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WSC-type Piston Pump Head
User's Guide

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UNPACKING AND STANDARD ACCESSORIES 1

The Gilson WSC-type Piston Pump Head (10WSC is currently available) is specially designed for applications using salt solutions (e. g. buffer salts, or ion-pairing salts included in the chromatographic mobile phases). It is supplied complete in a kit (Figure 1), with its standard accessories as listed in Table I.

Each pump head is filled with iso-propanol when delivered.

Unpack the kit and compare the contents with your purchase order and Table I to verify that all parts are included and undamaged.

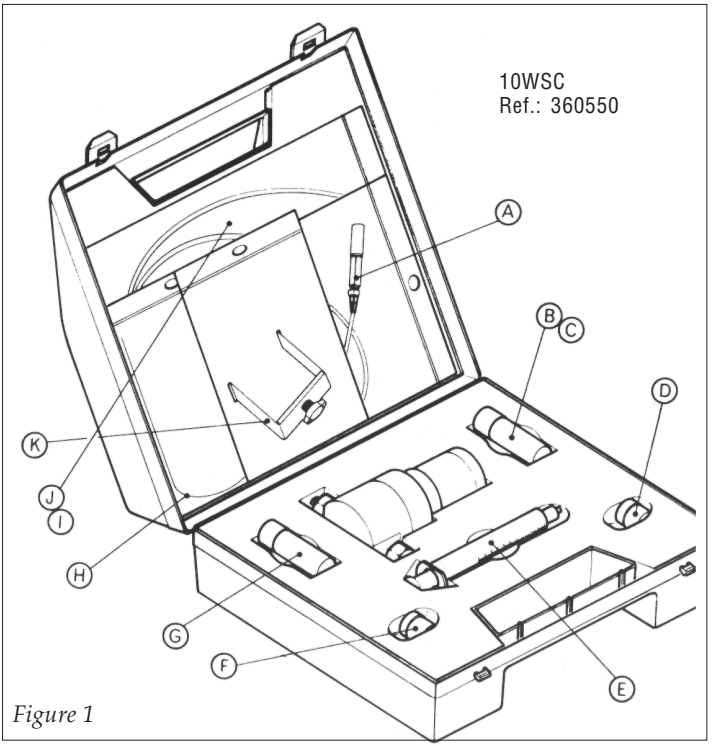


Figure 1

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Table I: Standard accessories

Item	Description	Reference	Qty
A	Inlet tubing assembly *	3645275	1
B	Male luer	495019	2
C	SSI screw	49031401	2
D	SSI ferrule	49031402	2
E	10 ml syringe	5435460058	1
F	Washer	3645329	1
G	Piston seal mounting tool	36620123	1
H	Stainless Steel tubing 250 mm	49932259	1
I	Versilic tubing 3 x 5 x 2000 mm	470219739	1
J	Tubing clamp	439460048	1
K	Clamp	3650039	1
	Allen wrench 3 mm	4320302	1
	User's Guide	LT801078	1

☞ *Letters A through K, see Figure 1.*

**3645275: PTFE inlet tubing, 1000 x 2 x 3 mm, equipped with a 10 µm stainless steel filter, a 3-way prime valve and EPF inlet tubing, 60 x 1.6 x 3 mm.*

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ADDITIONAL ACCESSORIES 2

1 FOR ANY LIQUID

4970050105	High pressure in-line filter, 316L, 0.5 µm, 2.5 cm^2, 0.4 ml, 100 MPa (SSI 05-0105)
29410652	Replacement filter, 316L, 0.5 µm, for high pressure in-line filter 4970050105 (SSI 05-0106)

It is recommended to place this filter upstream from the injector in any HPLC system. This efficient filter provides a final polish to the mobile phase and a durable protection to the injection valve.

2 FOR LOW-POLARITY ORGANIC SOLVENTS

5463125095	PTFE piston seal for 10 SC, 10WSC and 10 WTi heads.

This PTFE piston seal is black to be easily distinguished from the yellow HDPE seal. PTFE seals are the best qualified for alkanes, chlorinated solvents, tetrahydrofuran, and carbon dioxide (typically lasting twice as long for those solvents than HDPE seals).

3 FOR HIGH-VISCOSITY OR HIGH-DENSITY LIQUIDS

3650201	Spring-loaded check valve kit for 5SC, 10SC, 25SC and 10WSC heads

This spring-loaded check valve is specially designed for pumping highly viscous or dense liquids. Refer to Section 6.7.

