Velan Valves Ltd
Leicester, England

PISTON OPERATED

MODELS SPF 0-7, SP 6-8

INSTALLATION, SERVICING AND MAINTENANCE INSTRUCTIONS

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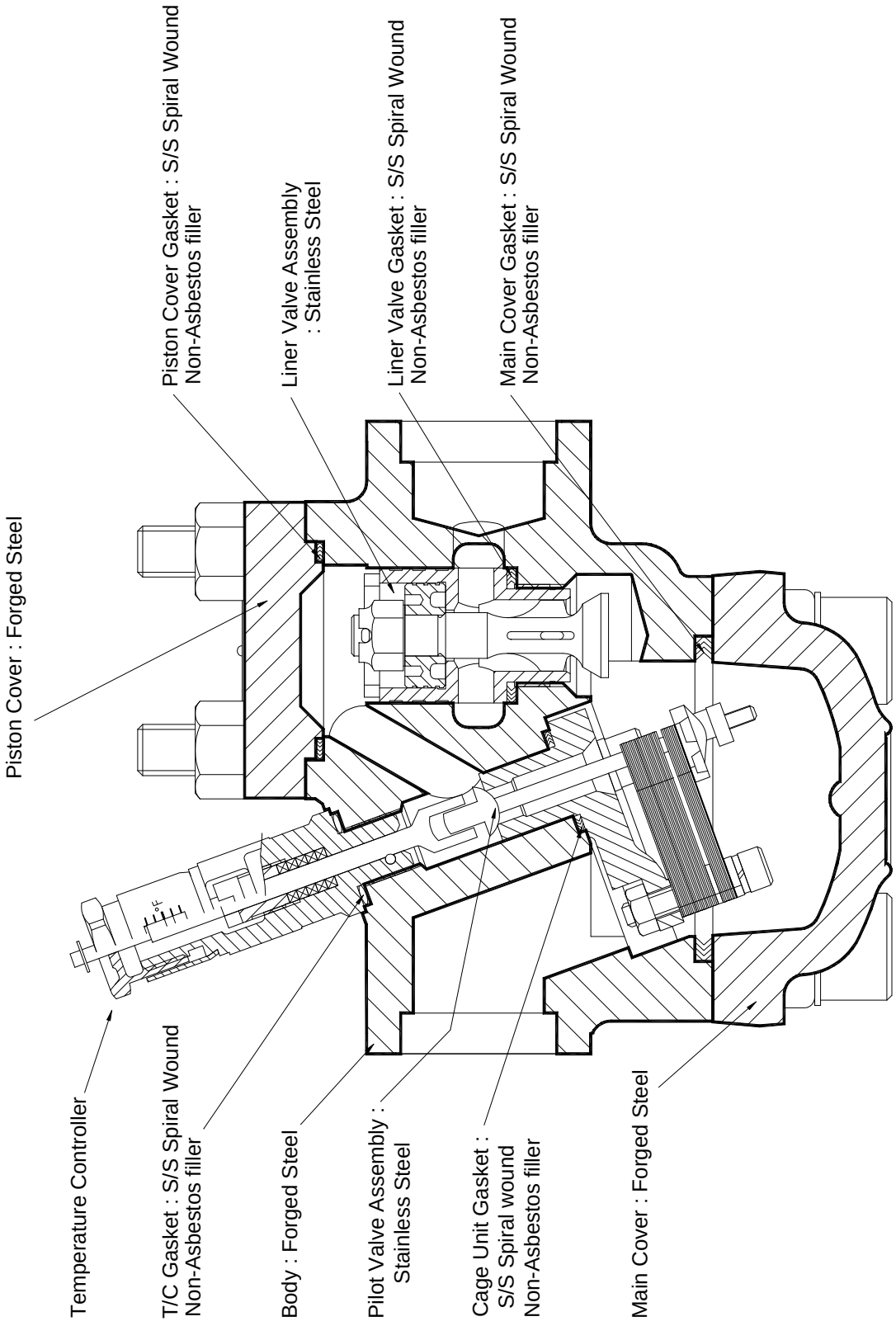

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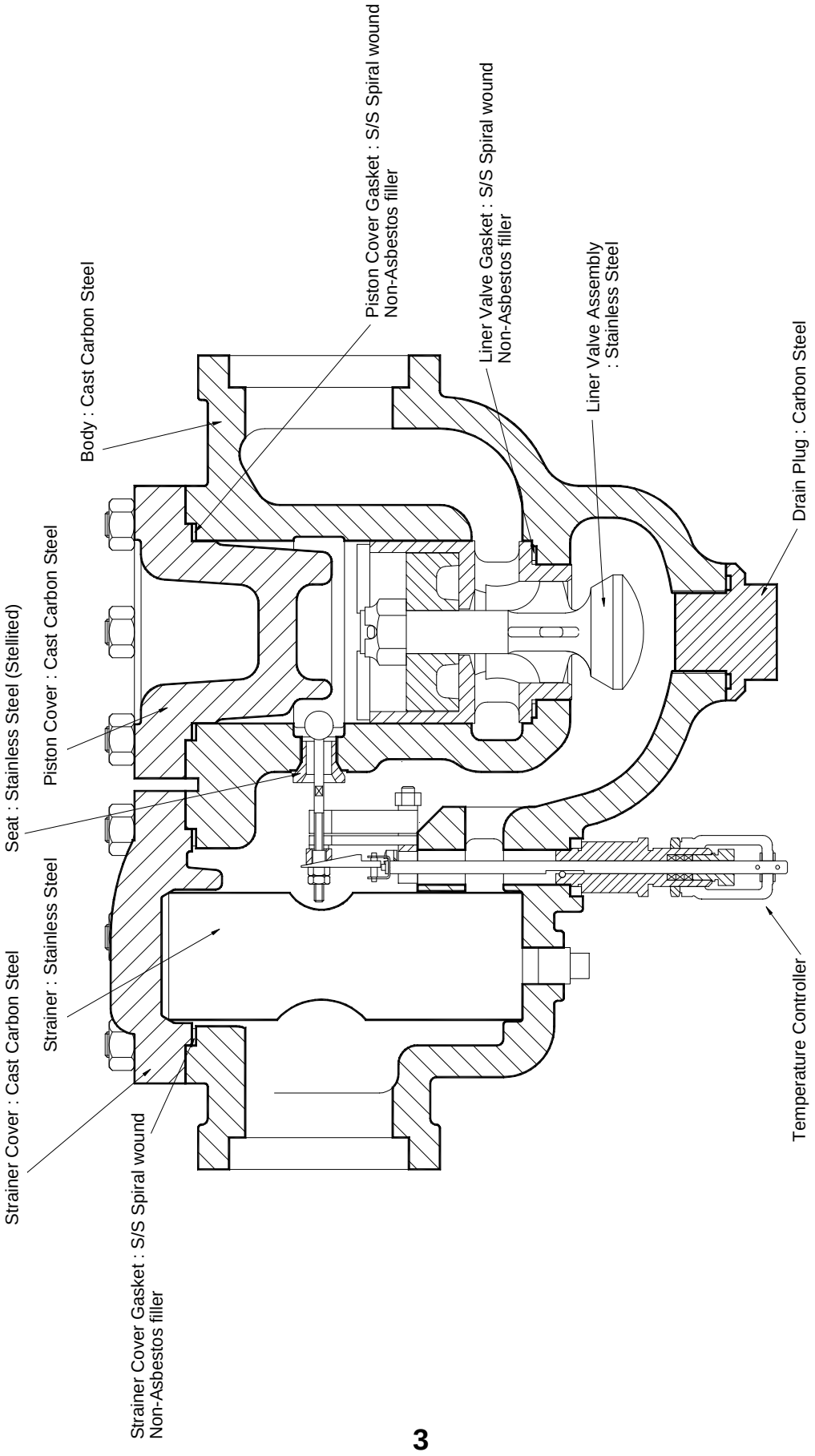


