WTi-type Piston Pump Heads
User's Guide

Solutions at Work for You

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CONTENTS

INTRODUCTION 1

1 WHY USE TITANIUM

The Gilson WTi-type Piston Pump Heads are specially designed for the stringent purification needs of biotechnology and for ion chromatography where the leaching of metal ions from stainless steel may cause undesirable interference.

These pump heads combine chemical inertness of pure titanium (ASTM Grade 2, Ti > 99%, Fe < 0.3%) with long term performance associated with the piston rinsing chamber. This chamber continuously washes the piston for troublefree pumping of high concentration saline solutions.

While metal ions may be responsible for a loss of enzymatic activity, or for interference with purified molecules, note that it is also important to use specially purified salts, solvents and reagents.

For information, Figure 1 shows the area of pitting corrosion at ambient temperatures, for AISI 316L stainless steel, in high concentration chloride containing acidic solutions.

In contrast, titanium resists corrosion by saturated sodium chloride solutions at ambient temperatures and by hydrochloric acid up to about 5%, i.e. 1.5M and pH approximately - 0.1 [(1)].

In addition, with the ability to rapidly self-repair its protective oxide film, titanium also exhibits high resistance to erosive and turbulent conditions [(2)].

References

[(1)] *P. A. Schweitzer, in Corrosion Resistance Tables, M. Dekker Inc., 1976.*

[(2)] *K. A. Chandler, in Marine and Offshore Corrosion, Butterworths Ltd, 1985, p. 137.*

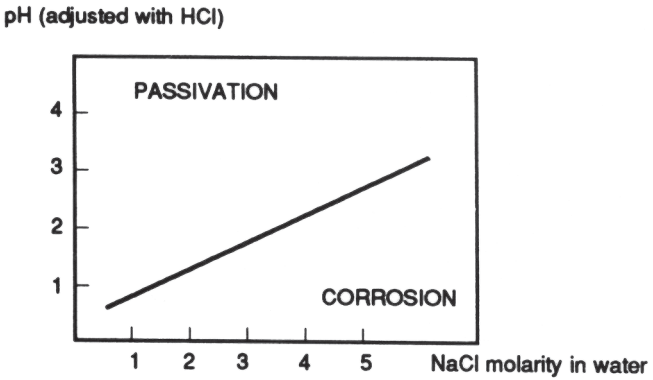


Figure 1: Corrosion area of AISI 316L stainless steel by chloride ions in acidic solutions at ambient temperatures. (Source: Gilson tests, 15 samples, 600 days.)

2 UNPACKING AND STANDARD ACCESSORIES

The Gilson WTi-type Piston Pump Head series consists of three models: 10WTi, 25WTi and 200WTi.

The pump head is supplied complete in a kit (Fig. 2 A and B), with its standard accessories shown in Table I, II and III.

The pump head and the rinsing chamber contain isopropanol when delivered.

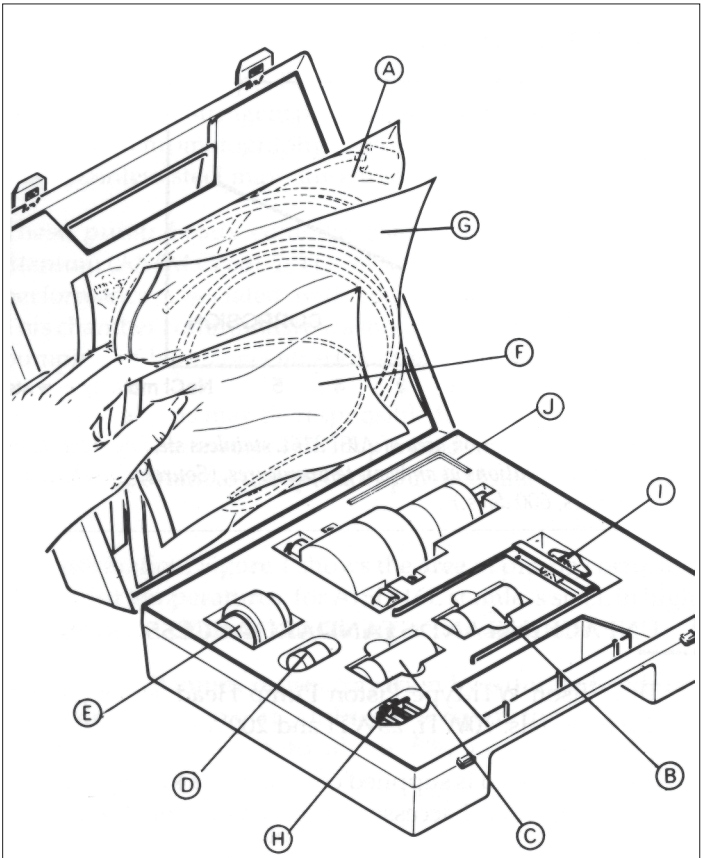


Figure 2A: 200WTi Piston Pump Head kit

Table I: Standard accessories for Model 200WTi (360532T)