It consists of two spring-loaded check valve cartridges to be substituted for the standard cartridges, plus a silicone rubber inlet tubing, 2000 x 5 x 3 mm, and a male luer fitting, to be substituted for the standard inlet tubing assembly. This kit is capable of being used without an inlet filter.

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4 FOR LIQUIDS AT NON- AMBIENT TEMPERATURES

Gilson pump heads operate from -20°C up to 100°C, provided that the liquid pumped, including liquefied gases and melted solids, is chemically compatible with the materials (see Specifications).

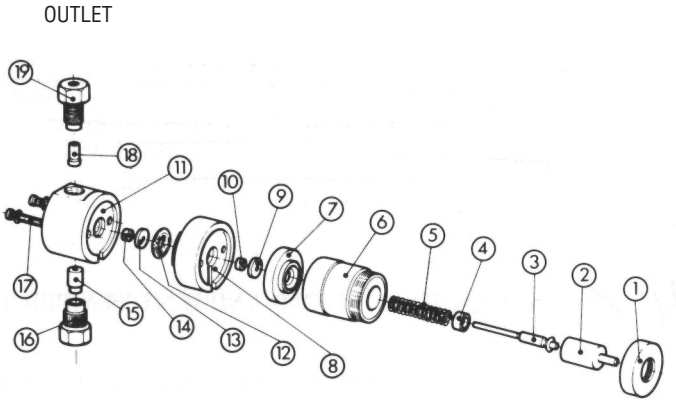
The following thermostatic jacket kit is available for heating or cooling Gilson pump heads. It requires a standard cryothermostat (not supplied by Gilson) that generates a temperature-controlled circulating liquid.

360350400	Thermostatic jacket kit for any model of Gilson piston pump heads. *Requires metallic inlet (see below 3650205).*

This kit has its own additional accessories:

3650205	Metallic inlet kit for 5SC, 10SC, 25SC and 10WSC pump heads. *Consists of inlet check-valve screw for 1/8" SSI fitting, two SSI 1/8" screws and ferrules, and 316L tubing, 2000 x 3.2 x 2.1 mm.*
5463125795	Piston seal, PTFE-graphite, for heads 10SC, 10WSC and 10WTi.
360358311	Fitting for European gas cylinder, 5/8" BSP, 1/8" SSI.
360358314	Spare seal for fitting of European gas cylinder, FEP, 10.5 x 2.7 mm, 5 units.
	Fitting for American gas cylinder, 0.5-14 NPSH, 1/8 " SSI *(21 02 51 30, to be ordered from Gilson USA).* Spare Seal for fitting of American gas cylinder, one unit *(49 03 17 04, to be ordered from Gilson USA).*

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1 - Threaded cover
2 - Piston tail guide
3 - Piston assembly
4 - Spring spacer
5 - Return spring
6 - Ball housing assembly
7 - Housing spacer
8 - Rinse body
9 - Anti-extrusion gasket
10 - Piston seal
11 - Head body
12 - O-ring
13 - Anti-extrusion gasket
14 - Piston seal
15 - Inlet check valve cartridge
16 - Inlet check valve support screw
17 - Screws
18 - Outlet check valve cartridge
19 - Outlet check valve support screw

Figure 2

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SETUP 4

1 MOUNTING THE PUMP HEAD TO THE PUMP MODULE

⚠ ***Switch the power off before mounting (or removing) the pump head to (or from) the pump.***

- Carefully insert the pump head into the opening of the pump. Note that at the bottom of the head body there is a notch which must be fitted onto the matching notch pin, just below the opening for the pump head.
- Holding the pump head in place with one hand, set the clamp diagonally over the head. Turn the clamp clockwise into position in the slots on either side of the pump head. Finger-tighten the thumb screw until the clamp holds the head securely.

⚠ ***Make sure that the clamp ends are secured in their slots on both sides.***

2 TUBING CONNECTIONS

Shown in Figure 3.