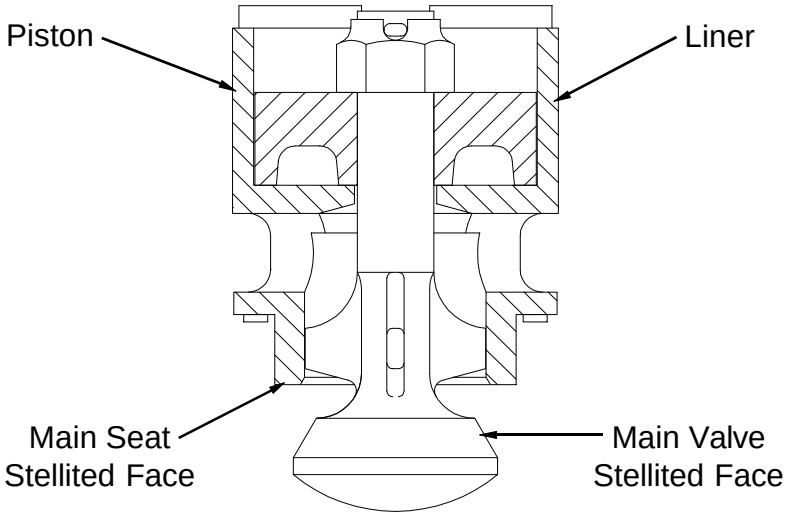
MODELS SPF 0-7, SP 6-8

INSTALLATION, SERVICING AND MAINTENANCE INSTRUCTIONS

1. FEATURES

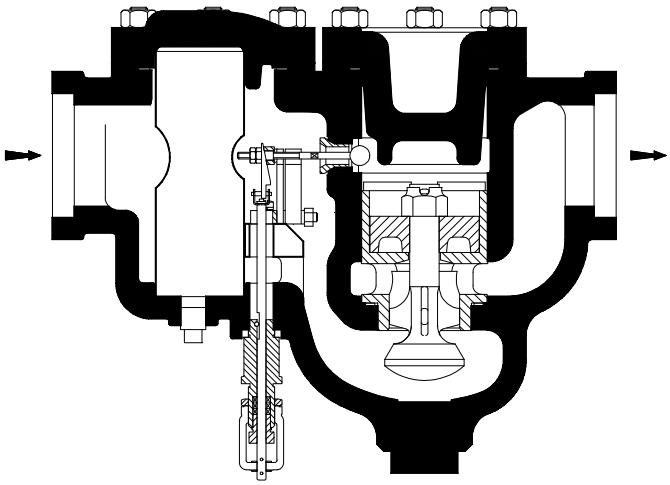
Velan piston operated traps combine the bimetal heat pressure and mechanical principles of operation to provide a steam trap of compact dimensions, yet capable of handling exceptionally high codensate loads at pressures up to 1500 p.s.i.g (105 bar) and 1050°F (570°C), at close to steam temperatures.

The bimetal is used to operate a free floating pilot valve opening into a chamber above a piston, to which is attached the main valve. When the pilot valve is open, pressure building above the piston will move the main valve fom the main seat, allowing condensate to flow through the large orifice. Steam entering will activate the bimetal, which will close the pilot valve. Pressure above the psiton leaks into the return line and the pressure will then close the main valve.



a. Fast warm-up with automatic air venting

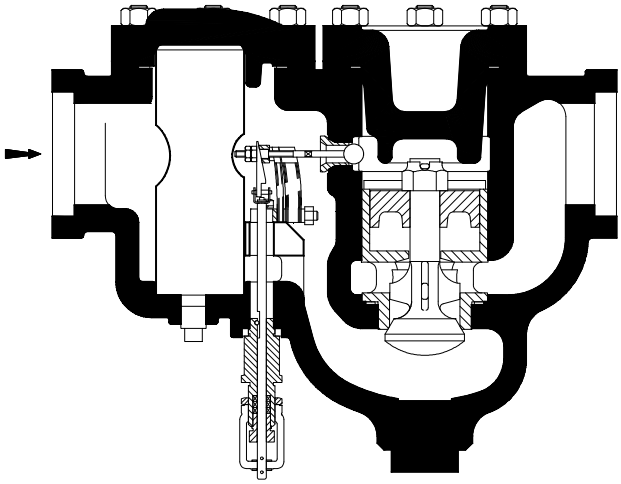
When the bimetal is cool the pilot valve is open and the main valve is fully open. Large volumes of air, gases and condensate will be discharged rapidly through the main orifice which is held wide open, ensuring no air binding or water logging occurs to delay equipmnt warm up. Steam wasting by-passes, or other secondary air venting systems are unnecessary.



b. Positive Steam Trapping

i : Saturated Steam

Incoming steam contacting the bimetal develops the thermal power, this closes the pilot valve thereby reducing the pressure acting above the piston. Line pressure acting below the main valve closes it smoothly and tightly.

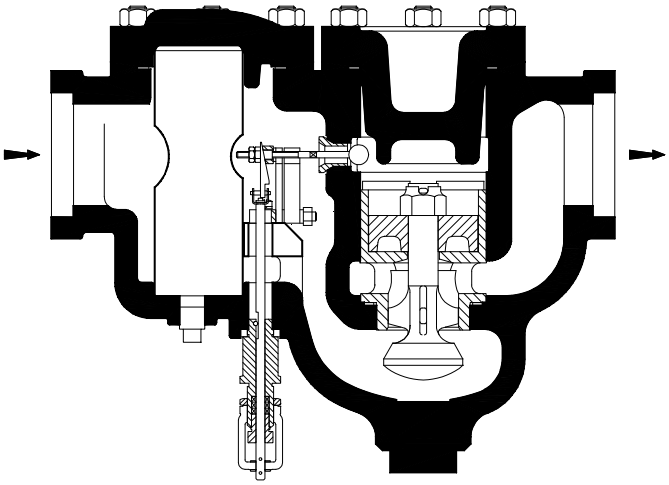


ii : Superheated steam

As for saturated steam, but higher steam temperature develops more bimetal force closing the pilot valve even tighter.

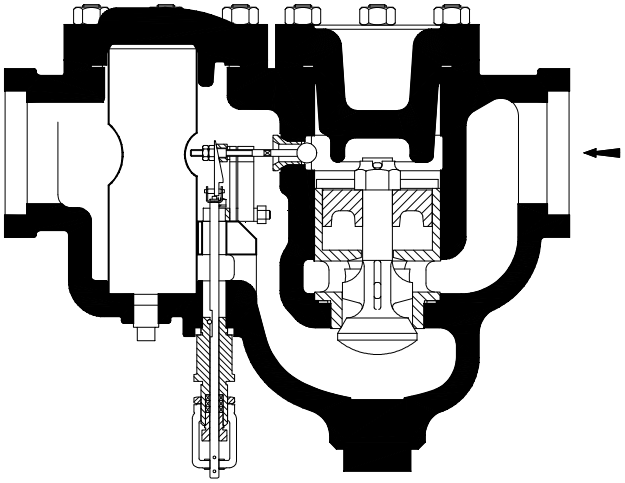
c. Condensate Discharge

Cooler condensate collecting in the trap reduces the bimetal force allowing the line pressure to open the pilot valve, pressurising the chamber above the piston, opening the main valve. Condensate and any air or incondensible gases is discharged through the ultra large main orifice.



d. Check Valve

For traps installed In a closed return line; any excess back pressure, or reverse flow will act under the piston, working as a temporary check valve, closing the main valve preventing back flow.

