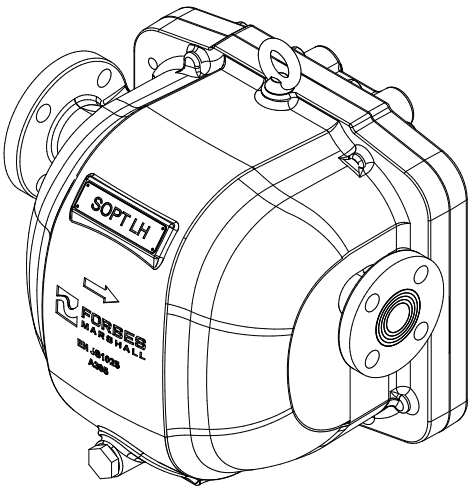
# Installation and Maintenance Manual

## Steam Operated Pumping Trap - Low Head

SOPT-LH



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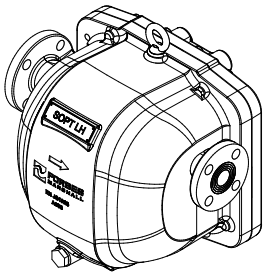
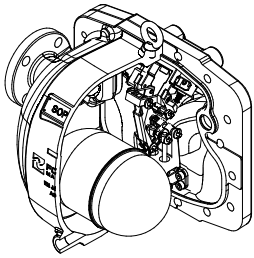
**PLEASE NOTE -** Throughout this manual this cautionary symbol is used to describe a potential damage or injury that might occur if the safety considerations are overlooked. This symbol denotes CAUTION, WARNING or DANGER.

## 1. Preface:

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

**Steam Operated Pumping Trap - Low Head (SOPT-LH)**



## 2. Important Safety Information:

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.

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 has to be determined.

iv) Forbes Marshall products are not intended to resist external stresses, hence necessary precautions to be take 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 gase s in the pipeline:**

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

**2.4 Hazardous environment and media:**

**T**he 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 part is recommended.

**2.7 Protective clothing:**

Consider for the requirement of any protective clothing for you/ or other in the vicinity for Protection against hazards of temperature (high or low), chemicals, radiation, dangers to Eye and face, noise and falling objects.

**2.8 Permits to work:**

All work to 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 stockiest 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. Product information

**Description**

SOPT - LH is a steam operated pumping trap with flanged connections. This innovative product is capable of working in trapping or pumping mode automatically, depending on the process conditions. The unit is operated by steam & is used for condensate evacuation from the process plant under all operating conditions including vacuum / stall.

**Size & Connection**

| Model | Condensate Inlet | Condensate Outlet | Motive Steam inlet | Steam Exhaust | Drain |
|---|---|---|---|---|---|
| SOPT-LH | 1 1/2" (Class150) | 1" (Class 150) | 1/2" Screwed BSPT/NPT/BSP | 1/2" Screwed BSPT/NPT/BSP | 1/2" Screwed BSPT/NPT/BSP |

**Limiting Conditions**

Sizes: 1 1/2" X 1"

Body design Conditions: Class 150

Max. Operating Pressure: 200 psi g @388.4°F

Max. Operating Temperature: 185 psi g @572°F

Min. Operating Temperature: 14°F

Discharge per cycle: 1.24 US gallons per strokes .

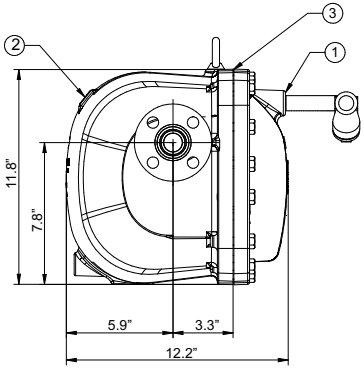
Max. Cold hydraulic test pressure : 348 psi g

