internals and clean the inlet valve. Replace it if found damaged.
	j) Exhaust valve leaking	j) Open the pump internals and clean it. Also check the setting of valve actuator disc and correct it if found disturbed.

Failure Mode	Possible Cause	Remedy
Pump working, overflows only during discharge.	a) Check inlet Check Valve.	a) Lap the seat and if the problem persists replace Check Valve
Pump working, continuously overflows	a) Pump under sized.	a) Verify the rated capacity as per the capacity table. Install additional pump as required.
	b) Inlet strainer partially choked	b) Clean the strainer Ensure all valves are fully open.
	c) Motive line strainer partially choked.	c) Clean the strainer and ensure inlet valve is fully open.
	d) Live steam reaching in pump receiver and receiver is pressurized.	d) Check the steam trap installed after the flash separator or process traps (if there is no flash separator), for leakage and rectify it.
	e) Receiver vent line is closed.	e) Make sure that receiver is vented to atmosphere as recommended.
	f) Insufficient motive pressure to achieve rated capacity.	f) Check motive pressure setting and maximum back pressure during operation. Compare with capacity table and increase motive pressure as required.
	g) Outlet Check Valve stuck open or leaking.	g) Open the Check Valve and clean it or replace it if found damaged.
	h) Motive isolation valve partially closed.	h) Check and ensure that motive isolation valve is fully open.
	i) Condensate return line size lesser than pump discharge.	i) Condensate return line size should be equal to or greater than pump discharge line.

9. Available Spares:

Figure 9: Available Spares for PPPPU

Sr.No.	SPARE PART	SPARE CONSIST OF	PART No.	SPARE CODE
1	MECHANISM KIT 40/50/80NB	ENTIRE MECHANISM IN ASSEMBLED CONDITION, WITH COVER PLATE, MECHANISM SUPPORT, ACTUATING DISC, PUSH ROD, PUSH ROD ACTUATOR, FLOAT ARM, FLOAT, GASKET, INLET VALVE & EXHAUST VALVE (PACK OF 1 ASSEMBLY)		SPARE-405080PPPPU- MKIT
2	PPPPU GASKET KIT 40/50/80NB	MECHANISM COVER PLATE GASKETS (PACK OF 2).	-	SPARE-405080PPPPU- GKIT
3	PPPPU INLET VALVE ASSEMBLY 40/50/80NB	INLET VALVE SEAT, INLET VALVE STEM, CASTLE LOCK NUT IN ASSEMBLED CONDITION - 1 NO. & COPPER GASKET-1NO.	-	SPARE-405080PPPPU- IVKIT
4	PPPPU EXHAUST VALVE ASSEMBLY 40/50/80NB	EXHAUST VALVE SEAT, EXHAUST VALVE HEAD & COPPER GASKET (PACK OF 1 EACH)	-	SPARE-405080PPPPU- EVKIT

Sr. No.	SPARE PART	SPARE CONSIST OF	PART No.	SPARE CODE
5	FLOAT ASSEMBLY 40/50/80NB	PPPPU FLOAT (PACK OF 1)	-	SPARE-405080PPPPU- FKIT
6	SPRING ASSEMBLY 40/50/80NB	BARREL SPRINGS (PACK OF 2)	-	SPARE-405080PPPPU- SKIT
7	MOTIVE LINE STEAM HOSE 40/50/80NB	500MM LONG MOTIVE STEAM HOSE SIZE 1/2" BSPT (PACK OF 1)	-	SPARE-405080PPPPU- INHKIT
8	EXHAUST LINE STEAM HOSE 40/50/80NB	500MM LONG STEAM EXHAUST HOSE SIZE 1"BSPT(PACK OF 1)	-	SPARE-405080PPPPU- EXHKIT
9	EXHAUST VALVE SEAT 40/50/80NB	EXHAUST VALVE ASSEMBLY SPARE CONSISTS OF : EXHAUST VALVE SEAT, EXHAUST VALVE HEAD & COPPER GASKET (PACK OF 1 EACH)	-	SPARE-405080PPPPUHP- EVKIT
10	ASBESTOS FREE COVER PLATE GASKETS 40/50/80NB	GASKET KIT SPARE CONSISTS OF : ASBESTOS FREE COVER PLATE GASKETS (PACK OF 2) & CRM SENSOR FLANGE GASKET (PACK OF 2)	-	SPARE-405080PPPPUHP- GKIT
11	INLET VALVE ASSLY KIT 40/50/80NB	VALVE SPARES, DN40/50/80 PPPPU-HP SPARE TYPE:INLET VALVE ASSEMBLY SPARE CONSISTS OF : INLET VALVE SEAT, INLET VALVE STEM, CASTLE LOCK NUT IN ASSEMBLED CONDITION - 1 NO. & COPPER GASKET-1NO.	-	SPARE-405080PPPPUHP- IVKIT

Sr.No.	SPARE PART	SPARE CONSIST OF	PART No.	SPARE CODE
12	MECHANISM KIT 40/50/80NB	VALVE SPARES, DN40/50/80 PPPPU-HP SPARE TYPE: MECHANISM KIT SPARE CONSISTS OF : COVER PLATE, MECHANISM SUPPORT ACTUATING DISC, PUSH ROD, PUSH ROD ACTUATOR, FLOAT ARM, FLOAT, GASKET, INLET VALVE & EXHAUST VALVE (PACK OF 1 ASSEMBLY)	-	SPARE-405080PPPPUHP- MKIT
13	SENSOR KIT	VALVE SPARES, SPARE PPPPU-HP , CONDENSATE RECOVERY METER SENSOR KIT, SPARE CONSISTS OF SENSOR ASSEMBLY PACK OF 1	-	SPARE-PPPPUHPCRM485- SNSRKIT
14	SENSOR KIT	VALVE SPARES, SPARE PPPPU-HP , CONDENSATE RECOVERY METER EX PROOF SENSOR KIT, SPARE CONSISTS OF EX PROOF SENSOR ASSEMBLY PACK OF 1	-	SPARE-PPPPUHPEXCR M485-SNSRKIT

How to Order:

Example: DN40 Pressure Powered Pump Package Unit PPPPU.

10. Warranty Period:

As per ordering information and agreements in the contract.



www.forbesmarshall.com

Forbes Marshall Arca

Codel International

Krohne Marshall

Forbes Vyncke

Forbes Marshall Steam Systems

A: Forbes Marshall Pvt. Ltd.

Opp. 106th Milestone, CTS 2220,
Mumbai-Pune Road, Kasarwadi,
Pune MH 411034 INDIA

P: +91(0)20-68138555

F: +91(0)20-68138402

E: ccmidc@forbesmarshall.com

Forbes Marshall International Pte. Ltd.

16A, Tuas Avenue 1,
#05-21, JTC Space @Tuas
Singapore - 639533

P: +65 6219 3890

CIN No: U28996PN1985PTC037806