

Installation and Maintenance Manual

Steam Operated Pumping Trap - Low Head Extra Capacity

SOPT - LHX

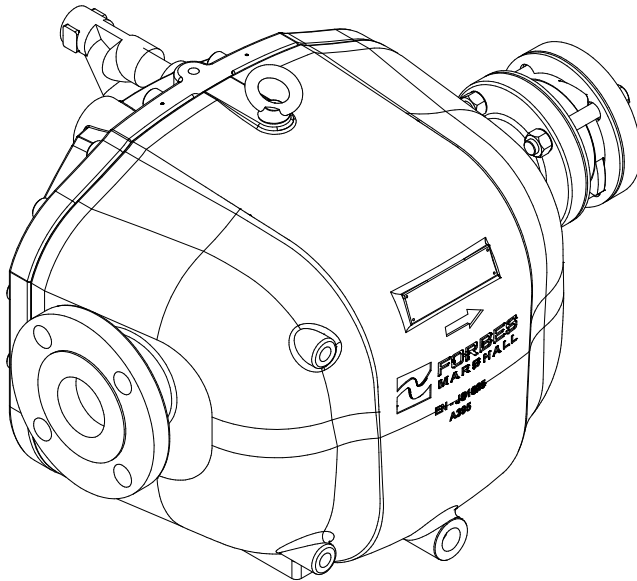


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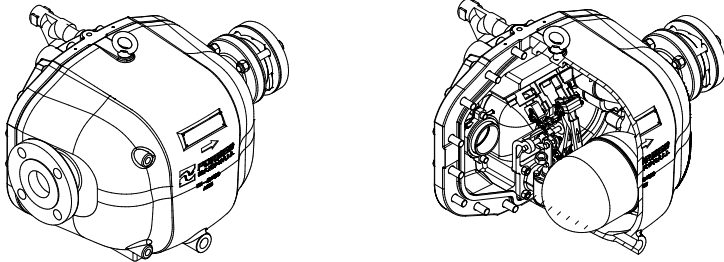
PLEASE NOTE - Throughout this manual this cautionary symbol is used to describe a potential damage or injury that might occur if the safety considerations are overlooked. This symbol denotes CAUTION, WARNING or DANGER.



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 Extra Capacity



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 gases 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:

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 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 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 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-LHX is a Steam Operated Pumping Trap - Low Head Extra Capacity 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 to remove condensate 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-LHX | 50 NB (Class150) | 40 NB (Class 150) | 15 NB Screwed BSPT | 25 NB Screwed BSPT | 15 NB Screwed BSPT |

Limiting Conditions

Sizes: 50 NB X 40 NB

Body design Conditions: PN16

Max. Operating Pressure: 13.8 barg @198° C

Max. Operating Temperature: 198° C @13.8 barg

Min. Operating Temperature: -10° C

Discharge per cycle: 6.7 Liters

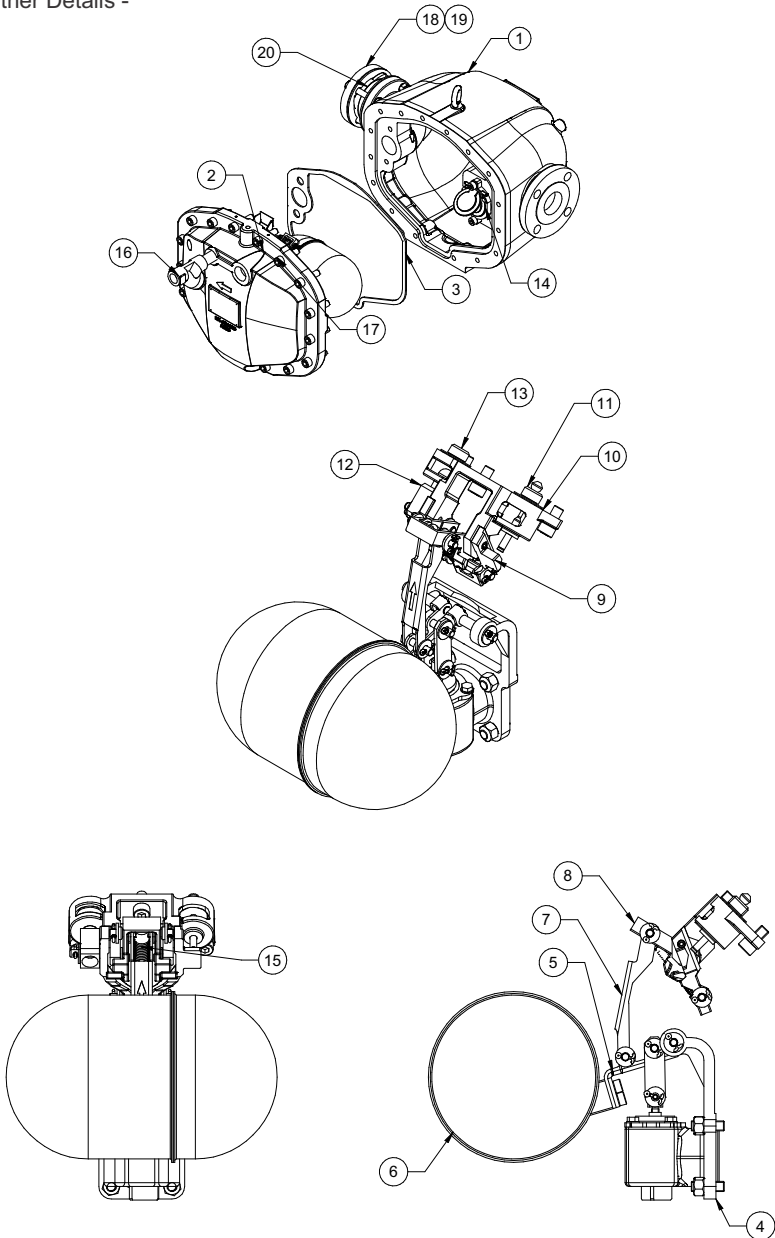
Max. Cold hydraulic test pressure : 24 barg