Item	Description	Reference	Qty
A	Inlet tubing, FEP, 2000 x 5 x 4 mm, equipped with a 25 µm, 24 cm^2 titanium filter	3650275	1
B	Male luer fitting, PVDF	495019	2
C	Polyacetal screw, Uptight flangeless type, 1/4"-28 TPI black	49041017	2
D	ETFE ferrule for 1/4" Uptight flangeless type fitting	49041015	2
E	Piston seal mounting tool	95360006	1
F	ETFE outlet tubing, 250 x 3.2 x 2.3 mm	470612502	1
G	Versilic® rinsing tubing, 2000 x 5 x 3 mm	470219739	1
H	Tubing nipper	439460048	1
I	Clamp	3650279	1
J	Allen wrench, 3 mm	4320302	1
	User's Guide	LT801181	1

☞ *Letters A through J, see Figure 2A.*

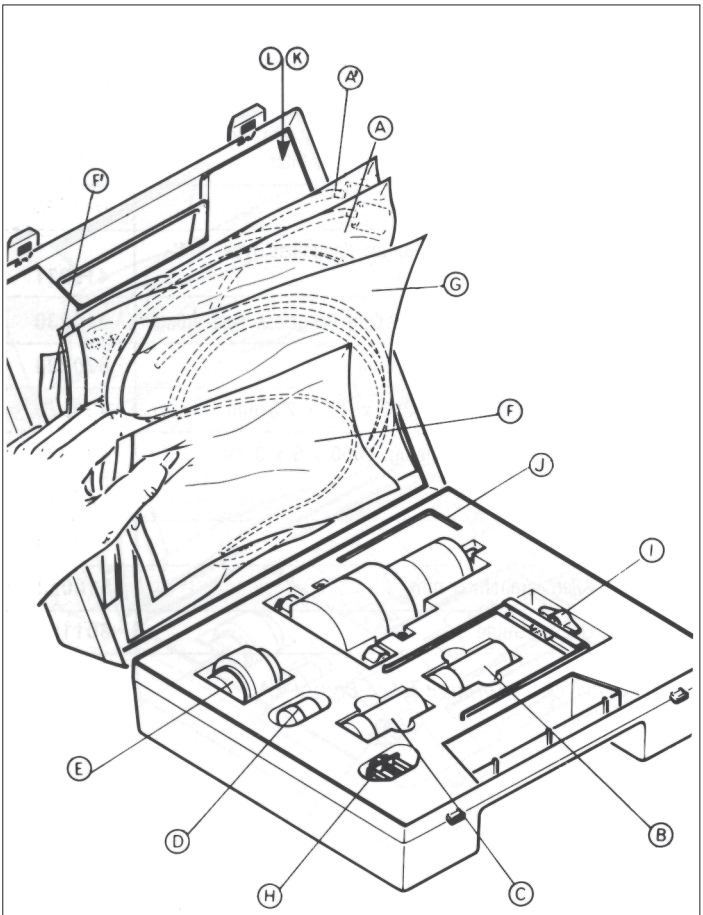


Figure 2B: 25WTi Piston Pump Head kit

Table II: Standard accessories for Model 25WTi (360523T)

Item	Description	Reference	Qty
A	Inlet tubing, FEP, 640 x 2 x 3 mm, equipped with a 10 µm titanium filter	3650113	1
A'	Inlet tubing length extension, FEP, 2 x 3 x 1000 mm	49948392	1
B	Male luer fitting, PVDF	495019	2
C	SSI screw SSI ferrule	49031401 49031402	2 2
D	Washer	3645329	1
E	Piston seal mounting tool	36620290	1
F	Titanium outlet tubing, 250 x 1.6 x 1 mm	49924259	1
F'	Titanium outlet tubing, 200 x 1.6 x 1 mm	49924209	1
G	Versilic rinsing tubing, 2000 x 5 x 3 mm	470219739	1
H	Tubing nipper	439460048	1
I	Clamp	3650279	1
J	Allen wrench, 3 mm	4320302	1
K	Coupling, PVDF, 1/4"-28 TPI	F1410153	1
L	User's Guide	LT801181	1