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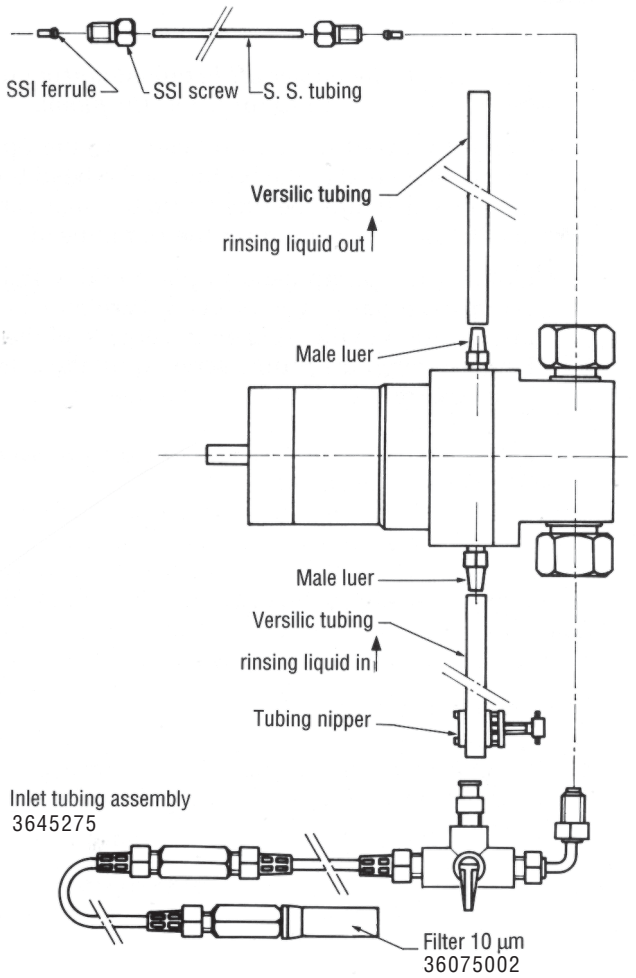


Figure 3

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OPERATION 5

1 SOLVENT DELIVERY

Please refer to the Pump User's Guide.

2 RINSING OPERATION

The ideal rinsing liquid is made from the same components as for the elution solvent, but it is free from saline ions. Water and any appropriate solvent may also be used.

The rinsing process can either be dynamic or static.

♦ DYNAMIC RINSING PROCESS

Circulate the rinsing liquid with gravity or with a peristaltic pump. The required rinsing speed depends on the flowrate and the salt content of the pumping solvent. In most applications, a rinsing flowrate of 1/10 of the pumping florate is sufficient (typically 0.1 ml/min for a pumping flowrate of 1 ml/min). It can be adjusted by the tubing clamp.

♦ STATIC RINSING PROCESS

Fill and keep the rinsing liquid in the rinsing chamber which has a capacity of about 0.25 ml. Then renew the rinsing liquid from time to time.



The dynamic process is recommended.

The rinsing chamber must always be filled with an appropriate solvent free from saline ions.

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PRECAUTIONS FOR USE 6

1 SOLVENT FILTRATION

The inlet filter attached to the end of the PTFE inlet line must be used with all solvents to protect the check valves.

In addition, it is recommended to include one unit of the high-pressure in-line filter, 4970050105, offered as an additional accessory, in any HPLC system. This efficient filter is to be placed between the prime/purge valve and the injection valve. It provides a durable protection to the injection valve and to the column.

2 USE OF A NEW PUMP HEAD OR A NEW PISTON SEAL

Whenever using a new pump head or a new piston seal, it is strongly recommended to follow the running-in procedure given below, which can be conveniently implemented using the prime-purge valve.

- Run the pump unloaded for 1-2 minutes at 20% of nominal flowrate with methanol.
- Run the pump at maximum operating pressure for 4 to 5 minutes, checking for any leaks.
- Repeat the first step, but for 30 minutes.

3 SOLVENT DEGASSING

Solvents should be degassed to avoid air bubble formation in the pump head or in the detector cell.

Vacuum filtration or helium sparging are much more efficient than ultrasonic degassing.