Max. Back pressure : 5 barg

Minimum Installation Head : 200mm

Recommended Installation Head : 300mm

Other Details -



| Item No. | Description | Material |
|-----------------|----------------------------------|---------------------|
| 1. | Base | ASTM A395/EN-JS1025 |
| 2. | Cover | ASTM A395/EN-JS1025 |
| 3. | Main Flange Gasket | Pure Graphite |
| 4. | Trap seat Assembly | Stainless Steel |
| 5. | Float Lever | Stainless Steel |
| 6. | Float | Stainless Steel |
| 7. | Crank Lever | Stainless Steel |
| 8. | Anchor Link | Stainless Steel |
| 9. | Actuator | Stainless Steel |
| 10. | Support Bracket | Stainless Steel |
| 11. | Steam Inlet Assembly | Stainless Steel |
| 12. | Exhaust Seat Assembly | Stainless Steel |
| 13. | Exhaust Valve Head Assembly | Stainless Steel |
| 14. | Flap Seat Assembly | Stainless Steel |
| 15. | Extension Spring | Stainless Steel |
| 16. | 15NB Strainer | Cast Steel |
| 17. | Hex Socket head Cap Screw M12X45 | ISO 4762 |
| 18. | 40NB #150 FMDCV | Stainless Steel |
| 19. | 40NB GASKET | Graphite |
| 20. | 40NB #150 FLANGE | ASTM A105 |

Trapping Capacity Chart

| Differential Pressure (bar g) | Capacity (Kg / hr) |
|--------------------------------------|-----------------------------|
| 1 | 7000 |
| 2 | 8500 |
| 3 | 9010 |
| 5 | 11800 |
| 7 | 11800 |

| Pumping Capacity Chart (For Installation Head 1000mm) | | |
|--|-----------------------------|--------------------|
| Motive Pressure (bar g) | Total Back Pressure (bar g) | Capacity (Kg/hr) |
| 2 | 0.5 | 2000 |
| 3 | 0.5 | 1988 |
| 3 | 1 | 1389 |
| 3 | 2 | 869 |
| 4 | 0.5 | 2258 |
| 4 | 1 | 1759 |
| 4 | 2 | 1181 |
| 4 | 3 | 637 |
| 5 | 0.5 | 2300 |
| 5 | 1 | 1839 |
| 5 | 2 | 1217 |
| 5 | 3 | 905 |
| 5 | 4 | 609 |
| 6 | 0.5 | 2460 |
| 6 | 1 | 1997 |
| 6 | 2 | 1456 |
| 6 | 3 | 1099 |
| 6 | 4 | 912 |
| 6 | 5 | 613 |
| 7 | 0.5 | 2525 |
| 7 | 1 | 2035 |
| 7 | 2 | 1466 |
| 7 | 3 | 1099 |
| 7 | 4 | 851 |
| 7 | 5 | 743 |
| 8 | 0.5 | 2455 |
| 8 | 1 | 2173 |
| 8 | 2 | 1651 |
| 8 | 3 | 1191 |
| 8 | 4 | 901 |
| 8 | 5 | 761 |
| 9 | 0.5 | 2452 |
| 9 | 1 | 2210 |
| 9 | 2 | 1654 |
| 9 | 3 | 1150 |
| 9 | 4 | 901 |
| 9 | 5 | 740 |
| 10 | 0.5 | 2518 |
| 10 | 1 | 2130 |
| 10 | 2 | 1634 |
| 10 | 3 | 1315 |
| 10 | 4 | 927 |
| 10 | 5 | 716 |