☞ *Letters A through L, see Fig. 2B (K and L under the frame).*

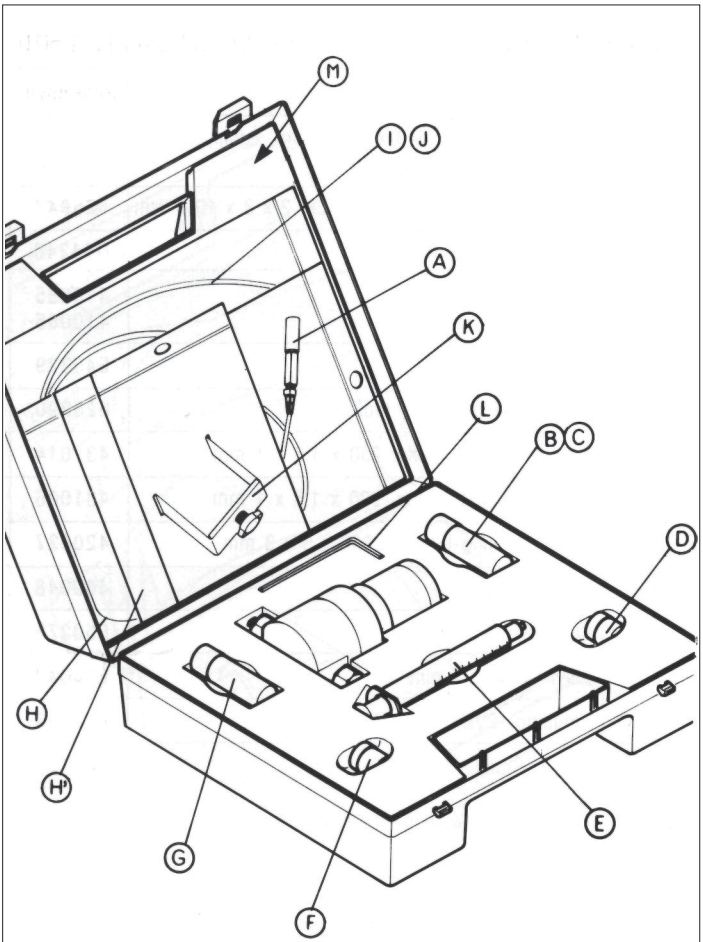


Figure 2C: 10WTi Piston Pump Head kit

Table III: Standard accessories for Model 10WTi (360551T)

Item	Description	Reference	Qty
A	Inlet tubing, PTFE, 1000 x 2 x 3 mm, equipped with a 10 µm, 11 cm^2 titanium filter, a 3-way prime valve and FEP inlet tubing, 60 x 1.6 x 3 mm	3645275T	1
B	Male luer fitting, PVDF	495019	2
C	SSI screw	49031401	2
D	SSI ferrule	49031402	2
E	10 ml syringe	36460058	1
F	Washer	3645329	1
G	Piston seal mounting tool	36620123	1
H	Titanium outlet tubing, 250 x 1.6 x 0.5 mm	49922259	1
H'	Titanium outlet tubing, 200 x 1.6 x 0.5 mm	49922209	1
I	Versilic rinsing tubing, 2000 x 5 x 3 mm	470219739	1
J	Tubing nipper	439460048	1
K	Clamp	3650039	1
L	Allen wrench, 3 mm	4320302	1
M	User's Guide	LT801181	1

☞ *Letters A through M, see Figure 2C (M under the frame).*

3 ADDITIONAL ACCESSORIES

♦ FOR 10WTi AND 25WTi PUMP HEADS

The following accessories contain no titanium components. However, these accessories can be used with a WTi pump head to expand its range of applications.

5463125095	PTFE piston seal for 10SC, 10WSC and 10WTi pump heads
5463050025	PTFE piston seal for 25SC and 25WTi pump heads

These PTFE piston seals are black to be easily distinguished from the yellow HDPE seals. 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).

☞ *The spring inside the piston seal is made of Hastelloy® C276 (wire) or Elgiloy® HT (ribbon).*

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

This spring-loaded check valve kit is specially designed for pumping highly viscous or dense liquids (refer to Section 5.7). It consists of a couple of spring-loaded check valve cartridges to be substituted for the standard cartridges, plus 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 has been qualified and may be used without the inlet filter.

☞ *The valve body and spring inside the check valve cartridge are made of stainless steel.*

3650205	Metallic inlet kit for 5SC, 10SC, 10WSC, 10WTi, 25SC and 25WTi pump heads

The metallic inlet kit is required for pumping liquids under high pressure at elevated temperatures or doing oxygen-free electrochemical analyses. It consists of:

- one inlet check valve screw for 1/8" SSI fitting
- one stainless steel tubing, 316L, 2000 x 3.2 x 2.1 mm
- two SSI 1/8" ferrules
- two SSI 1/8" screws.

♦ FOR 200WTi PUMP HEADS

5463140025	PTFE piston seal for 200WTi pump head

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).

☞ *The spring inside the piston seal is made of Hastelloy C276 (wire) or Elgiloy HT (ribbon).*

The following accessories allow you to adapt the length of tubing to your particular needs.

For longer inlet tubing

49966202	Tubing, FEP, 4 x 5 x 500 mm, equipped at both ends with PVDF M10 screw and flange-type fitting
499691002	Tubing, FEP, 4 x 5 x 1000 mm, equipped at both ends with PVDF M10 screw and flange-type fitting
499692002	Tubing, FEP, 4 x 5 x 2000 mm, equipped at both ends with PVDF M10 screw and flange-type fitting
F1410156	PVDF coupling for two M10 flat end male fittings

For outlet tubing

470612502	ETFE outlet tubing, 3.2 x 2.3 mm, offered per meter
49041017	Polyacetal screw, Uptight flangeless type, 1/4"-28TPI, black (Upchurch P-301)
49041015	ETFE ferrule for 1/4" Uptight flangeless type fittings (Upchurch P-300)
F1410153	PVDF coupling for two 1/4"-28TPI flat end male fittings
495023	Tee-fitting, PVDF, 1/4"-28TPI, 1.5 mm hole

