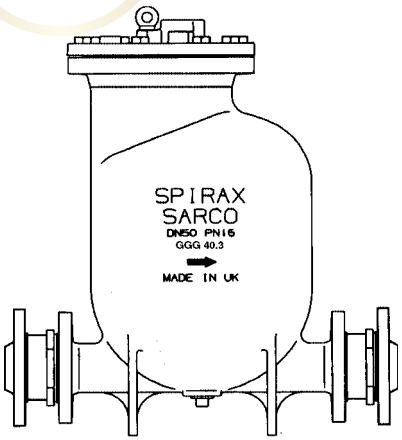
IM-P136-03
ST Issue 6

MFP14
Automatic Pumps
Installation and Maintenance Instructions



1. General

1.1 Description

The Spirax Sarco MFP14 automatic pump is a displacement receiver operated by steam or compressed air. It is generally used to lift liquids such as condensate to a higher level. Subject to the conditions being suitable, the pump can also be used to directly drain closed vessels under vacuum or pressure. In conjunction with a float steam trap, the pump is used to effectively drain temperature controlled heat exchangers under all operating conditions.

1.2 Sizes and pipe connections

DN25, DN40, DN50 and DN80 x 50; flanged BS 4504 PN16, ANSI Class 150, JIS/KS10 and screwed BSP (BS21 parallel).

1.3 Limiting conditions

Body design conditions PN16

Motive inlet pressure
Steam, air or gas, 13.8 bar g (200 psi) maximum

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

Filling head recommended above the pump is 0.3 m (12 ins).
Minimum filling head required is 0.15 m (6 ins) (reduced capacity).

1.4 Technical specifications

Standard pump operates with liquids of specific gravity 1.0 down to 0.8.

	DN80 x 50 DN50		DN40 DN25	
Average pump discharge per cycle	15L	3.3 gal	7 L	1.5 gal
Maximum steam consumption	20 kg/h	44 lb/h	16 kg/h	35 lb/h
Maximum air consumption	5.6 dm^3/s	12.3 scfm	4.4 dm^3/s	9.8 scfm

All pumps EN10204 (3.1.B.) certifiable, with TÜV approval available on request.

1.5 Accessories

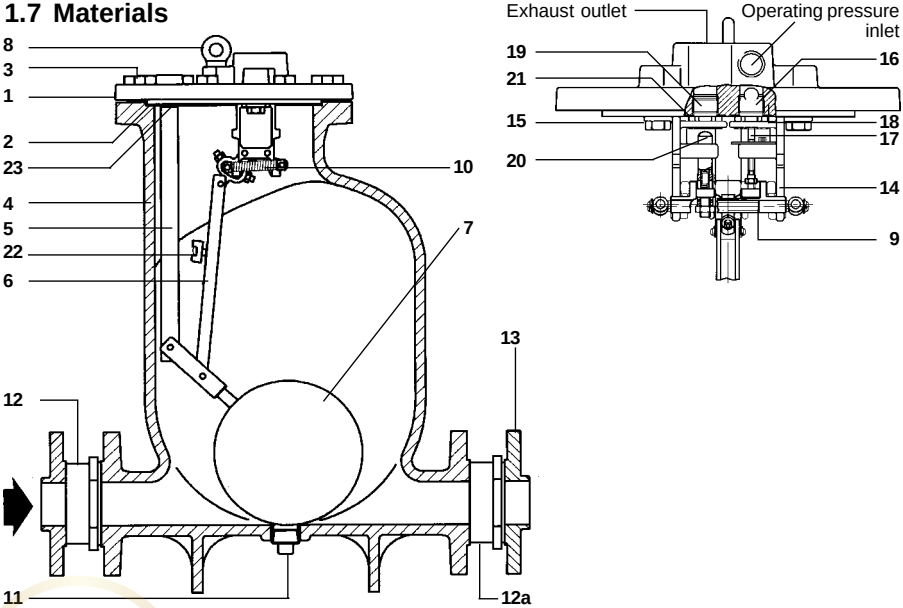
A flow counter for measuring liquid pumped. A plugged boss is provided on the pump cover, screwed ½" BSP for connecting the counter. The flow counter body is brass and must be installed in a vertical position. The flow counter can only be used when pump exhaust is vented to atmosphere.

1.6 How to order

Product (for example)
1 - Automatic pump, type MFP14, DN50 flanged BS 4504 PN16 with BSP motive fluid connections, complete with check valves and 2" BSP screwed boss flange.

Spares (see section 7)
Always order spares by using the description given in the columns headed 'Available spare' and by stating the size and type of pump.
Example - 1 - Cover gasket for DN50 Spirax Sarco MFP14 automatic pump.