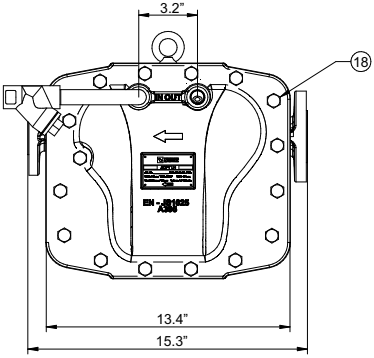
Max. Back pressure : 72.5 psi g

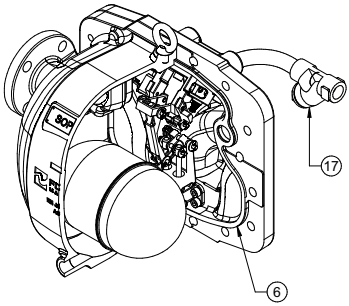
Minimum Required Filling Head : 7.9"(from the base of SOPT-LH)

Dimensions :

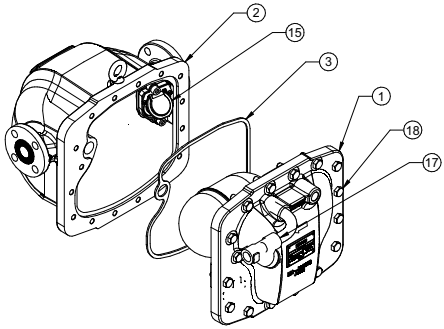
(Refer BoM for SOPT-LH Table)

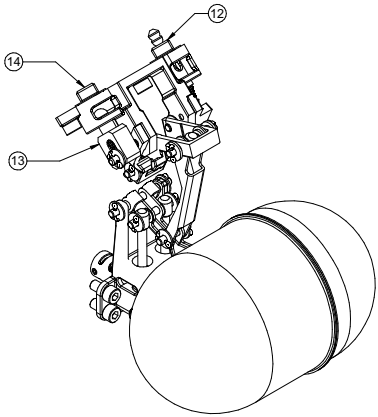


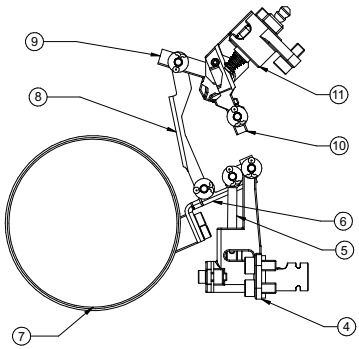



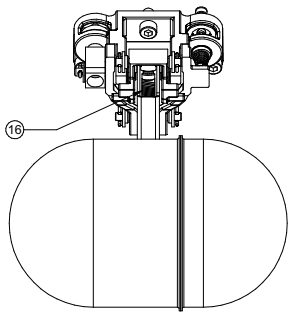



Other Details -



**BOM For SOPT-LH**

| Item No. | Description | Material |
|---|---|---|
| 1. | Base | ASTM A395/EN-JS1025 |
| 2. | Cover | ASTM A395/EN-JS1025 |
| 3. | Main Flange Gasket | Graphite |
| 4. | Trap Seat | Stainless Steel |
| 5. | Trap Valve Head | Stainless Steel |
| 6. | Float Lever | Stainless Steel |
| 7. | Float | Stainless Steel |
| 8. | Crank Lever | Stainless Steel |
| 9. | Anchor Link | Stainless Steel |
| 10. | Actuator | Stainless Steel |
| 11. | Support Bracket | Stainless Steel |
| 12. | Steam Inlet Assembly | Stainless Steel |
| 13. | Exhaust Valve Head Assembly | Stainless Steel |
| 14. | Exhaust Seat Assembly | Stainless Steel |
| 15. | Flap Seat Assembly | Stainless Steel |
| 16. | Extension Spring | Nimonic 90 |
| 17. | 1/2” Strainer | Cast Steel |
| 18. | Hex Head Screw M12 x 40 | ISO 4762/ ASTM A193 B7 |