For critical chromatographic connections downstream from injection

471200603	Tubing, FEP, 3.1 x 1.6 mm, offered per meter To be used with 49041017 screw and 49041015 ferrule.

For metallic inlet

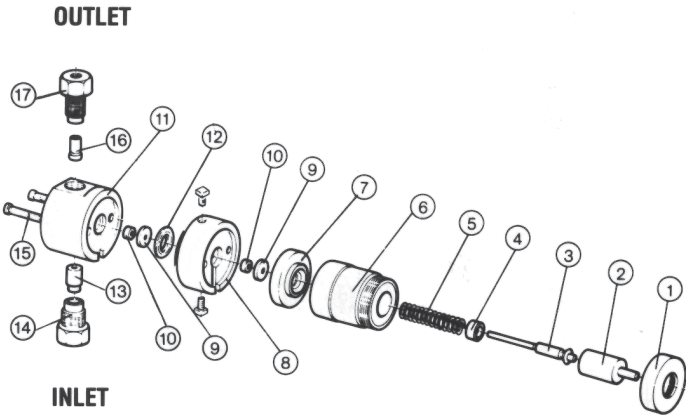
3650220	Metallic inlet fitting for 50SC, 100SC and 200WTi pump heads. Only consists of inlet check valve screw with Swagelok® fitting, 1/4", 316L. Tubing not supplied.

For any model

360350400		Thermostatic jacket kit for any model of Gilson piston pump heads Requires cryothermostat (not supplied) and metallic inlet (3650205 or 3650220 according to pump head model). Consists of:
	1	Thermostatic jacket for pump head, 9 ml, 316L, nickeled brass and PTFE, 1/4" Swagelok fittings.
3650039	1	Clamp for pump head SC thermostated and 10W standard.
3650279	1	Clamp for pump head 10W thermostated, 25W and 200W standard.
3650415	1	Clamp for pump head 25W and 200W thermostated.
3650420	1	Extension and insulation parts for piston pump head. *Includes piston extension block (3650416), thermal insulation crossbars (3650417), and six screws (4011534165). To be installed on any pump module equipped with heated or cooled pump head.*
LT801187	1	Instruction leaflet.

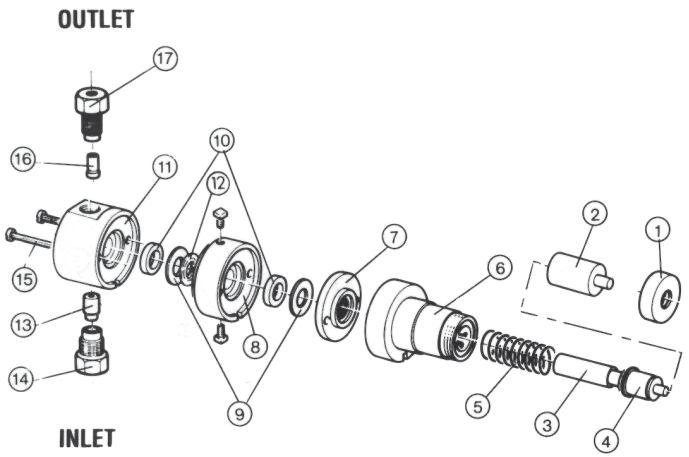
This kit allows cooling as well as heating Gilson piston pump heads. These heads operate normally from -20°C to 100°C, provided that the liquid pumped is chemically compatible with the materials of the pump head.

DESCRIPTION 2



1	Threaded cover	Stainless steel
2	Piston tail guide	Stainless steel
3	Piston assembly	Sapphire and stainless steel
4	Spring spacer	Stainless steel
5	Return spring	PTFE coated stainless steel
6	Ball housing assembly	Stainless steel
7	Housing spacer	Stainless steel
8	Rinse body	Stainless steel
9	Anti-extrusion gasket	PCTFE
10	Piston seal	HDPE with titanium spring
11	Head body	Titanium
12	O-ring	Nitrile rubber
13	Inlet check valve cartridge	Titanium
14	Inlet check valve support screw (Fig. 4)	Titanium and stainless steel
15	Screws	Stainless steel
16	Outlet check valve cartridge	Titanium
17	Outlet check valve support screw (Fig. 4)	Titanium and stainless steel

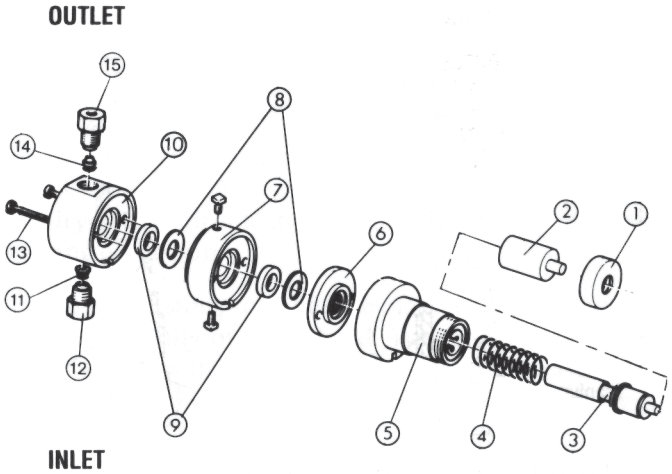
Figure 3A: Exploded view of 10WTi piston pump head assembly



