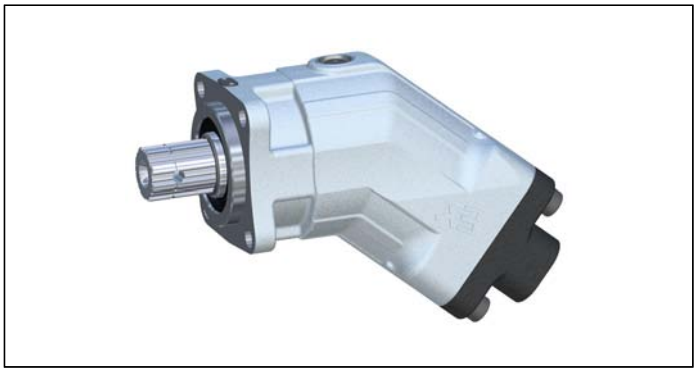
Axial Piston Fixed Pump
A17FO Series 10

RE 91520
Issue: 06.2012
Replaces: 03.2010



- Sizes 23 to 107
- Nominal pressure 300 bar
- Maximum pressure 350 bar
- For commercial vehicles
- Open circuit

Features

- Fixed pump with axial tapered piston rotary group of bent-axis design with special characteristics and dimensions for use in commercial vehicles
- The flow is proportional to the drive speed.
- Large-angle machine with 40° swivel angle, i.e. high power density, compact dimensions, optimum efficiency, economical design
- Simple adjustment of direction of drive
- Self-priming
- No case drain line necessary
- Flange and shaft designed for direct mounting on the power take-off of commercial vehicles
- Reduced noise

Contents

Ordering code

01	02	03		04	05	06	07	08	09	10		11
A17F	**O**		**/**	**10**	**N**	**L**	**W**	**K0**			**–**	

Axial piston unit

01	Bent-axis design, fixed, nominal pressure 300 bar, maximum pressure 350 bar, for commercial vehicles (truck)	**A17F**

Operating mode

02	Pump, open circuit	**O**

Sizes (NG)

03	Geometric displacement, see table of values on page 5	**023**	**032**	**045**	**063**	**080**	**107**	

Series

04	Series 1, index 0	**10**

Configuration of ports and fastening threads

05	Metric, port threads with profiled sealing ring according to DIN 3852	**N**

Direction of rotation[1)]

06	Viewed on drive shaft, counter-clockwise	**L**

Seals

07	FKM (fluor-caoutchouc) including the 2 shaft seal rings in FKM	**W**

Mounting flange

08	Special flange ISO 7653-1985 (for trucks)	**K0**

Drive shaft

09	Splined shaft similar to DIN ISO 14 (for trucks)	**E8**
	Splined shaft E8 with coupling flange	**C8**

Port plate for service lines

10	Threaded ports A and S at rear	**1**
	Threaded ports A and S at rear, with suction stud mounted in S	**2**

Standard / special version

11	Standard version	**0**
	Special version	**S**

1) Changing the direction of rotation, see page 7

Technical data

Hydraulic fluid

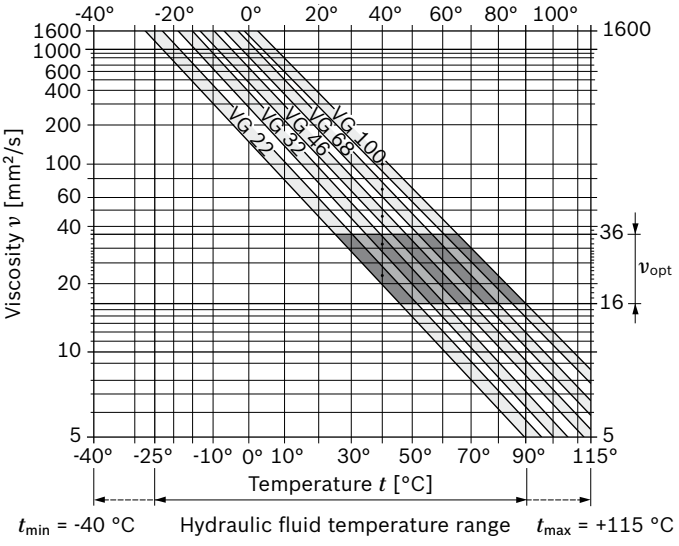
Before starting project planning, please refer to our data sheets RE 90220 (mineral oil) and RE 90221 (environmentally acceptable hydraulic fluids) for detailed information regarding the choice of hydraulic fluid and application conditions.

If environmentally acceptable hydraulic fluids are used, the limitations regarding technical data or other seals must be observed. Please contact us.

Note

Fixed pump A17FO is not suitable for operation with water-containing HF hydraulic fluid.

▼ **Selection diagram**



Details regarding the choice of hydraulic fluid

The correct choice of hydraulic fluid requires knowledge of the operating temperature in relation to the ambient temperature: in an open circuit the reservoir temperature.

The hydraulic fluid should be chosen so that the operating viscosity in the operating temperature range is within the optimum range (ν_{opt} see shaded area of the selection diagram). We recommended that the higher viscosity class be selected in each case.

Example: At an ambient temperature of X °C, an operating temperature of 60 °C is set in the circuit. In the optimum operating viscosity range (ν_{opt}, shaded area), this corresponds to the viscosity classes VG 46 or VG 68; to be selected: VG 68.

Note

The case drain temperature, which is affected by pressure and speed, can be higher than the reservoir temperature. At no point of the component may the temperature be higher than 115 °C. The temperature difference specified below is to be taken into account when determining the viscosity in the bearing.

If the above conditions cannot be maintained due to extreme operating parameters, please contact us.

Viscosity and temperature of hydraulic fluid

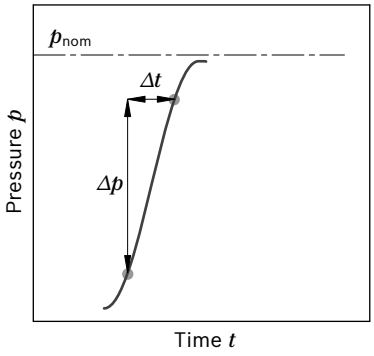
	Viscosity [mm²/s]	Temperature	Comment
Transport and storage at ambient temperature		T_{min} ≥ -40 °C T_{opt} = +5 °C to +20 °C	factory preservation: up to 12 months with standard, up to 24 months with long-term
(Cold) start-up	ν_{max} = 1600	T_{St} ≥ -40 °C	t ≤ 3 min, without load (p ≤ 50 bar), n ≤ 1000 rpm
Permissible temperature difference		ΔT ≤ 25 K	between axial piston unit and hydraulic fluid
Warm-up phase	ν < 1600 to 400	T = -40 °C to -25 °C	at p ≤ 0.7 • p_{nom}, n ≤ 0.5 • n_{nom} and t ≤ 15 min
Operating phase			
Temperature difference		ΔT = approx. 12 K	between hydraulic fluid in the bearing and at port R
Maximum temperature		115 °C	in the bearing
		103 °C	measured at port R
Continuous operation	ν = 400 to 10 ν_{opt} = 36 to 16	T = -25 °C to +90 °C	measured at port R, no restriction within the permissible data
Short-term operation	ν_{min} ≥ 7	T_{max} = +103 °C	measured at port R, t < 3 min, p < 0.3 • p_{nom}
Shaft seal FKM		T ≤ +115 °C	see page 4