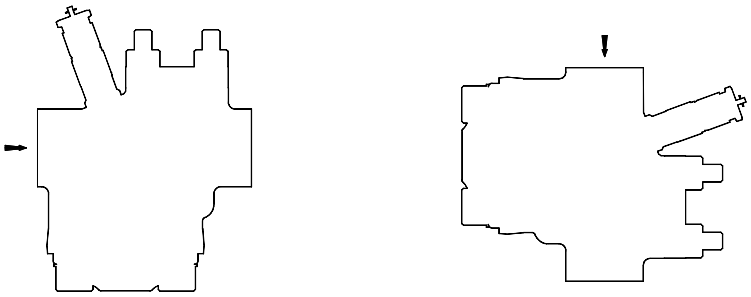


2. INSTALLATION AND OPERATION

a. Piston Traps can be installed in any position, horizontal or vertical without loss of operating efficiently. In the vertical position the trap is self draining and therefore freezeproof provided the condensate can drain away.

i. SPF

Installing the SPF trap in the horizontal position with the temperature controller uppermost (Fig.1) will ensure that the weight of the piston will hold the main valve in the open position when the installation is not operating, allowing condensate to drain, provided the piping runs will allow this. If this is not necessary, SPF traps can be installed with the main cover uppermost.



Horizontal Vertical

Fig.1

ii. SP

When SP traps are installed horizontally with the covers uppermost the main valve will be in the open position when the installation is not operating (Fig.2).

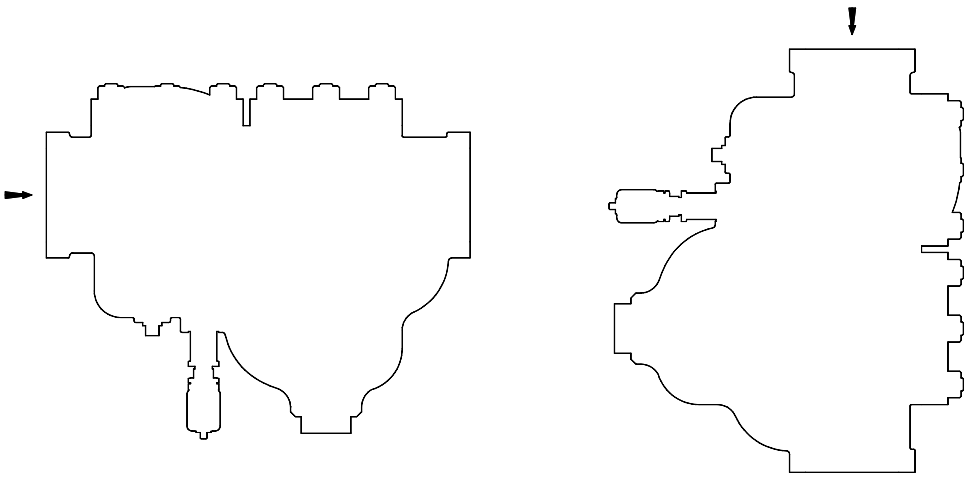


Fig.2

iii. When vertical the main valve will be open for both the SPF and SP models when the installation is not operating.

b. Install the trap a minimum of 5-8 ft (1.5-2.5 m) from the equipment drain point (Fig. 3). This cooling leg will act as a water seal and improve the trap performance. The condensate pipe to the trap inlet should not be insulated within a minimum distance of 2ft (0.6m) before the trap inlet. Should these minimums not be possible the trap performance can be increased by using the temperature controller, see below.

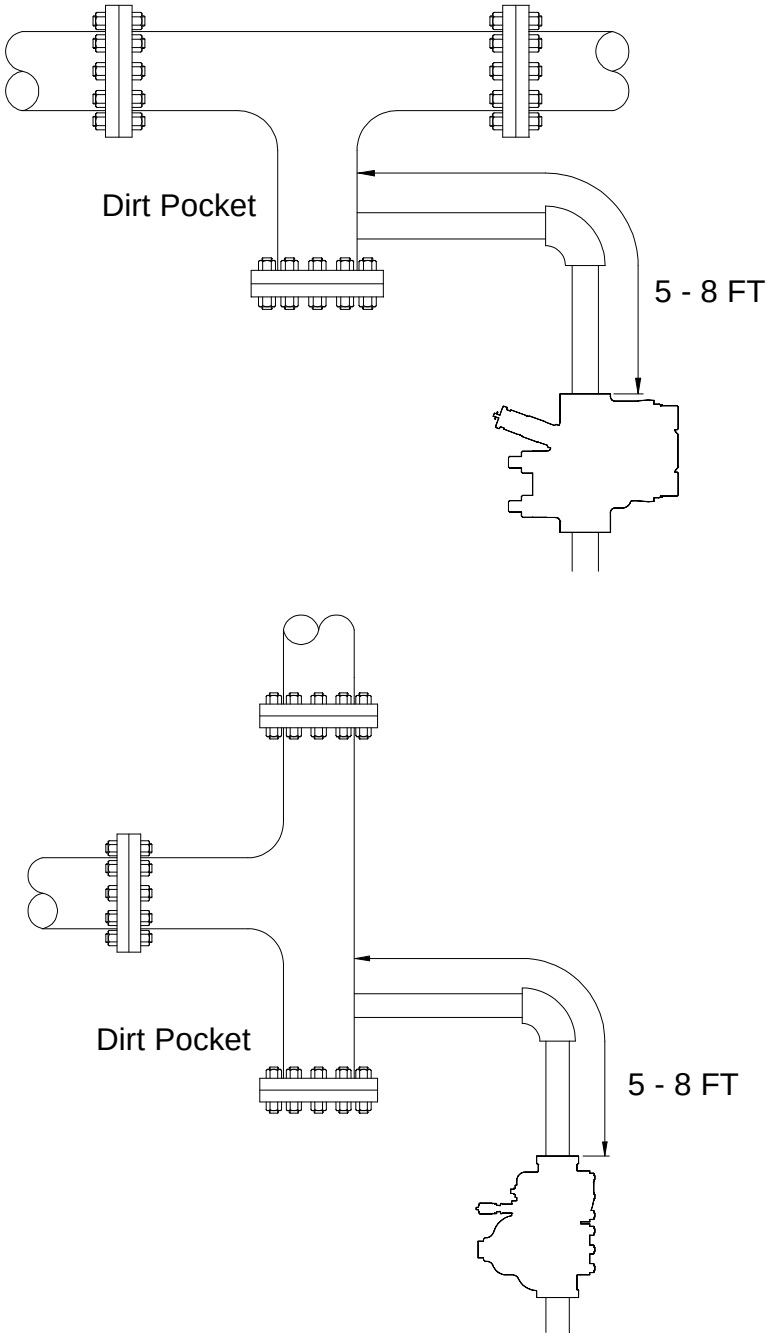


Fig.3

c. Secondary air vents are not necessary as air and incondensible gases are vented automatically through the main valve orifice. Also a strainer is fitted integrally within the SP trap body. If requested the SPF trap can be supplied with a strainer fitted integrally to the inlet connection.

d. Where a bypass is required the piping king unit (Fig. 4) should be used. This will provide considerable savings in space and the cost of installation compared with the standard bypass construction (Fig. 5). The piping king unit allows in line maintenance.