1	Threaded cover	Stainless steel
2	Piston tail guide	Stainless steel
3	Piston assembly	Sapphire and stainless steel
4	Spring spacer	Stainless steel
5	Return spring	PTFE coated stainless steel
6	Ball housing assembly	Stainless steel
7	Housing spacer	Stainless steel
8	Rinse body	Stainless steel
9	Anti-extrusion gasket	PCTFE
10	Piston seal	HDPE with titanium spring
11	Head body	Titanium
12	O-ring	Nitrile rubber
13	Inlet check valve cartridge	Titanium
14	Inlet check valve support screw (Fig. 4)	Titanium and stainless steel
15	Screws	Stainless steel
16	Outlet check valve cartridge	Titanium
17	Outlet check valve support screw (Fig. 4)	Titanium and stainless steel

Figure 3B: Exploded view of 25WTi piston pump head assembly

DESCRIPTION 2



1	Threaded cover	Stainless steel
2	Piston tail guide	Stainless steel
3	Piston assembly	Ceramic and stainless steel
4	Return spring	PTFE coated stainless steel
5	Ball housing assembly	Stainless steel
6	Housing spacer	Stainless steel
7	Rinse body	Stainless steel
8	Anti-extrusion gasket	PCTFE
9	Piston seal	HDPE with titanium spring
10	Head body	Titanium
11	Inlet check valve cartridge	Titanium
12	Inlet check valve support screw (Fig. 4)	Titanium and stainless steel
13	Screws	Stainless steel
14	Outlet check valve cartridge	Titanium
15	Outlet check valve support screw (Fig. 4)	Titanium and stainless steel

Figure 3C: Exploded view of 200WTi piston pump head assembly

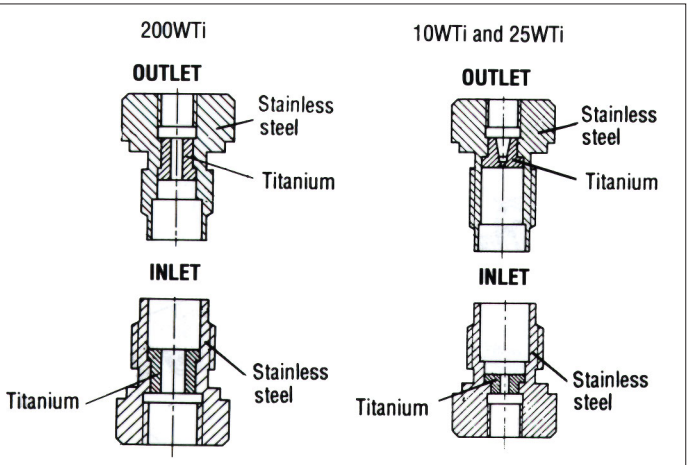


Figure 4: Inlet and Outlet check valve support screws

☞ *The check valve cartridge is composed as follows*

- *Valve ball: Ruby,*
- *Valve seat: Sapphire for 10WTi and 25WTi, Titanium for 200WTi,*
- *Valve body: Titanium.*

INSTALLATION 3

1 MOUNTING THE HEAD TO THE PUMP MODULE

⚠ *Before mounting or removing the piston pump head, turn off the main power switch on the pump module.*

Carefully insert the piston pump head into the opening of the pump. Note that at the bottom of the head body there is a notch which you must fit onto the matching notch pin, just below the opening of the pump.

Holding the piston pump head in place with one hand, set the clamp diagonally over the head. Turn the clamp clockwise until it engages the slots on either side of the piston pump head. Finger-tighten the thumb screw until the head is secured.

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

2 TUBING CONNECTIONS

♦ INLET AND OUTLET TUBING

Tubing connections are shown in Figure 5. Note that the inlet connection is a flanged fitting which needs only to be finger tightened. However, if leakage occurs, use an open-end wrench to slightly turn the nut until leakage stops. Be careful not to overtighten.

Specially with Model 200WTi head, to avoid excessive shaking of the inlet tubing at high flowrates, it is advisable to attach it at the pump side with a plastic locking collar (ref. 29501017), and at the solvent bottle neck, with a device adapted to its size.

RINSING TUBING

Finger-tighten the two male luer fittings, respectively at the inlet and outlet of the rinsing chamber. Install the Versilic tubing either for a dynamic or for a static process (see Section 4.2).

