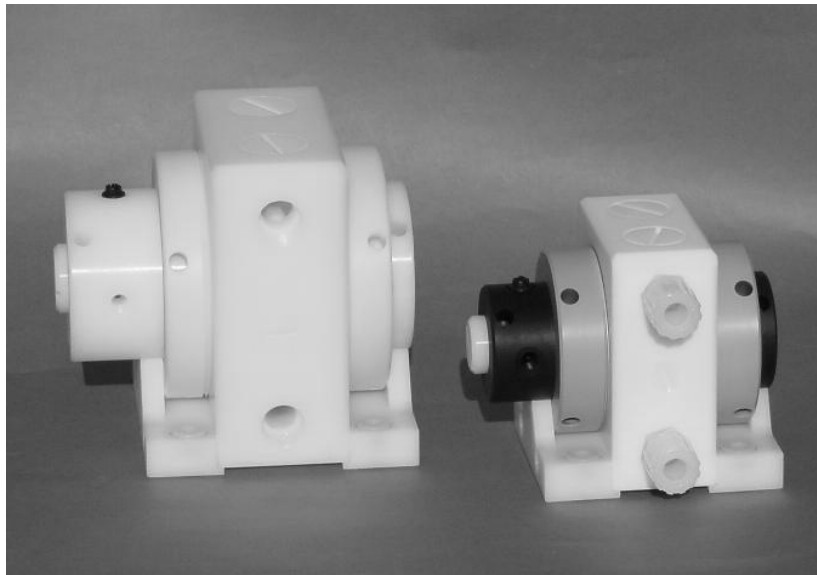


FUTUR T FUTUR H FUTUR E



Operating and Installation Instructions

ought to be studied before installing the pump

Introduction

The ALMATEC Maschinenbau GmbH is certified as a modern, quality-orientated enterprise according to DIN EN ISO 9001:2000. Before release for dispatch, any pump of the FUTUR series has to undergo an extended final control. The performance data registered during this are archived in our records and can be read back at any time.

The series FUTUR has specially been developed to meet the requirements of the semiconductor industry. These pneumatic diaphragm pumps differ from other available pneumatic pump types significantly. All pumps are assembled in a class 100 clean room with twofold preliminary cleaning of the individual parts and testing with de-ionised water. Afterwards, they are doubly sealed into plastic foils so that they can directly be taken into clean rooms within the intact inner sleeve.

Because of the significant differences, a diligent study of this Operating and Installation Instructions before putting into operation is necessary even for users experienced in applying pneumatic diaphragm pumps. Special tools or devices are not required. A multi-functional mounting tool [36] is enclosed with every pump.

You can as well send your FUTUR pump to our facilities in Kamp-Lintfort, Germany, if your workshop is not equipped accordingly or if you wish to avoid contamination during repairs which would subsequently give rise to extensive rinsing processes when reused in the plant. The required service is carried out promptly and under strict purity conditions.

Every individual part mentioned in the following text is identified by a number in square brackets corresponding with its item number in both the spare part list and the exploded view.

Commissioning



Before start-up respectively after the first hours of operation, the union nuts [22] must be checked for tightness; if necessary they have to be tightened. This may also be necessary after longer periods of stoppage, with large variations of temperature, transport as well as disassembly of the pump.

All wetted parts of the FUTUR T and FUTUR H consist of PTFE, the wetted housing parts of the FUTUR E are made of UPPE (ultra pure polyethylene). Before putting any pump into operation, make sure, that the materials of construction are resistant to the liquid to be pumped.

The maximum operating pressure is limited to 6 bar and the allowed maximum temperature of the liquid is 70°C for the FUTUR E. For the FUTUR H and FUTUR T the temperature limits are different. Here the maximum permissible limits for driving pressure and temperature of the medium are mutually dependent.

Driving air pressure	6 bar	5 bar	4 bar	3 bar	2 bar
FUTUR H : max. permissible temperature	100°C	130°C	150°C	180°C	200°C
FUTUR T : max. permissible temperature	100°C	110°C	120°C	130°C	130°C

Installation into the piping

Pumps must be connected load free without any tension. They cannot serve as a fixed point for the piping. Neglecting this causes leakage and maybe even damages. In case movements or vibrations have to be expected, we recommend the installation of compensators upstream and downstream of the pump. The FUTUR can be used standing free or can be installed using the anchor bolt bushings [27].

