SC-type Piston Pump Heads
User's Guide

Solutions at Work for You

GILSON
SOLUTIONS AT WORK FOR YOU

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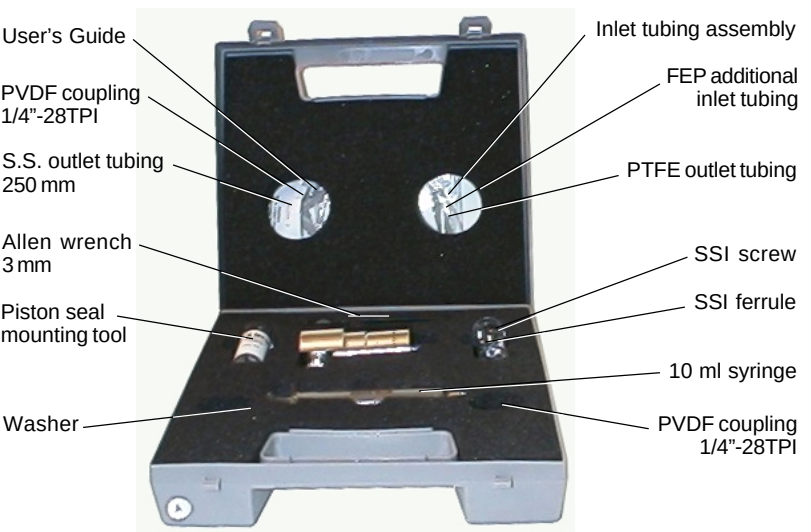
Unpacking and Standard Accessories 1

The Gilson SC-type Piston Pump Head series consists of five models: 5SC, 10SC, 25SC, 50SC and 100SC. Each one is supplied complete in a kit (Figure below), with the standard accessories as listed in Table overleaf.

Each pump head is filled with isopropanol 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.



Standard accessories

Model Reference	5SC 360510	10SC 360520	25SC 360522	50SC 360524	100SC 360530	Qty
Inlet tubing assembly*	3645275	3645275	3645357	3650069	3650069	1
FEP additional inlet tubing**	none		49948392	499493922		
PTFE outlet tubing 350 x 3 x 2 mm	none		36425019			1
SSI screw	49031401					2
SSI ferrule	49031402					2
10 ml syringe	36460058		none			1
PVDF coupling 1/4"-28TPI	none		F1410153			1
Washer	3645329		none	none		1
Piston seal mounting tool	36620122	36620123	36620290	36620291	36620292	1
S. S. outlet tubing 250 mm	49932259		49934259			1
Allen wrench 3 mm	4320302					1
PVDF coupling 1/4"-28TPI	none		F1410153	F1410156		1
User's Guide	LT801077					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 FEP inlet tubing, 60 x 1.6 x 3 mm.

*3645357: PTFE inlet tubing, 640 x 2 x 3 mm, equipped with a 20 µm stainless steel filter.

*3650069: FEP inlet tubing, 1000 x 3 x 4 mm, equipped with a 20 µm stainless steel filter.

**49948392: FEP additional inlet tubing, 1000 x 2 x 3 mm.

**499493922: FEP additional inlet tubing, 1000 x 3 x 4 mm.

**499692002: FEP additional inlet tubing, 2000 x 4 x 5 mm (not supplied, available as an additional accessory, only for 100 SC).

Additional Accessories 2

This section lists all the additional accessories that can be used with the pump heads.

For Any Liquid

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 for the injection valve.

Part Number	Description
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)

For Water, Aqueous Solutions and Polar Solvents

These HDPE (high density polyethylene) piston seals are yellow, to be easily distinguished from the black PTFE seals. PTFE black seals are recommended with alkanes, chlorinated solvents, tetra-hydrofuran and carbon dioxide. HDPE yellow seals give longer service with water, aqueous solutions, alcohols and acetonitrile.

Part Number	Description
5463088863	HDPE piston seal for 5SC head
5463125895	HDPE piston seal for 10SC and 10WSC heads
5463050825	HDPE piston seal for 25SC head
5463070820	HDPE piston seal for 50SC head
5463394862	HDPE piston seal for 100SC head

For High-Viscosity or High-Density Liquids

This spring-loaded check valve is specially designed for pumping highly viscous or dense liquids. Refer to Chapter 5, 'Viscosity'.

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.

Part Number	Description
3650201	Spring-loaded check valve kit, PCTFE envelope (for 5SC, 10SC, 25SC and 10WSC heads).

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 Technical Data).

The two following thermostatic kits are available for heating or cooling Gilson pump heads. Both require a standard cryothermostat (not supplied by Gilson) that generates a temperature-controlled circulating liquid.