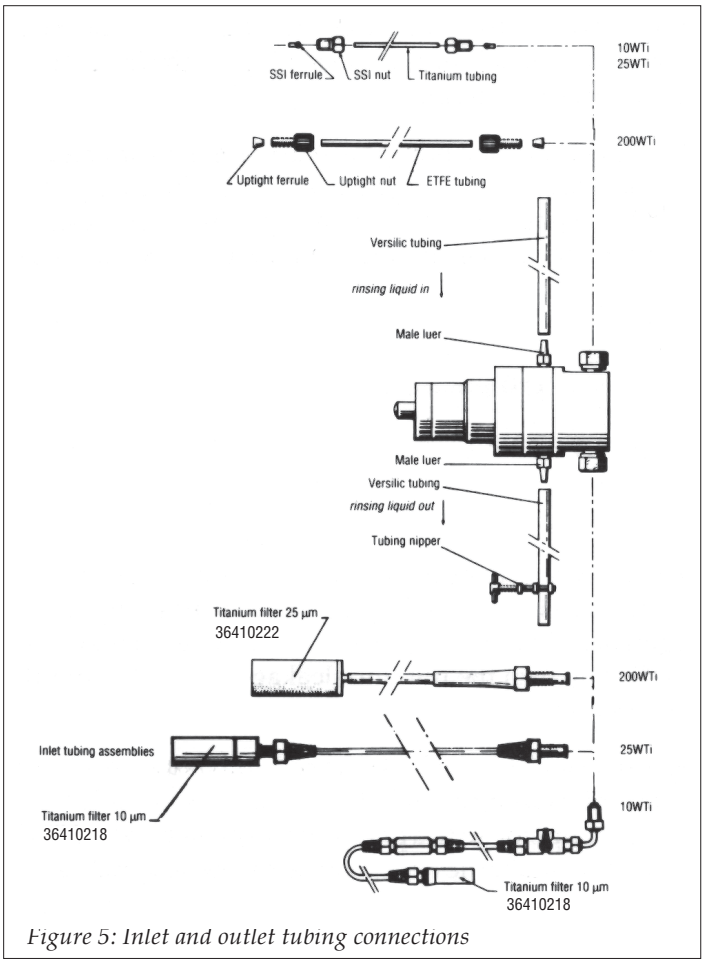


Figure 5: Inlet and outlet tubing connections

OPERATION 4

1 SOLVENT DELIVERY

Refer to the *pump User's Guide.*

When using a new head, see Section 5.1 for information about the starting procedure.

2 RINSING OPERATION

Whenever the salt concentration in the elution solvent is higher than 0.1M, the piston must be rinsed in the rinsing compartment.

The ideal rinsing liquid is free of saline ions but otherwise identical to the elution solvent. Water or any appropriate solvent may also be used.

The rinsing procedure can either be dynamic or static.

♦ DYNAMIC RINSING

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 flowrate is sufficient. It can be adjusted using the tubing nipper.

♦ STATIC RINSING

Fill and keep the rinsing liquid in the rinsing chamber (capacity 0.25 ml for 10WTi, 0.35 ml for 25WTi and 1.9 ml for 200WTi). Then, renew the rinsing liquid after about 50 hours of operation.

☞ *The dynamic procedure is recommended.*

PRECAUTIONS FOR USE 5

1 STARTUP WITH NEW PUMP HEAD OR PISTON SEAL

Whenever using a new piston pump head or a new piston seal, it is strongly recommended to follow the starting procedure:

1) Run the pump without backpressure for 1-2 minutes at 20% of nominal flowrate (2 ml/min for 10WTi, 5 ml/min for 25WTi and 40 ml/min for 200WTi) with methanol.
2) Run the pump at maximum operating procedure for 4-5 minutes, checking for any leaks.
3) Repeat step 1 for 30 minutes.

2 SOLVENT FILTRATION

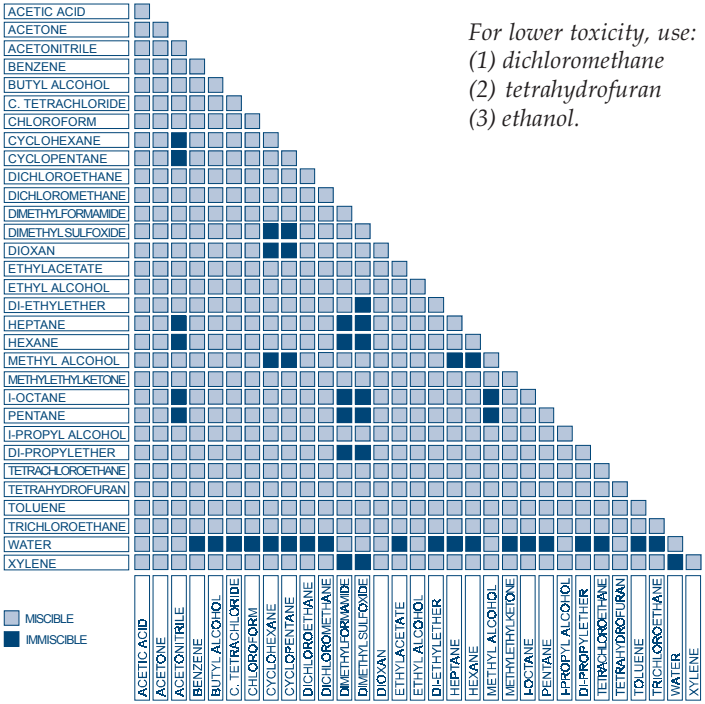
Filter solvents through a 0.45 µm membrane filter to minimize clogging of filters in the system.

The inlet filter attached to the end of the inlet line must be used with all solvents to protect the check valves from particle contamination. The reference number for this filter is noted in Figure 5.

3 SOLVENT MISCIBILITY

When changing solvents, make sure that the new solvent is miscible with the previous one. Otherwise, use an intermediate solvent. Refer to Table IV for solvent miscibility characteristics.

Table IV: Solvent miscibility



For lower toxicity, use:
(1) dichloromethane
(2) tetrahydrofuran
(3) ethanol.