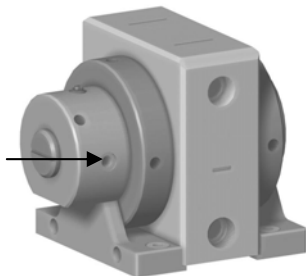
Connection of the suction and discharge line

The nominal width of the connection pipes has to be chosen in accordance to the connections of the pump:

Pump size	10	20	50	100	200
Nominal port size (NPT)	3/8"	1/2"	1"	1 1/4"	1 1/2"

A smaller piping can cause cavitation (suction line) as well as a loss of performance (suction and discharge line). In case the pipe is too big, the dry suction capacity of the pump can decrease. The suction line must be connected to the lower port of the center housing [1] and the discharge line to the upper port. A suction line with a steady upward gradient prevents the formation of air bubbles in the line obstructing the suction performance. As option the pumps can be equipped with Flaretek[®] connectors for PFA-pipe (special equipment code G).

Connection of the air supply



The bore to connect the compressed air is located in the left hand side housing [16] opposite to the muffler [20]. An appropriate cross-section of the air supply line must be ensured to supply the pump with driving air sufficiently. The line must be at least equal to the nominal width of the connection of the pump (R 1/4). The integrated air control system PERSWING P[®] is a precision-steering that requires oil-free, dry and clean compressed air for optimal function. The following minimum requirements of the air quality classes according to ISO-DIS 8573-1 must be met:

Solids content	→	Class 2
Water content	→	Class 3
Oil content	→	Class 3

In humid surroundings, icing from the outside may occur despite the driving air is dried. If so, a prolonged waste-air-exhaust (ca. 500 mm by pipe or hose) can be helpful. When installing the pump into boards or cabinets, it has to be ensured that cold air does not get caught behind the muffler.

Start-up and operation of the pump



- Due to the functional principle, pneumatic diaphragm pumps must not be operated with a positive suction pressure.
- Pressure tests of the plant a pump is included in may only be carried out with the pump disconnected from the pressure on both ports or by using the pressure the pump develops while operating. The load of a pressure in the plant may damage the pump.
- Depending on the application and the operating conditions of the pump, pump medium may emerge the muffler in case the pump is kept working after a diaphragm rupture.

The pump is ready to be operated after the connection of all lines. The pressure of the driving air should be limited to the amount required to meet the performance needed. Excessive pressure increases both the air consumption and the wear of the pump. However, the air-pressure should not be lower than 1,5 bar to ensure a steady and reliable flow. The pump is regulated by tuning the flow rate of the air (needle valve). An empty pump has to be driven slowly. In general, dry running at high frequency or for an extended period of time has to be avoided for air-operated double diaphragm pumps with a centred flow pattern. Any disregard may result in damaging the pump functionally. The pump starts operating automatically when air is supplied. As FUTUR pumps are self-priming, it is not necessary to pre-fill the suctions line and the pump itself. The suction capacity of a filled pump is much bigger, however; any throttling on the suction side can damage the pump. Short-term operation against a closed discharge for pressure testing is possible. In case special ways of operation (e.g. closed discharge) are necessary, this has to be tuned with the manufacturer. The max. stroke frequencies listed in the table below may not be exceeded during normal every-day operation. Otherwise, premature wear has to be expected.

Pump size	10	20	50	100	200
Max. number of strokes/min. at nominal performance	400	320	210	240	60

Disassembly



- Before beginning to disassemble the pump, ensure that it has been disconnected from the pressure on both product ports, drained, rinsed, and disconnected from the air supply.
- Procedure for rinsing: rinse the pump with neutral product, then turn around to the top, afterwards 90° to the side, and finally back to the top. Repeat this rinsing procedure several times.
- Pumps which have been used for corrosive, hazardous or toxic media may only be disassembled in compliance with appropriate additional safety regulations.

On both sides of the pump unscrew the head screws [29,30] with a screwdriver and remove the base frame [25]. Take out O-rings air channel [26].

