Horne SWM-1 Thermostatic Steam and Water Mixing Valve Installation, Commissioning, Operating and Maintenance Instructions

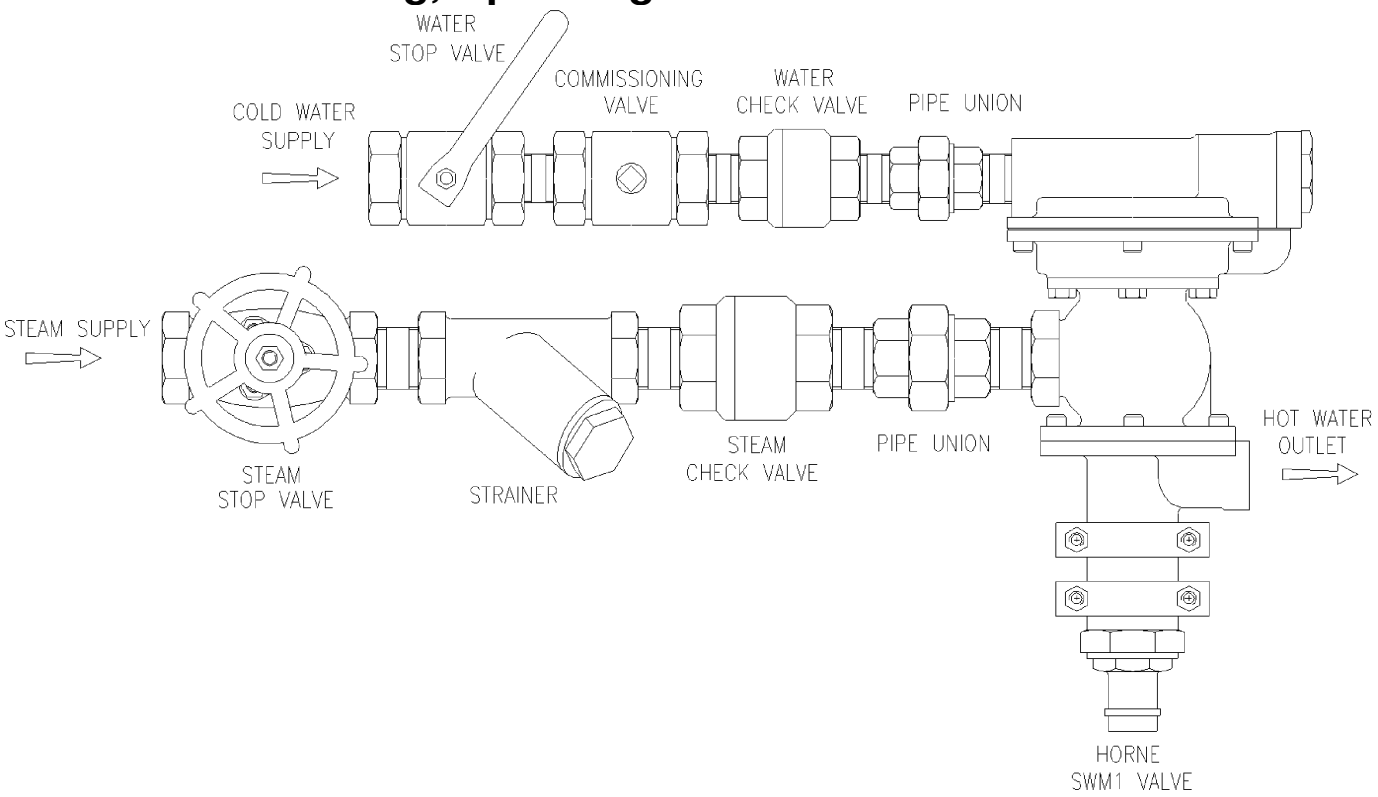


Fig 1

1) Installation

The Horne® Thermostatic Steam and Water Mixing Valve must be installed vertically with the temperature adjuster at the bottom as shown in Fig 1. The water inlet must be fitted with an isolating valve, commissioning valve and a non-return valve and the steam supply must be fitted with an isolating valve, strainer and non-return valve as shown in fig 1. Do not fit a steam trap to the branch serving the SWM1: allowing this branch to waterlog with condensate during periods of non-use allows the valve to cool and thus prolongs the life of the diaphragm, seals and thermostat element. The maximum recommended steam pressure is 6 bar; fit a steam pressure reducing valve if required.