Operating pressure range

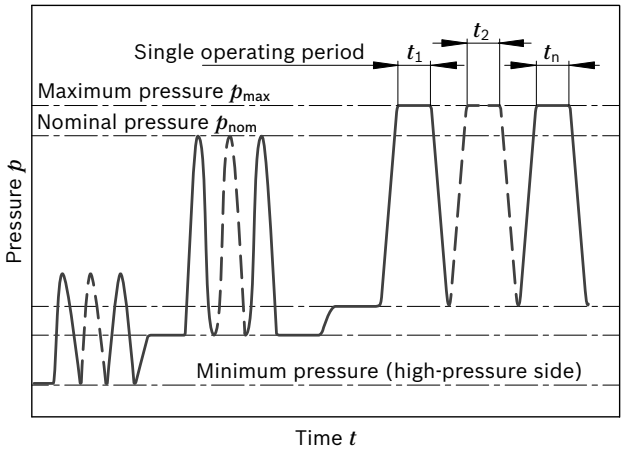
Valid when using hydraulic fluids based on mineral oils

Pressure at service line port A		Definition
Nominal pressure p_{nom}	300 bar absolute	The nominal pressure corresponds to the maximum design pressure.
Maximum pressure p_{max}	350 bar absolute	The maximum pressure corresponds to the maximum operating pressure within the single operating period. The sum of the single operating periods must not exceed the total operating period.
Single operating period	5 s	
Total operating period	50 h	
Minimum pressure (high-pressure side)	10 bar absolute	Minimum pressure at the high-pressure side (A) which is required in order to prevent damage to the axial piston unit.
Rate of pressure change $R_{A\,max}$	9000 bar/s	Maximum permissible rate of pressure rise and reduction during a pressure change over the entire pressure range.
Pressure at suction port S (inlet)		
Minimum pressure $p_{S\,min}$	0.8 bar absolute	Minimum pressure at suction port S (inlet) which is required in order to prevent damage to the axial piston unit. The minimum pressure is dependent on the speed of the axial piston unit.
Maximum pressure $p_{S\,max}$	2 bar absolute	

▼ **Rate of pressure change $R_{A\,max}$**



▼ **Pressure definition**



Total operating period = $t_1 + t_2 + ... + t_n$

Note

Values for other hydraulic fluids, please contact us.

Filtration of the hydraulic fluid

Finer filtration improves the cleanliness level of the hydraulic fluid, which increases the service life of the axial piston unit.

To ensure the functional reliability of the axial piston unit, a gravimetric analysis of the hydraulic fluid is necessary to determine the amount of solid contaminant and to determine the cleanliness level according to ISO 4406. A cleanliness level of at least 20/18/15 is to be maintained.

At very high hydraulic fluid temperatures (90 °C to maximum 115 °C), a cleanliness level of at least 19/17/14 according to ISO 4406 is necessary.

If the above classes cannot be achieved, please contact us.

Case drain fluid

The case drain chamber is connected to the suction chamber. A case drain line from the case to the reservoir is not required (port "R" is plugged).

Shaft seal

The FKM shaft seal may be used for case drain temperatures from -25 °C to +115 °C.

Note

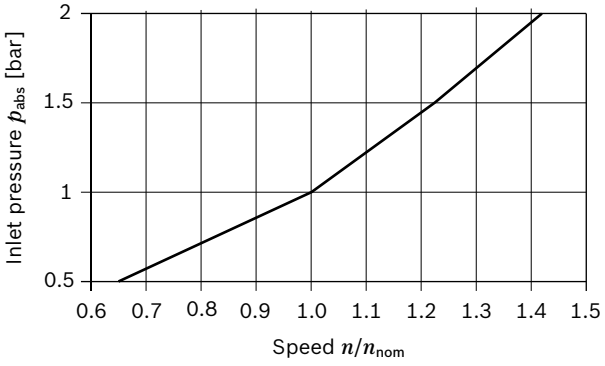
For the temperature range below -25 °C, the values in the table on page 3 are to be observed.

Table of values

Theoretical values, without efficiency and tolerances;
values rounded

Size		NG		23	32	45	63	80	107
Displacement geometric, per revolution		V_g	cm³	22.9	32	45.6	63	80.4	106.7
Speed maximum[1)]	at V_g	n_{nom}	rpm	3050	2750	2650	2200	2150	2000
Speed maximum[2)]		n_{max}	rpm	4300	3900	3800	3200	3100	2800
Flow	at n_{nom} and V_g	q_v	L/min	70	88	121	139	173	213
Power	at n_{nom}, V_g and Δp = 300 bar	P	kW	35	44	60	69	86	107
Torque	at V_g and Δp = 300 bar	T	Nm	109	153	218	301	384	509
Rotary stiffness		c	kNm/rad	2.56	3.12	4.18	6.25	8.73	11.2
Moment of inertia for rotary group		J_{GR}	kgm²	0.0012	0.0012	0.003	0.0042	0.0072	0.0116
Maximum angular acceleration		α	rad/s²	6500	6500	14600	7500	6000	4500
Case volume		V	L	0.25	0.29	0.4	0.5	0.6	0.75
Mass moment		T_G	Nm	4.7	4.7	8.6	9.9	15.3	20
Mass (approx.)		m	kg	5.9	5.9	8.4	9.3	12.3	15.0

1) The values are valid:
   – at an absolute pressure p_{abs} = 1 bar at suction port S
   – for the optimum viscosity range from ν_{opt} = 36 to 16 mm²/s
   – with hydraulic fluid based on mineral oils
2) Maximum speed (limiting speed) with increased inlet pressure p_{abs} at suction port S, see the following diagram.



Note

Operation above the maximum values or below the minimum values may result in a loss of function, a reduced service life or in the destruction of the axial piston unit. Other permissible limit values, with respect to speed variation, reduced angular acceleration as a function of the frequency and the permissible start up angular acceleration (lower than the maximum angular acceleration) can be found in data sheet RE 90261.

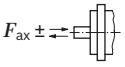
Determining the operating characteristics

Formulas		
Flow	$q_v = \frac{V_g \cdot n \cdot \eta_v}{1000}$	[L/min]
Torque	$T = \frac{V_g \cdot \Delta p}{20 \cdot \pi \cdot \eta_{mh}}$	[Nm]
Power	$P = \frac{2\pi \cdot T \cdot n}{60000} = \frac{q_v \cdot \Delta p}{600 \cdot \eta_t}$	[kW]

Key		
V_g	=	Displacement per revolution in cm³
Δp	=	Differential pressure in bar
n	=	Speed in rpm
η_v	=	Volumetric efficiency
η_{mh}	=	Mechanical-hydraulic efficiency
η_t	=	Total efficiency ($\eta_t = \eta_v \cdot \eta_{mh}$)

Permissible axial forces of the drive shaft

The values given are maximum values and do not apply to continuous operation. For drives with radial loading (pinion, V-belt drives), please contact us!