Screw the muffler [20] (at pump size 10 additionally the adapter muffler [21]) and the black plug [18] out of the side housing left hand [16]. Insert suitable round bar in one of the bore holes of the union nut [22] of the side housing left hand [16] and use it to unscrew the union nut [22]. Remove side housing left hand [16] from union nut [22]. Take the sliding ring [24] from the side housing left hand [16] and the O-ring union nut [23] from the union nut [22]. Unscrew the air valve cover [19] out of the side housing left hand [16] by using

the mounting tool [36]. Lay down the side housing left hand [16] flat on the side and if necessary, the PERSWING P® air control system [35] (without pilot piston) can be shoved out completely to the air valve cover side. Take the piston rings diaphragm bolt [15] out of diaphragm bolt left hand [12]. Draw the pilot piston of the air control system out of the diaphragm bolt left hand [12].

Insert suitable round bar in one of the bore holes of the union nut [22] of the side housing right hand [14] and use it to unscrew the union nut [22]. Remove side housing right hand [14] from union nut [22]. Take the sliding ring [24] from the side housing right hand [14] and the O-ring union nut [23] from the union nut [22].

Place the center housing [1] upright with product connectors to the front. Draw the O-ring diaphragm outer [9] from both sides. Unscrew diaphragm bolt left hand [12] and diaphragm bolt right hand [13] out of the diaphragms [7]. Unscrew one of the diaphragms [7] out of the cascade sleeve [11]. Remove the second diaphragm [7] together with the cascade sleeve [11] and unscrew them. Check the O-ring diaphragm inner [8] and renew if necessary (twist prevention). Remove gaskets diaphragm [10], they have to be replaced in any case.

Stand the center housing [1] upright again to take out the discharge valves. Loosen both valve stops discharge valve [6] at the top of the center housing [1] using the mounting tool [36]. Take out the exposed check valves [4]. One valve stop suction valve [5] is located at the front of the center housing [1] (between the product connectors), the other one at the rear. Unscrew both with the mounting tool [36] and draw the check valves [4] out of the center housing [1] sideways.

Assembly

The individual components are basically assembled in exactly the reverse order to that described for the disassembly. Therefore, this chapter contains mostly supplementary information.

One important aspect to be paid attention to is that all damaged sealing elements have to be replaced in any case. Piston rings [15] and gaskets diaphragm [10] must not be reused after being disassembled; new rings have to be fitted! The piston rings diaphragm bolt [15] are slashed, so it is easy to put them into the groove.

Press the whole cartridge of the PERSWING P® air control system [35] (without pilot piston) from the air valve cover side into the side housing left hand [16] (Attention: do not damage O-rings, moisten O-rings before assembly!).

The valve stops [5,6] must be screwed in until they match the surface of the center housing [1] flushly.

Lay down the center housing [1] on the left hand side and insert the gasket diaphragm [10] carefully. Screw the diaphragm bolt right hand [13] into the diaphragm [7]. Screw the diaphragm [7] into the cascade sleeve [11] and push it into the center housing [1]. Insert the O-ring diaphragm outer [9] into the diaphragm recess. Position the side housing right hand [14] in that way that the straight surface with the air bore holes is parallel to the lower side of the center housing [1]. Put on the sliding ring [24]. Lay the O-Ring union nut [23] in the union nut [22] and screw in the union nut [22] in the center housing [1]. When screwing in the union nut [22], insert a round bar in a bore hole of the side housing right hand [14] to prevent its rotating.

Insert the gasket diaphragm into the left side of the center housing [1] carefully. To install the second diaphragm [7], the just mounted diaphragm [7] has to be subjected with compressed air. For this the middle air bore holes on the right hand side of the center housing [1] is to use. The air feeding has to maintain as long as the left hand diaphragm [7] is tight to the center housing [1]. Screw the diaphragm bolt left hand [12] into the diaphragm [7] and insert the pilot piston of the air control system [35] in the diaphragm bolt left hand [12]. The assembly of the side housing left hand [16] is to do analog to the described procedure of the side housing right hand [14]. Do not forget to insert the fifth O-ring air valve housing before screwing the air valve cover [19]. Finally screw in the muffler [20] and the plug [18].

Because the just installed gaskets diaphragm [10] need time to settle, the assembly of the pump has to be rested for at least two hours.

Pump size	10	20	50	100	200
in mm (tolerance + 0,3 / - 0,5 mm)	28,8	31,3	35,5	41,3	59,3

After this break tighten the both union nuts [22] according to the nominal dimensions of the table above (space between outer edge of the union nut and center housing). When doing this pay attention to the described lockpin of the side housings [14,16] and to the parallel array to the center housing [1].