2) Commissioning

NB STEAM & WATER MIXING VALVES ARE USED TO PASS WATER AT SCALDING TEMPERATURES. ENSURE THAT ANYONE COMMISSIONING OR USING THIS VALVE IS SUITABLY PROTECTED BY PERSONAL PROTECTIVE EQUIPMENT IN ACCORDANCE WITH THE PREVAILING PPE REGULATIONS.

Correct commissioning of the valve is essential to ensure safe and satisfactory operation.

N.B. The valve may pass live steam if this procedure is not followed.

a) Connect the valve to the steam and water supplies as shown in fig 1. Note the check valves on the supply pipes.

b) DO NOT OPEN THE STEAM AND WATER SUPPLIES AT THIS STAGE.

c) Fully open the water commissioning valve.

d) Open the outlet.

e) Open the water supply to let cold water flow through the valve. Wait for the air in the valve to be purged out.

f) With the water running, slowly open the steam supply. Depending on the configuration of the steam pipe leading to the valve it may take some time to purge condensate out of the steam line.

g) Observe the temperature of the water at the outlet and ensure that this does not exceed the desired set temperature. The valve is set at the factory to approx. 60C. The thermostatic temperature range is 50 – 85C.

h) When the steam supply is fully opened, turn the temperature adjusting screw anti-clockwise to increase the set temperature, or clockwise to reduce it.

i) Continue turning the temperature adjusting screw until the required temperature setting is achieved or until the temperature stops increasing.

j) If the required temperature setting can be achieved then go to step m below.

k) The required temperature setting is not being achieved because the valve is passing more water then the steam supply is capable of heating to the required temperature. To correct this turn the adjusting screw clockwise until the water temperature DROPS by at least 5C from the maximum temperature obtainable.

l) Throttle the water commissioning valve by turning it clockwise until the water temperature reaches the required setting.

m) Now check for correct commissioning of the valve. The temperature should be capable of being increased by at least 5K from the set temperature by turning the temperature adjusting screw anticlockwise. Reduce the temperature to the required setting after performing this step. **NOTE: IF THE TEMPERATURE DOES NOT INCREASE AT THIS STAGE THEN THE VALVE IS NOT COMMISSIONED CORRECTLY AND THE PROCEDURE SHOULD BE REPEATED FROM STEP K ABOVE**.

n) The reason for operating the valve below the absolute maximum temperature obtainable is to ensure that the thermostatic mechanism is controlling the temperature by throttling the steam supply. It is necessary to ensure that the temperature setting is a “true” setting. If this instruction is not carried out then it is possible that increases in the steam pressure (e.g. from boiler modulation) may cause the water temperature to increase, and in extreme cases, for steam to flow from the outlet hose.

o) Remove the adjustment handle from the commissioning valve to prevent inadvertent adjustment.

3) Operation

The Horne® Thermostatic Steam and Water Mixing Valve is both pressure balanced and thermostatic. This means that if the cold water supply pressure should fail, or dramatically reduce, then the pressure balance mechanism will shut off the steam supply and live steam will not flow out of the valve. This works completely independently of the temperature control mechanism. Similarly, if the steam supply is turned on before the water supply then steam will not issue from the valve.

The thermostatic mechanism controls the temperature of the hot water by throttling the steam supply. It compensates for variations in the water supply pressure and variations in the steam supply pressure.