Size		NG		23	32	45	63	80	107
When standstill or when axial piston unit operating in non-pressurized conditions		$\pm F_{ax\ max}$	N	0	0	0	0	0	0
Permissible axial force per bar operating pressure	$F_{ax} \pm$ 	$+ F_{ax\ max}$	N/bar	24	33	43	53	60	71
		$- F_{ax\ max}$	N/bar	0	0	0	0	0	0

Note

Influence of the direction of the permissible axial force:

+ $F_{ax\ max}$ = Increase in service life of bearings

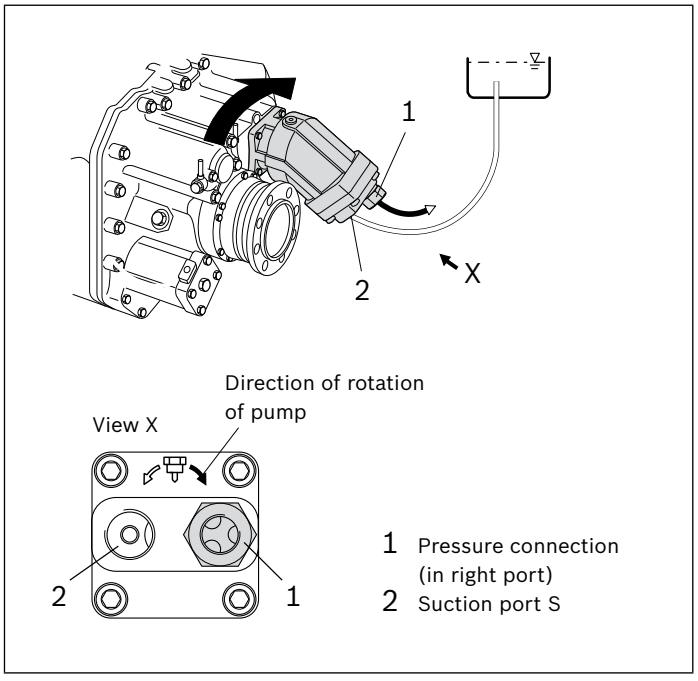
– $F_{ax\ max}$ = Reduction in service life of bearings (avoid)

Direction of rotation and changing the direction of rotation

The direction of rotation of the axial piston unit is defined by means of a pressure connection screwed into the service line port and can easily be changed.
By changing the pressure connection, the service line port and the suction port are exchanged. As a result, the permissible drive direction is changed.

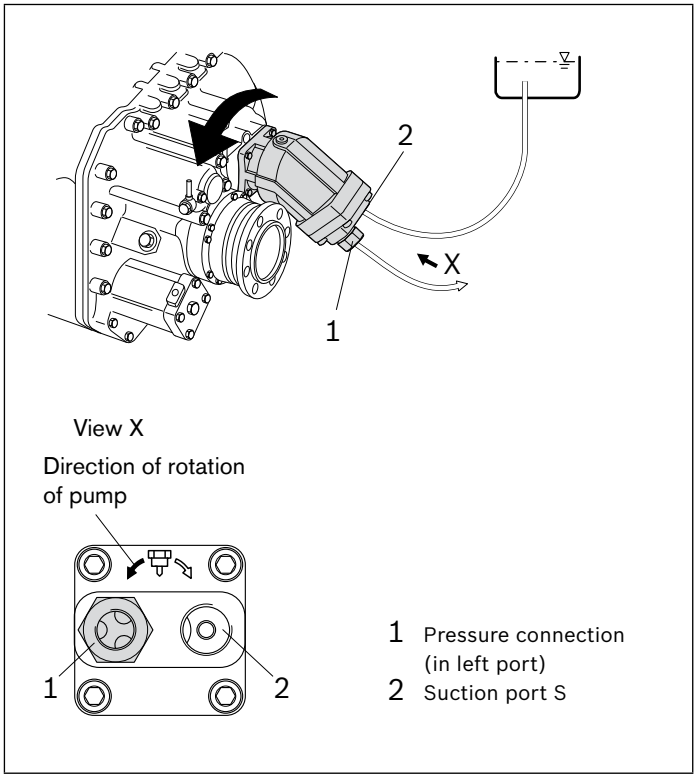
Direction of rotation on delivery
On delivery, the pressure connection (1) is pre-assembled in the right service line port of the axial piston unit. The permissible drive direction of the pump looking at the drive shaft: counter-clockwise. The power take-off turns clockwise.

Note
The pressure connection is pre-assembled on delivery and must be tightened to the torque specified for the thread size before installation (see table of tightening torques M_D).



Changing the direction of rotation
For power take-offs with counter-clockwise rotation, the direction of rotation of the axial piston unit must be changed.
To change the direction of rotation of the axial piston unit, you must change the pressure connection (1) from the right port to the left port.

Note
If the pump drive shaft moves while making the change, the axial piston unit may be damaged.
After unscrewing the pressure connection, do not turn the drive shaft of the pump!

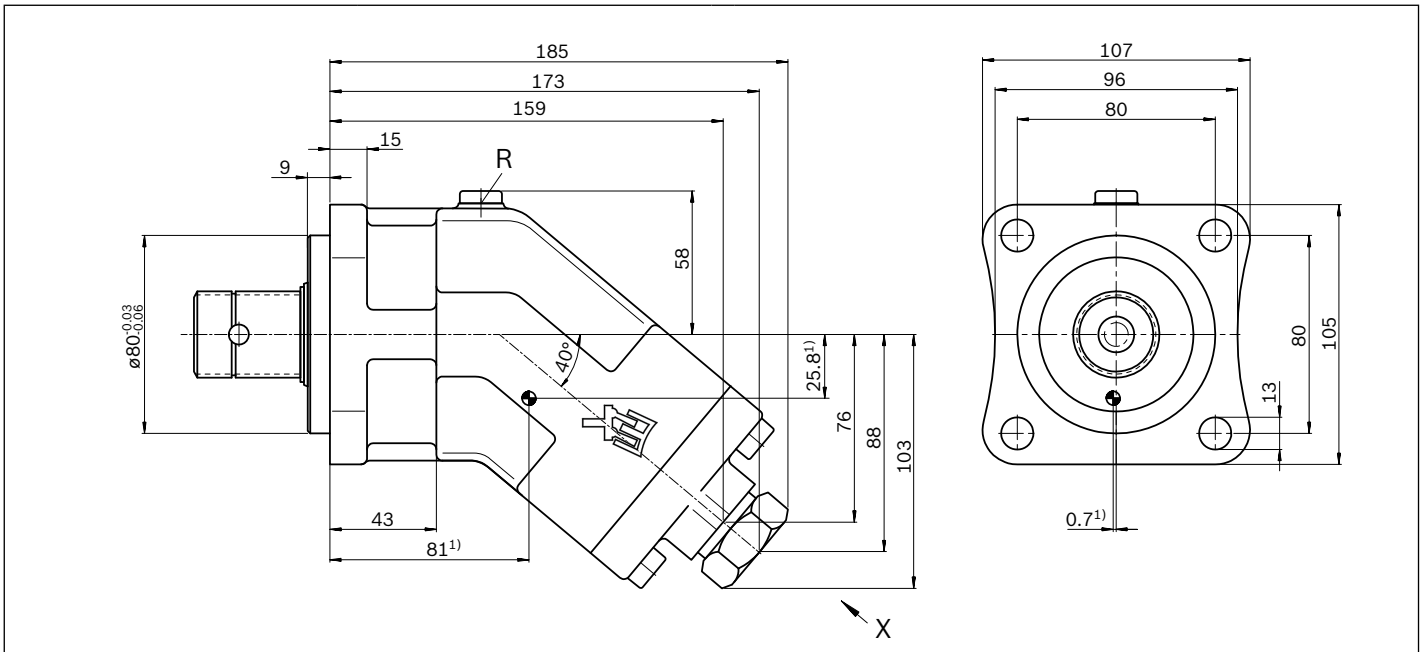


Tightening torque M_D of the pressure connection

Size	NG	23, 32	45, 63	80, 107
Tightening torque M_D	Nm	145	270	525
Size WAF	mm	36	41	50

Connecting the line to the pressure connection
If the tightening torque required for connecting the fittings used exceeds the tightening torque of the pressure connection, the pressure connection must be counterheld. The maximum permissible tightening torque of the female thread (see page 16) must not be exceeded.