Troubleshooting

Fault	Possible reason
Pump does not start:	Air supply line blocked, muffler clogged, air control defective, diaphragms are not assembled correctly.
Pump runs but does not take in the liquid:	Leakage within the suction line, suction line blocked, required suction beyond suction capacity.
Pump does not run smoothly:	Worn air control, diaphragm rupture.
Delivery deteriorates:	Air control iced up, air pressure dropped, suction line blocked, discharge line blocked, muffler clogged, changing viscosity of the fluid.
Air within the pumped medium:	Diaphragm rupture.
Pump stops:	Air control iced up, air pressure dropped, discharge line blocked, muffler clogged or iced up, air control defective, diaphragm rupture, pressure within the system exceeds the driving pressure.

Technical data

Pump size		10	20	50	100	200
Dimensions (mm),	length	185	201	246	303	374
	width	114	150	200	260	330
	height	130	167	222	265	345
Nominal port size (NPT)		3/8"	1/2"	1"	1 1/4"	1 1/2"
Air connection (NPT)		1/4"	1/4"	1/4"	1/4"	3/8"
Air classification acc. to ISO-DIS 8573-1:						
solids content, class		2	2	2	2	2
water content, class		3	3	3	3	3
oil content, class		3	3	3	3	3
Weight (kg),	FUTUR T	2,3	4,2	8,8	17,6	-
	FUTUR H	2,6	5,0	-	-	-
	FUTUR E	-	2,8	5,8	11,8	29,0
Suction head, dry (m.w.c.)		1	2.5	3.5	4	4,5
Suction head, with product (m.w.c.)		8	9	9	9	9
Max. permissible driving pressure (bar)		6	6	6	6	6
Max. sound pressure level acc. to DIN 45635, part 24, at maximum load [dB(A)]		72	72	72	72	72

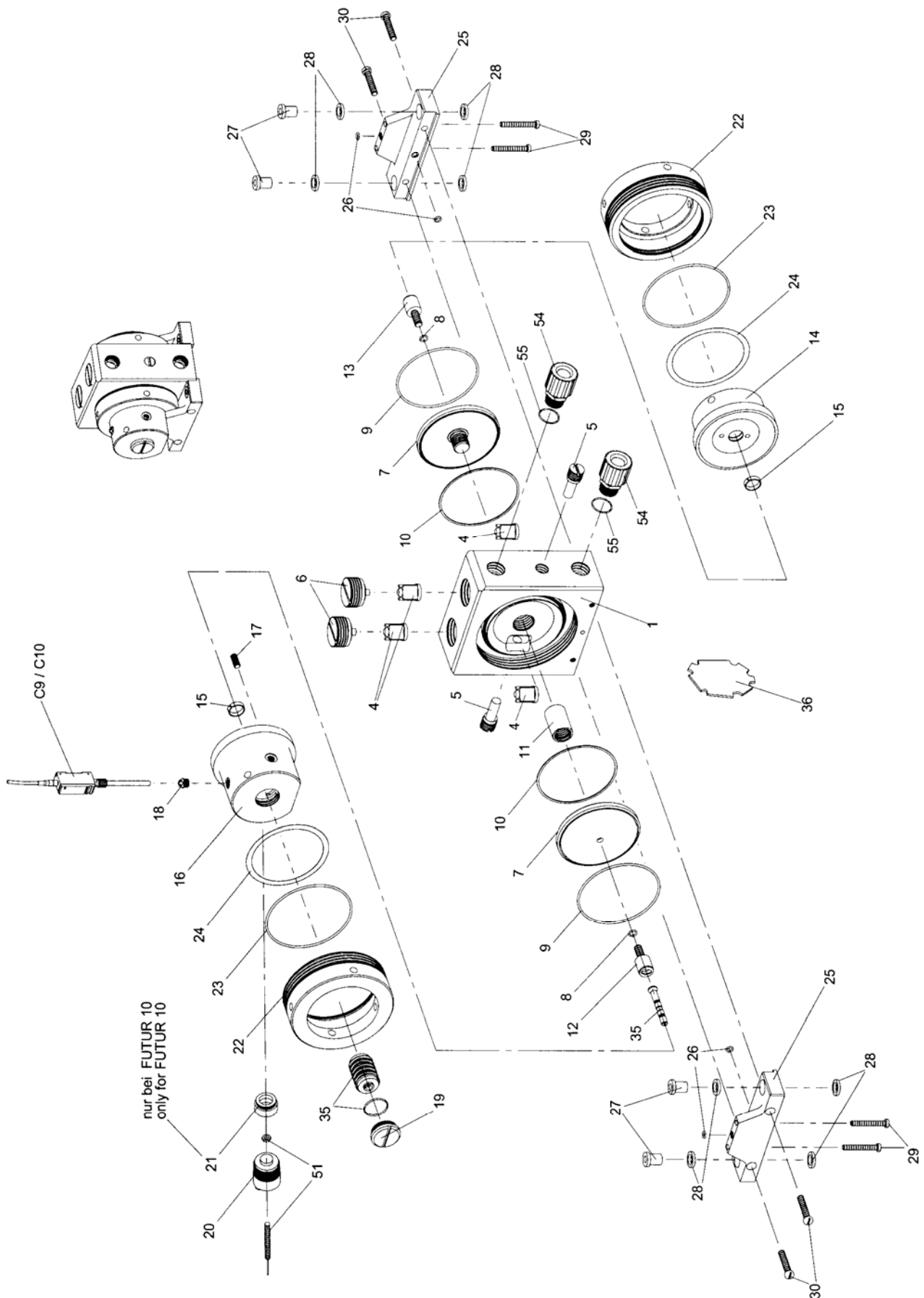
Max. permitted operating temperature in °C