**Trapping Capacity Chart:**
(For Installation Head 43")

| Differential Pressure (psi g) | Capacity (lbs/hr) |
|---|---|
| 14.5 | 3512 |
| 29 | 5046 |
| 43.5 | 5624 |
| 58 | 5884 |
| 72.5 | 6162 |
| 87 | 6576 |
| 101.5 | 7099 |
| 116 | 7637 |
| 130.5 | 8117 |
| 145 | 8558 |
| 159.5 | 9154 |
| 174 | 10355 |

| Pumping Capacity Chart (For Installation Head 19.7 Inch) | | |
|---|---|---|
| **Motive Pressure(psi g)** | **Total Back Pressure (psi g)** | **Capacity (lbs/hr)** |
| 29 | 7.25 | 1546.6 |
| 43.5 | 7.25 | 1630.2 |
| 43.5 | 14.5 | 1496 |
| 43.5 | 29 | 1247.4 |
| 58 | 7.25 | 1705 |
| 58 | 14.5 | 1603.8 |
| 58 | 29 | 1408 |
| 58 | 43.5 | 1075.8 |
| 72.5 | 7.25 | 1843.6 |
| 72.5 | 14.5 | 1566.4 |
| 72.5 | 29 | 1273.8 |
| 72.5 | 43.5 | 1047.2 |
| 72.5 | 58 | 1047.2 |
| 87 | 7.25 | 1509.2 |
| 87 | 14.5 | 1370.6 |
| 87 | 29 | 1247.4 |
| 87 | 43.5 | 1080.2 |
| 87 | 58 | 851.4 |
| 87 | 72 | 613.8 |
| 101.5 | 7.25 | 1683 |
| 101.5 | 14.5 | 1425.6 |
| 101.5 | 29 | 1397 |
| 101.5 | 43.5 | 1245.2 |
| 101.5 | 58 | 1016.4 |
| 101.5 | 72 | 884.4 |
| 116 | 7.25 | 1465.2 |
| 116 | 14.5 | 1328.8 |
| 116 | 29 | 1133 |
| 116 | 43.5 | 992.2 |
| 116 | 58 | 1029.6 |
| 116 | 72 | 917.4 |
| 130.5 | 7.25 | 1443.2 |
| 130.5 | 14.5 | 1390.4 |
| 130.5 | 29 | 1223.2 |
| 130.5 | 43.5 | 1093.4 |
| 130.5 | 58 | 1005.4 |
| 130.5 | 72 | 941.6 |
| 145 | 7.25 | 1313.4 |
| 145 | 14.5 | 1251.8 |
| 145 | 29 | 1080.2 |
| 145 | 43.5 | 935 |
| 145 | 58 | 869 |
| 145 | 72 | 855.8 |

| | | |
|---|---|---|
| 159.5 | 7.25 | 1056 |
| 159.5 | 14.5 | 1161.6 |
| 159.5 | 29 | 998.8 |
| 159.5 | 43.5 | 847 |
| 159.5 | 58 | 666.6 |
| 159.5 | 72 | 627 |
| 174 | 7.25 | 1201.2 |
| 174 | 14.5 | 1205.6 |
| 174 | 29 | 950.4 |
| 174 | 43.5 | 858 |
| 174 | 58 | 730.4 |
| 174 | 72 | 699.6 |
| 188.5 | 7.25 | 1007.6 |
| 188.5 | 14.5 | 787.6 |
| 188.5 | 29 | 726 |
| 188.5 | 43.5 | 684.2 |
| 188.5 | 58 | 651.2 |
| 188.5 | 72 | 611.6 |
| 200 | 7.25 | 963.6 |
| 200 | 14.5 | 930.6 |
| 200 | 29 | 818.4 |
| 200 | 43.5 | 704 |
| 200 | 58 | 730.4 |
| 200 | 72 | 624.8 |

**Note**
Pumping capacities shown in above chart are for condensate temperature of 194° F
For higher back pressures and filling heads other then 19.7" contact factory .

**Note :**
1. Total lift or back pressure (BP) (static head plus pressure head in the return system) must be sufficiently below the motive fluid inlet pressure to allow pump capacity to be achieved.

BP = (H x 0.433) + P + Pf

Where - BP - Back pressure in psi g

H - Height in feets

P - Pressure in return line in psi g

Pf - Piping frictional pressure drop in psi g

(Pf can be ignored if the downstream pipework is less than 328 fts to a non flooded condensate return and has been sized to take into account the effect of flash steam at the heat exchanger's full load operating conditions.)