4 SOLVENT DEGASSING

Degas the solvent to prevent air bubble formation in the piston pump head or detector cell. Vacuum filtration or helium sparging are more efficient methods than ultrasonic degassing.

Solvent degassing also improves baseline stability of UV absorbance detectors working at low wavelengths. For example, at 210 nm, a 1% change in the dissolved oxygen level will cause a 4×10^{-3} A. U. change in the absorbance of methanol.

5 CHANGING THE FLOWRATE

To protect the HPLC columns, change the flowrate in progressive steps, never abruptly.

6 SALINITY

The Gilson WTi-type piston pump heads are specially designed for pumping aggressive saline solutions, such as salt buffers, protein salting-out agents, and ion-pairing compounds, present at high concentration in chromatographic mobile phases.

These heads are particularly adapted for strong pH and ionic strength gradients required in biopolymer separations.

At ambient temperatures, in contrast with AISI 316L stainless steel (see Figure 1), titanium is stable towards sodium chloride solutions up to saturating concentrations (5.3 M).

Even if severe operating conditions are applied, there is no need to passivate this pump head, thanks to the ability of titanium to rapidly repair its protective oxide film.

In case of very high salinity, take care to keep the piston seal well rinsed by circulating water or a non-saline aqueous mixture in the rinsing compartment (see Section 4.2).

7 VISCOSITY

There is no direct relationship between the viscosity of the liquid to be delivered and the pumping capability of the head. However, consider the two following points when dealing with abnormally viscous liquid:

♦ INLET PRESSURE

Positive pressure on the pump inlet avoids cavitation. Use hydrostatic pressure by raising the reservoir, or apply a slight gas pressurization on the reservoir.

♦ THIXOTROPIC TEST

A check valve ball (ruby) must rapidly fall down in the considered liquid. Otherwise the pump head will not work satisfactorily.

8 TEMPERATURE

Gilson piston pump heads operate normally from -20°C to 100°C, provided that the liquid pumped is chemically compatible with the materials of the pump head (see Section 7). Liquids at temperature above 100°C have not been experimented.

For heating or cooling Gilson piston pump heads, use the Thermostatic Jacket Kit 360350400 (see Additional Accessories).

When the pump head is used for pumping hot liquids, circulate a cold liquid in the rinsing compartment.

MAINTENANCE 6

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 V gives an indication of replacement periods for maintenance parts, according to the type of use, intensive, regular or occasional. The data in Table V 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.

Table V: Indication of replacement periods for maintenance parts according to the type of use.

Use / Parts	Intensive *168 h/week*	Regular *40 h/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*

2 CHECK VALVES

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

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

The check valve cartridges must be cleaned or replaced if there is a check valve problem. This is indicated by an abnormal loss in flowrate. However, before assuming a check valve has failed, check the possibility of piston seal leakage.

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

No check valve sub-component is available from Gilson.

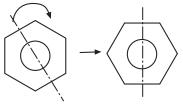
♦ CHECK VALVE CLEANING

- Disconnect the outlet tubing
- Pump isopropanol if it is miscible with the current solvent. Otherwise, pump an intermediate solvent first. When the piston pump head is filled with isopropanol, stop the flow for 15 minutes or more to dissolve any deposits.
- Flush out the isopropanol and return to operating conditions.
- If cleaning fails to restore normal performance, replace the check valve.

♦ CHECK VALVE REPLACEMENT

- Turn the pump off. Disconnect the inlet and/or outlet tubing.

- Unscrew the inlet and/or outlet check valve support screw(s) (items 14, 17)*, (items 12, 15)**.
- Take out the check valve cartridge(s).
- Insert the new check valve cartridge(s). Then re-assemble following the previous steps in the reverse order. Note that the inlet and outlet check valve cartridges and support screws are not interchangeable.
- Tighten the support screw(s) using the nominal torque of 7 N.m. This ensures tightness up to the specified maximum pressure. In the absence of a torque wrench, tighten the support screw manually until there is contact, then use an open-end spanner to turn the screw 1/12th of a turn maximum (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 check valve cartridges.



- Run the pump and check for leaks around the support screws. If leakage occurs, tighten the support screw gently until leakage stops.

☞ ** for Fig. 3A and 3B, ** for Fig. 3C*

3 PISTON SEAL

There are two identical piston seals in WTi-type piston pump head. One is located in the head body and the other in the rinse body. The piston seal consists of a seal ring made from HDPE (yellow) and a spring made from titanium. It must be changed whenever a seal leakage occurs. The appearance of some liquid at the notch located at the bottom of the head body indicates leakage in the piston seal of the head body. The same applies to the appearance of liquid at the notch in the rinse body.

Guidelines to select the piston seal according to the liquid are given in Section 1.3.