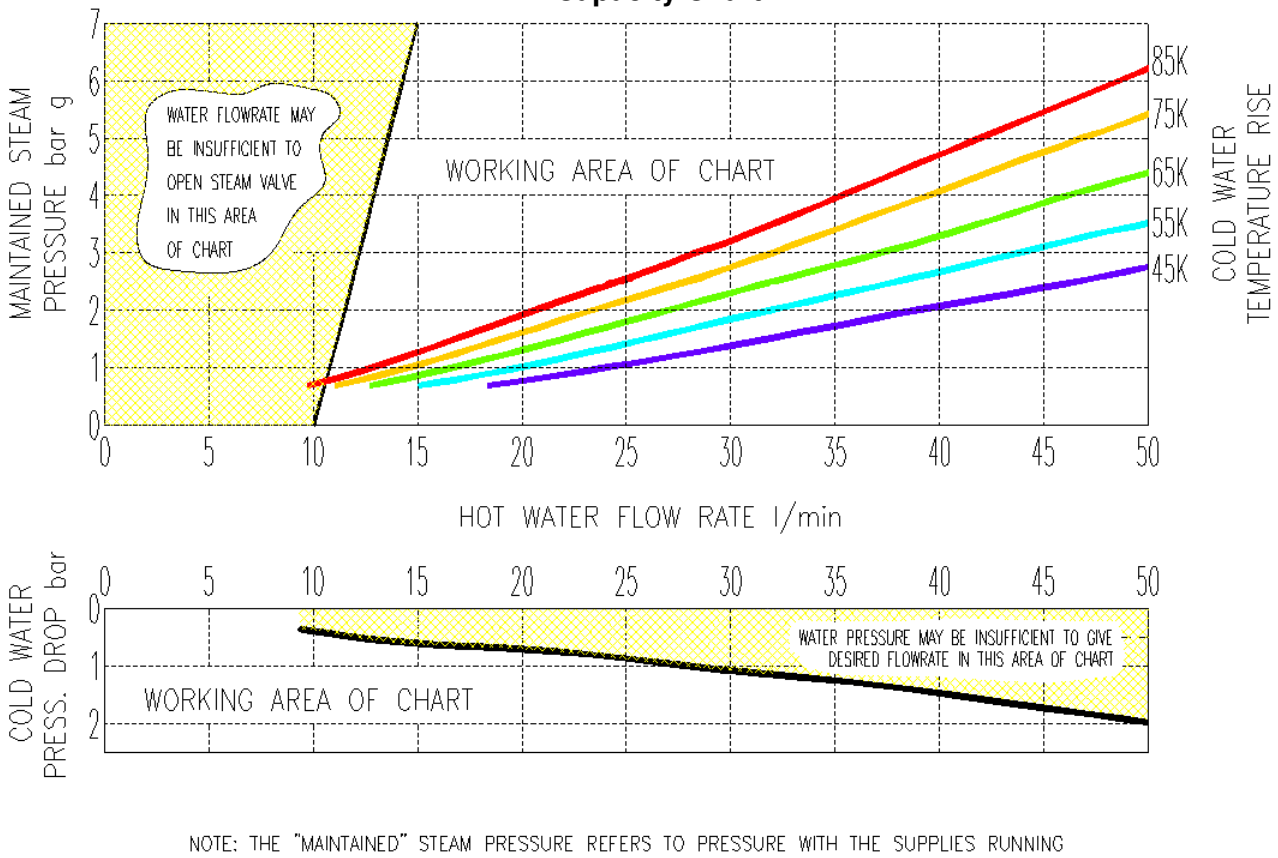
The same limitations of operation for any steam and water mixing valve apply – the valve can only produce as much hot water as the steam supply is capable of heating, and steam can only flow from a high pressure to a lower pressure.

Restrictions on the outlet of the valve (e.g. spray guns) increase the pressure inside the valve. Make sure that your steam supply is at a high enough pressure to overcome these restrictions. Generally a dynamic (i.e. with the steam flowing) steam pressure of 3 – 6 bar will satisfactorily work with spray guns.

During periods when the mixing valve is not being used the steam and cold water isolating valves must be closed.

NB All pipework, hoses, couplings, etc. must be capable of withstanding double the maximum pressure of the steam and water supplies at the maximum temperature being used. The design temperature range of the mixer valve is 50 – 85ºC. The maximum working pressure of the mixer valve is 10 bar. The maximum recommended steam pressure is 6 bar.

Capacity Chart



NOTE: THE "MAINTAINED" STEAM PRESSURE REFERS TO PRESSURE WITH THE SUPPLIES RUNNING

FIG 2

The capacity chart shows the heating capacity of the valve with respect to water flow rate and required temperature rise. The water temperature rise is the difference between the inlet and outlet water temperatures.

The capacity chart is split into two graphs. The lower graph relates to the water pressure drop across the valve. Read from the required flow rate down to the line of the graph and project to the left axis to read the water pressure drop across the valve. The shaded area of the lower graph represents conditions under which the water pressure may be insufficient to give the desired flowrate.