| | | |
|------|-----|------|
| 11 | 0.5 | 2499 |
| 11 | 1 | 2187 |
| 11 | 2 | 1726 |
| 11 | 3 | 1385 |
| 11 | 4 | 925 |
| 11 | 5 | 735 |
| 12 | 0.5 | 2546 |
| 12 | 1 | 2229 |
| 12 | 2 | 1809 |
| 12 | 3 | 1486 |
| 12 | 4 | 1045 |
| 12 | 5 | 777 |
| 13 | 0.5 | 2538 |
| 13 | 1 | 2277 |
| 13 | 2 | 1816 |
| 13 | 3 | 1522 |
| 13 | 4 | 1010 |
| 13 | 5 | 751 |
| 13.8 | 0.5 | 2500 |
| 13.8 | 1 | 2231 |
| 13.8 | 2 | 1832 |
| 13.8 | 3 | 1511 |
| 13.8 | 4 | 1173 |
| 13.8 | 5 | 823 |

Note

Pumping capacities shown in above chart are for condensate temperature of 90° C. For higher back pressures & different filling heads contact factory.

Note :

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

$$BP = (H \times 0.0981) + P + Pf$$

Where - BP - Back pressure in bar g

H - Height in meters

P - Pressure in return line in bar g

Pf - Piping frictional pressure drop in bar g

(Pf can be ignored if the downstream pipework is less than 100 meters 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 principle

The SOPT-LHX 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. The buildup of condensate will be discharged by opening two orifice trap mechanism.

- * In this way, the float will automatically modulate according to the rate of condensate entering the SOPT-LHX, controlling the rate of opening and closure of the trap.
- * With some temperature controlled equipment, it is possible that the system pressure PS may get lower than the back pressure.
- * If this occurs a standard trap will stall, allowing the condensate to flood the equipment being drained.
- * However, with the SOPT-LHX, the condensate simply fills 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-LHX increases above the total back pressure 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-LHX 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 ensure 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.

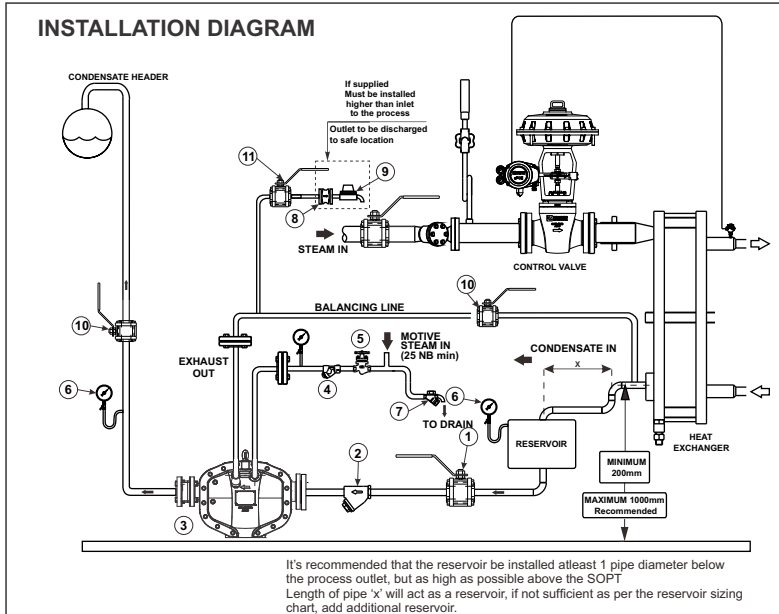
Ensure any residual internal pressure in the product or connecting lines is carefully relieved. Also ensure any hot parts have cooled to prevent risk of injury from burns. Always wear Appropriate safety clothing before carrying out any installation or maintenance work.