♦ REMOVING THE PISTON SEAL(S)

- Turn the pump off. Disconnect the tubing. Remove the head from the pump.
- Referring to Figure 3, dismount the head as follows:
  To replace the piston seal in the head body, follow the steps from a to d, as written hereafter. To replace the piston seal in the rinse body, only follow the steps from a to c.

  a) Unscrew the threaded cover (1).
  b) Take out the piston tail guide (2), the piston assembly (3), and the return spring (5) (4)**.*
  c) Loosen the two screws (15) (13)** on the back of the head and remove the ball housing assembly (6)* (5)** and the housing spacer (7)* (6)**.*
  d) Remove the rinse body (8) (7)**.*
- Remove the anti-extrusion gasket (9)* (8)**.
- Carefully take the piston seal out. If it remains tightly seated in the body, pry it out with care in order to avoid damaging the head body (11)* (10)** or rinse body (8)* (7)**. Once the piston seal has been removed, it must not be re-used.

☞ ** for Fig. 3A and 3B, ** for Fig. 3C*

♦ INSTALLING A NEW PISTON SEAL

- Inspect the piston and the location of the piston seal ensuring that they are clean, undamaged and completely free of particles.
- Referring to Figure 6, use the piston seal mounting tool (Fig. 2A/2B, item E, Fig. 2C, item G), which is composed of a seal pusher and a seal guide, to install the new piston seal as follows:

- *Set the guide onto the 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 body.*

- Re-assemble the head by reversing the instructions given for removing the seal(s), making note of the following:

  Referring to Figure 3, 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) (5)**, the housing spacer (7)* (6)**, the rinse body (8)* (7)** and the head body (11)* (10)** with the matching hole or notch on the same side.*
  After screwing the ball housing assembly (6) (5)**, the housing spacer (7)* (6)** and the rinse body (8)* (7)** onto the head body (11)* (10)**, put the body on a flat surface to facilitate the mounting of the other parts.*

- Run-in the new piston seal (see Section 5.1).

☞ ** for Fig. 3A and 3B, ** for Fig. 3C*

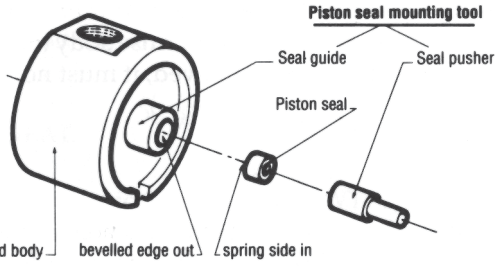


Figure 6: Piston seal installation

4 RETURN SPRING

Due to fatigue of the steel, the return spring (5)* (4)** should not be considered as having an unlimited lifetime. **We recommend that the spring is changed with every five piston seals used.**

☞ ** for Fig. 3A and 3B, ** for Fig. 3C*

To change the return spring, dismount the pump head by following the instructions described in Section 6.3. Unscrew the threaded cover and remove the piston tail guide, the piston assembly, the spring spacer and the spring. Replace the spring and re-assemble the pump head .

5 MAINTENANCE KIT

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

Description	Reference number
Maintenance kit for 10WTi pump head	364011T
Maintenance kit for 25WTi pump head	364012T
Maintenance kit for 200WTi pump head	364022

TECHNICAL DATA 7

Pump head (model)	Stroke volume (µl)	Flowrate range * (ml/min)	Pressure range (MPa) 302	303/305/306
10WTi		0.050 - 10	0.1 - 21	0.1 -60
25WTi		0.125 - 25	0.1 -8.4	0.1 -28
200WTi	1580	1 - 200	0.5 -1	0.5 - 3.5

☞ * *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 (see detail in Figure 3)
Titanium, sapphire, ceramic, ruby, PCTFE (polychlorotrifluoroethylene, Kel-F®), HDPE (high density polyethylene), ETFE (ethylene-tetrafluoroethylene, Tefzel®) and FEP (fluoroethylene-propylene).

Flowrate precision
At 20°C and over full working rage, 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	Reference number		
	10WTi 360551T	25WTi 360523T	200WTi 360532T
Piston seal PTFE (10)* (9)**	5463125095	5463050025	5463140025
HDPE (10)* (9)**	5463125896	5463050826	5463140825
Anti-extrusion gasket (9)* (8)**	3650015K	3650016K	3650273K
Inlet check valve cartridge (13)* (11)**	36501701	36501701	3650301
Outlet check valve cartridge (16)* (14)**	36501801	36501801	3650300
Piston assembly (3)	3650010	3650142	3650271
Spring spacer (4)	3650037	3650143	-
Piston tail guide (2)	3650027	3650028	3650028
Return spring (5)* (4)**	36300058	36300063	36300063
Ball housing assembly (6)* (5)**	3650067	3650277	3650277
O-ring (12)*	5464535106	5464535106	-
Inlet tubing without filter			3650276
Filter, titanium, 25 µm			36410222

☞ *Numbers in brackets, * see Fig. 3A and 3B, ** see Fig. 3C.*

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World Wide Web: www.gilson.com
E-mail: sales@gilson.com, service@gilson.com, training@gilson.com

World Headquarters

Gilson, Inc.
3000 W. Beltline Hwy., P.O. Box 620027, Middleton, WI 53562-0027, USA
Telephone: (1) 800-445-7661 or (1) 608-836-1551 • Fax: (1) 608-831-4451

Gilson SAS
19 avenue des Entrepreneurs
95400 Villiers-le-Bel, France
Telephone: (33) 1-34-29-50-00 • Fax: (33) 1-34-29-50-20