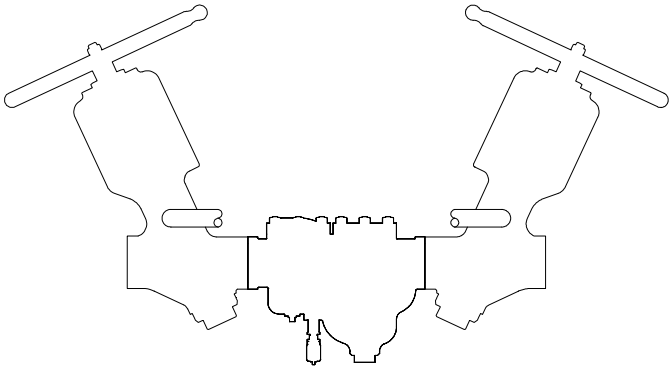


Fig.4

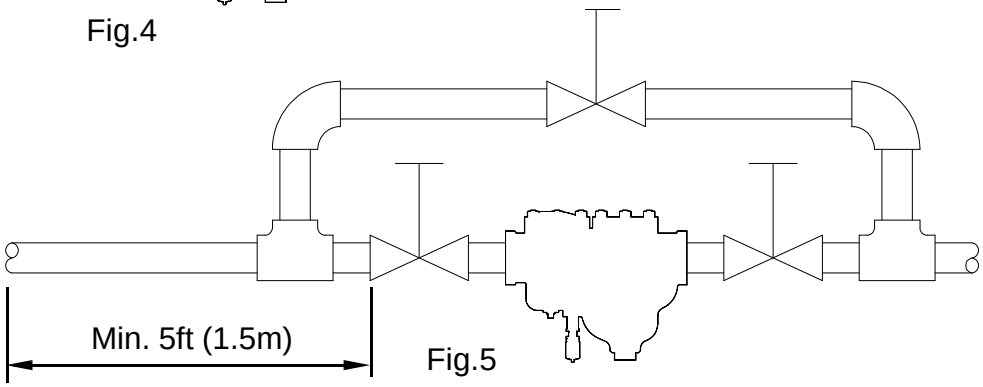


Fig.5

e. The pipe size for the inlet and outlet connections should not be smaller that the main orifice size in the trap to obtain the full capacity discharge indicated on the trap datasheet. No other considerations are necessary as the flashing of condensate before the trap does not affect the steam trap operation.

f. If possible, blow out the line or equipment with air or steam to remove dirt and scale, before installing the trap.

g. It is not necessary to dis-assemble the trap when welding into position. However correct welding procedures must be used without excessive heat input.

h. When operating, the trap will adjust to the quantity and flow condition of the condensate. If intermittent the trap will discharge intermittently. If the condensate flow is continuous the trap will discharge continuously, modulating to adjust to variations in the flow rate.

i. For checking the operation of the trap when installed in a closed return system the following methods can be used:

i. Fit a test valve as shown in Fig. 6.

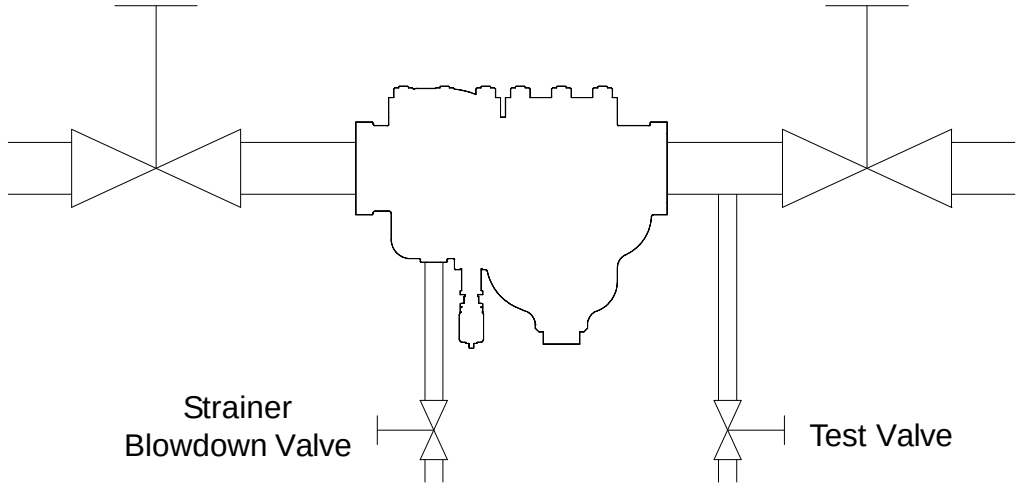


Fig. 6

ii. The trap can be supplied with a thermometer fitted to the outlet connection.

iii. A contact temperature recorder can be used to measure the temperature differential across the trap.

iv. Ultrasonic meters must be used with care if the trap is operating in a continuous discharge mode, as the results indicated can be misleading.

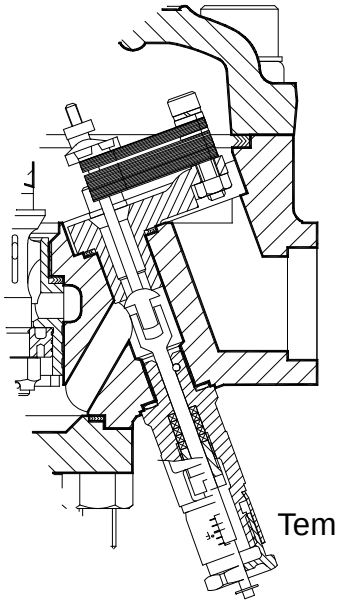
j. Pressure waves in excess of normal operating pressure (water Hammer), will overcome the bimetal closing force, opening the valves and dissipating the excess pressure downstream, preventing damage to the internals.

3. ADJUSTMENT

NOTE: Before undertaking any adjustment or repair work, always ensure that the trap is fully isolated from the system. Before removing any covers, loosen bolting and break gasket seals to release any pressurised steam trapped in the body

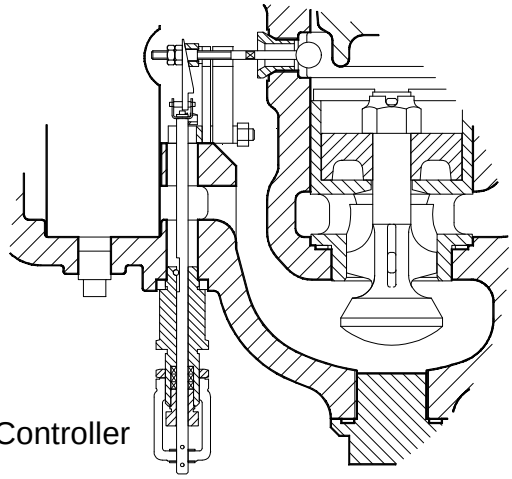
a. Bimetal/Pilot Valve Clearance

i. The defelction of the bimetal is controlled by the clearance between the valve and the valve seat, which also determines the discharge temperature. Increasing the clearance reduces the force exerted by the bimetal allowing a closer to saturation discharge temperature. This will also increase the amount of condensate discharged. Conversely reducing the clearance increases the bimetal force, increasing the amount of sub-cooling required before discharge takes place. It will also reduce the quantity of condensate discharged. All piston operated traps are fitted with temperature controllers which enables the trap to be fine tuned to suit specific operating conditions, thus increasing flexibility and allowing adjustments to be made during operation. The controllers fitted to SPF and SP traps are illustrated in Figs. 7 and 8.



