

Directional spool valves, direct operated, with solenoid actuation

RE 23178

Edition: 2013-06 Replaces: 04.09

Type WE



- Size 6
- Component series 6X
- Maximum operating pressure 350 bar [5076 psi]
- ► Maximum flow: 80 l/min [21 US gpm] DC 60 l/min [15.8 US gpm] - AC



Features

- ▶ 4/3, 4/2 or 3/2 directional design
- ► High-power solenoid
- ▶ Porting pattern according to DIN 24340 form A
- ► Porting pattern according to ISO 4401-03-02-0-05 and NFPA T3.5.1 R2-2002 D03
- ▶ Wet-pin DC or AC solenoids with detachable coil
- ► Solenoid coil can be rotated by 90°
- ► The coil can be changed without having to open the pressure-tight chamber
- ▶ Electrical connection as individual or central connection
- ► Manual override, optional
- ► Spool position monitoring, optional

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Ordering code

01	WF	03	04	05 6X	 06	07 F	- 08 T	09 T	10	11	12	13	14	15	16
		16													

01	3 main ports	3
	4 main ports	4
02	Directional valve	WE
03	Size 6	6
04	Symbols e.g. C, E, EA, EB, etc; for the possible version, see page 5	
05	Component series 60 to 69 (60 to 69: Unchanged installation and connection dimensions)	6X
06	With spring return	no code
	Without spring return	0
	Without spring return with detent	OF
07	High-power wet-pin solenoid with detachable coil	E
08	Direct voltage 24 V	G24
	AC voltage 230 V 50/60 Hz	W230
	AC voltage 120 V or 110 V 50/60 Hz	W110 W + voltage
	Direct voltage 205 V	G205
	DC solenoid with rectifier for AC voltage (not frequency-related; only available with plug-in connection with cover, see page 17)	W110R
	Connection to AC voltage mains via control with rectifier (see table below and page 4) 1) For further ordering codes for other voltages and frequencies, see page 8	

09	Without manual override	no code					
	With concealed manual override (standard)	N9 ²⁾					
	With manual override						
	With lockable manual override "mushroom button" (small)	N4 ²⁾					
	With lockable manual override "mushroom button" (big)	N5 ^{2; 3)}					
	With manual override "mushroom button" (big), not lockable	N6 ²⁾					
	With lockable manual override "nut"	N7 ²⁾					

Electrical connection

Individual connection								
Without mating connector, with connector according to DIN EN 175301-803	K4 ⁴⁾							
Without mating connector, with connector AMP Junior-Timer								
Without mating connector, with connector DT 04-2PA (Deutsch plug)								
Without mating connector, 4-pole with connector M12x1 according to IEC 60947-5-2, integrated interference protection circuit and status LED								
Without mating connector, 4-pole with connector M12x1 according to IEC 60947-5-2, integrated interference protection circuit and status LED (no connection pin 1 to pin 2)	K73L 5)							
Central connection								
Cable entry at the cover, with indicator light	DL							
Central plug-in connection at the cover, with indicator light (without mating connector); connector according to DIN EN 175201-804								
For further electrical connections, see data sheet 08010								

AC voltage mains (admissible voltage tolerance ±10%)	Nominal voltage of the DC solenoid in case of operation with alternating voltage	Ordering code
110 V - 50/60 Hz	96 V	G96
230 V - 50/60 Hz	205 V	G205

Ordering code

	WF	6		6X	1		F					1					*
01	02	03	04	05		06	07	80	09	10	11		12	13	14	15	16

Spool position monitoring

Without position switch	no code									
- Inductive position switch type QM										
Monitored spool position "a"	QMAG24									
Monitored spool position "b"	QMBG24									
Monitored rest position	QM0G24									
- Inductive position switch type QR	- Inductive position switch type QR									
Monitored rest position	QR0G24S									
Monitored spool position "a" and "b"	QRABG24E									
- Inductive position switch type QL										
Monitored spool position "a"	QLAG24									
Monitored spool position "b"	QLBG24									
- Inductive proximity sensor type QS										
Monitored spool position "a"	QSAG24W									
Monitored spool position "b"	QSBG24W									
Monitored spool position "0"	QS0G24W									
Monitored spool position "0" and "a"	QS0AG24W									
Monitored spool position "0" and "b"	QS0BG24W									
Monitored spool position "a" and "b"	QSABG24W									
For more information, see data sheet 24830										

Without throttle in	nsert		no code
With throttle inser	t see table:		
Port		Throttle Ø in mm [inch]	
	0.8 [0.031]	1.0 [0.039]	1.2 [0.047]
Р	= B08	= B10	= B12
А	= H08	= H10	= H12
В	= R08	= R10	= R12
A and B	= N08	= N10	= N12
Т	= X08	= X10	= X12

Clamping length

13	42 mm [1.65 inch] (standard)	no code
	22 mm [0.87 inch]	Z

Seal material

14	NBR seals	no code
	FKM seals	V
	Attention: Observe compatibility of seals with hydraulic fluid used! (Other seals upon request)	

15	Without locating hole	no code
	With locating hole	/60 8)
	With locating hole and locking pin ISO 8752-3x8-St	/62

tails in the plain text

Explanation of the footnotes see page 4.

Preferred types and standard units are contained in the EPS (standard price list).

Ordering code

- 1) Only for version "individual connection"
- 2) The manual override cannot be allocated a safety function. The manual override units may only be used up to a tank pressure of 50 bar.
- 3) With tank pressures above 50 bar, it cannot be guaranteed that the valve remains in the position switched by the manual override "N5".
- ⁴⁾ Mating connectors, separate order, see below and data sheet 08006
- 5) Only version "G24", see data sheet 08010
- 6) Mating connector, separate order, material no. R900005538

- Only possible in connection with the symbols G, J, D and E as well a reduced performance limit.
- 8) Locking pin ISO 8752-3x8-St, material no. **R900005694** (separate order)

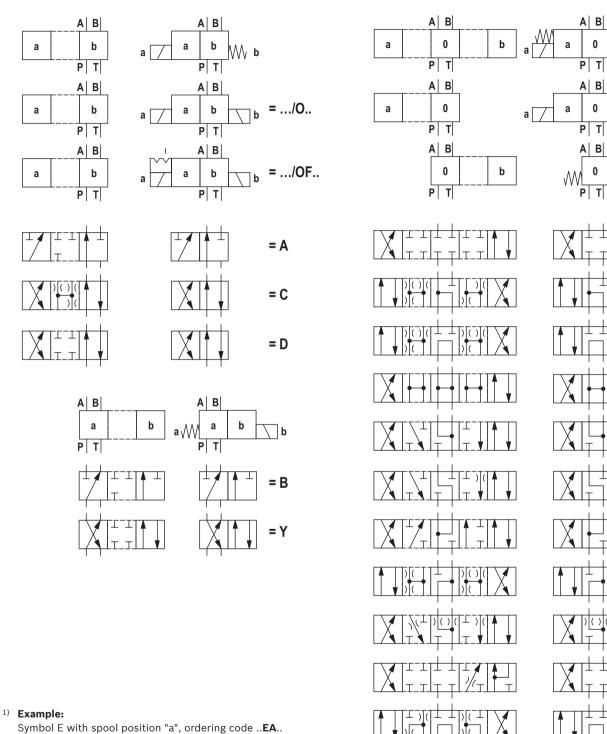
Mating connectors according to DIN EN 175301-803

For details a connectors, sheet 08006	see dat	_					
					Material number		
Port	Valve side	Color	Without circuitry	With indicator light 12 240 V	With indicator light and rectifier 12 240 V	With rectifier 12 240 V	With indicator light and Zener diode suppression circuit 24 V
	a	Gray	R901017010	-	-	-	-
M16 x 1.5	b	Black	R901017011	-	-	-	-
	a/b	Black	-	R901017022	R901017029	R901017025	R901017026
	a	Red/	R900004823	-	_	-	_
1/2" NPT		brown					
(Pg 16)	b	Black	R900011039	-	_	-	_
	a/b	Black	-	R900057453	R900057455	R900842566	_

 $= .A^{1}$

= .B

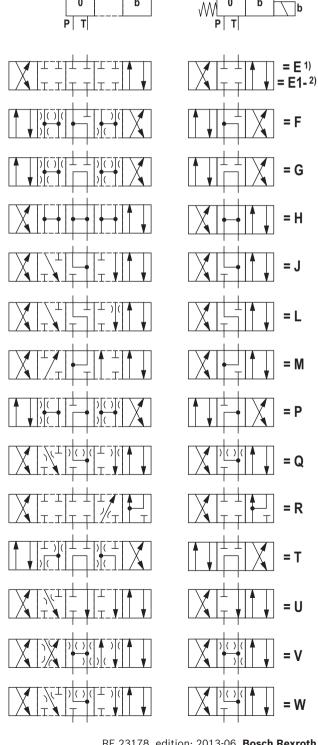
Symbols



2) Symbol E1-: P - A/B pre-opening, Caution in conjunction with differential cylinders due to pressure intensification!

Motices!

Representation according to DIN ISO 1219-1. Hydraulic interim positions are shown by dashes.



Function, section

Directional valves of type WE are solenoid operated directional spool valves. They control the start, stop and direction of a flow.

The directional valves basically consist of the housing (1), one or two electronic solenoids (2), the control spool (3), and one or two return springs (4).

In the de-energized condition, the control spool (3) is held in the central position or in the initial position by the return springs (4) (except for impulse spools). The control spool (3) is actuated by wet-pin electronic solenoids (2).

To ensure proper functioning, care must be taken that the pressure chamber of the electronic solenoid is filled with oil.

The force of the electronic solenoid (2) acts via the plunger (5) on the control spool (3) and pushes the latter from its rest position to the required end position. This enables the necessary direction of flow from P to A and B to T or P to B and A to T.

When the electronic solenoid (2) is de-energized, the return spring (4) pushes the control spool (3) back to its rest position.

An optional manual override (6) allows the control spool (3) to be moved without solenoid energization.

Without spring return "O" (only possible with symbols A, C and D)

This version is a directional valve with 2 spool positions and 2 electronic solenoids **without** detent. The valve without spring return at the control spool (3) has no defined basic position in the de-energized condition.

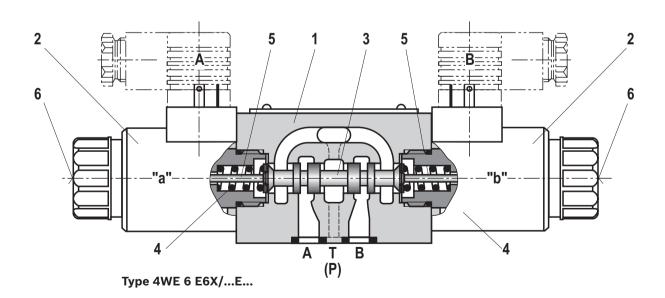
Without spring return with "OF" detent (only possible with symbols A, C and D)

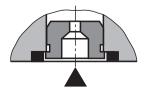
This version is a directional valve with 2 spool positions and 2 electronic solenoids **with** detent. The detents are used to fix the control spool (3) in the relevant spool position. During operation, continuous application of current to the electronic solenoid can thus be omitted which contributes to energy-efficient operation.

Notices!

Pressure peaks in the tank line to two or several valves can result in unintended control spool movements in the case of valves with detent! We therefore recommend that separate return lines be provided or a check valve installed in the tank line.

Due to the design principle, internal leakage is inherent to the valves, which may increase over the life cycle.





Throttle insert

The use of the throttle insert is required when, due to prevailing operating conditions, flows occur during the switching processes which exceed the performance limit of the valve.

(for applications outside these parameters, please consult us!)

general			
Weight	– Valve with one solenoid	kg [lbs]	1.45 [3.2]
	– Valve with two solenoids	kg [lbs]	1.95 [4.3]
Installation posit	tion		Any
Ambient tempera	ature range	°C [°F]	-30 +50 [-22 +122] (NBR seals) -20 +50 [-4 +122] (FKM seals)
MTTF _d values according to EN ISO 13849 Years		150 (for further details see data sheet 08012)	

hydraulic			
Maximum operating pressure	– Ports A, B, P	bar [psi]	350 [5076]
	– Port T	bar [psi]	210 [3050] (DC); 160 [2320] (AC) With symbols A and B, port T must be used as leakage oil connection.
Maximum flow		l/min [USgpm]	80 [21] (DC); 60 [15.8] (AC)
Flow cross-section	– Symbol Q	mm²	Approx. 6% of nominal cross-section
(spool position 0)	– Symbol W	mm ²	Approx. 3% of nominal cross-section
Hydraulic fluid			See table below
Hydraulic fluid temperature ran	ge	°C [°F]	-30 +80 [-22 +176] (NBR seals) -15 +80 [-4 +176] (FKM seals)
Viscosity range mm²/s [SUS]		mm²/s [SUS]	2.8 500 [35 2320]
9	Maximum admissible degree of contamination of the hydraulic fluid - cleanliness class according to ISO 4406 (c)		Class 20/18/15 ¹⁾

Hydraulic fluid		Classification	Suitable sealing materials	Standards	
Mineral oils		HL, HLP, HLPD, HVLP, HVLPD	NBR, FKM	DIN 51524	
Bio-degradable	– insoluble in water	HETG	NBR, FKM	VDMA 24568	
		HEES	FKM		
	- soluble in water	HEPG	FKM	VDMA 24568	
Flame-resistant	– water-free	HFDU, HFDR	FKM	ISO 12922	
	- containing water	HFC (Fuchs Hydrotherm 46M, Petrofer Ultra Safe 620)	NBR	ISO 12922	

Important information on hydraulic fluids!

- ► For more information and data on the use of other hydraulic fluids, refer to data sheet 90220 or contact us!
- ► There may be limitations regarding the technical valve data (temperature, pressure range, life cycle, maintenance intervals, etc.)!
- ► The flash point of the hydraulic fluid used must be 40 K higher than the maximum solenoid surface temperature.

► Flame-resistant – containing water:

- Maximum pressure difference per control edge 50 bar
- Pressure pre-loading at the tank port >20% of the pressure differential, otherwise increased cavitation
- Life cycle as compared to operation with mineral oil HL, HLP 50 to 100%
- ▶ **Bio-degradable:** When using bio-degradable hydraulic fluids that are simultaneously zinc-solving, zinc may accumulate in the fluid (per pole tube 700 mg zinc).
- The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and at the same time increases the life cycle of the components. For maintenance requirements of the hydraulic fluid and contamination limit values, see data sheet 07300.
 - For the selection of the filters, see www.boschrexroth.com/filter.

(for applications outside these parameters, please consult us!)

electric				
Voltage type			Direct voltage	Alternating voltage 50/60 Hz
Available voltages ²⁾		12, 24, 96, 205	110, 230	
(For ordering codes for A	C voltage solenoids, see below)			
Voltage tolerance (nominal voltage) %		±10		
Power consumption		W	30	_
Holding power		VA	_	50
Switch-on power		VA	_	220
Duty cycle		%	100	
Switching time according	- ON	ms	25 45	10 20
to ISO 6403 ³⁾	- OFF	ms	10 25	15 40
Maximum switching frequ	ency	1/h	15000	7200
Maximum surface temperature of the coil $^{4)}$ °C [°F]		120 [248]	180 [356]	
Protection class accord-	- With connector "K4", "K72L", "K73L"		IP 65 (with mating connector mounted and locked)	
ing to DIN EN 60529	– With connector "C4"		IP 66A (with mating connector n	nounted and locked)
	– With connector "K40"		IP 69K (with mating connector n	nounted and locked)

- 2) Special voltages available upon request
- 3) The switching times were determined at a hydraulic fluid temperature of 40 °C [104 °F] and a viscosity of 46 cSt. Deviating hydraulic fluid temperatures can result in different switching times! Switching times change depending on operating time and application conditions.
- 4) Due to the temperatures occurring at the surfaces of the solenoid coils, the standards ISO13732-1 and ISO 4413 need to be adhered to!

The specified surface temperature in AC solenoids is valid for the faultless operation. In case of error (e.g. blocking of the control spool), the surface temperature may rise to above 180 °C [356 °F]. Thus, the system must be checked for possible dangers considering the flash point (see page 7).

As fuse protection, circuit breakers (see table on page 19) must be used, unless the creation of an ignitable atmosphere can be excluded in a different way. Thus, the surface temperature can - in case of error - be limited to maximally 220 °C [428 °F]. The tripping current must lie within a time interval of 0.6 s with 8 to 10 times the nominal power supply. (tripping character-

The necessary non-tripping current of the fuse must not fall below the value I_1 (see table on page 19). The maximum tripping current of the fuse must not exceed the value I2 (see table on page 19).

The temperature dependence of the tripping behavior of the circuit breakers has to be considered according to the manufacturer's specifications.



Notices!

- ▶ The actuation of the manual override is only possible up to a tank pressure of approx. 50 bar [725 psi]. Avoid damage to the bore of the manual override! (Special tool for the operation, separate order, material no. R900024943). When the manual override is blocked, actuation of the opposite solenoid must be ruled out!
- ▶ The simultaneous actuation of 2 solenoids of one valve must be ruled out!



AC solenoids can be used for 2 or 3 mains; e.g. solenoid type W110 for:

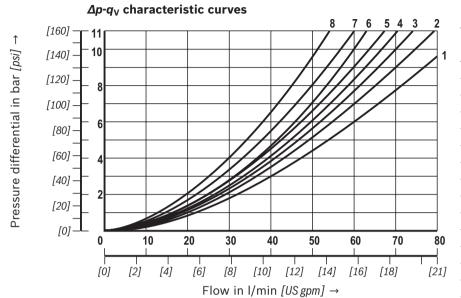
110 V, 50 Hz; 110 V, 60 Hz; 120 V, 60 Hz

Ordering code	Mains
W110	110 V, 50 Hz
	110 V, 60 Hz
	120 V, 60 Hz
W230	230 V, 50 Hz
	230 V, 60 Hz

When establishing the electrical connection, the protective earthing conductor (PE $\frac{1}{2}$) has to be connected correctly.

Characteristic curves

(measured with HLP46, ϑ_{oil} = 40 ± 5 °C [104 ± 9 °F])



Symbol		Direction	n of flow	
	P - A	P - B	A - T	B - T
A; B	5	5	_	_
С	3	3	5	3
D; Y	6	6	5	5
Е	5	5	3	3
F	3	5	3	3
Т	8	8	4	4
Н	2	1	2	2
J; Q	3	3	2	3
L	5	5	1	4
M	2	1	5	5
Р	5	3	3	3
R	6	6	1	_
V	3	2	3	3
W	3	3	2	2
U	5	5	4	1
G	7	7	4	4

- 7 Symbol "R" in spool position B A
- 8 Symbol "G" and "T" in central position P T
- 9 Symbol "H" in central position P T

(measured with HLP46, ϑ_{oil} = 40 ± 5 °C [104 ± 9 °F])

Motice!

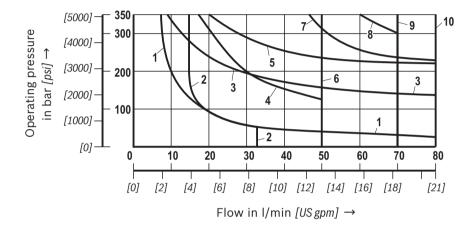
The specified performance limits are valid for operation with two directions of flow (e.g. from P to A and simultaneous return flow from B to T).

Due to the flow forces acting within the valves, the admissible performance limit may be considerably lower

with only one direction of flow (e.g. from P to A while port B is blocked).

In such cases of application, please consult us!

The performance limit was determined when the solenoids were at operating temperature, at 10% undervoltage and without tank preloading.



Solenoid voltage (DC solenoid)
12; 24; 48; 96; 125; 205 V

(other voltages, see page 11)

	DC solenoid
Characteristic curve	Symbol
1	A; B ¹⁾
2	V
3	A; B
4	F; P
5	J
6	G; H; T
7	A/O; A/OF; L; U
8	C; D; Y
9	M
10	E; E1 ⁻²); R ³); C/O; C/OF; D/O; D/OF; Q; W

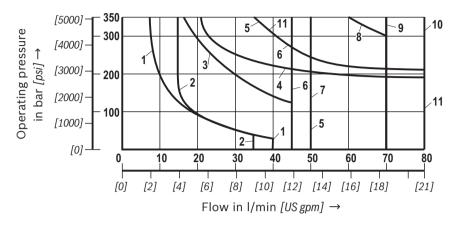
¹⁾ With manual override

²⁾ P – A/B pre-opening

³⁾ Return flow from actuator to tank

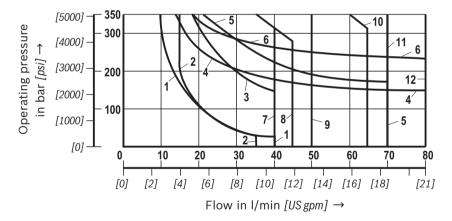
(measured with HLP46, ϑ_{oil} = 40 ± 5 °C [104 ± 9 °F])

See notice on page 10.



Solenoid voltage (DC solenoid)	
110; 180 V	

DC solenoid			
Characteristic curve	Symbol		
1	A; B		
2	V		
3	F; P		
4	J; L; U		
5	G		
6	T		
7	Н		
8	D; C		
9	M		
10	C/O; C/OF; D/O; D/OF; E; E1-; R, Q; W		
11	A/O; A/OF		

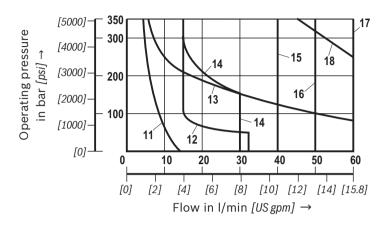


Solenoid voltage (DC solenoid)								
42; 80; 220 V								

	DC solenoid
Characteristic curve	Symbol
1	A; B
2	V
3	F; P
4	J; L; U
5	A/O; A/OF
6	E
7	Т
8	G
9	Н
10	D; C
11	M
12	C/O; C/OF; D/O; D/OF; E1-; R, Q; W

(measured with HLP46, ϑ_{oil} = 40 ± 5 °C [104 ± 9 °F])

See notice on page 10.

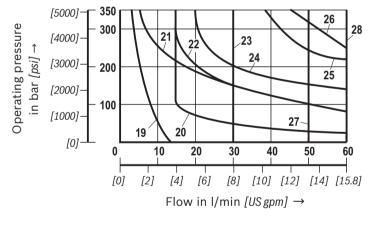


Characteristic curve	Symbol
11	A; B ¹⁾
12	V
13	A; B
14	F; P
15	G; T
16	Н
17	A/O; A/OF; C/O; C/OF; D/O; D/OF; E; E1-2); J; L; M; Q; R3); U; W
18	C; D; Y

	Solenoid voltage (AC solenoid)
W110	110 V; 50 Hz
	120 V; 60 Hz
W230	230 V; 50 Hz

(other voltages upon request)

- 1) With manual override
- 2) P A/B pre-opening
- 3) Return flow from actuator to tank

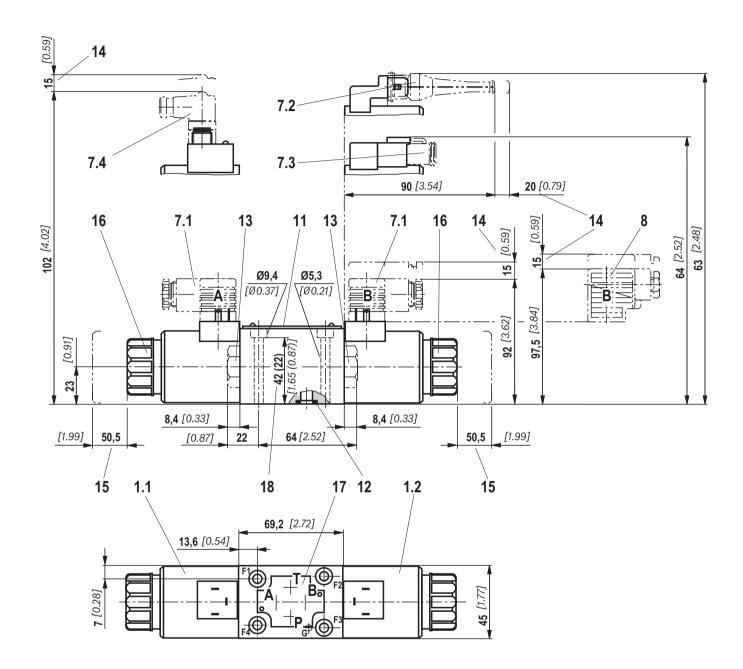


	AC solenoid - 60 Hz
Characteristic curve	Symbol
19	A; B ¹⁾
20	V
21	A; B
22	F; P
23	G; T
24	J; L; U
25	A/O; A/OF; Q; W
26	C; D; Y
27	Н
28	C/O; C/OF; D/O; D/OF; E; E1-2); M; R3)

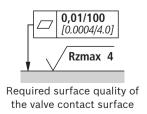
- (other voltages upon request)

- 1) With manual override
- 2) P A/B pre-opening
- 3) Return flow from actuator to tank

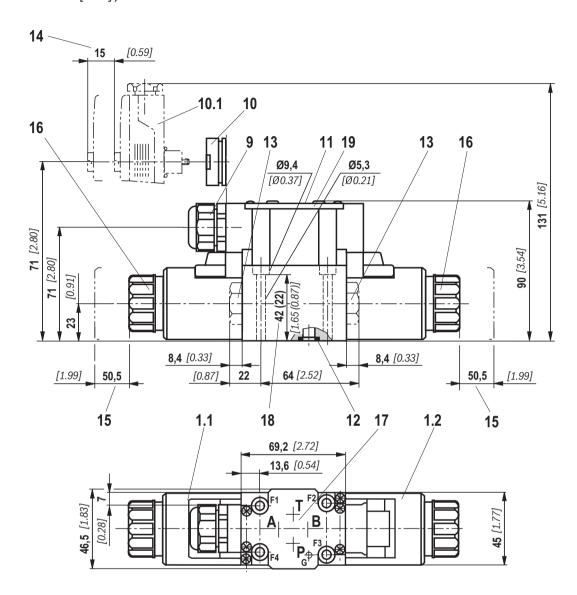
Dimensions: Valve with DC solenoid – **Individual connection** (dimensions in mm [inch])

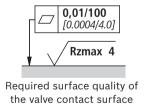


Dimensions for manual overrides see page 15. **Item explanations, valve mounting screws** and **subplates** see page 18.



Dimensions: Valve with DC solenoid – **Central connection** (dimensions in mm [inch])





Terminal assignment with central connection:

▶ 1 solenoid:

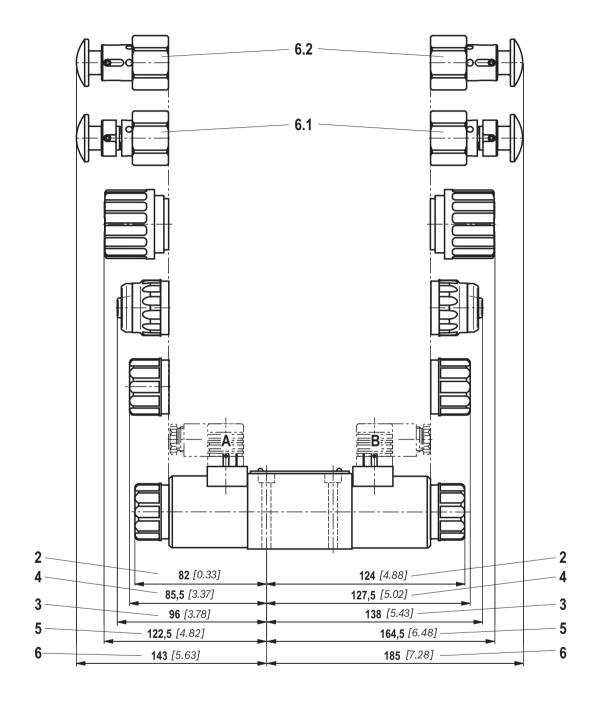
Always connect the solenoid to terminals 1 and 2, the protective earthing connector to terminal \bigoplus PE

▶ 2 solenoids:

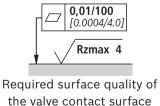
Always connect solenoid "a" to terminals 1 and 2, solenoid "b" to terminals 3 and 4, the protective earthing conductor to terminal \bigoplus PE

Dimensions for manual overrides see page 15. **Item explanations, valve mounting screws** and **subplates** see page 18.

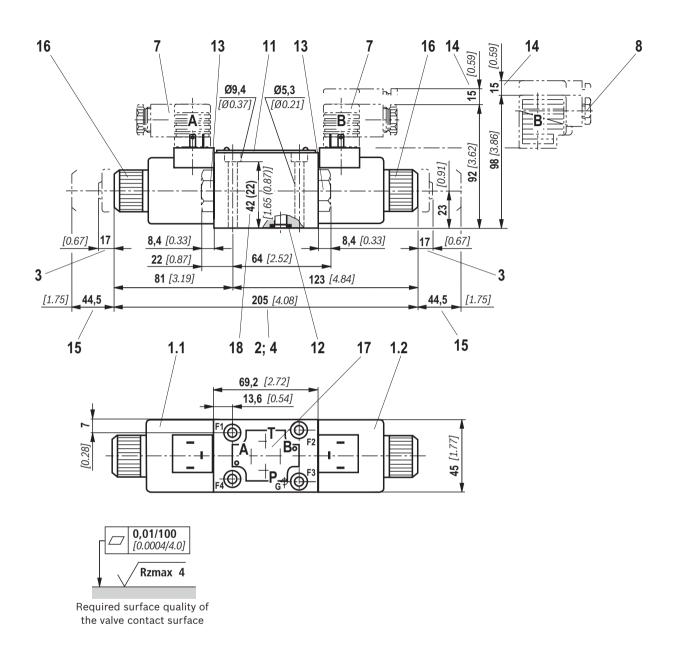
Dimensions: Valve with DC solenoid – Manual overrides (dimensions in mm [inch])



Item explanations, valve mounting screws and subplates see page 18.

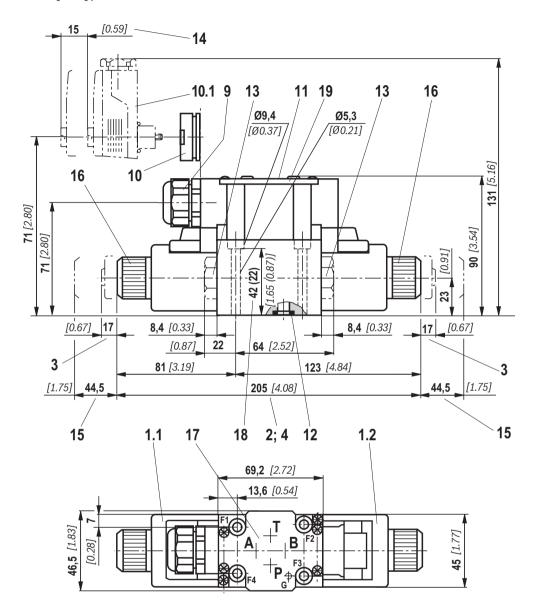


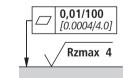
Dimensions: Valve with AC solenoid – **Individual connection** (dimensions in mm [inch])



Item explanations, valve mounting screws and subplates see page 18.

Dimensions: Valve with AC solenoid – **Central connection** (dimensions in mm [inch])





Required surface quality of the valve contact surface

Terminal assignment with central connection:

▶ 1 solenoid:

Always connect the solenoid to terminals 1 and 2, the protective earthing connector to terminal \bigoplus PE

▶ 2 solenoids:

Always connect solenoid "a" to terminals 1 and 2, solenoid "b" to terminals 3 and 4, the protective earthing to terminal (PE

Item explanations, valve mounting screws and subplates see page 18.

Dimensions

- 1.1 Solenoid "a"
- 1.2 Solenoid "b"
 - 2 Dimension for solenoid with concealed manual override "N9" (standard)
 - 3 Dimension for solenoid with manual override "N"
 - 4 Dimension for solenoid without manual override
 - 5 Dimension for solenoid with manual override "N7"
- 6 Dimension for solenoid with manual override "N5" and "N6"
- 6.1 Manual override "N5"
- 6.2 Manual override "N6"
- 7.1 Mating connector without circuitry for connector "K4" (separate order, see page 4 and data sheet 08006)
- 7.2 Mating connector (AMP Junior Timer) with connector "C4" (separate order, see data sheet 08006)
- 7.3 Mating connector DT 04-2PA (Deutsch plug) with connector "K40" (separate order, see data sheet 08006)
- 7.4 Mating connector angled with M12x1 plug-in connection with status LED "K72L" (separate order, see data sheet 08006)
 - 8 Mating connector **with** circuitry for connector "K4" (separate order, see page 4 and data sheet 08006)
 - 9 Cable gland Pg 16 [1/2" NPT] "DL"
- 10 Central plug-in connection "DKL"
- **10.1** Angled socket (red, separate order) Material no. **R900005538**)
 - 11 Name plate
 - 12 Identical seal rings for ports A, B, P, T

 Notice! The ports are clearly determined according to their tasks and must not be arbitrarily interchanged or closed
 - 13 Plug screw for valves with one solenoid
 - 14 Space required to remove the mating connector/ angled socket
 - 15 Space required to remove the coil
 - **16** Mounting nut, tightening torque $M_A = 4^{+1} \text{ Nm} [2.95^{+0.74} \text{ ft-lbs}]$
 - 17 Porting pattern according to DIN 24340 form A (without locating hole), or ISO 4401-03-02-0-05 and NFPA T3.5.1 R2-2002 D03 (with locating hole for locking pin ISO 8752-3x8-St, material no. R90005694, separate order)
 - **18** Alternative clamping length (): 22 mm [0.87 inch]
 - 19 Cover

Attention!

The valve may only be operated with properly mounted cover.

Subplates according to data sheet 45052

(separate order)

(without locating hole) G 341/01 (G1/4) G 342/01 (G3/8) G 502/01 (G1/2) (with locating hole) G 341/60 (G1/4) G 342/60 (G3/8) G 502/60 (G1/2) G 341/12 (SAE-6) 1) G 342/12 (SAE-8) 1

1) Upon request

Valve mounting screws (separate order)

► Clamping length 42 mm:

4 metric hexagon socket head cap screws ISO 4762 - M5 x 50 - 10.9-flZn-240h-L

(friction coefficient $\mu_{\text{total}} = 0.09 \text{ to } 0.14$); tightening torque $M_A = 7 \text{ Nm } [5.2 \text{ ft-lbs}] \pm 10\%$, material no. **R913000064**

or

4 hexagon socket head cap screws ISO 4762 - M5 x 50 - 10.9 2)

(friction coefficient μ_{total} = 0.12 to 0.17); tightening torque \textit{M}_{A} = 8.1 Nm [6 ft-lbs] ± 10%

4 hexagon socket head cap screws UNC 10-24 UNC x 2" ASTM-A574

G 502/12 (SAE-10) 1)

(friction coefficient μ_{total} = 0.19 bis 0.24); tightening torque \textit{M}_{A} = 11 Nm [8.2 ft-lbs] ± 15%, (friction coefficient μ_{total} = 0.12 to 0.17); tightening torque \textit{M}_{A} = 8 Nm [5.9 ft-lbs] ± 10%, material no. **R978800693**

► Clamping length 22 mm:

4 metric hexagon socket head cap screws ISO 4762 - M5 x 30 - 10.9-flZn-240h-L

(friction coefficient μ_{total} = 0.09 to 0.14); tightening torque \emph{M}_{A} = 7 Nm [5.2 ft-lbs] ± 10%, material no. **R913000316**

or

4 hexagon socket head cap screws ISO 4762 - M5 x 30 - 10.9 2)

(friction coefficient μ_{total} = 0.12 to 0.17); tightening torque $\textbf{\textit{M}}_A$ = 8.1 Nm [6 ft-lbs] ± 10%

4 hexagon socket head cap screws UNC 10-24 UNC x 1 1/4"

(friction coefficient μ_{total} = 0.19 to 0.24); tightening torque \textit{M}_{A} = 11 Nm [8.2 ft-lbs] ± 15%, (friction coefficient μ_{total} = 0.12 to 0.17); tightening torque \textit{M}_{A} = 8 Nm [5.9 ft-lbs] ± 10%, material no. **R978802879**

 $^{2)}$ Not included in the Rexroth delivery range

Data sheet 45052

Circuit breakers with tripping characteristic "K"

according to EN 60898-1 (VDE 0641-11), EN 60947-2 (VDE 0660-101), IEC 60898 and IEC 60947-2

AC solenoid	Lower rated current	Upper rated current	AC solenoid	Lower rated current	Upper rated current
	<i>I</i> ₁ in A	I ₂ in A		<i>I</i> ₁ in A	I ₂ in A
50 Hz			50 Hz		
W24	2.30	3.60	W24	1.73	2.40
W42	1.45	1.92	W42	1.13	1.92
W48	1.15	1.92	W48	1.09	1.92
W100	0.64	0.90	W100	0.58	0.90
W110	0.60	0.90	W110	0.52	0.90
W115	0.52	0.90	W115	0.43	0.90
W127	0.48	0.60	W127	0.37	0.60
W200	0.33	0.60	W200	0.30	0.60
W220	0.31	0.60	W220	0.26	0.36
W230	0.26	0.36	W230	0.20	0.36
W240	0.26	0.36	W240	0.22	0.36

More information

► Subplates

► Inductive position switch and proximity sensors (contactless)	Data sheet 24830
Smoothly switching version	Data sheet 23183
► Mineral oil-based hydraulic fluids	Data sheet 90220
► Reliability characteristics according to EN ISO 13849	Data sheet 08012
► General product information on hydraulic products	Data sheet 07008
▶ Installation, commissioning and maintenance of industrial valves	Data sheet 07300
► Hydraulic valves for industrial applications	Data sheet 07600-B
► Selection of the filters	www.boschrexroth.com/filter

Notes

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Directional spool valves, direct operated, with solenoid actuation

RE 23340

Edition: 2015-07 Replaces: 2013-06

Type WE



(€

Maximum operating pressure 350 bar [5076 psi]

Maximum flow 160 I/min [42.3 US gpm]

Features

- ▶ 4/3-, 4/2- or 3/2-way version
- ► Porting pattern according to ISO 4401-05-04-0-05 and NFPA T3.5.1 R2-2002 D05
- ► High-power solenoid, optionally rotatable by 90°
- ▶ Electrical connection as individual or central connection
- ► Cartridge optionally equipped with PWM connector (fast switching amplifier, energy reduction)
- ► Manual override, optional
- ► CE conformity according to the Low Voltage Directive 2006/95/EC for electrical voltages >50 VAC or > 75 VDC
- ▶ Solenoid coil with UR approval UL 429
- ▶ Approval according to CSA C22.2 No. 139-10, optional

Contents

Size 10

Component series 5X

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Ordering codes

01	02	03	04	05		06	07	08	09	10	11		12	13	14	15	16	17		
	WE	10		5X	/		E					/						*]	
						•	•												_	
01	3 main	ports																		3
	4 main	ports																		4
02	Direction	onal va	llve																	WE
03	Size 10	ı																		10
04	Symbol	s e. g.	C, E,	EA, EE	3, etc	; poss	ible ve	rsion	see pa	ge 4 a	nd 5									e. g. C
05	Compo	nent s	eries	50 to 5	59 (50) to 59	9: Uncl	nanged	d insta	llation	and o	connec	tion d	imens	ions)					5X
06	With sp	oring r	eturn																	no code
	With re	inforc	ed co	mpres	sion s	pring	(for q	uick sv	vitchir	ng off)										D
	Withou	ı t sprir	ng ret	urn																0
	Withou	ı t sprir	ng ret	urn wit	th det	tent														OF
07	High-po	wer w	/et-pir	n solen	oid w	/ith de	tachal	ble coi	I											Е
08	Direct v	/oltage	2 12 V	'																G12
	Direct v	Direct voltage 24 V									G24									
	Direct \	Direct voltage 26 V									G26									
	Direct v	Direct voltage 48 V									G48									
	Direct v	oltage/	96 V	'																G96
	Direct v	oltage/	110	V																G110 1)
	Direct v	oltage/	125	V																G125
	Direct v	oltage/	180	V																G180
	Direct v	oltage/	205	V																G205
	Direct v	oltage/	220	V																G220
	Alterna	ting vo	oltage	100 V																W100R 1)
	Alterna	ting vo	ltage	110 V																W110R 1)
	Alterna	ting vo	ltage	120 V																W120R 1)
	Alterna	ting vo	ltage	200 V																W200R 1)
	Alterna	ting vo	ltage	230 V																W230R 1)
	Connec	tion to	ο AC ν	oltage/	mair	ıs via d	contro	l with	rectifi	er (see	e table	e belov	v and	page 2	20). 2)					
	Electric	al con	necti	ons an	d ava	ilable	voltag	es see	page	10										
09	Withou	t man	ual ov	erride																no code
	With co	onceal	ed ma	anual o	verri	de (sta	andard	1)												N9 ³⁾
	With co	onceal	ed ma	anual o	verri	de and	prote	ctive o	ap ⁵⁾											N8 ³⁾
	With lo	ckable	man	ual ove	erride	"mus	hroom	butto	n" (lar	ge)										N5 3; 4)

Corrosion resistance (outside)

With manual override "mushroom button" (large), not lockable

10	None (valve housing primed)	no code
	Improved corrosion protection (240 h salt spray test according to EN ISO 9227) (see also page 10)	J3

N6 3)

Electrical connection

Ordering code	Nominal voltage of the DC solenoid in case of operation with alternating voltage	AC voltage mains (admissible voltage tolerance ±10 %)
G96	96 V	100 V - 50/60 Hz
G96	96 V	110 V - 50/60 Hz
G180	180 V	200 V - 50/60 Hz
G205	205 V	230 V - 50/60 Hz

Ordering codes

	WF	10		5X	1		Е					1						*
01	02	03	04	05		06	07	80	09	10	11		12	13	14	15	16	17

Individual connection							
Without mating connector; connector according to DIN EN 175301-803	K4 6)						
Without mating connector; connector according to DIN EN 175301-803 (coil with potted-in connector base and sealing element to valve housing (IP67))							
Without mating connector, 4-pole with connector M12x1 according to IEC 60947-5-2, integrated interference protection circuit and status LED							
Without mating connector; connector AMP Junior-Timer							
Central connection							
Cable entry at the cover, with indicator light	DL						
Central plug-in connection at the cover, with indicator light (without mating connector); connector according to DIN EN 175201-804	DK6L						
Without mating connector; threaded connection 1/2"-14 NPT	DAL						
Cable gland at the cover, with indicator light and cable bridge at the ground connection	DJL						
Mini-change connector, 5-pole	DK25L						
Additional electrical connections and available voltages see page 10							

Switching time increase

12	12 Without switching time increase						
	With switching time increase (only with symbol ".73"; not for version "D" with reinforced compression spring; more	A12					
	information upon request)						

Without throttle insert										
With throttle insert 8; 9):										
Port		Throttle Ø in mm [inch]								
	0.8 [0.031]	1.0 [0.039]	1.2 [0.047]							
Р	= B08	= B10	= B12							
Α	= H08	= H10	= H12							
В	= R08	= R10	= R12							
A and B	= N08	= N10	= N12							
T 10)	= X08	= X10	= X12							

Control spool play

14	Standard	no code
	Minimum (to be selected in case of reduced leakage → higher level of oil cleanliness recommended)	T06
	Increased (to be selected in case of a hydraulic fluid/environment temperature difference >25 K → increased internal leakage)	T12

Seal material

15	NBR seals	М
	FKM seals	V
	Seals for HFC hydraulic fluids	МН
	Low-temperature version	MT
	Observe compatibility of seals with hydraulic fluid used!	

16	16 Approval according to CSA C22.2 No. 139-10								
	Porting pattern according to ANSI B93.9 (if solenoid "a" is energized, channel P is connected to A)	AN							
17	Further details in the plain text	*							

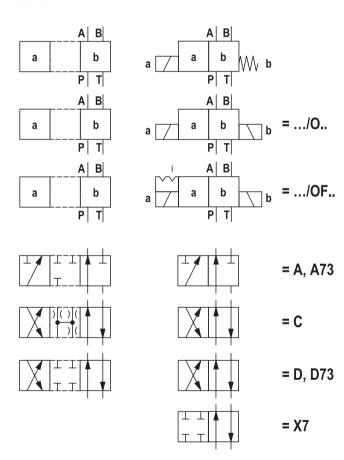
Explanation of the footnotes see page 4.

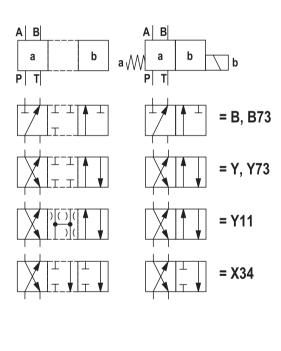
Ordering codes

- 1) Only for version "Central connection"
- 2) Only for version "Individual connection"
- 3) The manual override cannot be allocated a safety function. The manual override units may only be used up to a tank pressure of 50 bar.
- 4) With tank pressures above 50 bar, it cannot be guaranteed that the valve remains in the position switched by the "N5" manual override.
- 5) Protective cap must be removed prior to actuation.
- 6) Mating connectors, separate order, see page 20 and data sheet 08006.

- 7) Recommended for mobile applications; with additional sealing between solenoid coil and pole tube.
- 8) When the admissible valve performance limits are exceeded, throttle inserts are to be installed (for performance limits, see page 12 and 13).
- 9) Not with low-temperature version "MT".
- 10) If throttle inserts are used in channel T, the pressure in the working ports and for connection to the tank chambers must not exceed 210 bar.

Symbols

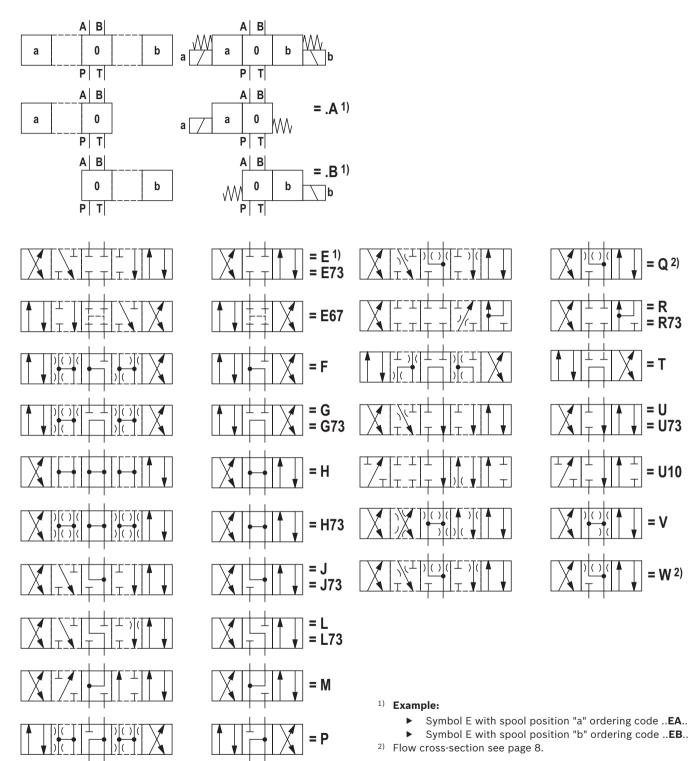




Motice:

Representation according to DIN ISO 1219-1. Hydraulic interim positions are shown by dashes.

Symbols



Notices!

- ► Representation according to DIN ISO 1219-1. Hydraulic interim positions are shown by dashes.
- ▶ Other symbols upon request.

Function, section

The directional valve type WE is a solenoid-actuated directional spool valve that can be used as electro-magnetic component. It controls the start, stop and direction of a flow.

The directional valve basically consists of housing (1), one or two electronic solenoids (2), the control spool (3), and the return springs (4).

In the de-energized condition, the control spool (3) is held in the central position or in the initial position by the return springs (4) (except for version "O").

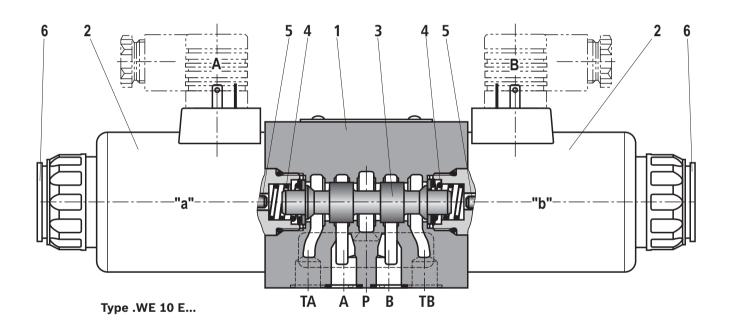
If the wet-pin electronic solenoid (2) is energized, the control spool (3) moves out of its rest position into the required end position. In this way, the required direction of flow according to the selected symbol is released.

After the electronic solenoid (2) has been switched off, the control spool (3) is pushed back into its central position or into its initial position (except for valves with "OF" detent and valves without type "O" spring).

A manual override (6) allows for the manual switching of the valve without solenoid energization.

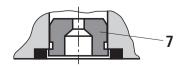
To ensure proper functioning, make sure that the pressure chamber of the solenoid is filled with oil.

More functions see page 7.



Throttle insert "B.."

Using a throttle insert (7) in channels P, A, B or T, the flow resistance at the valve can be increased. Its use is required when, due to prevailing operating conditions, flows occur during the switching processes, which exceed the performance limit of the valve.



Function, section

Without spring return "O" (only possible with symbols A, C and D)

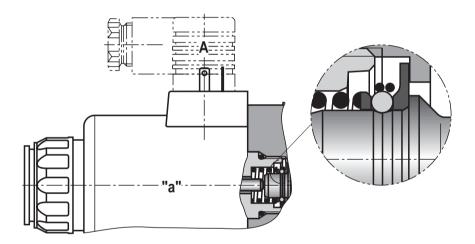
This version is a directional valve with 2 spool positions and 2 electronic solenoids **without** detent. The valve without spring return at the control spool (3) has no defined basic position in the de-energized condition.

Without spring return with "OF" detent (only possible with symbols A, C and D)

This version is a directional valve with 2 spool positions and 2 electronic solenoids **with** detent. The detents are used to fix the control spool (3) in the relevant spool position. During operation, continuous application of current to the electronic solenoid can thus be omitted which contributes to energy-efficient operation.

Motice:

Pressure peaks in the tank line to two or several valves can result in unintended movement of the control spool in the case of valves with detent! We therefore recommend that separate return lines be provided or a check valve installed in the tank line.



Type .WE 10 ../OF...

(For application outside these parameters, please consult us!)

general										
Weight			Individual connection	Central connection						
	- Valve with one solenoid	kg [lbs]	3.9 [8.6]	4.0 [8.8]						
	- Valve with two solenoids	kg [lbs]	5.5 [12.1]	5.6 [12.3]						
Installation position	1	Any 1)								
Ambient tempera- ture range	- Standard version		7 -20 +70 [-4 +158] (NBR seals) -15 +70 [+5 +158] (FKM seals)							
	– Version for HFC hydraulic fluid	°C [°F]	-20 +50 [-4 +122]							
	– Low-temperature version ²⁾	-40 +50 [-40 +122]								
Storage temperatur	e range	-20 +50 [-4 +122]								
MTTF _d values accor	ding to EN ISO 13849	300 (for further details see data sheet 08012)								

hydraulic		_				
Maximum operating pressure 2)	– Ports A, B, P	bar [psi]	350 [5076]			
	– Port T	bar [psi]	210 [3050] Tank pressure (standard)			
			With symbols A and B, port T must be used as leakage oil connection if the operating pressure exceeds the maximum admissi-			
			ble tank pressure.			
Maximum flow		l/min [US gpm]	160 [42.3]			
Flow cross-section	- Symbol Q	mm²	Approx. 6 % of nominal cross-section			
(spool position 0)	– Symbol W	mm²	Approx. 3 % of nominal cross-section			
Hydraulic fluid			See table below			
Hydraulic fluid temperature rang	ge	°C [°F]	-20 +80 [-4 +176] (NBR seals)			
(at the valve working ports)			-15 +80 [+5 +176] (FKM seals)			
			-20 +50 [-4 +122] (HFC hydraulic fluid)			
			-40 +50 [-40 +122] (low-temperature version)			
Viscosity range		2.8 500 [35 2320]				
Maximum admissible degree of fluid - cleanliness class according		Class 20/18/15 ³⁾				

Hydraulic fluid		Classification	Suitable sealing materials	Standards	Data sheet
Mineral oils		HL, HLP, HLPD, HVLP, HVLPD	NBR, FKM	DIN 51524	90220
Bio-degradable	▶ insoluble in water	HETG	NBR, FKM	ISO 15380	90221
		HEES	FKM		
	► soluble in water	HEPG	FKM	ISO 15380	7
Flame-resistant	▶ water-free	HFDU, HFDR	FKM	ISO 12922	90222
	► containing water	HFC (Fuchs Hydrotherm 46M, Petrofer Ultra Safe 620)	NBR	ISO 12922	90223

Important information on hydraulic fluids:

- ► For more information and data on the use of other hydraulic fluids, please refer to the data sheets above or contact us!
- ▶ There may be limitations regarding the technical valve data (temperature, pressure range, life cycle, maintenance intervals, etc.)!
- ► The flash point of the hydraulic fluid used must be 40 K higher than the maximum solenoid surface temperature.

► Flame-resistant – containing water:

- Maximum pressure differential per control edge 50 bar
- Pressure pre-loading at the tank port >20 % of the pressure differential, otherwise increased cavitation
- Life cycle as compared to operation with mineral oil HL, HLP 50 to 100 %
- ▶ Bio-degradable and flame-resistant: When using hydraulic fluids that are simultaneously zinc-solving, zinc may accumulate (700 mg zinc per pole tube).
- 1) With suspended installation, higher sensitivity to contamination. Horizontal installation is recommended.
- 2) In case of use at low temperatures, see project planning information on page 20.
- 3) The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and at the same time increases the life cycle of the components.
 - Available filters can be found at www.boschrexroth.com/filter.

(For application outside these parameters, please consult us!)

electric									
Voltage type			Direct voltage	Alternating voltage					
Nominal voltage ac	0		12, 24, 26, 48, 96, 110, 125, 180, 205, 220 Possible with central tion or via rectifie						
Voltage tolerance (nominal vo	ltage)	%	±10					
Nominal power acc	cording to V	DE 0580	W	40 5)					
Duty cycle (ED)			%	100 (S1 according to VDE 0580)					
Switching time 6)	- ON	Pressure change 5 %	ms	60 104 ^{7; 8)}					
		Pressure change 95 %	ms	90 165 ^{7; 8)}					
	- OFF	Pressure change 5 %	ms	12 50	230 330				
		Pressure change 95 %	ms	48 104	250 360				
Switching time	- ON			45 60					
according to ISO 6403 ⁹⁾	- OFF			20 30	250 360				
Maximum switchin	g frequency	1	1/h	15000 7200					
Protection class ac	cording to	DIN EN 60529		See page 10					
Protection class ac	cording to	VDE 0580		See page 10					
Maximum surface	temperature	e of the coil ¹⁰⁾	°C [°F]	140 [284]					
Insulation class VD	E 0580			F					
Electrical protection	on		Every solenoid must be protected individually, using a suitable fuse with tripping characteristics K (inductive loads). The valve must be installed on a surface that is included in the equipoten tial bonding.						
Protective earthing	g conductor	and screening	See connector pin assignment (CE-compliant installation) page 18 and 19						
Conformity			CE according to Low-Voltage Directive 2006/95/EC tested according to DIN EN 60204-1 (VDE0113-1): 2010-05 and DIN VDE 0580: 2000-07						

- 4) Mating connectors with rectifier see page 20
 - ► Possible voltages see page 2
 - ► Rectifiers must comply with the relevant standards as well as the coil performance data!
 - With a central connection, the rectifier is on the board
- 5) Reduction of the nominal power by approx. 40 % if a 24 V-coil with connector switching amplifier type VT-SSBA1-PWM-1X/V002/5 is used (separate order, material no. R901290194, see page 20 and data sheet 30362)
- 6) Measured with flow, 80 % performance limit and horizontal installation position.
- 7) Not with symbols A, B and .73.
- 8) Reduction of the switching time by approx. 50 % if a 12 V-coil with connector switching amplifier type VT-SSBA1-PWM-1X/V001/5 is used (separate order, material no. R901265633, see page 20 and data sheet 30362)
- 9) Measured without flow
- ¹⁰⁾ Possible surface temperature > 50 °C, provide contact protection!

Motices:

- ▶ The solenoid coils must not be painted.
- ▶ Actuation of the manual override is only possible up to a tank pressure of approx. 50 bar [725 psi]. Avoid damage to the bore of the manual override! (Special tool for the operation, separate order, material no. **R900024943**). When the manual override is blocked, actuation of the opposite solenoid must be ruled out!
- ➤ The simultaneous actuation of 2 solenoids of one valve must be ruled out!
- ► Use cables that are approved for a working temperature above 105 °C [221 °F].
- ▶ Valves with individual connection and a supply voltage of 12 V or 24 V can be operated with twice the voltage for reducing the switching time. For this purpose, the voltage has to be reduced to the nominal valve voltage after 100 ms by means of pulse width modulation. The maximum admissible switching frequency is 3 1/s.
- ▶ Due to possible overload of the board, valves with central connection must not be operated with twice the voltage.
- ► If the standard environmental conditions according to VDE 0580 cannot be provided, the valve must be especially protected!

(For application outside these parameters, please consult us!)