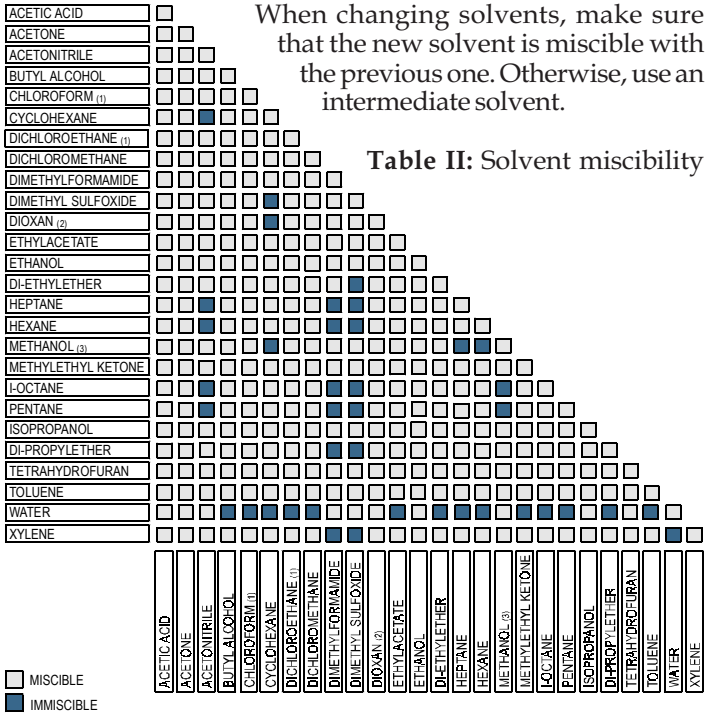
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Solvent degassing also contributes to better baseline stability with the UV absorbance detector working at low wavelength: at 210 nm, a 1% change in dissolved oxygen level will cause a 4 x 10^{-3} A. U. change in the absorbance of methanol.

4 SOLVENT MISCIBILITY

When changing solvents, make sure that the new solvent is miscible with the previous one. Otherwise, use an intermediate solvent.

Table II: Solvent miscibility



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5 CHANGING THE FLOWRATE

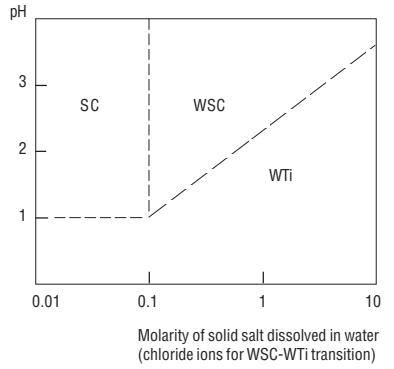
To protect the HPLC columns, the flowrate should be changed in progressive steps, never abruptly.

6 SALINITY AND ACIDITY

This section justifies the Gilson offer of three types of pump head: SC, WSC and WTi. Fig. 4 shows the typical working range of each type according to salinity and acidity at ambient temperatures.

Figure 4: Typical working range of each type of Gilson pump head according to salinity and acidity at ambient temperatures.

At low pH and high molarity, it is necessary to use WTi only with halides ions. But, for example, at pH 3 and 0.5 M NaCl, the WSC is sufficient.



The WSC-type piston pump head is specially designed for the troublefree pumping of saline solutions (e. g. buffer salts, or ion-pairing salts included in chromatographic mobile phases) and long-term performance.

In the particular case of solutions which contain halide ions (e. g. chloride), in addition to taking the above precautions, it is recommended to keep the concentration and the pH within the limits shown in Fig. 4.

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If you have to cross these limits occasionally, re-passivate the stainless steel according to the following procedure:

- Make up 200 ml of 50% nitric acid and pump 120 ml at 2 ml/min.
- Stop the pump for 30 minutes.
- Flush with water until acid has been removed (pH higher than 6).

This will reduce the possibility of pitting corrosion on the 316L stainless steel in stagnant liquid areas. **With a WTi-type head, there is no need for any of the above procedures.**

7 VISCOSITY

There is no direct relationship between the viscosity of the liquid to be delivered and the pumping capability of the head. The two following points must be considered when dealing with high-viscosity liquids.

♦ INLET PRESSURE

The pump head must be "in charge" to avoid cavitation and to be normally fed. This may be performed with hydrostatic pressure by raising the reservoir, or may require a slight gas pressurization of the reservoir.

♦ THIXOTROPIC TEST

The check valve ball of the pump head must rapidly fall down in the considered liquid at a speed of about 10 cm/s, otherwise the pump head will not work satisfactorily. Such a test can be performed in a graduate cylinder.

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Note that a non-abrasive suspension of 40 centipoises can be successfully pumped with the Model 10SC head.

For high-viscosity and/or high-density liquids, a spring-loaded check valve kit (3650201) is available as an additional accessory for Models 5SC, 10SC, 25SC and 10WSC.

This kit has been experimentally proven to work with oils in the range 7 cp to 79 cp and with mercury having a density of 13.6.

8 TEMPERATURE

The maximum temperature of the liquid pumped through the head is limited by the piston seal and by the front panel of the module.

Gilson pump heads can operate from -20°C up to 100°C, provided that the pumped liquid is chemically compatible with the liquid-contact parts (see Section 8).

For pumping a liquid at temperatures different from the ambient, the metallic inlet kit, 3650205, offered as an additional accessory, may be required (see Section 2.4).