1.7 Materials

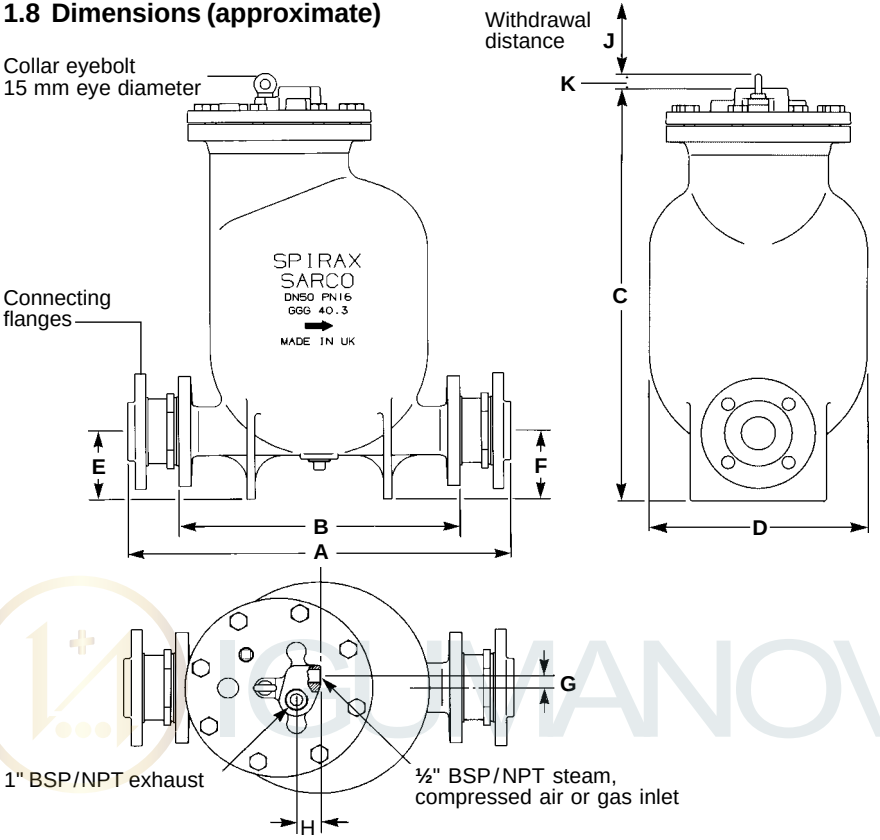


No	Part	Material	
1	Cover	SG iron	DIN 1693 GGG 40.3
2	Cover gasket	Synthetic fibre	
3	Cover screws	Stainless steel	ISO 3506 Gr A2-70
4	Body	SG iron	DIN 1693 GGG 40.3
5	Pillar	Stainless steel	BS 970, 431 S29
6	Connector rod	Stainless steel	BS 1449, 304 S11
7	Float and lever	Stainless steel	AISI 304
8	Eyebolt (integral)	SG iron	DIN 1693 GGG 40.3
9	Mechanism lever	Stainless steel	BS 3146 pt.2 ANC 2
10	Spring	Stainless steel	BS 2056, 302 S26 Gr2
11	Pressure plug	Steel	DIN267 Part III Class 5.8
12	Check valves	Stainless steel	DIN 17445, WS1 4313
13	Screwed boss flanges	Steel	BS4504 PN16
14	Mechanism bracket	Stainless steel	BS 3146 pt2 ANC 4B
15	Bracket screws	Stainless steel	BS6105 Gr A2-70
16	Inlet valve seat	Stainless steel	BS970, 431 S29
17	Inlet valve	Stainless steel	ASTM A276 304
18	Inlet valve seat gasket	Stainless steel	BS1449 409 S19
19	Exhaust valve seat	Stainless steel	BS970 431 S29
20	Exhaust valve	Stainless steel	BS3146 pt2 ANC 2
21	Exhaust valve seat gasket	Stainless steel	BS1449 409 S19
22	EPM actuator	ALNICO	
23	O-ring seal	EPDM	

Disposal

There are no hazardous materials used in the construction of this product. Any unwanted material can be recycled or disposed of in an environmentally friendly manner.

1.8 Dimensions (approximate)



Metric (mm)

Size DN	A	B	C	D	E	F	G	H	J	K	Weights kg Pump only	Weights kg Including check valves and flanges
25	410	305	498	280	68	68	18	13	480	22	51	58
40	440	305	518	280	81	81	18	13	480	22	54	63
50	557	420	627	321	104	104	18	33	580	22	72	82
80 x 50	573	420	627	321	119	104	18	33	580	22	73	86

Imperial (ins)

Size	A	B	C	D	E	F	G	H	J	K	Weights lbs Pump only	Weights lbs Including check valves and flanges
1"	16.1	12.0	19.6	11.0	2.7	2.7	0.7	0.5	19	0.9	112	128
1½"	17.3	12.0	20.4	11.0	3.2	3.2	0.7	0.5	19	0.9	119	139
2"	22.0	16.5	24.7	12.6	4.1	4.1	0.7	1.3	23	0.9	158	180
3" x 2"	22.6	16.5	24.7	12.6	4.7	4.1	0.7	1.3	23	0.9	161	189

2. Operation

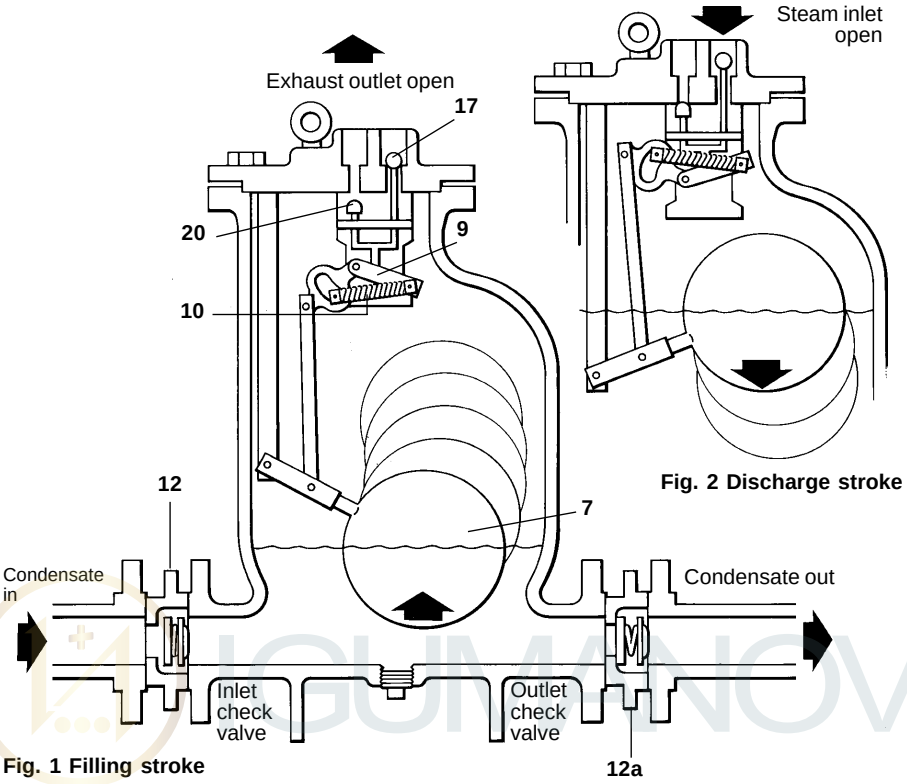


Fig. 2 Discharge stroke

Fig. 1 Filling stroke

1. Before start up the float (7) is at its lowest position with the steam valve (17) closed and exhaust valve (20) open. (Fig.1).

2. When liquid flows by gravity through inlet check valve (12) into pump body, the float (7) will rise.

3. As the float (7) continues to rise the mechanism link (9) is engaged which increases the tension in the springs (10). When the float (7) has risen to its upper tripping position, the linkage mechanism snaps upward over centre. The energy in the springs is released as mechanism link (9) accelerates upward, simultaneously opening the motive steam inlet valve and closing the exhaust valve (Fig.2).