Electrical connections and available voltages

		Ordering codes									class accord- EN 60529 ¹¹⁾	ass accord- E 0580							
			Direct voltage Alternating voltage										age	n cla	n cla				
	Connector ordering codes		G12	G24	G26	G48	965	G110	G125	G180	G205	G220	W100R	W110R	W120R	W200R	W230R	Protection ing to DIN	Protection clas ing to VDE
	Without mating connector, individual connection; connector according to	K4	1	1	-	1	1	-	1	1	1	√ 13)	-	-	-	-	-	IP65	I
nectio	DIN EN 175301-803	K4K ¹²⁾	13)	/ 13)	/ 13)	-	-	-	-	-	-	-	-	-	-	-	-	IP65, IP67	I
Individual connection	Without mating connector, 4-pole with connector M12x1 according to IEC 60947-5-2, integrated interference protection circuit and status LED	K72L	-	13)	-	-	-	-	-	-	-	-	-	-	-	-	-	IP65	15)
드	Without mating connector; connector AMP Junior-Timer	C4Z	-	-	/ 13)	-	-	-	-	-	-	-	-	-	-	-	-	IP66	¹⁵⁾
	Without mating connector; threaded connection 1/2"-14 NPT	DAL	1	1	-	-	1	-	-	-	1	1	1	1	1	1	1	IP65	I
Central connection	Central plug-in connection at the cover, with indicator light (without mating connec- tor) with connector according to DIN EN 175201-804	DK6L ¹⁷⁾	1	1	_	-	1	1	-	-	1	1	1	1	1	1	1	IP65	I
	Cable gland at the cover, with indicator light (terminal area 6 12 mm [0.23 0.47 inch])	DL ¹⁴⁾	1	1	-	-	1	1	-	-	1	1	1	1	1	1	1	IP65	I
	Cable gland at the cover, with indicator light and cable bridge at the ground connection	DJL ¹⁴⁾	-	1	_	-	-	1	_	_	_	-	1	1	-	1	1	IP65	I
	Mini-change connector, 5-pole according to ANSI/B93.55M-1981	DK25L ¹⁷⁾	-	1	-	-	1	-	-	-	-	_	1	1	1	1	1	IP65	I

- 11) Only with correctly mounted valve with a mating connector suitable for the protection class.
- 12) Recommended for mobile applications; with additional sealing between solenoid coil and pole tube.
- 13) Solenoid coils without "Recognized component" according to UL 429
- ¹⁴⁾ Possible with version "J3".
- 15) With protection class III, a protective extra-low voltage with isolation transformer (PELV, SELV) is to be provided.
- 16) Only with professionally designed connection with appropriate sealing to the central connection.
- $^{17)}$ Connector pin assignment see page 19

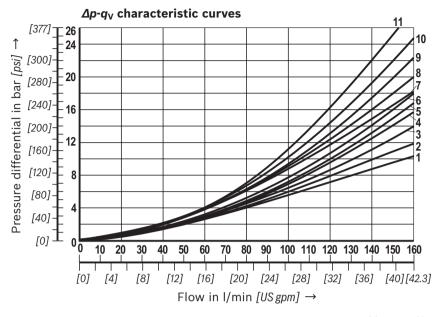
When establishing the electrical connection, the protective earthing conductor (PE $\frac{1}{2}$) has to be connected correctly.

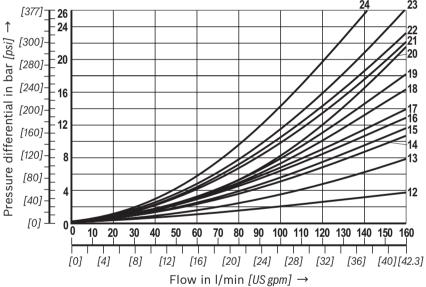


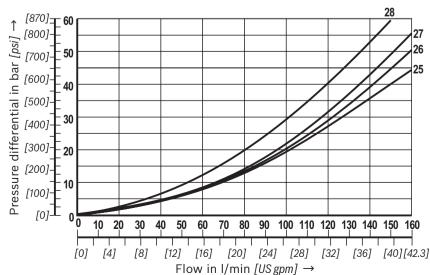
- ► The plug-in connectors used are not intended to be plugged in or disconnected during normal operation under load.
- ► Operation of the valves only admissible with appropriate and locked mating connector.

Characteristic curves

(measured with HLP46, ϑ_{oil} = 40 ± 5 °C [104 ± 9 °F])







	Direction of flow									
Symbol	P – A	P – B	A – T	B - T						
A; B	6	6	-	_						
A73, B73	23	23	-	_						
С	1	2	5	7						
D	2	2	5	7						
D73	25	26	26	27						
E	17	16	19	21						
E67	4	4	11	24						
E73	17	18	21	21						
F	2	3	22	23						
G	4	4	24	24						
G73	18	18	24	24						
Н	14	14	20	21						
H73	14	14	6	9						
J	3	3	9	11						
J73	22	21	23	24						
L	3	3	9	9						
L73	22	10	11	24						
М	14	14	6	8						
P	17	14	20	23						
Q	16	17	4	8						
R	18	21	18	24						
R73	24	24	23	24						
T	18	4	10	24						
U	3	3	6	11						
U10		Upon r	equest							
U73	22	22	23	24						
V	17	17	18	20						
W		Upon r	equest							
X7	Upon request									
X34	Upon request									
Υ	17	16	18	21						
Y11	3	2	4	9						
Y73	26	26	26	28						

Central position:

	Direction of flow				
Symbol	P – A	P - B	B - T	A - T	P - T
Н	12	12	13	13	15

(measured with HLP46, ϑ_{oil} = 40 ± 5 °C [104 ± 9 °F])

Motice:

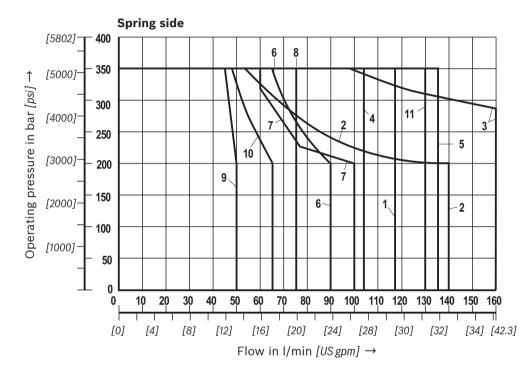
The specified performance limits are valid for operation with two directions of flow (e. g. from P to A and simultaneous return flow from B to T).

Due to the flow forces acting within the valves, the admissible performance limit may be considerably lower

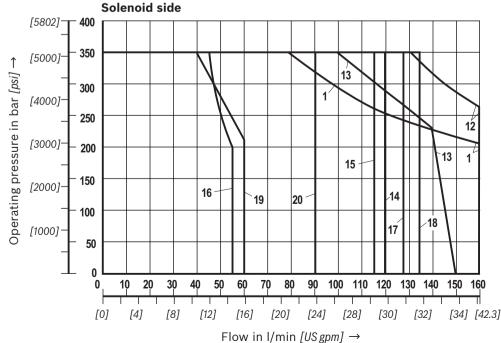
with only one direction of flow (e. g. from P to A while port B is blocked)!

In such cases of application, please consult us!

The performance limits were determined when the solenoids were at operating temperature, at 10 % undervoltage and without tank preloading.



Characteristic curve	Symbol
1	L
2	А
3	В
4	Υ
5	E73, Q
6	F
7	G73
8	M; V
9	Р
10	A73
11	H73



Characteristic curve	Symbol	
1	L	
12	A/O	
13	J	
14	Н	
15	D73	
16	B73	
17	Y11	
18	C; D; E73	
19	E67	
20	G	

(measured with HLP46, ϑ_{oil} = 40 ± 5 °C [104 ± 9 °F])

Motice:

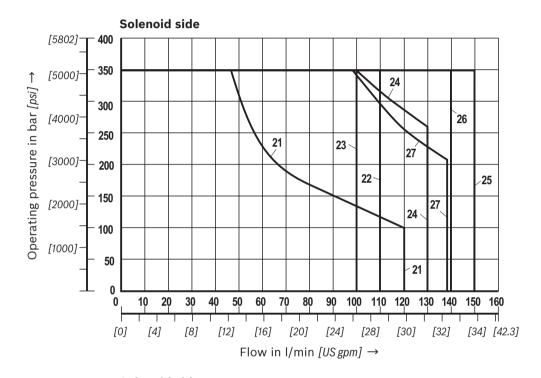
The specified performance limits are valid for operation with two directions of flow (e. g. from P to A and simultaneous return flow from B to T).

Due to the flow forces acting within the valves, the admissible performance limit may be considerably lower

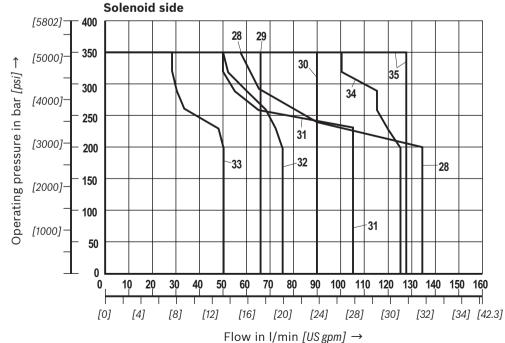
with only one direction of flow (e. g. from P to A while port B is blocked)!

In such cases of application, please consult us!

The performance limits were determined when the solenoids were at operating temperature, at 10 % undervoltage and without tank preloading.

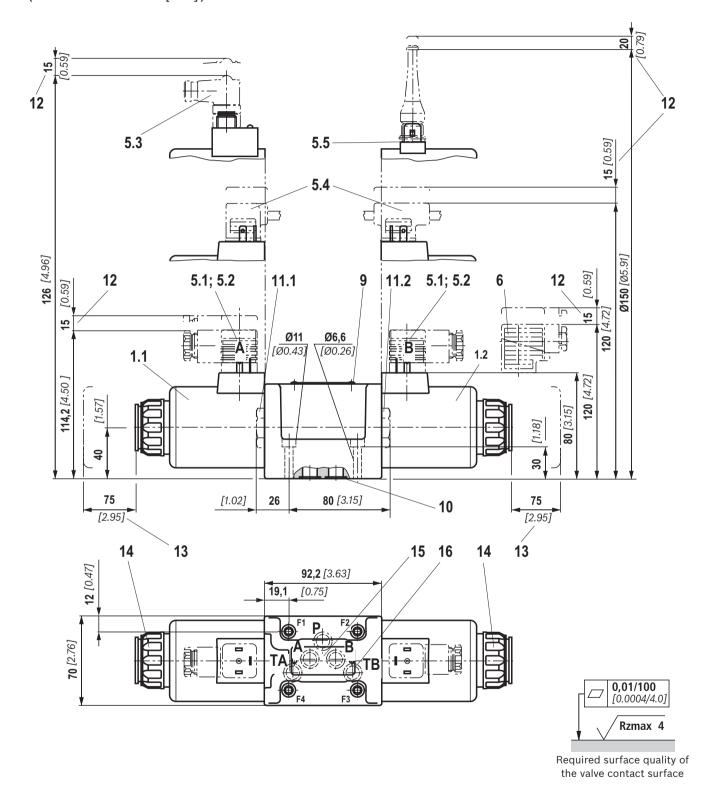


Symbol
A; B
G73
F; L73
E
C/O; D/O
J73
U



Characteristic curve	Symbol
28	Q
29	V
30	Р
31	R
32	R73
33	Т
34	U73
35	Y73

Dimensions: Individual connection (dimensions in mm [inch])

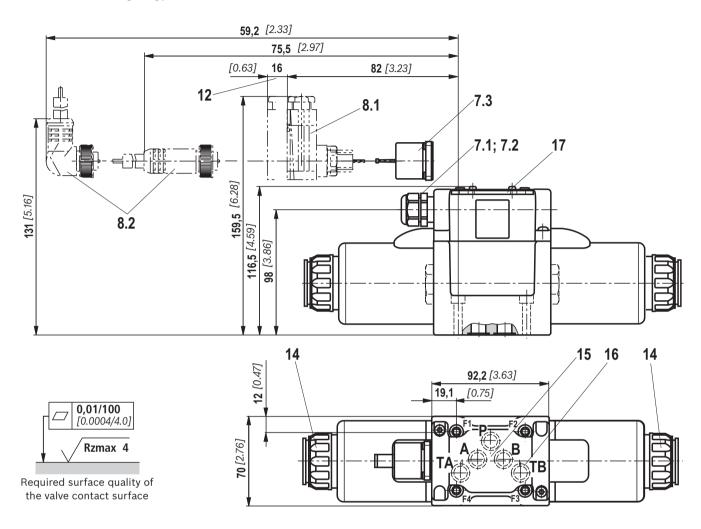


Notices:

- ▶ Deviating from ISO 4401, port T is called TA and port T1 is called TB in this data sheet.
- ▶ The dimensions are nominal dimensions which are subject to tolerances.

Dimensions for manual overrides see page 16. **Item explanations, valve mounting screws** and **subplates** see page 17.

Dimensions: Central connection (dimensions in mm [inch])



Special points with version "DAL" and "DL"

- Version "DL" is only suitable for permanently installed cables. Lines must be routed in a pullrelieved manner.
- ▶ Minimum line cross-section 0.75 mm² (AWG 18)
- ▶ With a maximum line cross-section of 1.50 mm² (AWG 16) and if wire end ferrules are used, wire end ferrules without flange must be crimped to a maximum cross-section of 1.5 mm x 2 mm (trapezoidal crimp) using an appropriate tool (e. g. "PZ 6/5", co. Weidmüller) to ensure that they fit into the printed circuit board terminals.
- ▶ Before crimping, the wires have to be stripped to 9^{-1} mm $[0.35^{-0.039} inch]$.
- ► For the corresponding line cross-section ¹⁾, wire end ferrules without flange (according to DIN 46228-1) with a length of 8 mm [0.31 inch] are to be used.
- ► For the earthing connection, ring cable lugs according to DIN 46234-4-1 are to be used, tightening torque *M*_A = 1.75 Nm [1.29 ft-lbs] ±10 %

Notice:

The dimensions are nominal dimensions which are subject to tolerances.

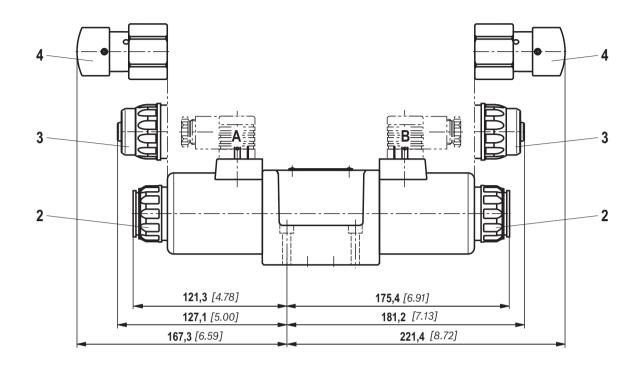
Dimensions for manual overrides see page 16. Item explanations, valve mounting screws and subplates see page 17.

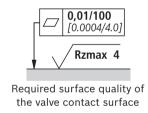
1) 0.75 mm² (AWG 20)
 1.00 mm² (AWG 18)
 1.50 mm² (AWG 16)

Motice:

The lines must be finely stranded.

Dimensions: Manual overrides (dimensions in mm [inch])





- 2 Version without and with concealed manual override "N9" (standard)
- **3** Version **with** concealed manual override and protective cap **"N8"**. (The protective cap must be removed prior to actuation.)
- 4 Version with manual override "N5" and "N6"

Item explanations, valve mounting screws and subplates see page 17.

Notice:

The dimensions are nominal dimensions which are subject to tolerances.

Dimensions

- 1.1 Solenoid "a"
- 1.2 Solenoid "b"
- 2 Version without and with concealed manual override "N9" (standard)
- 3 Version with concealed manual override and protective cap "N8". (The protective cap must be removed prior to actuation.)
- 4 Version with manual override "N5" and "N6"
- **5.1** Mating connector **without** circuitry for connector "K4" (separate order, see page 20 and data sheet 08006)
- **5.2** Mating connector **without** circuitry for connector "K4K" (separate order, see data sheet 08006)
- 5.3 Mating connector angled with M12x1 plug-in connection and status LED for connector "K72L" (separate order, see data sheet 08006)
- **5.4** Double mating connector **without/with** circuitry for connector "K4" (separate order, see data sheet 08006)
- **5.5** Mating connector (AMP Junior Timer) for connector "C4Z" (separate order, see data sheet 08006)
 - **6** Mating connector **with** circuitry for connector "K4" (separate order, see page 20 and data sheet 08006)
- 7.1 Cable gland Pg 16 "DL" (terminal area 6 ... 12 mm [0.24 ... 0.47 inch]); lock nut, tightening torqueM_A = 3.3 Nm [2.43 ft-lbs] ±10 %
- 7.2 Central connection box "DAL" 1/2" NPT, tightening torque $M_A = 5 \text{ Nm } [3.69 \text{ ft-lbs}] \pm 10 \text{ %}$; sealing by sealant
- 7.3 Connector "DK6L" and "DK25L"
- **8.1** Mating connector for connector "DK6L" (separate order, material no. **R900002803**, see data sheet 08006)
- **8.2** Mini-change connector, 5-pole for connector "DK25L" (separate order, material no. **R900057631**)
 - 9 Name plate
- 10 Identical seal rings for ports A, B, P, TA, TB
- 11.1 Plug screw for valves with one solenoid on B side
- 11.2 Plug screw for valves with one solenoid on A side
 - 12 Space required to remove the mating connector/angled socket
 - 13 Space required to remove the coil
 - **14** Mounting nut, tightening torque $M_A = 14.5\pm1.5$ Nm [10.69±1.1 ft-lbs]
 - **15** Porting pattern according to ISO 4401-05-04-0-05 and NFPA T3.5.1 R2-2002 D05
 - 16 Connection TB can only be used in connection with separately produced bore.
 - 17 Cover

Notice: The valve may only be operated with properly mounted cover! Tightening torque of the cover screws $M_A = 1.0 \text{ Nm } [0.74 \text{ ft-lbs}] \pm 10 \text{ \%}.$ Prior to opening the frame, it must be ensured that the valve has no voltage!

Subplates according to data sheet 45054 (separate order) G 66/01 (G3/8) G 67/01 (G1/2) G 534/01 (G3/4) G 66/12 (SAE-6; 9/16-18) ¹⁾ G 67/12 (SAE-8; 3/4-16) ¹⁾ G 534/12 (SAE-12; 1-1/16-12) ¹⁾

1) Upon request

Valve mounting screws (separate order) 4 metric hexagon socket head cap screws ISO 4762 - M6 x 40 - 10.9-flZn-240h-L (friction coefficient $\mu_{\text{total}} = 0.09 \text{ to } 0.14$); tightening torque $M_A = 12.5 \text{ Nm } [9.2 \text{ ft-lbs}] \pm 10 \text{ %}$,

material no. **R913000058**

or

4 hexagon socket head cap screws ISO 4762 - M6 x 40 - 10.9 (self procurement) (friction coefficient μ_{total} = 0.12 to 0.17); tightening torque M_{A} = 15.5 Nm [11.4 ft-lbs] ±10 %

4 UNC hexagon socket head cap screws 1/4-20 UNC x 1-1/2" ASTM-A574

(friction coefficient) μ_{total} = 0.19 to 0.24); tightening torque M_{A} = 25 Nm [18.4 ft-lbs] ±15 %, (friction coefficient μ_{total} = 0.12 to 0.17); tightening torque M_{A} = 19 Nm [14.0 ft-lbs] ±10 %, material no. **R978800710**

With different friction coefficients, the tightening torques are to be adjusted accordingly!

Over-current fuse and switch-off voltage peaks

Maximum admissible overvoltages according to DIN EN 60664-1:2008-01 (VDE 0110-1) (overvoltage category II):

Electrical connection 1)	Nominal voltage in V	Rated current in A	Maximum admissible switch-off overvoltage in V ²⁾
K4, K4K, DAL, D6KL, DL	12	3.72	500
K4, K4K, K72L, DAL, D6KL, DL, DJL, DK25L	24	1.74	500
K4, C4Z	26	1.70	500
K4	48	0.57	500
K4, DAL, D6KL, DL, DK25L	96	0.47	500
D6KL, DL, DJL	110	0.41	500
K4	125	0.22	500
K4, C4Z	180	0.28	500
K4, DAL, D6KL, DL	205	0.22	500
K4, DAL, D6KL, DL	220	0.21	500

¹⁾ Interference protection circuit integrated



When solenoid coils are switched off, voltage peaks result which may cause faults or damage in the connected control electronics. We therefore recommend limiting them to $2\,x$ nominal voltage by means of an interference protection circuit. It must be noted that a diode switched in an antiparallel form extends the switching off time.

Electrical connections, assignment – individual connection

Electrical connections and coil connection combinations

Connector ordering codes		Top view	Circuit diagram	Pin	Connections, assignment
Connector, 3-pole (2+PE) according to DIN EN 175301-803 (IP65)	K4, K4K ³⁾	4)		1 2	Solenoid coil, polarity- independent
				(1)	Earthing
Connector 4-pole according to IEC 60947-5-2, M12x1 with suppres-	K72L		+ + + + + + + + + + + + + + + + + + + +	1	Internal bridge
sor diode, only 24 V DC, integrated		H H T		3	Solenoid coil GND
interference protection circuit and status LED			20 3	4	Solenoid coil 24 V DC supply voltage
				5	without function
2-pole connector, type AMP Junior- Timer, rotated by 90° relative to valve axis	C4Z			1	Solenoid coil, polarity- independent
			12	2	

³⁾ Coil with potted-in connector base and sealing element to valve housing (IP67)

²⁾ To be ensured by user circuitry

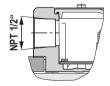
⁴⁾ M3, tightening torque maximum $M_{A \text{ max}} = 0.5 \text{ Nm} [0.37 \text{ ft-lbs}]$

Electrical connections, assignment – central connection

Electrical connections and coil connection combinations

Connector ordering codes		Top view	Circuit diagram	Pin	Connections, assignment
Cable gland at the cover, with indicator light (terminal area 6 12 mm [0.23 0.47 inch])	DL		Direct voltage (a) (a) (b) (b)	1+	Valve solenoid "a" ¹⁾
Cable gland at the cover, with indicator light and cable bridge at the ground connection (terminal area 6 12 mm [0.23 0.47 inch])	DJL	"b" 3+	(1+ 3+)	3+	Valve solenoid "b" ¹⁾
Without mating connector; threaded connection 1/2"-14 NPT (terminal area 6 12 mm [0.23 0.47 inch])	DAL ³⁾	"a" 1+	Alternating voltage	4-	Earthing
Central plug-in connection at the cover, with indicator light (without mating connector) with connector according to DIN EN 175201-804	DK6L		"a" PE 110 2 10 3 4 - 05 "b"	1 2 3 4 5 6	Valve solenoid "a" Valve solenoid "b" Not used Earthing
Mini-change connector, 5-pole according to ANSI/B93.55M-1981	DK25L		"a" 3 22 21 ("b")	1 5 2 4 3	Valve solenoid "a" Valve solenoid "b" Earthing

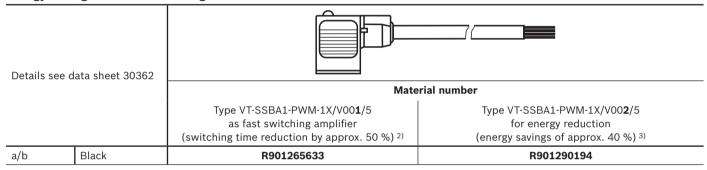
- 1) Core marking:
 - $+ \rightarrow red$
 - → blue
- ²⁾ Bridge only for version "DJL"
- 3) Cable gland with NPT thread



Mating connectors according to DIN EN 175301-803

For details a mating conn data sheet 0	ectors,	-						
	side			Material no.				
				\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\	With +: 6:	With indicator light and		
Port	Valve	Color	Without circuitry	With indicator light 12 240 V	With rectifier 12 240 V	Zener diode suppression circuit 24 V		
M10 1 F	а	Gray	R901017010	-	-	-		
M16 x 1.5	a/b	Black	R901017011	R901017022	R901017025	R901017026		
1/2" NPT	a	Red/brown	R900004823	-	-	-		
(Pg16)	a/b	Black	R900011039	R900057453	R900842566	-		

Energy savings and fast switching 1)



- Only with symbols C, D, E, E67, J, J2, Y and Y11; not for version "D" with reinforced compression spring
- $^{2)}\,\,$ Only available for "G12" and "K4/K4K" version
- 3) Only available for "G24" and "K4/K4K" version

Cartridge with PWM connector according to data sheet 30362:

- ▶ Depending on the control spool, increasing the performance limit is possible.
- ► With version "G24" (energy saving), the coil temperature is reduced by ≥ 30 °C for 100 % duty cycle.

Project planning information

Temperature range and maximum operating pressure in case of use at low temperatures

Port	Pressure	Temperature range in °C [°F]
– P, A, B, T	Static 100 bar [1450 psi]	-4035 [-4031]
– P, A, B	Dynamic from 100 bar [1450 psi] to 350 bar [5076 psi] in linear form as a function of the temperature	-3530 <i>[-3122]</i>
– T	Dynamic from 100 bar [1450 psi] to 210 bar [3050 psi] in linear form as a function of the temperature	-3530 <i>[-3122]</i>
– P, A, B, T	Maximum operating pressure	-30 +50 [-22 122]

Additional information

► Subplates	Data sheet 45054
► Hydraulic fluids on mineral oil basis	Data sheet 90220
► Environmentally compatible hydraulic fluids	Data sheet 90221
► Flame-resistant, water-free hydraulic fluids	Data sheet 90222
Connector switching amplifier type VT-SSBA1	Data sheet 30362
▶ Directional spool and seat valves with electrical actuation and M12x1 plug-in connection	Data sheet 08010
► Reliability characteristics according to EN ISO 13849	Data sheet 08012
► Hydraulic valves for industrial applications	Data sheet 07600-B
► CE declaration of conformity according to Low-voltage Directive 2006/95/EC	Upon request
► Selection of filters	www.boschrexroth.com/filter
► Information on available spare parts	www.boschrexroth.com/spc

Notes

Bosch Rexroth AG Hydraulics Zum Eisengießer 1 97816 Lohr am Main, Germany Phone +49 (0) 93 52/18-0 documentation@boschrexroth.de www.boschrexroth.de © This document, as well as the data, specifications and other information set forth in it, are the exclusive property of Bosch Rexroth AG. It may not be reproduced or given to third parties without its consent.

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Notes

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Notes		

4/2 and 4/3 proportional directional valves, direct operated, with electrical position feedback, without/with integrated electronics (OBE)

RE 29061/11.12 1/22 Replaces: 05.12

Type 4WRE and 4WREE

Size 6 and 10 Component series 2X

Maximum operating pressure 315 bar Maximum flow: 80 l/min (size 6)

180 l/min (size 10)

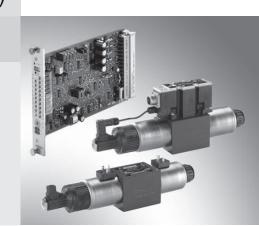


Table of contents

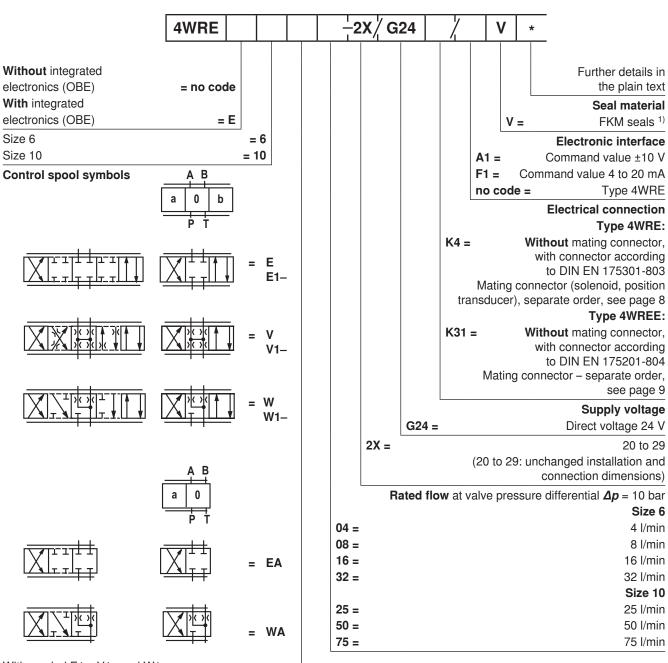
Contents Page Features 1 Ordering code 2 3 Symbols 4, 5 Function, section Technical data 6, 7 Electrical connection, mating connectors 8,9 Block diagram of the integrated electronics (OBE) for type 4WREE 10 Characteristic curves 11 to 17 Unit dimensions 18 to 22

Features

- Direct operated proportional directional valve with electrical position feedback and integrated electronics (OBE) with type 4WREE
- Control of flow direction and size
- Operation by means of proportional solenoids with central thread and detachable coil
- For subplate mounting: Porting pattern according to ISO 4401
- Spring-centered control spool
- Control electronics
 - Type 4WREE:
 - integrated electronics (OBE) with voltage or current input (A1 and/or F1)
 - Type 4WRE (4/3 version), separate order:
 - digital and analog amplifier in Euro-card format
 - analog amplifier in modular design
 - Type 4WRE...A (4/2 version), separate order:
 - analog amplifier in modular design

Information on available spare parts: www.boschrexroth.com/spc

Ordering code



With symbol E1-, V1- and W1-:

 $\begin{array}{ll} \mathsf{P} \to \mathsf{A} \colon \boldsymbol{q}_{\mathsf{V} \, \mathsf{max}} & \mathsf{B} \to \mathsf{T} \colon \boldsymbol{q}_{\mathsf{V}} / 2 \\ \mathsf{P} \to \mathsf{B} \colon \boldsymbol{q}_{\mathsf{V}} / 2 & \mathsf{A} \to \mathsf{T} \colon \boldsymbol{q}_{\mathsf{V} \, \mathsf{max}} \end{array}$

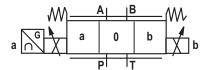
Notice:

In the zero position, spools W and WA have a connection from A to T and B to T with approx. 3 % of the relevant nominal cross-section.

¹⁾ Design SO660 with NBR seals at the valve connection surface

Symbols

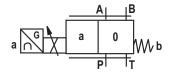
Proportional directional valve without integrated electronics Type 4WRE...



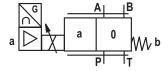
Proportional directional valve with integrated electronics Type 4WREE...



Type 4WRE...**A**...



Type 4WREE...A...



Function, section

Type 4WRE ...-2X/...

The 4/2 and 4/3 proportional directional valves are designed as direct operated devices in plate design. Operation is effected by proportional solenoids with central thread and detachable coil. The solenoids are controlled by external electronics.

Set-up:

The valve basically consists of:

- Housing (1) with connection surface
- Control spool (2) with compression springs (3 and 4) and spring plate (5 and 6)
- Solenoids (7 and 8) with central thread
- Position transducer (9)

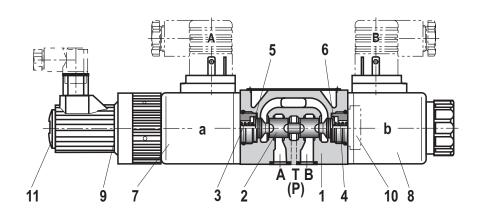
If Important note!

The PG fitting (11) must not be opened. Mechanical adjustment of the adjustment nut located below is prohibited and damages the valve!

Function:

- With de-energized solenoids (7 and 8), central position of the control spool (2) by compression springs (3 and 4) between spring plates (5 and 6)
- Direct operation of the control spool (2) by controlling a proportional solenoid, e.g. solenoid "b" (8)
 - → Displacement of the control spool (2) to the left proportional to the electric input signal
 - → Connection from P to A and B to T via orifice-type cross-sections with progressive flow characteristic
- Switching off of the solenoid (8)
 - → The compression spring (3) brings the control spool (2) back into the central position

In the de-energized condition, the control spool (2) is held in a mechanical central position by the return springs. With control spool symbol "V", this position does not correspond to the hydraulic central position! When the electric valve control loop is closed, the control spool is positioned in the hydraulic central position.



Valve with 2 spool positions: (Type 4WRE...A...)

The function of this valve design basically corresponds to the valve with three spool positions. The 2 spool position valves are, however, only equipped with solenoid "a" (7). Instead of the 2nd proportional solenoid, there is a plug screw (10).

Motice!

Due to the design principle, internal leakage is inherent to the valves, which may increase over the life cycle.

Motice!

The tank line must not be allowed to run empty. With corresponding installation conditions, a pre-charge valve (pre-charging pressure approx. 2 bar) is to be installed.

Function, section

Type 4WREE ...-2X/...

The 4/2 and 4/3 proportional directional valves are designed as direct operated devices in plate design. Operation is effected by proportional solenoids with central thread and detachable coil. The solenoids are controlled by the internal electronics.

Set-up:

The valve basically consists of:

- Housing (1) with connection surface
- Control spool (2) with compression springs (3 and 4) and spring plate (5 and 6)
- Solenoids (7 and 8) with central thread
- Position transducer (9)
- Integrated electronics (13)
- Electric zero point adjustment (12) accessible via Pg7

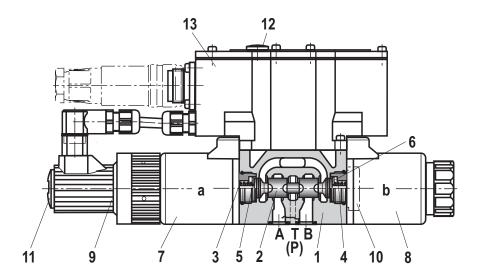
Important note!

The PG fitting (11) must not be opened. Mechanical adjustment of the adjustment nut located below is prohibited and damages the valve!

Function:

- With de-energized solenoids (7 and 8), central position of the control spool (2) by compression springs (3 and 4) between spring plates (5 and 6)
- Direct operation of the control spool (2) by controlling a proportional solenoid, e.g. solenoid "b" (8)
 - → Displacement of the control spool (2) to the left proportional to the electric input signal
 - → Connection from P to A and B to T via orifice-type crosssections with progressive flow characteristic
- Switching off of the solenoid (8)
 - → The compression spring (3) brings the control spool (2) back into the central position

In the de-energized condition, the control spool (2) is held in a mechanical central position by the return springs. With control spool symbol "V", this position does not correspond to the hydraulic central position! When the electric valve control loop is closed, the control spool is positioned in the hydraulic central position.



Valve with 2 spool positions: (Type 4WREE...A...)

The function of this valve design basically corresponds to the valve with three spool positions. The 2 spool position valves are, however, only equipped with solenoid "a" (7). Instead of the 2nd proportional solenoid, there is a plug screw (10).

Motice!

Due to the design principle, internal leakage is inherent to the valves, which may increase over the life cycle.

Motice!

The tank line must not be allowed to run empty. With corresponding installation conditions, a pre-charge valve (precharging pressure approx. 2 bar) is to be installed.

Technical data (For applications outside these parameters please consult us!)

general				
Sizes		Size	6	10
Weight	- Type 4WRE	kg	2.2	6.3
	- Type 4WREE	kg	2.4	6.5
Installation position			Any, preferably horizonta	l
Ambient temperature range	- Type 4WRE	°C	-20 to +70	
	- Type 4WREE	°C	-20 to +50	
Storage temperature range		°C	-20 to +80	
MTTF _d values according to EN ISC	D 13849	Years	150 1) (for more information	on see data sheet 08012)

hydraulic (measured with HLP46, $\vartheta_{Oil} = 40 \, ^{\circ}\text{C} \pm 5 \, ^{\circ}\text{C}$ and $p = 100 \, \text{bar}$)

•	· OII		,		
Maximum operating	- Port A, B, P	bar	31	15	
pressure	– Port T	bar	21	10	
Rated flow q _{V rated} with 2	1 p = 10 bar	l/min	4, 8, 16, 32	25, 50, 75	
Recommended maximu	m flow	l/min	80	180	
Hydraulic fluid			See table below		
Hydraulic fluid temperat	ure range	°C	-20 to +80 (preferably +40 to +50)		
Viscosity range mm²/s			20 to 380 (preferably 30 to 46)		
Maximum admissible degree of contamination of the hydraulic fluid, cleanliness class according to ISO 4406 (c)			Class 20/18/15 ²⁾		
Hysteresis		%	≤ 0.1		
Range of inversion 9		%	≤ 0.05		
Response sensitivity %		5 ≤ 0.05			
Zero shift upon change of hydraulic		%/10 K	< ≤ 0.15		
fluid temperature and op-	perating pressure	%/100 bar	≤ 0.1		

¹⁾ With control spool types E, E1, EA, W, W1, WA; in longitudinal control spool direction, there is sufficient positive overlap without shock/vibration load; observe the installation orientation with regard to the main direction of acceleration.

²⁾ The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and at the same time increases the service life of the components.
For the selection of the filters see www.boschrexroth.com/filter

Hydraulic fluid		Classification	Suitable sealing materials	Standards
Mineral oils and related hydrocarbons		HL, HLP	NBR, FKM	DIN 51524
Flame-resistant	 Containing water 	HFC (Fuchs HYDROTHERM 46M, Petrofer Ultra Safe 620)	NBR	ISO 12922

Important information on hydraulic fluids!

- For more information and data on the use of other hydraulic fluids refer to data sheet 90220 or contact us!
- There may be limitations regarding the technical valve data (temperature, pressure range, service life, maintenance intervals, etc.)!
- The flash point of the process and operating medium used must be 40 K higher than the maximum solenoid surface temperature.
- Flame-resistant water-containing: Maximum pressure differential per control edge 175 bar. Pressure pre-loading at the tank port > 20 % of the pressure differential; otherwise, increased cavitation.

Life cycle as compared to operation with mineral oil $\,$ HL, HLP 50 % to 100 %.

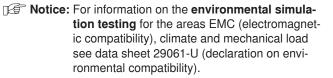
Technical data (For applications outside these parameters please consult us!)

electric						
Size		Size	6	10		
Voltage type			Direct voltage			
Solenoid coil	 Cold value at 20 °C 	Ω	2.65	4.55		
resistance	 Maximum hot value 	Ω	4.05	6.82		
Duty cycle	Duty cycle %			100		
Maximum coil temperat	rure 1)	°C	up to 150			
Electrical connection	- Type 4WRE		With connector according to DIN EN 175301-803 and ISO 4400			
see page 8 and 9			Mating connector according to DIN EN 175301-803 and ISO 4400 ²⁾			
- Type 4WREE		With connector DIN EN 175201-804				
			Mating connector DIN EN 175201-804 2)			
Protection class of the	valve according to EN 60529	9	IP65 with mating connector mounted and locked			

Control electronics

	100				
Type 4WRE 4/	/3 version				
	Amplifier in	Digital	VT-VRPD-2-2X/V0/0 according to RE 30126		
	euro-card format ²⁾	Analog	VT-VRPA2-1-1X/V0	VT-VRPA2-2-1X/V0	
			according to data sheet 30119	according to data sheet 30119	
	Module amplifier 2)	Analog	VT-MRPA2-1	VT-MRPA2-2	
			according to data sheet 30219	according to data sheet 30219	
Type 4WREA 4/	/2 version				
	Module amplifier 2)	Analog	VT-MRPA1-1	VT-MRPA1-2	
			according to data sheet 30219	according to data sheet 30219	
Type 4WREE			Integrated in the valve, see page 9		
	analog command valu	ue module	VT- SWMA-1-1X/ according to data sheet 29902		
	analog command valu	ue module	VT-SWMAK-1-1X/ according to	data sheet 29903	
	analog command valu	ue card	VT-SWKA-1-1X/ according to	data sheet 30255	
	digital command valu	e card	VT-HACD -1-1X/ according to	data sheet 30143	
Supply voltage	Nominal voltage	VDC	24		
	lower limit value	V	19.4		
	upper limit value	V	35		
Current consumption	I max	Α	< 2		
of the amplifier	Pulse current	А	3		

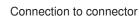
Due to the temperatures occurring at the surfaces of the solenoid coils, the European standards ISO 13732-1 and EN ISO 4413 need to be adhered to!

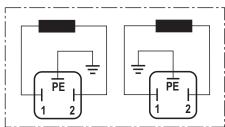


²⁾ Separate order

Electrical connection, mating connectors (dimensions in mm)

Type 4WRE (without integrated electronics)

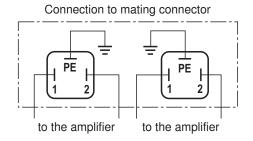


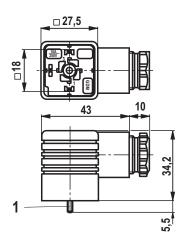


Mating connector CECC 75 301-803-A002FA-H3D08-G according to DIN EN 175301-803 and ISO 4400 Solenoid **a**, color gray separate order under the Material no. **R901017010** Solenoid **b**, color black separate order under the Material no. **R901017011**

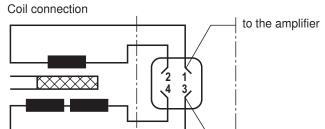
1 Mounting screw M3 Tightening torque $M_A = 0.5 \text{ Nm} + 0.1 \text{ Nm}$

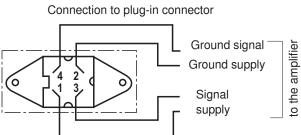
Coil





Inductive position transducer



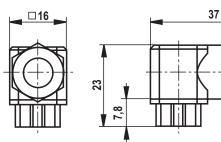


Pg7

Mating connector 4-pole Pg7-G4W1F separate order under the Material no. **R900023126** Connection cable:

Recommendation:

up to 50 m cable length type LiYCY 4 x 0.25 mm² Connect shield to PE only on the supply side.



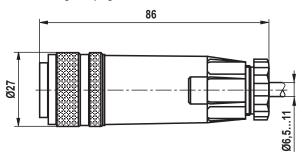
Electrical connection, mating connectors (dimensions in mm)

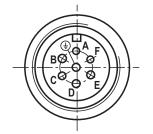
Type 4WREE (with integrated electronics (OBE)

Mating connector according to DIN EN 175201-804 separate order under the Material no. **R900021267** (plastic version)

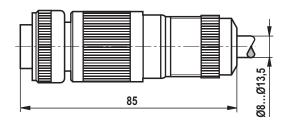
Angular design - separate order under the Material no. R900217845

Pin assignment see also block diagram page 10





Mating connector according to DIN EN 175201-804 separate order under the Material no. **R900223890** (metal version)



Device connector allocation	Contact	Signal with A1 interface	Signal with F1 interface			
Supply voltage	Α	24 VDC (<i>u</i> (t) = 19.4 to 35 V); <i>I</i> _{max} = 2 A				
	В		0 V			
Reference potential actual value	С	C Reference contact F; $R_e > 50 \text{ k}\Omega$ Reference contact				
Differential amplifier input	D	±10 V command value; $R_e > 50 \text{ k}\Omega$	4 to 20 mA command value; $R_e > 100 \Omega$			
	E	Reference poter	ntial command value			
Measuring output (actual value)		±10 V actual value 4 to 20 mA actual value (limit load 5 mA) load resistance max. 30				
	PE	Connected to cooling	element and valve housing			

Command value: Positive command value 0 to +10 V (or 12 to 20 mA) at D and reference potential at E result in flow

from $P \rightarrow A$ and $B \rightarrow T$.

Negative command value 0 to -10~V (or 12 to 4 mA) at D and reference potential at E result in flow

from $P \rightarrow B$ and $A \rightarrow T$.

For valves with 1 solenoid on side a (e. g. variant **EA** and **WA**), a positive command value 0 to +10 V

(or 4 to 20 mA) at D and reference potential at E result in flow from P \rightarrow B and A \rightarrow T.

Actual value: Actual value 0 to +10 V (or 12 to 20 mA) at F and reference potential at C result in flow from $P \rightarrow A$ and

B \rightarrow T, actual value 0 to -10 V (or 4 to 12 mA) result in flow from P \rightarrow B and A \rightarrow T.

With valves with 1 solenoid, a positive actual value 0 to +10 V (or 4 to 20 mA) at F and reference potential

at C result in flow from P \rightarrow B and A \rightarrow T.

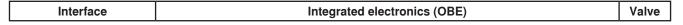
Connection cable: Recommendation: - up to 25 m cable length type LiYCY 7 x 0.75 mm²

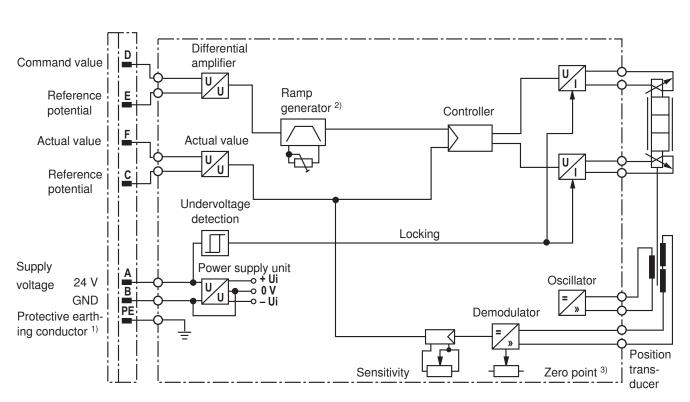
up to 50 m cable length type LiYCY 7 x 1.0 mm²
 External diameter see sketch of mating connector

Connect shield to PE only on the supply side.

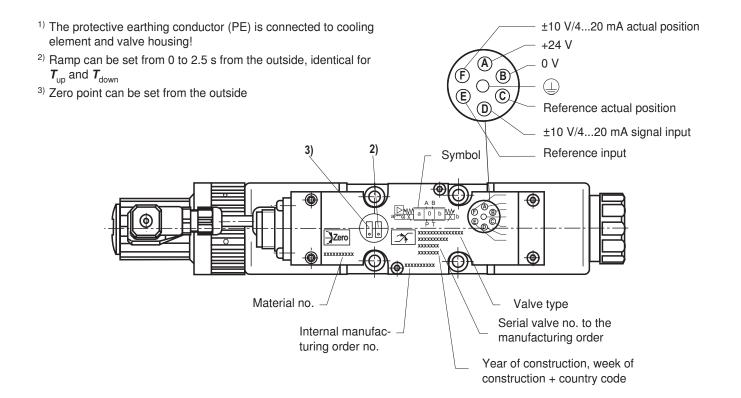
Integrated electronics (OBE) type 4WREE

Block diagram / pin assignment





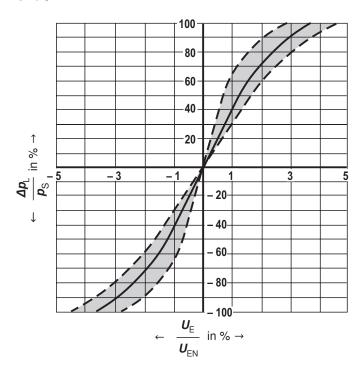
Notice: Electric signals taken out via control electronics (e.g. actual value) must not be used for switching off safetyrelevant machine functions!

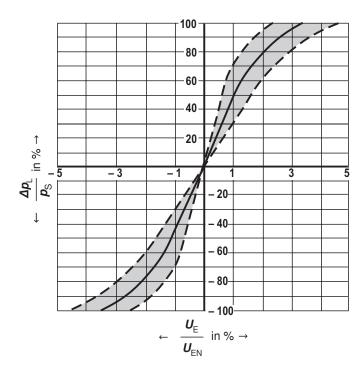


Characteristic curves: Type 4WREE (measured with HLP46, ϑ_{Oil} = 40 °C ± 5 °C) Size 6 and 10

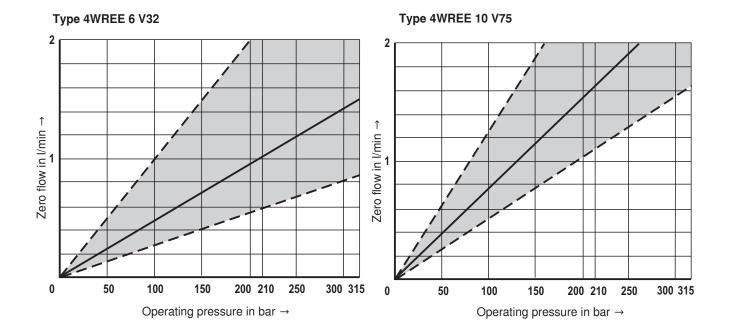
Pressure signal characteristic curve (control spool V), $p_s = 100$ bar

Size 6



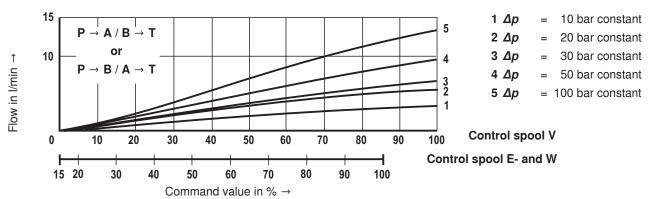


Zero flow with central control spool position



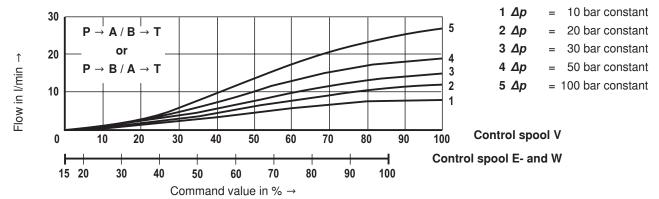
Characteristic curves: Type 4WREE (measured with HLP46, ϑ_{Oil} = 40 °C ± 5 °C and p = 100 bar) Size 6

4 l/min rated flow with 10 bar valve pressure differential

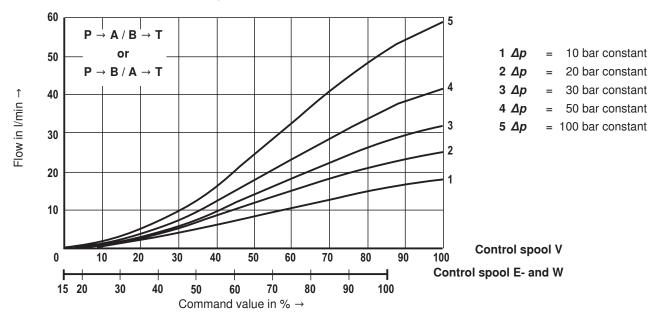


Characteristic curves: Type 4WREE (measured with HLP46, ϑ_{Oil} = 40 °C ± 5 °C and p = 100 bar) Size 6

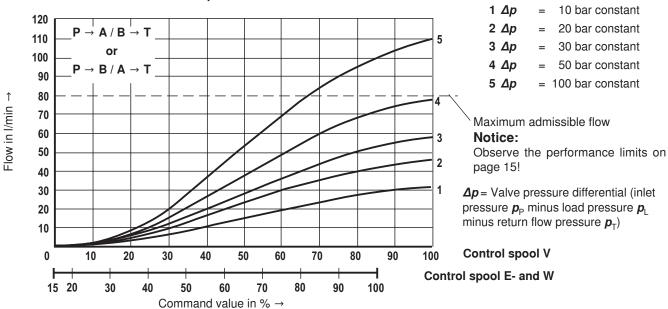
8 l/min rated flow with 10 bar valve pressure differential



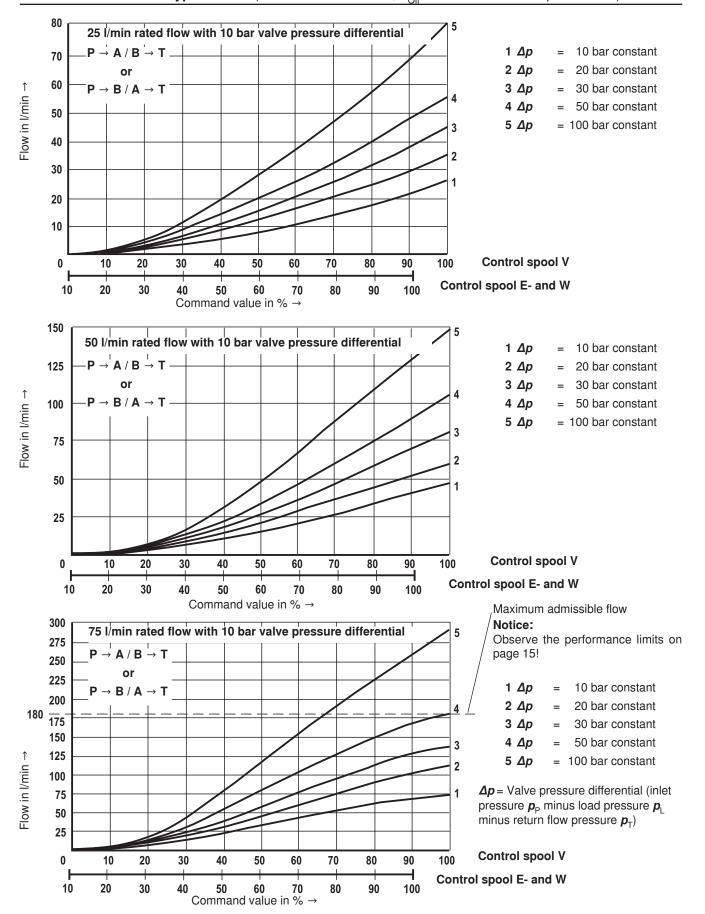
16 l/min rated flow with 10 bar valve pressure differential



32 I/min rated flow with 10 bar valve pressure differential



Characteristic curves: Type 4WREE (measured with HLP46, $\vartheta_{Oil} = 40 \text{ °C} \pm 5 \text{ °C}$ and p = 100 bar) Size 10

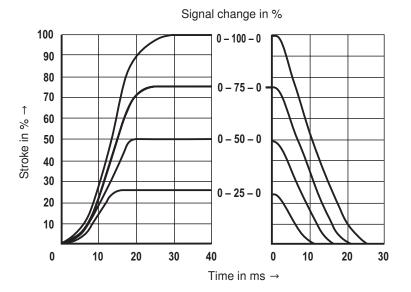


Transition function with stepped electric input signals: Type 4WREE

Size 6

(measured with HLP46, $\vartheta_{\rm Oil}$ = 40 °C ± 5 °C and $p_{\rm s}$ = 10 bar)

4/3 valve version Control spool E

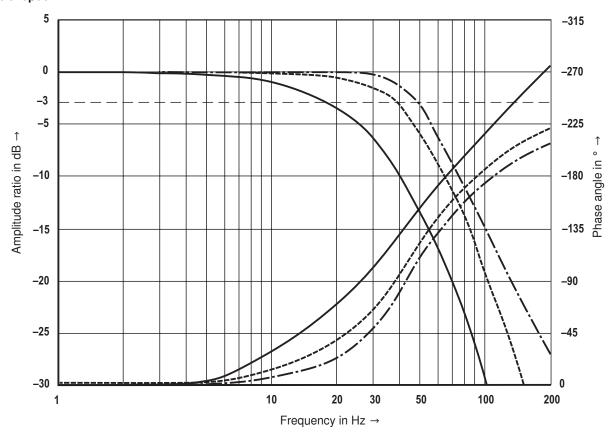


Frequency response characteristic curves: Type 4WREE

(measured with HLP46, $\vartheta_{\rm Oil}$ = 40 °C ± 5 °C, $p_{\rm s}$ = 10 bar)

Size 6

4/3 valve version Control spool V

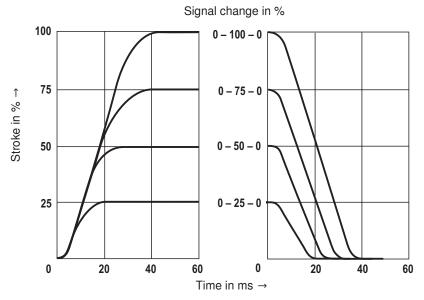


Signal ±10 %
Signal ±25 %
Signal ±100 %

Transition function with stepped electric input signals: Type 4WREE (measured with HLP46, ϑ_{Oil} = 40 °C ± 5 °C and p_{s} = 10 bar)

Size 10

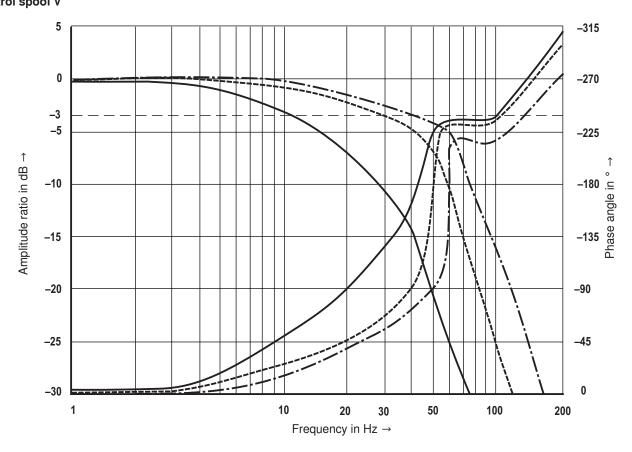
4/3 valve version Control spool E



Frequency response characteristic curves: Type 4WREE (measured with HLP46, ϑ_{Oil} = 40 °C ± 5 °C, p_{s} = 10 bar)

Size 10

4/3 valve version Control spool V

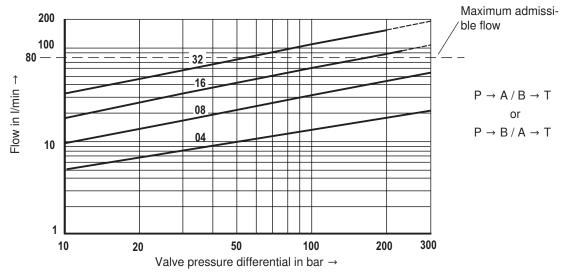


----- Signal ±10 %
----- Signal ±25 %
----- Signal ±100 %

Flow: Type 4WREE (measured with HLP46, $\vartheta_{\rm Oil}$ = 40 °C ± 5 °C)

Size 6

Load function with maximum valve opening Rated flow 4, 8, 16 and 32 l/min Control spool V

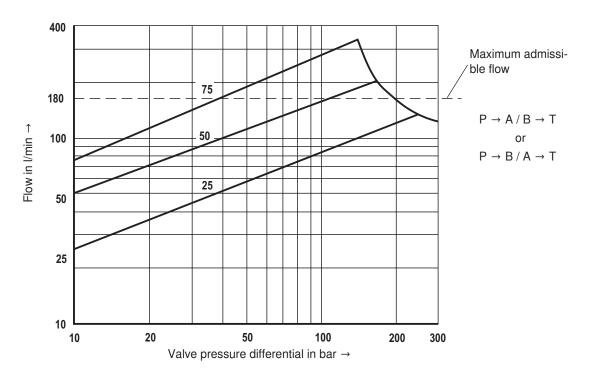


Observe the maximum admissible flow of 80 l/min!