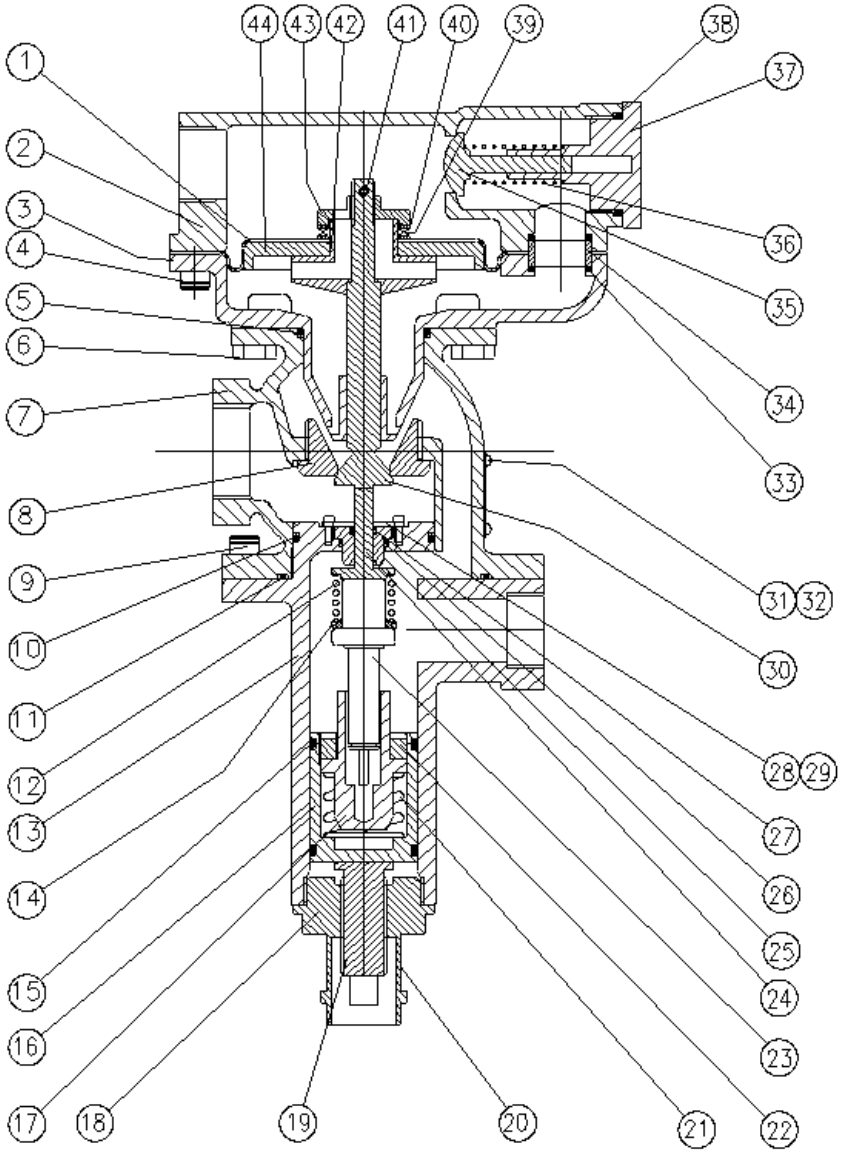
The upper graph relates to the heating capacity of the steam at various steam supply pressures. To use this chart read upwards from the required water flow rate until it crosses the appropriate temperature rise line (e.g. heating water from 10ºC to 75ºC = a temperature rise of 65K). Then project across from the intersection to the steam pressure axis. This shows the minimum steam supply pressure needed to heat the required flow rate of water by the required amount.

NB. The shaded area to the left of the upper graph represents conditions under which the low water flow rate may be insufficient to open the steam valve fully. The area below the lines towards the right hand side of the chart represents conditions where the steam supply pressure may not be sufficient to heat the water by the required temperature rise.

This chart relates to the capacity of the valve alone. Outlet fittings will affect the ultimate capacity of the installation.

4) Maintenance

Routine maintenance of the valve can be carried out without removing the valve from the pipework. FIG 3 below shows the component parts of the valve.