4. Steam flow through the inlet valve (17) increases the pressure within the body. This closes inlet check valve (12) and forces out the liquid through the discharge check valve (12a).

5. As the liquid level in the pump body falls the float lowers and the mechanism link (9) is engaged, which again increases the tension in the springs (10). When the float reaches the lower tripping position, the linkage mechanism snaps downward over centre. The energy in the spring is released thus accelerating the mechanism downward simultaneously opening the exhaust valve and close the steam inlet valve.

6. When the pressure in the pump body has exhausted to the same level as the pressure in the inlet pipe, the inlet check valve opens. Liquid will again flow through the check valve to fill the body and begin the next cycle.

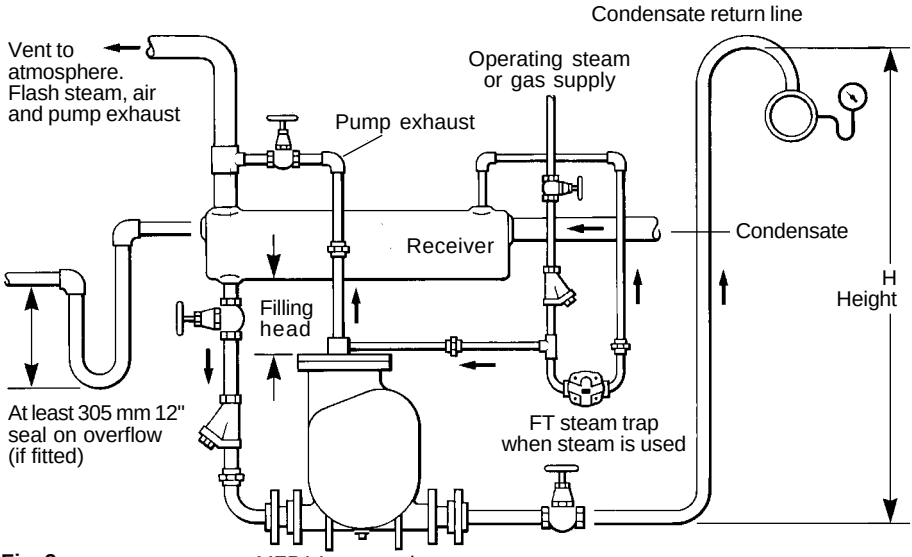


Fig. 3

3.1 Installation - vented systems

Caution. Before installation or any maintenance is performed, ensure that all steam, air or gas lines are isolated to prevent personnel injury.
Ensure any residual internal pressure in the pump 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.
An eyebolt is fitted to the pump to assist lifting (pump weighs 70 kg, 154 lbs). On no account should this be removed or used to lift anything more than the pump. Always use suitable lifting gear and ensure the pump is safely secured.

1. Install the pump below the equipment to be drained with the exhaust connection vertically upwards. Pump should be installed with the recommended filling head (the vertical distance between the top of the pump and the bottom of the reservoir/receiver) as shown in Fig 3. For other filling head variations, refer to separate capacity chart.

2. To prevent equipment flooding during the pump discharge stroke, a vented receiver or reservoir pipe should be installed in a horizontal plane ahead of the pump as shown in Fig. 3. For proper receiver/reservoir sizing, refer to 'Inlet receiver capacities' table shown on page 7. All inlet line fittings must be full bore.

3. Connect the check valves (12) and (12a) to the pump making sure that the flow through the valves is in the correct direction.
   For best performance, horizontal piping runs immediately ahead of the inlet check valve and after the discharge check valve should be kept to a minimum. Connect the discharge to the return main or other return point.
   Torque tighten inlet and outlet flange bolts to 76 - 84 N m (56 - 62 lb/ft)

4. Connect the operating medium (steam, air or gas) supply to the motive supply inlet in the cover. Supply main should have a strainer and a steam trap (steam service) installed upstream of the supply inlet. The steam trap discharge should be piped to the receiver or reservoir piping ahead of the pump.

5. The pump exhaust line must be piped unreduced and unrestricted to atmosphere. The line should be vertical, if possible. If horizontal runs must be used, line should be pitched so that it is self draining to the pump or receiver. Refer to the table on page 7 for recommended vent pipe sizing.

Inlet receiver capacities

Sufficient reservoir volume is needed above the filling head level to accept the condensate reaching pump during the discharge stroke. The receiver can be a length of pipe of large diameter or a tank. If desired, receiver overflow piping can be installed as shown in Fig.3 and piped to a suitable drain. The piping must form a U-type water seal at least 305 mm (12 in) deep immediately after the receiver.

	Receiver size	
Pump size	**Metric**	**Imperial**
DN25	0.6 m x DN200	24" x 8"
DN40	0.6 m x DN200	24" x 8"
DN50	0.65 m x DN250	26" x 10"
DN80 x 50	1.10 m x DN250	44" x 10"

Inlet piping with no receiver fitted

When draining a single piece of equipment and a receiver is not supplied ahead of the pump, install with sufficient piping as given in the table below, and use recommended filling head. This will prevent any flooding of the equipment while the pump is discharging.

The table below illustrates the length of reservoir piping above the top of the pump when the pump is installed without a receiver.

Metric

Pump sizes DN 25, 40, 50, 80 x 50

	Inlet check valve and pipe size			
Liquid load kg/h	DN25 m	DN40 m	DN 50 m	DN80 x 50 m
277 or less	1.2			
454	2	1.2		
681	3	1.5	1.2	
908	4	1.8	1.5	
1 362		3	2.1	
1 816		3.6	3	
2 270			3.6	1.2
2 724				1.5
3 178				1.8
3 632				2.1
4 086				2.4
4 540				2.7
9 994				3

Imperial

Pump sizes 1", 1½", 2", 3" x 2"

	Inlet check valve and pipe size			
Liquid load lb/h	1" ft	1½" ft	2" ft	3" x 2" ft
598 or less	3.9			
546	6.6	3.9		
1 500	9.8	4.9	4	
2 000	13.1	5.9	5	
3 000		9.8	7	
4 000		11.8	10	
5 000			12	4
6 000				5
7 000				6
8 000				7
9 000				8
10 000				9
11 000				10

Recommended filling head

300 mm (12 ins)
Minimum 150 mm (6 ins) with reduced capacity
Note: To achieve rated capacity, pump must be installed with check valves as supplied by Spirax Sarco.