## 4. Product working principlele

* The SOPT-LH automatic pump trap operates on positive displacement principle. Condensate enters the body through the inlet swing check valve causing the float to rise. The float is connected to the trap mechanism. If the upstream system pressure (Ps) is sufficient to overcome the back pressure (Pb). The buildup of condensate will be discharged by opening two orifice trap mechanism. (Patented)
* In this way, the float will automatically modulate according to the rate of condensate entering the SOPT-LH, controlling the rate of opening and closure of the trap.
* In case of some temperature controlled equipment, it is possible that the Ps may get lower than the Pb.
* If this occurs a standard trap would stall, allowing the condensate to flood the equipment being drained in absence of SOPT-LH.
* However, with the SOPT-LH, the condensate simply drains from equipment into the main chamber - lifting the float until the changeover linkage is engaged, opening the motive inlet and closing the exhaust valve.
* The snap action mechanism ensures a rapid change from the trapping mode to the active Pumping mode. With the motive inlet valve open, the pressure in the SOPT-LH increases above the total Pb and the condensate is forced out through the trap seat into the plant's return system.
* As the condensate level falls within the main chamber, the float makes the mechanism snap again ,causing the motive inlet to close and the exhaust valve to open.
* As the pressure inside the SOPT-LH equalizes with the condensate inlet pressure through the open exhaust valve, condensate re-enters via the inlet swing check valve. At the same time the outlet ball check valve ensures no condensate can drain back into the main chamber and the trapping or pumping cycle begins again.

## 5. Installation Guidelines

Before any installation or maintenance procedure, always ensure that all steam or Condensate lines are isolated.

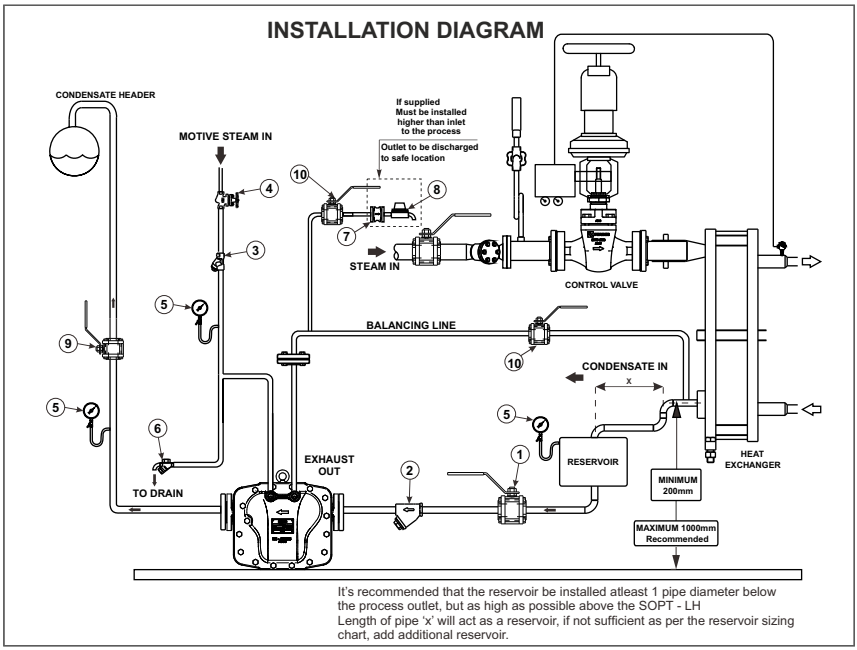
Ensure any residual internal pressure in the product or connecting lines is carefully relieved. Also ensure any hot parts have cooled to prevent risk of injury from burns. Always wear Appropriate safety clothing before carrying out any installation or maintenance work.

A lifting point is on the top of the body. On no account should this be used lift anything more than the total weight of the product (105 lbs approximately). Always use suitable lifting gear and ensure the product is safety secured.