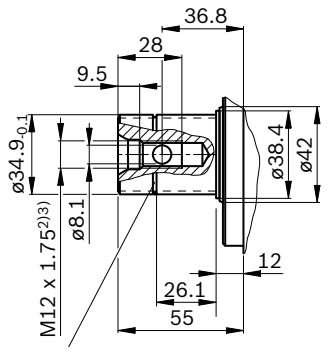
Dimensions size 23, 32



Drive shaft

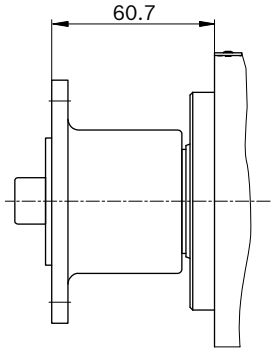
Splined shaft similar to DIN ISO 14 ...with coupling flange

E8 – 8x32x35



Groove for retaining ring
35 x 1.5 DIN 471

C8



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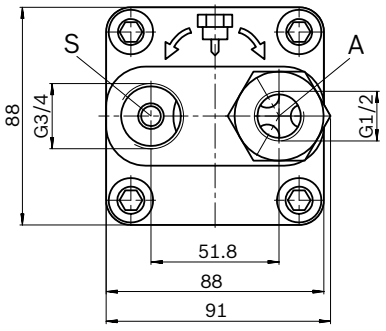
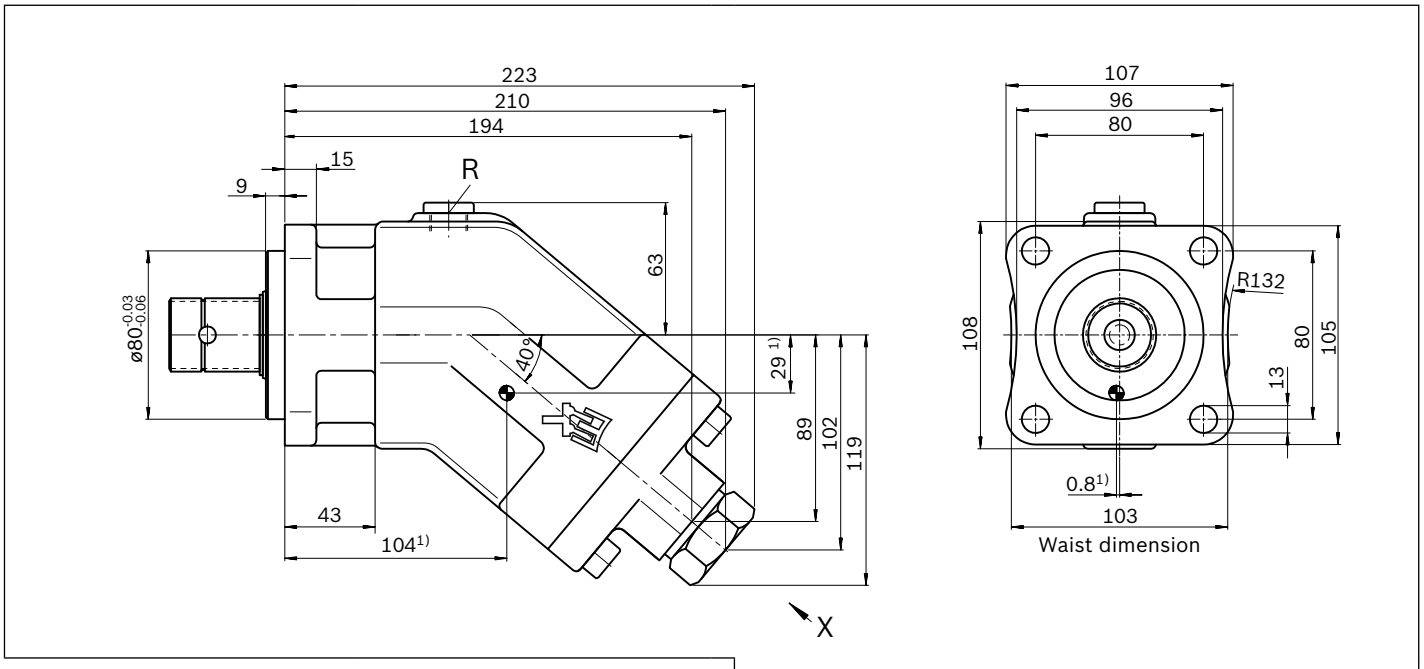


Ports

Designation	Port for	Standard	Size[3)]	Maximum pressure [bar][4)]	State[7)]
A	Service line	DIN ISO 228	G1/2; 14 deep	350	O
S	Suction line	DIN ISO 228	G3/4; 16 deep	2	O
R	Air bleed	DIN 3852[6)]	M10 x 1; 8 deep	2	X[5)]

1) Center of gravity
2) Center bore according to DIN 332 (thread according to DIN 13)
3) Observe the general instructions on page 16 for the maximum tightening torques.
4) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
5) Only open port R for filling and air bleed.
6) The spot face can be deeper than specified in the appropriate standard.
7) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

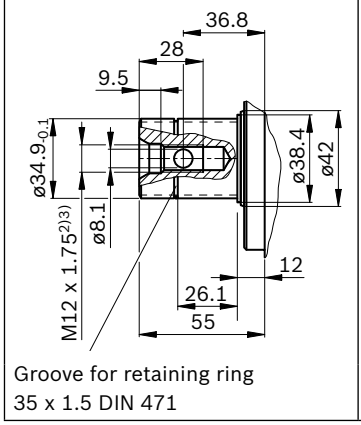
Dimensions size 45



Drive shaft

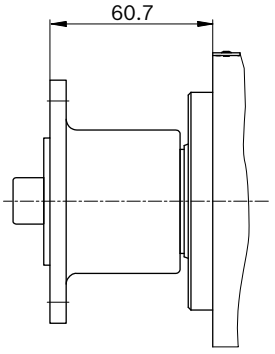
Splined shaft similar to DIN ISO 14 ...with coupling flange

E8 – 8x32x35



Groove for retaining ring
35 x 1.5 DIN 471

C8



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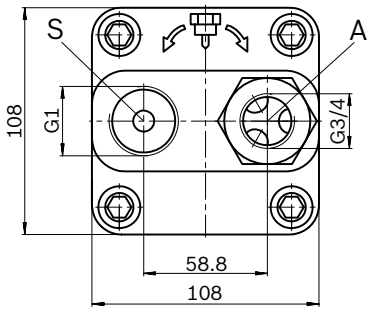