Receiver vent sizing

The minimum vent diameter of the receiver should be as follows:

Pump size		**Receiver vent diameter**	
DN25	1"	50 mm	2"
DN40	1½"	65 mm	2½"
DN50	2"	80 mm	3"
DN80 x 50	3" x 2"	100 mm	4"

3.2 Installation - closed loop steam systems

(A closed-loop steam installation is one in which the exhaust line of the pump is piped back [pressure equalized] to the steam space being drained).

Caution
Before installation or any maintenance is performed, ensure that all steam, air or gas lines are isolated to prevent personnel injury.
Ensure any residual internal pressure in the pump 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.
An eyebolt is fitted to the pump to assist lifting (pump weighs 70 kg, 154 lbs). On no account should this be removed or used to lift anything more than the pump. Always use suitable lifting gear and ensure the pump is safely secured.

1. Install the pump below the equipment being drained with the exhaust connection vertically upwards. The pump should be installed with the recommended filling head (vertical distance between the top of the pump and the bottom of the reservoir/receiver) as shown on Figs 4 and 5. For other filling head variants, refer to separate capacity chart.
2. To prevent equipment flooding during the pump discharge stroke, a receiver or reservoir pipe should be installed in a horizontal plane ahead of the pump as shown in Fig 4. For proper receiver/reservoir sizing refer to 'Inlet Piping' table shown on Page 7. All inlet fittings must be full bore.
3. Connect the check valves (12) and (12a) to the pump, making sure that the flow through the valves is in the correct direction. For the best performance, horizontal piping runs immediately ahead of the inlet check valve and after the discharge check valve should be kept to a minimum. Connect the discharge to the return main or other installation point.
4. Connect the operating medium (steam only) supply to the motive supply inlet in the cover. Supply main should have a strainer and a steam trap installed upstream of the supply inlet. The steam trap discharge should be piped to the receiver or reservoir piping ahead of the pump.
5. Exhaust line should be piped, unrestricted, to the reservoir. (In some specific cases it can be connected to the inlet pipe between the control valve and the equipment or directly into the top (inlet side) of the equipment). A thermostatic air vent should be installed at the highest point of the exhaust line to vent all non-condensibles during start-up. Any horizontal runs in exhaust line should be pitched so that the line is self-draining.
6. If, at any time, the back pressure against the pump is less than the pressure in the equipment being drained, a properly sized float and thermostatic trap must be installed between the pump and discharge check valve as shown in Fig 5.

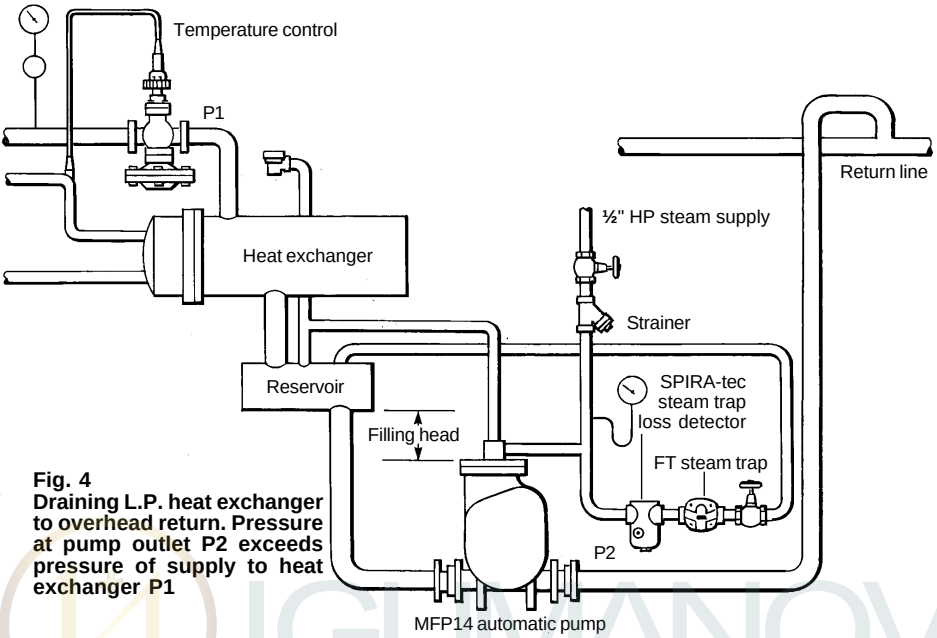


Fig. 4
Draining L.P. heat exchanger to overhead return. Pressure at pump outlet P2 exceeds pressure of supply to heat exchanger P1

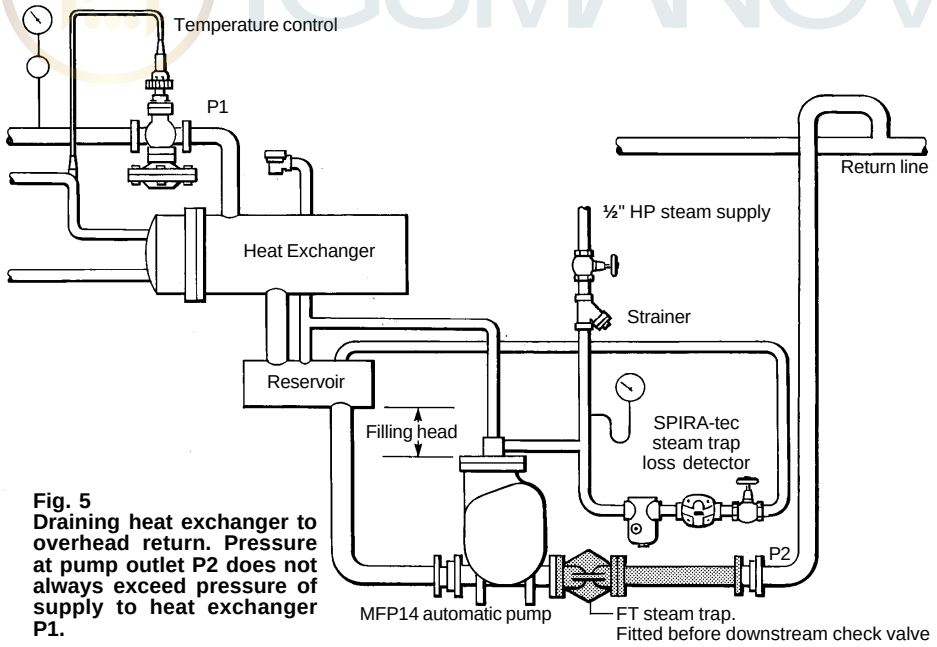


Fig. 5
Draining heat exchanger to overhead return. Pressure at pump outlet P2 does not always exceed pressure of supply to heat exchanger P1.