**Note:** If pumping a potentially explosive media, the motive supply media must be an inert gas with no oxygen present.

## 5.1 Inlet piping

To prevent condensate backing up into the equipment being drained, it is recommended that the inlet pipework is sufficiently sized to accumulate condensate during the pump's discharge cycle. Generally a length and diameter of pipe to accommodate 3.5 liters of condensate will be sufficient. It is essential that a Forbes Marshall Y-type strainer with a maximum 0.8 mm perforation screen size is fitted at the condensate inlet of the SOPT-LH.




| | |
|---|---|
| 1 | 40 NB Isolation Valve |
| 2 | 40 NB Forbes Marshall FMSTR31 Strainer 0.8 Perforation |
| 3 | 15 NB Forbes Marshall Screwed Strainer ( FMSTR51 ) Dutch Weave type/100 mesh |
| 4 | 15 NB Forbes Marshall Piston valve |
| 5 | Pressure Gauge with syphon |
| 6 | 15 NB Forbes Marshall Thermodynamic trap |
| 7 | 15 NB Forbes Marshall Soft seated Disk check valve (If supplied) |
| 8 | 15 NB Forbes Marshall Air vent (If supplied) |
| 9 | 25 NB Isolation Valve |
| 10 | 15 NB Vent Isolation Valve |

### 5.2 Guidelines for Motive steam line connection :

At a minimum, the inlet piping should be at least 25 mm (1") pipe from the steam header dropping to the SOPT- LH. Only when the steam (motive) inlet pipework is close to 0.5 m to the pump the motive line piping should be reduced to 1/2" / 15NB and fed to the SOPT-LH.

### 5.3 Air vent

**(If supplied)** 15NB Air vent with Air vent isolation valve and soft seated 15NB FMDCV must be fitted on the balancing line at elevation higher than Steam inlet as shown in installation diagram

### 5.4 Recommended installation head

Installation head should be within 200mm (min) to 1000mm (max-recommended) from the base of the SOPT-LH unit.

**Note**: During cold start-up conditions, it is possible for hydraulic pulsing of the inlet check valve to occur. It is advisable in this case to install a throttling isolation valve to reduce the filling pressure.

### 5.5 Connections (refer to installation diagram)

The SOPT-LH has four connection ports. The 40NB (1-1/2") port should be connected to the outlet of the equipment being drained. And the 25NB (1") port should be connected to plant condensate outlet line. Flow should be from 40NB port to 25NB port. The 15NB (1/2") "IN" port should be connected to a trapped motive steam supply. (*It is important to ensure this line is drained of condensate at all times using a Forbes Marshall Thermodynamic steam trap and steam is fed to SOPT - LH though 100 mesh strainer or dutch weave strainer ). The screwed 15NB (1/2") "OUT" port should be connected as close as possible to the condensate outlet of the equipment. This line is known as balancing line. This balance line must always be connected to the top of the condensate inlet pipe, as shown in Fig. It is recommended that this balancing line should be hard line (No flexible house with metal to metal contact seals)for typical vacuum application.

### 5.6 Outlet piping

It is important for the outlet piping to be correctly sized to prevent excessive back pressure on the SOPT-LH. This pipework should be sized to take into account the effects of flash steam at the heat exchanger full load operating condition.

## 6. Startup and Commissioning

* After ensuring the inlet and outlet pipe connections and motive / exhaust connections are coupled in accordance with Installation diagram, slowly open the motive steam inlet line to supply pressure to the SOPT- LH. Slowly open the vent isolation valve. Ensure that the vent line is properly drained.
* Ensure that the balancing line isolation valve is open.
* Slowly open the isolation valves in the condensate inlet and discharge lines, allowing condensate to fill the body of the SOPT-LH.
* After approx 2-3 min. close the vent isolation valve.
* The SOPT-LH is now ready to operate.

* When the process plant is operational, the SOPT-LH will discharge condensate under pressure conditions as per specifications into the return line.
* If any irregularities are observed, recheck the installation according to the recommendations. If the unit fails to operate, then consult the fault finding section.

## 7. Maintenance Guidelines

### 7.1 Mechanisms inspection and repair

Please ensure the safety recommendations are observed before commencing with any maintenance of this product.