Part Number	Description
360350400	Thermostatic jacket kit for any model of Gilson piston pump heads. Requires metallic inlet (see below 3650205 or 3650220 according to pump head model).
3650430	Complete thermostatic kit for 5SC, 10SC and 25SC pump heads. Includes all required components (jacket, other elements of the thermostating loop, and full thermostated line).

These kits have their own additional accessories:

Part Number	Description
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.
3650220	Metallic inlet fitting for 50SC, 100SC and 200WTi pump heads. Only consists of inlet check-valve screw with Swagelok fitting, 1/4", 316L. Tubing not supplied.

Additional Accessories 2

Part Number	Description
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).
	Spare Seal for fitting of American gas cylinder, one unit (49 03 17 04).

For Heads 50SC and 100SC

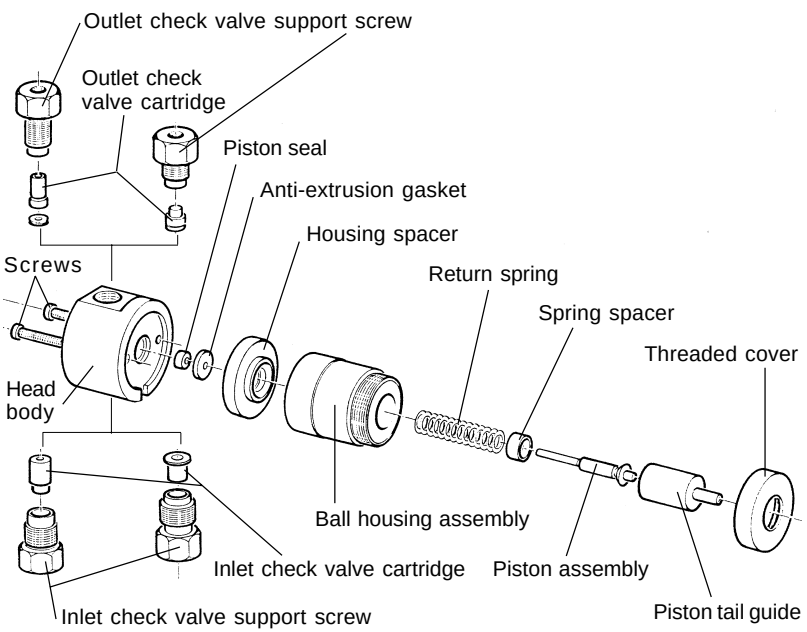
These items answer the need to extend the length of the inlet tubing up to three meters, so that a large capacity reservoir located on the floor can feed one or more preparative workstations.

Part Number	Description
3650075	Inlet tubing, FEP, 3 x 4 x 3000 mm, M10 and 20 µm filter (for 50SC and 100SC).
F1410156	Union fitting, PVDF, M10.

Additional Accessories 2

Description 3

Outlet



Inlet

5SC
10SC
25SC

50SC
100SC

Description 3

Setup 4

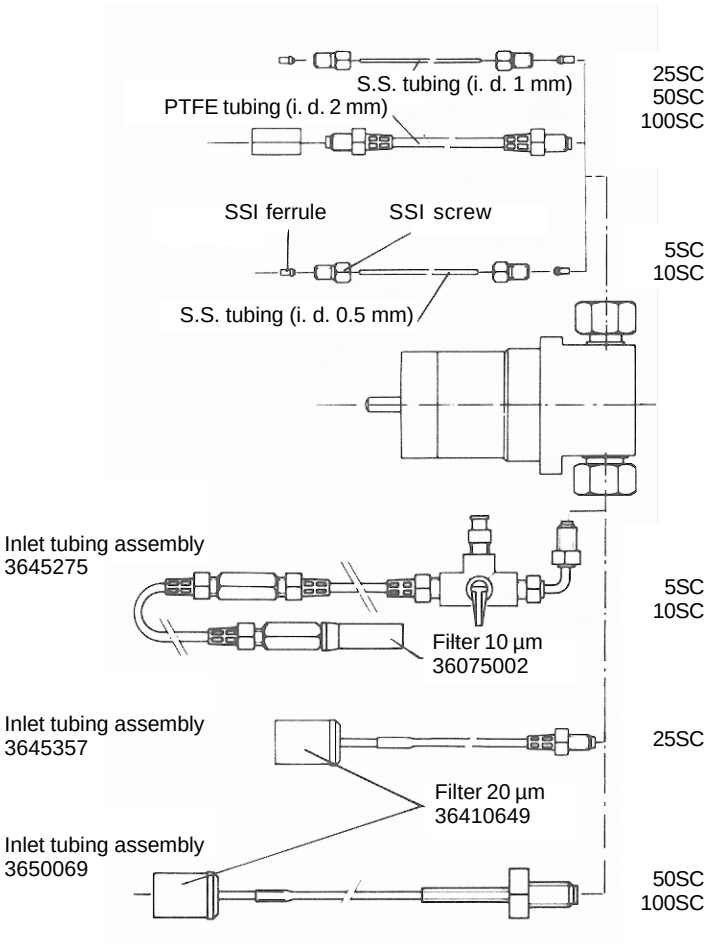
Switch the power off before mounting (or removing) the pump head on (or from) the pump.