4. Commissioning

1. Slowly open supply (steam, air or gas) to provide pressure at the MFP14 pump inlet valve. Check that trap is operational.
2. Open isolation valves in the condensate inlet and discharge line.
3. Open valve(s) ahead of the unit allowing condensate to enter the receiver and fill the pump body. Pump will discharge when full.
4. Observe operation for any abnormalities. MFP14 pump(s) should cycle periodically (min cycle time is 8 seconds) with an audible exhaust at the end of the pumping cycle. If any irregularities are observed, recheck installation instructions for proper arrangement. Consult Spirax Sarco if necessary.
5. If overflow piping has been provided, check that a water seal has been established to prevent any steam from being emitted in normal operation. Prime piping if necessary.

5. Maintenance

Mechanism inspection and repair

Caution. Before installation or any maintenance is performed, ensure that all steam, air or gas lines are isolated to prevent personnel injury.

Ensure any residual internal pressure in the pump 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.

An eyebolt is fitted to the pump to assist lifting (pump weighs 70 kg, 154 lbs). On no account should this be removed or used to lift anything more than the pump. Always use suitable lifting gear and ensure the pump is safely secured.

When dismantling the pump, care should be taken to prevent personal injury from the strong snap action mechanism.

Always handle with care.

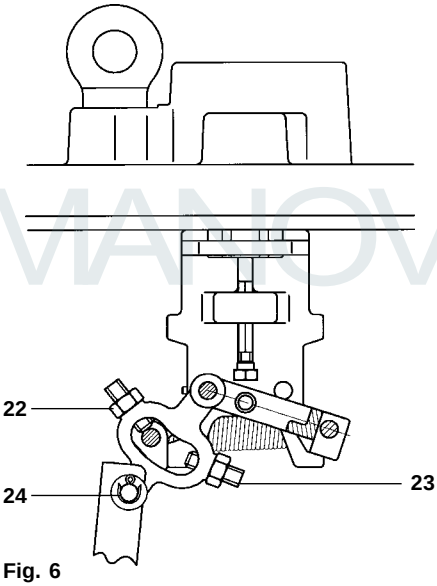


Fig. 6

1. Disconnect all connections to the cover. Remove cover bolts and lift the cover and mechanism assembly from the body, noting the cover orientation.
2. Visually inspect the mechanism to verify that it is free of dirt and scale and moves freely. **Note: The socket set screws (Fig. 6 items 22,23) are factory set and must not be disturbed during the following maintenance procedures.**
3. Visually check springs (item 10 Fig. 7). If defective, remove split pins and washers and slide spring assemblies from shafts. Replace with new spring assemblies (see section 5e - spring setting) and install new split pins and washers.

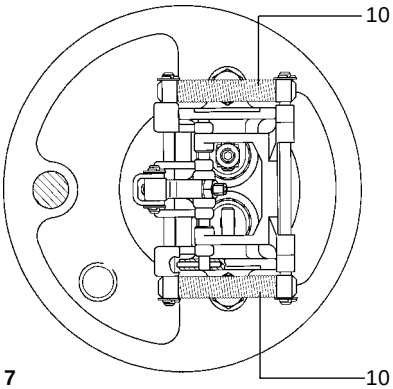


Fig. 7

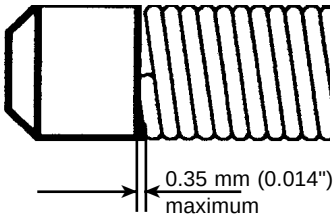


Fig. 8

4. To check inlet and exhaust valves :
   a) Remove shaft (item 24 Fig. 6) from mechanism end of connector rod and rotate float and connector rod to opposite side of pillar.
   b) Remove spring split pins and washers and slide spring assemblies from pivot shafts.

   c) Remove locking nut from inlet valve stem. (Note this has been secured using loctite 620 adhesive).

   d) Remove mechanism bracket screws and lift mechanism from cover.

   e) To remove exhaust valve (if necessary), ease exhaust side bracket off main shaft and exhaust valve. (This is achieved by lifting the levers up, away from the bracket feet, and tilting the bracket sideways and up). Remove exhaust valve from lever.

   f) Remove seats (and inlet valve) from cover. (Note their respective positions in the cover. The DN25 and DN40 valve seats can be identified by a double row of diamond grooves on the exhaust seat and a single row on the inlet seat. The DN50 and DN50 x 80 valve seats can be distinguished as the inlet valve seat contains a series of holes around each flat, whilst the exhaust valve seat is blank).

   g) Visually inspect seating surfaces of inlet and exhaust valves for signs of wear (inlet valve must be removed to check seat). Clean seating areas and re-install or replace if necessary.

5) To reassemble, reverse the above procedure noting the following :-

   a) Ensure exhaust and inlet seats (with inlet valve) are placed in correct locations (ref 4f) and torque tighten to 129 - 143 N m (95 - 105 lbft).

   b) Exhaust valve assembly - Place spring into body of exhaust valve. Slide valve on to lever whilst holding spring down in bottom of bore. Fit socket set screw and locknut to valve.

   c) Torque tighten mechanism retaining screws to 38 - 42 N m (28 - 31 lbft).

   d) Note that inlet valve lock nut is screwed on to stem, split portion first and secured with loctite 620 or 272 adhesive.

   e) Before fitting new spring assemblies, check that the spring anchor holes are in line and that the spring ends are within 0.35 mm (0.014") of the anchor's shoulder (Fig 8). **The spring ends may lightly touch the shoulders but must not bind against them.** Always use new split pins and washers when replacing springs and reassembling connector shafts.

f) Reset inlet and exhaust valves as follows :-

Inlet valve: With valve operating lever against the stop furthest from cover (i.e. the inlet valve in the closed position) set the lock nut so that there is the correct gap between the nut and lever drive pin when the valve is on its seat. See table below:-

Inlet valve gap		
Pump size	Metric	Imperial
DN80 x 50	4.7 mm ±0.2	0.185"
DN50	4.7 mm ±0.2	
DN40	2.7 mm ±0.4	0.105"
DN25	2.7 mm ±0.4	

Exhaust valve : With the valve operating lever against the stop closest to the cover (i.e. exhaust valve in the closed position) and the valve held firmly on its seat, screw in the set screw until it touches the drive pin and then unscrew it 3¾ turns for the DN80 x 50 and DN50 pumps and 2¾ turns for the DN40 and DN25 pumps. Lock this screw in this position.