**Tools required**

5/16" A/F Allen Key, 15/64" A/F Allen Key, Torque wrench, 3/4" A/F spanner, 3/4" Hex socket, 3 A/F Allen Key

### 7.2 To remove the Base Assly

**7.2.1** After removing flange bolt, remove base assly carefully, so that there is no damage to SOPT-LH internal mechanism.

**7.2.2** Visually inspect the mechanism for obvious damage. Check that it is free of dirt and scale and operates freely when the floats are moved up and down.

**7.2.3** Inspect the spring assembly for damage. Make sure the valves slide freely and the spring loaded exhaust valve moves on its guide.

**7.2.4** Inspect the float to ensure they are undamaged. Check all the pivot point to ensure they are moving freely.

**7.2.5** Ensure the inlet swing check valve is free to move and the sealing faces of both the seat and the flap are clean and undamaged. (If the seat is badly scored or damaged a new swing check valve assembly may be required).

**7.2.6** Check the two outlet orifices are free from dirt and debris. Ensure they open and close smoothly.

### 7.3 If a Base is to be fitted

**7.3.1** Ensure the gasket face in the body is clean and free from debris. Carefully slide the new cover assembly into the existing body, whilst ensuring the new gasket is carefully aligned with the gasket faces and no parts of it are trapped or pinched outside the sealing areas.

**7.3.2** Refit the Base bolts ensuring they are sequentially tightened in opposing pairs, gradually increasing torque to 48.9 - 54.4 lbs.force.feet

| Hex. head / Hex. socket head cap screw | Tools | Torque |
|---|---|---|
| M12 x 40 | Hex Head 3/4" Spanner | 48.9 - 54.4 lbs.force.feet |

**7.3.3** Carefully reconnect the motive steam supply and the exhaust lines to the connections marked (IN) and (OUT), then follow the start-up procedure as mentioned in section 6 commissioning to bring the SOPT-LH back into operation.

## 8. Trouble Shooting

Installation and troubleshooting should only be performed by qualified personnel. Before any maintenance is attempted, ensure any residual internal pressure in the product or connecting lines is carefully relieved. Also ensure any hot parts have cooled to prevent risk of injury from burns. Always wear appropriate safety clothing before carrying out any installation and maintenance work.

A lifting point is on the top of the body. On no account should this be used to lift anything more than the total weight of the product (105 lbs approximately). Always use suitable lifting gear and ensure the product is safely secured. When dismantling this product, care should be taken prevent injury from the snap action mechanism. Always handle with care.

The SOPT-LH has been throughly tested before it leaves the factory. This includes a Comprehensive functional test. If the unit has failed to operate, it is likely that an installation problem could exist. Please check the following before commencing with the trouble-Shooting chart.

**Trouble areas to check first**

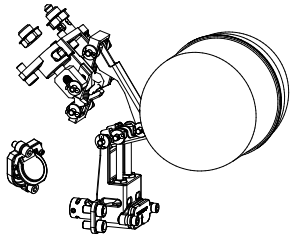
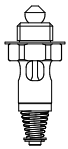
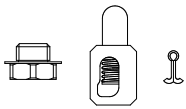
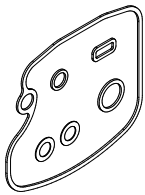
- Are all isolating valves open?
- Is the condensate inlet strainer clean and free from debris?
- Is the installation head available exceed 7.9" from the base of the SOPT-LH?
- Is the available motive pressure is less than the total back pressure? (not exceeding 200 psi g)
- Is the exhaust balance line (OUT) connected to the outlet of the equipment being drained and is it free from obstruction (refer to installation diagram)?
- Is the direction of flow though the unit correct? (from inlet to outlet).