Flow: Type 4WREE (measured with HLP46, ϑ_{Oil} = 40 °C ± 5 °C)

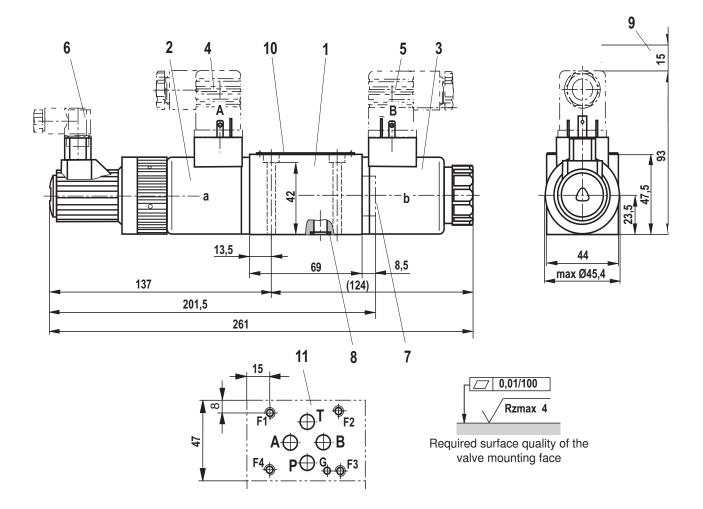
Size 10

Load function with maximum valve opening Rated flow 25, 50 and 75 l/min Control spool V



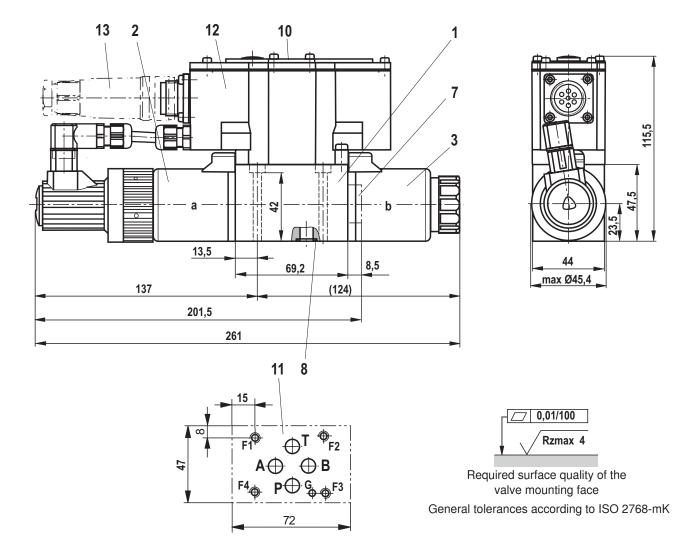
Observe the maximum admissible flow of 180 l/min!

Unit dimensions: Type 4WRE (dimensions in mm)



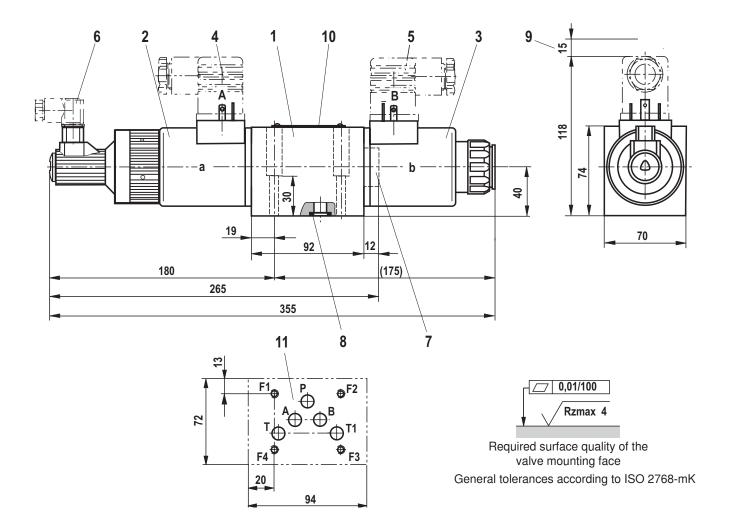
- 1 Valve housing
- 2 Proportional solenoid "a" with inductive position transducer
- 3 Proportional solenoid "b"
- 4 Mating connector "A", color gray, separate order see page 8
- Mating connector "B", color black, separate order – see page 8
- 6 Mating connector for inductive position transducer, separate order see page 8
- 7 Plug screw for valve with one solenoid (2 spool positions, version EA or WA)
- 8 Identical seal rings for ports A, B, P, and T
- 9 Space required to remove the mating connector
- 10 Name plate
- 11 Machined valve mounting face, porting pattern according to ISO 4401-03-02-0-05 (with locating hole) Deviating from the standard:
 - without locating hole "G"
 - Ports P, A, B and T with Ø 8 mm

Unit dimensions: Type 4WREE (dimensions in mm)



- 1 Valve housing
- 2 Proportional solenoid "a" with inductive position transducer
- 3 Proportional solenoid "b"
- 7 Plug screw for valve with one solenoid (2 spool positions, version **EA** or **WA**)
- 8 Identical seal rings for ports A, B, P, and T
- 10 Name plate
- 11 Machined valve mounting face, porting pattern according to ISO 4401-03-02-0-05 (with locating hole)
 - Deviating from the standard:
 - without locating hole "G"
 - Ports P, A, B and T with Ø 8 mm
- 12 Integrated electronics (OBE)
- **13** Mating connector, separate order see page 9

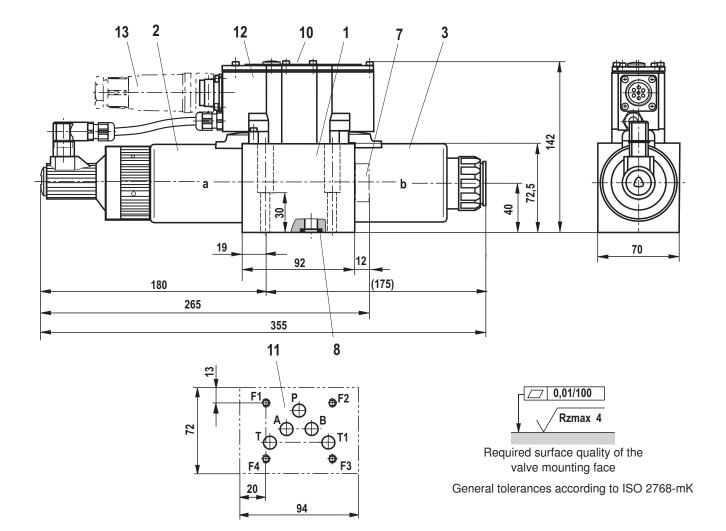
Unit dimensions: Type 4WRE (dimensions in mm)



- 1 Valve housing
- 2 Proportional solenoid "a" with inductive position transducer
- 3 Proportional solenoid "b"
- 4 Mating connector "A", color gray, separate order see page 8
- 5 Mating connector "B", color black, separate order see page 8
- 6 Mating connector for inductive position transducer, separate order see page 8
- 7 Plug screw for valve with one solenoid (2 spool positions, version EA or WA)
- 8 Identical seal rings for ports A, B, P, T and T1
- 9 Space required to remove the mating connector
- 10 Name plate
- Machined valve contact surface, porting pattern according to ISO 4401-05-04-0-05 differing from the standard: Connection T1 Ø 11.2 mm

Unit dimensions: Type 4WREE (dimensions in mm)

size 10



- 1 Valve housing
- 2 Proportional solenoid "a" with inductive position transducer
- 3 Proportional solenoid "b"
- 7 Plug screw for valve with one solenoid (2 spool positions, version **EA** or **WA**)
- 8 Identical seal rings for ports A, B, P, T and T1
- 10 Name plate
- 11 Machined valve contact surface, porting pattern according to ISO 4401-05-04-0-05 differing from the standard: Connection T1 \varnothing 11.2 mm
- 12 Integrated electronics (OBE)
- 13 Mating connector, separate order – see page 9

Unit dimensions

Hexagon socket head cap screws	3	Material number
Size 6	4x ISO 4762 - M5 x 50 - 10.9-flZn-240h-L Tightening torque M_A = 7 Nm ±10 % or 4x ISO 4762 - M5 x 50 - 10.9 Tightening torque M_A = 8.9 Nm ±10 %	R913000064
Size 10	4x ISO 4762 - M6 x 40 - 10.9-flZn-240h-L Tightening torque M_A = 12.5 Nm ±10 % or 4x ISO 4762 - M6 x 40 - 10.9 Tightening torque M_A = 15.5 Nm ±10 %	R913000058

Notice: This tightening torque of the hexagon socket head cap screws refers to the maximum operating pressure!

Subplates	Data sheet
Size 6	45052
Size 10	45054

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Axial piston variable pump A10VSO Series 31

RE 92711

Edition: 10.2016 Replaces: 01.2012



- ► All-purpose medium pressure pump
- ▶ Sizes 18 to 140
- ► Nominal pressure 280 bar
- ► Maximum pressure 350 bar
- ▶ Open circuit

Features

- ► Variable pump with axial piston rotary group in swashplate design for hydrostatic drives in open circuit.
- ► The flow is proportional to the drive speed and displacement.
- ► The flow can be infinitely varied by adjusting the swashplate angle.
- ▶ 2 drain ports
- ► Excellent suction performance
- ▶ Low noise level
- ▶ Long service life
- ► Favorable power/weight ratio
- ► Versatile controller range
- ▶ Short control time
- ► The through drive is suitable for adding gear pumps and axial piston pumps up to the same size, i.e., 100% through drive.
- Suitable for operation with mineral oil and HF hydraulic fluids

Contents	
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Type code

01	02	03	04	05		06	07		08	09		10	1	1	12	2	13
	A10VS	0			1	31		_	V		Τ						
Versi	on									18	28	45	71	88	100	140	
01	Standard v	ersion (without co	ode)						•	•	•	•	•	•	•	
	HFA, HFB,	HFA, HFB, HFC hydraulic fluid (except for Skydrol)									•	E					
		ligh-speed version (external dimensions are not affected by this option).										н					
Axial	piston unit																
02	Swashplate		n, variable,	nominal pr	essure 2		aximum p	ressure 350) bar	•	•	•	•	•	•	•	A10VS
Oper	ating mode																!
03	Pump, ope	n circui	t														0
Size (<u> </u>
04	Geometric	displac	ement. (se	e table of v	alues or	n pages 6	and 7)			18	28	45	71	88	100	140	1
						. 8						1			1		J
05	rol device Two-point	control	direct one	rated						•	•	•	•	•	•	•	DG
00	Pressure c			hydrau	lic					•	•	•	•	•	•	•	DR
	with flow			hydrau		-T open				•	•	•	•	•	•	•	DFR
				3 · · · · ·			l with flus	hing function	on	•	•	•	•	•	•	•	DFR1
	with pre	ssure c	ut-off	hydrau		emote con				•	•	•	•	•	•	•	DRG
	-			electric		egative co	ntrol	U = 12 V		•	•	•	•	•	•	•	ED71
								<i>U</i> = 24 V		•	•	•	•	•	•	•	ED72
				electric	cal p	ositive co	ntrol	<i>U</i> = 12 V		•	•	•	•	•	•	•	ER71
								U = 24 V		•	•	•	•	•	•	•	ER72
	Pressure,fl	ow and	power con	troller						-	•	•	•	•	•	•	DFLR
Serie	s																
06	Series 3, ir	ndex 1															31
Direc	tion of rota	tion								,							
07	Viewed on	drive sh	naft				clo	ckwise									R
							cou	ınter-clocky	wise								L
Seali	ng material																
08	FKM (fluor	oelastor	mer)														V
	NBR (nitril	e rubbe	r) only if u	sing HFA, H	IFB and	HFC hydra	aulic fluids	(position	01; order	code "E"	')						Р
Drive	shaft																
09	Splined sh	aft		standa	rd shaft					•	•	•	•	•	•	•	s
	ANSI B92.1	a		similar	to shaft	"S" howe	ver for hig	her input t	orque	•	•	•	•	•	-	-	R
	Parallel key	ed shaf	ft	permis	sible thr	ough-drive	e torque (:	see page 9))		•					•	Р
	DIN 6885																
Mour	ting flange									18	28	45	71	88	100	140	
10	ISO 3019-2	2						2-hole		•	•	•	•	•	•	-	Α
								4-hole			-	-	-	-	-	•	В
Work	ing port																
11	SAE flange	-	stening	at side	, opposit	te				•	•	•	-	-	•	•	12
	thread, me	tric								-	-	-	•	•	-	-	42

01	02	03	04	05		06	07		08	09	10	11	12	13
	A10VS	0			/	31		-	V					

Through drive	(for	mounting	options,	see	page 42)
i ili ougli ulive	(101	mounting	οριιστίο,	300	page 4	_

Flange ISO 3019-1	Hub for splined shaft ¹⁾								
Diameter	Diameter	18	28	45	71	88	100	140	
without through drive		•	•	•	•	•	•	•	N
82-2 (A)	5/8 in 9T 16/32DP	•	•	•	•	•	•	•	K
	3/4 in 11T 16/32DP	•	•	•	•	•	•	•	K
101-2 (B)	7/8 in 13T 16/32DP	-	•	•	•	•	•	•	K
	1 in 15T 16/32DP	-	-	•	•	•	•	•	K
127-2 (C)	1 1/4 in 14T 12/24DP	-	-	-	•	•	•	•	K
	1 1/2 in 17T 12/24DP	-	-	-	-	-	•	•	K
152-4 (D)	1 3/4 in 13T 8/16DP	_	—	_	_	_	—	•	K
									_
Ø63, metric 4-hole	Shaft key Ø 25	-	•	•	•	•	•	•	K
Flange ISO 3019-2									
Diameter									
80, 2-hole	3/4 in 11T 16/32DP	•	•	•	•	•	•	•	K
100, 2-hole	7/8 in 13T 16/32DP	-	•	•	•	•	•	•	K
	1 in 15T 16/32DP	-	-	•	•	•	•	•	К
125, 2-hole	1 1/4 in 14T 12/24DP	-	-	_	•	•	•	•	к
									I -
	1 1/2 in 17T 12/24DP	-	-	_	_	_	•	•	К

Connectors for solenoids²⁾

13	Without connector (without solenoid, with hydraulic control only, without code)	•	•	•	•	•	•	•	
	HIRSCHMANN connector – without suppressor diode	•	•	•	•	•	•	•	Н

• = Available

o = On request

- = Not available

Notice

- ▶ Note the project planning notes on page 48.
- ► In addition to the type code, please specify the relevant technical data when placing your order.

¹⁾ Hub for splined shaft according to ANSI B92.1a

²⁾ Connectors for other electric components can deviate.

4 **A10VSO Series 31** | Axial piston variable pump Hydraulic fluids

Hydraulic fluids

The A10VSO variable pump is designed for operation with HLP mineral oil according to DIN 51524.

Application instructions and requirements for hydraulic fluids should be taken from the following data sheets before the start project planning:

- ▶ 90220: Hydraulic fluids based on mineral oils and related hydrocarbons
- ▶ 90221: Environmentally acceptable hydraulic fluids
- ▶ 90222: Fire-resistant, water-free hydraulic fluids (HFDR/HFDU) (for permissible technical data, see data sheet 90255)
- ▶ 90223: Fire-resistant, water-containing hydraulic fluids (HFAE, HFAS, HFB, HFC)
- ▶ 90225: Restricted technical data only for operation
- with fire-resistant, water-free and water-containing hydraulic fluids (HFDR, HFDU, HFB, HFC)- technical data

Notes on selection of hydraulic fluid

The hydraulic fluid should be selected so that the operating viscosity in the operating temperature range is within the optimum range (v_{opt} see selection diagram).

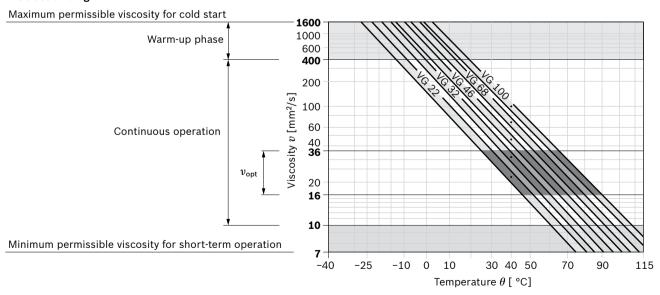
Notice

► The axial piston unit is suitable for operation with watercontaining HF hydraulic fluid. See version "E"

Viscosity and temperature of hydraulic fluids

	Viscosity	Shaft seal	Temperature ³⁾	Comment
Cold start	$v_{\text{max}} \le 1600 \text{ mm}^2/\text{s}$	NBR ²⁾	θ _{St} ≥ -40 °C	$t \le 3$ min, without load ($p \le 50$ bar), $n \le 1000$ min ⁻¹
		FKM	θ _{St} ≥ -25 °C	Permissible temperature difference between axial piston unit and hydraulic fluid in the system maximum 25 K
Warm-up phase	$v = 1600 \dots 400 \text{ mm}^2/\text{s}$			$t \le 15 \text{ min, } p \le 0.7 \times p_{\text{nom}} \text{ and } n \le 0.5 \times n_{\text{nom}}$
Continuous	$v = 400 \dots 10 \text{ mm}^2/\text{s}^{1)}$	NBR ²⁾	θ = +85 °C	measured at port L, L₁
operation		FKM	θ = +110 °C	
	$v_{\rm opt}$ = 36 16 mm ² /s			Range of optimum operating viscosity and efficiency
Short-term	$v_{min} = 10 7 \text{ mm}^2/\text{s}$	NBR ²⁾	θ = +85 °C	$t \le 3 \text{ min}, p \le 0.3 \times p_{\text{nom}}, \text{ measured at port } \mathbf{L}, \mathbf{L}_1$
operation		FKM	θ = +110 °C	

▼ Selection diagram



¹⁾ Corresponds e.g. for VG 46 to a temperature range of +4 °C to +85 °C (see selection diagram)

²⁾ Version EA10VSO...-P (if operating with HFA, HFB and HFC hydraulic fluids

³⁾ If the temperature at extreme operating parameters cannot be adhered to, 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. A cleanliness level of at least 20/18/15 is to be maintained according to ISO 4406.

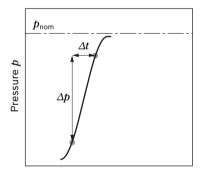
At very high hydraulic fluid temperatures (maximum 110 $^{\circ}$ C, measured at port **L**, **L**₁), at least a cleanliness level of 19/17/14 according to ISO 4406 is necessary.

Please contact us if the above classes cannot be observed.

Working pressure range

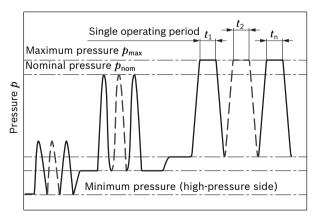
Pressure at working port B		Definition
Nominal pressure p_{nom}	280 bar	The nominal pressure corresponds to the maximum design pressure.
Maximum pressure p_{max}	350 bar	The maximum pressure corresponds to the maximum working pressure within the
Single operating period	2 ms	single operating period. The sum of the single operating periods must not exceed
Total operating period	300 h	the total operating period.
Minimum pressure $p_{B abs}$ (high-pressure side)	10 bar ¹⁾	Minimum pressure on the high-pressure side (B) which is required in order to prevent damage to the axial piston unit.
Rate of pressure change $R_{\text{A max}}$	16000 bar/s	Maximum permissible speed of pressure build-up and reduction during a pressure change across the entire pressure range.
Pressure at suction port S (inlet)		
Minimum pressure Standard $p_{\text{S min}}$	0.8 bar absolute	Minimum pressure at suction port S (inlet) that is required in order to avoid damage to the axial piston unit. The minimum pressure depends on the rotational speed and displacement of the axial piston unit.
Maximum pressure $p_{\text{S max}}$	10 bar	
Case pressure at port L, L ₁		
Maximum pressure $p_{\text{L max}}$	2 bar ¹⁾ absolute	Maximum 0.5 bar higher than inlet pressure at port $\bf S$, but not higher than $p_{\rm Lmax}$. A case drain line to the reservoir is required.

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



Time t

▼ Pressure definition



Time t

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

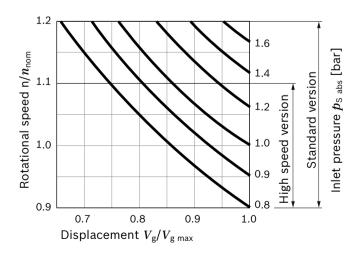
1) Other values on request

Notice

Working pressure range valid when using hydraulic fluids based on mineral oils. Please contact us for values for other hydraulic fluids.

Minimum permissible inlet pressure at suction port S with speed increase

In order to avoid damage to the pump (cavitation), a minimum inlet pressure must be guaranteed at suction port **S**. The minimum inlet pressure level depends on the rotational speed and the displacement of the variable pump.



During continuous operation in overspeed over n_{nom} , a reduction in operational service life is to be expected due to cavitation erosion.

Technical data, standard unit

Size		NG		18	28	45	71	88	100	140
Displacement, geo	ometric,	V_{gmax}	cm ³	18	28	45	71	88	100	140
Rotational speed	at V_{gmax}	n_{nom}	rpm	3300	3000	2600	2200	2100	2000	1800
maximum ¹⁾	at $V_{\rm g}$ < $V_{\rm g max}^{2)}$	$n_{\sf max}$	rpm	3900	3600	3100	2600	2500	2400	2100
Flow	at n_{nom} and V_{gmax}	$q_{ m v\; max}$	l/min	59	84	117	156	185	200	252
	at $n_{\rm E}$ = 1500 rpm and $V_{\rm g\;max}$	$q_{\sf vE\; max}$	l/min	27	42	68	107	132	150	210
Power	at n_{nom} , $V_{g\;max}$	P_{max}	kW	28	39	55	73	86	93	118
at Δp = 280 bar	at $n_{\rm E}$ = 1500 rpm and $V_{\rm g\;max}$	$P_{E\;max}$	kW	12.6	20	32	50	62	70	98
Torque	Δp = 280 bar	T_{max}	Nm	80	125	200	316	392	445	623
at V_{gmax} and	Δp = 100 bar	T	Nm	30	45	72	113	140	159	223
Rotary stiffness	S	c	Nm/rad	11087	22317	37500	71884	71884	121142	169437
of drive shaft	R	c	Nm/rad	14850	26360	41025	76545	76545	_	_
	Р	c	Nm/rad	13158	25656	41232	80627	80627	132335	188406
Moment of inertia	a for rotary group	J_{TW}	kgm²	0.00093	0.0017	0.0033	0.0083	0.0083	0.0167	0.0242
Case volume		V		0.4	0.7	1.0	1.6	1.6	2.2	3.0
Weight without th	nrough drive (approx.)		l. a	12.9	18	23.5	35.2	35.2	49.5	65.4
Weight with throu	igh drive (approx.)	m	kg	14	19.3	25.1	38	38	55.4	74.4

Determining	the charact	teristics		
Flow	~ -	$V_{g} \times n \times \eta_{v}$		[1/:-1
FIOW	q_{v} =	1000		[l/min]
Torque	T -	$V_{g} \times \Delta p$		[Nm]
Torque	1 -	$20 \times \pi \times \eta_{mh}$		נואווון
Power	р -	$2 \pi \times T \times n$	$q_{v} \times \Delta p$	- [kW]
rowei	P =	60000	$=$ $600 \times \eta_{\rm t}$	- [KVV]

Key

- $V_{\rm g}$ Displacement per revolution [cm³]
- Δp Differential pressure [bar]
- n Rotational speed [rpm]
- η_{v} Volumetric efficiency

 $\eta_{
m hm}$ Hydraulic-mechanical efficiency

 $\eta_{\rm t}$ Total efficiency ($\eta_{\rm t}$ = $\eta_{\rm v} \times \eta_{\rm hm}$)

Notice

- ► Theoretical values, without efficiency and tolerances; values rounded
- ▶ 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. Bosch Rexroth recommends checking the load by means of test or calculation / simulation and comparison with the permissible values.

¹⁾ The values are applicable:

[–] For the optimum viscosity range from $\nu_{\rm opt}$ = 36 to 16 mm²/s

⁻ For hydraulic fluid based on mineral oils

[–] For absolute pressure p_{abs} = 1 bar at suction port **S**

²⁾ For a speed increase up to $n_{\text{max perm}}$, please observe the diagram on page 6.

Technical data, high-speed version (external dimensions are the same as the standard version)

Size		NG	·	45	71	100	140
Displacement, geo per revolution	ometric,	$V_{g\;max}$	cm ³	45	71	100	140
Rotational speed	at V_{gmax}	n_{nom}	rpm	3000	2550	2300	2050
maximum ¹⁾	at $V_{\rm g}$ < $V_{\rm g max}^{2)}$	$n_{\sf max}$	rpm	3300	2800	2500	2200
		perm					
Flow	at n_{nom} and $V_{g\;max}$	$q_{ m v\; max}$	l/min	135	178	230	287
Power	at $n_{ m nom}$, $V_{ m gmax}$ and Δp = 280 bar	P_{max}	kW	63	83	107	134
Torque	Δp = 280 bar	T _{max}	Nm	200	316	445	623
at $V_{ m gmax}$ and	Δp = 100 bar	T	Nm	72	113	159	223
Rotary stiffness	S	c	Nm/rad	37500	71884	121142	169537
drive shaft	R	c	Nm/rad	41025	76545	_	_
	Р	c	Nm/rad	41232	80627	132335	188406
Moment of inertia	for rotary group	J_{TW}	kgm²	0.0033	0.0083	0.0167	0.0242
Case volume		V	I	1.0	1.6	2.2	3.0
Weight without th	rough drive (approx.)		1	23.5	35.2	49.5	65.4
Weight with throu	igh drive (approx.)	m	kg	25.1	38	55.4	74.4

Notice

- ► Theoretical values, without efficiency and tolerances; values rounded
- ▶ 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. Bosch Rexroth recommends checking the load by means of test or calculation / simulation and comparison with the permissible values.

Technical data, HF hydraulic fluids, maximum rotational speed

Hydraulic fluid ³⁾ E-version	Size		NG		18	28	45	71	88	100	140
HFA	at nominal pressure p_{N}	140 bar		W 100 100	2450	2250	1950	1650	1550	1500	1350
	at maximum pressure p_{max}	160 bar	$-n_{nom}$	rpm	2450	2250	1950	1650	1550	1500	1350
HFB	at nominal pressure $p_{ m N}$	140 bar		rnm	2650	2400	2100	1760	1650	1600	1450
	at maximum pressure p_{\max}	160 bar	$-n_{nom}$	rpm	2630	2400	2100	1760	1650	1600	1430
HFC	at nominal pressure $p_{ m N}$	175 bar		rnm	2650	2400	2100	1760	1650	1600	1450
	at maximum pressure p_{\max}	210 bar	$-n_{nom}$	rpm	2630	2400	2100	1760	1650	1600	1430
Technical data, HFD hydrai	ulic fluids										
HFDR, HFDU polyalkylene glycol	at nominal pressure $p_{ m N}$	280 bar	n_{nom}	rpm	2650	2400	2100	1760	1650	1600	1450
HFDU polyol ester	at nominal pressure $p_{ m N}$	280 bar	_		3300	3000	2600	2200	2100	2000	1800

¹⁾ The values are applicable:

[–] At absolute pressure $p_{\rm abs}$ = 1 bar at suction port **S**

[–] For the optimal viscosity range of $v_{\rm opt}$ = 36 to 16 mm²/s

⁻ For hydraulic fluid based on mineral oils

 $_{\rm 2)}$ For a speed increase up to $n_{max\;perm},$ please observe the diagram on page 6.

³⁾ For further information on HF hydraulic fluids, please see data sheets 90223 and 90225

Permissible radial and axial forces of the drive shafts

Size		NG		18	28	45	71	88	100	140
Maximum radial force at a/2	a/2 a/2	$F_{ m q\ max}$	N	350	1200	1500	1900	1900	2300	2800
Maximum axial force	$F_{ax} \overset{+}{\longleftarrow}$	± $F_{\text{ax max}}$	N	700	1000	1500	2400	2400	4000	4800

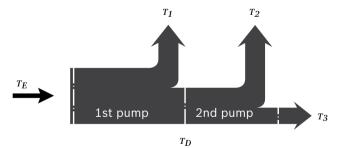
Notice

► The values given are maximum values and do not apply to continuous operation. Drives with radial loading (pinion, V-belt drives) are not permissible!

Permissible input and through-drive torques

Size			18	28	45	71	88	100	140
Torque at V_{gmax} and Δp = 280 b	T_{max}	Nm	80	125	200	316	392	445	623
Maximum input torque at drive	shaft ²⁾								
S	T_{Emax}	Nm	124	198	319	626	626	1104	1620
	Ø	in	3 /4	7 /8	1	1 1/4	1 1/4	1 1/2	1 3/4
R	T_{Emax}	Nm	160	250	400	644	644	_	_
	Ø	in	3 /4	7 /8	1	1 1/4	1 1/4	_	_
P	T_{Emax}	Nm	88	137	200	439	439	857	1206
	Ø	in	18	22	25	32	32	40	45
Maximum through-drive torque									
S	T_{Dmax}	Nm	108	160	319	492	492	778	1266
R	T_{Dmax}	Nm	120	176	365	548	548	_	_
P	T_{Dmax}	Nm	88	137	200	439	439	778	1206

▼ Distribution of torques



Torque at 1st pump	T_1		
Torque at 2nd pump	T_2		
Torque at 3rd pump	T_3		
Input torque	T_E	=	$T_1 + T_2 + T_3$
	T_E	<	T_{Emax}
Through-drive torque	T_D	=	T_2 + T_3
	T_D	<	T_{Dmax}

- 1) Efficiency not considered
- 2) For drive shafts with no radial force

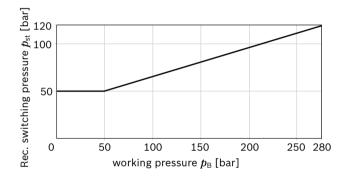
DG - Two-point control, direct operated

The variable pump can be set to a minimum swivel angle by connecting an external switching pressure to port **X**. This will supply control fluid directly to the stroking piston; a minimum control pressure of $p_{\rm st} \ge 50$ bar is required. The variable pump can only be switched between $V_{\rm g\ max}$ or $V_{\rm g\ min}$.

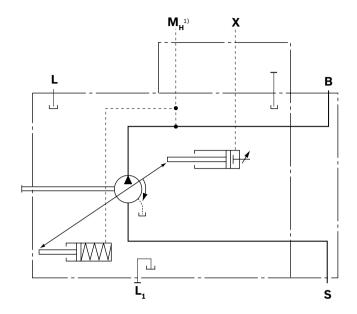
Please note that the required control pressure at port ${\bf X}$ is directly dependent on the actual working pressure $p_{\rm B}$ in port ${\bf B}$. (See control pressure characteristic curve). The maximum permissible switching pressure is 280 bar.

Switching pressure $p_{\rm st}$ in **X** = 0 bar $\triangle V_{\rm g \ max}$ Switching pressure $p_{\rm st}$ in **X** \ge 50 bar $\triangle V_{\rm g \ min}$

▼ Switching pressure characteristic curve



▼ Circuit diagram

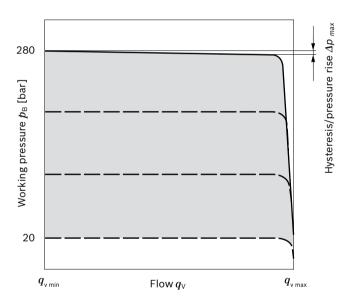


DR - Pressure controller

The pressure controller limits the maximum pressure at the pump outlet within the control range of the variable pump. The variable pump only supplies as much hydraulic fluid as is required by the consumers. If the working pressure exceeds the pressure command value at the pressure valve, the pump will regulate to a smaller displacement to reduce the control differential.

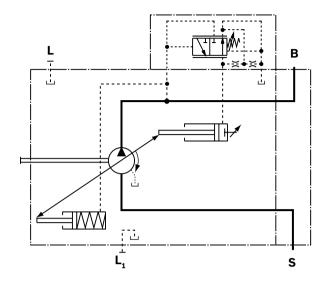
- ▶ Initial position in depressurized state: $V_{g \text{ max}}$.
- Setting range¹⁾ for infinitely variable 20 to 280 bar pressure control.
 Standard is 280 bar.

▼ Characteristic curve

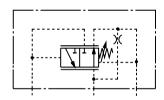


Characteristic curve valid at n_1 = 1500 rpm and θ_{fluid} = 50 °C.

▼ Circuit diagram, sizes 18 to 100



▼ Circuit diagram, size 140



Controller data

NG		18	28	45	71	88	100	140
Pressure increase	∆ <i>p</i> [bar]	4	4	6	8	9	10	12
Hysteresis and repeatability	<i>∆p</i> [bar]			m	aximu	m 3		
Pilot fluid consumption	[l/min]			maxin	num a	pprox.	3	

In order to prevent damage to the pump and the system, the permissible setting range must not be exceeded.
 The range of possible settings at the valve is higher.

DRG - Pressure controller, remote controlled

For the remote controlled pressure controller, the LS pressure limitation is performed using a separately arranged pressure relief valve. Therefore any pressure control value under the pressure set on the pressure controller can be regulated. Pressure controller DR see page 11.

A pressure relief valve is externally piped up to port **X** for remote control. This relief valve is not included in the scope of delivery of the DRG control.

When there is differential pressure of 20 bar Δp (standard setting), the quantity of control fluid at the port is **X** approx. 1.5 l/min. If a different setting (range 10 to 22 bar) is required, please state in plain text.

As a separate pressure relief valve (1) we recommend:

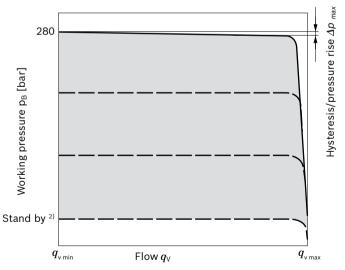
a direct operated, hydraulic or electric proportional one, suitable for the control fluid mentioned above.

The max. length of piping should not exceed 2 m.

- ▶ Basic position in depressurized state: $V_{g \text{ max}}$.
- ► Setting range¹⁾ for pressure control 20 to 280 bar (3). Standard is 280 bar.
- ► Setting range for differential pressure 10 22 bar(2) Standard is 20 bar.

Unloading port **X** to the reservoir results in a zero stroke (standby) pressure which is approx. 1 to 2 bar higher than the defined differential pressure Δp , however system influences are not taken into account.

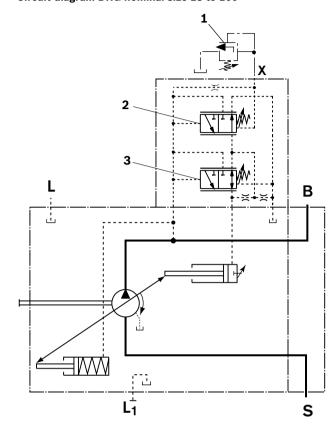
▼ Characteristic curve DRG



Characteristic curve valid for n_1 = 1500 rpm and t_{fluid} = 50 °C.

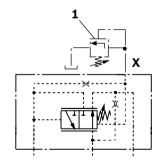
- In order to prevent damage to the pump and the system, the permissible setting range must not be exceeded.The range of possible settings at the valve is higher.
- 2) Zero stroke pressure from pressure setting Δp on controller (2)

▼ Circuit diagram DRG nominal size 18 to 100



- **1** The separate pressure relief valve and the line are not included in the scope of delivery.
- 2 Remote controlled pressure cut-off (G).
- 3 Pressure controller (DR)

▼ Circuit diagram, size 140



Controller data DRG

NG		18	28	45	71	88	100	140
Hysteresis and repeatability	∆ <i>p</i> [bar]			m	aximu	m 4		
Pilot fluid consumption	[l/min]		ı	maxim	um ap	prox. 4	4.5	

DFR/DFR1 - Pressure flow controller

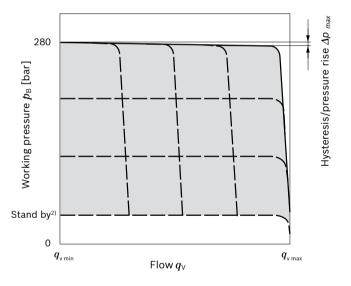
In addition to the pressure controller function (see page 11), a variable orifice (e.g. directional valve) is used to adjust the differential pressure upstream and downstream of the orifice. This is used to control the pump flow. The pump flow is equal to the actual hydraulic fluid quantity required by the consumer. With all controller combinations, the $V_{\rm g}$ reduction has priority.

- ▶ Basic position in depressurized state: $V_{\rm g\ max}$.
- ► Setting range¹⁾ to 280 bar.
- ► For pressure controller data see page 11

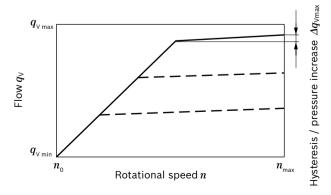
Notice

► The DFR1 version has no unloading between **X** and the reservoir. Unloading the LS-pilot line must be possible in the valve system. Because of the flushing function of the flow controller in the DRS control valve, sufficient unloading of the **X**-line must also be provided.

▼ Characteristic curve

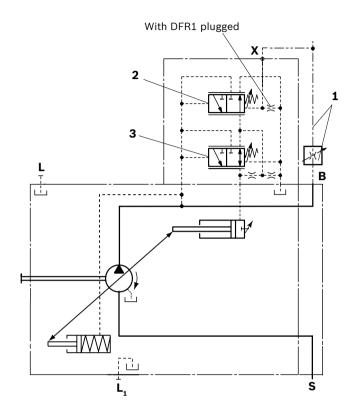


▼ Characteristic curve at variable rotational speed

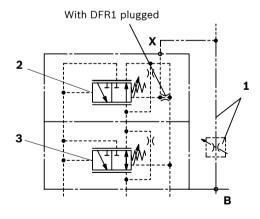


Characteristic curve valid at n_1 = 1500 rpm and θ_{fluid} = 50 °C.

▼ Circuit diagram DFR size 18 to 100



▼ Circuit diagram, size 140



- **1** The metering orifice (control block) and the line is not included in the scope of delivery.
- 2 Pressure and flow controller (FR).
- 3 Pressure controller (DR)

For further information see page 14

- In order to prevent damage to the pump and the system, the permissible setting range must not be exceeded.
 The range of possible settings at the valve is higher.
- 2) Zero stroke pressure from pressure setting Δp on controller (2)

Differential pressure Δp :

► Standard setting: 14 bar
If another setting is required, please state in plain text.

► Setting range: 14 bar to 22 bar

Relieving the load on port ${\bf X}$ to the reservoir results in a zero stroke ("standby") pressure which lies about 1 to 2 bar

higher than the defined differential pressure Δp , however, system influences are not taken into account.

Controller data

DR pressure controller data see page 11.

Maximum flow deviation measured at drive speed n = 1500 rpm.

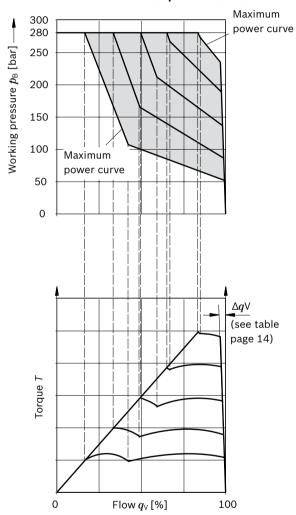
NG		18	28	45	71	88	100	140
Flow deviation	Δq_{Vmax} [l/min]	0.9	1.0	1.8	2.8	3.4	4.0	6.0
Hysteresis and repeat- ability	<i>∆p</i> [bar]			m	aximu	m 4		
Pilot fluid	[l/min]		maxin	num ap	prox.	3 to 4.	5 (DFR	1)
consumption			ma	ximum	appro	x. 3 (E	FR1)	

DFLR - Pressure, flow and power control

Pressure controller equipped like DR, see page 11. Equipment of the flow controller like DFR1, see page 13 In order to achieve a constant drive torque with varying working pressures, the swivel angle and with it the output flow from the axial piston pump is varied so that the product of flow and pressure remains constant.

Flow control is possible below the power control curve.

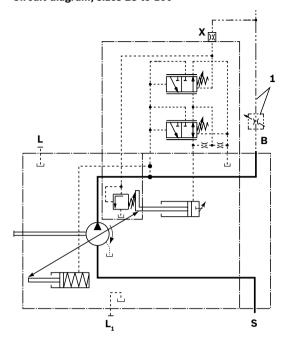
▼ Characteristic curve and torque characteristic



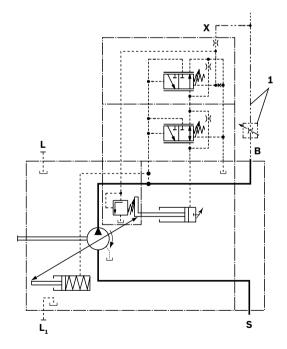
Please contact us regarding beginning of control at < 50 bar

When ordering please state the power characteristics to be set at the factory in plain text, e.g. 20 kW at 1500 rpm.

▼ Circuit diagram, sizes 28 to 100



▼ Circuit diagram, size 140



1 The metering orifice (control block) and the line is not included in the scope of delivery.

Controller data

For technical data of pressure controller DR see page 11. For technical data of flow controller FR see page 14. Control fluid consumption approx. 5.5 I/min max.

ED - Electrohydraulic pressure control

The ED valve is set to a certain pressure by a specified variable solenoid current.

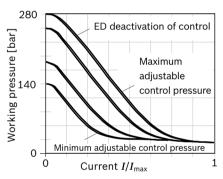
With changes on the consumer (load pressure), this causes an increase or decrease in the pump swivel angle (flow) in order to maintain the electrically set pressure level.

The pump thus only delivers as much hydraulic fluid as the consumers can take. The desired pressure level can be set steplessly by varying the solenoid current.

As the solenoid current signal drops towards zero, the pressure will be limited to p_{max} by an adjustable hydraulic pressure cut-off (secure fail safe function in case of power failure, e.g. for fan speed control). The swivel time characteristic of the ED control was optimized for the use as a fan drive system.

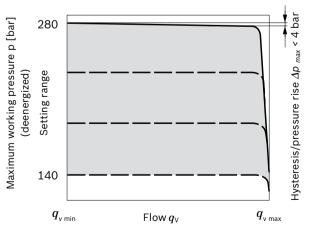
When ordering, specify the type of application in plain text.

▼ Static current-pressure characteristic curve ED (negative characteristic curve measured with pump in zero stroke)



 Hysteresis static current-pressure characteristic curve < 3 bar.

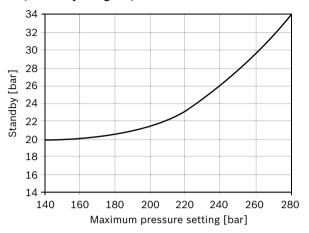
▼ Flow-pressure characteristic curve



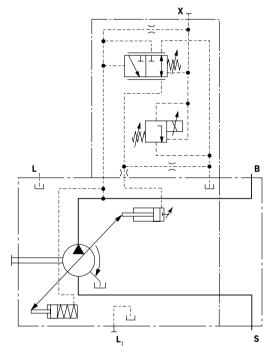
Characteristic curves valid at n_1 = 1500 rpm and t_{fluid} = 50 °C. Control fluid consumption: 3 to 4.5 l/min.

For standby standard setting, see diagram on right, other values on request.

▼ Influence of the pressure setting on standby (maximally energized)



▼ Circuit diagram ED71/ED72



Technical data, solenoid	ED71	ED72
Voltage	12 V (±20%)	24 V (±20%)
Control current		
Start of control at $p_{ m max}$	0 mA	0 mA
Start of control at p_{\min}	1200 mA	600 mA
Current limit	1.54 A	0.77 A
Nominal resistance (at 20 °C)	5.5 Ω	22.7 Ω
Dither frequency	100 to	100 to
	200 Hz	200 Hz
Duty cycle	100%	100%
Electronic controls and type of	protection, see p	age 44

Operating temperature range at valve -20 °C to +115 °C

ER - Electrohydraulic pressure control

The ER valve is set to a certain pressure by a specified variable solenoid current.

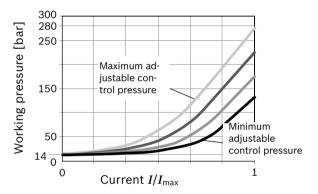
When changing the consumer (load pressure), this causes an increase or decrease in the pump swivel angle (flow) in order to maintain the electrically set pressure level.

The pump thus only delivers as much hydraulic fluid as the consumers can take. The desired pressure level can be set steplessly by varying the solenoid current.

If the solenoid current goes to zero, the pressure is limited to p_{\min} (standby) by the adjustable, hydraulic pressure cut-off.

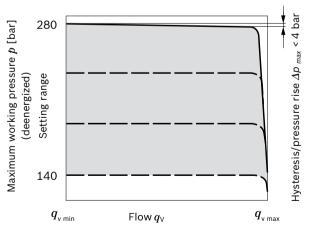
Observe project planning note.

▼ Current-pressure characteristic curve (positive characteristic curve measured with pump in zero stroke)



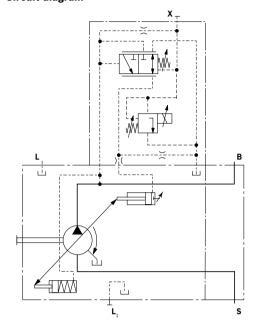
► Hysteresis static < 3 bar.

▼ Flow-pressure characteristic curve



- ► Characteristic curve valid at n_1 = 1500 rpm and θ_{fluid} = 50 °C.
- ► Control fluid consumption: 3 to 4.5 l/min.
- Standby standard setting 14 bar. Other values on request.
- Influence of pressure setting on stand by ±2 bar

▼ Circuit diagram



Technical data, solenoid	ER71	ER72				
Voltage	12 V (±20%)	24 V (±20%)				
Control current						
Start of control at p_{min}	100 mA	50 mA				
End of control at p_{max}	1200 mA	600 mA				
Current limit	1.54 A	0.77 A				
Nominal resistance (at 20 °C)	5.5 Ω	22.7 Ω				
Dither frequency	100 to	100 to				
	200 Hz	200 Hz				
Duty cycle 100% 100%						
Electronic controls and type of protection, see page 44						
Operating temperature range at valve -20 °C to +115 °C						

Project planning note!

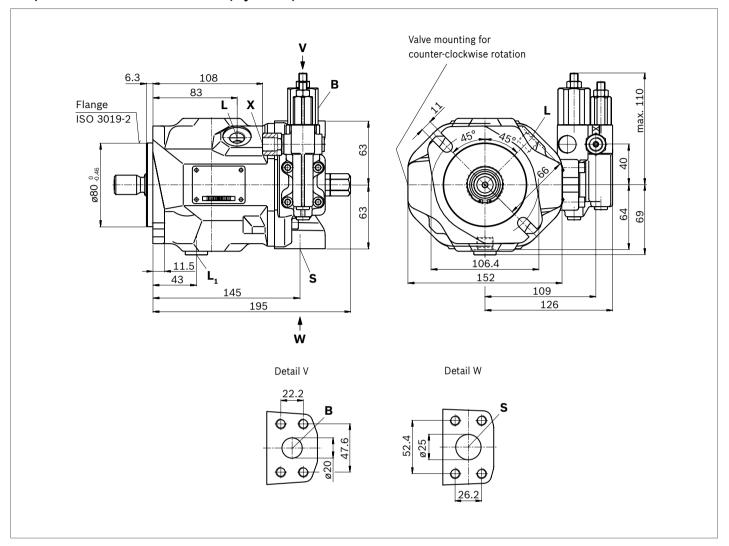
Excessive current levels (I > 1200 mA at 12 V or I > 600 mA at 24 V) to the ER solenoid can result in undesired pressure increases which can lead to pump or system damage. Therefore:

- ▶ Use I_{max} current limiter solenoids.
- An intermediate plate pressure controller can be used to protect the pump in the event of overflow.

An accessory kit with intermediate plate pressure controller can be ordered from Bosch Rexroth under part number R902490825.

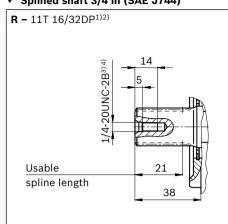
Dimensions, size 18

DFR/DFR1 - Pressure flow controller, hydraulic, clockwise rotation

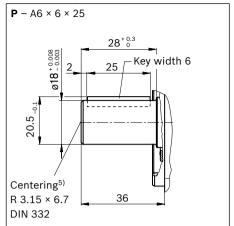


▼ Splined shaft 3/4 in (SAE J744)

▼ Splined shaft 3/4 in (SAE J744)



▼ Parallel keyed shaft, DIN 6885



Ports		Standard	Size ⁴⁾	$p_{\rm max\;abs}$ [bar] ⁶⁾	State ¹⁰⁾
В	Working port (standard pressure series) Fastening thread	SAE J518 ⁷⁾ DIN 13	3/4 in M10 × 1.5; 17 deep	350	0
S	Suction port (standard pressure series) Fastening thread	SAE J518 ⁷⁾ DIN 13	1 in M10 × 1.5; 17 deep	10	0
L	Drain port	DIN 3852 ⁸⁾	M16 × 1.5; 12 deep	2	O ₉₎
L ₁	Drain port	DIN 3852 ⁸⁾	M16 × 1.5; 12 deep	2	X ₉₎
Х	Pilot pressure port	DIN 3852	M14 × 1.5; 12 deep	350	0
X	Pilot pressure port with DG-control	DIN ISO 228	G1/4 in; 12 deep	350	0

 $_{\rm 1)}$ Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5

²⁾ Splines according to ANSI B92.1a, spline runout is a deviation from standard.

³⁾ Thread according to ASME B1.1

⁴⁾ For notes on tightening torques, see the instruction manual

⁵⁾ Coupling axially secured, e.g. with a clamp coupling or radially mounted clamping screw

⁶⁾ Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.

⁷⁾ Metric fastening thread is a deviation from standard.

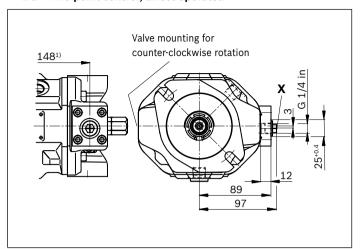
⁸⁾ The countersink can be deeper than as specified in the standard.

⁹⁾ Depending on the installation position, L or L₁ must be connected (also see installation instructions starting on page 45).

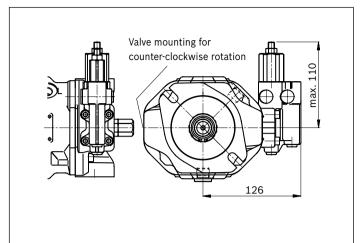
¹⁰⁾ O = Must be connected (plugged when delivered)X = Plugged (in normal operation)

20

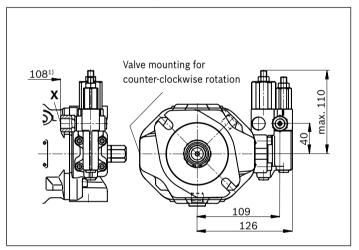
▼ DG - Two-point control, direct operated



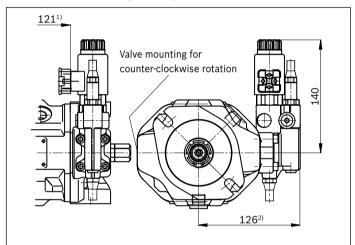
▼ DR – Pressure controller



▼ DRG - Pressure controller, remote controlled



▼ ED7., ER7. - Electrohydraulic pressure control

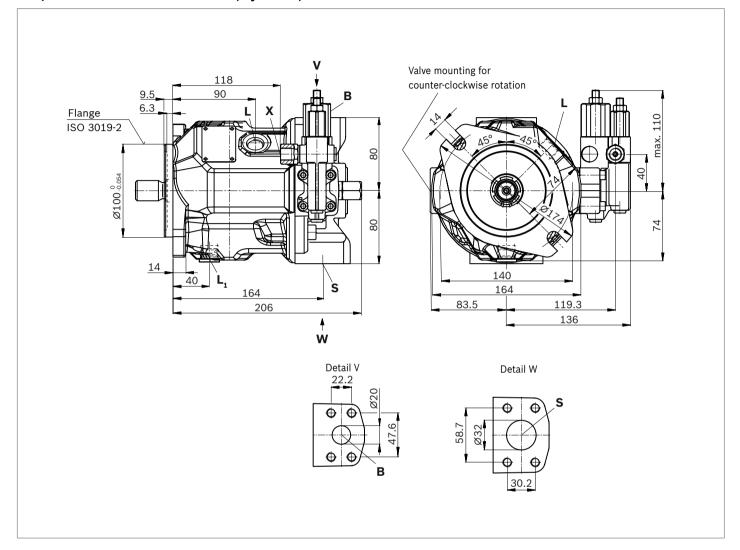


¹⁾ To flange surface

²⁾ ER7.: 161 mm if using an intermediate plate pressure controller

Dimensions, size 28

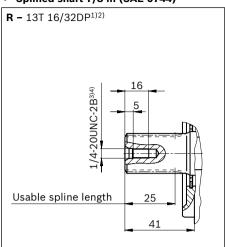
DFR/DFR1 - Pressure flow controller, hydraulic, clockwise rotation



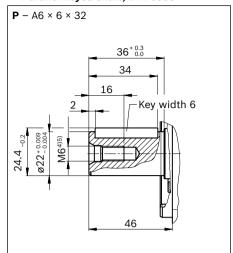
▼ Splined shaft 7/8 in (SAE J744)

S - 13T 16/32DP¹⁾ 333.1 16 5 25.1

▼ Splined shaft 7/8 in (SAE J744)



▼ Parallel keyed shaft, DIN 6885



Ports		Standard	Size ⁴⁾	$p_{\sf max\;abs}$ [bar] $^{6)}$	State ¹⁰⁾
В	Working port (standard pressure series) Fastening thread	SAE J518 ⁷⁾ DIN 13	3/4 in M10 × 1.5; 17 deep	350	0
S	Suction port (standard pressure series) Fastening thread	SAE J518 ⁷⁾ DIN 13	1 1/4 in M10 × 1.5; 17 deep	10	0
L	Drain port	DIN 3852 ⁸⁾	M18 × 1.5; 12 deep	2	O ₉₎
L ₁	Drain port	DIN 3852 ⁸⁾	M18 × 1.5; 12 deep	2	X _{a)}
х	Pilot pressure port	DIN 3852	M14 × 1.5; 12 deep	350	0
X	Pilot pressure port with DG-control	DIN ISO 228	G1/4 in; 12 deep	350	0

 $_{\rm 1)}$ Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5

Splines according to ANSI B92.1a, spline runout is a deviation from standard.

³⁾ Thread according to ASME B1.1

⁴⁾ For notes on tightening torques, see the instruction manual

⁵⁾ Thread according to DIN 13, center bore according to DIN 332-2

⁶⁾ Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.

⁷⁾ Metric fastening thread is a deviation from standard.

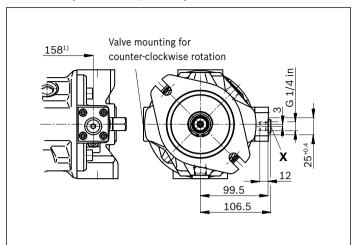
⁸⁾ The countersink can be deeper than as specified in the standard.

⁹⁾ Depending on the installation position, L or L_1 must be connected (also see installation instructions starting on page 45).