6. Float replacement

Unscrew the float from the retaining bolt. It will be necessary to remove the float lever shaft to gain access to the hex socket. Reassemble the new float to the lever using a new bolt, washers and a suitable locking compound on the bolt threads. If the lever shaft has been removed, fit new split pins and washers.

7. When reinstalling the cover and mechanism assembly, the cover should be oriented as noted (1) above. Always fit new gaskets. Torque tighten cover bolts to 121-134 N m (89 - 99 lb/ft) Follow the start up procedure to bring the pump back in operation.

6. Fault finding

If a correctly sized MFP14 pump does not operate properly, an incorrect arrangement is suspected in new installations. For existing installations where the pump operates occasionally or not at all, the cause is often a change in the system supply or back pressure conditions beyond the original design parameters. With the system conditions and problem symptoms determined, check the following in turn and correct as necessary.

Caution
Installation and troubleshooting should be performed by qualified personnel. Before disconnecting any connections to the pump or piping system, every effort should be made to assure that internal pressure has been relieved and that the motive supply line is isolated to prevent inadvertent discharge of the pump. When disconnecting any connection, piping / bolts should be removed slowly so that if the line is under pressure, this fact will be apparent before completely removing the pipe or component. Always relieve pressure before disconnecting any joint.

SYMPTON 1	Pump fails to operate on start up.
Cause 1a	**Motive supply closed.**
Check and cure 1a	Open valves to supply motive pressure to pump.
Cause 1b	**Condensate inlet line closed.**
Check and cure 1b	Open all valves to allow condensate to reach pump.
Cause 1c	**Condensate discharge line closed.**
Check and cure 1c	Open all valves to allow free discharge from pump to destination.
Cause 1d	**Motive pressure insufficient to overcome back pressure.**
Check and cure 1d	Check motive pressure and static back pressure. Adjust motive pressure to 0.6 to 1 bar or more higher than static back pressure.
Cause 1e	**Check valve(s) installed in wrong direction.**
Check and cure 1e	Verify proper flow direction and correct if required.
Cause 1f	**Restricted vent.**
Check and cure 1f	On vented or closed systems, ensure that vent line is unrestricted and self draining to the pump or receiver.

SYMPTON 2	Supply line/equipment flooded, but pump appears to cycle normally (periodic audible exhaust observed).
Cause 2a	**Pump undersized.**
Check and cure 2a	Verify rated capacity table. Increase check valve size or install additional pump as required.
Cause 2b	**Insufficient filling head.**
Check and cure 2b	Verify required filling head per section 1, page 2 - Lower pump to achieve required filling head.
Cause 2c	**Insufficient motive pressure to achieve rated capacity.**
Check and cure 2c	Check motive pressure setting and maximum back pressure during operation. Compare to capacity table. Increase motive pressure as required to meet load conditions.
Cause 2d	**Restriction in condensate inlet line.**
Check and cure 2d	Verify that full bore fittings are used. Clean the strainer, if fitted. Check that all valves are fully open.
Cause 2e	**Inlet or outlet check valve stuck open (debris).**
Check and cure 2e	Isolate check valve and relieve line pressure. Remove disc check valve and visually inspect he disc and spring. Ensure these are free from debris clean seating surfaces to reinstall or replace if necessary.
SYMPTON 3	**Supply line/equipment flooded, and pump has stopped cycling (audible periodic exhaust not observed).**
Cause 3a	**Discharge line closed or blocked.**
Check and cure 3a	Check motive pressure and static back pressure (at pump discharge). If equal, a closed or blocked discharge line is suspected. Check all valves downstream of pump to ensure an unobstructed discharge.
Cause 3b	**Discharge check valve stuck closed.**
Check and cure 3b	After checking per 3(a), isolate discharge check valve and relieve line pressure. Remove the check valve and visually inspect. Clean seating surfaces and reinstall or replace, if necessary.
Cause 3c	**Insufficient motive pressure.**
Check and cure 3c	If motive pressure is below static back pressure, increase motive pressure setting to 0.6 to 1 bar g or more above the static back pressure. Do not exceed rated pressure limits of equipment.

For steps **3(d) to 3(g)** (see page 15 opposite) - with exhaust/feedback line isolated from the equipment being drained (close-loop systems), break the exhaust/feedback connection at the pump cover and:-

Important safety note:

For steps **(d) through to (g).** It is necessary to disconnect the exhaust/feedback line at the pump exhaust connection. To avoid injury to personnel on closed loop systems care should be exercised to assure that the pump is isolated (motive supply, condensate inlet and discharge

and exhaust feed back line all closed) and that internal pressure is relieved prior to breaking this connection. Also, under fault conditions it is possible that hot condensate may run out of the exhaust connection when disconnected for both closed loop and vented systems. This possibility should be taken into consideration when performing these steps to avoid scalding personnel. Always wear suitable protective safety clothing/equipment. When dismantling the pump, care should be taken to prevent personal injury from the strong snap action mechanism. Always handle with care.