ITEM No.	No OFF	DESCRIPTION
1	1	ROLLING ELEMENT DIAPHRAGM
2	1	WATER INLET HOUSING
3	1	WATER DISTRIBUTOR HOUSING
4	6	INLET HOUSING SCREW (M8 x 20 SKT HEAD CAP)
5	1	WATER DISTRIBUTOR SEAL
6	6	VALVE BODY SCREW (M8 x 12 HEX HEAD)
7	1	STEAM VALVE BODY
8	1	STEAM VALVE SEAT
9	6	OVERHEAT HSG SCREW (M6 x 18 SKT HEAD CAP)
10	1	OVERHEAT HOUSING SEAL
11	1	OVERHEAT HOUSING FACE SEAL
12	1	ELEMENT LOADING SPRING
13	1	OVERHEAT PROTECTION HOUSING
14	1	ELEMENT SPRING SEAT
15	2	ADJUSTMENT/OVERHEAT PISTON SEAL
16	1	ADJUSTMENT/OVERHEAT PISTON
17	1	ELEMENT SHROUD
18	1	ADJUSTMENT LOCKSHIELD
19	1	ADJUSTING SCREW
20	1	SERIAL NUMBER LABEL
21	1	OVERHEAT SPRING
22	1	OVERHEAT SPRING RETAINING NUT
23	1	THERMOSTAT ELEMENT
24	1	THERMOSTAT ROD
25	1	STEAM SEAL HOUSING
26	1	STEAM SEAL HOUSING SEAL
27	1	STEAM SEAL
28	1	STEAM SEAL RETAINING PLATE
29	2	STEAM SEAL RETAINING PLATE SCREW
30	1	STEAM VALVE DISK & LIFTING ROD
31	1	NAMEPLATE
32	4	FIXING SCREWS
33	2	BY-PASS PIPE SEAL
34	1	BY-PASS PIPE
35	1	BY-PASS VALVE SPOOL
36	1	BY-PASS VALVE SPRING
37	1	BY-PASS VALVE SPOOLGUIDE
38	1	BY-PASS HOUSING SEAL
39	1	WAVE SPRING
40	2	WAVE SPRING SUPPORT WASHER
41	1	DIAPHRAGM RETAINING PIN
42	1	WATER PISTON HOUSING
43	1	DIAPHRAGM RETAINING NUT
44	1	WATER PISTON

 Drawing No 8348 Issue 5

FIG 3

To order spare parts, please refer to the type of valve and the serial number, the Part reference number and name from the table above, and this drawing number. For example. “SWM1, Serial Number 1234, thermostat element, item 23 on drawing 8348 Issue 5.”

Common Maintenance Tasks
Note that a seals kit is available and that all seals should be replaced when the valve is disassembled. New seals should be lightly smeared with silicon grease immediately prior to assembly. Note that the seals used throughout are special high temperature rated "O" rings. All maintenance tasks are simplified if the valve is removed from the pipework and dismantled at a clean bench.

1) **To replace the thermostat element.**
    - The thermostat element (23) can be replaced without removing the valve from the pipework. Ensure that the steam supply is safely isolated and allow the valve to cool down to a comfortable temperature to work with. Isolate the water supply at the isolation valve near the steam and water mixing valve.
    - Open the outlet fitting to release any pressure in the valve.
    - Remove the adjustment lockshield (18) with a spanner.
    - The adjustment/overheat piston (16) inside the overheat protection housing (13) must now be removed. Close the outlet fitting so that water cannot flow through the valve. Place your hand below the open cover and **VERY GENTLY** crack open the water supply. ***CAUTION : Opening the supply too quickly could cause the piston to be forcefully ejected from the housing***. The water pressure will slowly drive the adjustment/overheat piston (16) downwards until it can be removed by hand. Be careful not to allow the piston to drop or it may be damaged. The piston will come out with the thermostat element (23), element loading spring (12) and element spring seat (14) sitting in it. Note the location of each of these parts for re-assembly. **NB IF THE OVERHEAT PROTECTION HOUSING IS REMOVED DO NOT CLAMP IT IN A VICE OR THE CYLINDER MAY BECOME DISTORTED.**
    - Correctly position these loose parts on the new element and press the adjustment/overheat piston into the overheat housing (13) to re-assemble the valve. Ensure that the element loading spring (12) remains in place and during reassembly, and that it re-seats on the thermostat rod (24). (This can be checked by looking in the hot water outlet). Note that the adjustment lockshield (18) does **not** have a seal between it and the overheat housing (13) and this thread should not be sealed by any means.