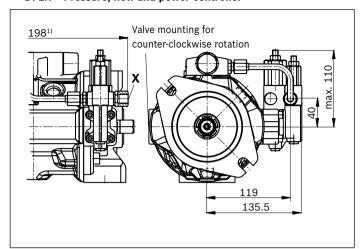
¹⁰⁾ O = Must be connected (plugged when delivered)

X = Plugged (in normal operation)

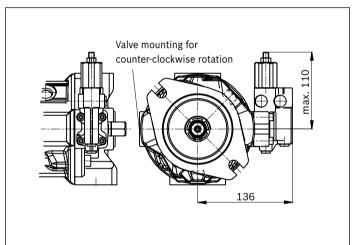
▼ DG - Two-point control, direct operated



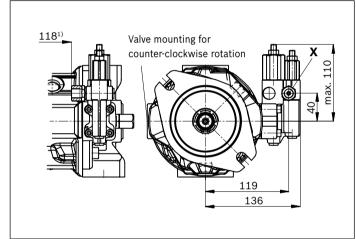
▼ DFLR - Pressure, flow and power controller



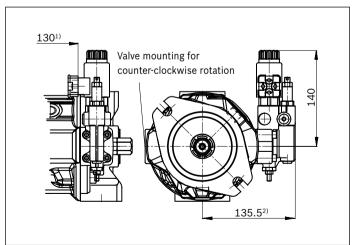
▼ DR - Pressure controller



▼ DRG - Pressure controller, remote controlled



▼ ED7., ER7. - Electrohydraulic pressure control



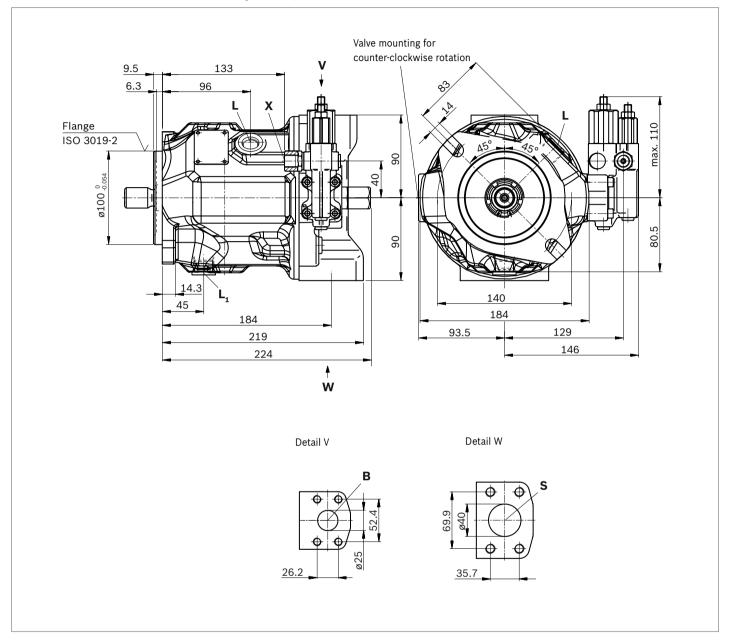
¹⁾ To flange surface

²⁾ ER7.: 170.5 mm if using an intermediate plate pressure controller

24

Dimensions, size 45

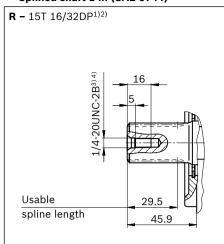
DFR/DFR1 - Pressure flow controller, hydraulic, clockwise rotation



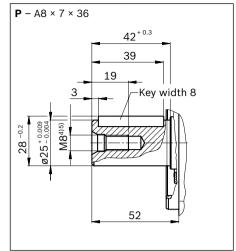
▼ Splined shaft 1 in (SAE J744)

S - 15T 16/32DP¹⁾ 38 16 5 30 45.9

▼ Splined shaft 1 in (SAE J744)



▼ Parallel keyed shaft, DIN 6885



Ports		Standard	Size ⁴⁾	$p_{\rm max\;abs}$ [bar] ⁶⁾	State ¹⁰⁾
В	Working port (standard pressure series) Fastening thread	SAE J518 ⁷⁾ DIN 13	1 in M10 × 1.5; 17 deep	350	0
S	Suction port (standard pressure series) Fastening thread	SAE J518 ⁷⁾ DIN 13	1 1/2 in M12 × 1.75; 20 deep	10	0
L	Drain port	DIN 3852 ⁸⁾	M22 × 1.5; 14 deep	2	O ₉₎
L ₁	Drain port	DIN 38528)	M22 × 1.5; 14 deep	2	X ₉₎
Х	Pilot pressure port	DIN 3852	M14 × 1.5; 12 deep	350	0
Х	Pilot pressure port with DG-control	DIN ISO 228	G1/4 in; 12 deep	350	0

Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5

Splines according to ANSI B92.1a, spline runout is a deviation from standard.

³⁾ Thread according to ASME B1.1

⁴⁾ For notes on tightening torques, see the instruction manual

⁵⁾ Thread according to DIN 13, center bore according to DIN 332-2

⁶⁾ Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.

⁷⁾ Metric fastening thread is a deviation from standard.

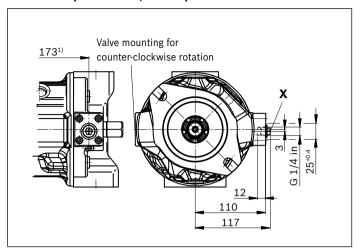
⁸⁾ The countersink can be deeper than as specified in the standard.

⁹⁾ Depending on the installation position, L or L_1 must be connected (also see installation instructions starting on page 45).

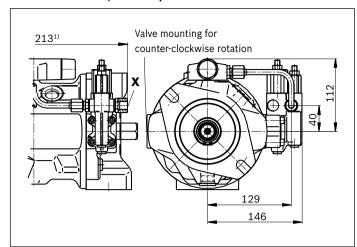
¹⁰⁾ O = Must be connected (plugged when delivered)

X = Plugged (in normal operation)

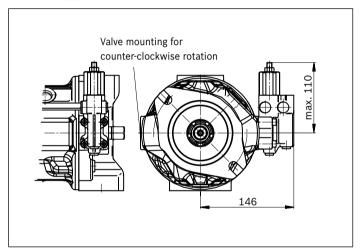
▼ DG - Two-point control, direct operated



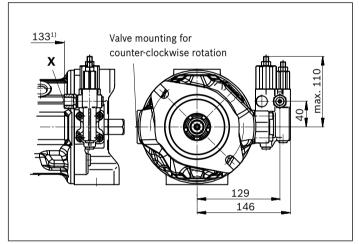
▼ DFLR - Pressure, flow and power controller



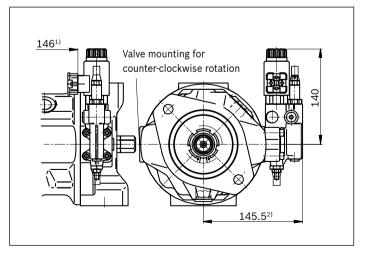
▼ DR - Pressure controller



▼ DRG - Pressure controller, remote controlled



▼ ED7., ER7. - Electrohydraulic pressure control

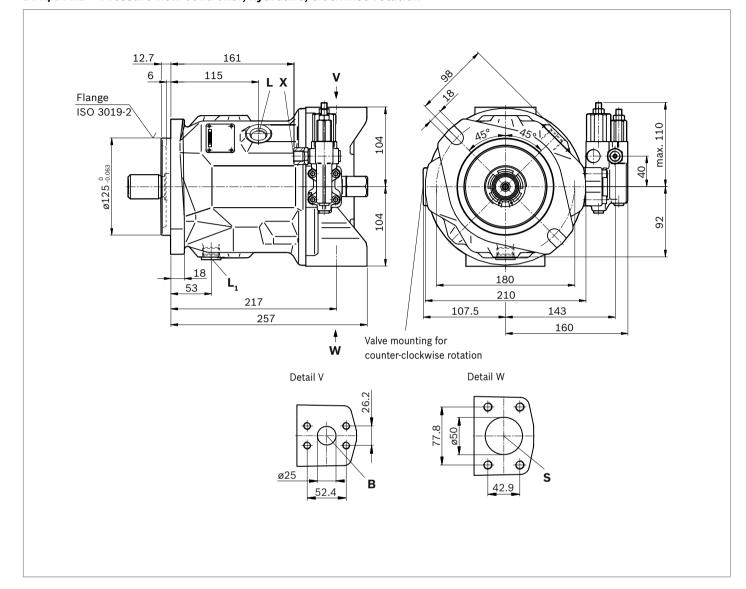


¹⁾ To flange surface

 $_{2)}\;\;\text{ER7.:}\;180.5\;\text{mm}\;\text{if using an intermediate plate pressure controller}$

Dimensions sizes 71 and 88

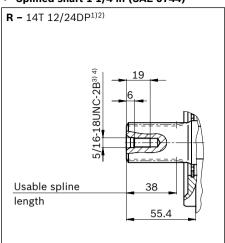
DFR/DFR1 - Pressure flow controller, hydraulic, clockwise rotation



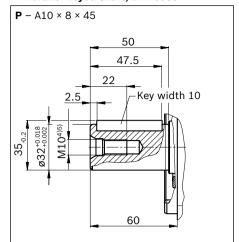
▼ Splined shaft 1 1/4 in (SAE J744)

S - 14T 12/24DP¹⁾ 47.5 19 6 39.5 55.4

▼ Splined shaft 1 1/4 in (SAE J744)



▼ Parallel keyed shaft, DIN 6885



Ports		Standard	Size ⁴⁾	$p_{\sf max\;abs}$ [bar] $^{6)}$	State ¹⁰⁾
В	Working port (standard pressure series)	SAE J518 ⁷⁾	1 in	350	0
	Fastening thread	DIN 13	M10 × 1.5; 17 deep		
S	Suction port (standard pressure series)	SAE J518 ⁷⁾	2 in	10	0
	Fastening thread	DIN 13	M12 × 1.75; 20 deep		
L	Drain port	DIN 38528)	M22 × 1.5; 14 deep	2	O ₉₎
L ₁	Drain port	DIN 38528)	M22 × 1.5; 14 deep	2	X ₉₎
х	Pilot pressure port	DIN 3852	M14 × 1.5; 12 deep	350	0
Х	Pilot pressure port with DG-control	DIN ISO 228	G1/4 in; 12 deep	350	0

Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5

Splines according to ANSI B92.1a, spline runout is a deviation from standard.

³⁾ Thread according to ASME B1.1

⁴⁾ For notes on tightening torques, see the instruction manual

⁵⁾ Thread according to DIN 13, center bore according to DIN 332-2

⁶⁾ Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.

⁷⁾ Metric fastening thread is a deviation from standard.

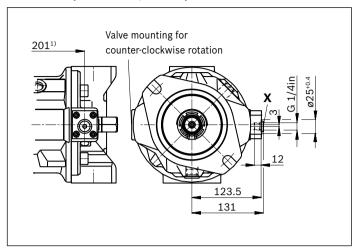
⁸⁾ The countersink can be deeper than as specified in the standard.

⁹⁾ Depending on the installation position, L or L_1 must be connected (also see installation instructions starting on page 45).

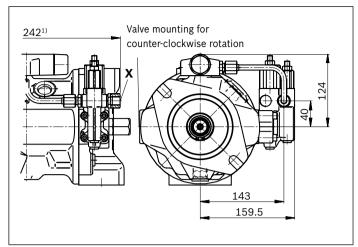
¹⁰⁾ O = Must be connected (plugged when delivered)

X = Plugged (in normal operation)

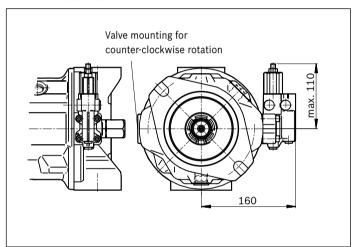
▼ DG - Two-point control, direct operated



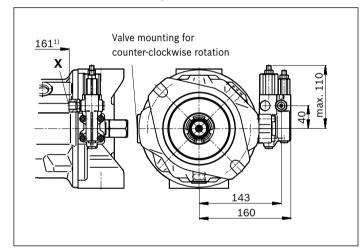
▼ DFLR - Pressure, flow and power controller



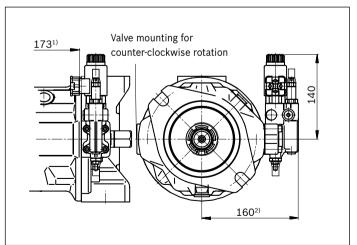
▼ DR - Pressure controller



▼ DRG - Pressure controller, remote controlled



▼ ED7., ER7. - Electrohydraulic pressure control

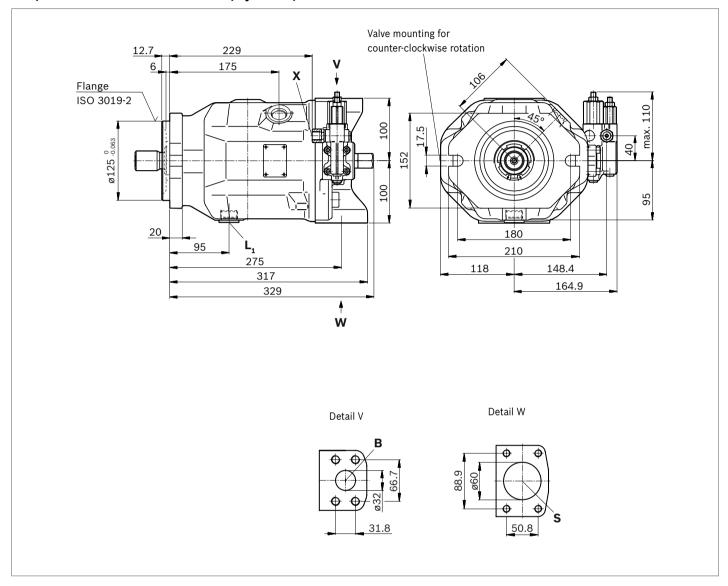


¹⁾ To flange surface

 $^{^{2)}}$ ER7.: 195 mm if using an intermediate plate pressure controller

Dimensions, size 100

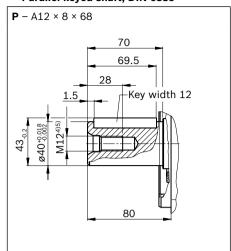
DFR/DFR1 - Pressure flow controller, hydraulic, clockwise rotation



▼ Splined shaft 1 1/2 in (SAE J744)

S - 17T 12/24DP¹⁾ 54 28 9.5 43.5 61.9

▼ Parallel keyed shaft, DIN 6885



Ports		Standard	Size ⁴⁾	p _{max abs} [bar] ⁶⁾	State ¹⁰⁾
В	Working port (high-pressure series) Fastening thread	SAE J518 ⁷⁾ DIN 13	1 1/4 in M14 × 2; 19 deep	350	0
S	Suction port (standard pressure series) Fastening thread	SAE J518 ⁷⁾ DIN 13	2 1/2 in M12 × 1.75; 17 deep	10	0
L	Drain port	DIN 3852 ⁸⁾	M27 × 2; 16 deep	2	O ₉₎
L ₁	Drain port	DIN 38528)	M27 × 2; 16 deep	2	X ₉₎
х	Pilot pressure port	DIN 3852	M14 × 1.5; 12 deep	350	0
х	Pilot pressure port with DG-control	DIN ISO 228	G1/4 in; 12 deep	350	0

Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5

Splines according to ANSI B92.1a, spline runout is a deviation from standard.

³⁾ Thread according to ASME B1.1

⁴⁾ For notes on tightening torques, see the instruction manual

⁵⁾ Thread according to DIN 13, center bore according to DIN 332-2

⁶⁾ Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.

⁷⁾ Metric fastening thread is a deviation from standard.

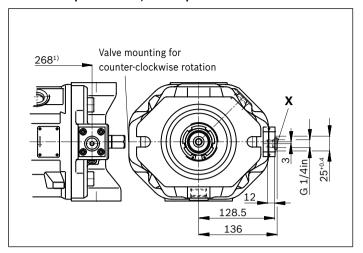
⁸⁾ The countersink can be deeper than as specified in the standard.

⁹⁾ Depending on the installation position, L or L_1 must be connected (also see installation instructions starting on page 45).

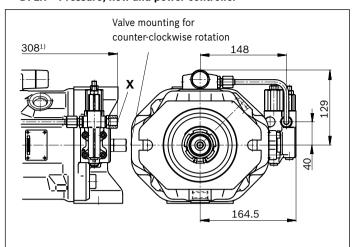
¹⁰⁾ O = Must be connected (plugged when delivered)

X = Plugged (in normal operation)

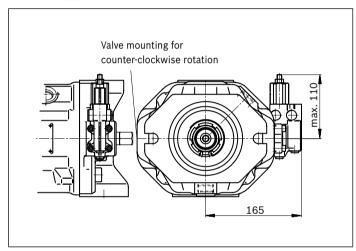
▼ DG - Two-point control, direct operated



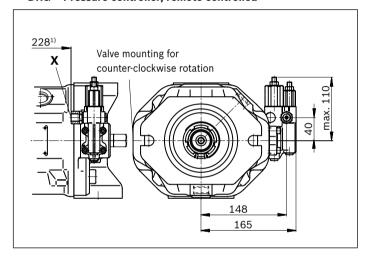
▼ DFLR - Pressure, flow and power controller



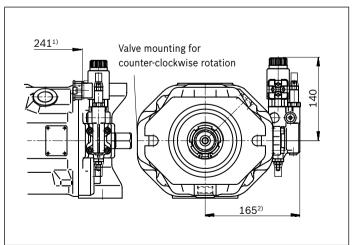
▼ DR - Pressure controller



▼ DRG - Pressure controller, remote controlled



▼ ED7., ER7. - Electrohydraulic pressure control

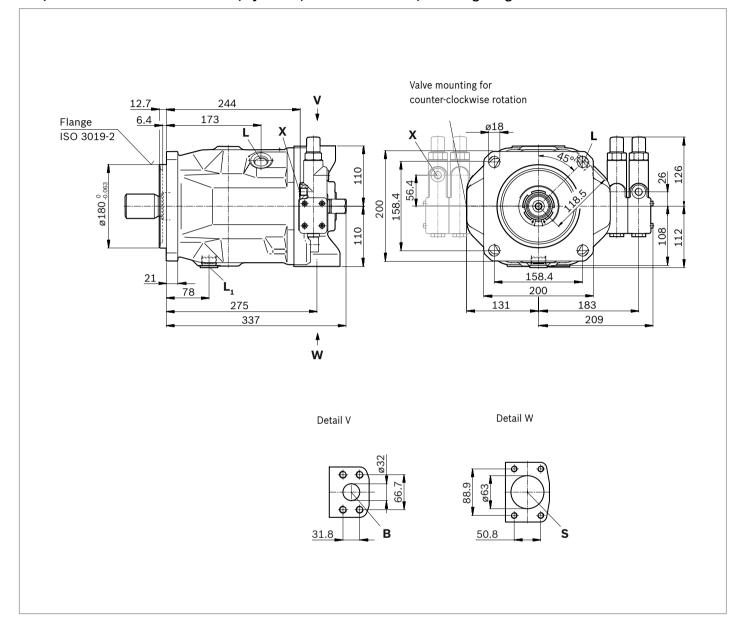


¹⁾ To flange surface

²⁾ ER7.: 200 mm if using an intermediate plate pressure controller

Dimensions, size 140

DFR/DFR1 - Pressure flow controller, hydraulic, clockwise rotation, mounting flange D

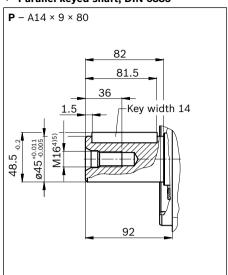


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▼ Splined shaft 1 3/4 in (SAE J744)

S - 13T 8/16DP¹⁾ 67 32 10 05 8 75 75

▼ Parallel keyed shaft, DIN 6885



Ports		Standard	Size ⁴⁾	$p_{\sf max\; abs}$ [bar] $^{6)}$	State ¹⁰⁾
В	Working port (high-pressure series)	SAE J518 ⁷⁾	1 1/4 in	350	0
	Fastening thread	DIN 13	M14 × 2; 19 deep		
S	Suction port (standard pressure series)	SAE J518 ⁷⁾	2 1/2 in	10	0
	Fastening thread	DIN 13	M12 × 1.75; 17 deep		
L	Drain port	DIN 3852 ⁸⁾	M27 × 2; 16 deep	2	O ₉₎
L ₁	Drain port	DIN 3852 ⁸⁾	M27 × 2; 16 deep	2	X ₉₎
х	Pilot pressure port	DIN 3852	M14 × 1.5; 12 deep	350	0
х	Pilot pressure port with DG-control	DIN 3852	M14 × 1.5; 12 deep	350	0
M _H	High pressure measurement (only with control DG)	DIN 3852	M14 × 1.5; 12 deep	350	X

Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5

²⁾ Splines according to ANSI B92.1a, spline runout is a deviation from standard.

³⁾ Thread according to ASME B1.1

⁴⁾ For notes on tightening torques, see the instruction manual

⁵⁾ Thread according to DIN 13, center bore according to DIN 332-2

⁶⁾ Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.

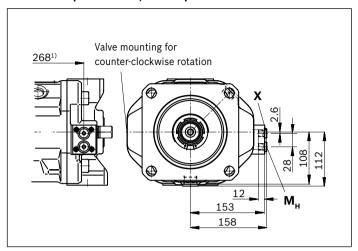
⁷⁾ Metric fastening thread is a deviation from standard.

⁸⁾ The countersink can be deeper than as specified in the standard.

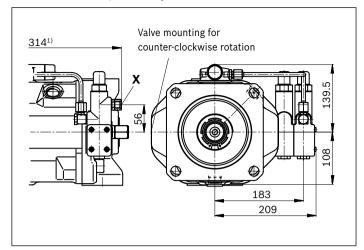
⁹⁾ Depending on the installation position, L or L_1 must be connected (also see installation instructions starting on page 45).

¹⁰⁾ O = Must be connected (plugged when delivered)
X = Plugged (in normal operation)

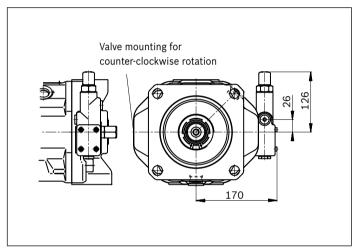
▼ DG - Two-point control, direct operated



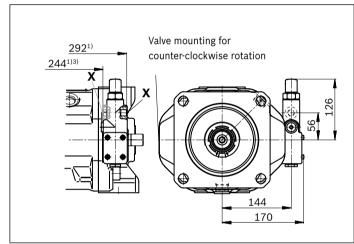
▼ DFLR - Pressure, flow and power controller



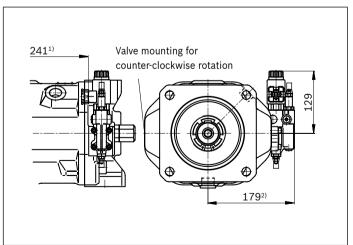
▼ DR - Pressure controller



▼ DRG - Pressure controller, remote controlled



▼ ED7., ER7. - Electrohydraulic pressure control



¹⁾ To flange surface

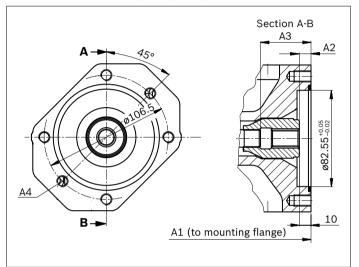
 $_{\rm 2)}$ ER7.: 214 mm if using an intermediate plate pressure controller

Dimensions, through drive

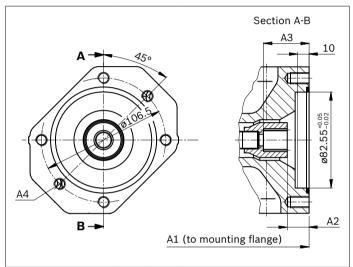
Flange ISO 3019-1 (SAE) Hub for splined shaft ¹⁾		Availability over sizes							Code	
Diameter	Symbol	Diameter	18	28	45	71	88	100	140	
82-2 (A)	8, o°, o-o	5/8 in 9T 16/32DP	•	•	•	•	•	•	•	K01
		3/4 in 11T 16/32DP	•	•	•	•	•	•	•	K52

• = Available - = Not available

▼ 82-2



▼ 82-2



K01	NG	A1	A2	А3	A4 ²⁾
(SAE J744 16-4 (A))					
	18	182	10	43.3	M10×1.5; 14.5 deep
	28	204	10	33.7	M10×1.5; 16 deep
	45	229	10.7	53.4	M10×1.5; 16 deep
	71	267	11.8	61.3	M10×1.5; 20 deep
	88	267	11.8	61.3	M10×1.5; 20 deep
	100	338	10.5	65	M10×1.5; 16 deep
	140	350	10.8	77.3	M10×1.5; 16 deep

K52 (SAE J744 19-4 (A-B))	NG	A1	A2	А3	A4 ²⁾
	18	182	18.8	38.7	M10×1.5; 14.5 deep
	28	204	18.8	38.7	M10×1.5; 16 deep
	45	229	18.9	38.7	M10×1.5; 16 deep
	71	267	21.3	41.4	M10×1.5; 20 deep
	88	267	21.3	41.4	M10×1.5; 20 deep
	100	338	19	38.9	M10×1.5; 16 deep
	140	350	18.9	38.6	M10×1.5; 16 deep

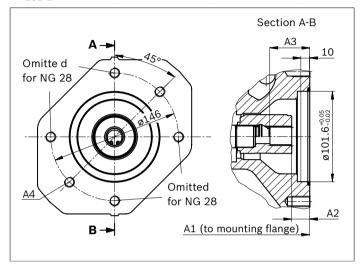
 $_{\mbox{\scriptsize 1)}}$ According to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5

²⁾ Thread according to DIN 13, see instruction manual for maximum tightening torques.

Flange ISO 3019-1 (SAE)		Hub for splined shaft ¹⁾	Availab	ility over	sizes					Code
Diameter	Symbol	Diameter	18	28	45	71	88	100	140	
101-2 (A)	8, 8, 00	7/8 in 13T 16/32DP	-	•	•	•	•	•	•	K68
		1 in 15T 16/32DP	_	_	•	•	•	•	•	K04

• = Available - = Not available

▼ 101-2



▼ 101-2	
	Section A-B
A - 450	A3 10 10 10 10 10 10 10 10 10 10 10 10 10

K68	NG	A1	A2	А3	A4 ²⁾
(SAE J744 22-4 (B))					
	28	204	17.8	41.7	M12×1.75 ³⁾
	45	229	17.9	41.7	M12×1.75; 18 deep
	71	267	20.3	44.7	M12×1.75; 20 deep
	88	267	20.3	44.7	M12×1.75; 20 deep
	100	338	18	41.9	M12×1.75; 20 deep
	140	350	17.8	41.6	M12×1.75; 20 deep

K04	NG	A1	A2	А3	A4 ²⁾
(SAE J744 25-4 (B-B))					
	45	229	18.4	46.7	M12×1.75; 18 deep
	71	267	20.8	49.1	M12×1.75; 20 deep
	88	267	20.8	49.1	M12×1.75; 20 deep
	100	338	18.2	46.6	M12×1.75; 20 deep
	140	350	18.3	45.9	M12×1.75; 20 deep

 $_{\mbox{\scriptsize 1)}}$ According to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5

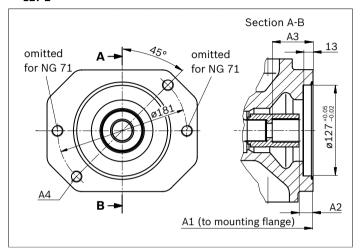
²⁾ Thread according to DIN 13, see instruction manual for maximum tightening torques.

³⁾ Continuous

Flange ISO 3019-1 (SAE)		Hub for splined shaft ¹⁾	Availabi	Availability over sizes							
Diameter	Symbol	Diameter	18	28	45	71	88	100	140		
127-2 (C)	o°, o-o	1 1/4 in 14T 12/24DP	-	-	-	•	•	•	•	K07	
		1 1/2 in 17T 12/24DP	-	-	-	_	-	•	•	K24	

• = Available - = Not available

▼ 127-2



	Section A-B
A - 45° A - 45	A3 13 13 13 13 13 10 10 10 10 1

K07	NG	A1	A2	А3	A4 ²⁾
(SAE J744 32-4 (C))					
	71	267	21.8	58.6	M16×2 ³⁾
	88	267	21.8	58.6	M16×2 ³⁾
	100	338	19.5	56.4	M16×2 ³⁾
	140	350	19.3	56.1	M16×2; 24 deep

K24	NG	A1	A2	А3	A4 ²⁾
(SAE J744 38-4 (C-C))					
	100	338	10.5	65	M16×2 ³⁾
	140	350	7.9	73.3	M16×2; 32 deep

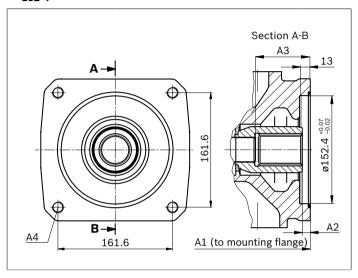
According to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5

²⁾ Thread according to DIN 13, see instruction manual for maximum tightening torques.

Flange ISO 30	Flange ISO 3019-1 (SAE) Hub for splined shaft ¹⁾		Availabi	Availability over sizes							
Diameter	Symbol	Diameter	18	28	45	71	88	100	140		
152-4 (A)	\$3	1 3/4 in 13T 8/16DP	-	_	_	-	_	_	•	K17	
63-4	\$3	Metric keyed shaft Ø25	_	•	•	•	•	•	•	K57	

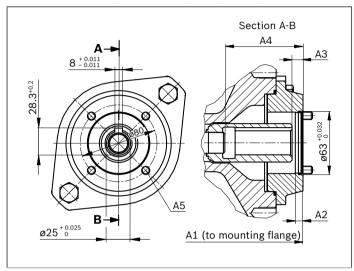
• = Available - = Not available

▼ 152-4



K17	NG	A1	A2	А3	A4 ²⁾
(SAE J744 44-4 (D))					
	140	350	11	77.3	M16×2; ³⁾

▼ **63-4** metric⁴⁾



K57 (4-hole flange)	NG	A1	A2	А3	A4	A5 ⁵⁾
	28	232	8	10.6	58.4	M8
	45	257	8	11	81	M8
	71	283	8	12.5	77	M10
	88	283	8	12.5	77	M10
	100	354	8	10.5	81	M10
	140	366	8	11	93	M8

According to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5

²⁾ Thread according to DIN 13, see instruction manual for maximum tightening torques.

³⁾ Continuous

⁴⁾ For mounting an R4 radial piston pump (see data sheet 11263)

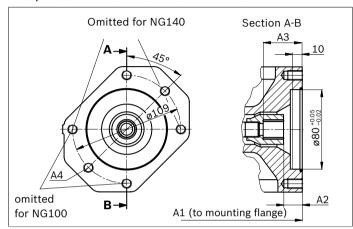
⁵⁾ Screws for mounting the radial piston motor are included in the scope of delivery

40 **A10VSO Series 31** | Axial piston variable pump Dimensions, through drive

Flange ISO 3019-2		Hub for splined shaft ¹⁾	Availabi	Availability over sizes							
Diameter	Symbol	Diameter	18	28	45	71	88	100	140		
80, 2-hole	8, 00, 00	3/4 in 11T 16/32DP	•	•	•	•	•	•	•	KB2	
100, 2-hole	o°	7/8 in 13T 16/32DP	-	•	•	•	•	•	•	KB3	
		1 in 15T 16/32DP	_	_	•	•	•	•	•	KB4	

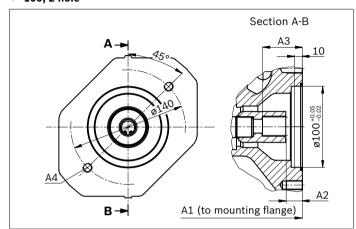
• = Available - = Not available

▼ 80, 2-hole



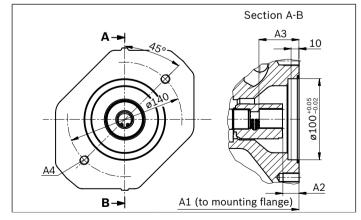
KB2	NG	A1	A2	А3	A4 ²⁾
(SAE J744 19-4 (A-B))					
	18	182	18.8	38.7	M10×1.5; 14.5 deep
	28	204	18.8	38.7	M10×1.5; 16 deep
	45	229	18.9	38.7	M10×1.5; 16 deep
	71	267	21.3	41.4	M10×1.5; 20 deep
	88	267	21.3	41.4	M10×1.5; 20 deep
	100	338	19	38.9	M10×1.5; 20 deep
	140	350	18.9	38.6	M10×1.5; 20 deep

▼ 100, 2-hole



KB3	NG	A1	A2	А3	A4 ²⁾
(SAE J744 22-4 (B))					
	28	204	17.8	41.7	M12×1.5 ³⁾
	45	229	17.9	41.7	M12×1.5 ³⁾
	71	267	20.3	44.1	M12×1.5; 20 deep
	88	267	20.3	44.1	M12×1.5; 20 deep
	100	338	18	41.9	M12×1.5; 20 deep
	140	350	17.8	41.6	M12×1.5; 20 deep

▼ 100, 2-hole



KB4	NG	A1	A2	А3	A4 ²⁾
(SAE J744 25-4 (B-B))					
	45	229	18.4	46.7	M12×1.75 ³⁾
	71	267	20.8	49.1	M12×1.75; 20 deep
	88	267	20.8	49.1	M12×1.75; 20 deep
	100	338	18.2	46.6	M12×1.75; 20 deep
	140	350	18.3	45.9	M12×1.75; 20 deep

 $_{\rm 1)}$ According to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5

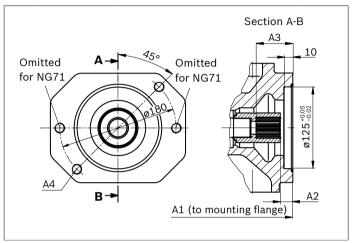
²⁾ Thread according to DIN 13, see instruction manual for maximum tightening torques.

³⁾ Continuous

Flange ISO 3019-2		Hub for splined shaft ¹⁾	Availabi	Availability over sizes						
Diameter	Symbol	Diameter	18	28	45	71	88	100	140	
125, 2-hole	ర°, ం-ం	1 1/4 in 14T 12/24DP	-	_	-	•	•	•	•	KB5
		1 1/2 in 17T 12/24DP	-	-	-	-	_	•	•	KB6
180, 2-hole	\$3	1 3/4 in 13T 8/32DP	_	-	-	-	_	-	•	KB7

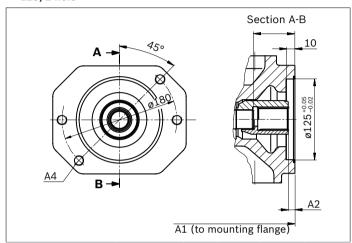
• = Available - = Not available

▼ 125, 2-hole



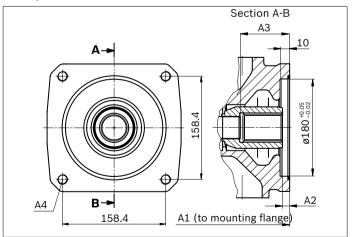
KB5	NG	A1	A2	А3	A4 ²⁾
(SAE J744 32-4 (C))					
	71	267	21.8	58.6	M16×2 ³⁾
	88	267	21.8	58.6	M16×2 ³⁾
	100	338	19.5	56.4	M16×2 ³⁾
	140	350	19.3	56.1	M16×2; 24 deep

▼ 125, 2-hole



KB6	NG	A1	A2	А3	A4 ²⁾
(SAE J744 38-4 (C-C))					
	100	338	10.5	65	M16×2 ³⁾
	140	350	10.1	77.3	M16×2; 32 deep

▼ 180, 4-hole



KB7	NG	A1	A2	А3	A4 ²⁾
(SAE J744 44-4 (D))					
	140	350	11.3	77.3	M16×2 ³⁾

- $_{\rm 1)}$ According to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
- 2) Thread according to DIN 13, see instruction manual for maximum tightening torques.
- 3) Continuous

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Overview of mounting options

SAE – mounting flange

Through drive			Mounting option	Mounting options – 2nd pump						
Flange ISO 3019-1	Hub for splined shaft	Code	A10VSO/31 NG (shaft)	A10V(S)O/5x NG (shaft)	Gear pump Design (NG)	Through drive available for size				
82-2 (A)	5/8 in	K01	18 (U)	10 (U) 18 (U)	AZPF	18 to 140				
	3/4 in	K52	18 (S, R)	10 (S) 18 (S, R)	-	18 to 140				
101-2 (B)	7/8 in	K68	28 (S, R) 45 (U, W) ¹⁾	28 (S, R) 45 (U, W) ¹⁾	AZPN/G	28 to 140				
	1 in	K04	45 (S, R)	45 (S, R) 60, 63, 72 (U, W) ²⁾	PGH4	45 to 140				
127-2 (C)	1 1/4 in	K07	71 (S, R) 88 (S, R) 100 (U, W) ³⁾	85 (U, W) ³⁾ 100 (U,W)	-	71 to 140				
	1 1/2 in	K24	100 (S)	85 (S) 100 (S)	PGH5	100 to 140				
152-4 (4-hole D)	1 3/4 in	K17	140 (S)	_	-	140				

ISO - mounting flange

Through drive			Mounting options	Mounting options – 2nd pump						
Flange ISO 3019-2	Hub for splined shaft	Code	A10VSO/31 NG (shaft)	A10V(S)O/5x NG (shaft)	External gear pump design (size)	Through drive available for size				
80, 2-hole	3/4 in	KB2	18 (S, R)	10 (S)	-	18 to 140				
100, 2-hole	7/8 in	KB3	28 (S, R)	-	-	28 to 140				
	1 in	KB4	45 (S, R)	-	-	45 to 140				
125, 2-hole	1 1/4 in	KB5	71 (S, R) 88 (S, R)	-	-	71 to 140				
	1 1/2 in	KB6	100 (S)	-	-	100 to 140				
180, 4-hole	1 3/4 in	KB7	140 (S)	-	-	140				

ISO - mounting flange for keyed shaft

Through drive			Mounting options – 2nd pump		
Flange ISO 3019-2	Hub for keyed shaft	Code		Radial piston pump	Through drive available for size
63-4 metric	3/4 in	K57		R4	28 to 140

¹⁾ Not for main pump NG28 with K68

²⁾ Not for main pump NG45 with K04

³⁾ Not for main pump NG71 and NG88 with K07

Combination pumps A10VSO + A10VSO

By using combination pumps, it is possible to have independent circuits without the need for splitter gearboxes. When ordering combination pumps, the type designations of the 1st and 2nd pumps must be linked by a "+".

Order example:

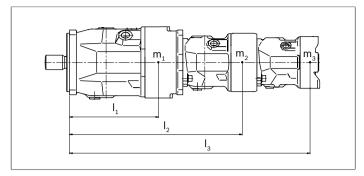
A10VSO100DFR1/31R-VSA12K04+ A10VSO45DFR/31R-VSA12N00

If no further pumps are to be mounted at the factory, the simple type designation is sufficient.

It is permissible to use a combination of two single pumps of the same nominal size (tandem pump) considering a dynamic mass acceleration of maximum 10 g (= 98.1 m/s²) without additional support brackets.

Each through drive is plugged with a **non-pressure-resistant** cover. Before commissioning the units, they must therefore be equipped with a pressure-resistant cover. Through drives can also be ordered with pressure-resistant covers. Please specify in plain text.

For combination pumps consisting of more than two pumps, the mounting flange must be rated for the permissible mass torque (please contact us).



m_1, m_2, m_3	Weight of pump	[kg]
l_1, l_2, l_3	Distance from center of gravity	[mm]
$T_m = (m_1 \times l_1)$	$+ m_2 \times l_2 + m_3 \times l_3) \times \frac{1}{102}$	[Nm]

Permissible mass moment of inertia

Size			18	28	45	71	88	100	140
static	T_m	Nm	500	880	1370	2160	2160	3000	4500 ¹⁾ 3000 ²⁾
dynamic at 10 g (98.1 m/s ²)	T_m	Nm	50	88	137	216	216	300	450 ¹⁾ 300 ²⁾
Weight without through drive (N00)	m	kg	12.9	18	23.5	35.2	35.2	49.5	65.4
Weight with through drive (K)			13.8	19.3	25.1	38	38	55.4	74.4
Distance, center of gravity without through drive (N00)	l_1	mm	92	100	113	127	127	161	159
Distance, center of gravity with through drive (K)	l_1	mm	98	107	120	137	137	178	180

^{1) 4-}hole flange (D)

^{2) 2-}hole flange (C)

Connector for solenoids

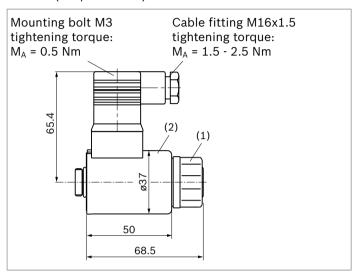
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HIRSCHMANN DIN EN 175 301-803-A /ISO 4400

without bidirectional suppressor diode H

There is the following type of protection with the installed mating connector:

► IP65 (DIN/EN 60529)



The seal ring in the cable fitting is suitable for lines of diameter 4.5 mm to 10 mm.

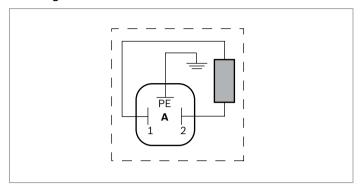
The mating connector is not included in the scope of delivery. This can be supplied by Bosch Rexroth on request.

Electronic controls

Control	Electronics		Further information
Electric amplifier	VT 2000 ¹⁾	analog	29904
Electrical amplifier modules	VT 11029 VT 11030 ¹⁾	analog	29741
Valve amplifiers for proportional pressure valves	VT-VSPA1-1 ¹⁾ VT-VSPA1K-1 ¹⁾	analog	30111

Bosch Rexroth material number: R902602623

Device plug on the solenoid
according to DIN 43650



Notice

- ► If necessary, you can change the position of the connector by turning the solenoid.
- ▶ The procedure is defined in the instruction manual.

Installation instructions

General

The axial piston unit must be filled with hydraulic fluid and air bled during commissioning and operation. This must also be observed following a longer standstill as the axial piston unit may empty via the hydraulic lines.

Particularly with the "drive shaft up/down" installation position, filling and air bleeding must be carried out completely as there is, for example, a danger of dry running. The leakage in the housing area must be discharged to the reservoir via the highest available tank port $(\mathbf{L}, \mathbf{L}_1)$.

For combination pumps, the leakage must be drained off at each pump.

If a shared drain line is used for several units, make sure that the respective case pressure is not exceeded. The shared drain line must be dimensioned to ensure that the maximum permissible case pressure of all connected units is not exceeded in any operational conditions, particularly at cold start. If this is not possible, separate drain lines must be installed if necessary.

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

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

When designing the reservoir, ensure adequate distance between the suction line and the drain line. This prevents the heated, return flow from being drawn directly back into the suction line.

Key, see page 47.

Installation position

See the following examples 1 to 12.

Further installation positions are available upon request.

Recommended installation position: 1 and 3

Below-reservoir installation (standard)

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

Insta	allation position	Air bleed	Filling
1	mation position	L	L ₁
•	h _{t min} SBI		-1
2 ¹⁾		L ₁	L
	h _{t min} SB		
3		L ₁	L
	h _{t min} SBI		
41)		L	L ₁
	h _{t min} SB		

¹⁾ Because complete air bleeding and filling are not possible in this position, the pump should be air bled and filled in a horizontal position before installation.

46

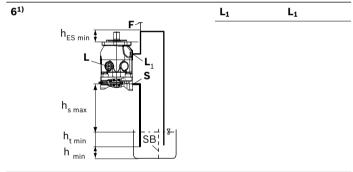
Above-reservoir installation

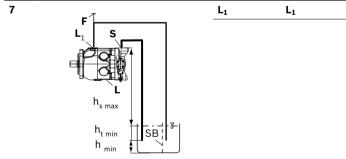
Above-reservoir installation means that the axial piston unit is installed above the minimum fluid level of the reservoir. To prevent the axial piston unit from

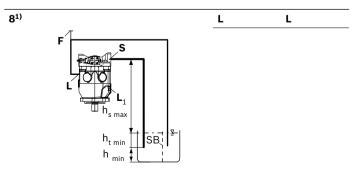
draining in position 6, the height difference hES min must be at least 25 mm. Observe the maximum permissible suction height $h_{\text{S max}}$ = 800 mm

A check valve in the drain line is only permissible in individual cases. Consult us for approval..

Installation position	Air bleed	Filling
F L S h _{s max}	L	L
h _{t min}		







Key, see page 47.

Inside-reservoir installation

Inside-reservoir installation is when the axial piston unit is installed in the reservoir below the minimum fluid level.

The axial piston unit is completely below the hydraulic fluid. If the minimum fluid level is equal to or below the upper edge of the pump, see chapter "Above-reservoir installation". Axial piston units with electrical components (e.g., electric control, sensors) may not be installed in a reservoir below the fluid level.

Installat	ion position	Air bleed	Filling
9	SB view d	Via the highest available port L	Automatically via the open port L or L ₁ due to the position under the hydraulic fluid level
101)	SB - vimin d	Via the highest available port L ₁	Automatically via the open port L , L ₁ due to the position under the hydraulic fluid level
11	L S S S S S S S S S S S S S S S S S S S	Via the highest available port L ₁	Automatically via the open port L or L ₁ due to the position under the hydraulic fluid level
12 ¹⁾	S cim d	Via the highest available port L	Automatically via the open port L or L ₁ due to the position under the hydraulic fluid level

¹⁾ Because complete air bleeding and filling are not possible in this position, the pump should be air bled and filled in a horizontal position before installation.

Key	
F	Filling / air bleeding
S	Suction port
L; L ₁	Drain port
SB	Baffle (baffle plate)
h _{t min}	Minimum required immersion depth (200 mm)
h_{min}	Minimum required distance to the reservoir bottom (100 mm)
h _{ES min}	Minimum necessary height required to protect the axial piston unit from draining (25 mm)
h _{S max}	Maximum permissible suction height (800 mm)

Notice

Port **F** is part of the external piping and must be provided on the customer side to make filling and air bleeding easier.

Project planning notes

- ► The A10VSO axial piston variable pump is designed to be used in open circuit.
- ► The project planning, installation and commissioning of the axial piston unit requires the involvement of qualified skilled personnel.
- ▶ Before using the axial piston unit, please read the corresponding instruction manual completely and thoroughly. If necessary, this can be requested from Bosch Rexroth.
- ► Before finalizing your design, please request a binding installation drawing.
- ► The specified data and notes contained herein must be observed.
- ► Depending on the operating conditions of the axial piston unit (working pressure, fluid temperature), the characteristic curve may shift.
- ▶ Preservation: Our axial piston units are supplied as standard with preservative protection for a maximum of 12 months. If longer preservative protection is required (maximum 24 months), please specify this in plain text when placing your order. The preservation periods apply under optimal storage conditions, details of which can be found in the data sheet 90312 or in the instruction manual.
- ► Not all versions of the product are approved for use in a safety function according to ISO 13849. Please consult the responsible contact person at Bosch Rexroth if you require reliability parameters (e.g. MTTF_d) for functional safety.
- ▶ Depending on the type of control used, electromagnetic effects can be produced when using solenoids. When a direct current is applied, solenoids do not cause electromagnetic interference nor is their operation impaired by electromagnetic interference.
 - Other behavior can result when a modulated direct current (e.g. PWM signal) is applied. Potential electromagnetic interference for persons (e.g. persons with a pacemaker) and other components must be tested by the machine manufacturer.

- Pressure controllers are not protection against overpressure. A pressure relief valve is to be provided for the hydraulic system.
- ► Working 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 working ports and function ports are only intended to accommodate hydraulic lines.

Safety instructions

- ▶ During and shortly after operation, there is a risk of getting burnt on the axial piston unit and especially on the solenoids. Take the appropriate safety measures (e.g. by wearing protective clothing).
- ▶ Moving parts in control equipment (e.g. valve spools) can, under certain circumstances, get stuck in position as a result of contamination (e.g. impure hydraulic fluid, abrasion, or residual dirt from components). As a result, the hydraulic fluid flow and the build-up of torque in the axial piston unit can no longer respond correctly to the operator's specifications. Even the use of various filter elements (external or internal flow filtration) will not rule out a fault but merely reduce the risk. The machine/ system manufacturer must test whether remedial measures are needed on the machine for the application concerned in order to bring the driven consumer into a safe position (e.g. safe stop) and ensure any measures are properly implemented.

Bosch Rexroth AG

Mobile Applications An den Kelterwiesen 14 72160 Horb a.N., Germany Tel. +49 7451 92-0 info.ma@boschrexroth.de www.boschrexroth.com © Bosch Rexroth AG 2016. All rights reserved, also regarding any disposal, exploitation, reproduction, editing, distribution, as well as in the event of applications for industrial property rights. The data specified within only serves to describe the product. No statements concerning a certain condition or suitability for a certain application can be derived from our information. The information given does not release the user from the obligation of own judgment and verification. It must be remembered that our products are subject to a natural process of wear and aging.



External Gear Pumps Series F

RE 10 089/02.12 Replaces: RE 10 089/12.10

AZPF-...





Fixed pumps $V = 4.0...28 \text{ cm}^3/\text{rev}$

Overview of contents

Contents Page General Product overview Ordering code single pumps Ordering code multiple pumps 5 Drive shaft Front cover 9 Line ports Pumps with integral valves 10 Design calculations for pumps 10 Performance charts 11 Noise charts 14 **Specifications** 16 Drive arrangements 17 Multiple pumps through drives 19 **Dimensions** 20 Notes for commissioning and maintenance 59 Service parts 60 **Fittings** 62 Ordering-No. 64

Features

Nominal pressure 280 bar
Slide bearings for heavy duty applications
Drive shafts to ISO or SAE
Combination of several pumps possible
Line ports:
 connection flange or screw thread
Consistent high quality thru mass production
Numerous configuration variants available

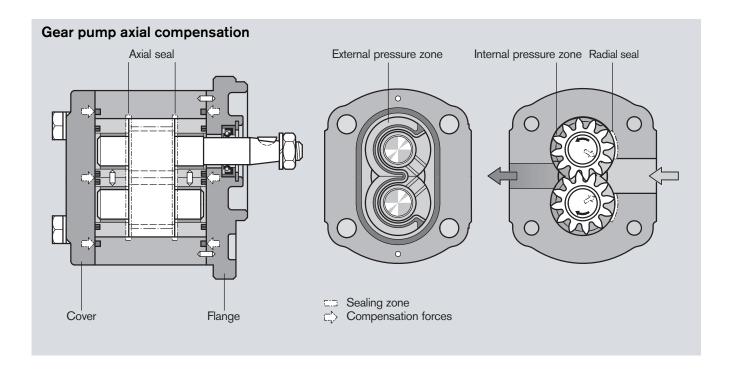
General

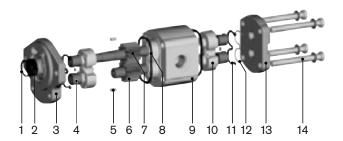
Rexroth external gear pumps are available as standard gear pumps in the 4 series of B, F, N and G and as SILENCE gear pumps in the series of S, T and U, in which the displacements are graded by different gear widths. Further configuration variants are given by different flanges, shafts, valve arrangements and multiple pump combinations.

Construction

The external gear pump consists essentially of a pair of gears supported in bearing bushings and the case with a front and a rear cover. The drive shaft protrudes from the front cover where it is sealed by the shaft seal ring. The bearing forces are absorbed by special bearing bushings with sufficient elasticity to produce surface contact instead of line contact. They also ensure excellent resistance to galling – especially at low speed. The gears have 12 teeth. This keeps both flow pulsation and noise emission to a minimum.

The internal sealing is achieved by forces which are proportional to delivery pressure. This ensures optimum efficiency. The bearings provide the seal at the ends of the gaps between the teeth which carry the pressurized oil. The sealing zone between the gear teeth and the bearing is controlled by the admission of operating pressure to the rear of the bearing bushings. Special seals form the boundary of the zone. The radial clearance at the tips of the gear teeth is sealed by internal forces pushing them against the case.





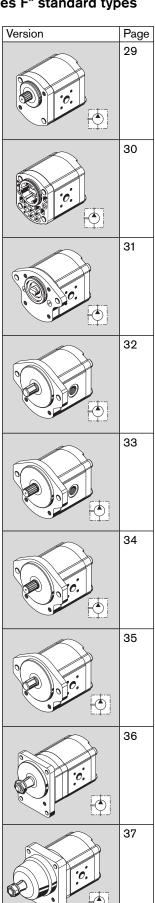
- 1 Retaining ring
- 2 Shaft seal ring
- 3 Front cover
- 4 Slide bearing
- 5 Centering pin
- 6 Gear
- 7 Gear (frictional)

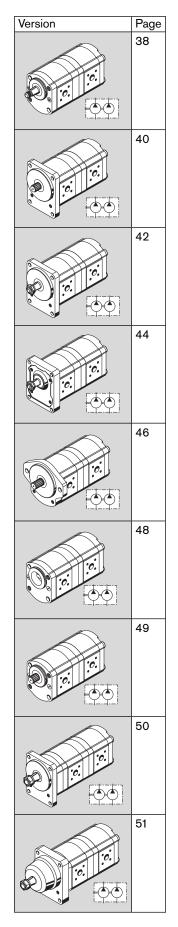
- 8 Case seal
- 9 Pump case
- 10 Bearing
- 11 Axial zone seal
- 12 Support
- 13 End cover
- 14 Fixing screws

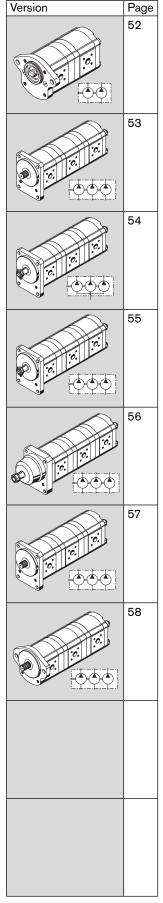
Version

Product overview of "Series F" standard types

Version	Page
io.	20
i i i i i i i i i i i i i i i i i i i	21
· i i i i i i i i i i i i i	22
i.i.	23
	24
	25
ic.	26
ic.	27
ic.	28

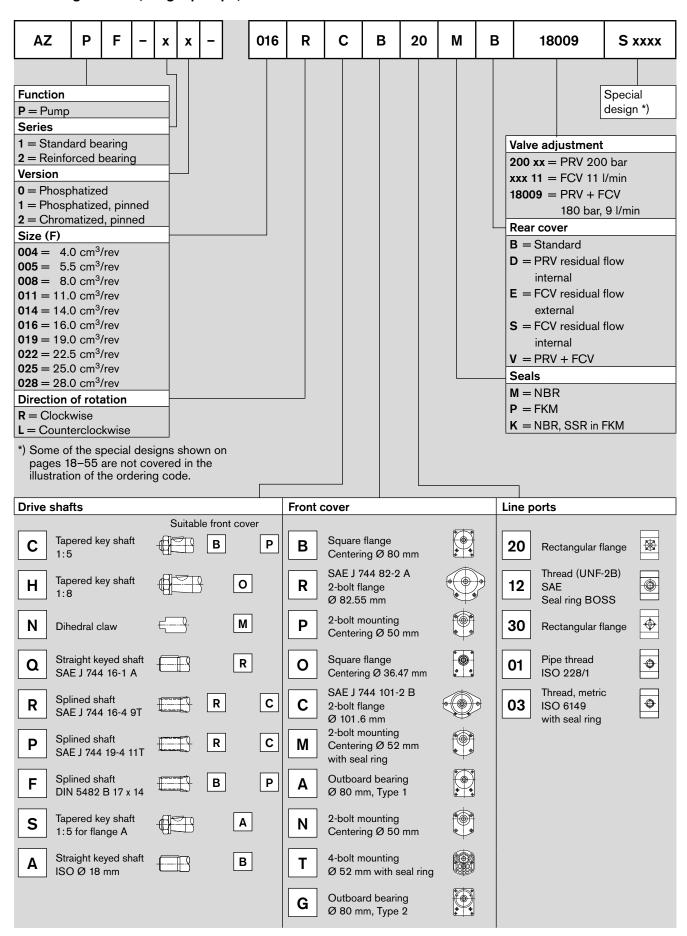






Ordering code

External gear units, single pumps, standard

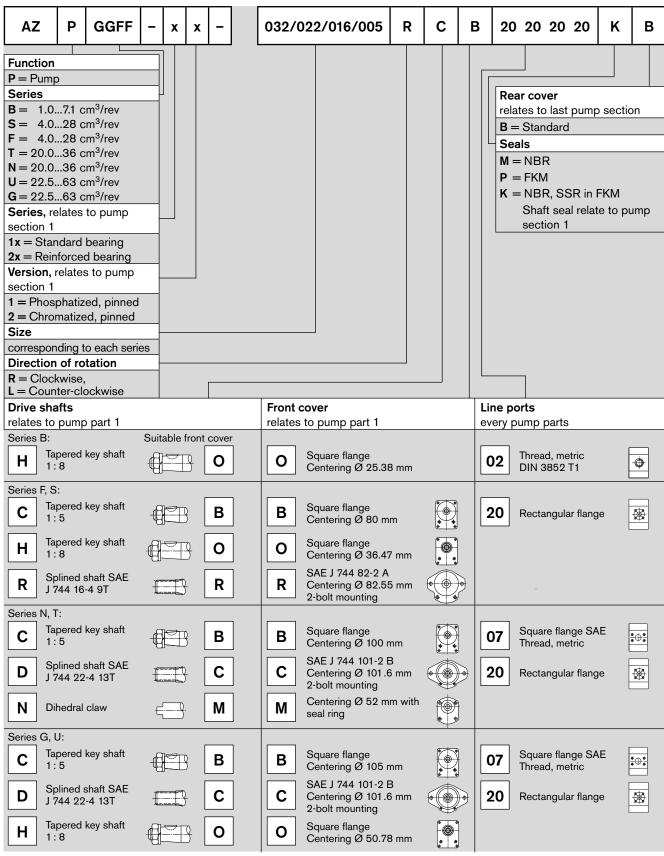


Not all variants can be selected by using ordering code!

Please select the required pump by using the selection tables (standard types) or after consultation with Bosch Rexroth! Special options are possible upon request.