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Designation	Port for	Standard	Size[3)]	Maximum pressure [bar][4)]	State[7)]
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S	Suction line	DIN ISO 228	G1; 18 deep	2	O
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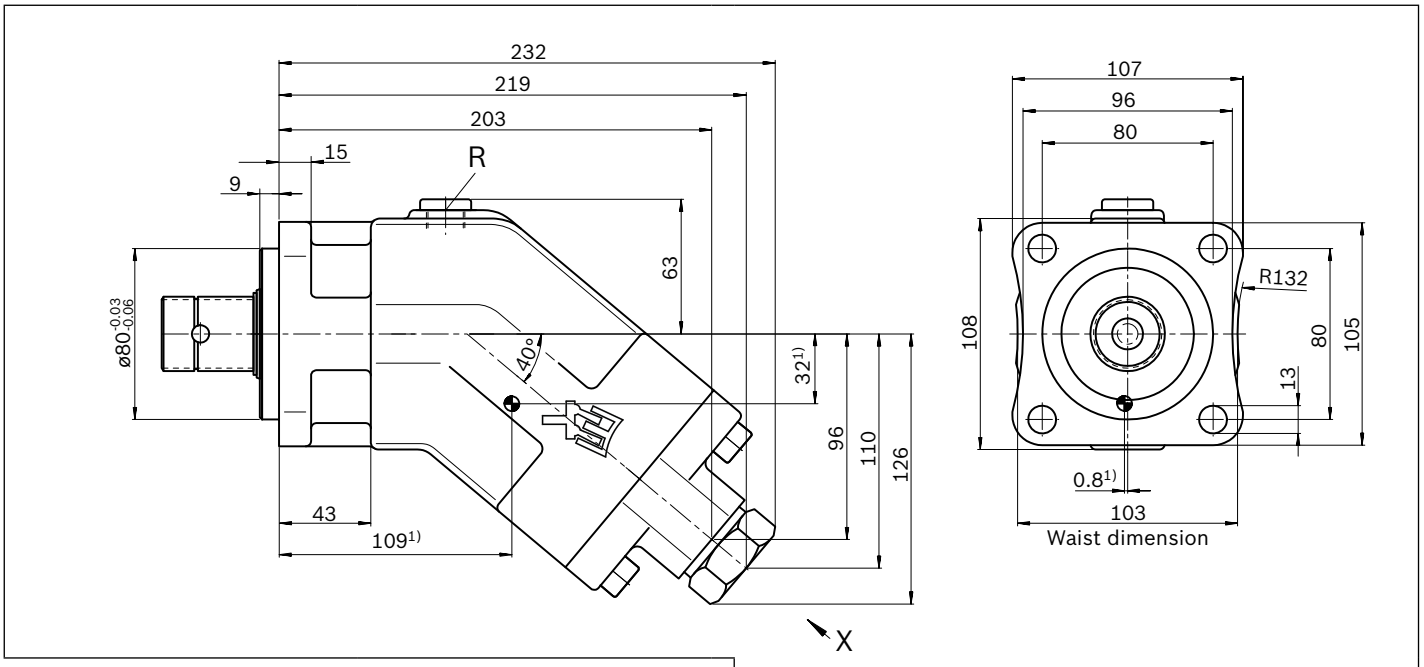
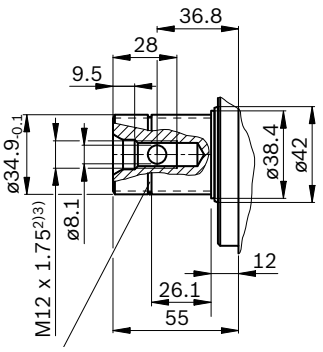
Dimensions size 63



Drive shaft

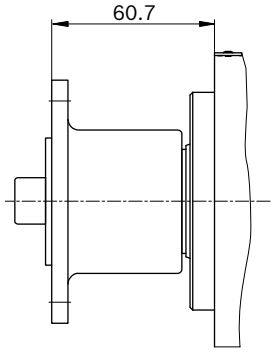
Splined shaft similar to DIN ISO 14 ...with coupling flange

E8 – 8x32x35



Groove for retaining ring
35 x 1.5 DIN 471

C8



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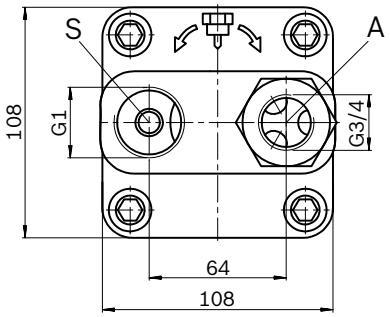

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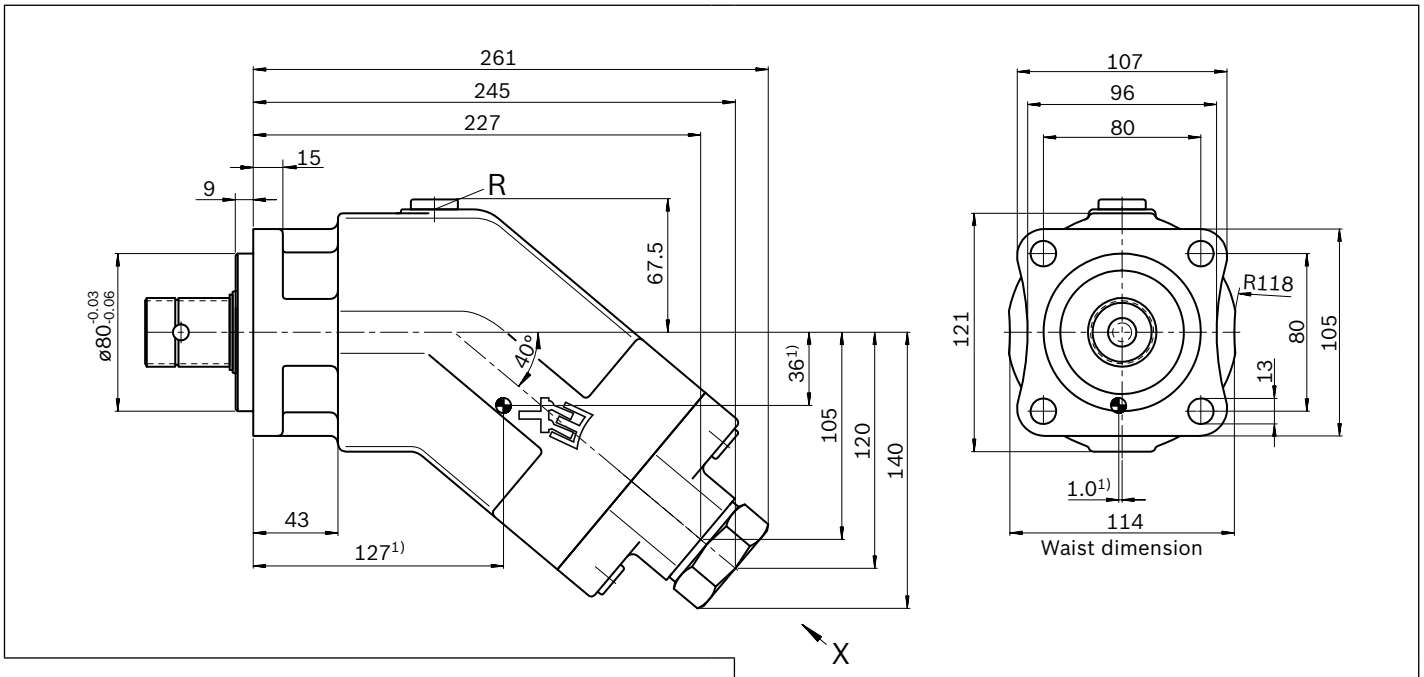
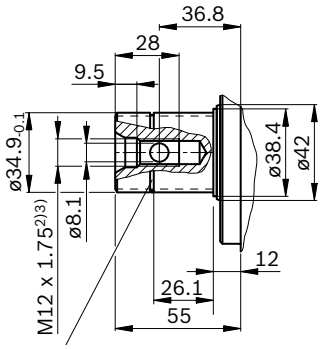
Dimensions size 80