Carefully insert the pump head into the opening of the pump. Note that at the bottom of the head body there is a notch. This 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.

Tubing Connections



Precautions for use 5

This chapter describes the precautions to take in order to ensure optimal use of your pump head.

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.

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.

Solvent Degassing

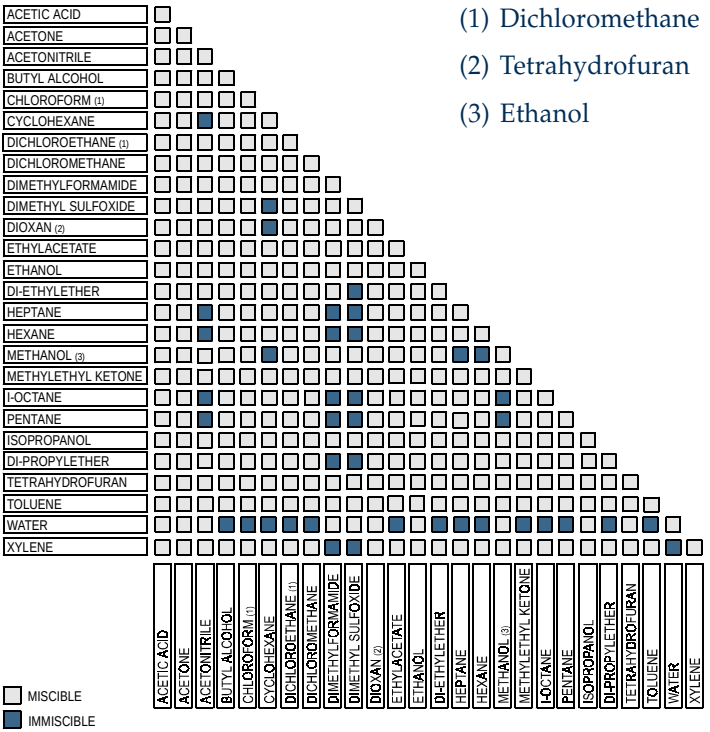
Solvents should be degassed to avoid air bubble formation in the pump head or in the detector cell.

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

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 4×10^{-3} A. U. change in the absorbance of methanol.

Solvent Miscibility

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



(1) Dichloromethane

(2) Tetrahydrofuran

(3) Ethanol

Changing the Flowrate

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

Salinity and Acidity

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

Special precautions to take when using SC-type pump heads.

In order to avoid any possible deposit of solid crystal inside SC-type pump heads when pumping saline solutions (e.g. buffer salts, or ion-pairing salts included in chromatographic mobile phases):

- At the end of the day, run the pump at a very low flowrate (10 µl/min).
- At the end of the run, rinse the head with water to remove any salt which may have precipitated.

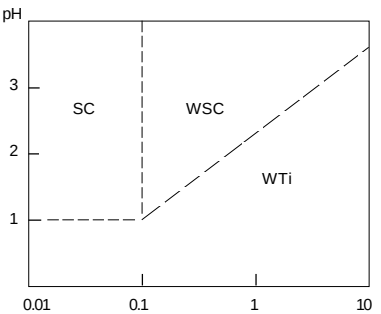
With a WSC or WTi-type pump head, this precaution is not necessary.

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 the Figure overleaf.

Salinity and Acidity

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

- Make up 100 ml of 50% nitric acid and pump 60 ml at 2 ml/min.
- Stop the pump for 30 minutes.
- Flush the system with water until acid has been removed (pH higher than 6).



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.

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 graduated cylinder. 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.

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 liquid pumped is chemically compatible with the liquid-contact parts (see Chapter 7 'Technical Data').

A complete thermostatic kit is available for heads 5, 10 and 25 (see Chapter 2, 'Additional Accessories - For Liquids at Non-ambient temperatures').

Maintenance 6

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 'Replacement periods for maintenance periods' gives an indication of replacement periods for maintenance parts, according to the type of use: intensive, regular or occasional. The data of this table 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).