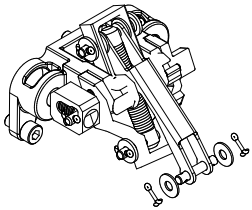
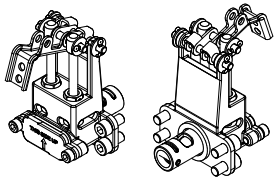
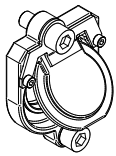
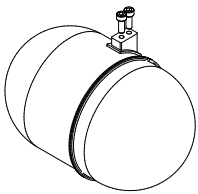
## 9. Trouble-shooting guide:

| Failure Mode | Possible Cause | Remedy |
|---|---|---|
| **SOPT-LH fails to operate on start up** | No motive pressure. | Motive supply pressure exceeds total back pressure. |
| | Inlet isolation valve may be closed. | Inlet pipe is free from obstructions and the isolation valve is fully open |
| | Motive inlet and exhaust lines incorrectly connected. | Motive = IN, Exhaust = OUT. |
| | The rate of condensate produced by the process may be very low. | The SOPT-LH to cycle slowly.<br>The process being drained is operating correctly. |
| **Equipment Flooded and SOPT-LH stopped Cycling** | ]Blocked exhaust line. | Balance line is free from obstruction and is not waterlogged. Refer to Installation diagram. |
| | Blocked condensate inlet line. | Inspect and clean the strainer mesh, check for blockages. |
| | Blocked condensate outlet line. | Inspect line for blockages. |
| | Damaged mechanism. | Mechanism operates as shown in working principle section Replace malfunctioning part. |
| | No motive steam available. | Steam supply to SOPT-LH is available and at the correct pressure.<br>Motive Pressure must exceed total backpressure. |
| | Leaking motive inlet valve. | This indicates the SOPT-LH Mechanism is stuck on the discharge cycle. Check mechanism for Excessive friction. Check motive inlet valve and spring For correct operation - replace malfunctioning part. |
| | Broken spring. | If SOPT-LH body is cold, this indicates the SOPT-LH mechanism is stuck on The filling cycle. Check pump mechanism spring - replace malfunctioning Part. |
| **Equipment Flooded but SOPT-LH appears to cycle normally** | SOPT-LH is undersized for the application. | Check system parameters agreed with the ustomer sizing sheet / graph. |

| | | |
|---|---|---|
| **Chattering or banging in SOPT-LH discharge line** | Live steam entering discharge line. | Ensure steam traps draining the motive supply line are discharging to a non-flooded condensate return. Condensate return is adequately sized. |
| **Chattering or banging of SOPT-LH inlet check valve flap** | Hydraulic pulsing of the inlet check valve) | Reduce installation head or throttle the condensate inlet valve. |

## 9.1. Available Spares

| SR.NO | DESCRIPTION | PART CODE NO. | KIT VIEW |
|---|---|---|---|
| 1 | mechanism assembly kit | SPARE-040SOPT-LH-MKIT |  |
| 2 | Inlet valve seat assembly kit | SPARE-040SOPT-LH-IVKIT |  TORQUE: 59 ± 3.7 lbs.force.ft<br>TOOL REQUIRED: 7/8"A/F SPANNER |
| 3 | Exhaust valve head assembly kit | SPARE-040SOPT-LH-EVKIT |  TORQUE: 59 ± 3.7 lbs.force.ft<br>TOOL REQUIRED: 7/8"A/F SPANNER |
| 4 | *Gasket kit | SPARE-040SOPT-LH-GKIT |  |

| SR.NO | DESCRIPTION | PART CODE NO. | KIT VIEW |
|---|---|---|---|
| 5 | Support Bracket assembly Kit | SPARE-040SOPT-LH-SBKIT |  TORQUE: 14.8 ± 1.5 lbs/ft TOOL REQUIRED: 15/64" ALLEN KEY |
| 6 | Trap seat assembly kit | SPARE-040SOPT-LH-TSKIT |  TORQUE: 14.8 ± 1.5 lbs.force.ft TOOL REQUIRED: 15/64" ALLEN KEY |
| 7 | Inlet check valve assembly kit | SPARE-040SOPT-LH-ICVKIT |  TORQUE: 29.5 ± .2.2 lbs.force.ft TOOL REQUIRED: 5/16" ALLEN KEY |
| 8 | Float assembly kit | SPARE-040SOPT-LH-FKIT |  TORQUE: 5.9 ± .1.4 lbs.force.ft TOOL REQUIRED: 3/16" ALLEN KEY |

* Order Gasket kit with all other Spare Kits.

## 10. Warranty Period

As per ordering information and agreements in the contract.

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