Pump model	FUTUR H	FUTUR T	FUTUR E
at max. 6 bar	100	100	70
at max. 5 bar	130	110	70
at max. 4 bar	150	120	70
at max. 3 bar	180	130	70
at max. 2 bar	200	130	70

Spare part list

Pump size					FUTUR 10 T / H	FUTUR 20 T / H / E	FUTUR 50 T / E	FUTUR 100 T / E	FUTUR 200 E
Item	Pc.	Description	Pump code	Material	Part number	Part number	Part number	Part number	Part number
1	1	Center housing Center housing	T, H E	PTFE-TFM UPPE	6 10 010 69 -	6 15 010 69 6 15 010 52	6 25 010 69 6 25 010 52	6 32 010 69 6 32 010 52	- 6 40 010 52
4	4	Check valve Check valve	T, H E	PTFE-TFM UPPE	8 10 011 69 -	8 15 011 69 8 15 011 52	8 25 011 69 8 25 011 52	8 32 011 69 8 32 011 52	- 8 40 011 52
5	2	Valve stop, suction valve	T, H, E	PTFE-TFM	8 10 812 69	8 15 812 69	8 25 812 69	8 32 812 69	8 40 812 69
6	2	Valve stop, discharge valve	T, H, E	PTFE-TFM	8 10 813 69	8 15 813 69	8 25 813 69	8 32 813 69	8 40 813 69
7	2	Diaphragm Diaphragm	T, H E	PTFE PTFE/UPPE	6 10 020 69 -	6 15 020 69 6 15 220 66	6 25 020 69 6 25 220 66	6 32 020 69 6 32 220 66	- 6 40 120 52
8	2	O-ring, diaphragm inner	T, H, E	FKM	9 04 593 74	9 06 538 74	9 10 544 74	9 15 546 74	9 15 546 74
9	2	O-ring, diaphragm outer	T, H, E	FKM	9 66 533 74	9 90 586 74	9 99 609 74	9 99 612 74	9 99 644 71
10	2	Gasket diaphragm	T, H, E	PTFE	6 10 026 69	6 15 026 69	6 25 026 69	6 32 026 69	6 40 026 69
11	1	Cascade sleeve	T, H, E	PTFE-TFM	6 10 032 69	6 15 032 69	6 25 032 69	6 32 032 69	6 40 032 69
12	1	Diaphragm bolt, left hand	T, H, E	PEEK	6 10 021 86	6 15 021 86	6 25 021 86	6 32 021 86	6 40 021 86
13	1	Diaphragm bolt, right hand	T, H, E	PEEK	6 10 023 86	6 15 023 86	6 25 023 86	6 32 023 86	6 40 023 86
14	1	Side housing, right hand Side housing, right hand	T, E H	UPPE/PA PTFE conductive	6 10 014 52 6 10 014 65	6 15 014 52 6 15 014 65	6 25 014 52 -	6 32 014 52 -	6 40 014 53 -
15	2	Piston ring, diaphragm bolt	T, H, E	PTFE-PPS	8 10 825 61	8 15 825 61	8 25 825 61	8 32 825 61	8 40 825 61
16	1	Side housing, left hand Side housing, left hand	T, E H	UPPE/PA PTFE conductive	6 10 015 52 6 10 015 65	6 15 015 52 6 15 015 65	6 25 015 52 -	6 32 015 52 -	6 40 015 53 -
17	1	Set screw DIN 551	T, H, E	PA	9 06 201 53	9 06 201 53	9 10 206 53	9 12 207 53	6 40 016 53
18	1	Plug GPN 730	T, H, E	PA	730 R 1/4	730 R 1/4	730 R 1/4	730 R 1/4	730 R 1/4
19	1	Air valve cover	T, H, E	PE	8 15 731 52	8 15 731 52	8 25 731 52	8 32 731 52	8 32 731 52
20	1	Muffler, cpl.	T, H, E	PE	1 08 244 51	1 08 244 51	1 15 244 51	1 40 244 51	1 40 244 51