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

Check Valves

The Gilson check valves are supplied in clean pre-mounted cartridges. Each one is thoroughly 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 detected by an abnormal loss in flowrate.

The check valves must not be disassembled 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).
- 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.
- 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 mechanical stop, i.e. to the metal on metal contact.
- Run the pump and check for leaks around the support screws. Tighten any leaking support screw until the leakage stops.

Piston Seal

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). It 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 Chapter 2.

Disassembling the pump head

- Turn off the pump. Disconnect the inlet/outlet tubing. Detach the pump head from the pump.
- Referring to the exploded view, page 13, dismount the pump head as follows:
  - Unscrew the threaded cover,
  - Take out the piston tail guide, the piston assembly, the spring spacer, and the return spring.
  - Loosen the two screws on the back of the pump head and remove the ball housing and the housing spacer.
  - Remove the anti extrusion gasket.

Piston Seal

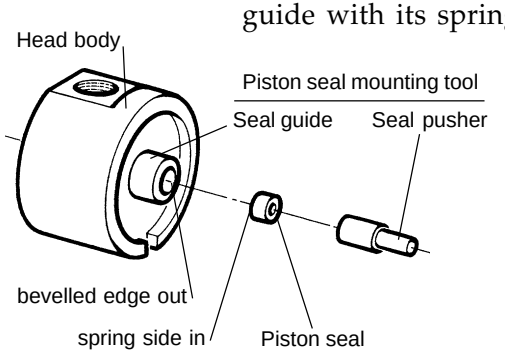
- Carefully take out the piston seal.

If it remains tightly seated in the head body, pry it out with care in order to avoid damaging the pump head body.

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 the Figure below, use the piston seal mounting tool, which is composed of a seal pusher and a seal guide, to install the new piston seal.
  - Set the guide onto the pump head 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.

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

- Run-in the new piston seal according to Chapter 5.

Piston Seal

Referring to the pump head exploded view, ensure the piston assembly and the spring spacer are correctly assembled, i.e. spherical male into spherical female. Line up the ball housing assembly, the housing spacer and the head body with the matching hole or notch on the same side. After screwing the ball housing assembly and the housing spacer onto the head body, put the body on a flat surface to facilitate the mounting of the other parts.

Return Spring

Due to fatigue of the steel, the return spring (see pump head exploded view) 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, Chapter 4, 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.

Maintenance Kit

For your convenience, a maintenance kit for each pump head is available.

Part Number	Description	
364005	Maintenance kit for	5SC pump head
364010	Maintenance kit for	10SC pump head
364012	Maintenance kit for	25SC pump head
364013	Maintenance kit for	50SC pump head
364015	Maintenance kit for	100SC pump head

Maintenance 6

Technical Data 7

Pump head (model)	Flowrate range* (ml/min)	Pressure range (MPa)* 302	303/305	Stroke volume (µl)
5SC	0.010 - 5	0.1 - 42	0.1 - 60	39.4
10SC	0.050 - 10	0.1 - 21	0.1 - 60	78.8
25SC	0.125 - 25	0.1 - 8.4	0.1 - 28	197
50SC	0.250 - 50	0.5 - 4.2	0.5 - 14	394
100SC	0.500 - 100	0.5 - 2.1	0.5 - 7	788

* Minimum indicated to obtain specified precision and accuracy. Flowrate adjustable down to 0.01% of maximum flowrate.

1 MPa = 10 bar = 145 psi

Liquid Flow Data

Liquid Contact Materials

316L stainless steel, titanium, sapphire or ceramic, ruby, PCTFE (polychlorotrifluoroethylene), PEEK, PTFE, Hastelloy® C276 or 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.

List of Replacement Parts 8

Description	Part Number 5SC 360510	10SC 360520	25SC 360522	50SC 360524	100SC 360530
Piston seal PTFE	5463088063	5463125095	5463050025	5463070020	5463394062
HDPE	5463088863	5463125895	5463050825	5463070820	5463394862
Anti-extrusion gasket	3650014K	3650015K	3650016K	3650017K	3650018K
Inlet check valve cartridge	36501701	36501701	36501701	3650263	3650263
Outlet check valve cartridge	36501801	36501801	36501801	3650267	3650267
Piston assembly	3650008	3650009	3650011	3650012	3650013
Spring spacer	3650019	3650019	3650019	3650020	3650020
Piston tail guide	3650027	3650027	3650027	3650028	3650028
Return spring	36300058	36300058	36300058	36300062	36300062
Ball housing assembly	3650067	3650067	3650067	3650068	3650068

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

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