Drive shaft

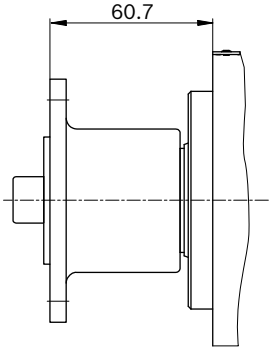
Splined shaft similar to DIN ISO 14 ...with coupling flange

E8 – 8x32x35



Groove for retaining ring
35 x 1.5 DIN 471

C8



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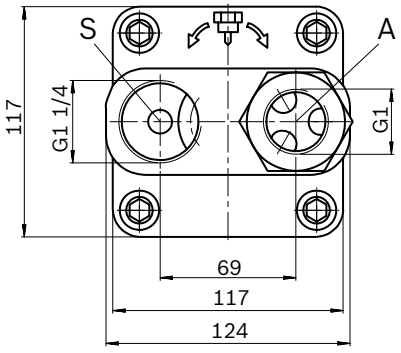

Ports

Designation	Port for	Standard	Size[3)]	Maximum pressure [bar][4)]	State[7)]
A	Service line	DIN ISO 228	G1; 18 deep	350	O
S	Suction line	DIN ISO 228	G1 1/4; 20 deep	2	O
R	Air bleed	DIN 3852[6)]	M10 x 1; 8 deep	2	X[5)]

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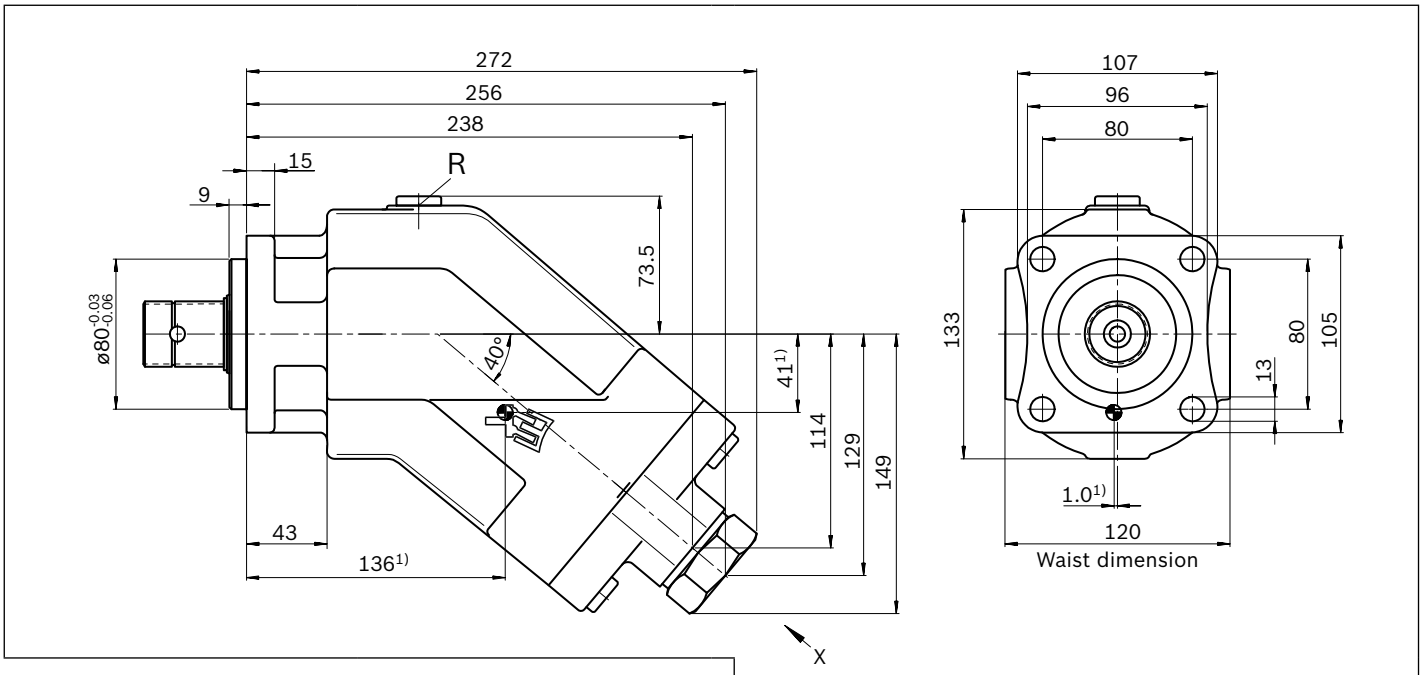
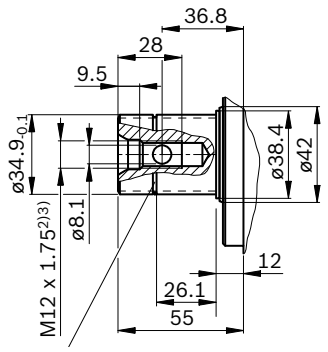
Dimensions size 107



Drive shaft

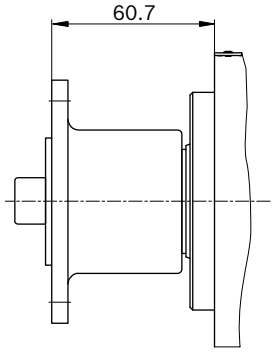
Splined shaft similar to DIN ISO 14 ...with coupling flange