Cause 3d	**Motive inlet valve leaking/or worn.**
Check and cure 3d	Slowly open motive supply line, leaving the condensate inlet and discharge lines closed. Observe the exhaust connection for significant steam or air leakage. If leakage is observed and is not considered to be flash steam, an inlet valve problem is indicated. Isolate pump, remove cover and mechanism assembly and visually inspect. Replace inlet valve and seat assembly.
Cause 3e	**Mechanism faults.** 1). Broken springs 2). Ruptured float 3). Mechanism binding
Check and cure 3e	With motive line open, slowly open the condensate inlet line to the pump allowing pump to fill and observe exhaust connection. Keep personnel clear of exhaust! If condensate is emitted from the exhaust connection without the pump mechanism tripping a mechanism fault is clearly indicated. Isolate the pump by shutting off motive supply and condensate inlet, remove cover and mechanism assembly, and visually inspect. Examine springs and float for obvious defects. Manually operate the mechanism and check for any source of binding or increased friction. Repair and / or replace all defects observed.
Cause 3f	**Exhaust/feedback causing vapour lock (vented or closed loop).**
Check and cure 3f	If the mechanism is heard to trip and no fluid is emitted from the exhaust connection, slowly open the discharge line from the pump and observe operation. Keep personnel clear of exhaust connection. If pump cycles normally, a fault in the exhaust / feed back line is suspected. Recheck the exhaust/feedback piping layout for compliance with the installation instructions. Exhaust/feed back line must be self draining to prevent vapour locking the pump. Fit thermostatic air vent to balance line on closed loop applications.
Cause 3g	**Inlet check valve stuck closed.**
Check and cure 3g	If the mechanism does not trip and fluid does not emit is suspected that the fault lies in the condensate inlet piping. Ensure that all valves leading to the pump have been opened. If so, this indicates that the inlet check valve is stuck closed or there is insufficient filling head. Isolate the pump and check valve and relieve line pressure. Remove the check valve and visually inspect. Clean seating surfaces and reinstall or replace, if necessary. Reinstall exhaust/ feed back connection and open line.

Symptom 3 continued overleaf.

SYMPTON 3 CONTD.	Supply line/equipment flooded, and pump has stopped cycling (audible periodic exhaust not observed).
Cause 3h	**Inlet strainer blocked.**
Check and cure 3h	Close isolation valve ahead of strainer. Remove strainer cap and screen. Clean screen in pail of water or replace if damaged. Insert screen in cap and refit to strainer. Open isolation valve.

SYMPTON 4	Changing or banging in return main after discharges.
Cause 4a	**Vacuum created at pump outlet after discharge because of acceleration/deceleration of large water slug in return main (usually results from long horizontal run with multiple rises and drops).**
Check and cure 4a	Install a vacuum breaker at the top of the lift (at highest point in return line). For pressurised return systems an air eliminator may be required downstream of the vacuum breaker (See Fig 13).
Cause 4b	**Pump 'blow-by'.**
Check and cure 4b	Check condensate inlet pressure and static back pressure at the pump discharge. If the inlet pressure equals or exceeds the static back pressure, a 'blow through' problem is suspected. On vented systems, check for leaking traps discharging into the condensate inlet line which would increase inlet line pressure. Replace any faulty traps. On closed loop systems, if condensate inlet pressure can exceed static back pressure under normal operation (i.e boost in equipment operating pressure via a modulating control valve or significant decrease in static return main pressure), a pump/trap combination is required. The pump/trap combination will prevent passage of steam into the return main and allow the pump to cycle normally when condensate is present (See Fig. 5).

SYMPTON 5	Vent line discharging excessive flash steam. (Vented applications only).
Cause 5a	**Faulty steam traps discharging live steam into condensate inlet line. (See also 4(b), Pump 'blow-by').**
Check and cure 5a	Check for leaking traps discharging into condensate return. Repair or replace faulty traps. (See also 4(b), Pump 'blow-by').
Cause 5b	**Excessive (over 20kg/hr or 45 lb/hr) flash steam being vented through pump.**
Check and cure 5b	Vent receiver or reservoir piping ahead of pump.
Cause 5c	**Exhaust valve stuck or worn.**
Check and cure 5c	Isolate pump and remove cover and mechanism assembly. Remove exhaust valve and seat assembly. Visually inspect seating surface Clean and reinstall or replace, if worn.

7. Spare parts

The spare parts available are shown in heavy outline. Parts drawn in broken line are not available as spares.

Available spare

Cover gasket	**2**
Float	**7**
Inlet/outlet check valve (each)	**12**
Cover and internal mechanism assembly	**1, 2, 7** (complete)
Valve set (inlet and exhaust valve and seats)	**16, 17, 18, 19, 20, 21**
Spring set (1 pair springs)	**10**

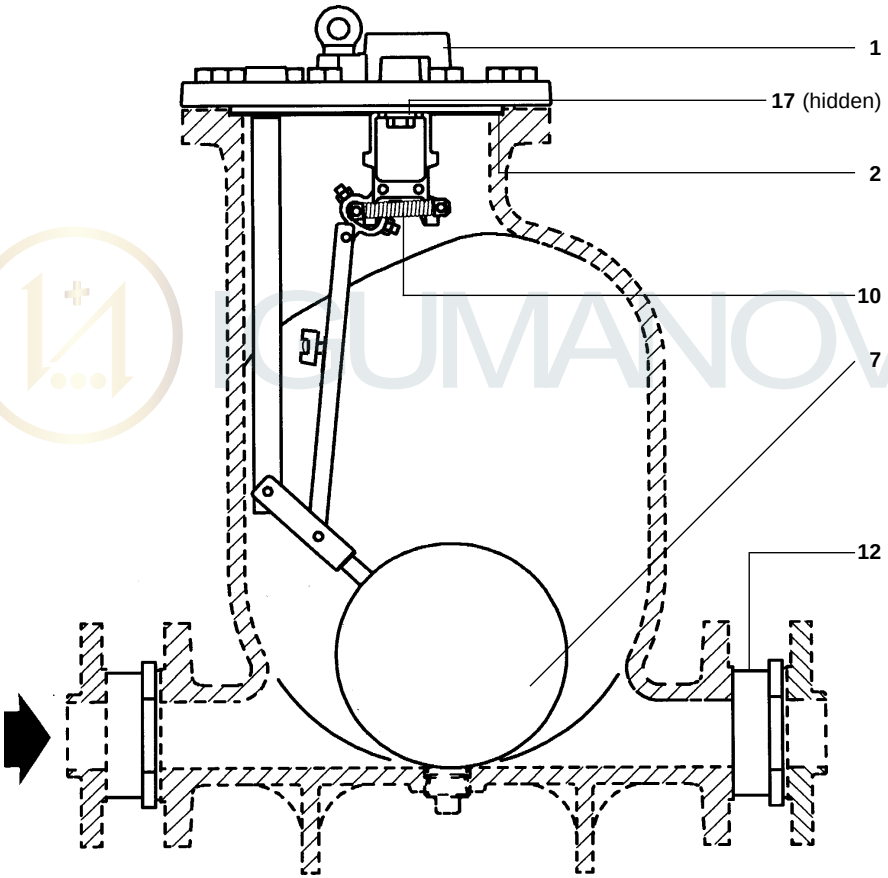
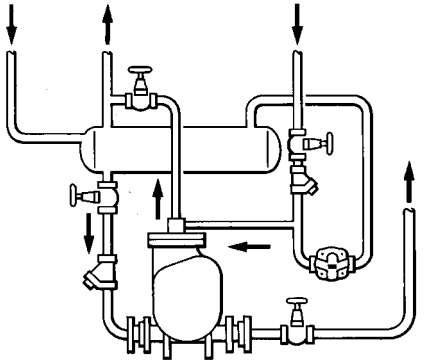