SPF
Temperature Controller

Fig. 7



SP
Temperature Controller

Fig. 8

ii. Setting the clearance

Set the temperature controller in the mid position.

For the SPF this is when the edge of the adjusting ring is centred in the window of the indicator, see Fig. 7.

For the SP this is when the centre of the wedge is in line with the stem, Fig. 8.

The clearance is then measured at point ‘X’ (Fig. 9) between the top of the rockerplate and the underside of the adjusting nut for SP (Fig. 10)

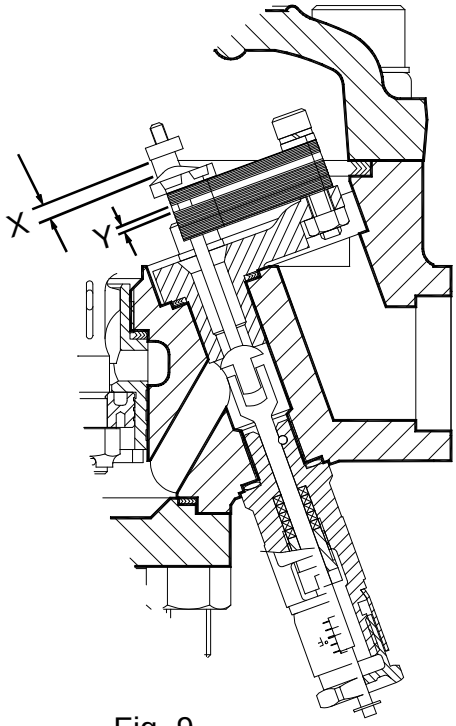


Fig. 9

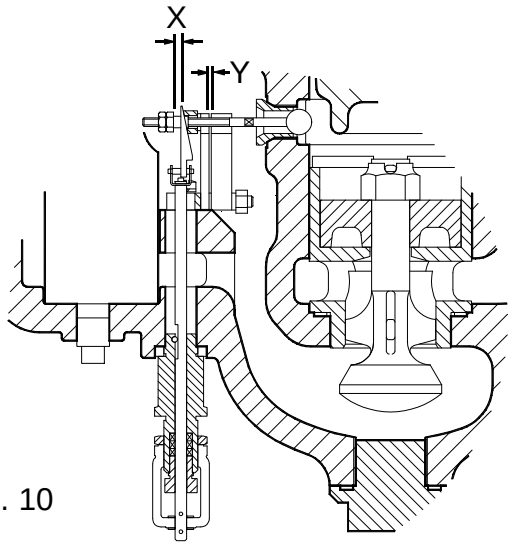


Fig. 10

The standard is made at a temperature of 65°F (18ºC) and will allow the valve to commence opening at 15ºF (8ºC) approx below saturation with full discharge, as shown in the capacity diagrams for each model, around 40ºF (22ºC) sub-cooling. When the ambient temperature changes, an alternative setting as shown in the table below should be used.

iii. Adjustment Chart

A standard setting gauge is available – see tool part numbers, or feeler gauges of the correct amount may be used.

The gauge should be sliding fit at point ‘X’ without reducing the gap ‘Y’ between the bimetal segments – see Figs. 9 or 10 for the appropriate model.

ROOM TEMP		SPF	SP
°F	°C		
50	10	.122	.138
55	12.8	.117	.133
60	15.6	.113	.129
65	18.3	.109	.125
70	21.1	.104	.120
75	23.4	.100	.116
80	26.7	.096	.112
85	29.4	.091	.107
90	32.2	.087	.103
95	35	.083	.099
100	37.8	.079	.095

SETTINGS IN INCHES

iv. Using the Temperature Controller

Increase temperature / quantity of condensate discharge.

Turn the adjusting ring anti-clockwise, which will increase the valve clearance for the SPF, or lower the wedge for the SP. Dependant on the pressure of the gland packing rings a spanner (wrench may be required. For the SP wedge type controller the adjusting ring is locked in position using a locknut. It is necessary to loosen the nut before attempting readjustment and it should be relocked once the final operation position is achieved.

Decrease Temperature / Quantity of Condensate Discharge

Turning the adjusting ring clockwise which will decrease the valve clearance for the SPF, or raise the wedge for the SP. For the SPF the movement of the adjusting ring can be viewed through the graduated window in the indicator.

Additional Adjustment

Should the range of adjustment offered by the temperature controller be insufficient to meet the required condition, further ajsutment can be provided as follows:

SPF

Return the adjusting ring to the central position, re-move the pilot valve cover, remove the cage unit, turn the valve, clockwise or anti clockwise ½ or one additional full turn as required. Replace the cage unit ensuring the valve locates correctly in the fork on the temperature controller stem, and complete re-assembly. Use the controller to provide the required condition as described above.

SP

Remove the pilot valve cover and wind the wedge into its central position. Hold valve stem with stem key (see tool part numbers) located in the flat beneath the bimetal release the locknut without moving the adjusting nut, alter the adjusting nut to increase or decrease the clearance as required, relock the adjusting nut in its new position and complete re-assembly. Use the controller to provide the required condition. Move the adjusting nut ½ turn or max of one full turn.

For current production a standard locknut is fitted to secure the adjusting nut. Older models use a self-locking nut. Care must be taken to ensure that the steam is prevented from rotating whilst this type of locknut is being turned. Particulary when relocking the adjusting nut, otherwise the clearance will be changed. Removal of the self locking part of the nut will facilitate reassembly and re-adjustment.

The SP Models:-

Factory setting wedge approx in centre position

Wedge moved up less clearance delayed opening

Wedge in lowest position – quickest reaction – near to steam temp discharge.

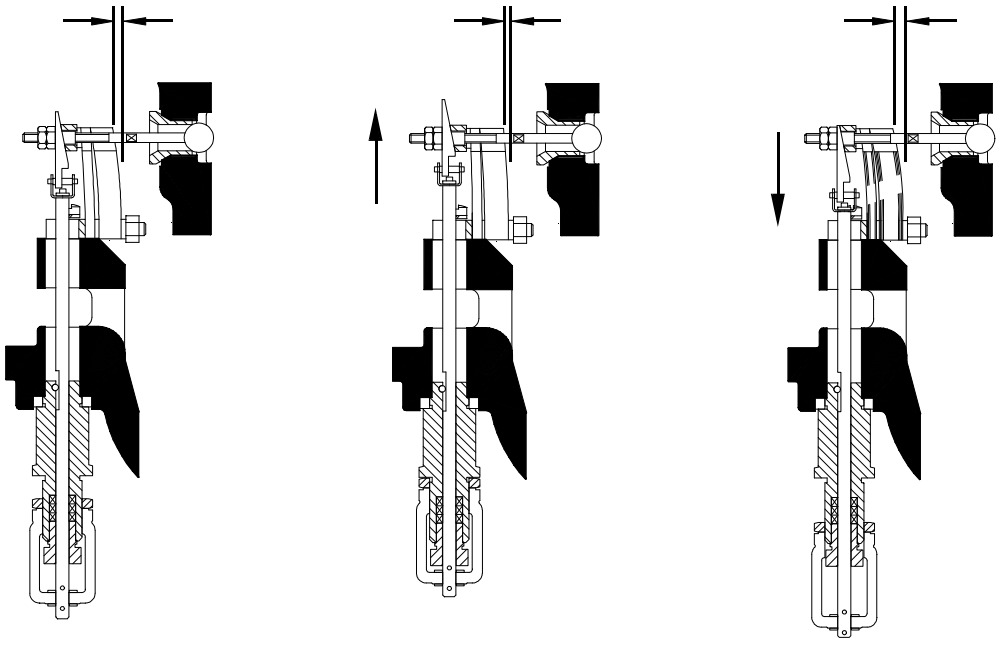


Fig. 11

b. High Back Pressure

Piston Traps will operate against very high back pressures, but the discharge temperature and capacity will be correspondingly affected. For effective operation when the back pressure exceeds 30%, the clearance should be increased progressively as described below. Ensure that the trap will continue to close tight on steam. Do not confuse with discharge of flash steam. The trap can operate against back pressure of 80%.