E8 – 8x32x35

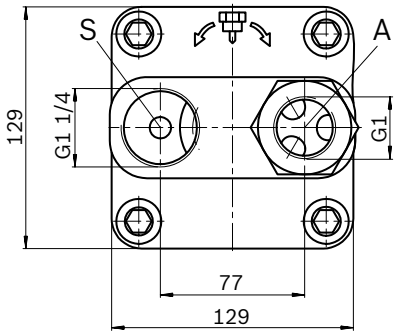


Groove for retaining ring
35 x 1.5 DIN 471

C8



View X



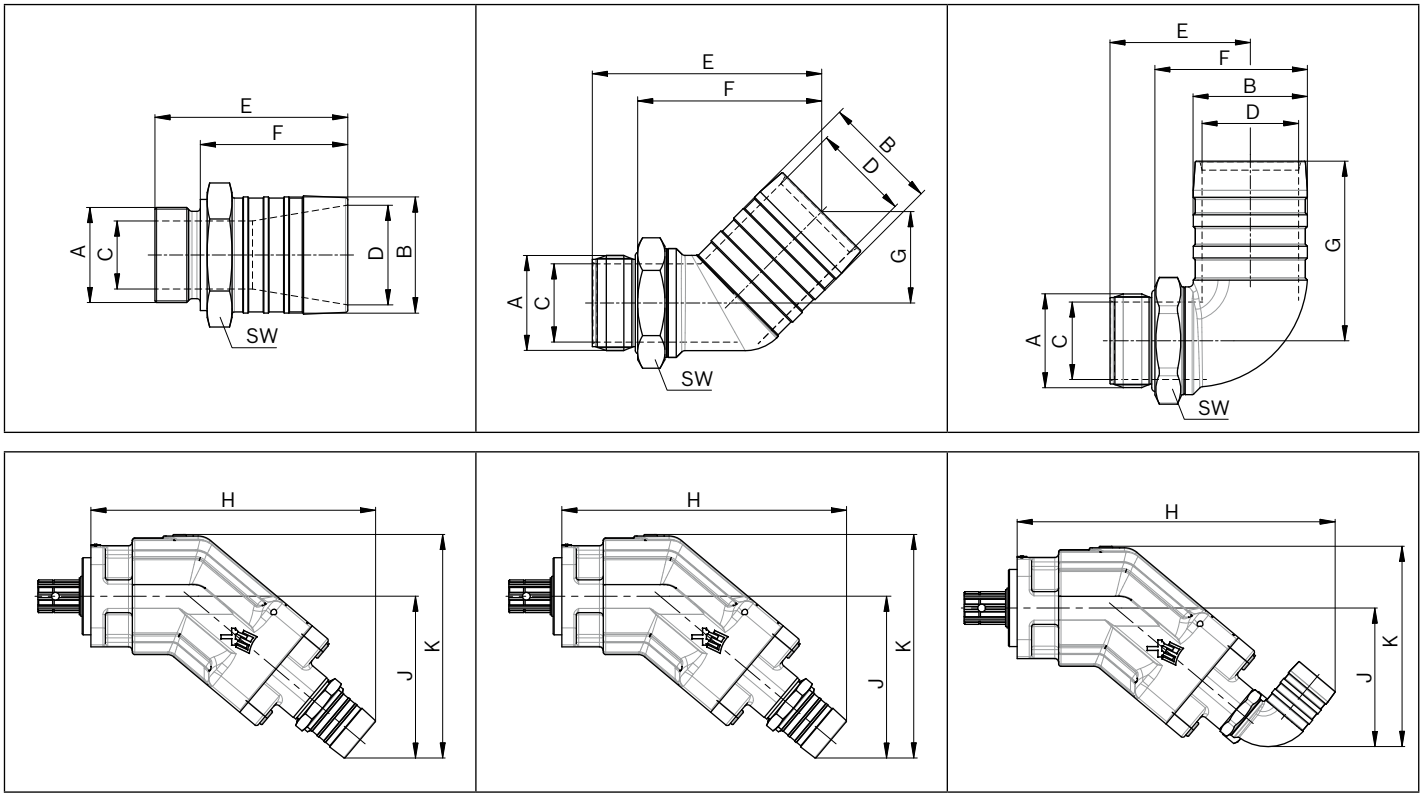
Ports

Designation	Port for	Standard	Size[3)]	Maximum pressure [bar][4)]	State[7)]
A	Service line	DIN ISO 228	G1; 18 deep	350	O
S	Suction line	DIN ISO 228	G1 1/4; 20 deep	2	O
R	Air bleed	DIN 3852[6)]	M10 x 1; 8 deep	2	X[5)]

1) Center of gravity
2) Center bore according to DIN 332 (thread according to DIN 13)
3) Observe the general instructions on page 16 for the maximum tightening torques.
4) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
5) Only open port R for filling and air bleed.
6) The spot face can be deeper than specified in the appropriate standard.
7) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

Suction stud

Dimensions



Axial piston unit		Suction stud												
NG	Port S	Inner ⌀		Version	Material number	C	D	E	F	G	SW	H	J	K
	A	B [in]	B [mm]											
23, 32	G3/4	1 1/2	39	Straight	R909831856	18	33.5	70	54	–	41	221	132	186
45	G1	1 1/2	39		R902600251	23.5	33.5	72	54	–	41	248	139	197
63												257	146	204
63	G1	2	51		R902602028	26	44	82	64	–	55	268	157	215
80	G1 1/4	2	51		R902600252	30	44	85	65	–	55	295	168	232
107												306	177	245
107	G1 1/4	2 1/2	63		R902601630	31	54	82	64	–	65	308	180	248
23, 32	G3/4	1 1/2	39	45°	R909831601	20	31	101	82	43	36	259	126	180
45	G1	1 1/2	39		R909831600	26	31	101	82	45	41	287	132	190
63												296	139	197
63	G1	2	51		R902602029	26	43	100	81	44	41	295	145	203
80	G1 1/4	2	51		R909831597	34	43	101	81	40	50	317	156	220
107												328	165	234
107	G1 1/4	2 1/2	63		R902601631	35	54	100	81	44	50	331	169	237
23, 32	G3/4	1 1/2	39	90°	R909831602	20	31	62	43	81	36	265	117	171
45	G1	1 1/2	39		R909831599	26	31	64	44	85	41	296	127	185
63												305	134	192
63	G1	2	51		R902602030	26	43	62	42	81	41	305	138	196
80	G1 1/4	2	51		R909831598	35	43	63	43	80	50	330	144	208
107												341	153	221

Dimensions in mm

Notes on suction line

- Keep as short and straight as possible, without bend
- Use a supporting ring for plastic hoses
- Use two hose clamps to protect the suction hose against air suction
- Note pressure resistance of suction hose compared to ambient pressure

Replacing seals

The O-rings used as seals to prevent air from entering the suction line are to be replaced after every removal and new installation in order to guarantee complete sealing.

Material number for O-rings:

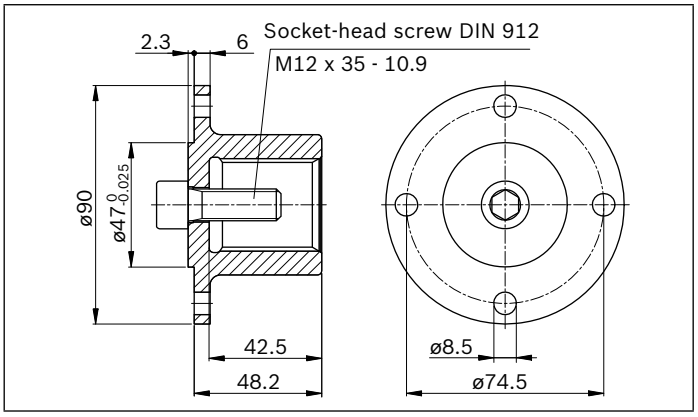
- R902083796: O-ring for suction stud G3/4
- R902083802: O-ring for suction stud G1
- R902083808: O-ring for suction stud G1 1/4

Coupling flange

There are specially modified coupling flanges in 4-hole and 6-hole designs for the cardan-shaft drive.

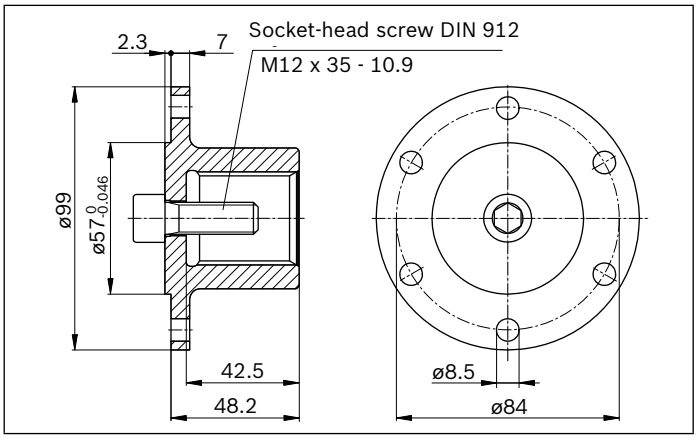
4-hole coupling flange, complete – Ø90

Material number: R902060152



6-hole coupling flange, complete – Ø100

Material number: R902060153



Note

The coupling flange is installed by screwing it onto the drive shaft with the help of the threaded bore in the end of the drive shaft.
The coupling flange must be glued onto the splined drive shaft with Loctite 574 and clamped (= 130 Nm).
Sudden or abrupt forces acting on the drive shaft could lead to damage to the rotary group and must therefor be avoided.