Ordering code

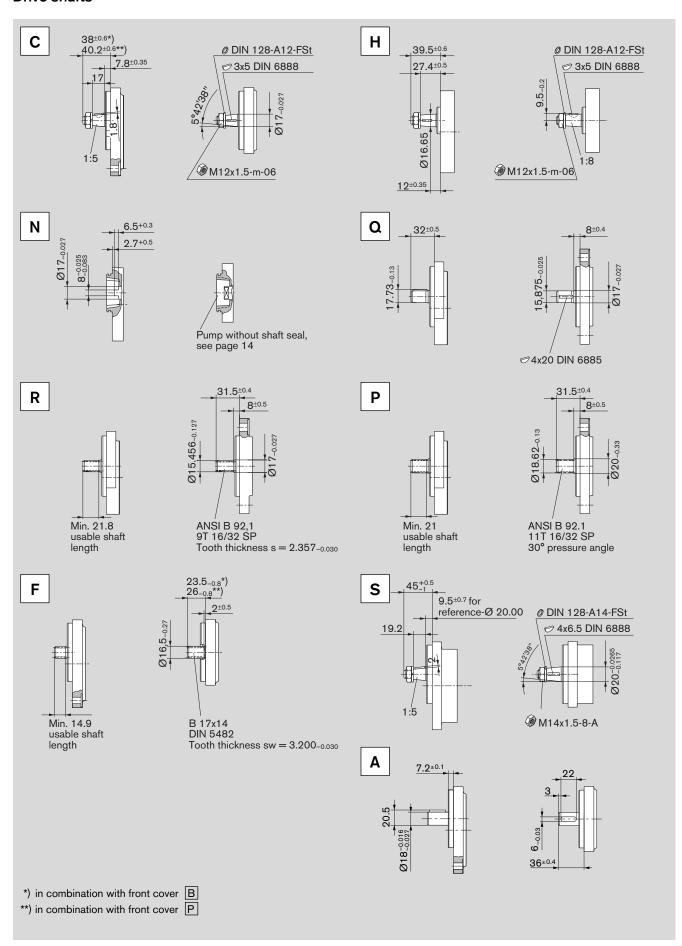
External gear units, multiple pumps, standard



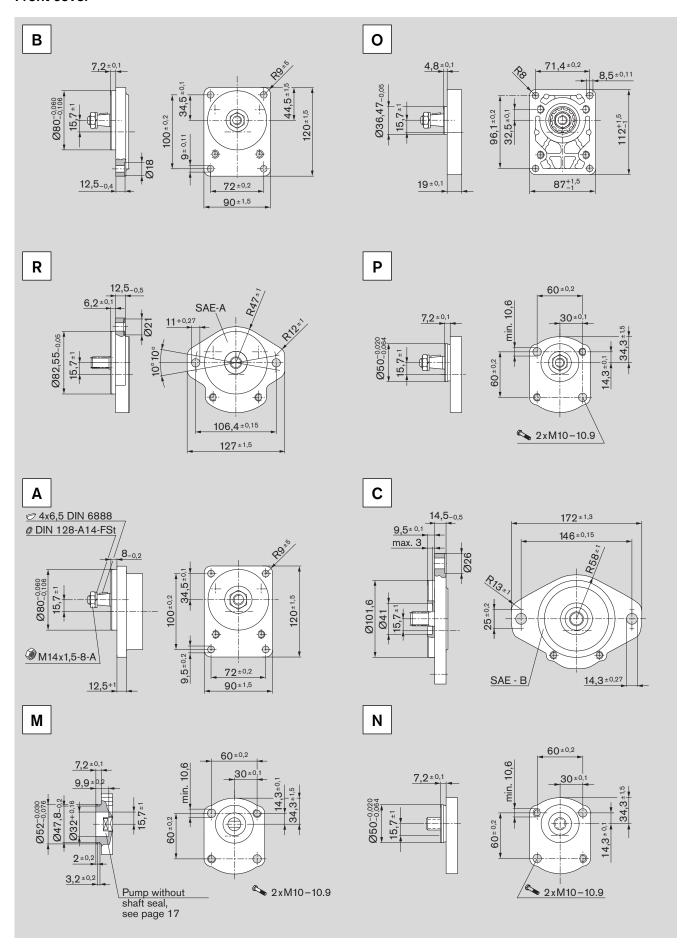
Not all variants can be selected by using ordering code!

Please select the required pump by using the selection tables (standard types) or after consultation with Bosch Rexroth! Special options are possible upon request.

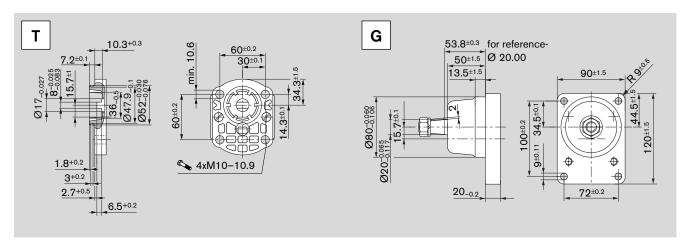
Drive shafts



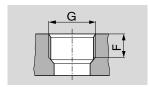
Front cover



Front cover (continued)



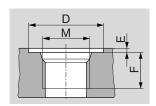
Line ports



O1 Pipe thread ISO 228/1

At pressures $p_2 >$ 210 bar limited fatigue strength

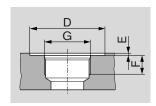
Ordering	Size	Pressure s	side	Suction si	de
code		G	F	G	F
01	416 cm ³	G 1/2	16	G ³ / ₄	16
	1928 cm ³	G ³ / ₄		G1	19



Thread, metric ISO 6149 with seal ring

At pressures $p_2 >$ 210 bar limited service life

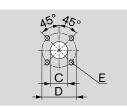
Ordering	Size	Pressure sid	le			Suction side				
code		M	D	E	F	М	D	E	F	
03	45.5 cm ³	M 18 x 1.5	29	0.5	16	M 18 x 1.5	29	0.5	16	
	816 cm ³	M 22 x 1.5	34		18	M 27 x 2	40		19	
	1928 cm ³					M33 x 2	46		22	



Thread (UN-2B, UNF-2B) SAE seal ring BOSS

At pressures $p_2 >$ 210 bar limited service life

Ordering	Size	Pressure side			Suction side				
code		G	D	E	F	G	D	E	F
12	45.5 cm ³	9/16-18 UNF-2B	25	0.5	13	9/16-18 UNF-2B	25	0.5	13
	8 cm ³	7/8-14 UNF-2B	35		16	7/8-14 UNF-2B	35		16
	1128 cm ³					1 1/16-12 UN-2B	45	1	19

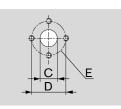


Rectangular flange

20

*) Dimension of Series 2

Ordering	Size	Pressure s	ide		Suction sid	n side		
code		С	D	E	С	D	E	
20	45.5 cm ³	15	35	M6, depth 13	15	40	M 6, depth 13	
	822.5 cm ³				20			
	1928 cm ³ *)				26	55	M8, depth 13	

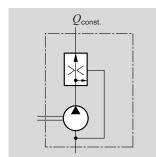


30 Rectangular flange

Ordering	Size	Pressure s	ide		Suction side				
code		С	D	E	С	D	E		
30	48 cm ³	13.5	30.2	M 6, depth 13	13.5	30.2	M6, depth 13		
	1128 cm ³				20.0	39.7	M.8. depth 13		

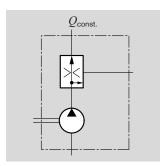
Gear pumps with integral valves

In order to reduce external pipework it is possible to incorporate a flow-control valve or pressure-relief valve in the rear cover of the gear pump. A typical application of this is in the supply of hydraulic oil in power steering systems. The pump delivers a constant flow irrespective of the speed at which it is driven. The excess flow is either returned internally to the suction port or distributed externally to other items of equipment.



3-way flow-control valve. Excess flow returned to suction line

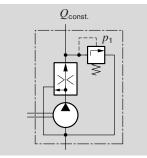
 $Q_{\rm const.} = 2...30$ l/min



3-way flow-control valve. Excess flow distributed externally; loadable

$$Q_{\rm const.}$$
 = 2...30 l/min



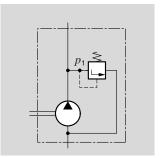


3-way flow-control valve with pressure-relief valve.

Excess flow returned to suction line

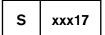
$$Q_{\text{const.}} = 2...30 \text{ l/min}$$

 $p_1 = 100...180 \text{ bar}$



Pressure-relief valve. Discharge returned to suction line $p_1 = 5...250$ bar

Ordering code



E xxx12

V 15011

D 180xx

Design calculations for pumps

The design calculations for pumps are based on the following parameters:

 $V \ [\mathrm{cm^3/rev}] \ Displacement$ $Q \ [l/min] \ Delivery$ $p \ [\mathrm{bar}] \ Pressure$ $M \ [\mathrm{Nm}] \ Drive \ torque$ $n \ [\mathrm{rev/min}] \ Drive \ speed$ $P \ [\mathrm{kW}] \ Drive \ power$

It is also necessary to allow for different efficiencies such as:

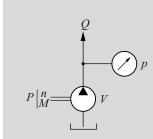
 $\begin{array}{ll} \eta_{\rm v} & {\rm Volumetric~efficiency} \\ \eta_{\rm hm} & {\rm Hydraulic-mechanical} \\ & {\rm efficiency} \end{array}$

 $\eta_{\rm t}$ Overall efficiency

The following formulas describe the various relationships.

They include correction factors for adapting the parameters to the usual units encountered in practice.

Caution: Diagrams providing approximate selection data will be found on subsequent pages.



 $Q = V \cdot n \cdot n \cdot 10^{-5}$

$$p = \frac{M \cdot \eta_{\text{hm}}}{1.59 \cdot V}$$

$$P = \frac{p \cdot Q}{6 \cdot n}$$

 $V = \frac{Q}{n \cdot \eta_{y}} \cdot 10^{5}$

$$n = \frac{Q}{V \cdot \eta_{v}} \cdot 10^{5}$$

$$V = \frac{M \cdot \eta_{\text{hm}}}{159 \cdot p}$$

$$M = \frac{1.59 \cdot V \cdot \eta_{\rm hm}}$$

$$Q = \frac{6 \cdot P \cdot \eta_{t}}{p}$$

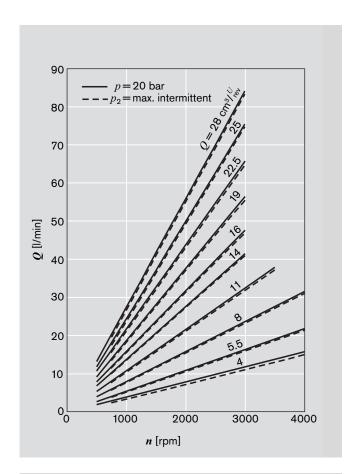
$$p = \frac{6 \cdot P \cdot \eta_{\mathsf{t}}}{O}$$

 $V \text{ [cm}^3\text{/rev] } Q \text{ [l/min] } p \text{ [bar]}$

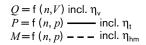
n [rev/min] P [kW] M [Nm]

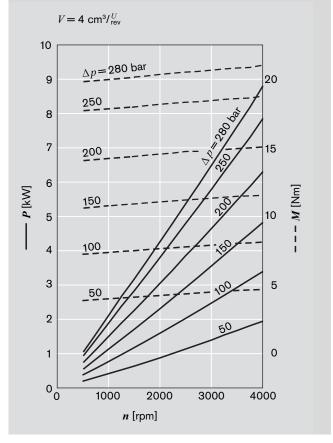
Caution: η [%] e.g. 95 [%]

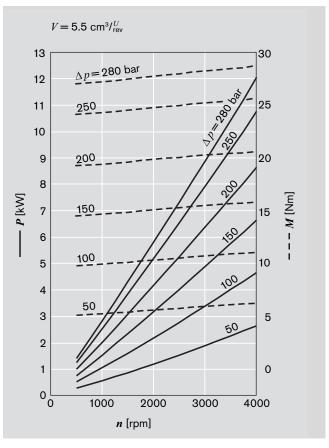
Performance charts



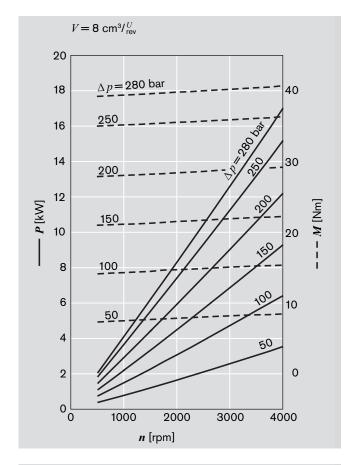
$$\nu = 32 \text{ mm}^2/\text{s}, \, \vartheta = 50 \,^{\circ}\text{C}$$

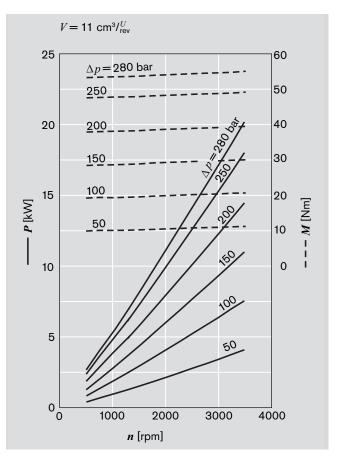


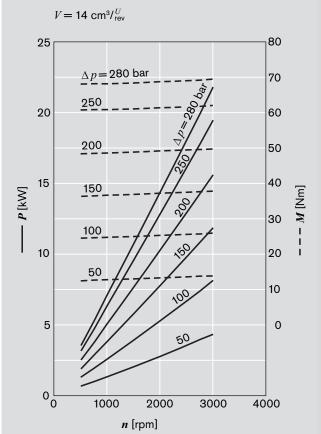


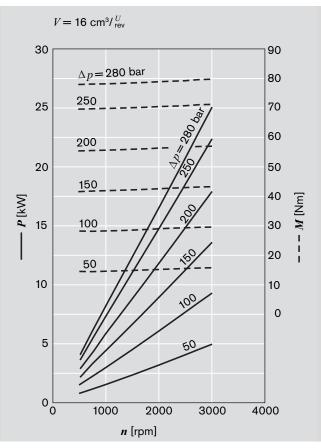


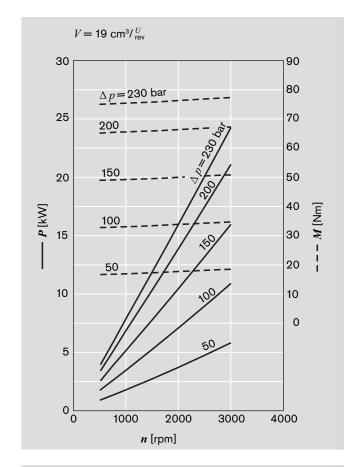
Performance charts (continued)

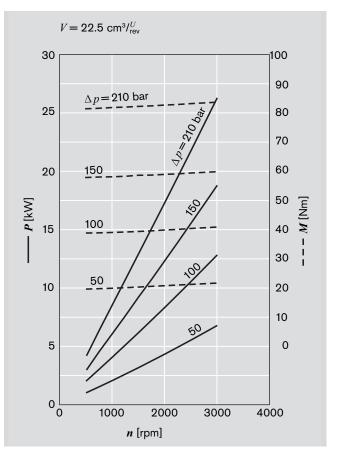


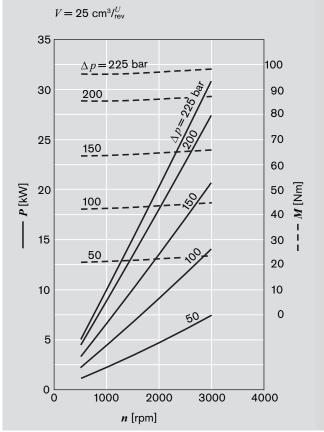


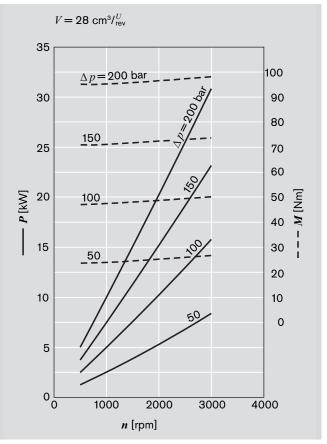












Noise charts

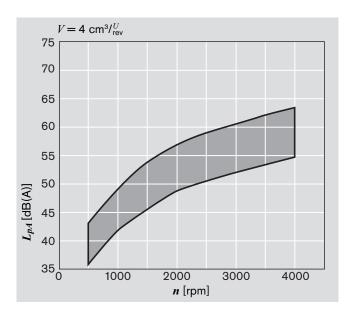
Noise level dependent on rotational speed, pressure range between 10 bar and pressure value p_2 (see page 16 Specifications table).

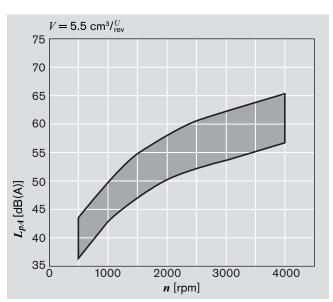
Oil data: $v = 32 \text{ mm}^2/\text{s}$, $\vartheta = 50 \,^{\circ}\text{C}$.

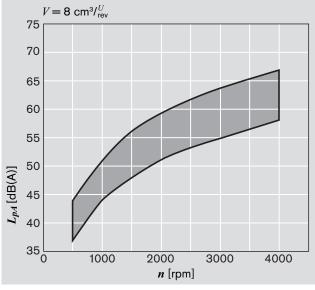
Sound pressure level calculated from noise measurements made in the sound absorbent measuring room compliant with DIN 45 635, Part 26.

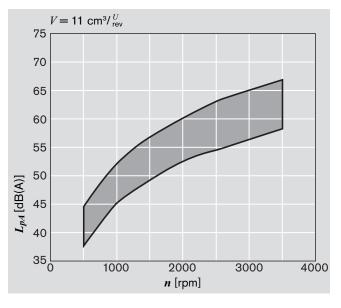
Spacing between measuring sensor - pump: 1 m.

These are typical characteristic values for the respective model. They describe the airborne sound emitted solely by the pump. Environmental influences (installation site, piping, further system components) are not taken into consideration. Each value applies for a single pump.

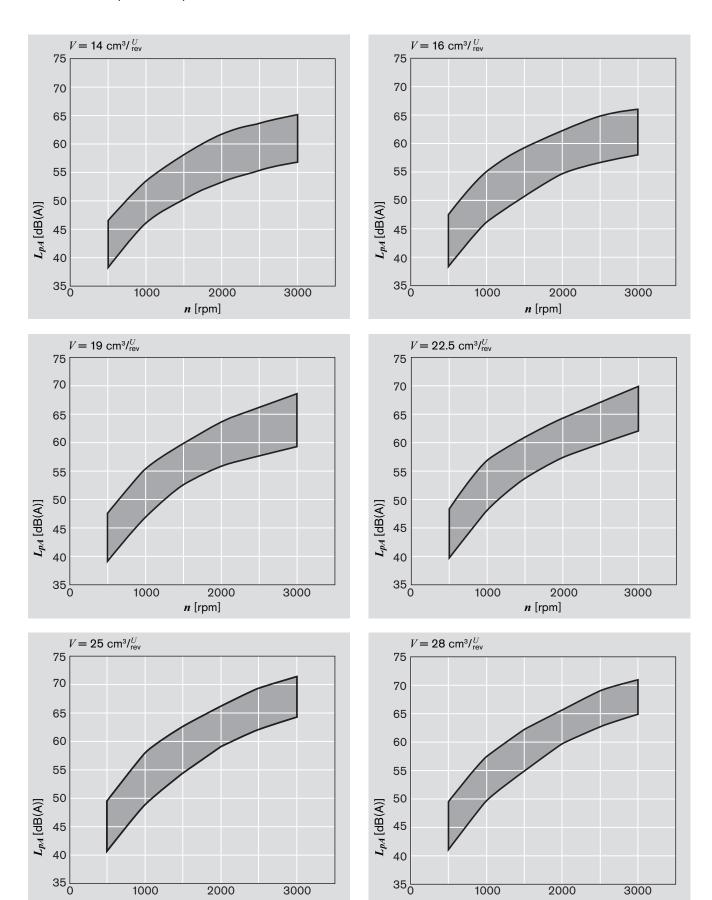








Noise charts (continued)



2000

n [rpm]

3000

1000

2000

n [rpm]

3000

1000

Specification

General	
Construction	External gear pump
Mounting	Flange or through-bolting with spigot
Line ports	Screw, flange
Direction of rotation (looking on shaft)	Clockwise or counter-clockwise, the pump may only be driven in the direction indicated
Installation position	Any
Load on shaft	Radial and axial forces after consulting
Ambient temperature range	-30°C+80°C or max. 110°C with FKM seal
Hydraulic fluid	 Mineral oil compliant with DIN 51 524, 1-3, however under higher load at least HLP compliant with DIN 51 524 Part 2 recommended. Comply with RE 90220 Further operating fluids possible after consultation
Viscosity	12800 mm ² /s permitted range 20100 mm ² /s recommended range 2000 mm ² /s range permitted for starting
Hydraulic fluid temperature range	max. +80°C with NBR seals*) max. +110°C with FKM seals**)
Filtration ***)	At least cleanliness level 20/18/15 compliant with ISO 4406 (1999)

- *) NBR = Perbunan®
- **) FKM = Viton®
- ***) During the application of control systems or devices with critical counter-reaction, such as steering and brake valves, the type of filtration selected must be adapted to the sensitivity of these devices/systems.

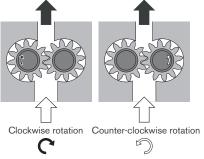
Safety requirements pertaining to the whole systems are to be observed.

In the case of applications with high numbers of load cycles please consulting.

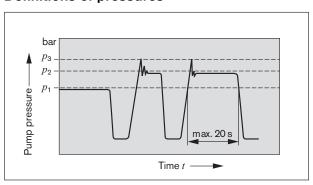
Definition of direction of rotation

Always look on the drive shaft.

Caution: Dimensions drawings always show clockwise-rotation pumps. On counter-clockwise-rotation pumps the positions of the drive shaft and the suction and pressure ports are different.



Definitions of pressures



 p_1 max. continuous pressure p_2 max. intermittent pressure p_3 max. peak pressure

AZPT-IX												
Displaceme	ent	V	cm ³ /rev	4	5.5	8	11	14	16	19	22.5	22.5
Suction pre	essure		0.73 (a	bsolute), v	vith tande	m pumps:	$p_{\rm e} (p_2) = r$	nax. 0.5 >	$p_{\rm e}(p_{\rm 1})$			
Max. continuous pressure p_1		hor	250						210	180	210	
Max. intermittent pressure p_2			bar			2	280			230	210	230
Max. peak	pressure		300						250	230	250	
Min. rotatio	nal speed	<100	rpm	600	500	500	500	500	500	500	500	500
at bar	12 mm ² /s	100180		1200	1200	1000	1000	800	800	800	800	800
		180 <i>p</i> ₂		1400	1400	1400	1200	1000	1000	1000	1000	1000
	25 mm ² /s	p_2		700	700	700	600	500	500	500	500	500
Max. rotational speed at p_2				4000		3500	3000	3000	3000	2500	3000	
	*\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \											

*) Version with extended bearings

AZPF-2x

AZPT-ZX													
Displacement		V	cm ³ /rev	4	5.5	8	11	14	16	19	22.5	25	28
Suction press	sure	p_{e}		0.73 (a	0.73 (absolute), with tandem pumps: $P_{\rm e}$ ($P_{\rm 2}$) = max. 0.5 > $P_{\rm e}$ ($P_{\rm 1}$)						₁)		
Max. continuous pressure p_1		har	250								195	170	
Max. intermittent pressure p_2		bar				280				250	225	200	
Max. peak pre	Max. peak pressure p_3				300						290	265	240
Min. rotationa	l speed	<100	rpm	600	500	500	500	500	500	500	500	500	500
at bar	12 mm ² /s	100180		1200	1200	1000	1000	800	800	800	800	800	800
		180 <i>p</i> ₂		1400	1400	1400	1200	1000	1000	1000	1000	1000	1000
	25 mm ² /s	p_2]	700	700	700	600	500	500	500	500	500	500
Max. rotationa	al speed at	p_2			4000		3500	3000	3000	3500	3500	3000	3000

Drive arrangements

1. Flexible couplings

The coupling must not transfer any radial or axial forces to the pump.

The maximum radial runout of shaft spigot is 0.2 mm.

Refer to the fitting instructions provided by the coupling manufacturer for details of the maximum permitted shaft misalignment.

2. Coupling sleeve

Used on shafts with DIN or SAE splining. Caution: There must be no radial or axial forces exerted on the pump shaft or coupling sleeve. The coupling sleeve must be free to move axially. The distance between the pump shaft and drive shaft must be 2⁺¹. Oil-bath or oil-mist lubrications is necessary.

3. Drive shaft with tang

For the close-coupling of the pumps to electric motor or internal-combustion engine, gear, etc.

The pump shaft has a special tang and driver ③ (not included in supply). There is no shaft sealing.

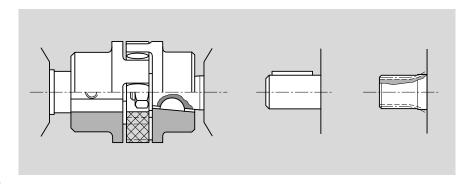
The recommended arrangements and dimensions for the drive end and sealing are as follows.

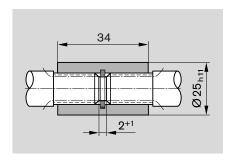
① Drive shaft

Case-hardening steel DIN 17 210 e.g. 20 MnCrS 5 case-hardened 0.6 deep; HRC 60 \pm 3. Surface for sealing ring ground without rifling $R_{\rm max.} \leq 4 \mu {\rm m}$

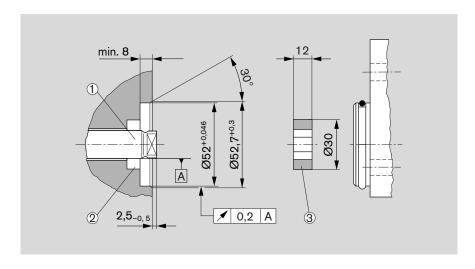
2 Radial shaft seal ring

Rubber-covered seal (see DIN 3760, Type AS or double-lipped ring). Cut 15° chamfer or fit shaft seal ring with protection sleeve.





Splined shaft	M _{max} [Nm]	V [cm ³ / rev]	p _{max} [bar]
DIN	100	428	p_{max}
SAE 9t	110		
SAE 11t	180		



Drive with tang

AZPF-1x

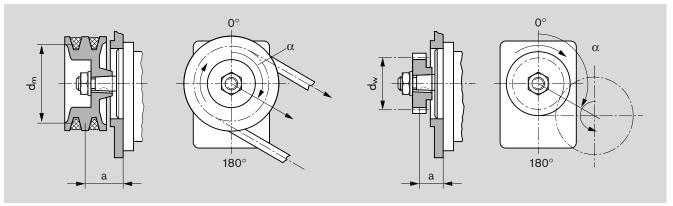
M _{max.} [Nm]	V [cm ³ /rev]	p _{max.} [bar]	
65	414	280	
	16	230	
65	19	190	
	22.5	160	

AZPF-2x

$M_{\rm max.}$	V	$p_{max.}$
[Nm]	[cm ³ /rev]	[bar]
85	414	280
	16	280
	19	250
	22.5	210
	25	190
	28	170

4. V-belts and straight gearwheels or helical toothed gear drives without outboard bearing

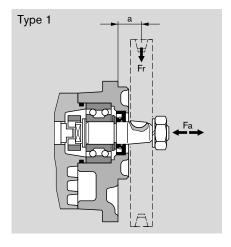
When proposing to use V-belt or gear drive, please submit details of the application for our comments (especially dimensions a, d_m , d_w and angle a). For helical toothed gear drives, details of the helix angle β are also required.

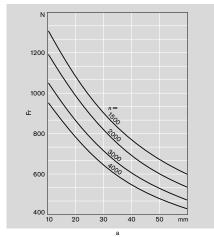


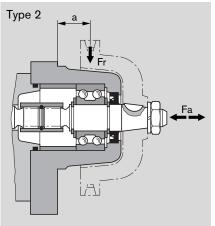
5. Outboard bearing

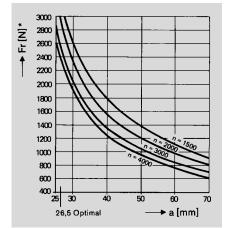
Outboard bearing eliminate possible problems when the pumps are driven by V-belts or gearwheels. The diagrams below show the maximum radial and axial loads that can be tolerated based on a bearing life of $L_{\rm H}=1000$ hours.

$M_{ m max.}$ [Nm]	V [cm ³ /rev]	p _{max.} [bar]
65	16	230
	19	190
	22.5	160









Multiple gear pumps

Gear pumps are well-suited to tandem combinations of pumps in which the drive shaft of the first pump is extended to drive a second pump and sometimes a third pump in the same manner. A coupling is fitted between each pair of pumps. In most cases each pump is isolated from its neighbor, i.e. the suction ports are separate from one another. A common suction port is also possible as an option.

Caution: Basically, the specifications for the single pumps apply, but with certain restrictions:

Max. speed: This is determined by the highest rated pump speed in use.

Pressures: These are restricted by the strength of the drive shaft, the through drives and the drivers. Appropriate data is given in the dimensional drawings.

Pressure restrictions during standard through drive

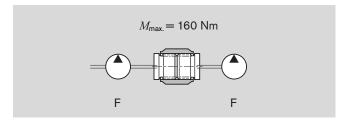
In the case of series S, the driver for the second pumping stage can carry a load of up to $M_{\rm max} = 65$ Nm, i.e. there is a pressure restriction for the second stage and any further stages.

M _{max.} [Nm]	V [cm ³ /rev]	p _{max.} [bar]		
65	16	230		
	19	190		
	22.5	160		
	25	140		
	28	130		

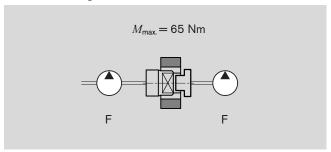
If the first stage is driven through a tang (driver) or outboard bearing type 1, pressure restrictions apply as indicated in the formula below.

Reinforced through drives are available for applications with higher transfer torques and/or rotational vibrations. Customized designs available on request.

Reinforced through drive



Standard through drive

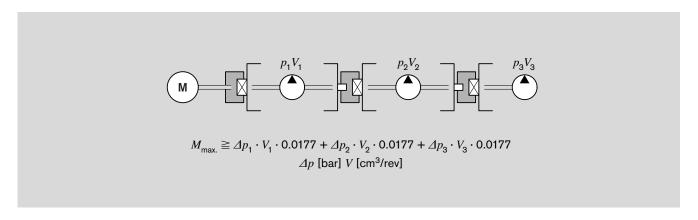


Combinations

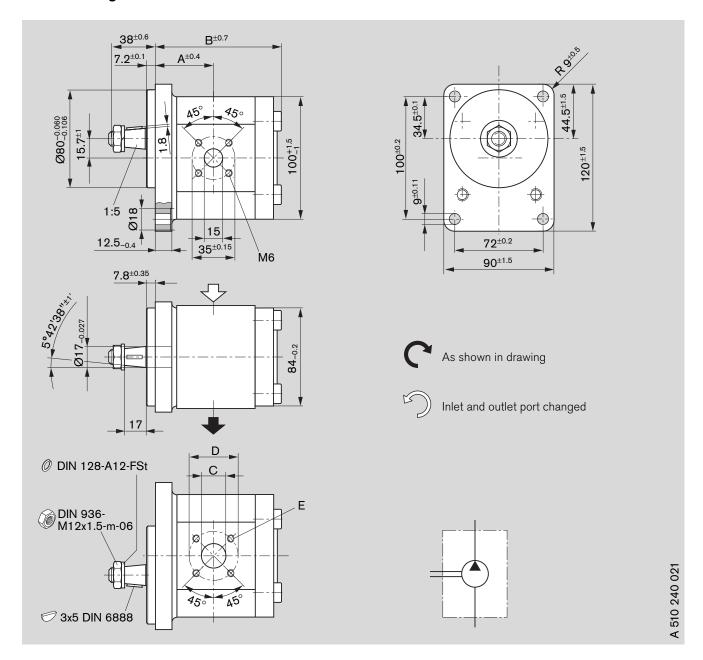
Series	M _{max.} [Nm]	Series
pump 1		pump 2
F	65	F
F	65	S
F	12	В

Max. trans	sferrable o	drive torque *	
Function	Code letter	Designation	Max. transferrable drive torque * [Nm]
Splined shafts	R	SAE J744 16-4 9T	110
Spli	P SAE	SAE J744 19-4- 11T	180
Tapered key shaft	С	1:5	155
Tape key s	Н	1:8	160
Cylinder shafts	G	Shafts Ø 15.875	55
Cylir she	А	Shafts Ø 18	75
Claw	N	Dihedral claw	65

^{*} These values only apply when the conditions described on page 16 are complied with. Bosch Rexroth is to be consulted if the stated values are exceeded.



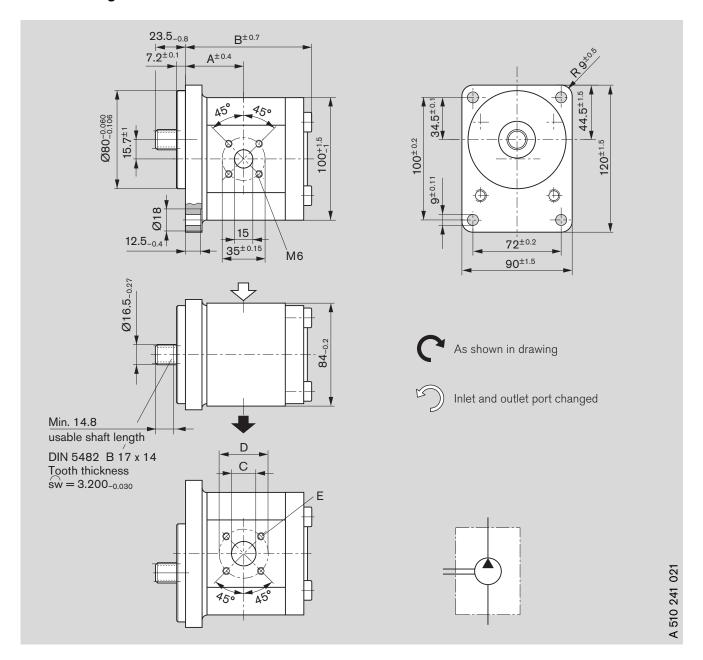
Standard range



Ordering code	
AZPF – 10 – 🔲 🔲 📗	CB 20 MB
AZPF – 11 – 🔲 🔲 📗	C B 20 M B*

Displace-	Orderi	ng-No.	Max.	Max.	kg	Dimension				
ment		\sim	operating	rotation						
	l))	(~	pressure	speed		[mm]				
[cm ³ /rev]	L D	R	[bar]	[rpm]		Α	B	C	D	E
4	0 510 225 306	0 510 225 006	280	4000	3.2	39.9	85.0	15	40	M 6
5.5	0 510 325 306	0 510 325 006	280	4000	3.2	41.1	87.5	15	40	depth 13
8	0 510 425 307	0 510 425 009	280	4000	3.3	43.2	91.6	20	40	
11	0 510 525 311	0 510 525 009	280	3500	3.5	47.0	96.6	20	40	
14	0 510 525 319	0 510 525 018	280	3000	3.7	47.5	101.6	20	40	
16	0 510 625 315	0 510 625 022	280	3000	3.7	47.5	105.0	20	40	
19	0 510 625 314	0 510 625 013	230	3500	3.8	47.5	110.0	20	40	
22.5	0 510 725 330*	0 510 725 030	210	2500	3.8	55.1	115.4	20	40	

Standard range

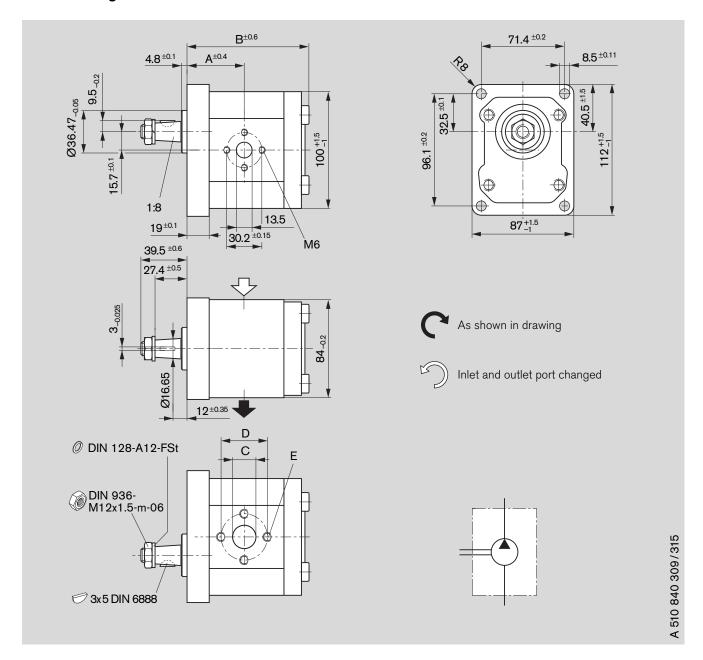


Ordering code

AZPF - 10 - _ _ _ _ _ F B 20 M B AZPF - 11 - _ _ _ _ F B 20 M B*

Displace-	Orderi	Max.	Max.	kg	Dimension					
ment		\sim	operating	rotation						
	"))	(~	pressure	speed		[mm]				
[cm ³ /rev]	L D	R	[bar]	[rpm]		Α	B	C	D	E
4	0 510 225 307	0 510 225 007	280	4000	3.1	39.9	85.0	15	40	M6
5.5	0 510 325 307	0 510 325 007	280	4000	3.2	41.1	87.5	15	40	depth 13
8	0 510 425 308	0 510 425 010	280	4000	3.3	43.2	91.6	20	40	
9	0 510 425 336*	_	280	4000	3.4	43.7	92.4	20	40	
11	0 510 525 312	0 510 525 010	280	3500	3.5	47.0	96.6	20	40	
14	0 510 525 328	0 510 525 030	280	3000	3.6	47.5	101.6	20	40	
16	0 510 625 317	0 510 625 015	280	3000	3.65	47.5	105.0	20	40	
19	0 510 625 316	0 510 625 014	230	3000	3.8	47.5	110.0	20	40	
22.5	0 510 725 349	_	230	3000	4.4	61.1	127.4	20	40	
22.5	_	0 510 725 062	210	2500	4.0	55.1	115.4	20	40	

Standard range

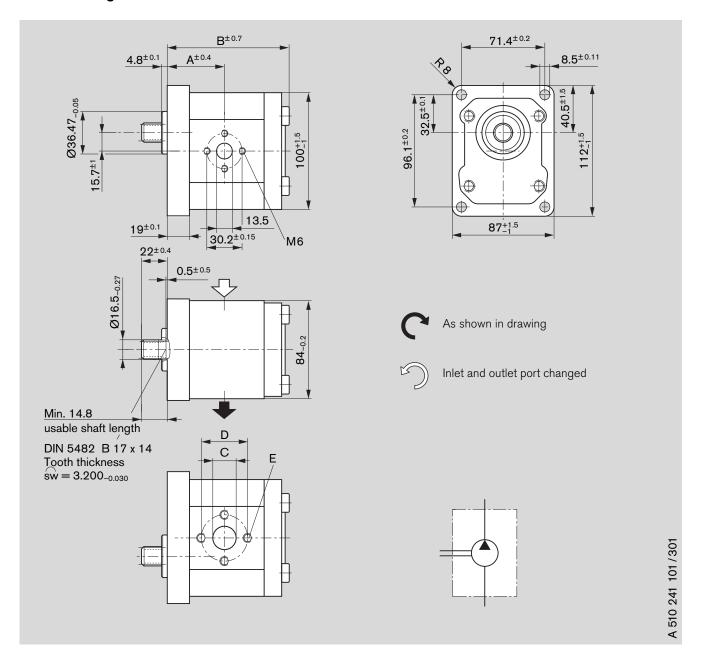


Ordering code

AZPF - 12 - _ _ _ _ _ H O 30 K B AZPF - 22 - _ _ _ H O 30 K B*

Displace-	Ordering-No.		Max.	Max.	kg	Dimension				
ment			operating	rotation						
		(*	pressure	speed		[mm]				
[cm ³ /rev]	L D	R	[bar]	[rpm]		Α	B	C	D	E
4	0 510 225 317	0 510 225 022	280	4000	3.1	41.4	84.1	13.5	30.2	M6
5.5	0 510 325 320	0 510 325 025	280	4000	3.2	42.6	86.6	13.5	30.2	depth 13
8	0 510 425 334	0 510 425 043	280	4000	3.3	44.7	92.5	13.5	30.2	
11	0 510 525 374	0 510 525 074	280	3500	3.4	48.5	97.5	13.5	30.2	M8
14	0 510 525 375	0 510 525 075	280	3000	3.6	49.0	102.5	13.5	30.2	depth 13
16	0 510 625 381	0 510 625 075	280	3000	3.6	49.0	105.9	13.5	30.2	
19	0 510 625 386*	0 510 625 076*	280	3500	4.1	59.9	121.1	20.0	39.7	
22.5	0 510 725 410*	0 510 725 112*	250	3500	4.2	62.6	126.5	20.0	39.7	
25	0 510 725 411*	0 510 725 113*	225	3000	4.4	64.7	132.5	20.0	39.7	
28	0 510 725 412*	0 510 725 114*	200	3000	4.5	67.1	137.3	20.0	39.7	

Standard range

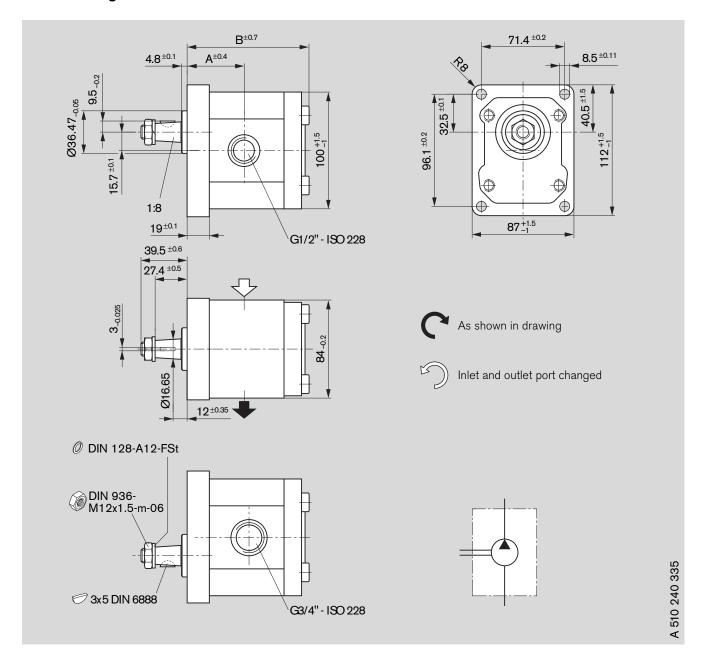


Ordering code

AZPF - 10 - _ _ _ _ _ F O 30 M B AZPF - 10 - _ _ _ F O 30 P B*

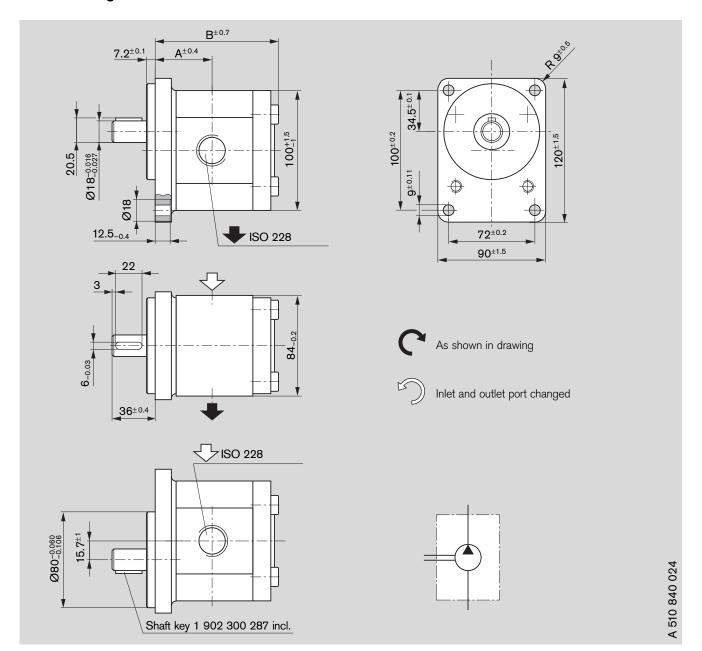
Displace-	Ordering-No.		Max.	Max.	kg	Dimens	Dimension			
ment		\sim	operating	rotation						
		(~	pressure	speed		[mm]				
[cm ³ /rev]	L D	R	[bar]	[rpm]		Α	В	C	D	E
8	0 510 425 315	0 510 425 021	280	4000	3.3	44.7	93.1	13.5	30.2	M6, depth 13
11	0 510 525 323	0 510 525 024	280	3500	3.4	48.5	98.1	20.0	39.7	M8, depth 13
11	0 510 525 331*	_	210	3500	3.3	48.5	98.1	20.0	39.7	
14	_	0 510 525 034*	210	3000	3.4	49.0	103.1	20.0	39.7	
16	0 510 625 327*	0 510 625 039*	210	3000	3.5	49.0	106.5	20.0	39.7	
19	_	0 510 625 049*	210	3000	3.7	49.0	111.5	20.0	39.7	
19	0 510 625 332*	_	210	3000	4.0	59.9	123.5	20.0	39.7	
22.5	0 510 725 348*	0 510 725 076*	210	3000	4.2	62.6	127.8	20.0	39.7	

Standard range



Displace-	place- Ordering-No.		Max.	Max.	kg	Dimension			
ment			operating	rotation					
	"))	(-	pressure	speed		[mm]			
[cm ³ /rev]	L	R	[bar]	[rpm]		Α	B	G	
4	-	-	_	_	-	_	_	ISO 228	
5.5	-	0 510 325 018	280	4000	3.1	42.6	89.0	depth 16	
8	-	0 510 425 027	280	4000	3.15	44.7	93.1		
11	-	0 510 525 039	280	3500	3.3	48.5	98.1		
14	-	0 510 525 040	280	3000	3.4	49.0	103.1		
16	-	0 510 625 047	280	3000	3.58	49.0	106.5		
19	-	0 510 625 052	230	3000	3.6	49.0	111.5		
22.5	_	0 510 725 084	210	2500	3.8	56.6	116.4		

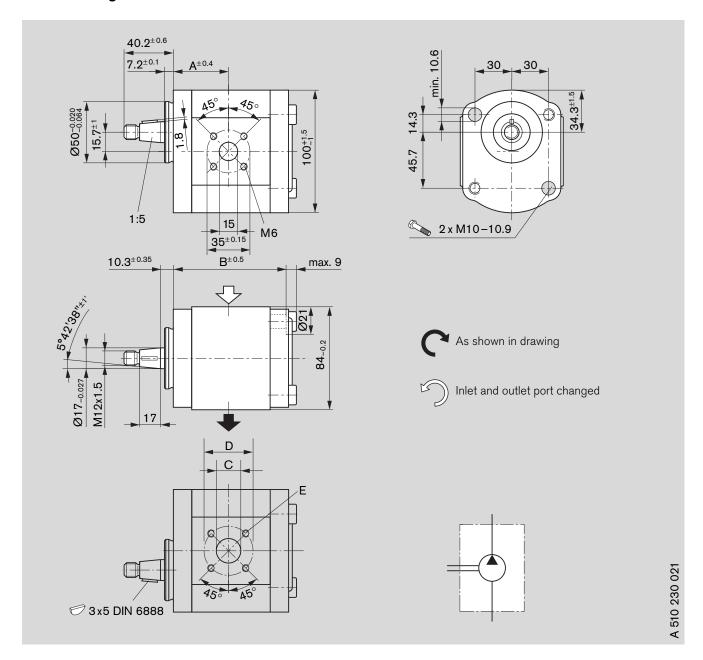
Standard range



Ordering code AZPF - 11 - _ _ _ _ _ A B 01 M B

Displace-	Ordor	ing-No.	Max.	Max.	ka	Dimension				
•	Order	ing-ivo.			kg	Dimension				
ment		\sim	operating	rotation						
	¹²))	(~	pressure	speed		[mm]				
[cm ³ /rev]	L	R	[bar]	[rpm]		Α	В	G		
4	0 510 225 318	0 510 225 023	280	4000	3.3	39.9	84.3	G ¹ / ₂ – ISO 228		
5.5	0 510 325 321	0 510 325 026	280	4000	3.3	41.1	85.2	depth 16		
8	0 510 425 335	0 510 425 044	280	4000	3.4	43.2	89.3	· .		
11	0 510 525 376	0 510 525 076	280	3500	3.6	45.6	94.3	G ³ / ₄ – ISO 228		
14	_	-	_	_	-	-	_	depth 16		
16	0 510 625 382	0 510 625 077	250	3000	3.8	49.9	102.7] '		
19	-	-	-	-	-	-]_			
22.5	0 510 725 418	0 510 725 120	180	2500	4.1	55.1	114.7			

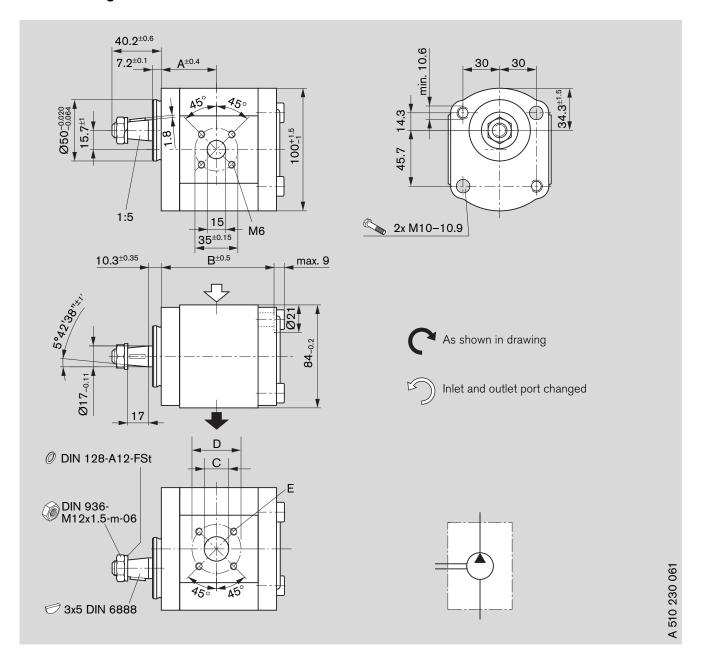
Standard range



Ordering code	
AZPF - 10 - [ИB
AZPF - 10 - [∢ B*
AZPF - 11 - [¶ B**

Displace-	Ordering-No. Max. Max. kg Dimension									
ment		\sim	operating	rotation						
	"))	pressure	speed		[mm]					
[cm ³ /rev]	L	R	[bar]	[rpm]		Α	В	C	D	E
4	0 510 215 009	0 510 215 309	280	4000	2.5	37.7	73.7	15	40	M6
5.5	0 510 315 307	0 510 315 006	280	4000	2.65	38.6	76.2	15	40	depth 13
8	0 510 415 316**	_	280	4000	2.7	40.6	80.3	20	40	
11	0 510 515 309	0 510 515 007	280	3500	2.75	44.5	85.5	20	40	
14	0 510 515 316	0 510 515 018	280	3000	3.1	45.0	90.3	20	40	
16	0 510 615 317	0 510 615 010	280	3000	2.9	45.0	93.7	20	40	
19	0 510 615 318	0 510 615 005	230	3000	3.2	45.0	98.7	20	40	
22.5	0 510 715 306*	_	210	2500	3.3	52.5	104.1	20	40	

Standard range

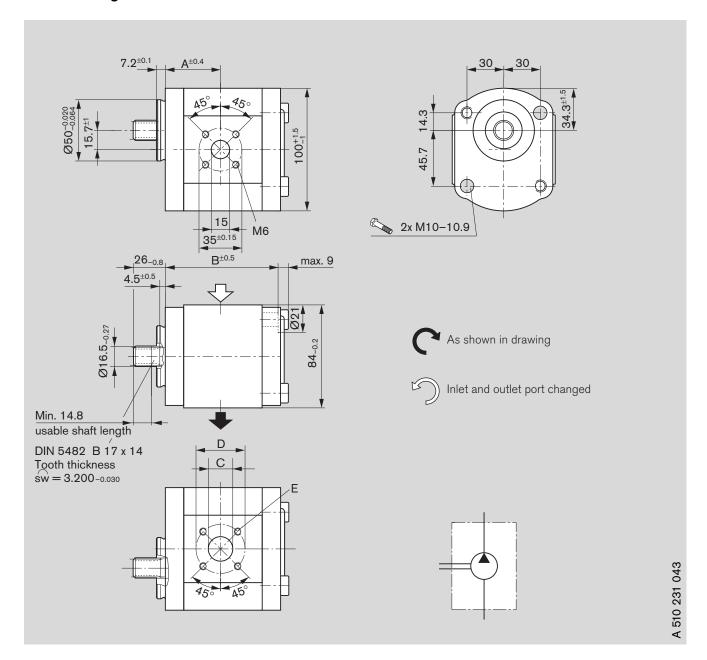


Ordering code

AZPF - 10 - _ _ _ _ _ C N 20 M B AZPF - 11 - _ _ _ _ C N 20 M B*

Displace-	Orderi	ing-No.	Max.	Max.	kg	Dimens	sion			
ment		\sim	operating	rotation						
	")	(~	pressure	speed		[mm]				
[cm ³ /rev]	L D	R	[bar]	[rpm]		Α	В	C	D	E
4	0 510 215 306	0 510 215 006	280	4000	2.6	37.4	73.7	15	40	M6
5.5	0 510 315 304	0 510 315 004	280	4000	2.6	38.6	76.2	15	40	depth 13
8	0 510 415 313	0 510 415 005	280	4000	2.8	40.7	80.3	20	40	
11	0 510 515 310	0 510 515 004	280	3500	2.9	44.5	85.3	20	40	
14	_	0 510 515 015*	280	3000	3.0	45.0	90.3	20	40	
16	0 510 615 314	0 510 615 006	280	3000	3.1	45.0	93.7	20	40	
19	0 510 615 341	_	230	3000	3.2	45.0	98.7	20	40	

Standard range

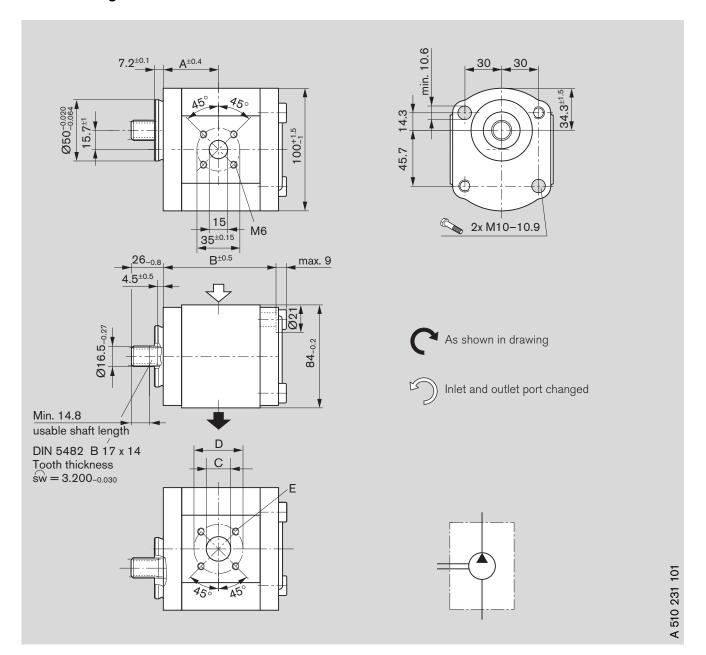


Ordering code

AZPF - 10 - _ _ _ _ _ F N 20 M B

Displace-	Order	ing-No.	Max.	Max.	kg	Dimen	sion			
ment		\sim	operating	rotation						
	"))	(~	pressure	speed		[mm]				
[cm ³ /rev]	L	R	[bar]	[rpm]		Α	B	C	D	E
5.5	_	0 510 315 007	280	4000	2.55	38.6	76.2	15	40	M 6
8	-	_	_	_	-	-	_	-		depth 13
11	-	0 510 515 011	280	3500	2.85	44.5	85.3	20	40	
14	_	_	_	_	_	_	_	_		
16	_	-	_	_	-	_	_	_		
19	-	0 510 615 009	230	3000	3.2	45.0	98.7	20	40	
19	-	_	_	_	-	_	_	-		
22.5	_	-	_	_	-	_	_	-		

Standard range



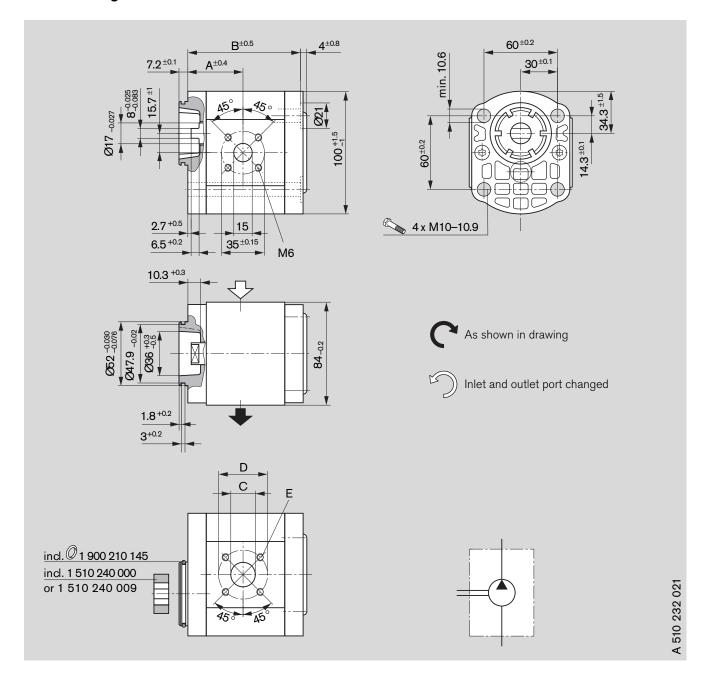
Ordering code

AZPF - 10 - _ _ _ _ _ _ F P 20 P B AZPF - 12 - _ _ _ _ _ F P 20 P B*

AZPF - 12 - _ _ _ _ _ _ F P 20 P B S xxxx**

Displace-	Orderi	ng-No.	Max.	Max.	kg	Dimens	sion			
ment		\sim	operating	rotation						
	L))	(~	pressure	speed		[mm]				
[cm ³ /rev]	L	R	[bar]	[rpm]		Α	В	С	D	E
5.5	_	_	_	_	_	_	_	_	_	M6
8	0 510 415 328	_	210	4000	2.7	40.7	80.3	20	15	depth 13
11	0 510 515 337*	0 510 515 012	280	3500	2.8	44.5	85.3	20	15	
14	0 510 515 338	0 510 515 013	210	3000	3.0	45.0	90.3	20	15	
16	_	_	_	_	_	_	_	_	_	
19	_	_	_	_	_	_	_	-	_	
22.5	0 510 715 320**	0 510 715 008**	210	3000	3.6	58.6	116.1	20	15	