21	1	Adapter, muffler	T	PE	6 10 033 52	-	-	-	-
22	2	Union nut Union nut Union nut	T H E	PE PEEK PA	6 10 029 80 6 10 029 86 -	6 15 029 80 6 15 029 86 6 15 029 53	6 25 029 80 - 6 25 029 53	6 32 029 80 - 6 32 029 53	- - 6 40 029 53
23	2	O-ring, union nut	T, H, E	FKM	9 73 660 74	9 98 661 74	9 99 662 74	9 99 663 74	9 99 666 71
24	2	Sliding ring	T, H, E	PTFE	6 10 030 60	6 15 030 60	6 25 030 60	6 32 030 60	6 40 030 60
25	2	Base frame	T, H, E	PE/PA	6 10 017 52	6 15 017 52	6 25 017 52	6 32 017 52	6 40 017 53
26	4	O-ring, air channel	T, H, E	FKM	9 06 538 74	9 06 538 74	9 08 541 74	9 10 544 74	9 14 546 72
27	4	Anchor bolt bushing	T, H, E	PE	8 25 418 52	8 25 418 52	8 25 418 52	8 25 418 52	8 25 418 52
28	8	Damper ring	T, H, E	FKM	1 15 149 74	1 15 149 74	1 15 149 74	1 15 149 74	1 15 149 74
29	4	Head screw DIN 84	T, H, E	PA	9 06 226 53	9 06 227 53	9 08 227 53	9 08 227 53	9 08 227 53
30	4	Head screw DIN 84	T, H, E	PA	9 10 227 53	9 10 227 53	9 10 227 53	9 10 227 53	9 10 227 53
35	1	PERSWING P® air control system, cpl.	T, H, E	PETP	6 10 201 84	6 15 201 84	6 25 201 84	6 32 201 84	6 32 201 84
36	1	Mounting tool	T, H, E	PA	6 10 000 53	6 10 000 53	6 10 000 53	6 10 000 53	6 10 000 53

Exploded view



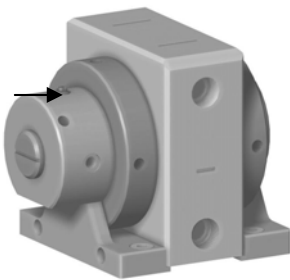
Special equipment

Pneumatic stroke counting (code C 9 / C 10)

On the codes C 9 / C 10 the strokes of the pump are registered pneumatically. The pressure switch registers the changes in pressure within the air chamber behind one of the diaphragms.

The pneumatic stroke counting system is available in two types:

- C 9 pressure switch 1 - 10 bar, cpl. assembled with bracket; socket with cable 5 m; adapter straight NPT 1/4"; hose DN 4/6, 2.5 m
- C 10 as C 9 and a stroke counter



Assembly: Remove the black plug [18] (see arrow) out of the additional air connection of the side housing left hand [16] and screw in the adapter straight. Link up the adaptor straight and the pressure switch with the hose. Connect the socket to the electrical connection plug of the pressure switch and the cable to existing registering devices (code C 9) resp. to the enclosed stroke counter (code 10). Technical data, connection schemes and further details can be found in the technical documentation delivered by the manufacturers of the pressure transmitter and the

stroke counter.



The pneumatic stroke counting system requires a minimum counter pressure of 1.5 bar for optimal function!