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 (70 kgs). 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 10 litres 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-LHX.



| | |
|----|---|
| 1 | 50 NB Isolation Valve |
| 2 | 50 NB Forbes Marshall FMSTR31 Strainer 0.8 Mesh |
| 3 | 40 NB Forbes Marshall Disk Check valve (FMDCV) |
| 4 | 15 NB Forbes Marshall Screwed Strainer (FMSTR51) Dutch Weave type |
| 5 | 15 NB Forbes Marshall Piston valve |
| 6 | Pressure Gauge with syphon |
| 7 | 15 NB Forbes Marshall Thermodynamic trap |
| 8 | 15 NB Forbes Marshall Soft seated Disk check valve (If supplied) |
| 9 | 15 NB Forbes Marshall Air vent (If supplied) |
| 10 | 25 NB Forbes Marshall Piston Valve |
| 11 | 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-LHX. Only when the steam (motive) inlet pipework is close to 0.5 m to the pump should the motive line piping be reduced to 1/2" / 15NB and fed to the SOPT-LHX.

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 is least 0.2 m from the base of the SOPT-LHX 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-LHX has four connection ports. The DN40 (1 1/2") port should be connected to the outlet of the equipment being drained, 40NB FM Disk check valve (It comes with the product) must be installed after SOPT-LHX as shown in installation diagram. And the DN50 (2") port should be connected to condensate inlet line. Flow should be from 50NB port to 40NB port. The DN15 (1/2") 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-LHX though 100 mesh strainer or dutch weave strainer). The screwed DN25 (1") port should be balanced back as close as possible to the condensate outlet of the equipment . 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 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-LHX. This pipework should be sized to take into account the effects of flash steam at the heat exchangers 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-LHX. Ensure the exhaust /balance line is open and not restricted in any way.
- * Slowly open the isolation valves in the condensate inlet and discharge lines, allowing condensate to fill the body of the SOPT-LHX.
- * The SOPT-LHX is now ready to operate.

- * When the process plant is operational, the SOPT-LHX 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

7.2 Removal and fitting of base assembly

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

Tools required

10A/F Allen Key, Flat blade screw driver, Torque wrench, 19 A/F spanner, 19 Hex socket.

7.3 To remove the Base Assly

- 7.3.1 After removing flange bolt, remove base assly carefully, so that there is no damage to SOPT-LHX internal mechanism.
- 7.3.2 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.
- 7.3.3 Inspect the spring assembly for damage. Make sure the valves slide freely and the spring loaded exhaust valve moves on its guide.
- 7.3.4 Inspect the floats to ensure they are undamaged. Check all the pivot point to ensure they are moving freely.
- 7.3.5 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).
- 7.3.6 Check the two outlet orifices are free from dirt and debris. Ensure they open and close smoothly.

7.4 If a Base is to be fitted

- 7.4.1 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.
- 7.4.2 Refit the Base bolts ensuring they are sequentially tightened in opposing pairs, gradually increasing torque to 90-100 N m

| Hex. head / Hex. socket head cap screw | Tools | Torque |
|--|---|------------|
| M12 x 40 M12 x 35 M12 x 70 | Allen Key 10 A/F Hex Head 19 Spanner Hex Head 19 Socket | 90-100 N-m |

- 7.4.3 Carefully reconnected 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-LHX 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 (70 kgs). 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-LHX has been thoroughly 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

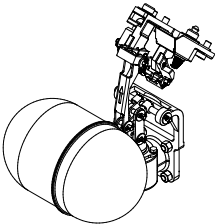
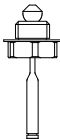
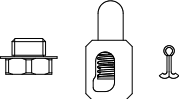
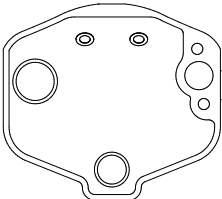
- * Are all isolating valves open?
- * Is the condensate inlet strainer clean and free from debris?
- * Does the installation head available exceed 0.2 m from the base of the SOPT-LHX?
- * Is the available motive pressure is less than the total back pressure? (not exceeding 14 bar g)
- * Is the exhaust 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?