MODEL : SPF

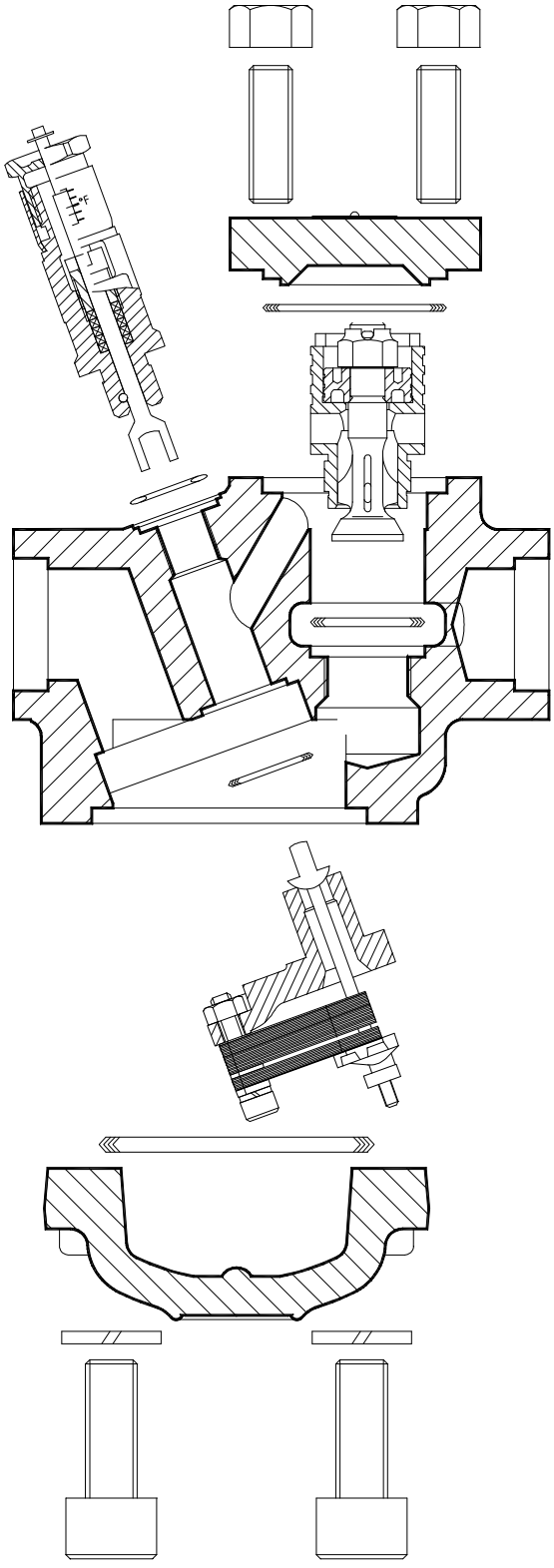


Fig.12

Alterations to the valve clearance can be performed with the trap in line as described in section 3. For the SP models access to the strainer screen is gained by removing the pilot valve cover. There is no integral strainer fitted inside the SPF trap. If required a separate strainer is fitted to the inlet connection of the trap and access to the screen will be by the appropriate cover.

a. Dis-assembly

SPF Models (Fig. 12)

i. Pilot valve Mechanism
Remove cage unit allen screws.
Lift out cage unit and cage unit gasket.
Unscrew temperature controller from the trap body.

To remove the valve, note the clearance setting and rotate the valve clockwise. The stem will withdraw through the caged nut above the rocker plate. Do not lose the adjusting nut, which will now be loose.
Do not remove the bimetal assembly from the cage unit holder unless it is damaged and inoperative.

ii. Main Valve Mechanism

Remove piston cover nuts, cover and gasket.

Remove the liner locking screw located in the side of the body. First remove the hexagon cap and gasket, giving access to the allen type headless set screw with conical point. Turn anti clockwise to remove.

Insert the piston assembly removal tool (see toll part nos) into the slots on the liner and turn anti clockwise to remove the complete assembly and gasket.

To remove the main valve and piston first remove the cotter pin from the valve stem followed by the retaining nut. Remove the main valve from the piston and the piston from the liner.