Diaphragm monitoring sensor (code D)

The diaphragm sensor is installed into the muffler of the pump and registers any liquid, regardless of its conductivity. Hence, an immediate reaction after a diaphragm rupture is possible. In case of humid surrounding air a false alert may occur despite operating the pump with dried compressed air. Diaphragm monitoring is available in three variations:

- D 1 Diaphragm sensor, 2-wire-Namur, intrinsically safe EEx ia IIC T6
- D 5 Diaphragm sensor, 3-wire
- D 6 Diaphragm sensor, 3-wire with plug (only pump sizes 10 - 50)

For further details, please refer to the data delivered by the manufacturer.

Flaretek®-connectors for PFA-pipe (code G)

The suction and the discharge ports of the FUTUR T and FUTUR H can be equipped with Flaretek®-connectors for PFA piping which are widely used in the semiconductor industry. The Flaretek®-connectors are fitted by the manufacturer and must not be removed or replaced! They have been specially modified for the FUTUR and have been fitted in gas-tight. The correct functioning, sealing and purity of the pumps can only be warranted with these original product connectors!

Pulsation damper

In general, replacement pumps deliver a pulsating flow due to their oscillating working principle. On the FUTUR series, the air channels and air chambers as well as the cascade sealing are designed to keep the pulsation comparatively small, especially on the suction side. In case the remaining pulsation on the discharge side is not tolerable for the given application, appropriate pulsation dampers of the type D are available for any pump size and configuration, which can easily be added to any pump without having to change the product connections. In case your pump is equipped with a pulsation damper, please pay attention to the separate operating manual for the damper.

Spare part list for special equipment

Pump size					FUTUR 10 T / H	FUTUR 20 T / H / E	FUTUR 50 T / E	FUTUR 100 T / E	FUTUR 200 E
Item	Pc.	Description	Pump code	Material	Part number	Part number	Part number	Part number	Part number
18	1	C 9: Adaptor straight	T, H, E	PP	1 00 877 51	1 00 877 51	1 00 877 51	1 00 877 51	1 00 877 51
	1	Hose	T, H, E	PE	1 00 876 51	1 00 876 51	1 00 876 51	1 00 876 51	1 00 876 51
	1	Pressure switch	T, H, E	diverse	1 00 972 99	1 00 972 99	1 00 972 99	1 00 972 99	1 00 972 99
	1	Socket with cable	T, H, E	diverse	1 00 973 99	1 00 973 99	1 00 973 99	1 00 973 99	1 00 973 99
-	1	C 10: Stroke counter	T, H, E	diverse	1 00 071 99	1 00 071 99	1 00 071 99	1 00 071 99	1 00 071 99
51	1	D 1: Diaphragm sensor, 2-wire-Namur	T, H, E	PBTP	1 00 773 99	1 00 773 99	1 00 773 99	1 00 773 99	1 00 773 99
51	1	D 5: Diaphragm sensor, 3-wire	T, H, E	PTFE	1 00 473 99	1 00 473 99	1 00 473 99	1 00 473 99	1 00 473 99
51	1	D 6: Diaphragm sensor, 3-wire with plug	T, H, E	PTFE	1 00 573 99	1 00 573 99	1 00 573 99	-	-
-	2	G: Flaretek®-connector for PFA-pipe	T	PFA/PVDF	1 10 012 57	1 15 012 57	1 25 012 57	1 32 012 57	-
-	2	Flaretek®-connector for PFA-pipe	H	PFA/PFA	1 10 312 57	1 15 312 57	-	-	-
-	2	O-ring, Flaretek®-connector	T, H	FKM/FEP	9 16 559 74	9 18 501 74	9 28 534 74	9 30 582 59	-

The FUTUR series at a glance

Model:	FUTUR T
Materials:	Center housing PTFE-TFM Side housings UPPE
Pump sizes:	10, 20, 50, 100
Liquids:	Acids and caustics

Model:	FUTUR H
Materials:	Center housing PTFE-TFM Side housings PTFE conductive
Pump sizes:	10, 20
Liquids:	Hot applications with acids and caustics

Model:	FUTUR E
Materials:	Center housing UPPE Side housings UPPE
Pump sizes:	20, 50, 100, 200
Liquids:	Slurries

Model:	FUTUR SL S
Materials:	Center housing SS 316 L Side housings SS 316 L
Pump sizes:	20, 50
Liquids:	Solvents

Subject to change without notice, 2007/01

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