Fig. 9

8. Typical applications

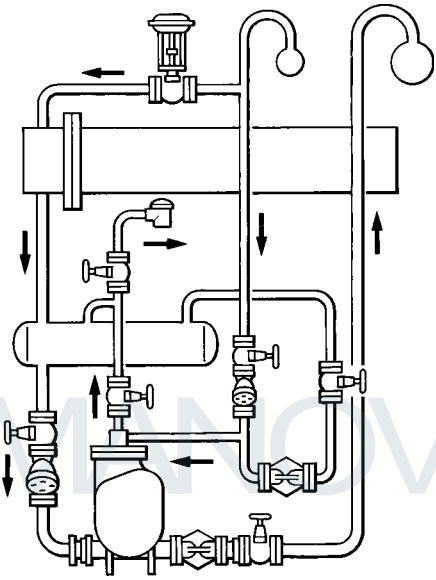
The sketches below do not necessarily represent recommended arrangements for specific service conditions; but rather serve only to illustrate the variety of applications where the mechanical fluid pump can be utilised. Design requirements for each application should be evaluated for the best condensate recovery arrangement tailored to your specific needs.

For use of mechanical fluid pump arrangements other than those described previously, and for any additional information you may require, contact Spirax Sarco.



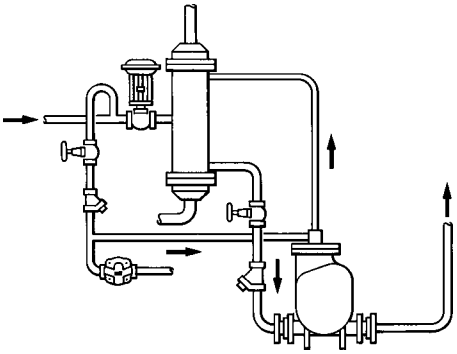
MFP14 automatic pump

Fig. 10 Condensate recovery (open system)
Pumping high temperature condensate without cavitation or mechanical seal problems. Provides maximum heat energy recovery.



MFP14 automatic pump

Fig. 11 Condensate removal from process vessels and heat exchangers (pump / trap combination, closed system)
Removal of condensate under all pressure conditions ensures stable temperatures. Also prevents bottom end tube corrosion and potential waterhammer and freezing.



MFP14 automatic pump

Fig. 12 Condensate removal from vacuum equipment
Simple and efficient solution to difficult problem without the need for expensive electrical pumps.

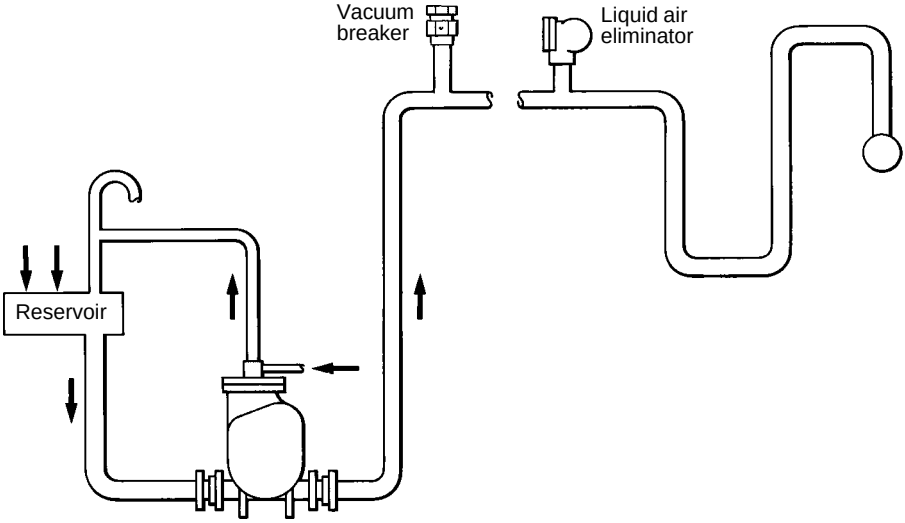


Fig. 13 MFP14 automatic pump discharging to long delivery line

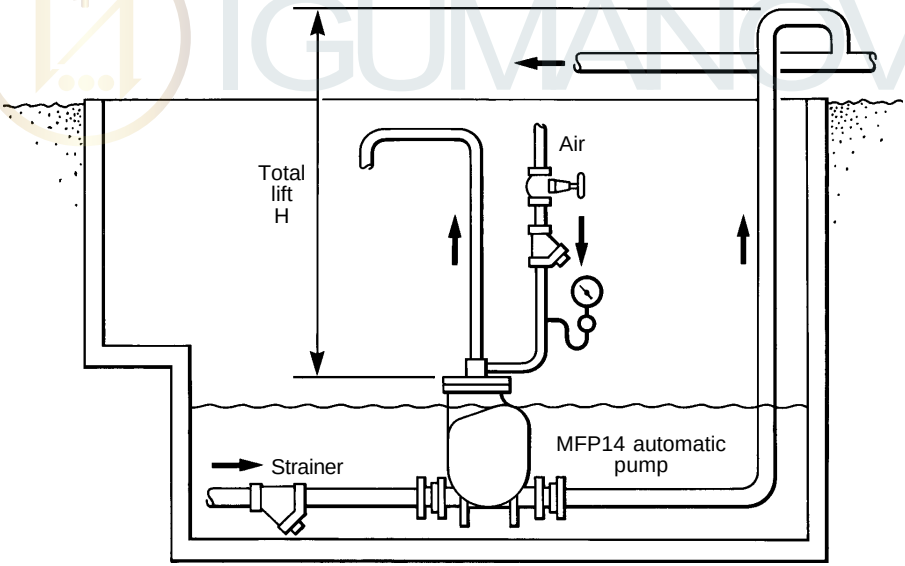


Fig. 14 MFP14 automatic pump draining water from sump pit