MODEL : SP

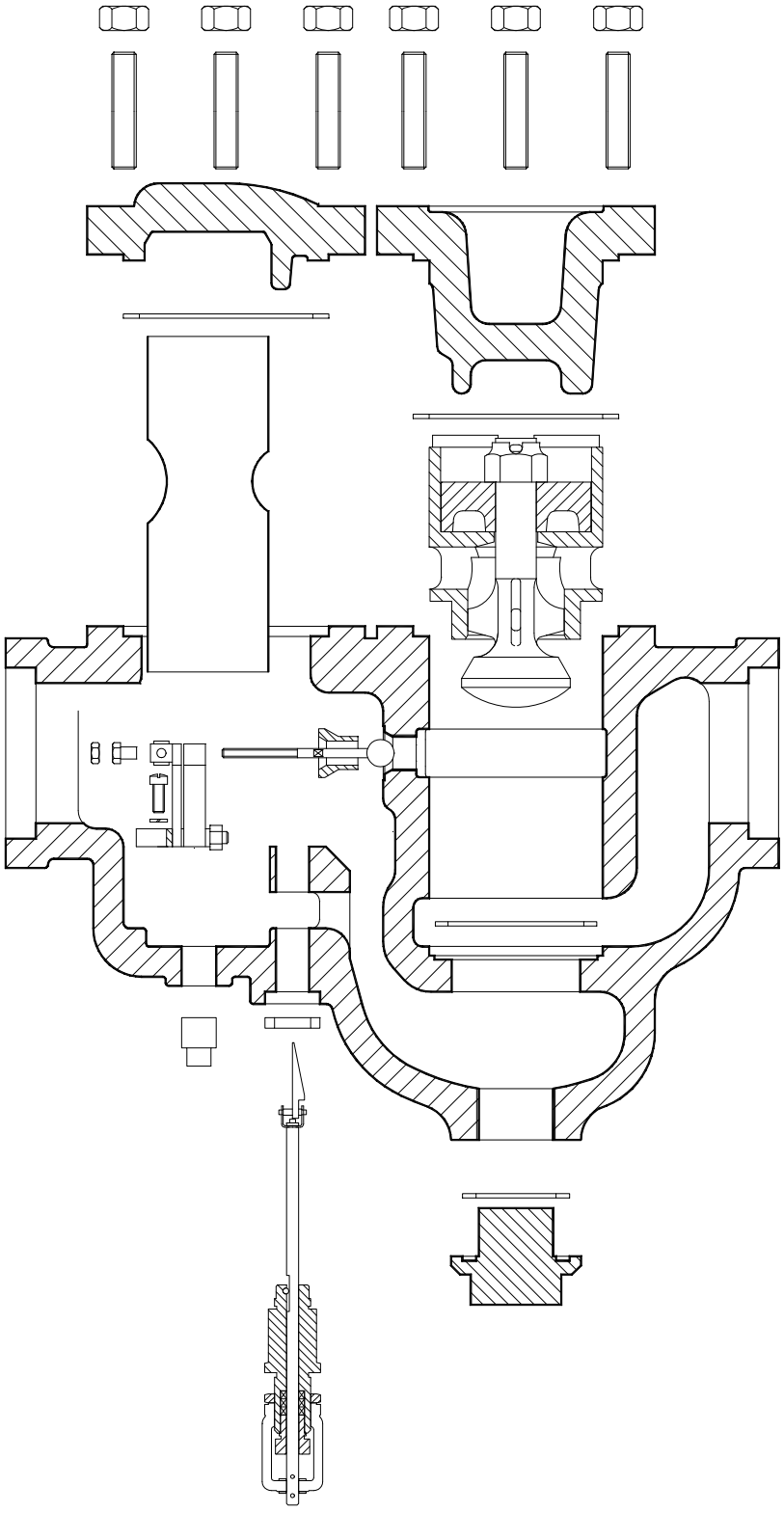


Fig.13

SP Models (Fig. 13)

i. Pilot Valve Mechanism

Remove Strainer cover nuts, cover and gasket.
Remove strainer screen.

Remove bimetal element, undo retaining nuts and remove lock washers. Bimetal can then be removed by manouevring the valve stem though slot in the bimetal and rocker.

Some models are fitted with screwed in type pilot valve seats. Unscrewing the seat enables the seat and pilot valve assembly to be removed. Other models are manufactured with a welded in seat. For these, the pilot valve is removed through the piston chamber.

To remove the temperature controller unscrew the T.C body from the trap body. Should for any reason the fork holder not rotate freely on the stem, it will first be necessary to remove the pilot valve stem. For traps fitted with a welded seat, remove the locknut and adjusting nut and push the valve stem clear of the wedge.

Two types of temperature controller retainment are used. For L.P models the adjusting ring body is screwed into the body. Turn the adjusting ring body anti-clockwise to remove the controller and gasket.

H.P models have a flanged retainer. Remove the two nuts and remove the controller, flange and gasket.

ii. Main Valve Mechanism

Follow the sequence in section a) ii. For SPF. For models with the welded seat, the pilot valve must be removed before unscrewing the main valve assembly cage unit.

b. Valve Seating Examination and Testing

Pilot Valve

i. SPF Models

Unscrew pilot valve from cage unit and examine seating faces for damage. If slight, remove the nut on the top plate and relap the valve seat using and appropriate compound.

Should the seat be heavily pitted or wire drawn (cut) it may be repaired by using a drill of appropriate size. Damage up to 1/64 inch (0.4mm) can be re-paired and leave an adequate stellite deposit. If the damage is greater replace the cage unit.

Replace a severely worn valve assembly.

ii. SP Models

If fitted with a screwed seat, remove from the body and examine the seating faces. If damage is slight, repair by relapping using an appropriate compound. If severe pitting or wire drawing (cutting) of the seating faces is apparent, replace with new units.

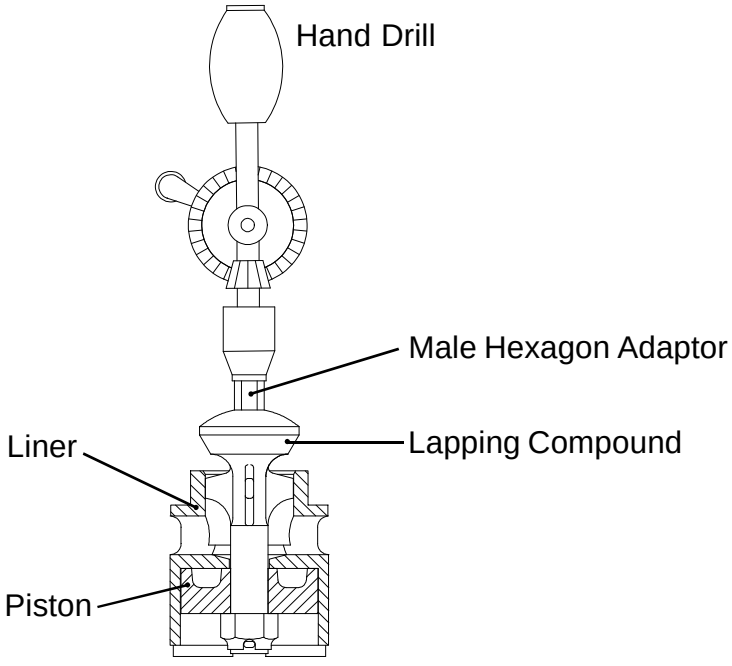
For traps fitted with a welded seat, if the damage is slight it may be possible to repair by relapping by applying the compound to the valve and turning the ball by hand against the seat. Alternatively replace the valve.

If the seat is badly damaged it can be replaced by removing the trap body to the workshop. Locate a 1" (25mm) drill through the inlet connection and drill until the seat weld is broken. Push the old seat out of the recess towards the inlet connection. Do not drill further than necessary as the location recess will be shortened.

Fit a new seat into the recess and re seal weld through the inlet connection, ensuring that the new seat is squarely located in the bottom of the recess.

Main Valve – All Models

Examine the seating surfaces for wear or damage. If slight they can be relapped by hand. A hexagon adaptor of the correct size can be fitted into the recess in the valve head and fitted to a hand drill if preferred. (Fig. 14)



Complete Liner Valve Assembly

Fig. 14

This operation can be performed with the trap in line and the cage unit removed through the cover opening.

More severe pitting can be removed by re skimming the valve and seat faces in the workshop. Do not remove more than 1/64" (0.4mm) material to ensure that an adequate thickness of stellite hard facing remains.

Testing for leakage – SPF and SP models

Plenty piston operated traps are designed to enable the tightness of the pilot and main valves to be checked whilst in line. However should this contravene local health and safety requirements and it is not possible to position adequate protection for the person checking, it should not be attempted for any reason. Use alternative method.

i. Remove piston cover and gasket.

ii. Wind up the temperature controller to reduce the pilot valve clearance, approx 3 ½ turns. This is necessary to compensate for the elimination of the normal operating pressure above the piston with the cover fitted.

Slowly introduce steam into the trap and observe the pilot valve for closing. No leakage of live steam should be apparent if the seating faces are in good condition. Then check main valve. Fig.15. Even if pilot valve leaks the main valve has to close. If fitted open test valve (Fig. 6). No steam should be escaping.

If a screwed seat is fitted check there is no leakage between the seat and the body Fig.16.