2) **To replace the steam valve disk and/or steam valve seat**
   The steam valve seat (8) is made from a high grade engineering polymer and should not require regular replacement.
    - Cool the valve, isolate the supplies and remove the valve from the pipework.
    - Remove the six overheat housing screws (11).
    - Remove the overheat housing (13) from the valve body (7) and carefully lay it down on a clean surface on its side. Ensure that the thermostat rod (24) which protrudes from the overheat housing (13) does not get damaged while the valve is disassembled. Do not remove the thermostat rod (24); it protects the seal in the steam seal housing (25).
    - Remove the 6 water distributor housing screws (4) and separate the two housings, being careful not to damage the diaphragm (1) which is clamped between them.
    - Rest the water distributor housing (3) on its side on a clean surface.
    - Remove the diaphragm retaining pin (41) using pliers while supporting the steam valve disk & lifting rod (30). Unscrew the diaphragm retaining nut (43). This is only hand tight and should not require tools. Remove the water piston housing (42) and withdraw the steam valve disk & lifting rod (30).
    - If necessary, unscrew the steam valve seat using a tool with prongs to engage with the slots on the top of the seat. A suitable tool can be made from 1 ½" steam pipe (See fig 4 on next page).
    - Screw in the new steam valve seat (8) tightly and reverse the above procedure to re-assemble the valve. A sealing compound such as Hylomar or red Hermetite should be used to seal the thread on the steam valve seat, however, screw the seat in dry first to ensure the threads are clean and the seat can be fully inserted before using a sealant.

To replace the diaphragm

The diaphragm (1) is a thin flexible membrane which permits the inlet water flowrate to open the steam valve. If the diaphragm leaks for any reason, the steam valve is unlikely to open sufficiently to heat the water. In cases of major damage, the steam valve may fail to open at all. It is thus fail-safe.

- Safely isolate the steam and water supplies and disconnect the water supply pipe.
- Remove the six screws (4) securing the water inlet housing (2) to the water distributor housing (3).
- Take care not to lose either the by-pass pipe (34) or its two seals (33).
- Remove the water inlet housing (2).
- This reveals the diaphragm (1). Remove the Retaining Pin (41), using pliers, while supporting the steam valve disk & lifting rod (30). Unscrew the diaphragm retaining nut (43) and remove the Wave Spring (39) and the two support washers (40).
- Remove the diaphragm from the piston (44).
- Replace the diaphragm with the new one and reverse the above procedure to re-assemble the valve. Be careful not to forget to fit the bypass pipe (34) or either of its two seals (33). Note that the diaphragm is a gasket and so the six screws (4) should be tightened progressively in a diagonal sequence to avoid leaks. Torque these screws to 11 lbft (15 Nm). Do not overtighten them or the seal at the diaphragm gasket may be compromised.