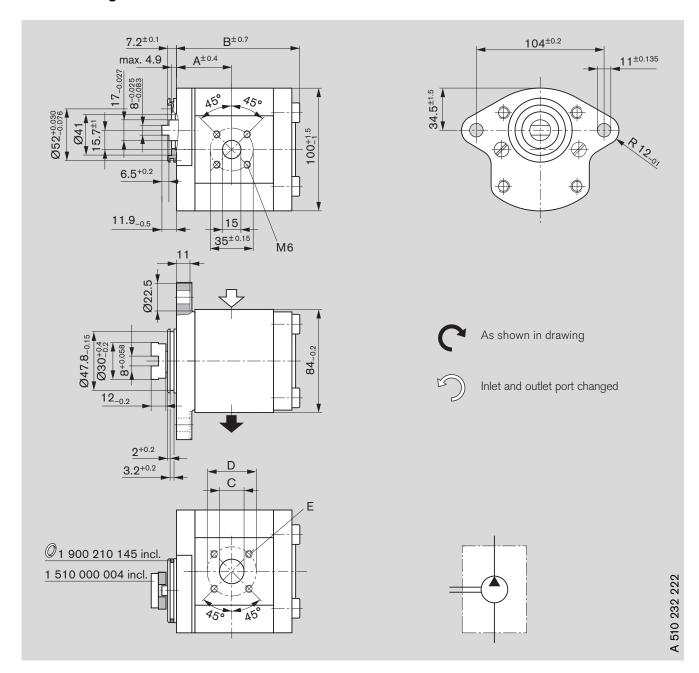
Standard range



Ordering code AZPF - XX - 🔲 🔲 🔲 N T 20 M B

Displace-	Order	ing-No.	Max.	Max.	kg	Dimens	sion			
ment		\sim	operating	rotation						
	")	(-	pressure	speed		[mm]				
[cm ³ /rev]	L	R	[bar]	[rpm]		Α	В	C	D	E
4	0 510 215 307	0 510 215 007	280	4000	2.5	37.4	73.7	15	40	M6
5.5	0 510 315 305	0 510 315 005	280	4000	2.5	38.6	76.2	15	40	depth 13
8	0 510 415 314	0 510 415 006	280	4000	2.5	40.7	80.3	20	40	
11	0 510 515 311	0 510 515 005	280	3500	2.6	44.5	85.3	20	40	
14	0 510 515 340	0 510 515 019	280	3000	2.38	45.0	90.3	20	40	
16	0 510 615 315	0 510 615 007	230	3000	3.0	45.0	93.7	20	40	
19	0 510 615 321	0 510 615 008	190	3000	3.0	45.0	98.7	20	40	
22.5	0 510 715 307	0 510 715 004	160	2500	3.2	52.6	104.1	20	40	

Standard range

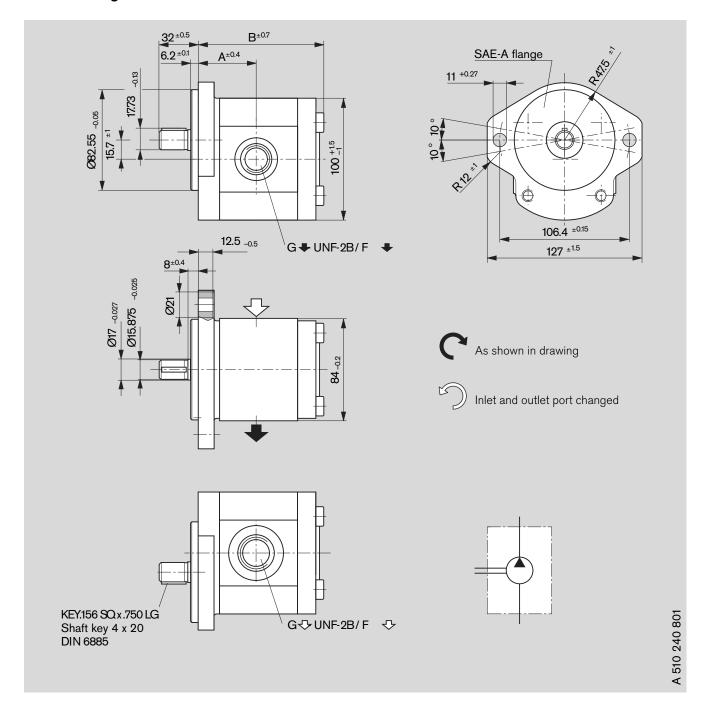


Ordering code

AZPF - 10 - _ _ _ _ _ N L 20 K B
AZPF - 11 - _ _ _ N L 20 K B*

Displace-	Ordering-No.		Max.	Max.	kg	Dimens	sion			
ment			operating	rotation		[]				
	<i>))</i>		pressure	speed		[mm]				
[cm ³ /rev]	L D	R	[bar]	[rpm]		Α	B	C	D	E
4	_	0 510 225 012	280	4000	2.8	37.4	81.7	15	40	M 6
5.5	0 510 325 312	0 510 325 012	280	4000	2.82	38.6	84.4	15	40	depth 13
8	0 510 425 331*	0 510 425 019	280	4000	3.0	40.7	88.5	20	40	
11	_	0 510 525 025	280	3500	3.1	44.5	93.3	20	40	
16	0 510 625 358*	0 510 625 027*	230	3000	3.3	45.0	101.9	20	40	
19	0 510 625 368	0 510 625 032	190	3000	3.5	45.0	106.9	20	40	
22.5	_	0 510 725 044*	160	3000	4.0	58.6	122.5	20	40	

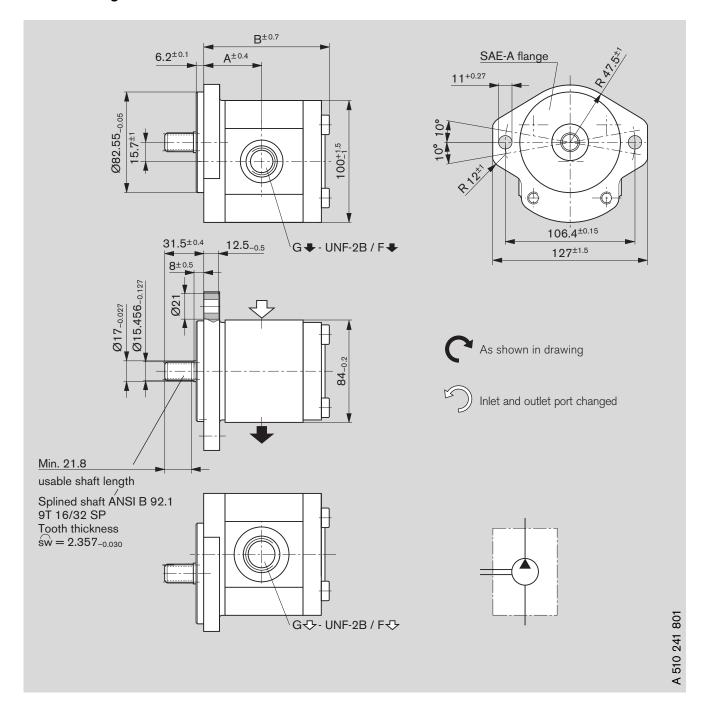
Standard range



Ordering code

Displace-	Orderii	ng-No.	Max.	Max.	kg	Dimens	ion				
ment		\sim	operating	rotation							
	"))	(*	pressure	speed		[mm]					
[cm ³ /rev]	L	R	[bar]	[rpm]		Α	В	G⇔	G ▼	F⇔	F₩
4	_	0 510 225 011	260	4000	3.3	39.9	85.0	9/16-18	9/16-18	13	13
5.5	_	0 510 325 011	260	4000	3.3	41.1	87.5	9/16-18	9/16-18	13	13
8	_	0 510 425 016	260	4000	3.4	43.2	91.6	7/8-14	7/8-14	16	16
11	_	0 510 525 015	260	3500	3.6	47.0	96.6	7/8-14	7/8-14	16	16
14	_	0 510 525 031	230	3000	3.65	47.5	101.6	11/16-12	7/8-14	19	16
16	-	0 510 625 021	200	3000	3.7	47.5	105.0	11/16-12	7/8-14	19	16
19	-	0 510 625 041	170	3500	3.9	47.5	110.0	11/16-12	7/8-14	19	16
22.5	_	0 510 725 059	140	2500	4.0	55.1	115.4	11/16-12	7/8-14	19	16

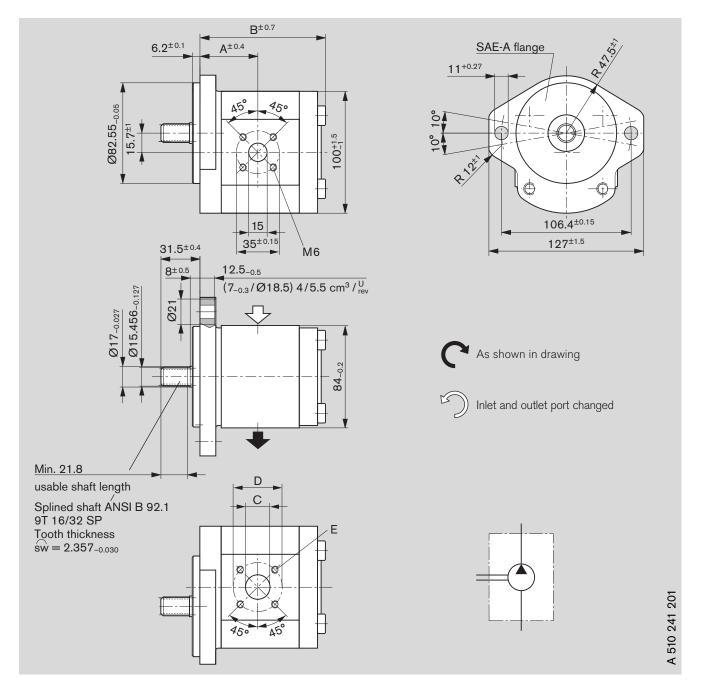
Standard range



Ordering code

Dis-	Orderi	ng-No.	Max.	Max.	kg	Dimens	ion				
place-		\sim	operating	rotation							
ment		(*	pressure	speed		[mm]					
[cm ³ /rev]	L D	R	[bar]	[rpm]		Α	В	G⇔	G ▼	F⇔	F₩
4	_	0 510 225 010	280	4000	3.15	39.9	82.7	9/16-18	9/16-18	13	13
5.5	_	0 510 325 010	280	4000	3.2	41.4	85.2	9/16-18	9/16-18	13	13
8	_	0 510 425 015	280	4000	3.3	43.2	91.1	7/8-14	7/8-14	16	16
11	0 510 525 315	0 510 525 014	280	3500	3.4	47.0	96.1	11/16-12	7/8-14	19	16
14	_	0 510 525 041	280	3000	3.5	47.5	101.1	11/16-12	7/8-14	19	16
16	_	0 510 625 020	280	3000	3.75	47.5	104.5	11/16-12	7/8-14	19	16
19	0 510 625 346	0 510 625 048	230	3000	3.9	47.5	109.5	11/16-12	7/8-14	19	16
22.5	_	0 510 725 063	210	2500	4.0	55.1	114.9	11/16-12	7/8-14	19	16

Standard range



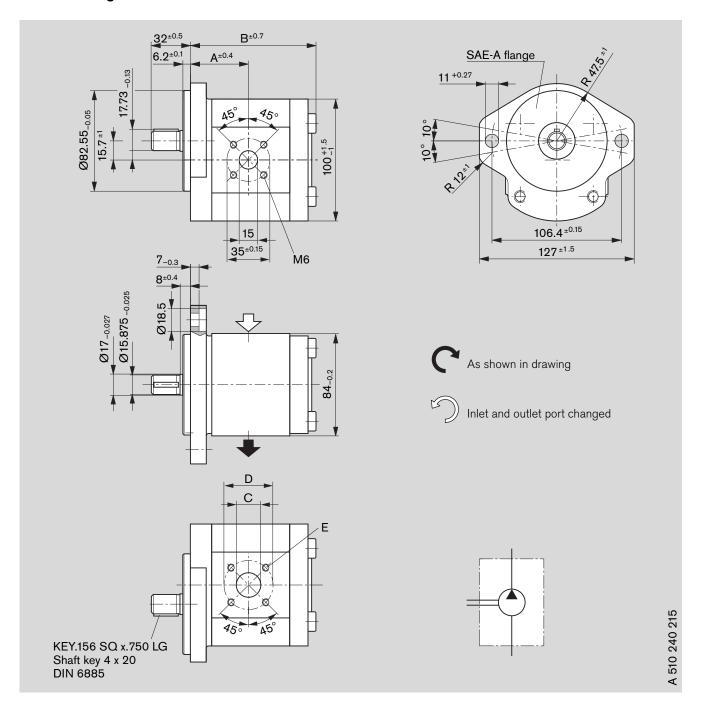
Ordering code

AZPF - 10 - _ _ _ _ _ R R 20 M B

AZPF - 11 - _ _ _ R R 20 K B*

Displace-	Orderi	ng-No.	Max.	Max.	kg	Dimens	sion			
ment		\sim	operating	rotation						
	"))	(~	pressure	speed		[mm]				
[cm ³ /rev]	L D	R	[bar]	[rpm]		Α	B	C	D	E
4	0 510 225 314	0 510 225 013	280	4000	3.15	39.9	85.0	15	40	M6
5.5	0 510 325 313	0 510 325 013	280	4000	3.2	41.1	87.5	15	40	depth 13
8	0 510 425 314	0 510 425 020	280	4000	3.3	43.2	91.6	20	40	
11	0 510 525 324*	0 510 525 019	280	3500	3.5	47.0	96.6	20	40	
14	0 510 525 325	0 510 525 020	280	3000	3.6	47.5	101.6	20	40	
16	0 510 625 329	0 510 625 028	280	3000	3.8	47.5	105.0	20	40	
19	0 510 625 330*	0 510 625 029*	230	3000	3.9	47.5	110.0	20	40	
22.5	0 510 725 361	0 510 725 077*	210	2500	4.1	55.1	115.4	20	40	

Standard range

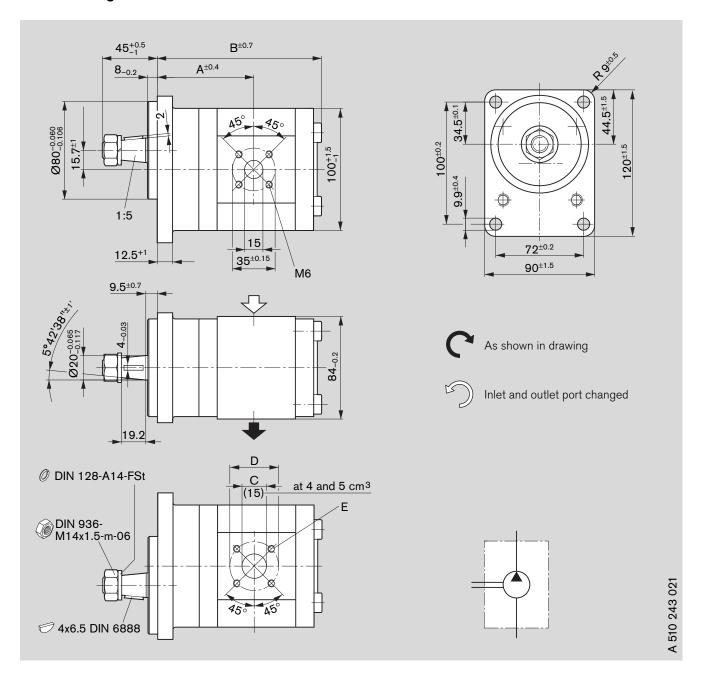


Ordering code

AZPF - 10 - \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ B

A=11 10	<u> </u>	(20 III B								
Displace-	Order	ing-No.	Max.	Max.	kg	Dimens	sion			
ment			operating	rotation						
		(*	pressure	speed		[mm]				
[cm ³ /rev]	L D	R	[bar]	[rpm]		Α	В	C	D	E
4	-	0 510 225 014	280	4000	3.2	39.9	84.5	15	40	M6
5.5	-	0 510 325 016	280	4000	3.3	41.1	87.0	15	40	depth 13
8	-	0 510 425 025	280	4000	3.3	43.2	91.1	20	40	
11	-	0 510 525 033	280	3500	3.5	47.0	96.1	20	40	
16	-	0 510 625 042	200	3000	3.8	47.5	104.5	20	40	
19	-	0 510 625 043	170	3000	3.9	47.5	109.5	20	40	
22.5	0 510 725 396	0 510 725 060	140	2500	3.9	55.1	114.9	20	40	

Standard range

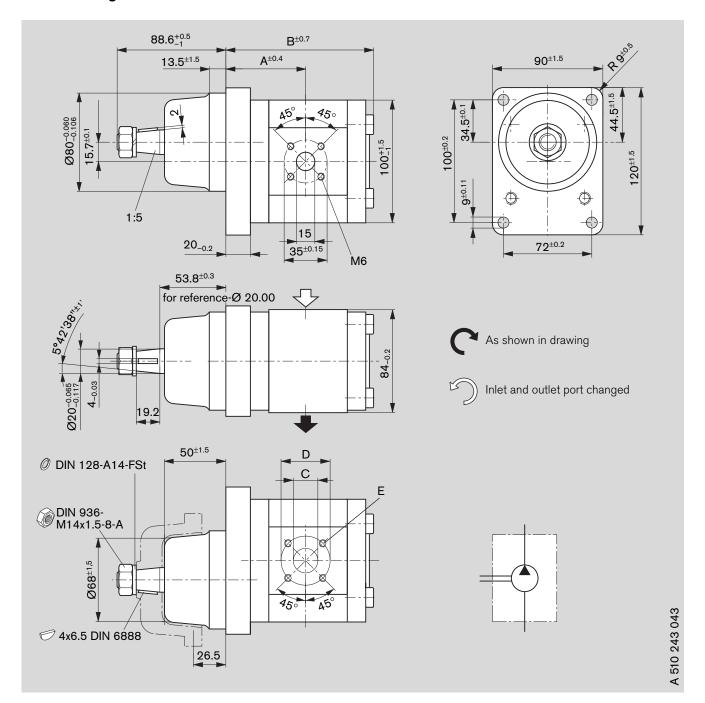


Ordering code

AZPF - 11 - _ _ _ _ _ S A 20 M B AZPF - 11 - _ _ _ _ _ S S A 20 K B*

Displace-	Orderi	ing-No.	Max.	Max.	kg	Dimens	sion			
ment		\sim	operating	rotation						
	"))	(~	pressure	speed		[mm]				
[cm ³ /rev]	L P	R	[bar]	[rpm]		Α	B	C	D	E
4	0 510 245 300	0 510 245 001	280	4000	3.1	71.1	114.2	15	40	M6
5.5	0 510 345 300	0 510 345 001	280	4000	3.1	72.3	116.7	15	40	depth 13
8	0 510 445 300	0 510 445 001*	280	4000	3.3	74.4	120.8	20	40	
11	0 510 545 300	0 510 545 001	280	3500	3.5	78.2	125.8	20	40	
14			280	3000		78.7	130.8	20	40	
16	0 510 645 300	0 510 645 004	230	3000	3.6	78.7	134.2	20	40	
19		0 510 645 002	190	3000	3.9	78.7	139.2	20	40	
22.5			160	2500		92.3	156.6	20	40	

Standard range

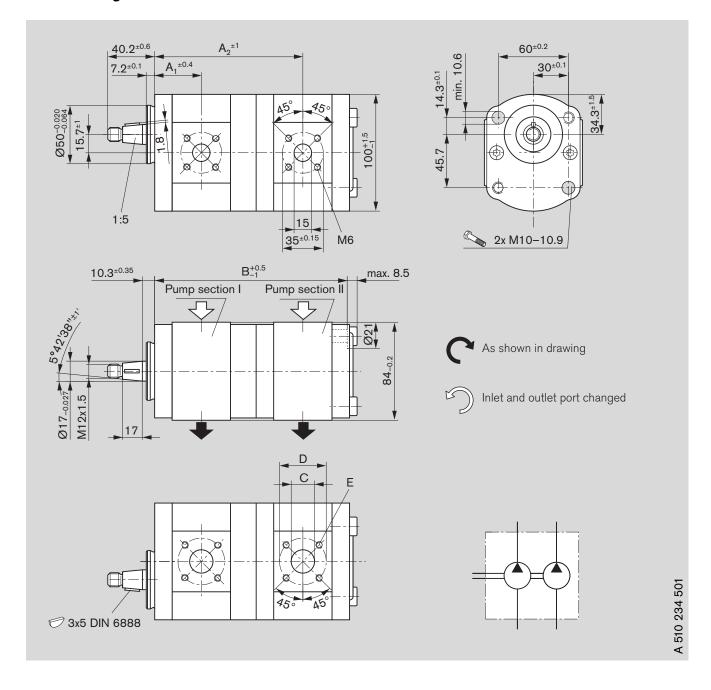


Ordering code

AZPF - 10 - T S G 20 M B

7211 10		20 W D								
Displace-	Order	ring-No.	Max.	Max.	kg	Dimens	sion			
ment			operating	rotation						
	"))	(•	pressure	speed		[mm]				
[cm ³ /rev]	L	R	[bar]	[rpm]		Α	В	C	D	E
11	-	0 510 545 003	280	3500	3.8	64.5	113.8	20	40	M6
14	0 510 545 302	0 510 545 002	280	3000	4.0	65.0	118.8	20	40	depth 13
16	-	0 510 645 005	230	3000	4.1	65.0	122.0	20	40	
19	-	0 510 645 003	230	3000	4.3	65.0	127.0	20	40]

Standard range

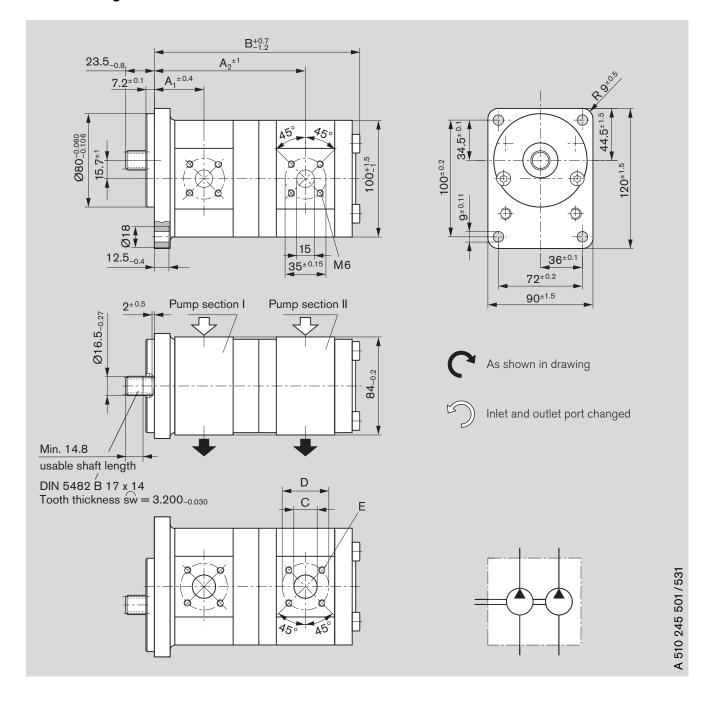


Ordering code AZPFF - 12 - _ _ _ _ / _ _ _ _ _ _ _ _ C P 20 20 K B

Displa	12 - ace-	, 		Max.	·	Max.	kg	Dimer	nsion				
ment		1		opera	•	rotation							
L 3,	1			press	sure	speed		, ,					
[cm ³ /			R	[bar]	l D	[rpm]		[mm]	۱.۸	B	C 1)	l D	E
P _I	P _{II}	L	T	P _I	P _{II}	4000	4.0		A ₂		<u> </u>		
5.5	4	0 510 365 305	-	280	280	4000	4.8	38.6	121.6	157.9	15	40	M6 depth 13
8	4	0 510 465 324	0 510 465 011	280	280	4000	4.4	40.7	125.7	162.0	20	40	depin 13
8	5.5	0 510 465 344	0 510 465 032	280	280	4000	4.4	40.7	126.9	164.5	20	40	-
8	8	0 510 465 320	0 510 465 023	280	280	4000	5.4	40.7	129.0	168.6	20	40	-
11	4	0 510 565 387	-	280	280	3500	4.5	44.5	130.7	167.0	20	40	-
11	5.5	0 510 565 319	0 510 565 095	280	280	3500	4.5	44.5	131.9	169.5	20	40	-
11	8	0 510 565 389	0 510 565 014	280	280	3500	4.6	44.5	134.0	173.6	20	40	-
11	11	0 510 565 376	0 510 565 061	280	280	3500	4.8	44.5	137.8	178.6	20	40	-
14	4	0 510 565 406	-	280	280	3000	4.6	45.0	135.7	172.0	20	40	_
14	8	0 510 565 335	0 510 565 072	280	280	3000	4.8	45.0	139.0	178.6	20	40	_
14	11	0 510 565 393	-	280	280	3000	5.0	45.0	142.8	183.6	20	40	
14	14	-	0 510 565 417	280	280	3000	5.0	45.0	143.3	188.6	20	40	
16	4	0 510 665 348	_	280	280	3000	4.75	45.0	139.1	175.4	20	40	
16	5.5	0 510 665 337	-	280	280	3000	4.8	45.0	140.3	177.9	20	40	
16	8	0 510 665 328	0 510 665 135	280	280	3000	6.0	45.0	142.4	182.0	20	40	
16	11	0 510 665 382	0 510 665 152	280	280	3000	5.0	45.0	146.2	187.0	20	40	
16	14	0 510 665 381	0 510 665 144	280	280	3000	5.1	45.0	146.7	192.0	20	40	
16	16	0 510 665 330	0 510 665 052	280	230	3000	6.4	45.0	146.7	195.4	20	40	
19	4	0 510 665 369	-	230	280	3000	4.9	45.0	144.1	180.4	20	40	_
19	5	0 510 665 442	_	230	280	3000	4.8	45.0	145.3	183.2	20	40]
19	11	0 510 665 368	_	230	280	3000	5.2	45.0	146.2	192.0	20	40]
19	14	0 510 665 418	_	230	280	3000	5.0	45.0	151.7	197.0	20	40]
19	19	0 510 665 336	_	230	190	3000	6.6	45.0	151.7	205.4	20	40]
22	8	0 510 765 345	0 510 765 045	210	280	2500	5.1	52.6	152.8	192.4	20	40	
22	11	0 510 765 309	0 510 765 049	210	280	2500	5.2	52.6	156.7	197.7	20	40]
22	16	0 510 765 343	0 510 765 028	210	230	2500	5.5	52.6	157.1	205.8	20	40]

^{1) 4} and 5.5 cm³ Ø 15

Standard range



Ordering code

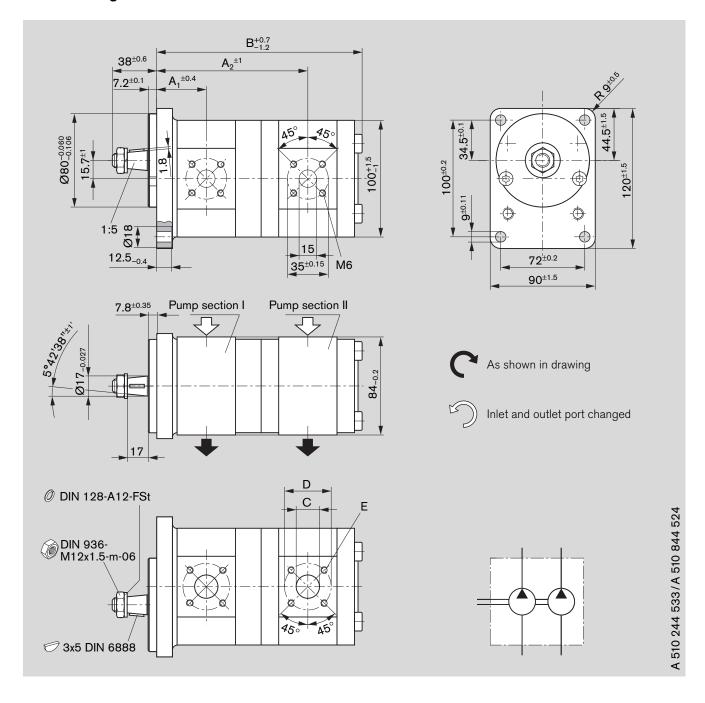
AZPFF - 10 - _ _ _ _ / _ _ _ _ _ F B 20 20 M B

AZPFF - 11 - _ _ _ _ / _ _ _ _ F B 20 20 M B*

Displa	ice-	Orderi	ng-No.		oper-	Max.	kg	Dimer	nsion				
ment				ating	pres-	rotation							
	_	")	(-	sure		speed							
[cm ³ /ı			_	[bar]		[rpm]		[mm]			4		
Pı	P _{II}	L	R	P _I	P _{II}			A ₁	A_2	В	C 1)	D	E
8	5.5	0 510 465 345	-	280	280	4000	5.1	43.2	129.4	174.0	20	40	M6
8	8	0 510 465 326*	_	280	280	4000	5.1	43.2	131.5	178.1	20	40	depth 13
11	4	_	0 510 565 032	280	280	3500	6.3	47.0	133.2	176.5	20	40	
11	5.5	0 510 565 332	0 510 565 034	280	280	3500	6.35	47.0	134.4	179.0	20	40	
11	8	0 510 565 334*	0 510 565 018	280	280	3500	6.4	47.0	136.5	183.1	20	40	
11	11	0 510 565 328	0 510 565 035	280	280	3500	6.5	47.0	140.3	188.1	20	40	
14	4	0 510 565 367	-	280	280	3000	6.4	47.5	138.2	181.5	20	40	
14	5.5	0 510 565 069	-	280	280	3500	6.5	47.5	139.4	183.7	20	40	
14	8	0 510 565 356	0 510 565 019	280	280	3000	6.5	47.5	141.5	188.1	20	40	
16	4	-	0 510 665 058	280	280	3000	6.7	47.5	141.6	184.9	20	40	
16	8	0 510 665 333	0 510 665 064	280	280	3000	6.8	47.5	144.9	191.5	20	40	
16	11	0 510 665 347	0 510 665 036	280	280	3000	6.9	47.5	148.7	196.5	20	40	
16	16	0 510 665 334	0 510 665 029	280	230	3000	7.3	47.5	149.2	204.9	20	40	
19	4	-	0 510 665 115	230	280	3000	5.5	47.5	146.6	189.0	20	40	
19	11	0 510 665 375*	_	230	280	3000	5.9	47.5	153.7	201.5	20	40	
19	19	0 510 665 420	0 510 665 097	230	190	3000	6.3	47.5	154.2	214.9	20	40]
22.5	5.5	0 510 765 317	0 510 765 022	210	280	2500	5.8	61.1	165.2	209.8	20	40	1
22.5	8	0 510 765 331	_	210	280	2500	6.18	61.1	167.3	213.9	20	40	1
22.5	16	0 510 765 341	_	210	230	2500	6.4	61.1	171.6	227.3	20	40	1
22.5	22.5	0 510 765 338	_	210	160	2500	7.05	61.1	185.2	249.7	20	40	1

^{1) 4} and 5.5 cm³ Ø 15

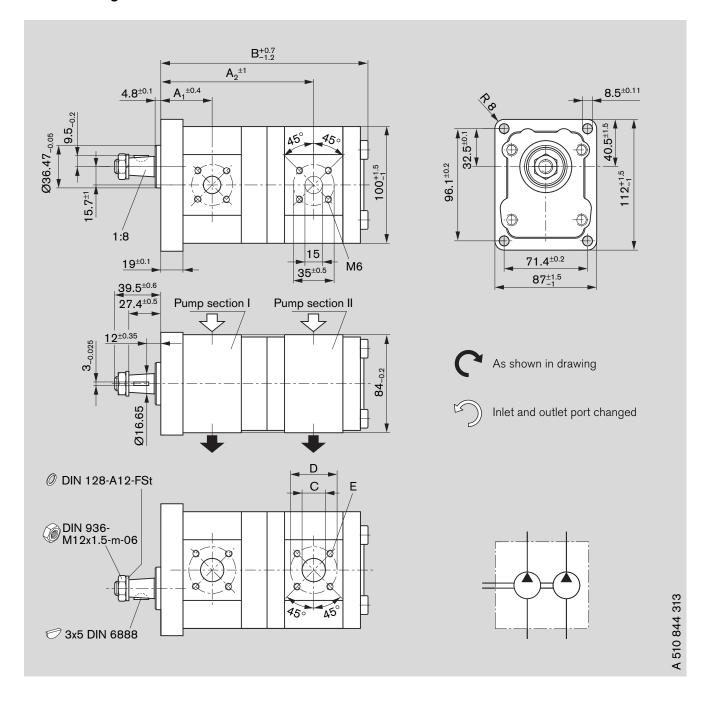
Standard range



AZPFF	- 11 -	- 🗌 🗎 🖊 🖊 📗] 🔲 🔲 C B 20 2	0 M B	*								
Displa	ce-	Orderii	ng-No.	Max.		Max.	kg	Dimen	sion				
ment			\sim	opera	ating	rotation							
		"))	(~	press	ure	speed							
[cm ³ /ı				[bar]		[rpm]		[mm]			45		
P _I	P _{II}	L	R	P _I	$ P_{\parallel} $			A ₁	A ₂	В	C 1)	D	E
4	4	0 510 900 002*	0 510 900 001*	280	280	4000	4.5	39.9	121.6	164.4	15	40	M6
5.5	4	0 510 900 005*	-	280	280	4000	4.9	41.1	124.1	166.9	15	40	depth 13
5.5	5.5	0 510 900 004*	0 510 900 003*	280	280	4000	5.0	41.1	125.3	169.4	15	40	
8	16	_	0 510 900 042*	280	230	3000	5.6	43.2	135.8	191.0	20	40	
8	4	0 510 900 008*	0 510 900 051*	280	280	4000	5.1	43.2	128.2	171.0	20	40	
8	5.5	0 510 900 009*	0 510 900 007*	280	280	4000	5.1	43.2	129.4	173.5	20	40	
8	8	0 510 900 010*	0 510 900 006*	280	280	4000	5.2	43.2	131.5	177.6	20	40	
11	4	0 510 900 015*	0 510 900 012*	280	280	3500	5.2	47.0	133.2	176.0	20	40	
11	5.5	0 510 900 017*	0 510 900 046*	280	280	3500	5.2	47.0	134.4	178.5	20	40]
11	8	0 510 900 016*	0 510 900 044*	280	280	3500	5.4	47.0	136.5	182.6	20	40	1
11	11	0 510 900 018*	0 510 900 039*	280	280	3500	5.5	47.0	140.3	187.6	20	40]
14	4	0 510 900 036*	-	280	280	3000	5.3	47.5	138.2	181	20	40	1
14	5.5	_	0 510 900 060*	280	280	3000	5.4	47.5	139.4	183.5	20	40	1
14	8	0 510 900 020*	0 510 900 011*	280	280	3000	5.5	47.5	141.5	187.6	20	40	1
14	8	0 510 565 364	0 510 565 012	280	280	3000	5.6	47.5	141.5	188.1	20	40	1
14	11	0 510 900 019*	0 510 900 013*	280	280	3000	5.6	47.5	145.3	192.6	20	40	1
14	11	0 510 565 353	0 510 565 033	280	280	3000	5.7	47.5	145.3	193.1	20	40	1
14	14	_	0 510 900 014*	280	280	3000	5.8	47.5	145.8	197.6	20	40	1
14	14	_	0 510 565 037	280	280	3000	5.9	47.5	145.8	198.1	20	40	1
16	4	0 510 900 059*	0 510 900 021*	280	280	3000	5.5	47.5	141.6	184.4	20	40	1
16	5.5	0 510 900 028*	_	280	280	3000	5.5	47.5	142.8	186.9	20	40	1
16	8	0 510 900 035*	0 510 900 022*	280	280	3000	5.6	47.5	144.9	191.0	20	40	1
16	11	0 510 900 029*	0 510 900 023*	280	280	3000	5.7	47.5	148.7	196.0	20	40	1
16	14	-	0 510 900 061*	280	280	3000	5.9	47.5	149.2	201.0	20	40	1
16	16	0 510 900 030*	0 510 900 024*	280	230	3000	6.0	47.5	149.2	204.4	20	40	-
19	4	0 510 900 043*	0 510 900 049*	230	280	3000	5.6	47.5	146.6	189.4	20	40	-
19	5.5	-	0 510 665 067	230	280	3000	5.6	47.5	147.8	192.4	20	40	-
19	5.5	_	0 510 900 027*	230	280	3000	5.6	47.5	147.8	191.9	20	40	-
19	8	0 510 900 031*	0 510 900 027	230	280	3000	5.8	47.5	149.9	196.0	20	40	-
19	8	0 510 665 325*		230	280	t	-	ł			20	40	-
19	11	0 510 665 325	0 510 665 024 0 510 900 052*	230	280	3000	6.7 5.9	47.5 47.5	149.9 153.7	201.0	20	40	1
19	11	0 510 900 032	_ 0 0 10 900 002	230	280	3000	6.9	47.5	153.7	201.5	20	40	1
19	14		- -	-			-				20	40	1
	16	0 510 900 053*		230	280	3000	6.0 7.1	47.5 47.5	154.2	206.0		40	1
19	-	0 510 665 327	0 510 665 053	230	230	3000		-	154.2	209.9	20	-	-
19	16	0 510 900 033*	0 510 900 026*	230	230	3000	6.1	47.5	154.2	209.4	20	40	-
19	19	0 510 900 034*	0 510 900 025*	230	210	3000	6.2	47.5	154.2	214.4	20	40	-
19	19	0 510 665 400	0 510 665 025	230	190	3000	6.2	47.5	154.2	214.9	20	40	-
22.5	4		0 510 900 050*	210	280	2500	5.8	55.1	152.0	194.8	20	40	-
22.5	5.5	0 510 900 055*	0 510 900 045*	210	280	2500	5.8	55.1	153.2	197.3	20	40	-
22.5	8	0 510 900 057*	0 510 900 040*	210	280	2500	5.9	55.1	155.3	201.4	20	40	4
22.5	8	_	0 510 765 023	230	280	3000	5.9	61.0	167.3	213.9	20	40	-
22.5	11	-	0 510 900 054*	210	280	2500	6.0	55.1	159.1	206.4	20	40	-
22.5	11	0 510 765 320	-	210	250	3000	6.3	61.0	171.1	218.9	20	40	-
22.5	14	0 510 900 048*	0 510 900 058*	210	280	2500	6.2	55.1	159.6	211.4	20	40	
22.5	16	0 510 900 041*	0 510 900 037*	210	230	2500	6.2	55.1	159.6	214.8	20	40	1
22.5	16	0 510 765 340	_	210	230	3000	6.55	61.0	171.6	227.3	20	40	1
22.5	22.5	0 510 900 056*	0 510 900 038*	210	180	2500	6.5	55.1	167.2	225.2	20	40	_
22.5	22.5	-	0 510 765 012	210	160	3000	6.5	61.0	185.2	249.7	20	40	
1) .		m ³ Ø 15											

^{1) 4} and 5.5 cm³ Ø 15

Standard range



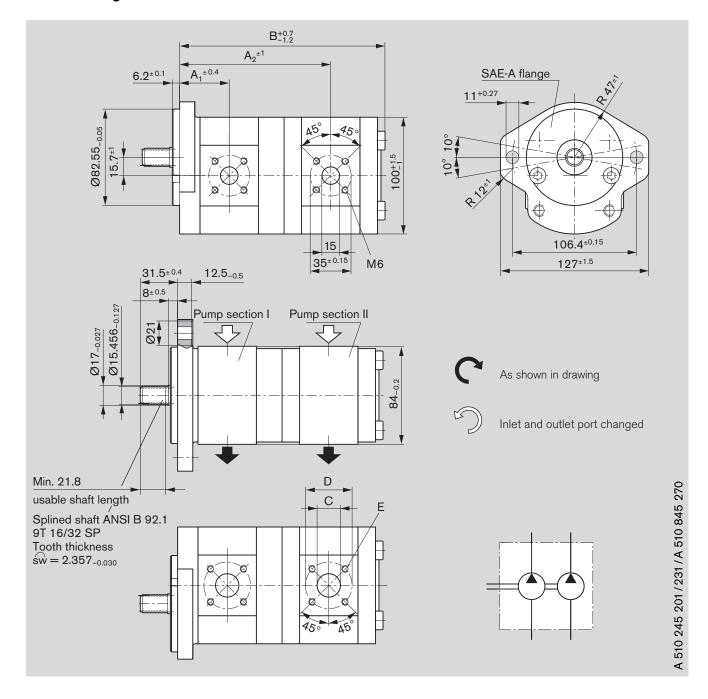
Ordering code

AZPFF - 10 - _ _ _ _ / _ _ _ _ H O 20 20 M B AZPFF - 10 - _ _ _ _ / _ _ _ _ H O 20 20 K B*

Displa	ice-	Orderi	ng-No.	Max.		Max.	kg	Dimer	nsion				
ment				opera	ating	rotation	_						
			(*	press	sure	speed							
[cm ³ /ı	rev]			[bar]		[rpm]		[mm]					
P _I	$ P_{\parallel} $	L	R	P _I	$ P_{\parallel} $			A ₁	A_2	В	C 1)	D	E
4	4	_	0 510 901 500	280	280	4000	4.7	41.4	123.1	165.9	15	40	M 6
8	5.5	0 510 901 512		280	280	4000	4.9	44.7	130.9	175.0	20	40	depth 13
8	8	-	0 510 901 504	280	280	4000	5.0	44.7	133.0	179.1	20	40	
11	4	_	0 510 901 509	280	280	3500	5.0	48.5	134.7	177.5	20	40	
11	5.5	0 510 565 436*	0 510 901 503	280	280	3500	5.1	48.5	135.9	180.0	20	40	
14	5.5	0 510 565 435*	-	280	280	3000	5.2	49.0	140.9	185.0	20	40	
14	11	-	0 510 901 513	280	280	3000	5.5	49.0	146.8	194.1	20	40	
16	5.5	-	0 510 901 510	280	280	3000	5.3	49.0	144.3	188.4	20	40	
16	8	0 510 901 514	-	280	280	3000	5.4	49.0	146.4	192.5	20	40	
16	14	_	0 510 901 515	280	280	3000	5.7	49.0	150.7	202.5	20	40	
16	16	_	0 510 901 501	280	230	3000	5.8	49.0	150.7	205.9	20	40	
19	8	_	0 510 901 507	230	280	3000	5.5	49.0	151.4	197.5	20	40]
19	11	_	0 510 901 508	230	280	3000	5.6	49.0	155.2	202.5	20	40]
19	16	_	0 510 901 502	230	230	3000	5.9	49.0	155.7	210.9	20	40	1
19	19	0 510 901 506	_	230	190	3000	6.0	49.0	155.7	215.9	20	40	1
22.5	16	0 510 901 511	_	210	230	2500	6.1	56.6	161.1	216.3	20	40	1
22.5	19	_	0 510 901 505	210	190	2500	6.2	56.6	161.7	220.3	20	40	1

^{1) 4} and 5.5 cm³ Ø 15

Standard range

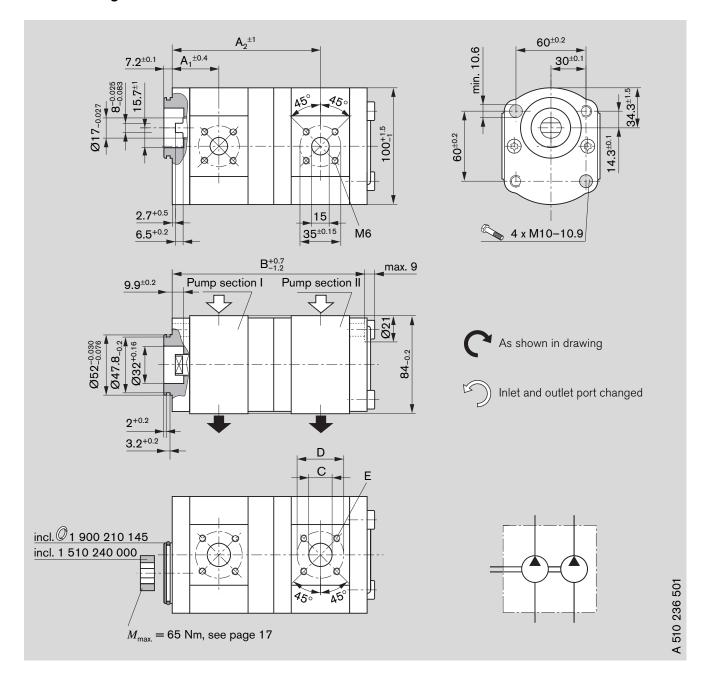


Ordering code

AZPF	- 11 -	- 🗆 🗆 🗆 🗆 🖸		20 K B	**													
Displa	ice-	Orderi	ng-No.	Max.		Max.	kg	Dimer	nsion									
ment			\sim	opera	ating	rotation												
	_		('	press	ure	speed												
[cm ³ /				[bar]		[rpm]		[mm]			1\		. –					
P _I	P _{II}	L	R	P _i	P _{II}			A ₁	A ₂	В	C 1)	D	E					
5.5	4	0 510 901 029*	-	280	280	4000	4.9	41.1	124.1	166.9	15	40	M6					
5.5	5.5	_	0 510 901 042*	280	280	4000	5.0	41.1	125.3	169.4	15	40	depth 13					
8	4	0 510 901 032*	0 510 901 034*	280	280	4000	5.0	43.2	128.2	171.0	20	40						
8	5.5	0 510 901 018*	0 510 901 030*	280	280	4000	5.1	43.2	129.4	173.5	20	40						
8	8	-	0 510 901 021*	280	280	4000	5.1	43.2	131.5	177.6	20	40						
11	4	-	0 510 901 024*	280	280	3500	5.1	47.0	133.2	176.0	20	40						
11	4	-	0 510 565 022	280	280	3500	5.2	47.0	133.2	176.5	20	40						
11	5.5	0 510 901 015*	0 510 901 000*	280	280	3500	5.2	47.0	134.4	178.5	20	40						
11	5.5	-	0 510 565 023	280	280	3500	5.2	47.0	134.4	179.0	20	40						
11	8	0 510 901 031*	0 510 901 037*	280	280	3500	5.3	47.0	136.5	182.6	20	40]					
11	11	0 510 901 009*	0 510 901 035**	280	280	3500	5.5	47.0	140.3	187.6	20	40						
14	5.5	0 510 901 033*	-	280	280	3000	5.4	47.5	139.4	183.5	20	40						
14	8	-	0 510 901 016*	280	280	3000	5.5	47.5	141.5	187.6	20	40						
14	11	0 510 565 346	-	280	280	3000	5.7	47.5	145.3	193.1	20	40						
14	11	0 510 901 001*	0 510 901 011*	280	280	3000	5.6	47.5	145.3	192.6	20	40						
14	14	_	0 510 901 036*	280	280	3000	5.7	47.5	145.8	197.6	20	40						
16	4	_	0 510 901 028*	280	280	3000	5.4	47.5	141.6	184.4	20	40						
16	5.5	0 510 901 014*	0 510 901 008*	280	280	3000	5.4	47.5	142.8	186.9	20	40						
16	8	0 510 901 006*	0 510 901 005*	280	280	3000	5.5	47.5	144.9	191.0	20	40						
16	11	0 510 901 012*	0 510 901 002*	280	280	3000	5.7	47.5	148.7	196.0	20	40						
16	11	0 510 665 354	0 510 665 042	280	280	3000	5.8	47.5	148.7	196.0	20	40						
16	16	0 510 901 027*	0 510 901 022*	280	280	3000	5.9	47.5	149.2	204.4	20	40						
19	4	_	0 510 901 044*	230	280	3000	5.5	47.5	146.6	189.4	20	40						
19	5.5	0 510 901 041*	0 510 901 043*	230	280	3000	5.6	47.5	147.8	191.9	20	40						
19	8	0 510 901 017*	0 510 901 003*	230	280	3000	5.7	47.5	149.9	196.0	20	40						
19	8	_	0 510 665 126**	230	280	3000	5.6	47.5	149.9	196.0	20	40]					
19	8	_	0 510 665 047	230	280	3000	5.8	47.5	149.9	196.0	20	40]					
19	11	0 510 665 435	0 510 901 004*	230	280	3000	5.8	47.5	153.7	201.0	20	40]					
19	14	0 510 901 040*	0 510 901 025*	230	280	3000	5.9	47.5	154.2	206.0	20	40						
19	16	0 510 901 039*	0 510 901 045*	230	230	3000	6.0	47.5	154.2	209.4	20	40						
19	19	0 510 901 010*	_	230	190	3000	6.2	47.5	154.2	214.4	20	40						
19	19	_	0 510 665 132	230	190	3000	6.1	47.5	154.2	214.4	20	40						
22.5	4	-	0 510 901 023*	210	280	2500	5.7	55.1	152.0	t	20	40	1					
22.5	5.5	_	0 510 901 020*	210	280	2500	5.7	55.1	153.2	 	20	40	1					
22.5	8	_	0 510 765 016	180	280	2500	7.6	55.1	155.3	201.4	20	40	1					
22.5	11	0 510 901 019*	0 510 901 026*	210	280	2500	5.9	55.1	159.1	206.4	20	40	1					
22.5	14	0 510 901 013*	0 510 901 007*	210	280	2500	6.1	55.1	159.6	211.4	20	40	1					
22.5	22.5	0 510 901 038*	_	210	180	2500	6.4	55.1	167.2	225.2	20	40	1					

^{1) 4} and 5.5 cm³ Ø 15

Standard range

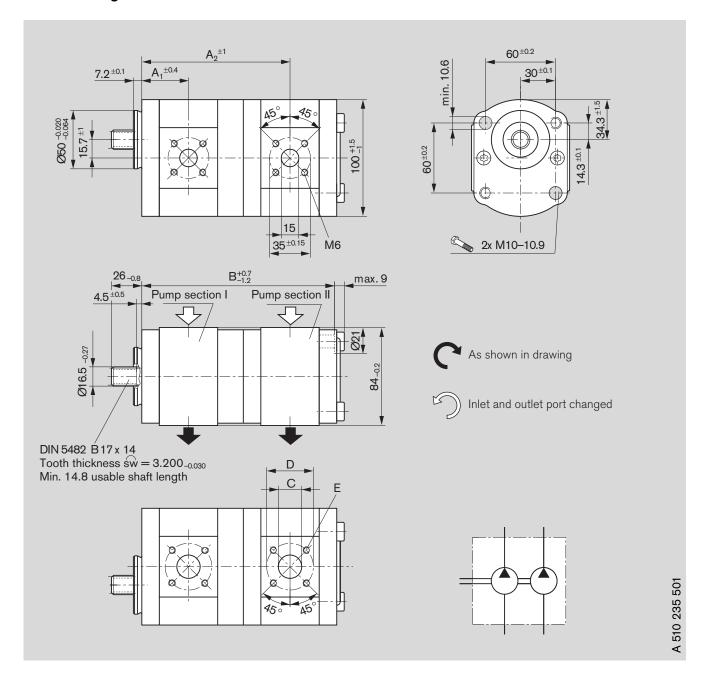


Ordering code

AZPF	- 10 -	<u>- </u>		20 M I	3								
Displa	ice-	Orderi	ng-No.	Max.		Max.	kg	Dimer	nsion				
ment				opera	ating	rotation							
		"))	(~	press	ure	speed							
[cm ³ /ı	ev]			[bar]		[rpm]		[mm]					
P _I	$ P_{\parallel} $	L	R	Pı	$ P_{\parallel} $			A ₁	A_2	В	C 1)	D	E
5.5	4	0 510 365 314	0 510 365 010	280	280	4000	4.2	38.6	121.6	157.9	15	40	M 6
8	4	_	0 510 465 012	280	280	4000	4.4	40.7	125.7	162.0	20	40	depth 13
8	5.5	0 510 465 346	_	280	280	4000	4.4	40.7	126.9	164.5	20	40	
8	8	_	0 510 465 008	280	380	4000	5.6	40.7	129.0	168.6	20	40	
11	4	0 510 565 329	0 510 565 015	280	280	3500	4.5	44.5	130.7	167.0	20	40	
11	5.5	-	0 510 565 016	280	280	3500	4.6	44.5	131.9	169.5	20	40	
11	8	0 510 565 379	0 510 565 078	280	280	3500	4.65	44.5	134.0	173.6	20	40	
16	16	0 510 665 339	0 510 665 030	280	230	3000	5.2	45.0	146.7	195.4	20	40	
22.5	8	0 510 765 312	-	210	280	2500	5.2	52.5	152.8	192.4	20	40	

^{1) 4} and 5.5 cm³ Ø 15

Standard range



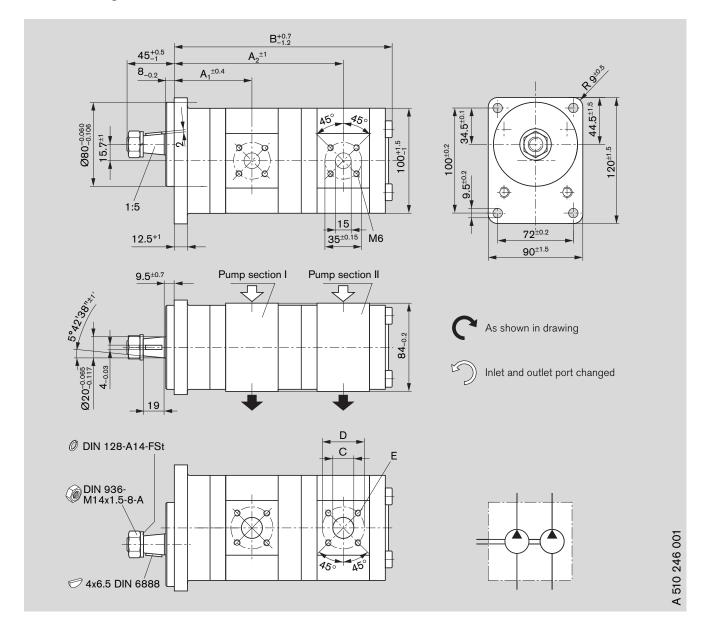
Ordering code

AZPFF - 10 - _ _ _ _ / _ _ _ _ _ F P 20 20 M B AZPFF - 10 - _ _ _ _ / _ _ _ _ F P 20 20 K B*

Displa	ace-	Orderi	ng-No.	Max.	atina	Max. rotation	kg	Dimer	nsion				
[cm ³ /	roul	9	C	press [bar]	U	speed		[mm]					
P _i	P _{II}	1	R	P,	P _{II}	[rpm]		A,	A ₂	В	C 1)	l D	ΙE
		0.540.405.055				4000	4.4	<u> </u>			<u> </u>		
8	4	0 510 465 355	-	280	280	4000	4.4	40.7	125.7	162.0	20	40	M6
11	8	0 510 565 385	_	280	280	3500	4.6	44.5	134.0	173.6	20	40	depth 13
16	8	_	0 510 665 071	280	280	3000	4.85	45.0	142.4	182.0	20	40	
16	11	_	0 510 665 076	280	280	3000	4.98	45.0	146.2	187.0	20	40	
16	14	0 510 665 404*	_	280	280	3000	5.12	45.0	146.7	192.0	20	40	
16	16	0 510 665 376	0 510 665 062	280	230	3000	5.2	45.0	146.7	195.4	20	40	