Gilson representatives can help you to evaluate the suitability of each pump head for particular applications.

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MAINTENANCE 7

1 OVERVIEW

General maintenance of a Gilson piston pump head, irrespective of type and model, consists of:

- cleaning check valves and filter
- replacing parts subject to wear and tear: piston seal, check valves, piston assembly, anti-extrusion gasket and return spring.

The case of unattended continuous operation of automatic systems has an increasing practical importance. For this reason, Table III gives an indication of replacement periods for maintenance parts, according to the type of use, intensive, regular or occasional. The data of Table III assumes that the pump is working at half of its maximum flowrate and pressure. The nature of the liquid and the pump head model have only a small influence on these figures.

If the pump head is installed on a 305 pump, the time between each maintenance operation can be viewed by using the **Info** soft key in the pump menu (see 305 User's Guide).

Table III: Replacement periods for maintenance parts

Use / Parts	**Intensive** *(168 h/week)*	**Regular** *(40h/week)*	**Occasional** *10 h/week)*
Piston seal	2-3 months *1300-2000 h*	6-9 months *1000-1400 h*	1 year *500 h*
Set of check valves	3-6 months *2000-4000 h*	1 year *2000 h*	2 years *1000 h*
Piston assembly	6-12 months *4000-8000 h*	2-3 years *2000-3000 h*	5 years *2500 h*
Anti-extrusion gasket	6-12 months *4000-8000 h*	2-3 years *2000-3000 h*	5 years *2500 h*
Return spring	1 year *8000 h*	2-3 years *2000-3000 h*	5 years *2500 h*

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2 CHECK VALVES

The Gilson check valves are supplied in clean pre-mounted cartridges. Each one is strictly checked and then packed separately.

Reliable flowrates will be achieved only if the check valves are kept in good operating condition by proper care and maintenance.

The check valve cartridge must be cleaned or replaced if there is a check valve problem. This can be determined by an abnormal loss in flowrate.

We strongly advise against the disassembling of the check valves into sub-components.

No check valve sub-component is available from Gilson.

CHECK VALVE CLEANING

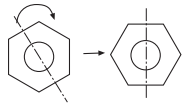
- Pump isopropanol if it is miscible with the current solvent. Otherwise, pump an intermediate solvent first. When the pump head is filled with isopropanol, stop the flow for 15 minutes or more to dissolve sticky deposits.
- If this procedure fails to restore the normal performance, replace the check valves with new ones.

CHECK VALVE REPLACEMENT

- Turn off the pump. Disconnect the inlet/outlet tubing and detach the head from the pump.
- Unscrew the inlet/outlet check valve support screws which contain the inlet/outlet check valve cartridges.
- Take out the check valve cartridges *(if necessary, by means of a clean compressed air flow)*.
- Tighten the support screws at the nominal torque of 7 N.m which ensures tightness up to the maximum pressure. In the absence of a dynamometric wrench, tighten up to the

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mechanical stop, then slacken off 1/12 of a turn (see the figure opposite). If leakage is observed, then re-tighten the leakage support screw until the leakage stops. There is no longer a risk of damage to the new cartridges.



- Re-insert the new check valve cartridges. Then, follow the above steps in reverse order. Note that neither the check valve cartridges nor their support screws are interchangeable from inlet to outlet.
- Run the pump and check for leaks around the support screws. Tighten any leaking support screw until the leakage stops.

3 PISTON SEAL

There are two identical piston seals in the 10WSC piston pump head. One is located in the head body and the other one in the rinse body. The piston seal consists of a seal ring made of either graphite reinforced PTFE (black) or HDPE (yellow) and a spring made of Hastelloy® C-276 (wire) or Elgiloy® HT (ribbon). Each one must be changed whenever a piston seal leakage occurs. This can be easily detected by the appearance of some liquid at the notch located at the bottom of the pump head.

Guidelines to select the piston seal according to the liquid are given in Section 2.2.

♦ DISASSEMBLING THE PUMP HEAD

- Turn off the pump. Disconnect the inlet/outlet tubing. Detach the pump head from the pump.
- Referring to Figure 2, dismount the pump head as follows:
  a) Unscrew the threaded cover (1),
  b) Take out the piston tail guide (2), the piston assembly (3), the spring spacer (4), and the return spring (5).

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c) Loosen the two screws (17) on the back of the pump head and remove the ball housing (6) and the housing spacer (7).
d) Remove the first anti extrusion gasket (9) and the rinse body (8).
e) Remove the O-ring (12) and the second anti-extrusion gasket (13).