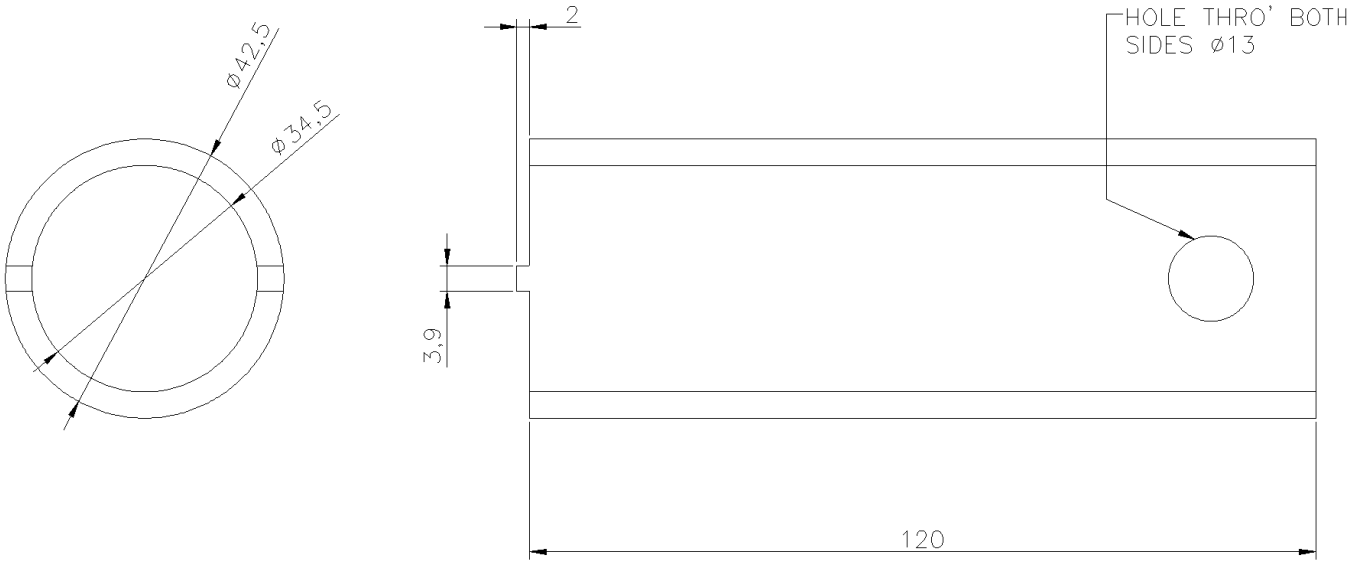


Fig 4 Tool for removing steam valve seat made from 1 ½" Steam Pipe

Fault Finding

Most problems with the Horne SWM-1 can be traced to incorrect commissioning. The commissioning procedure is essential to ensure that the valve "balances" the steam and water supplies – i.e. that the valve does not pass more water than the steam can heat and that the valve is actively controlling the steam flowrate to enable thermostatic temperature control. Correct commissioning will "tune" the valve to the site conditions. The valve is capable of accommodating significant variations in site conditions without the need for re-commissioning. However, correct initial commissioning is essential for optimum performance.

Symptom	Possible Cause	Remedy
Valve only passes cold water at inlet supply temperature	• Steam supply shut off	• Turn on steam supply
	• Insufficient water flowrate through valve so steam valve does not lift.	• Follow commissioning instructions and re-commission valve
	• Steam pressure may be too high for water flowrate	• Try throttling steam isolating valve to reduce steam pressure and, if successful, fit a PRV to steam supply
	• Water Pressure is too high for steam pressure.	• Throttle water supply at water commissioning valve and repeat commissioning procedure
	• Burst diaphragm	• Replace diaphragm
	• Unsuitable outlet fittings	• Remove outlet fittings from hose end and see if valve passes hot water
	• Defective thermostat element (note this is highly unlikely in a new valve)	• Replace thermostat element
Valve does not heat water hot enough	• Not enough steam available !	• Follow commissioning procedure to establish maximum amount of water which available steam can heat.
	• Too high a water flowrate for the available steam	• Reduce the water flowrate at the water commissioning valve by repeating commissioning procedure.

Parts Replacement Schedule.

The following schedule is intended as a guide only as the wear and tear on any individual valve will depend upon the site conditions, duty cycle etc. and so it should be regarded as indicating the *maximum* recommended service life of the appropriate components.

Seals	Replace with a spares seals kit every 3 years.
Diaphragm	Replace with a spare diaphragm every 3 years
Thermostat element	Replace with a spare thermostat element every 1 year.

The valve should be periodically tested by closing the cold water supply when steam supply and outlet are open. The valve should immediately shut off the steam supply so that no steam or water comes from the outlet. Restoring the water supply should cause the valve to permit hot water to pass again, which should return to the same temperature as before after a few moments.

This test verifies the function of :-

- The thermostat element, which has to actively control the temperature after the water supply has been restored.
- The diaphragm, which has to sense the restored water flowrate to open the steam supply
- The free movement of the valve internals which have to move freely to shut off the steam supply. (Build-up of scale could cause the internals to seize).
- The steam valve disk and seat, which will not provide a tight shut-off of the steam supply if either is pitted or damaged in any way.

If a small flow from the outlet continues during this test, first check the efficiency of the water isolating valve before considering maintenance of the SWM1. If the water isolating valve does not seal tightly then the SWM1 will simply pass the isolating valve leakage.

Horne Engineering Ltd
PO Box 7
Rankine Street
Johnstone
Renfrewshire
Scotland
PA5 8BD
U.K.

Tel 01505 321 455
Fax 01505 336 287
Email sales@horne.co.uk
Web www.horne.co.uk