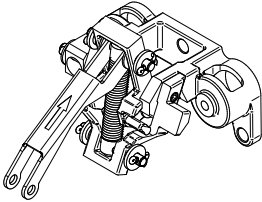
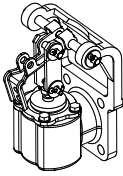
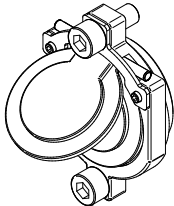
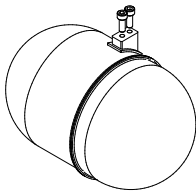
Trouble-shooting guide

SYMPTOM SOPT-LHX fails to operate on start up

| | |
|---|--|
| CAUSE 1 CHECK and CURE | No motive pressure. Motive supply pressure exceeds total back pressure. |
| CAUSE 2 CHECK and CURE | Inlet isolation valve maybe closed. Inlet pipe is free from obstructions and the isolation valve is open |
| CAUSE 3 CHECK and CURE | Motive inlet and exhaust lines incorrectly connected. Motive = IN, Exhaust = OUT. |
| CAUSE 4 CHECK and CURE | The rate of condensate produced by the process maybe very low, causing The SOPT-LHX to cycle slowly. The process being drained is operating correctly. |
| SYMPTOM CAUSE 1 CHECK and CURE | Equipment Flooded and SOPT-LHX stopped Cycling Blocked exhaust line Balance line is free from obstruction and is not waterlogged. Refer to Installation diagram. |
| CAUSE 2 CHECK and CURE | Blocked condensate inlet line. Inspect and clean the strainer mesh, check for blockages. |
| CAUSE 3 CHECK and CURE | Blocked condensate outlet line. Inspect line for blockages. |
| CAUSE 4 CHECK and CURE | Damaged mechanism. Mechanism operates as shown in working principle section Replace malfunctioning part. |
| CAUSE 5 CHECK and CURE | No motive steam available. Steam supply to SOPT-LHX is available and at the correct pressure. Motive Pressure must exceed total backpressure. |
| CAUSE 6 CHECK and CURE | Leaking motive inlet valve. If SOPT-LHX body is not (observe safety note), this indicates the SOPT-LHX Mechanism is stuck on the discharge cycle. Check mechanism for Excessive friction. Check motive inlet valve and spring For correct operation - replace malfunctioning part. |
| CAUSE 7 CHECK and CURE | Broken spring. If SOPT-LHX body is cold, this indicates the SOPT-LHX mechanism is stuck on The filling cycle. Check pump mechanism spring - replace malfunctioning Part. |
| SYMPTOM | Equipment Flooded but SOPT-LHX appears to cycle normally |
| CAUSE 1 CHECK and CURE | SOPT-LHX is undersized for the application. Check system parameters agree with the custom sizing sheet / graph. |
| SYMPTOM CAUSE 1 CHECK and CURE | Chattering or banging in SOPT-LHX 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. |
| SYMPTOM CAUSE 1 CHECK and CURE | Chattering or banging of SOPT-LHX inlet check valve flap Hydraulic pulsing of the inlet check valve Reduce installation head to SOPT-LHX install throttling valve on SOPT-LHX Condensate inlet. |

9.1 Available Spares

| SR.NO | DESCRIPTION | PART CODE NO. | KIT VIEW |
|-------|---------------------------------|-------------------------|---|
| 1 | mechanism assembly kit | SPARE-050SOPT-LHX-MKIT |  |
| 2 | Inlet valve seat assembly kit | SPARE-050SOPT-LHX-IVKIT |  <p>TORQUE: 75 - 85 Nm TOOL REQUIRED: 22 A/F SPANNER</p> |
| 3 | Exhaust valve head assembly kit | SPARE-050SOPT-LHX-EVKIT |  <p>TORQUE: 75 - 85 Nm TOOL REQUIRED: 22 A/F SPANNER</p> |
| 4 | *Gasket kit | SPARE-050SOPT-LHX-GKIT |  |

| SR.NO | DESCRIPTION | PART CODE NO. | KIT VIEW |
|-------|--------------------------------|--------------------------|--|
| 5 | Support Bracket assembly Kit | SPARE-050SOPT-LHX-SBKIT |  <p>TORQUE: 18 - 22 Nm TOOL REQUIRED: 6 mm ALLEN KEY</p> |
| 6 | Trap seat assembly kit | SPARE-050SOPT-LHX-TSKIT |  <p>TORQUE: 18 - 22 Nm TOOL REQUIRED: 6 mm ALLEN KEY</p> |
| 7 | Inlet check valve assembly kit | SPARE-050SOPT-LHX-ICVKIT |  <p>TORQUE: 37 - 43 Nm TOOL REQUIRED: 8 mm ALLEN KEY</p> |
| 8 | Float assembly kit | SPARE-050SOPT-LHX-FKIT |  <p>TORQUE: 7 - 9 Nm TOOL REQUIRED: 5 mm ALLEN KEY</p> |

* Order Gasket kit with all other Spare Kits.

10. Warranty Period

As per ordering information and agreements in the contract.

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