☞ *For replacing the piston seal:*
- in the head body, follow the steps from a to e,
- in the rinse body, only follow the steps from a to c.

- Carefully take out the piston seal. If it remains tightly seated in the head body, pry it out with care in order to avoid damaging the pump head body (11) or rinse body (8).

⚠ ***Once the piston seal has been removed, it must not be re-used.***

♦ INSTALLING A NEW PISTON SEAL

- Inspect the piston and the area around the piston seal to ensure that they are clean, undamaged and completely free of any particles.
- Referring to Figure 5, use the piston seal mounting tool, (Figure 1, G), which is composed of a seal pusher and a seal guide, to install the new piston seal.
  - Set the guide onto the pump head body or rinse body with its bevelled edge out.
  - Insert the new piston seal in the guide with its spring side down.
  - Press the seal pusher with your finger until the piston seal goes down to the pump head.

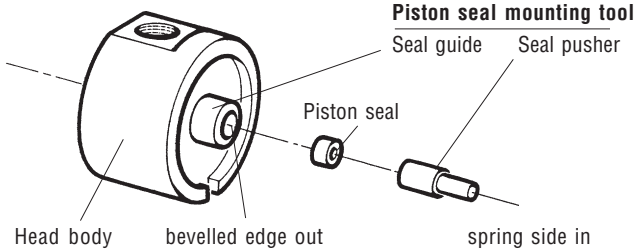


Figure 5

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- Re-assemble the pump head by following the disassembling pump head instructions in reverse order.

☞ *Referring to Figure 2, ensure the piston assembly (3) and the spring spacer (4) are correctly assembled, i.e. spherical male into spherical female.*

Line up the ball housing assembly (6), the housing spacer (7) and the head body (11) with the matching hole or notch on the same side. After screwing the ball housing assembly (6) and the housing spacer (7) and the rinse body (8) onto the head body (11), put the body on a flat surface to facilitate the mounting of the other parts.

- Run-in the new piston seal according to Section 5.2.

4 RETURN SPRING

Due to fatigue of the steel, the return spring (Figure 2, item 5) should not be considered as having an unlimited lifetime. **We recommend that the spring is changed with every five piston seals used.**

To change the return spring, dismount the pump head by following the instructions, Section 4.1, in reverse. Unscrew the threaded cover and remove the piston tail guide, the piston assembly, the spring spacer and the spring. Replace the spring and reassemble the pump head.

5 MAINTENANCE KIT

For your convenience, a maintenance kit for the 10WSC pump head is available.

Description	Reference number
Maintenance kit for 10WSC pump head	364011

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APPENDICES 8

1 SPECIFICATIONS

Pump head (model)	Flowrate range* (ml/min)	Pressure range (MPa)* 302	303/305
10WSC	0.050 - 10	0.1 - 21	0.1 - 60

☞ ** Minimum indicated to obtain specified precision and accuracy. Flowrate adjustable down to 0.01% of maximum flowrate. 1 MPa = 10 bar = 145 psi*

Liquid contact materials: 316L stainless steel, titanium, sapphire/ceramic, ruby, PCTFE (polychlorotrifluoroethylene), PEEK, PTFE, Hastelloy® C276/Elgiloy® HT.

Flowrate precision: At 20°C and over full working range, coefficient of variation is 0.1 to 0.6 % with aqueous solutions or hydro-organic polar solvent mixtures, and 0.3 to 1% with hydrocarbons or chlorinated volatile solvents.

Flowrate accuracy: At 20°C and over full working range, maximum accuracy error with water is
- for 302 and 303: 0 to -2.5% up to 10 MPa
- for 305 and 306: ± 1% up to 60 MPa.

Trademarks: Hastelloy is a registered trademark of Haynes. Elgiloy is a registered trademark of Elgiloy Co.

2 REPLACEMENT PARTS

☞ *The numbers in brackets are the index numbers illustrated in Figure 2. Refer to Table I and Figure 3 for the reference numbers of accessories.*

Description		Reference Number
Piston seal (10) (14)	PTFE	5463125095
	HDPE	5463125895
Anti-extrusion gasket (9) (13)		3650015K
Inlet check valve cartridge (15)		3650170
Outlet check valve cartridge (18)		3650180
Piston assembly (3)		3650010
Spring spacer (4)		3650037
Piston tail guide (2)		3650027
Return spring (5)		36300058
Ball housing assembly (6)		3650067
O-ring (12)		5464535106

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