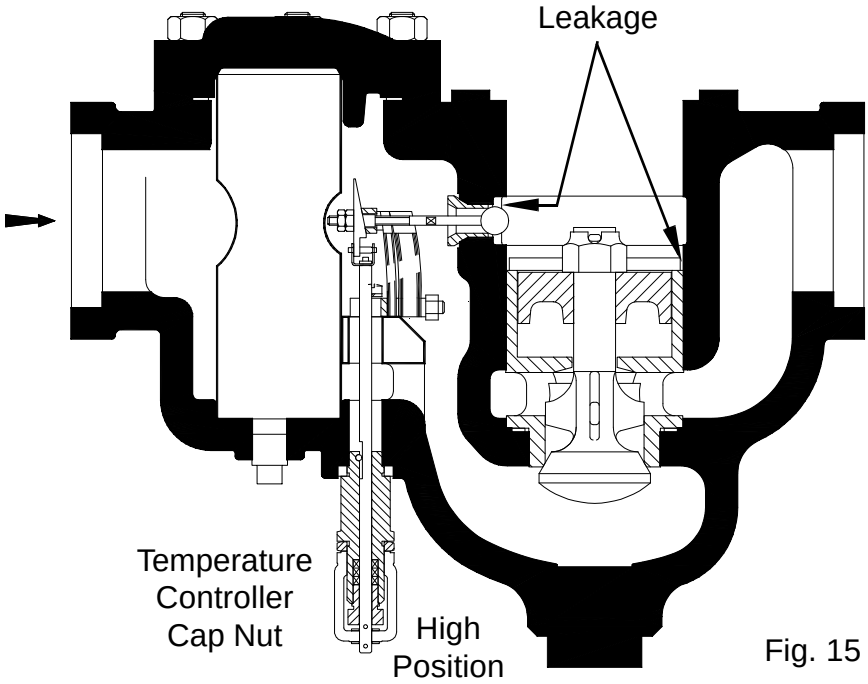


Fig. 15

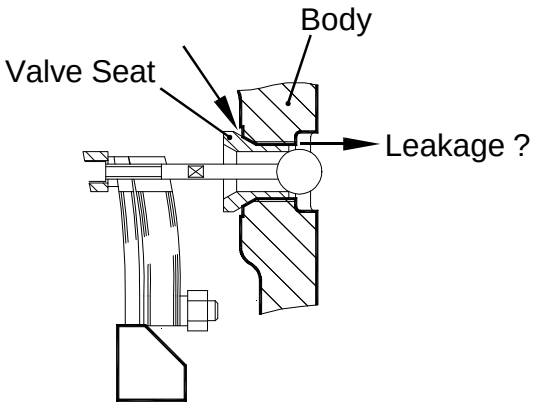


Fig. 16

Alternative Method – SPF and SP Models

i. Remove trap to workshop.

ii. To test the pilot valve – remove the main valve cage unit; fit blanking plug to seal the main valve port (see table below for thread details); replace piston cover and gasket; fit air connection adaptor to outlet connection and attach to air supply; remove access cover to the pilot valve mechanism, fill pilot valve chamber with water to cover pilot valve seating areas; apply air through outlet connection; defective sealing will b indicated by a flow of air bubbles. Re lap or replace defective parts and remove plugs and adaptors.

iii. To test the main valve – remove pilot valve access cover; wind up temperature controller until valve is firmly seated, if insufficient travel available on controller use the adjusting nut to assist; do not force the controller. Replace cover and gasket; remove piston cover; fit air line adaptor to the inlet connection blank outlet connection; apply air; fill piston chamber with water above piston level; deflective sealing will be indicated by a flow of air bubbles; tighten liner on gasket to check gasket tightness and repeat, if still faulty relap or repair – if badly damaged replace main valve seat assembly as required.

After testing is completed before returning trap to service reset temperature controller to the original operating position.

Main valve cage unit assembly – thread sizes.

TRAP TYPE	THREAD SIZE
SPF - 0/1/2/3	1.1/4 - 12UNF-2B
SPF - 4/5/6/7	1.13/16 - 12UNF-2B
SP - 6/7/8	2.3/4 - 12UNF - 2B

c. Re-assembly

Re-assembly is the reverse of dis-assembly. The following points should be noted.

i. Before replacing the main valve cage unit assembly, check that the body gasket seating faces are undamaged. For best results fit new gasket. Ensure cage unit is effectively tightened to seal the gasket.

ii. Replace the line locking screw, tightening firmly – but do not over tighten. This may cause distortion in the liner bore, which will retard the free movement of the piston. Replace the gasket over the screw and refit the hexagon locking cap, tightening firmly to ensure adequate compression of the gasket.

iii. For type SPF temperature controllers must be refitted to the body before the cage unit is replaced. For SP the controller can be fitted after re assembly of the bimetal and pilot valve assembly. Ensure tha the straight face of the wedge is in contact with the adjusting nut see Fig. 10, ie taper facing pilot valve.

iv. Replace cage unit or bimetal, checking that bimetal plates are clean and not corroded and that the space between the segments is clear.

The bimetal assembly should not be disassembled for any reason. Each plate must be concentric and in line with each other. Any plates that have moved out of the alignment may interfere with the free movement of the valve, and will reduce the closing force exerted by the bimetal assembly. Bimetal plates must also be fitted the correct way up or they will exert a negative force and movement. Markings on the underside and on the rear edge indicate whether the plates are assembled correctly.

The bimetal must be correctly aligned with the centre of the valve orifice, to ensure that it pulls the valve evenly and squarely into the seat. For the SPF traps the cage unit construction ensures this automatically provided the bimetal has not been loosened or dislodged. For SP models a liner bar (see Tool No Chart) should be inserted through the valve orifice, locating into the bimetal rocker aperture. Tightening the bimetal holding screws, then removing the liner bar ensures the bimetal is correctly aligned. Replace the valve through the piston chamber and refit the adjusting nut. For the SPF ensure that the anti - rotation tab is central in its slot and does not impede free movement of the valve.

v. Ensure that the clearances have been reset to their original settings with the temperature controllers in their central positions wherever possible.

vi. Before replacing the strainer screen for SP traps and if fitted to the SPF, ensure it is clean and undamaged.

vii. Ensure body and cover gasket seating faces are clean and undamaged. Fit new spiral wound gaskets ensuring that the inner ring is fully supported between the gasket faces for 100% of its periphery. This is important. If any part of this first ring is not fully supported, leakage may occur.

Replace cover tightening the nuts evenly and diagonally opposite until the body /cover faces are in full metal to metal contact.

5. OPERATING CHECKS

a. Inspection of Liner and Piston

While piston and liner are made from high quality stainless steel, should the trap performance have deteriorated and moving the temperature controller bring no improvement, both parts should be inspected to ensure sliding surfaces are not damaged and the piston can move freely and rotate without binding.

b. Chatttering of Piston

Under occasional unusual conditions the main valve and piston may “Chatter” – open and close rapidly for a brief period prior to closing. Moving the temperature controller to marginally reduce the clearance will usually return operation to normal.

6. TOOL PART NUMBERS

MODEL	STEM KEY	SETTING GAUGE	LINER BAR
SPF-0	N/A	L99005/B3	L99038
SPF-1			L99037
SPF-2			L99035
SPF-3			L99034
SPF-4			L99040
SPF-5			L99038
SPF-6			L99036
SPF-7			L99033
SP-6			L99030
SP-7	L99003	L99004/A4	L99031
SP-8			L99032

LINER VALVE REMOVAL TOOL

SPF 0-3 : L99050
SPF 4-7 : L99051
SP 6-8 : L99052

7. BOLTING TORQUE

MODEL	MAIN COVER		PISTON COVER		CAGE UNIT	
	Ft.lb	Nm	Ft.lb	Nm	Ft.lb	Nm
SPF - 0/1/2/3	160	217	60	81	35	47
SPF - 4/5/6/7	160	217	100	136	35	47

MODEL	STRAINER COVER		PISTON COVER	
	Ft.lb	Nm	Ft.lb	Nm
SP - 6	24	33	24	33
SP - 7/8	60	81	60	81