Installation instructions

General

During commissioning and operation, the axial piston unit must be filled with hydraulic fluid and air bled. This must also be observed following a relatively long standstill as the axial piston unit may drain back to the reservoir via the hydraulic lines.

The case drain chamber is internally connected to the suction chamber. A case drain line from the case to the reservoir is not required.

To achieve favorable noise values, decouple all connecting lines using elastic elements and avoid above-reservoir installation.

In all operating conditions, the suction line must flow into the reservoir below the minimum fluid level. The permissible suction height h_S results from the overall loss of pressure; it must not, however, be higher than $h_{S\ max}$ = 800 mm. The minimum suction pressure at port S must also not fall below 0.8 bar absolute during operation and during cold start.

Installation position

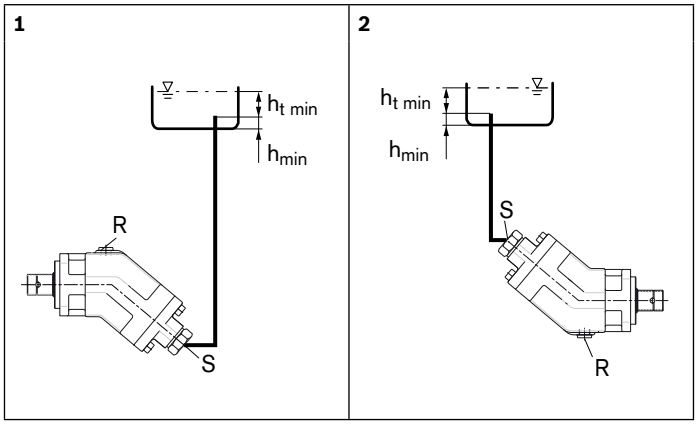
See the following examples 1 to 4.

Further installation positions are available upon request.

Recommended installation position: 1 and 2.

Below-reservoir installation (standard)

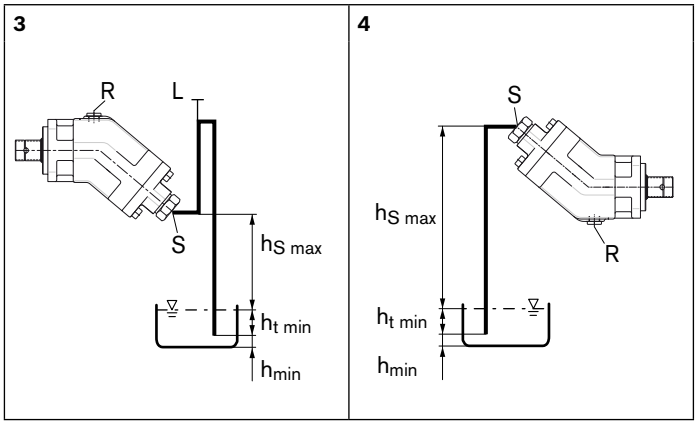
Below-reservoir installation means that the axial piston unit is installed outside of the reservoir below the minimum fluid level.



Installation position	Air bleed	Filling
1	R	S
2	–	S

Above-reservoir installation

Above-reservoir installation means that the axial piston unit is installed above the minimum fluid level of the reservoir. Observe the maximum permissible suction height $h_{S\ max}$ = 800 mm.



Installation position	Air bleed	Filling
3	R	L
4	S	S

Key	
L	Filling / air bleed
R	Air bleed port
S	Suction port
$h_{t\ min}$	Minimum required immersion depth (200 mm)
h_{min}	Minimum required spacing to reservoir bottom (100 mm)
$h_{S\ max}$	Maximum permissible suction height (800 mm)

Other related documents

Other pumps with special characteristics and dimensions for use in commercial vehicles can be found in the following data sheets:

- RE 91510: Fixed pump A17FNO, 250/300 bar
- RE 91540: 2-circuit fixed pump A18FDO, 350/400 bar
- RE 92260: Fixed pump A17VO, 300/350 bar
- RE 92270: Variable pump A18VO, 350/400 bar
- RE 92280: Variable pump A18VLO, 350/400 bar

General instructions

- The pump A17FO is designed to be used in open circuits.
- The project planning, installation and commissioning of the axial piston unit requires the involvement of qualified personnel.
- Before using the axial piston unit, please read the corresponding instruction manual completely and thoroughly. If necessary, these can be requested from Bosch Rexroth.
- During and shortly after operation, there is a risk of burns on the axial piston unit. Take appropriate safety measures (e. g. by wearing protective clothing).
- Depending on the operating conditions of the axial piston unit (operating pressure, fluid temperature), the characteristic may shift.
- Service line ports:
  - The ports and fastening threads are designed for the specified maximum pressure. The machine or system manufacturer must ensure that the connecting elements and lines correspond to the specified application conditions (pressure, flow, hydraulic fluid, temperature) with the necessary safety factors.
  - The service line ports and function ports can only be used to accommodate hydraulic lines.
- The data and notes contained herein must be adhered to.
- Before finalizing your design, request a binding installation drawing.
- The product is not approved as a component for the safety concept of a general machine according to ISO 13849.
- A pressure-relief valve is to be provided in the hydraulic system.
- The following tightening torques apply:
  - Fittings:
    Observe the manufacturer's instructions regarding the tightening torques of the fittings used.
  - Mounting bolts:
    For mounting bolts with metric ISO threads according to DIN 13, we recommend checking the tightening torque in individual cases in accordance with VDI 2230.
  - Female threads in the axial piston unit:
    The maximum permissible tightening torques $M_{G\ max}$ are maximum values of the female threads and must not be exceeded. For values, see the following table.
  - Threaded plugs:
    For the metallic threaded plugs supplied with the axial piston unit, the required tightening torques of threaded plugs M_V apply. For values, see the following table.

Ports **Standard**	**Size of thread**	**Maximum permissible tightening torque of the female threads $M_{G\ max}$**	**Required tightening torque of the threaded plugs M_V**	**WAF** **Hexagon socket of the threaded plugs**
DIN 3852[1)]	M10 x 1	15 Nm	15 Nm[2)]	5 mm
DIN ISO 228	G1/2	200 Nm	–	–
	G3/4	330 Nm	–	–
	G1	480 Nm	–	–
	G1 1/4	720 Nm	–	–

1) The tightening torques apply for screws in the "dry" state as received on delivery and in the "lightly oiled" state for installation.

2) In the “lightly oiled” state, the M_V is reduced to 10 Nm for M10 x 1.

Bosch Rexroth AG
Mobile Applications
Glockeraustrasse 4
89275 Elchingen, Germany
Tel.: +49 73 08 82-0
Fax: +49 73 08 72 74
info.brm@boschrexroth.de
www.boschrexroth.com/axial-piston-pumps