^{1) 4} and 5.5 cm³ Ø 15

Standard range

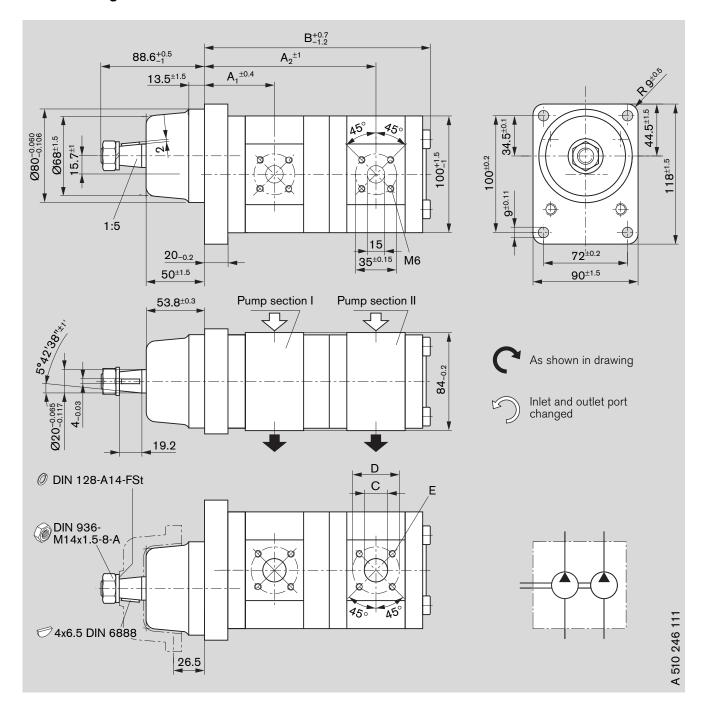


Ordering code

AZPFF	- 10 -	<u> </u>		ZO IVI D	<u> </u>								
Displa	ice-	Orderi	ng-No.	Max.		Max.	kg	Dimer	nsion				
ment				opera	ting	rotation							
			(*	press	ure	speed							
[cm ³ /ı	rev]			[bar]		[rpm]		[mm]					
P _I	$ P_{\parallel} $	L	R	Pı	$ P_{\parallel} $			A ₁	A_2	В	C 1)	D	ΙE
4	4	0 510 255 300	_	280	280	4000	4.8	71.3	153.0	197.0	15	40	M 6
5.5	4	0 510 355 301	_	280	280	4000	5.0	72.6	155.5	199.5	15	40	depth 13
8	5.5	0 510 455 300	0 510 455 001	280	280	4000	5.2	74.6	160.8	206.1	20	40	
8	8	0 510 455 301	0 510 455 002	280	280	4000	5.3	74.6	163.0	210.2	20	40	
11	5.5	0 510 555 300	0 510 555 001	280	280	3500	5.3	79.0	165.8	211.1	20	40	
11	8	0 510 555 301	0 510 555 002	280	280	3500	5.4	79.0	168.0	215.2	20	40	
11	11	0 510 555 302	0 510 555 003	280	280	3500	5.5	79.0	172.3	220.2	20	40	
16	4	0 510 655 300	0 510 655 001	280	280	3000	6.4	79.0	173.0	217.0	20	40	
16	5.5	0 510 655 301	0 510 655 002	280	280	3000	5.5	79.0	174.2	219.5	20	40	
16	8	0 510 655 302	0 510 655 003	280	280	3000	5.6	79.0	176.3	223.6	20	40	
16	11	0 510 655 303	0 510 655 004	280	280	3000	5.7	79.0	180.7	228.6	20	40	
16	16	0 510 655 304	0 510 655 005	280	230	3000	6.0	79.0	180.7	237.0	20	40	

^{1) 4} and 5.5 cm³ Ø 15

Standard range



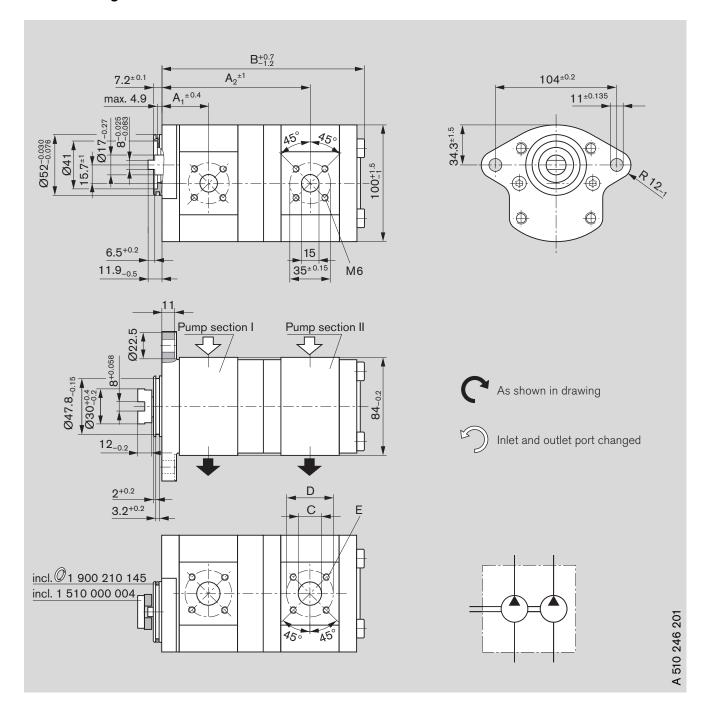
Ordering code:

AZPFF - 10 - | | / | | | | S G 20 20 P B

AZFF	<u> </u>	<u>- </u>		20 P D									
Displ	ace-	Orderi	ng-No.	Max.		Max.	kg	Dimer	nsion				
ment			\sim	opera	ating	rotation							
		"))	(~	press	ure	speed							
[cm ³ /	rev]			[bar]		[rpm]		[mm]					
P _i	$ P_{\parallel} $	L	R	P _I	$ P_{\parallel} $			A ₁	A_2	В	C 1)	D	E
16	16	_	0 510 655 007	280	280	3000	6.2	65.0	166.7	221.9	20	40	M 6
19	19	-	0 510 655 011	230	190	3000	6.6	65.0	171.7	231.9	20	40	depth 13

^{1) 4} and 5.5 cm³ Ø 15

Standard range



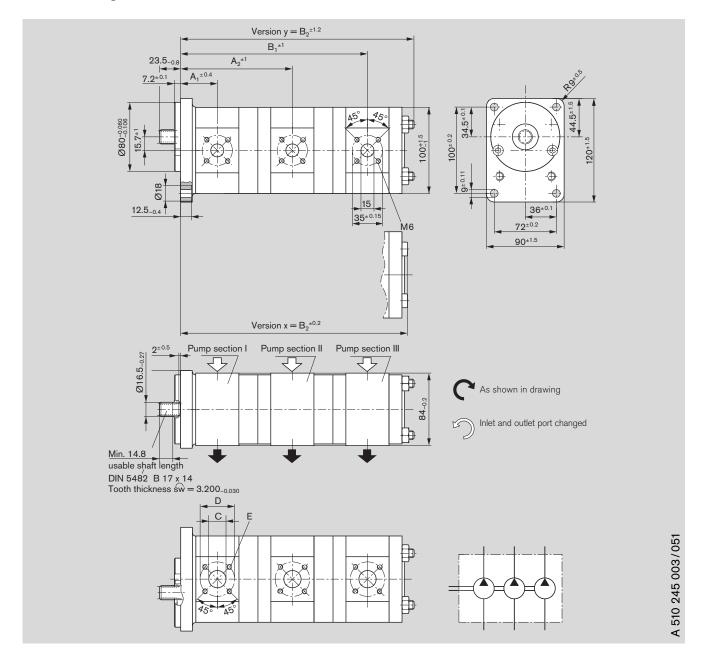
Ordering code

AZPFF - 10 - | | | / | | | N L 20 20 K B

Displa	ice-	Orderi	ng-No.	Мах.		Max.	kg	Dimer	nsion				
ment			\sim	opera	iting	rotation							
		"))	(-	press	ure	speed							
[cm ³ /	rev]			[bar]		[rpm]		[mm]					
P _I	$ P_{\parallel} $	L	R	P _I	$ P_{\parallel} $			A ₁	A_2	В	C 1)	D	E
5.5	5.5	_	0 510 365 009	280	280	4000	4.65	38.6	122.8	169.2	15	40	M 6
11	11	_	0 510 565 043	280	280	3500	5.2	44.5	137.5	187.4	20	40	depth 13
16	8	0 510 665 449	_	280	280	3000	5.2	45.0	142.4	188.4	20	40	
16	22.5	0 510 665 068	_	280	160	2500	6.17	45.0	160.3	226.6	20	40	

^{1) 4} and 5.5 cm³ Ø 15

Standard range



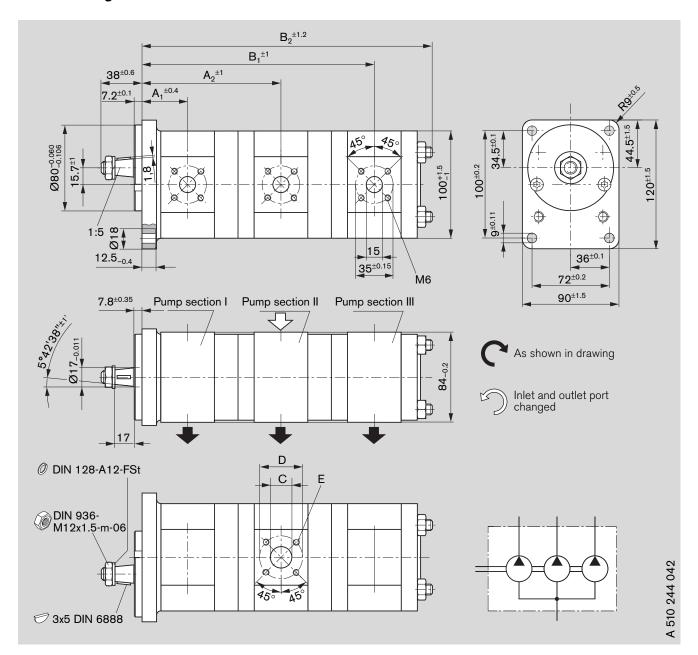
_	
Ordering	code

AZPFFF - 10 - _ _ _ / _ _ _ / _ _ _ F B 20 20 20 M B AZPFFF - 11 - _ _ / _ _ _ / _ _ _ F B 20 20 20 M B*

Dis	place) -	Order	ing-No.	Max.	opera	ating	Max. rota-	kg	Dime	nsion						
mer	nt 1 ³ /rev	.1	5	~	pres			tion speed		[mm]							ion
1 -		'ı P	L L	\mathcal{L}_{R}	P _l	P _{II}	P _{III}	[rpm]		A ₁	$ A_2 $	B ₁	$ B_2 $	C 1)	D	ΙE	Version
11	4	4	0 510 565 371	-	280	280	280	3500	6.9	47.0	133.2	214.9	259.0	20	40	M 6	у
14	4	8	0 510 565 408	_	280	280	280	3000	7.2	47.5	138.2	223.2	270.6	20	40	depth 13	х
14	8	8	0 510 565 422	_	280	280	280	3000	7.3	47.5	141.5	229.8	275.9	20	40		х
16	4	4	0 510 665 379	_	280	280	280	3000	7.2	47.5	141.6	223.3	267.4	20	40		х
16	5.5	5.5	0 510 665 416	0 510 665 061	280	280	280	3000	7.4	47.5	142.8	227.0	272.4	20	40		х
16	11	4	0 510 665 372	-	280	210	210	3000	7.5	47.5	148.7	234.9	276.5	20	40		х
16	11	5.5	_	0 510 665 092*	280	210	120	3000	7.6	47.5	148.7	236.1	280.2	20	40		х
16	16	11	0 510 665 371	-	280	120	120	3000	8.1	47.5	149.2	250.4	302.5	20	40		х
19	8	5.5	_	0 510 665 111*	230	250	160	3000	7.5	47.5	149.2	236.1	280.2	20	40		х
19	11	5.5	-	0 510 665 112*	230	230	230	3000	7.6	47.5	153.7	241.1	285.2	20	40		x

^{1) 4} and 5.5 cm³ Ø 15

Standard range



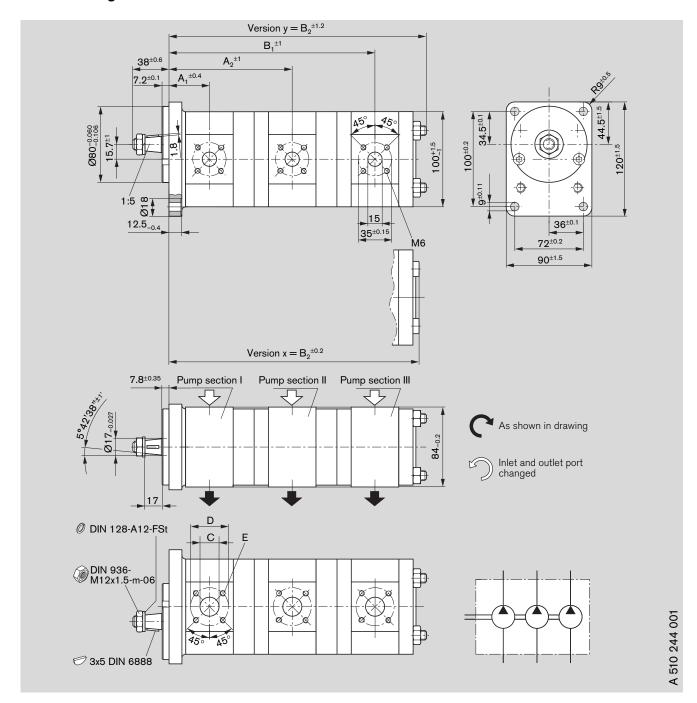
Ordering code

ΑZ	PFFF	- 11	/			c	B 20	20 20 M B								
Dis	place	ement	Ord	ering-No.	Max.	opera	ating	Max. rota-	kg	Dime	nsion					
				\sim	pres	sure		tion speed								
[cr	n³/rev]		[bar]			[rpm]		[mm]								
P_{l}	$ P_{\parallel} $	$ P_{\parallel} $	L D	R	P _I	$ P_{\parallel} $	$ P_{\parallel} $			A ₁	A_2	B ₁	B_2	C 1)	D	E
8	8	5.5	_	0 510 465 031	230	230	230	4000	6.5	43.2	119.5	193.7	238.1	20	40	M 6
11	11	8	_	0 510 565 065	230	230 230 230		3500	6.8	47.0	128.3	205.8	251.9	20	40	depth 13
11	11	8	_	0 510 565 0802)	280	280 280 280 3		3500	6.8	47.0	128.3	205.8	251.9	20	40	

^{1) 4} and 5.5 cm³ Ø 15

²) heavy through drive

Standard range



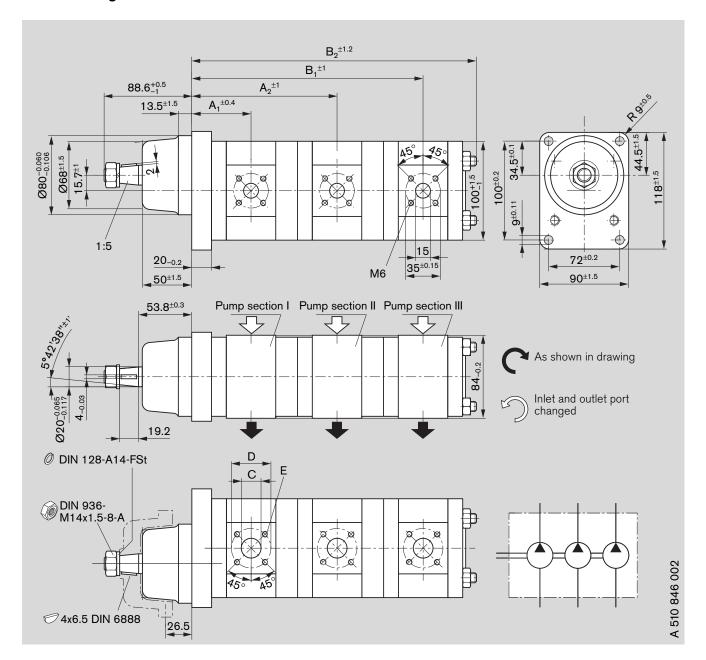
Ordering	code
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AZPFFF - 10 - _ _ _ / _ _ _ / _ _ _ _ C B 20 20 20 M B AZPFFF - 11 - _ _ _ / _ _ _ _ C B 20 20 20 K B*

Displ	ace	-	Orderir	ng-No.	Max.	opera	ating	Max.	kg	Dimer	nsion						
ment				\sim	pres			rotation									8
[cm ³	rev]]	'))	(-	[bar]			speed		[mm]						İ	/ersion
P_{l}	$ P_{\parallel}$	$ P_{III} $	L	R	Pı	$ P_{\parallel} $	$ P_{III} $	[rpm]		A ₁	A_2	B ₁	$ B_2 $	C 1)	D	E	Ve
8	8	4	_	0 510 465 027	280	280	280	4000	7.0	43.2	131.5	216.5	260.6	20	40	M6	х
11	8	8	_	0 510 565 081	280	230	230	3500	7.2	47.0	136.5	224.8	272.2	20	40	depth 13	х
16	4	4	0 510 665 419*	_	280	280	280	3000	7.1	47.5	141.6	223.3	267.4	20	40		х
16	8	4	_	0 510 665 134	280	280	280	3000	7.3	47.5	144.9	229.9	272.7	20	40		х
22.5	8	9	0 510 765 334*	_	230	210	210	3000	8.15	61.6	167.3	255.6	307.5	20	40		у

^{1) 4} and 5.5 cm³ Ø 15

Standard range

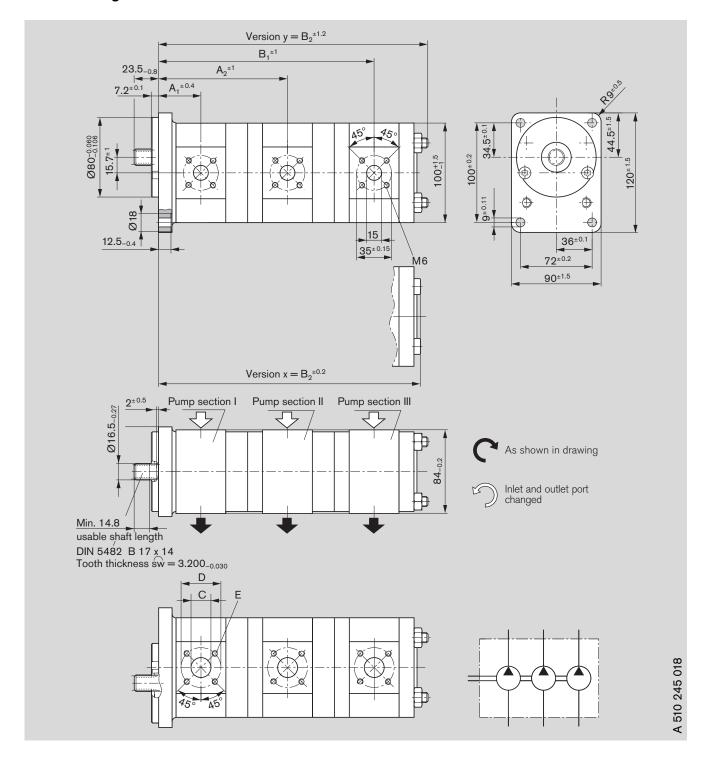


Ordering code

AZF	AZPFFF - 10 - 🗌 🔲 🗍 / 🔲 🔲 / 📗 🔲 S G 20 20 20 M B															
Dis	place	ment	Orde	ering-No.	Max.	Max. operating			kg	Dimension						
				pres	sure		rotation									
[cm	³ /rev	·]	"))	[bar]			speed		[mm]							
Pı	$ P_{\parallel} $	$ P_{ }$	L D	R	Pı	$ P_{\parallel} $	$ P_{ }$	[rpm]		A_1	A_2	B ₁	$ B_2 $	C 1)	D	E
8	8	5.5	_	0 510 455 004	280	250	250	4000	7.4	60.7	149.0	235.2	284.0	20	40	M6
14	14	5.5	_	0 510 555 007	280	210	210	3000	7.9	65.0	163.3	255.3	304.0	20	40	depth 13

^{1) 4} and 5.5 cm³ Ø 15

Standard range

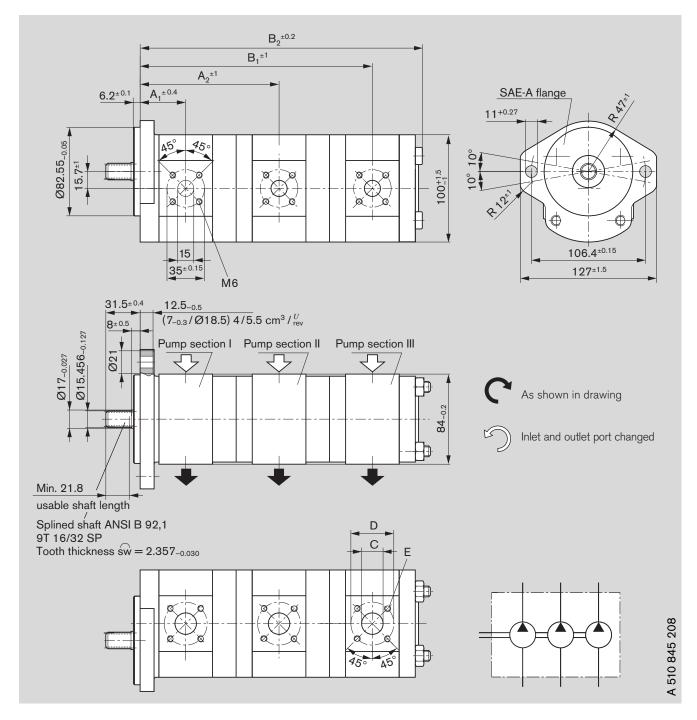


Ordering code

AZP	FFF	- 1	0/] F B	20 20 2	0 M B	}							
Disp	lace) -	Orderi	ng-No.	Max.	Max. operating			kg	Dimension							
ment [cm ³ /rev]		_']		C				rotation speed		[mm]							sion
P _i	$ P_{\parallel}$	- P _{III}	L D	R	P _i	$ P_{\parallel} $	P_{III}	[rpm]		A ₁	A_2	B ₁	$ B_2 $	C 1)	D	E	Ver
8	8	4	-	0 510 465 019	280	280	280	4000	7.0	43.2	131.5	216.5	260.8	20	40	M 6	х
19	16	4	0 510 665 380	_	230	190	190	3000	7.8	47.5	154 2	248.3	297.5	20	40	depth 13	v

 $^{^{1}}$) 4 and 5.5 cm 3 Ø 15

Standard range



Ordering	code:

ΑZI	AZPFFF – 10 – 🔲 🔲 / 🔲 🔲 / 📗 🔲 R R 20 20 20 M B																
Dis	plac	emen	t	Orde	ring-No.	Max. operating			Max.	kg	Dime	nsion					
[cn	[cm ³ /rev]				[bar]			rotation speed		[mm]							
P	$ P_{\parallel} $	$ P_{\parallel} $		L	R	P _I	$ P_{\parallel} $	$ P_{\parallel} $	[rpm]		A_1	A_2	B ₁	B_2	C ¹)	D	E
8			-		0 510 465 025	280	280	280	4000	7.0	43.2	129.4	213.6	257.7	20	40	M6
																	depth 13

^{1) 4} and 5.5 cm³ Ø 15

Notes for commissioning

Filter recommendation

The major share of premature failures in external gear pumps is caused by contaminated hydraulic fluid.

As a warranty cannot be issued for dirt-specific wear, we recommended filtration compliant with cleanliness level 20/18/15 ISO 4406, which reduces the degree of contamination to a permissible dimension in terms of the size and concentration of dirt particles:

Operating pressure [bar]	>160	<160
Contamination class ISO 4406	18/15	19/16
To be reached with $\beta_X = 75$	20	25

We recommend that a full-flow filter always be used. Basic contamination of the hydraulic fluid used may not exceed class 20/18/15 according to ISO 4406. Experience has shown that new fluid quite often lies above this value. In such instances a filling device with special filter should be used.

General

- The pumps supplied by us have been checked for function and performance. No modifications of any kind may be made to the pumps; any such changes will render the warranty null and void!
- Pump may only be operated in compliance with permitted data (see pages 15 – 18).

Project planning notes

Comprehensive notes and suggestions are available in Hydraulics Trainer, Volume 3 RE 00 281, "Project planning notes and design of hydraulic systems". Where external gear pumps are used we recommend that the following note be adhered to.

Technical data

All stated technical data is dependent on production tolerances and is valid for specific marginal conditions.

Note that, as a consequence, scattering is possible, and at certain marginal conditions (e.g. viscosity) the technical data may change.

Characteristics

When designing the external gear pump, note the maximum possible service data based on the characteristics displayed on pages 10 to 12.

Additional information on the proper handling of hydraulic products from Bosch Rexroth is available in our document: "General product information for hydraulic products" RE 07 008.

Contained in delivery

The components with characteristics as described under ordering code and device measurements, pages 20 – 58, are contained in delivery.

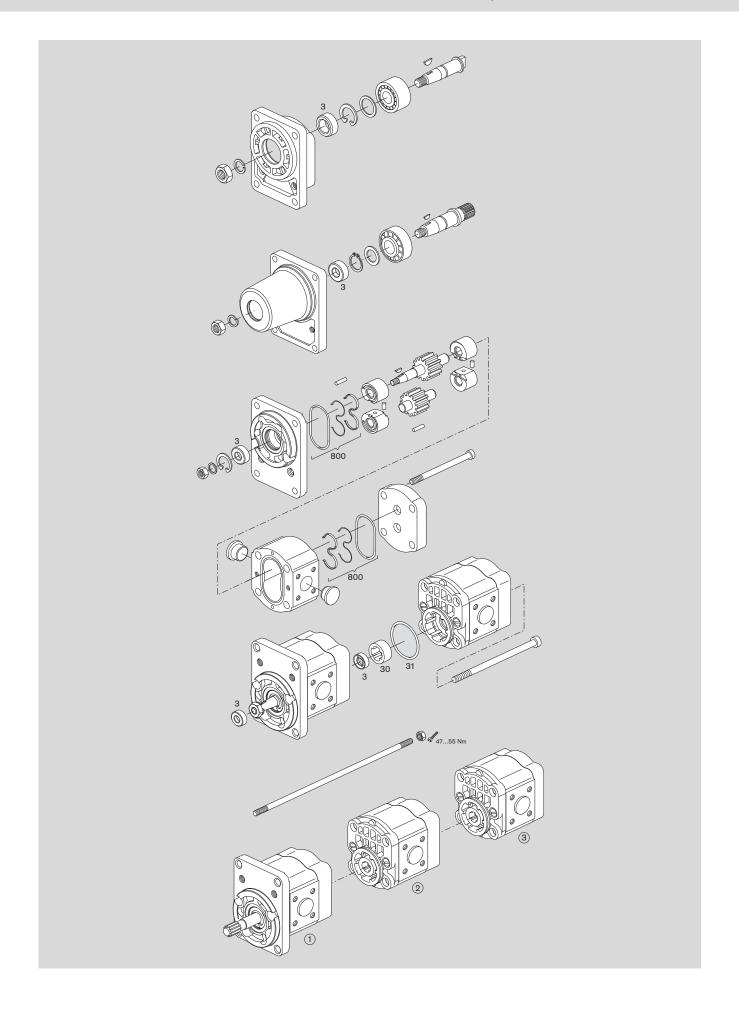
You can find further information in our publication: "General Operating Instructions for External Gear Units" RE 07 012-B1.

Service parts

		la		0.6.1.	l	ls	lo	l	Tp:
Page	Ordering code	Seal kit		Shaft seal ring	1	Dimension	_		Dimen-
		Pos. 800 1 517 010		Pos. 3 1 510 283	rial		Pos. 31 1 900 210	rial	sion
20	AZPF − 1x − □□□ □ CB 20 M B	152	NBR	008	NRR	17 x 30 x 7			1
21	AZPF – 1x – □□□ □ FB 20 MB	152	NBR	008	+	17 x 30 x 7	 		1
22	AZPF - 1x - □□□ □ HO 30 KB	152	NBR	044	-	18 x 30 x 7	-		1
23	AZPF - 1x - □□□ □ FO 30 MB	152	NBR	008	-	17 x 30 x 7	-		
23	AZPF - 1x - □□□ □ FO 30 MB	193	FKM	027	+	17 x 30 x 7	<u> </u>		
24	AZPF - 1x - □□□ □ HO 01 MB	152	NBR	008	-	17 x 30 x 7	-		
25	AZPF - 1x - □□□ □ AB 01 MB	208	FKM	037	+	18 x 30 x 6	 		
26	AZPF - 1x - □□□ □ CP 20 MB	152	NBR	008	-	17 x 30 x 7			
26	AZPF - 1x - □□□ □ CP 20 KB	152	NBR	027	1	17 x 30 x 7			
27	AZPF - 1x - □□□ □ CN 20 MB	152	NBR	008		17 x 30 x 7		NRD	45 x 2.5
28	AZPF - 1x - □□□ □ FN 20 MB	152	NBR	008		17 x 30 x 7		INDIX	45 X 2.5
29	AZPF - 1x - \(\bigcup \bigcup \) \(\text{FN 20 MB} \)	193	FKM	027	 	17 x 30 x 7			
30	AZPF - 1x -	152	NBR	008		17 x 30 x 7		NRP	45 x 2.5
31	AZPF - 1x -	152	NBR	008	1	17 x 30 x 7	1	NBR	-
32	AZPF - 1x - \(\sqrt{12 MB} \) \(\qquad \	152	NBR	008	<u> </u>	17 x 30 x 7		INDIX	40 X 2.0
33	AZPF - 1x -	152	NBR	008	_	17 x 30 x 7	!		
34	AZPF - 1x - □□□ □ RR 20 MB	152	NBR	008		17 x 30 x 7	-		
34	AZPF – 1x – □□□□ □ RR 20 KB	152	NBR	027	1	17 x 30 x 7	-		
35	AZPF - 1x - □□□ □ QR 20 MB	152	NBR	008		17 x 30 x 7	<u> </u>		
36	AZPF - 1x - □□□ □ SA 20 MB	152	NBR	008		17 x 30 x 7		NBR	45 x 2.5
36	AZPF - 1x - □□□ □ SA 20 KB	152	NBR	015	-	17 x 30 x 7	-	-	45 x 2.5
37	AZPF − 1x − □□□ □ SG 20 MB	152		009	1	20 x 40 x 7			45 x 2.5
39	AZPF – 1x – □□□ □ CP 20 20 KB	152		027/008		17 x 30 x 7	<u> </u>	1	45 x 2.5
41	AZPFF – 1x – □□□ / □□□ □ FB 20 20 MB			008 (2x)	+	17 x 30 x 7	 	-	45 x 2.5
43	AZPFF – 1x – □□□ / □□□ □ CB 20 20 MB	152 (2x)		008 (2x)		17 x 30 x 7		-	1
45	AZPFF – 1x – □□□ / □□□ □ HO 20 20 MB	152 (2x)		008 (2x)	1	17 x 30 x 7		-	45 x 2.5
45	AZPFF – 1x – □□□ / □□□ □ HO 20 20 KB	152 (2x)		027/008	_	17 x 30 x 7			_
	7 E 11 1 1 E E E 110 20 20 NO			02//000	NBR				
47	AZPFF − 1x − □□□ / □□□ □ RR 20 20 M B	152 (2x)	NBR	008 (2x)	NBR	17 x 30 x 7	145	NBR	45 x 2.5
47	AZPFF − 1x − □□□ / □□□ □ RR 20 20 K B	152 (2x)	NBR	027 (2x)	FKM	17 x 30 x 7	145	NBR	45 x 2.5
48	AZPFF − 1x − □□□ / □□□ □ NM 20 20 M B	152 (2x)	NBR	008	NBR	17 x 30 x 7	145	NBR	45 x 2.5
49	AZPFF − 1x − □□□ / □□□ □ FP 20 20 MB	152	NBR	008 (2x)	NBR	17 x 30 x 7	145	NBR	45 x 2.5
49	AZPFF − 1x − □□□ / □□□ □ FP 20 20 K B	152 (2x)	NBR	027	FKM	17 x 30 x 7	145	NBR	45 x 2.5
50	AZPFF − 1x − □□□ / □□□ □ SA 20 20 MB	152 (2x)	NBR	008/009	NBR	17 x 30 x 7	145	NBR	45 x 2.5
51	AZPFF − 1x − □□□ / □□□ □ SG 20 20 P B	193 (2x)	FKM	015/027	FKM	17 x 30 x 7	1 520 210 101	FKM	45 x 2.5
52	AZPFF − 1x − □□□ / □□□ □ NL 20 20 K B	152 (2x)	NBR	027 (2x)	FKM	17 x 30 x 7	145	NBR	45 x 2.5
53	AZPFFF - 1x - 000 / 000 / 000 0 FB 20 20 20 MB	152 (3x)	NBR	008 (3x)	NBR	17 x 30 x 7	145 (2x)	NBR	45 x 2.5
54	AZPFFF - 1x - \(\sum \) / \(\sum \) / \(\sum \) CB 20 20 20 M B	152 (3x)	NBR	008 (3x)	NBR	17 x 30 x 7	145 (2x)	NBR	45 x 2.5
55	AZPFFF - 1x - \(\sum \) / \(\sum \) / \(\sum \) CB 20 20 20 M B	152 (3x)	NBR	008 (3x)	NBR	17 x 30 x 7	145 (2x)	NBR	45 x 2.5
55	AZPFFF - 1x - 000 / 000 / 000 0 CB 20 20 20 KB	152 (3x)	NBR	027/008 (2x)	FKM/ NBR	17 x 30 x 7	145	NBR	45 x 2.5
56	AZPFFF - 1x - 000 / 000 / 000 0 SG 20 20 20 MB	152 (3x)	NRR	008 (3x)	1	17 x 30 x 7	145 (2x)	NRR	45 x 2.5
57	AZPFFF - 1x - \(\text{\ti}\text{\texitilent{\texitilent{\texi{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\ti}\tint{\text{\text{\text{\text{\text{\text{\texitilent{\text{\ti}\tint{\text{\text{\text{\text{\text{\text{\text{\text{\text{\ti}\tint{\text{\text{\text{\text{\text{\texi}\tint{\text{\text{\ti}}\tint{\text{\text{\tinit}\tint{\text{\text{\texi}\tint{\text{\text{\texi}\tint{\text{\text{\texicl{\texi}\tiint{\texi}\tint{\tinitht{\text{\texi}\tint{\text{\tii}\tint{\tiint{\tii}\tin	152 (3x)		008 (3x)	+	17 x 30 x 7			45 x 2.5
58	AZPFFF - 1x - \(\text{\ti}\text{\texitilent{\texitilent{\texi{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\ti}\tint{\text{\text{\text{\text{\text{\text{\texitilent{\text{\ti}\tint{\text{\text{\text{\text{\text{\text{\text{\text{\text{\ti}\tint{\text{\text{\text{\text{\text{\texi}\tint{\text{\text{\ti}}\tint{\text{\text{\tinit}\tint{\text{\text{\texi}\tint{\text{\text{\texi}\tint{\text{\text{\texi{\texi}\tii}\tint{\tiint{\texi{\text{\texi}\tint{\text{\texi}\tiint{\texi}\tint{\tiin}\t	152 (3x)		008 (3x)	-	17 x 30 x 7			45 x 2.5
	= Perhunan® FKM = Viton®	102 (01)	ווטוי	000 (0x)	ווטוי	11 1 00 1 1	1 70 (24)	ווטוי	1 TO A 2.0

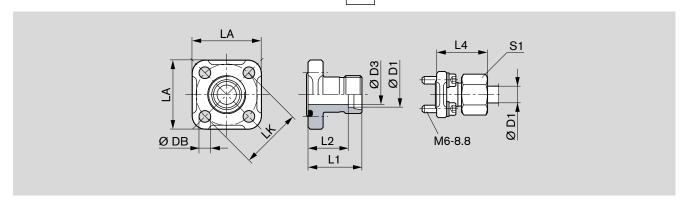
 $\mathsf{NBR} = \mathsf{Perbunan} \circledast \ \mathsf{FKM} = \mathsf{Viton} \circledast$

For further service parts refer to CD-ROM HYparts 1 987 760 010 $\,$



Fittings

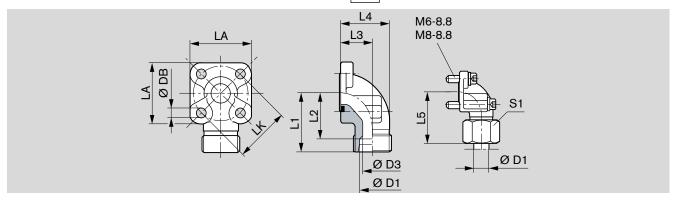
Gear pump flange, straight, for rectangular flange 20 see page 9



LK	D1	D3	L1	L2	L4	LA	S1	DB	Screws 4x	Seal ring NBR *)	Mass [kg]	Part number	p [bar]
35	10L	8	30	23.0	39.0	40	19	6.4	M 6x22	20x2.5	0.09	1 515 702 064	315
35	12L	10	30	23.0	39.0	40	22	6.4	M 6x22	20x2.5	0.10	1 515 702 065	315
35	15L	12	30	23.0	38.0	40	27	6.4	M 6x22	20x2.5	0.10	1 515 702 066	250
40	15L	12	35	28.0	43.0	42	27	6.4	M 6x22	24x2.5	0.12	1 515 702 067	100
40	18L	15	35	27.5	44.0	42	32	6.4	M 6x22	24x2.5	0.13	1 515 702 068	100
40	22L	19	35	27.5	44.5	42	36	6.4	M 6x22	24x2.5	0.12	1 515 702 069	100
40	28L	24	42	27.5	34.5	42	41	6.4	M 6x22	24x2.5	0.15	1 515 702 008	100

Complete fittings with seal ring, metric screw set, nuts and olive. *) NBR = Perbunan®

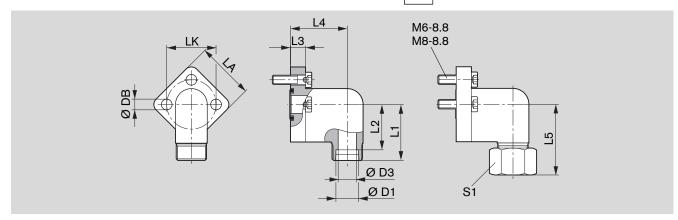
Gear pump flange, 90° angle, for rectangular flange 20 see page 9



LK	D1	D3	L1	L2	L3	L4	L5	LA	S1	DB	Screws		Seal ring	Mass	Part number	p
											2x	2x	NBR *)	[kg]		(bar)
35	10L	8	38	31.0	16.5	26.5	47.0	40	19	6.4	M 6x22	M 6x35	20x2.5	0.16	1 515 702 070	315
35	12L	10	38	31.0	16.5	26.5	47.0	40	22	6.4	M 6x22	M 6x35	20x2.5	0.16	1 515 702 071	315
35	15L	12	38	31.0	16.5	26.5	46.0	40	27	6.4	M 6x22	M 6x35	20x2.5	0.15	1 515 702 072	250
35	16S	12	38	29.5	20.0	31.0	48.0	40	30	6.4	M 6x22	M 6x40	20x2.5	0.18	1 515 702 002	315
35	18L	15	38	29.5	20.0	31.0	47.0	40	32	6.4	M 6x22	M 6x40	20x2.5	0.18	1 545 702 006	250
35	20S	16	45	34.5	25.0	38.0	56.0	40	36	6.4	M 6x22	M 6x45	20x2.5	0.24	1 515 702 017	315
40	15L	12	38	31.0	22.5	36.5	46.0	42	27	6.4	M6x22	M 6x22	24x2.5	0.15	1 515 702 073	100
40	18L	15	38	30.5	22.5	36.5	47.0	42	32	6.4	M6x22	M 6x22	24x2.5	0.17	1 515 702 074	100
40	20S	16	40	29.5	22.5	35.5	50.0	42	36	6.4	M6x22	M 6x45	24x2.5	0.20	1 515 702 011	250
40	22L	19	38	30.5	22.5	36.5	47.5	42	36	6.4	M6x22	M 6x22	24x2.5	0.17	1 515 702 075	100
40	28L	22	40	32.5	28.0	43.0	49.0	42	41	6.4	M6x20	M 6x50	24x2.5	0.24	1 515 702 010	100
40	35L	31	41	30.5	34.0	55.0	52.0	42	50	6.4	M6x22	M6x60	24x2.5	0.33	1 515 702 018	100

Complete fittings with seal ring, metric screw set, nuts and olive. *) $NBR = Perbunan^{®}$

Gear pump flange, 3-hole, 90° angle, for rectangular flange 30 see page 9



LK	D1	D3	L1	L2	L3	L4	L5	LA	S1	DB	Screws	Seal ring	Mass	Part number	p
											3x	NBR *)	[kg]		[bar]
30	12L	10	37	30.0	10	37.5	46	38	22	6.4	M 6x22	16x2.5	0.13	1 515 702 146	250
30	15L	12	37	30.0	10	37.5	47	38	27	6.4	M 6x22	16x2.5	0.14	1 515 702 147	250
30	18L	15	37	30.0	10	37.5	47	38	32	6.4	M 6x22	16x2.5	0.17	1 515 702 148	160
40	22L	19	43	35.5	14	41.0	53	48	36	8.4	M8x30	24x2.5	0.29	1 515 702 149	160
40	28L	24	43	35.5	14	41.0	53	48	41	8.4	M8x30	24x2.5	0.40	1 515 702 150	160

Complete fittings with seal ring, metric screw set, nuts and olive. *) NBR = Perbunan®

Note

You can find the permissible tightening torques in our publication:

"General Operating Instructions for External Gear Units" RE 07 012-B1.

Ordering-No.

Ordering-No.	Page	Ordering-No.	Page	Ordering-No.	Page	Ordering-No.	Page
0 510 215 006	27	0 510 365 305	39	0 510 515 007	26	0 510 555 007	56
0 510 215 007	30	0 510 365 314	48	0 510 515 011	28	0 510 555 300	50
0 510 215 009	26	0 510 415 005	27	0 510 515 015	27	0 510 555 301	50
0 510 215 306	27	0 510 415 006	30	0 510 515 018	26	0 510 555 302	50
0 510 215 307	30	0 510 415 313	27	0 510 515 019	30	0 510 565 012	43
0 510 215 309	26	0 510 415 314	30	0 510 515 309	26	0 510 565 014	39
0 510 225 006	20	0 510 415 316	26	0 510 515 310	27	0 510 565 015	48
0 510 225 007	21	0 510 425 009	20	0 510 515 311	30	0 510 565 016	48
0 510 225 010	33	0 510 425 010	21	0 510 515 316	26	0 510 565 018	41
0 510 225 011	32	0 510 425 015	33	0 510 515 317	26	0 510 565 019	41
0 510 225 012	31	0 510 425 016	32	0 510 515 337	29	0 510 565 022	47
0 510 225 013	34	0 510 425 019	31	0 510 515 340	30	0 510 565 023	47
0 510 225 014	35	0 510 425 020	34	0 510 525 009	20	0 510 565 032	41
0 510 225 022	22	0 510 425 021	23	0 510 525 010	21	0 510 565 033	43
0 510 225 023	25	0 510 425 025	35	0 510 525 014	33	0 510 565 034	41
0 510 225 306	20	0 510 425 027	24	0 510 525 015	32	0 510 565 035	41
0 510 225 307	21	0 510 425 043	22	0 510 525 018	20	0 510 565 037	43
0 510 225 314	34	0 510 425 044	25	0 510 525 019	34	0 510 565 043	52
0 510 225 317	22	0 510 425 307	20	0 510 525 020	34	0 510 565 061	39
0 510 225 318	25	0 510 425 308	21	0 510 525 024	23	0 510 565 065	54
0 510 245 001	36	0 510 425 314	34	0 510 525 025	31	0 510 565 069	41
0 510 245 300	36	0 510 425 315	23	0 510 525 030	21	0 510 565 072	39
0 510 255 300	50	0 510 425 331	31	0 510 525 031	32	0 510 565 078	48
0 510 315 004	27	0 510 425 334	22	0 510 525 033	35	0 510 565 080	54
0 510 315 005	30	0 510 425 335	25	0 510 525 034	23	0 510 565 081	55
0 510 315 006	26	0 510 425 336	21	0 510 525 039	24	0 510 565 095	39
0 510 315 007	28	0 510 445 001	36	0 510 525 040	24	0 510 565 319	39
0 510 315 304	27	0 510 445 300	36	0 510 525 041	33	0 510 565 328	41
0 510 315 305	30	0 510 455 001	50	0 510 525 074	22	0 510 565 329	48
0 510 315 307	26	0 510 455 002	50	0 510 525 075	22	0 510 565 332	41
0 510 325 006	20	0 510 455 004	56	0 510 525 076	25	0 510 565 334	41
0 510 325 007	21	0 510 455 300	50	0 510 525 311	20	0 510 565 335	39
0 510 325 010	33	0 510 455 301	50	0 510 525 312	21	0 510 565 346	47
0 510 325 011	32	0 510 465 008	48	0 510 525 315	33	0 510 565 353	43
0 510 325 012	31	0 510 465 011	39	0 510 525 319	20	0 510 565 356	41
0 510 325 013	34	0 510 465 012	48	0 510 525 323	23	0 510 565 364	43
0 510 325 016	35	0 510 465 019	57	0 510 525 324	34	0 510 565 367	41
0 510 325 018	24	0 510 465 023	39	0 510 525 325	34	0 510 565 371	53
0 510 325 025	22	0 510 465 025	58	0 510 525 328	21	0 510 565 376	39
0 510 325 026	25	0 510 465 027	55	0 510 525 331	23	0 510 565 379	48
0 510 325 306	20	0 510 465 031	54	0 510 525 374	22	0 510 565 385	49
0 510 325 307	21	0 510 465 032	39	0 510 525 375	22	0 510 565 387	39
0 510 325 312	31	0 510 465 320	39	0 510 525 376	25	0 510 565 389	39
0 510 325 313	34	0 510 465 324	39	0 510 545 001	36	0 510 565 393	39
0 510 325 320	22	0 510 465 326	41	0 510 545 002	37	0 510 565 406	39
0 510 325 321	25	0 510 465 344	39	0 510 545 003	37	0 510 565 408	53
0 510 345 001	36	0 510 465 345	41	0 510 545 300	36	0 510 565 417	39
0 510 345 300	36	0 510 465 346	48	0 510 545 302	37	0 510 565 422	53
0 510 355 301	50	0 510 465 355	49	0 510 555 001	50	0 510 565 435	45
0 510 365 009	52	0 510 515 004	27	0 510 555 002	50	0 510 565 436	45
0 510 365 010	48	0 510 515 005	30	0 510 555 003	50	0 510 615 005	26

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0 510 615 006	27	0 510 655 004	50	0 510 665 372	53	0 510 765 320	43
0 510 615 007	30	0 510 655 005	50	0 510 665 375	41	0 510 765 331	41
0 510 615 008	30	0 510 655 007	51	0 510 665 376	49	0 510 765 334	55
0 510 615 009	28	0 510 655 011	51	0 510 665 379	53	0 510 765 338	41
0 510 615 010	26	0 510 655 300	50	0 510 665 380	57	0 510 765 340	43
0 510 615 314	27	0 510 655 301	50	0 510 665 381	39	0 510 765 341	41
0 510 615 315	30	0 510 655 302	50	0 510 665 382	39	0 510 765 343	39
0 510 615 318	26	0 510 655 303	50	0 510 665 400	43	0 510 765 345	39
0 510 615 321	30	0 510 655 304	50	0 510 665 404	49	0 510 900 001	43
0 510 615 341	27	0 510 665 024	43	0 510 665 416	53	0 510 900 002	43
0 510 625 013	20	0 510 665 025	43	0 510 665 418	39	0 510 900 003	43
0 510 625 014	21	0 510 665 029	41	0 510 665 419	55	0 510 900 004	43
0 510 625 015	21	0 510 665 030	48	0 510 665 420	41	0 510 900 005	43
0 510 625 020	33	0 510 665 036	41	0 510 665 435	47	0 510 900 006	43
0 510 625 021	32	0 510 665 042	47	0 510 665 442	39	0 510 900 007	43
0 510 625 022	20	0 510 665 047	47	0 510 665 449	52	0 510 900 008	43
0 510 625 027	31	0 510 665 052	39	0 510 715 004	30	0 510 900 009	43
0 510 625 028	34	0 510 665 053	43	0 510 715 008	29	0 510 900 010	43
0 510 625 029	34	0 510 665 058	41	0 510 715 306	26	0 510 900 011	43
0 510 625 032	31	0 510 665 061	53	0 510 715 307	30	0 510 900 012	43
0 510 625 039	23	0 510 665 062	49	0 510 715 320	29	0 510 900 013	43
0 510 625 041	32	0 510 665 064	41	0 510 725 030	20	0 510 900 014	43
0 510 625 042	35	0 510 665 067	43	0 510 725 044	31	0 510 900 015	43
0 510 625 043	35	0 510 665 068	52	0 510 725 059	32	0 510 900 016	43
0 510 625 047	24	0 510 665 071	49	0 510 725 060	35	0 510 900 017	43
0 510 625 048	33	0 510 665 076	49	0 510 725 062	21	0 510 900 018	43
0 510 625 049	23	0 510 665 092	53	0 510 725 063	33	0 510 900 019	43
0 510 625 052	24	0 510 665 097	41	0 510 725 076	23	0 510 900 020	43
0 510 625 075	22	0 510 665 111	53	0 510 725 077	34	0 510 900 021	43
0 510 625 076	22	0 510 665 112	53	0 510 725 084	24	0 510 900 022	43
0 510 625 077	25	0 510 665 115	41	0 510 725 112	22	0 510 900 023	43
0 510 625 314	20	0 510 665 126	47	0 510 725 113	22	0 510 900 024	43
0 510 625 315	20	0 510 665 132	47	0 510 725 114	22	0 510 900 025	43
0 510 625 316	21	0 510 665 134	55	0 510 725 120	25	0 510 900 026	43
0 510 625 317	21	0 510 665 135	39	0 510 725 330	20	0 510 900 027	43
0 510 625 327	23	0 510 665 144	39	0 510 725 348	23	0 510 900 028	43
0 510 625 329	34	0 510 665 152	39	0 510 725 349	21	0 510 900 029	43
0 510 625 330	34	0 510 665 325	43	0 510 725 361	34	0 510 900 030	43
0 510 625 332	23	0 510 665 326	43	0 510 725 396	35	0 510 900 031	43
0 510 625 346	33	0 510 665 327	43	0 510 725 410	22	0 510 900 032	43
0 510 625 358	31	0 510 665 328	39	0 510 725 411	22	0 510 900 033	43
0 510 625 368	31	0 510 665 330	39	0 510 725 412	22	0 510 900 034	43
0 510 625 381	22	0 510 665 333	41	0 510 725 418	25	0 510 900 035	43
0 510 625 382	25	0 510 665 334	41	0 510 765 012	43	0 510 900 036	43
0 510 625 386	22	0 510 665 336	39	0 510 765 016	47	0 510 900 037	43
0 510 645 002	36	0 510 665 337	39	0 510 765 022	41	0 510 900 038	43
0 510 645 003	37	0 510 665 339	48	0 510 765 023	43	0 510 900 039	43
0 510 645 004	36	0 510 665 347	41	0 510 765 028	39	0 510 900 040	43
0 510 645 005	37	0 510 665 348	39	0 510 765 045	39	0 510 900 041	43
0 510 645 300	36	0 510 665 354	47	0 510 765 049	39	0 510 900 042	43
0 510 655 001	50	0 510 665 368	39	0 510 765 309	39	0 510 900 043	43
0 510 655 002	50	0 510 665 369	39	0 510 765 312	48	0 510 900 044	43
0 510 655 003	50	0 510 665 371	53	0 510 765 317	41	0 510 900 045	43

Ordering-No.	Page	Ordering-No.	Page
Graeimig ree	. ago	G. Gog	. 490
0 510 900 046	43	0 510 901 038	47
0 510 900 047	43	0 510 901 039	47
0 510 900 048	43	0 510 901 040	47
0 510 900 049	43	0 510 901 041	47
0 510 900 050	43	0 510 901 042	47
0 510 900 051	43	0 510 901 043	47
0 510 900 052	43	0 510 901 044	47
0 510 900 053	43	0 510 901 045	47
0 510 900 054	43	0 510 901 500	45
0 510 900 055	43	0 510 901 501	45
0 510 900 056	43	0 510 901 502	45
0 510 900 057	43	0 510 901 503	45
0 510 900 058	43	0 510 901 504	45
0 510 900 059	43	0 510 901 505	45
0 510 900 060	43	0 510 901 506	45
0 510 900 061	43	0 510 901 507	45
0 510 901 000	47	0 510 901 508	45
0 510 901 001	47	0 510 901 509	45
0 510 901 002	47	0 510 901 510	45
0 510 901 003	47	0 510 901 511	45
0 510 901 004	47	0 510 901 512	45
0 510 901 005	47	0 510 901 513	45
0 510 901 006	47	0 510 901 514	45
0 510 901 007	47	0 510 901 515	45
0 510 901 008	47	0 010 001 010	
0 510 901 009	47		
0 510 901 010	47		
0 510 901 010	47		
0 510 901 011	47		
0 510 901 012	47		
0 510 901 013	47		
0 510 901 014	47		
0 510 901 016	47		
0 510 901 016	47		
0 510 901 018 0 510 901 019	47		
0 510 901 019	47		
	47		
0 510 901 021	47		
0 510 901 022	47		
0 510 901 023	47		
0 510 901 024	47		
0 510 901 025	47		
0 510 901 026	47		
0 510 901 027	47		
0 510 901 028	47		
0 510 901 029	47		
0 510 901 030	47		
0 510 901 031	47		
0 510 901 032	47		
0 510 901 033	47		
0 510 901 034	47		
0 510 901 035	47		
0 510 901 036	47		
0 510 901 037	47		

The AZ configurator at www.boschrexroth.com/azconfigurator

The AZ configurator assists you to configure your individual external gear unit easily and user-friendly. You only need to specify your requirements: From the displacement, direction of rotation, drive shaft, connection flange right up to the required rear cover. You immediately receive a project drawing (PDF format) if a configuration already exists. You receive the price of the configured external gear unit upon request.



The AZ configurator assists you to configure your individual external gear unit easily and userfriendly – all data needed for project planning are acquired thru menu guidance.



Selection is made either on an ordering code or your technical requirements. This means that you can search for external gear units that have already been configured, or you specify the configuration variant of the external gear unit based upon the operating parameters you require.



If the external gear unit you selected has been released you will receive the part number, ordering code and a detailed installation drawing. If your special configuration is not available please send your specification to Rexroth. One of our employees will then contact you.

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The data specified above only serve to describe the product. No statements concerning a certain condition or suitability for a certain application can be derived from our information. The information given does not release the user from the obligation of own judgment and verification. It must be remembered that our products are subject to a natural process of wear and aging.



Axial piston variable pump A10VO series 31



- All-purpose medium pressure pump
- ➤ Sizes 18 to 100 Size 140 (see data sheet 92705)
- ► Nominal pressure 280 bar (4100 psi)
- ► Maximum pressure 350 bar (5100 psi)
- ▶ Open circuit

Features

- ► Variable pump with axial piston rotary group in swashplate design for hydrostatic drives in open circuit.
- ▶ Flow is proportional to drive speed and displacement.
- ► The flow can be smoothly changed by adjusting the swashplate.
- ▶ 2 drain ports
- ► Excellent suction characteristics
- ► Low noise level
- ▶ Long service life
- ► Good power to weight ratio
- ► Versatile controller range
- Short control time
- ► The through drive is suitable for adding gear pumps and axial piston pumps up to the same size, i.e., 100% through drive.

Contents 2 Type code Hydraulic fluids 4 6 Working pressure range Technical data, standard unit 8 Technical data, high-speed version 9 DG - Two-point control, direct operated 12 DR - Pressure controller 13 14 DRG - Pressure controller, remotely controlled DFR / DFR1 / DRSC - Pressure flow controller 15 DFLR - Pressure, flow and power controller 17 ED - Electro-hydraulic pressure control 18 ER - Electro-hydraulic pressure control 20 EC4 - Electro-hydraulic control valve (positive control) 22 Dimensions, size 18 to 100 24 Dimensions, through drive 48 Overview of mounting options 51 Combination pumps A10VO + A10VO 52 Connector for solenoids 53 Swivel angle sensor 54 Installation instructions 55 Project planning notes 59 Safety instructions 60

2 **A10VO series 31** | Axial piston variable pump Type code

Type code

01	02	03	04	05		06	07		08	09		10		11	1	2	13
	A10V	0			/	31		_	V								
Versi	on										18	28	45	71	88	100	
01	Standard vers	sion (witho	ut code)								•	•	•	•	•	•	
	High-speed ve	ersion (exte	ernal dim	ensions a	re the sa	ame as th	ie standar	d version))		-	_	•	•	-	•	Н
Axial	piston unit																
02	Swashplate d maximum pre	_		, nominal pressure 280 bar (4100 psi), (5100 psi)							•	•	•	•	•	•	A10V
Opera	ating mode															_	
03	Pump, open o	circuit															0
Size (NG)																
04	Geometric dis	splacement	, see tab	le of valu	es on pa	age 8 and	9				18	28	45	71	88	100]
Contr	ol device																
05	Two-point cor	ntrol, direc	t operate	ed .							•	•	•	•	•	•	DG
	Pressure cont	roller	Hydra	ulic							•	•	•	•	•	•	DR
	With flow o	controller	Hydra	ulic		X-T of	oen				•	•	•	•	•	•	DFR
						X-T pl	lugged, wi	ith flushin	g functior	1	•	•	•	•	•	•	DFR1
						X-T pl	lugged wit	thout flush	ning funct	ion	•	•	•	•	•	•	DRSC
	With press	ure cut-off	Hydra	ulic	Remote controlled						•	•	•	•	•	•	DRG
			Electr	c		Negat	tive contro	ol <u>U</u>	= 12 V		•	•	•	•	•	•	ED71
								U	= 24 V		•	•	•	•	•	•	ED72
			Electr	ic		Positi	ive contro	l <u>U</u>	= 12 V		•	•	•	•	•	•	ER71 ¹⁾
								U	= 24 V		•	•	•	•	•	•	ER72 ¹⁾
	Electro-hydra	ulic contro	l valve			Positi	ive contro	l U	= 12 V to	24 V	-	● ³⁾	•	•	● ⁵⁾	•4)	EC4 ²⁾
	Pressure, flov	v and powe	er contro	ller							-	•	•	•	•	•	DFLR
Serie	s																
06	Series 3, inde	x 1	,														31
Direc	tion of rotatio	n															
07	Viewed on dri	ive shaft						Clock	kwise								R
								Coun	ter-clockv	vise							L
Seali	ng material																
08	FKM (fluoroca	arbon rubb	er)														V
Drive	shaft										18	28	45	71	88	100	
09	Splined shaft		Stand	ard shaft							•	•	•	•	•	•	S
	ISO 3019-1		Simila	Similar to shaft "S" however for higher torque							•	•	•	•	•	-	R
				Reduced diameter; limited suitability for through drive (see table ovalues, page 10)						ble of	•	•	•	•	•	•	U
				Same as "U", higher torque; limited suitability for through drive (s table of values, page 10); for mounting option, see page 51							-	•	•	•	•	•	w

 $_{\mbox{\scriptsize 1)}}$ Observe the project planning notes on page 21.

²⁾ The electro-hydraulic EC4 control valve is always equipped with a swivel angle sensor (see also page 22 and 54).

 $_{3)}$ Only with lateral working ports (order item 12 port plate 12 and 62)

Only available with mounting flange "D" (not available for versions with mounting flange "C")

 $_{5)}$ Further variant with series 32 features on request

01	02	03	04 0	5	06	07		80	09		10		11	1:	2	13
	A10V	0		/	31		_	V								
/loui	nting flange									18	28	45	71	88	100	
10	Based on ISC	3019-1 (SAE)	SAE C; 2	SAE C; 2-hole						•	•	•	● 5)	•	С
				SAE C; 2	SAE C; 2/4-hole					-	-	-	-	-	•	D
Nork	ing port									18	28	45	71	88	100	
11	SAE flange co	onnections	i	Fastenin	g thread		Not fo	r through	drive	-	•	•	-	-	•	11
	according to			metric;	rear					-	-	-	•	•	_	41
	working ports	s metric		Fastenin	•		For th	rough dri	ve	•	•	•	-	-	•	12
				metric;	lateral top	bottom				-	-	-	•	•	_	42
	SAE flange co		·	Fastenin	g thread		Not fo	r through	drive	-	•	•	-	-	•	61
	according to			UNC; rear						-	-	-	•	•	_	91
	working ports	SUNC		Fastenin	Fastening thread		For th	rough dri	ve	•	•	•	-	-	•	62
				UNC; lat	teral top bo	ottom				-	_	_	•	•	_	92
hro	ugh drive (for	mounting	options, see p	age 51)												
12	For flange IS	O 3019-1		Hub for	splined sha	aft ⁶⁾										
	Diameter		Mounting ⁷⁾	Diamete	r					18	28	45	71	88	100	
	Without thro	ugh drive								•	•	•	•	•	•	NOO
	82-2 (A)		800 000	5/8 in	9T 16/32	DP				•	•	•	•	•	•	K01
				3/4 in	11T 16/3	2DP				•	•	•	•	•	•	K52
	101-2 (B)	·	80000	7/8 in	13T 16/3	2DP		·		-	•	•	•	•	•	K68
				1 in	15T 16/3	2DP				-	-	•	•	•	•	K04
	127-2 (C)		& 000	1 1/4 in	14T 12/2	4DP				-	-	-	•	•	•	K07
				1 1/2 in	17T 12/2	4DP				-	-	-	-	-	•	K24
Conn	ector for sole	noids ⁸⁾								18	28	45	71	88	100	
	1															

• = Available • = On request - = Not available

DEUTSCH - molded connector, 2-pin, without suppressor diode

Without connector (without solenoid, only for hydraulic controls, without code)

Notice

- ► Observe the project planning notes on page 59 and the project planning notes regarding each control device.
- ► In addition to the type code, please specify the relevant technical data when placing your order.

⁶⁾ Hub for splined shaft according to ANSI B92.1a (drive shaft allocation according to ISO 3019-1)

⁷⁾ Mounting holes pattern viewed from through drive with control at top.

⁸⁾ Connectors for other electric components can deviate.

Hydraulic fluids

The A10V(S)O variable pump is designed for operation with HLP mineral oil according to DIN 51524.

See the following data sheets for application instructions and requirements for hydraulic fluids before the start of project planning:

- ▶ 90220: Hydraulic fluids based on mineral oils and related hydrocarbons
- ▶ 90221: Environmentally acceptable hydraulic fluids
- ▶ 90222: HFD hydraulic fluids (for permissible technical data, see data sheet 90225)

Selection of hydraulic fluid

Bosch Rexroth evaluates hydraulic fluids on the basis of the Fluid Rating according to the technical data sheet 90235. Hydraulic fluids with positive evaluation in the Fluid Rating are listed in the following data sheet:

▶ 90245: Bosch Rexroth Fluid Rating List for Rexroth hydraulic components (pumps and motors)

The hydraulic fluid should be selected so that the operating viscosity in the operating temperature range is within the optimum range (v_{opt} ; see selection diagram).

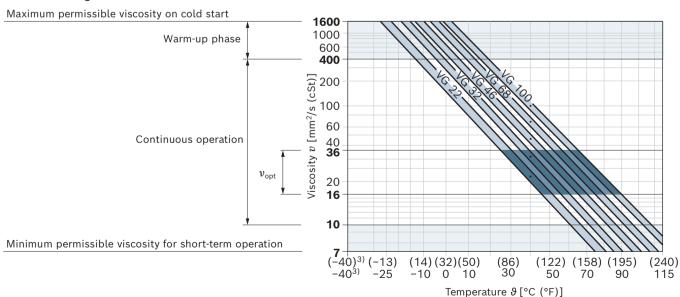
Notice

The axial piston unit is not suitable for operation with water-free HF hydraulic fluids / HF hydraulic fluids containing water / HFx hydraulic fluids.

Viscosity and temperature of hydraulic fluids

	Viscosity	Shaft seal	Temperature ²⁾	Comment
Cold start	$v_{\text{max}} \le 1600 \text{ mm}^2/\text{s (cSt)}$	FKM	$\theta_{St} \ge -25 ^{\circ}\text{C} (-13 ^{\circ}\text{F})$	$t \le 1$ min, without load ($p \le 30$ bar (435 psi), $n \le 1000$ min ⁻¹ (rpm). Permissible temperature difference between axial piston unit and hydraulic fluid in the system maximum 25 K (45 °F)
Warm-up phase	$v = 1600 \dots 400 \text{ mm}^2/\text{s (cSt)}$			$t \le 15 \text{min}, p \le 0.7 \times p_{\text{nom}} \text{ and } n \le 0.5 \times n_{\text{nom}}$
Continuous	$v = 400 \dots 10 \text{ mm}^2/\text{s } (\text{cSt})^{1)}$	FKM	θ ≤ +110 °C (230 °F)	Measured at port L, L ₁
operation	$v_{\rm opt}$ = 36 16 mm ² /s (cSt)			Optimal operating viscosity and efficiency range
Short-term operation	v_{min} = 10 7 mm ² /s (cSt)	FKM	θ ≤ +110 °C (230 °F)	$t \le 1 \text{ min, } p \le 0.3 \times p_{\text{nom}}, \text{ measured at port } \mathbf{L}, \mathbf{L}_1$

▼ Selection diagram



¹⁾ This corresponds, for example on the VG 46, to a temperature range of +4 $^{\circ}$ C to +85 $^{\circ}$ C (+39 $^{\circ}$ F to +185 $^{\circ}$ F) (see selection diagram)

If the temperature at extreme operating parameters cannot be adhered to, please contact us.

³⁾ For applications in the low-temperature range, 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.

A cleanliness level of at least 20/18/15 is to be maintained according to ISO 4406

At a hydraulic fluid viscosity of less than 10 mm²/s (cSt) (e.g., due to high temperatures during short-term operation) at the drain port, a cleanliness level of at least 19/17/14 acc. to ISO 4406 is required.

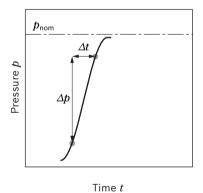
For example, viscosity corresponds to 10 mm²/s at:

- HLP 32 a temperature of 73 °C
- HLP 46 a temperature of 85 °C

Working pressure range

Pressure at working port B		Definition
Nominal pressure $p_{\sf nom}$	280 bar (4100 psi)	The nominal pressure corresponds to the maximum design pressure.
Maximum pressure p_{max}	350 bar (5100 psi)	The maximum pressure corresponds to the maximum working pressure
Single operating period	2 ms	within a single operating period. The sum of single operating periods must
Total operating period	300 h	not exceed the total operating period.
Minimum pressure $p_{B \text{ absolute}}$ (high-pressure side)	10 bar (145 psi) ¹⁾	Minimum pressure on the high-pressure side (B) which is required in order to prevent damage to the axial piston unit.
Rate of pressure change $R_{ m A\ max}$	16000 bar/s (232060 psi/s)	Maximum permissible speed of pressure build-up and reduction during a pressure change across the entire pressure range.
Pressure at suction port S (inlet)		
Minimum Standard pressure $p_{\text{S min}}$	0.8 bar (12 psi) absolute	Minimum pressure at suction port S (inlet) which is required to prevent damage to the axial piston unit. The minimum pressure depends on the rotational speed and displacement of the axial piston unit.
Maximum pressure $p_{\text{S max}}$	10 bar (145 psi) absolute ²⁾	
Case pressure at port L, L ₁		
Maximum pressure $p_{\text{L max}}$	2 bar (30 psi) absolute ²⁾	Maximum 0.5 bar (7.5 psi) higher than inlet pressure at port $\bf S$, but not higher than $p_{\rm L\ max}$. The case pressure must always be higher than the ambient pressure. A drain line to the reservoir is required.
Pilot pressure port X with exte	rnal high pressure	
Maximum pressure p_{max}	350 bar (5100 psi)	When designing all control lines with external high pressure, the values for the rate of pressure change, maximum single operating period and total operating period applicable to port B must not be exceeded.

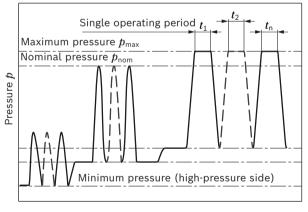
▼ Rate of pressure change $R_{A \text{ max}}$



Notice

- Working pressure range applies when using hydraulic fluids based on mineral oils. Please contact us for values for other hydraulic fluids.
- ► In addition to the hydraulic fluid and the temperature, the service life of the shaft seal is influenced by the rotational speed of the axial piston unit and the case pressure.
- ► The case pressure must be greater than the external pressure (ambient pressure) at the shaft seal.

▼ Pressure definition



Time t

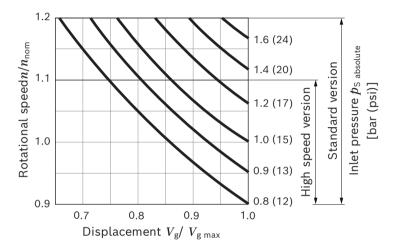
Total operating period = $t_1 + t_2 + ... + t_n$

¹⁾ Lower pressure is time-dependent, please contact us

²⁾ Other values on request

Minimum permissible inlet pressure at suction port S with speed increase

In order to prevent damage to the pump (cavitation), a minimum inlet pressure must be ensured at the suction port **S**. The level of the minimum input pressure depends on the rotational speed and the displacement volume of the variable pump.



During continuous operation in overspeed over n_{nom} , a reduction in operational service life is to be expected due to cavitation erosion.

Technical data, standard unit

Size		NG		18	28	45	71	88	100
Geometric displacement, per revolution		$V_{\sf g\; max}$	cm ³	18	28	45	71	88	100
			inch ³	1.10	1.71	2.75	4.33	5.37	6.10
Maximum	at $V_{g\;max}$	n_{nom}	rpm	3300	3000	2600	2200	2100	2000
$rotational\ speed^{1)}$	at $V_{\rm g}$ < $V_{\rm g max}^{2)}$	$n_{max\;perm}$	rpm	3900	3600	3100	2600	2500	2400
Flow	at n_{nom} and V_{gmax}	$q_{ m v\;max}$	l/min	59	84	117	156	185	200
			gpm	15.6	22	30.9	41.2	8.9	52.8
Power	at n_{nom} , V_{gmax} and	P_{max}	kW	28	39	55	73	86	93
	Δp = 280 bar (4100 psi)		HP	38	52	74	98	115	125
Torque at	Δp = 280 bar (4100 psi)	$M_{\sf max}$	Nm	80	125	200	316	392	445
$V_{g\;max}$ and			lb-ft	59	92	148	233	289	328
	$\Delta p = 100 \text{ bar (1450 psi)}$	M	Nm	30	45	72	113	140	159
			lb-ft	22	33	53	83	103	117
Rotary stiffness S		с	Nm/rad	11087	22317	37500	71884	71884	121142
of drive shaft			lb-ft/rad	8177	16460	27659	53019	53019	89350
	R	С	Nm/rad	14850	26360	41025	76545	76545	_
			lb-ft/rad	10953	19442	30258	56457	56457	-
	U	С	Nm/rad	8090	16695	30077	52779	52779	91093
			lb-ft/rad	5967	12314	22184	38928	38928	67187
	W	С	Nm/rad	_	19898	34463	57460	57460	101847
			lb-ft/rad	-	14676	25419	42380	42380	75118
Moment of inertia	of the rotary group	$J_{\sf TW}$	kgm ²	0.00093	0.0017	0.0033	0.0083	0.0083	0.0167
			lbs-ft²	0.022	0.040	0.078	0.197	0.197	0.396
Maximum angular	acceleration ³⁾	α	rad/s²	6800	5500	4000	2900	2600	2400
Case volume		V	l	0.4	0.7	1.0	1.6	1.6	2.2
			gal	0.106	0.185	0.264	0.420	0.420	0.580
Weight without th	rough drive (approx.)	m	kg	12.9	18	23.5	35.2	35.2	49.5
			lbs	28	40	52	78	78	109
Weight with throu	igh drive (approx.)		kg	14	19.3	25.1	38	38	55.4
			lbs	31	43	55	84	84	122

Notice

- ► Theoretical values, without efficiency and tolerances; values rounded
- ▶ 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. Bosch Rexroth recommends checking the loading by means of test or calculation / simulation and comparison with the permissible values.

For formulas to determine the characteristics, see page 9

¹⁾ The values are applicable:

⁻ at absolute pressure p_{abs} = 1 bar (15 psi) at suction port **S**

[–] for the optimum viscosity range from $v_{\rm opt}$ = 36 to 16 mm²/s (cSt)

⁻ with hydraulic fluid based on mineral oils

 $_{\rm 2)}$ For a speed increase up to $n_{\rm max\;perm},$ please observe the diagram on page 7.

³⁾ The data are valid for values between the minimum required and maximum permissible rotational speed. It applies for external stimuli (e.g. diesel engine 2 to 8 times rotary frequency, cardan shaft twice the rotary frequency). The limit value is only valid for a single pump. The load capacity of the connection parts must be considered.

Technical data, high-speed version

Size		NG		45	71	100
Geometric displacement, per revolution		$V_{\sf g\; max}$	cm ³	45	71	100
			inch ³	2.75	4.33	6.10
Maximum	at $V_{\sf g\;max}$	n_{nom}	rpm	3000	2550	2300
rotational speed ¹⁾	at $V_{\rm g} < V_{\rm g max}^{2)}$	$n_{max\;perm}$	rpm	3300	2800	2500
Flow	at n_{nom} and $V_{g\;max}$	$q_{ m v\; max}$	l/min	135	178	230
			gmp	35.7	47	60.8
Power	at n_{nom} , $V_{g\;max}$ and	P_{max}	kW	63	83	107
	Δp = 280 bar (4100 psi)		HP	84	111	143
Torque	$\Delta p = 280 \text{ bar (4100 psi)}$	$M_{{ m max}}$	Nm	200	316	445
at $V_{ m g\; max}$ and			lb-ft	148	233	328
	Δp = 100 bar (1450 psi)	M	Nm	72	113	159
			lb-ft	53	83	117
Rotary stiffness of S		c	Nm/rad	37500	71884	121142
drive shaft			lb-ft/rad	27659	53019	89350
	R	с	Nm/rad	41025	76545	_
			lb-ft/rad	30258	56457	_
	U	с	Nm/rad	30077	52779	91093
			lb-ft/rad	22184	38928	67187
	W	с	Nm/rad	34463	57460	101847
			lb-ft/rad	25419	42380	75118
Moment of inertia	of the rotary group	J_{TW}	kgm ²	0.0033	0.0083	0.0167
			lb-ft²	0.078	0.107	0.396
Maximum angular a	acceleration ³⁾	α	rad/s²	4000	2900	2400
Case volume		V	l	1.0	1.6	2.2
			gal	0.264	0.420	0.580
Weight without thr	ough drive (approx.)		kg	23.5	35.2	49.5
			lbs	52	78	109
Weight with throug	h drive (approx.)	m	kg	25.1	38	55.4
			lbs	55	84	122

Determination of the characteristics							
Flow	$q_{\scriptscriptstyle ee}$	=	$\frac{V_{\rm g} \times n \times \eta_{\rm v}}{1000 (231)}$			[l/min (gpm)]	
Torque			$V_{g} \times \Delta p$			[Nm	
Torque	М	_	20 (24) $\times \pi \times \eta_{mh}$			(lb-ft)]	
Dawar	. D -		$2 \pi \times M \times n$		$q_{\scriptscriptstyle extsf{V}} imes \Delta p$	[kW	
Power		' =	60000 (33000)	=	600 (1714) × n _t	(HP)]	

Key

- $V_{\rm g}$ Displacement per revolution [cm 3 (inch 3)]
- Δp Differential pressure [bar (psi)]
- n Rotational speed [rpm]
- $\eta_{\scriptscriptstyle extsf{V}}$ Volumetric efficiency
- $\eta_{
 m hm}$ Hydraulic-mechanical efficiency
- $\eta_{\rm t}$ Total efficiency ($\eta_{\rm t}$ = $\eta_{\rm v} \times \eta_{\rm hm}$)

Observe notice on page 8

- 1) The values are applicable:
 - at absolute pressure $p_{\rm abs}$ = 1 bar (15 psi) at suction port **S**
 - for the optimum viscosity range from $v_{\rm opt}$ = 36 to 16 mm²/s (cSt)
 - with hydraulic fluid based on mineral oils
- $_{\rm 2)}$ For a speed increase up to $n_{\rm max\;perm},$ please observe the diagram on page 7.
- 3) The data are valid for values between the minimum required and maximum permissible rotational speed. It applies for external stimuli (e.g. diesel engine 2 to 8 times rotary frequency, cardan shaft twice the rotary frequency). The limit value is only valid for a single pump. The load capacity of the connection parts must be considered.

Permissible radial and axial loading of the drive shaft

Size		NG		18	28	45	71	88	100
Maximum radial force at a/2	Fq	$F_{q\;max}$	N	350	1200	1500	1900	1900	2300
	a/2 a/2		lbf	79	270	337	427	427	517
Maximum axial force	Fax +	$\pm F_{ m ax\ max}$	N	700	1000	1500	2400	2400	4000
	- ax - -		lbf	157	225	337	540	540	899

Notice

- ► The values given are maximum values and do not apply to continuous operation. All loads of the drive shaft reduce the bearing service life!
- ► For drives with radial loading (pinion, V-belt), please contact us

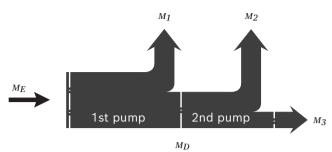
Permissible inlet and through-drive torques

Size	<u>'</u>			18	28	45	71	88	100
Torque at V_{gmax} and	'	M_{max}	Nm	80	125	200	316	392	445
$\Delta p = 280 \text{ bar } (4100 \text{ p})$	osi) ¹⁾		lb-ft	59	92	148	232	289	328
Max. input torque or	drive shaft ²⁾								
	S	$M_{E\;max}$	Nm	124	198	319	626	626	1104
			lb-ft	91	145	235	462	462	814
		Ø	inch	3/4	7/8	1	1 1/4	1 1/4	1 1/2
	R	$M_{E\;max}$	Nm	160	250	400	644	644	_
			lb-ft	118	184	295	475	475	-
		Ø	inch	3/4	7/8	1	1 1/4	1 1/4	-
	U	$M_{E\ max}$	Nm	59	105	188	300	300	595
			lb-ft	43	77	139	221	221	438
		Ø	inch	5/8	3/4	7/8	1	1	1 1/4
	W	$M_{E\ max}$	Nm	_	140	220	394	394	636
			lb-ft	_	103	162	291	291	469
		Ø	inch	_	3/4	7/8	1	1	1 1/4
Maximum through-dr	ive torque								
	S	$M_{D\;max}$	Nm	108	160	319	492	492	778
			lb-ft	80	118	235	363	363	573
	R	$M_{D\;max}$	Nm	120	176	365	548	548	_
			lb-ft	89	130	269	404	404	-
	U	M_{Dmax}	Nm	59	105	188	300	300	595
			lb-ft	43	77	139	221	221	438
	W	M_{Dmax}	Nm	_	140	220	394	394	636
			lb-ft	-	103	162	291	291	469

¹⁾ Efficiency not considered

²⁾ For drive shafts with no radial force

▼ Distribution of torques



Torque at 1st pump	M_1	
Torque at 2nd pump	M_2	
Torque at 3rd pump	M_3	
Input torque	$M_E =$	$M_1 + M_2 + M_3$
	M_E <	M_{Emax}
Through-drive torque	M_D =	$M_2 + M_3$
	M_D <	$M_{D,max}$

DG - Two-point control, direct operated

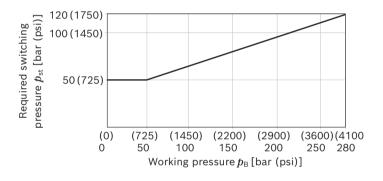
The variable pump can be set to a minimum swivel angle by connecting an external switching pressure to port **X**. This will supply control fluid directly to the stroking piston; a minimum control pressure of $p_{St} \ge 50$ bar (725 psi) is required.

The variable pump can only be switched between $V_{\mathrm{g\ max}}$ or $V_{\mathrm{g\ min}}.$

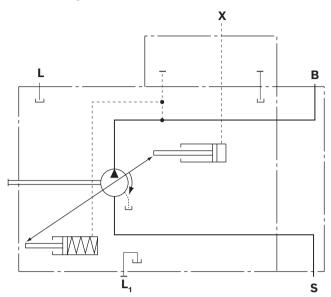
Please note that the required switching pressure at port \mathbf{X} is directly dependent on the actual working pressure $p_{\rm B}$ in port \mathbf{B} . (See switching pressure characteristic curve). The maximum permissible switching pressure is 280 bar (4100 psi).

Switching pressure $p_{\rm St}$ in **X** = 0 bar (0 psi) $\triangle V_{\rm g \ max}$ Switching pressure $p_{\rm St}$ in **X** \ge 50 bar (725 psi) $\triangle V_{\rm g \ min}$

▼ Switching pressure characteristic curve



▼ Circuit diagram DG



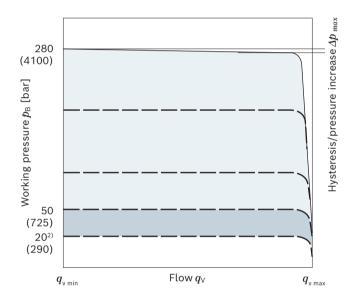
DR - Pressure controller

The pressure controller limits the maximum pressure at the pump outlet within the control range of the variable pump. The variable pump only supplies as much hydraulic fluid as is required by the consumers. If the working pressure exceeds the pressure command value at the pressure valve, the pump will regulate to a smaller displacement to reduce the control differential.

- lacktriangle Basic position in depressurized state: $V_{\rm g\ max}$.
- ► Setting range¹⁾ for infinitely variable 50 to 280 bar pressure control (725 to 4100 psi).

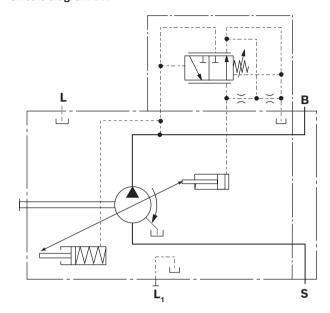
 Standard is 280 bar (4100 psi).

▼ Characteristic curve



Characteristic curve valid at n_1 = 1500 rpm and ϑ_{fluid} = 50 °C (120 °F).

▼ Circuit diagram DR



Controller data DR

NG		18	28	45	71	88	100
Pressure	Δp [bar	4	4	6	8	9	10
increase	(psi)]	(60)	(60)	(87)	(115)	(130)	(145)
Hysteresis and repeatability	<i>∆p</i> [bar (psi)]	- ` '					
Pilot fluid	[l/min		max	imum a	approx.	3 (0.8)	
consumption	(gpm)]						

¹⁾ In order to prevent damage to the pump and the system, the permissible setting range must not be exceeded. The range of possible settings at the valve is higher.

For settings below 50 bar (725 psi), please use the SO275 special pressure controller (setting range: 20 ti 100 bar (510 to 1450 psi)).

14

DRG - Pressure controller, remotely controlled

For the remotely controlled pressure controller, the pressure limitation is performed using a separately arranged pressure relief valve. Therefore, any pressure control value under the pressure set on the pressure controller can be regulated. Pressure controller DR see page 13.

A pressure relief valve is externally piped up to port **X** for remote control. This relief valve is not included in the scope of delivery of the DRG control.

When there is differential pressure of 20 bar (290 psi) Δp (standard setting), the quantity of control fluid at the port is **X** approx. 1.5 l/min (0.4 gpm). If another setting is required (range from 10 to 22 bar (145 to 320psi)) please state in plain text.

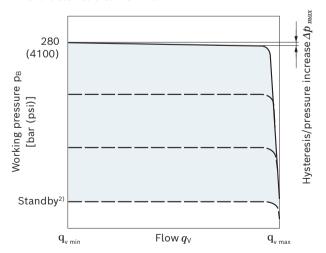
As a separate pressure relief valve (1) we recommend:

- ► A direct operated, hydraulic or electric proportional one, suitable for the quantity of pilot fluid mentioned above.

 The maximum line length should not exceed 2 m (6.6 ft).
- ▶ Basic position in depressurized state: $V_{g \text{ max}}$.
- ► Setting range¹⁾ for pressure control 50 to 280 bar (725 to 4100 psi) (3).
 Standard is 280 bar (4100 psi).
- Setting range for differential pressure 10 to 22 bar (145 to 320 psi) (2)
 Standard is 20 bar (290 psi).

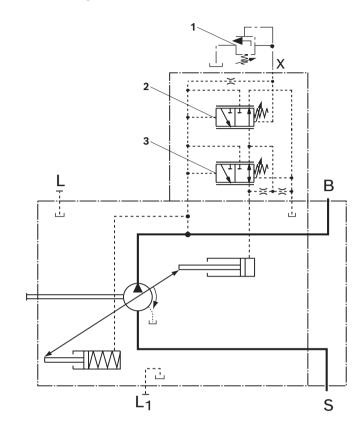
Unloading port **X** to the reservoir results in a zero stroke pressure (standby) which is approx. 1 to 2 bar (15 to 30 psi) higher than the defined differential pressure Δp , however system influences are not taken into account.

▼ Characteristic curve DRG



Characteristic curve valid at n_1 = 1500 rpm and θ_{fluid} = 50 °C (120 °F).

▼ Circuit diagram DRG



- **1** The separate pressure relief valve and the line are not included in the scope of delivery.
- 2 Remotely controlled pressure cut-off (G)
- 3 Pressure controller (DR)

Controller data DRG

NG		18	28	45	71	88	100
Pressure increase	Δ <i>p</i> [bar (psi)]	4 (60)	4 (60)	6 (87)	8 (115)	9 (130)	10 (145)
Hysteresis and repeatability	Δ <i>p</i> [bar (psi)]			maxin	num 4 (6	60)	
Pilot fluid consumption DR and DRG	[l/min (gpm)]		max	imum a	approx. 4	4.5 (1.2)	

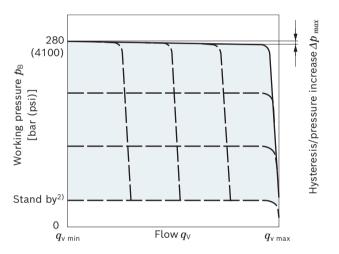
- In order to prevent damage to the pump and the system, the permissible setting range must not be exceeded.
 The range of possible settings at the valve is higher.
- 2) Zero stroke pressure from pressure setting Δp on controller (2)

DFR / DFR1 / DRSC - Pressure flow controller

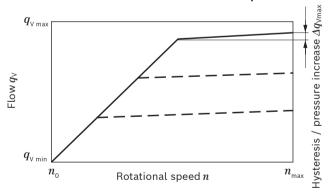
In addition to the pressure controller function (see page 13), an adjustable orifice (e.g. directional valve) is used to adjust the differential pressure upstream and downstream of the orifice. This is used to control the pump flow. The pump flow is equal to the actual hydraulic fluid quantity required by the consumer. With all controller combinations, the $V_{\rm g}$ reduction has priority.

- ▶ Basic position in depressurized state: $V_{\text{g max}}$.
- ► Setting range¹⁾ to 280 bar (4100 psi). Standard is 280 bar (4100 psi).
- ▶ DR pressure controller data see page 13

▼ Characteristic curve



▼ Characteristic curve at variable rotational speed



Characteristic curves valid at n_1 = 1500 rpm and ϑ_{fluid} = 50 °C (120 °F).

▼ Circuit diagram DFR

- **1** The metering orifice (control block) and the line is not included in the scope of delivery.
- 2 Flow controller (FR).
- 3 Pressure controller (DR)

Notice

▶ The DFR1 and DRSC versions have no unloading between **X** and the reservoir. The LS must thus be unloaded in the system. Because of the flushing function of the flow controller in the DFR1 control valve, sufficient unloading of the **X** line must also be provided. If this unloading of the **X** line does not have to be guaranteed, the DRSC control valve must be used.

For further information see page 16

In order to prevent damage to the pump and the system, the permissible setting range must not be exceeded.
 The range of possible settings at the valve is higher.

²⁾ Zero stroke pressure from pressure setting Δp on controller (2)

Differential pressure Δp :

► Standard setting: 14 bar (200 psi)

If another setting is required, please state in the plain text.

▶ Setting range: 14 bar to 22 bar (200 to 320 psi) Unloading port **X** to the reservoir results in a zero stroke pressure (standby) which is approx. 1 to 2 bar (15 to 30 psi) higher than the defined differential pressure Δp , however system influences are not taken into account.

Controller data

DR pressure controller data, see page 13 Maximum flow deviation measured at drive speed n = 1500 rpm.

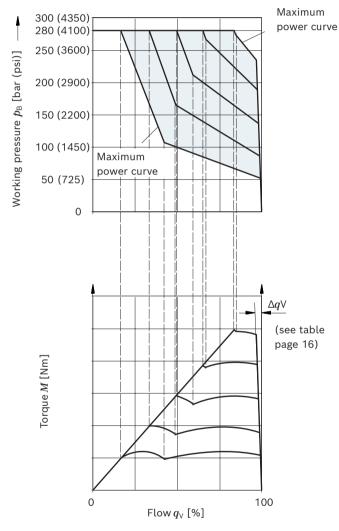
NG		18	28	45	71	88	100
Pressure increase	Δp						
	[bar (psi)]	4	4	6	8	9	10
		(60)	(60)	(87)	(115)	(130)	(145)
Flow deviation	Δq_{Vmax}						
	[l/min	0.9	1.0	1.8	2.8	3.4	4.0
	(gpm)]	(0.20)	(0.30)	(0.50)	(0.70)	(0.90)	(1.10)
Hysteresis and	Δp				maximum		
repeatability	[bar (psi)]				4		
	- 1, 72				(60)		
Pilot fluid	[l/min		r	naximum approx.	3 to 4.5 (0.8 to 1	.2) at DFR	
consumption	(gpm)]			maximum appre	ox. 3 (0.8) at DFR	1/DRSC	

DFLR - Pressure, flow and power controller

Pressure controller equipped as DR(G), see page 13 and 14.

Flow controller equipped like DFR, DFR1, see page 15. In order to achieve a constant drive torque with varying working pressures, the swivel angle and with it the output flow from the axial piston pump is varied so that the product of flow and pressure remains constant. Flow control is possible below the power control curve.

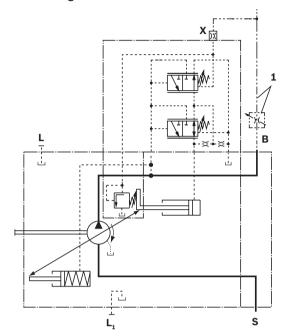
▼ Characteristic curve and torque characteristic



Please contact us regarding beginning of control at < 50 bar (725 psi)

When ordering please state the power characteristics to be set at the factory in plain text, e.g. 20 kW (27 HP) at 1500 rpm.

▼ Circuit diagram DFLR



1 The metering orifice (control block) and the line is not included in the scope of delivery.

Controller data

- ► For technical data of pressure controller DR see page 13.
- ▶ For technical data of flow controller FR see page 16.
- ► Pilot fluid consumption: maximum approx. 5.5 l/min (1.5 gpm)

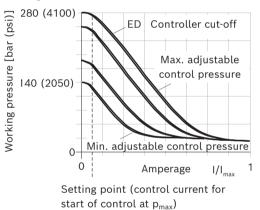
ED - Electro-hydraulic pressure control

The ED valve is set to a certain pressure by a specified variable solenoid current.

When changing the consumer (load pressure), this causes an increase or decrease in the pump swivel angle (flow) in order to maintain the electrically set pressure level. The pump thus only delivers as much hydraulic fluid as the consumers can take. The desired pressure level can be set steplessly by varying the solenoid current.

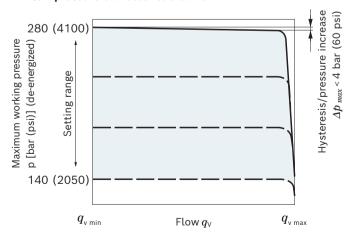
As the solenoid current signal drops towards zero, the pressure will be limited to $p_{\rm max}$ by an adjustable hydraulic pressure cut-off (secure fail safe function in case of power failure, e.g. for fan speed control). The swivel time characteristic of the ED control was optimized for the use as a fan drive system. When ordering, specify the type of application in plain text.

▼ Current/pressure characteristic curve ED (negative characteristic curve)



Hysteresis static < 3 bar (45 psi).

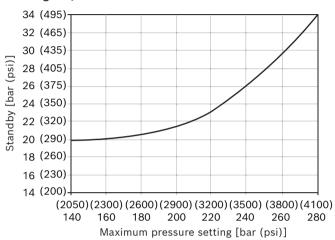
▼ Flow-pressure characteristic curve



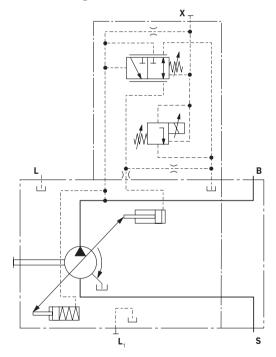
Characteristic curves valid at n_1 = 1500 rpm and ϑ_{fluid} = 50 °C (120 °F).

- ▶ Pilot fluid consumption: 3 to 4.5 l/min (0.8 to 1.2 gpm).
- ► For standby standard setting, see the following diagram; other values on request.

Influence of the pressure setting on standby (maximally energized)



▼ Circuit diagram ED71/ED72



Technical data, solenoids	ED71	ED72
Voltage	12 V (±20%)	24 V (±20%)
Control current		
Start of control at p_{max}	100 mA	50 mA
Start of control at p_{min}	1200 mA	600 mA
Current limit	1.54 A	0.77 A
Nominal resistance (at 20 °C (68 °F))	5.5 Ω	22.7 Ω
Dither frequency	100 Hz	100 Hz
Recommended amplitude	120 mA	60 mA
Duty cycle	100%	100%
Type of protection: see connec	tor version page	53
Operating temperature rar	nge at valve -20	°C to +115 °C

The following electronic control units are available for controlling the electro-hydraulic pressure control:

BODAS Controllers	Data sheet
RC5-6, series 40	95207
RC18-12, series 40	95208
RC27-18, series 40	95208

Notice

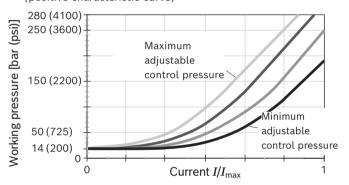
With **ED71**, de-energized operating condition (jump from 100 to 0 mA) results in a pressure increase of the maximum pressure of 4 to 5 bar (60 to 75 psi). With **ED72**, de-energized operating condition (jump from 50 to 0 mA) results in a pressure increase of the maximum pressure of 4 to 5 bar (60 to 75 psi).

ER - Electro-hydraulic pressure control

The ER valve is set to a certain pressure by a specified variable solenoid current.

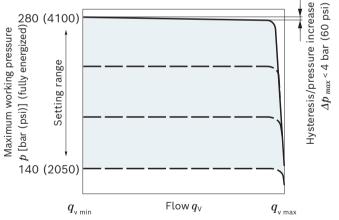
When changing the consumer (load pressure), this causes an increase or decrease in the pump swivel angle (flow) in order to maintain the electrically set pressure level. The pump thus only delivers as much hydraulic fluid as the consumers can take. The desired pressure level can be set steplessly by varying the solenoid current. If the solenoid current drops towards zero, the pressure will be limited to p_{\min} (standby) by an adjustable hydraulic pressure cut-off. Observe project planning note.

▼ Current-pressure characteristic curve (positive characteristic curve)



Hysteresis static < 3 bar (45 psi).

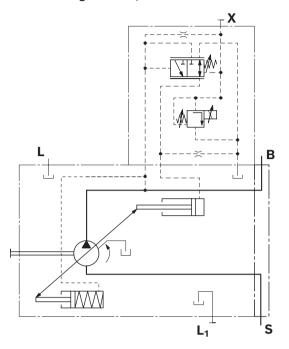
▼ Flow-pressure characteristic curve



Characteristic curves valid at n_1 = 1500 rpm and ϑ_{fluid} = 50 °C (120 °F).

- ▶ Pilot fluid consumption: 3 to 4.5 l/min (0.8 to 1.2 gpm).
- ► Standby standard setting 14 bar (200 psi). Other values on request.
- ► Influence of pressure setting on standby ± 2 bar (±30 psi).

▼ Circuit diagram ER71/ER72



Technical data, solenoids	ER71	ER72
Voltage	12 V (±20%)	24 V (±20%)
Control current		
Start of control at p_{min}	100 mA	50 mA
End of control at $p_{\sf max}$	1200 mA	600 mA
Current limit	1.54 A	0.77 A
Nominal resistance (at 20 °C (68 °F))	5.5 Ω	22.7 Ω
Dither frequency	100 Hz	100 Hz
Recommended amplitude	120 mA	60 mA
Duty cycle	100%	100%

Type of protection, see connector version page 53 Control electronics, see page 21

Operating temperature range at valve -20 °C to +115 °C (-4 °F to +239 °F)

The following electronic control units are available for controlling the electro-hydraulic pressure control:

BODAS Controllers	Data sheet	
RC5-6, series 40	95207	
RC18-12, series 40	95208	
RC27-18, series 40	95208	

Project planning note

Excessive current levels (I > 1200 mA at 12 V or I > 600 mA at 24 V) to the ER solenoid can result in undesired pressure increases which can lead to pump or system damage. Therefore:

- ▶ Use I_{max} current limiter solenoids.
- ► An intermediate plate pressure controller can be used to protect the pump in the event of overflow.

An accessory kit with intermediate plate pressure controller can be ordered from Bosch Rexroth under part number R902490825.

EC4 - Electro-hydraulic control valve (positive control)

The proportional directional valve EC4 serves to control an axial piston variable pump with eOC control functions in an electronically closed control circuit.

The valve spool is clamped between a proportional solenoid and a spring and releases a opening cross-section depending on the stroke.

This results in a proportionality of the solenoid current with respect to the opening cross-section and thus the swiveling speed of the pump.

The neutral position, which does not lead to a swivel motion, is assigned to a respective neutral current. If the neutral current is above the neutral position (I_neutral), the pump swivels in the direction of $V_{\rm g\ max}/100\%$; if it is below, the pump swivels in the direction of $V_{\rm g\ min}/0\%$. With eOC closed loop control, the pump can also be operated in the swiveling range $V_{\rm g\ min}/0\%$ - please contact us if required.

For control of the pump with BODAS eOC, a swivel angle sensor is required.

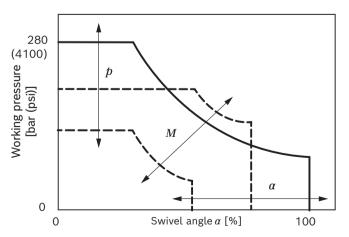
Further information about the swivel angle sensor can be found on page 54 and in data sheet 95153.

Further information on project planning of the BODAS eOC control system including other required system components can be found in data sheet 95345.

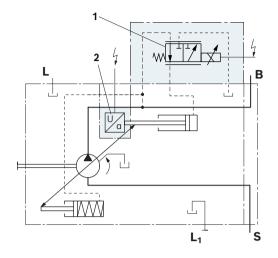
The BODAS eOC control software supports all four basic control types of axial piston variable pumps in electrically closed control circuits:

- ► Pressure and differential pressure regulation (p)
- \blacktriangleright Swivel angle and flow control (α)
- ► Torque control (*M*)
- Power control

▼ Control variants with EC4¹⁾



▼ Circuit diagram EC4



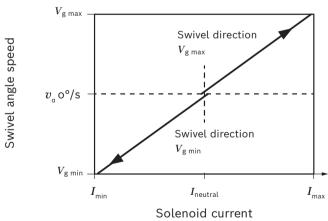
- 1 Proportional directional valve EC4
- 2 Swivel angle sensor (see data sheet 95153)

The following electronic control units are available for controlling the proportional solenoids:

BODAS Controllers	Data sheet	
RC5-6, series 40	95207	
RC18-12, series 40	95208	
RC27-18, series 40	95208	

For further technical data on the solenoid with respective information, see pages 23 and 53

▼ Operating principle EC4



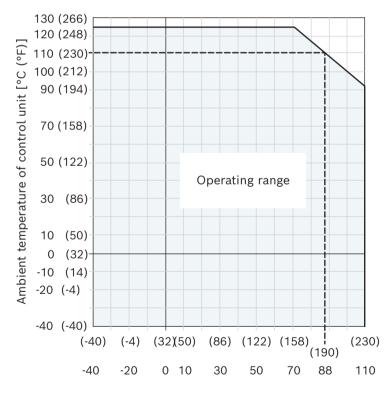
¹⁾ Display for positive quadrants 0% to +100%

Solenoid technical data

	EC4
Maximum solenoid current	1900 mA
Nominal resistance at 20 °C (68 °F) winding temperature	4.26 ±0.26 Ω
Hot resistance 180 °C (356 °F) winding temperature	6.92 ±0.42 Ω
Limit temperature for winding	Insulating material class H (180 °C (356 °F))
Hydraulic fluid or operating temperature	from -40 °C to 110 °C (-40 °F to 230 °F)
Type of protection and con	trol electronics, see page 53

Notice

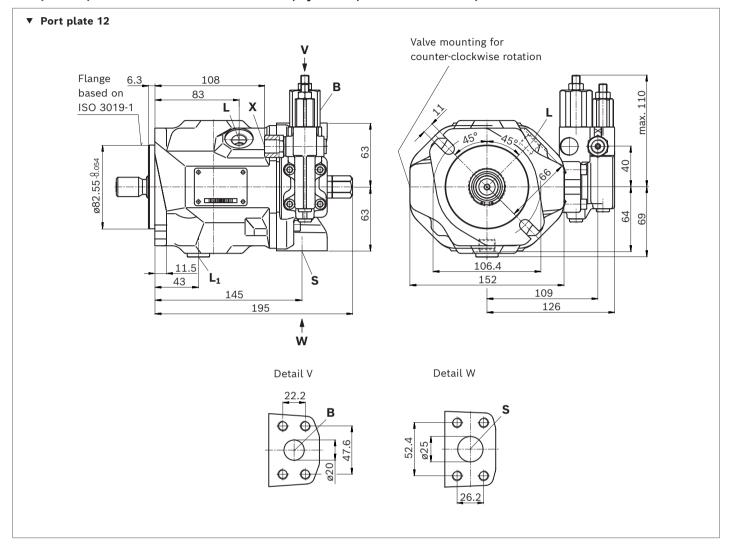
- ► The coil has a limit voltage of 100 V. In general, the maximum current must not be exceeded by the actual current.
- ► For calculation of the hot resistance, a temperature coefficient of 0.0039k⁻¹ is to be applied.
- ▼ Characteristic curve of permitted operating range Example: At a hydraulic fluid temperature of 88 °C (190 °F), an ambient temperature of 110 °C (230 °F) is permitted.



Hydraulic fluid temperature [°C (°F)]

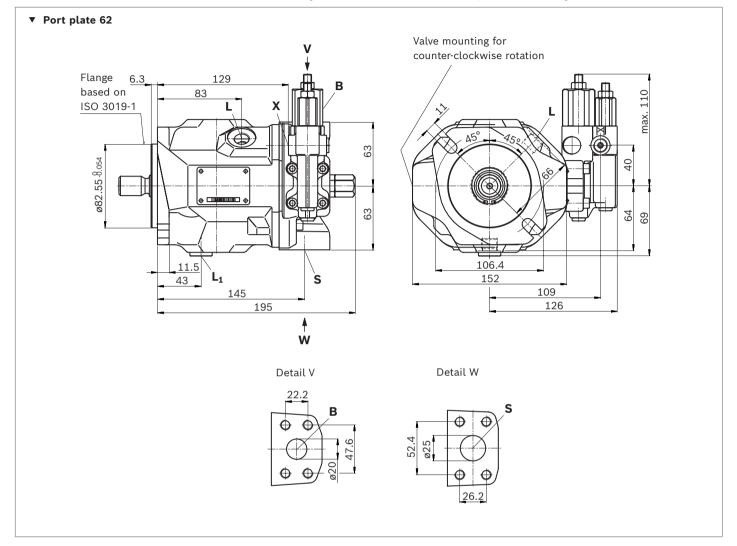
24

DFR / DFR1 / DRSC - Pressure flow controller, hydraulic; clockwise rotation, version: Ports metric

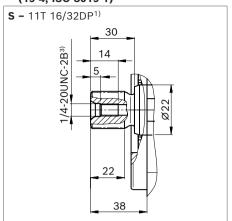


Dimensions, size 18

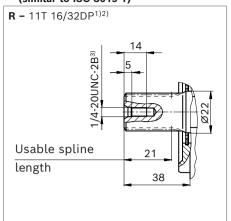
DFR / DFR1 / DRSC - Pressure flow controller, hydraulic; clockwise rotation, version: SAE ports



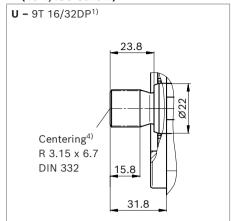
▼ Splined shaft 3/4 in (19-4, ISO 3019-1)



▼ Splined shaft 3/4 in (similar to ISO 3019-1)



▼ Splined shaft 5/8 in (16-4, ISO 3019-1)



Ports -	version metric port plate 12	Standard	Size	$p_{\sf max}$ [bar (psi)] $^{5)}$	State ⁸⁾
В	Working port (standard pressure series) Fastening thread	ISO 6162-1 DIN 13	3/4 in M10 × 1.5; 17 (0.67) deep	350 (5100)	0
S	Suction port (standard pressure series) Fastening thread	ISO 6162-1 DIN 13	1 in M10 × 1.5; 17 (0.67) deep	10 (145)	0
L	Drain port	DIN 3852 ⁶⁾	M16 × 1.5; 12 (0.47) deep	2 (30)	O ⁷⁾
L ₁	Drain port	DIN 3852 ⁶⁾	M16 × 1.5; 12 (0.47) deep	2 (30)	X ⁷⁾
Х	Pilot pressure	DIN 3852	M14 × 1.5; 12 (0.47) deep	350 (5100)	0
Х	Pilot pressure with DG-control	DIN 3852-2	G1/4 in; 12 (0.47) deep	350 (5100)	0

Ports - v	version SAE port plate 62	Standard	Size	$p_{\sf max}$ [bar (psi)] $^{5)}$	State ⁸⁾
В	Working port (standard pressure series) Fastening thread	ISO 6162-1 ASME B1.1	3/4 in 3/8-16 UNC-2B; 20 (0.79) deep	350 (5100)	0
S	Suction port (standard pressure series) Fastening thread	ISO 6162-1 ASME B1.1	1 in 3/8-16 UNC-2B; 20 (0.79) deep	10 (145)	0
L	Drain port	ISO 11926 ⁶⁾	9/16-18 UNF-2B; 13 (0.51) deep	2 (30)	O ⁷⁾
L ₁	Drain port	ISO 11926 ⁶⁾	9/16-18 UNF-2B; 13 (0.51) deep	2 (30)	X ⁷⁾
X	Pilot pressure	ISO 11926	7/16-20 UNF-2B; 11.5 (0.45) deep	350 (5100)	0
X	Pilot pressure with DG-control	DIN 3852-2	G1/4 in; 12 (0.47) deep	350 (5100)	0

¹⁾ Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5

²⁾ Splines according to ANSI B92.1a, spline runout is a deviation from standard ISO 3019-1.

³⁾ Thread according to ASME B1.1

⁴⁾ Coupling axially secured, e.g. with a clamp coupling or radially mounted clamping screw

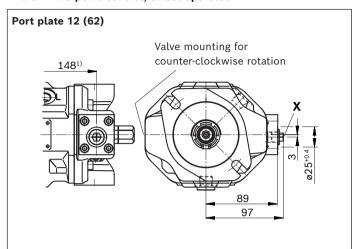
⁵⁾ Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.

⁶⁾ The countersink may be deeper than specified in the standard.

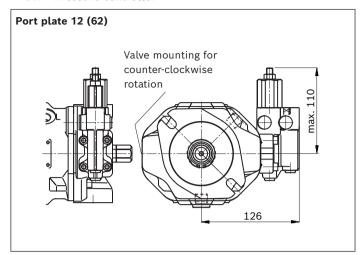
 $^{^{7)}\,}$ Depending on the installation position, L or L_1 must be connected (also see installation instructions on page 55).

⁸⁾ O = Must be connected (plugged on delivery) X = Plugged (in normal operation)

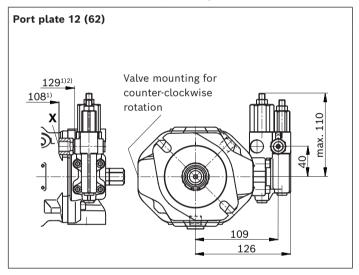
▼ DG - Two-point control, direct operated



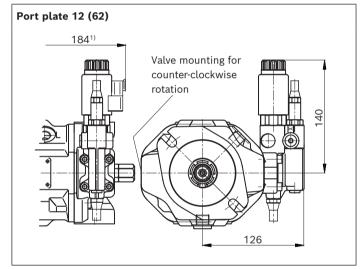
▼ DR - Pressure controller



▼ DRG - Pressure controller, remotely controlled



▼ ED7.,ER7. - Electro-hydraulic pressure control

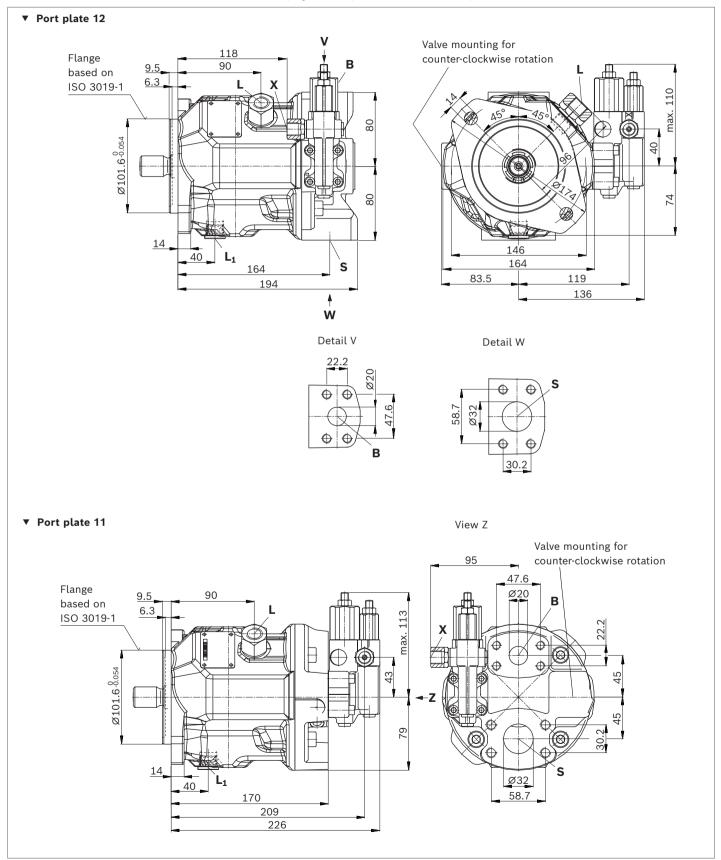


¹⁾ To flange surface

²⁾ For version with port plates 62

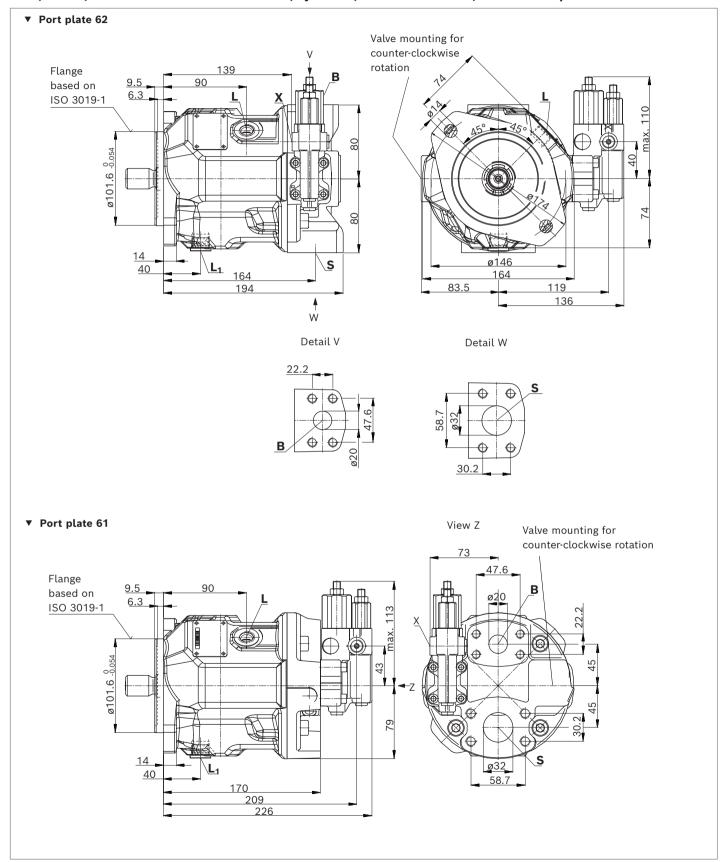
Dimensions, size 28

DFR / DFR1 / DRSC - Pressure flow controller, hydraulic; clockwise rotation, version: Ports metric

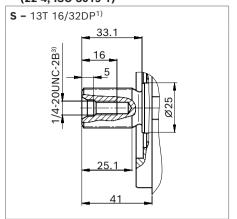


Dimensions, size 28

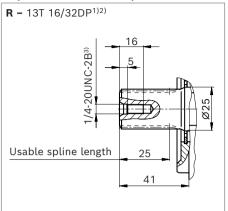
DFR / DFR1 / DRSC - Pressure flow controller, hydraulic; clockwise rotation, version: SAE ports



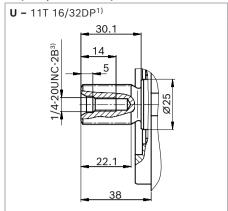
▼ Splined shaft 7/8 in (22-4, ISO 3019-1)



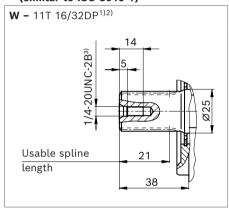
▼ Splined shaft 7/8 in (similar to ISO 3019-1)



▼ Splined shaft 3/4 in (19-4, ISO 3019-1)



▼ Splined shaft 3/4 in (similar to ISO 3019-1)

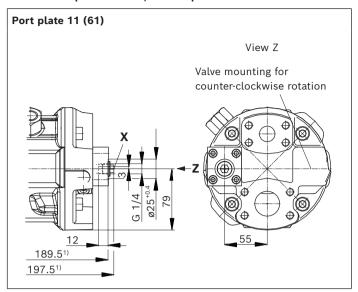


Ports -	Ports - version metric port plate 11/12		Size	p_{max} [bar (psi)] ⁴⁾	State ⁷⁾
В	Working port (standard pressure series)	ISO 6162-1	3/4 in	350 (5100)	0
	Fastening thread	DIN 13	M10 × 1.5; 17 (0.67) deep		
S	Suction port (standard pressure series)	ISO 6162-1	1 1/4 in	10 (145)	0
	Fastening thread	DIN 13	M10 × 1.5; 17 (0.67) deep		
L	Drain port	DIN 3852 ⁵⁾	M18 × 1.5; 12 (0.47) deep	2 (30)	O ⁶⁾
L ₁	Drain port	ISO 11926 ⁵⁾	3/4-16 UNF-2B; 15 (0.59) deep	2 (30)	X ⁶⁾
Х	Pilot pressure	DIN 3852	M14 × 1.5; 12 (0.47) deep	350 (5100)	0
Х	Pilot pressure with DG-control	DIN 3852-2	G1/4 in; 12 (0.47) deep	350 (5100)	0

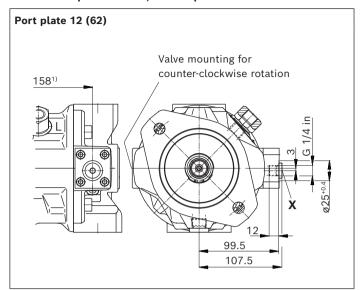
Ports - version SAE port plate 61/62		Standard	Size	$p_{\sf max}$ [bar (psi)] $^{4)}$	State ⁷⁾
В	Working port (standard pressure series)	ISO 6162-1	3/4 in	350 (5100)	0
	Fastening thread	ASME B1.1	3/8-16 UNC-2B; 20 (0.79) deep		
S	Suction port (standard pressure series)	ISO 6162-1	1 1/4 in	10 (145)	0
	Fastening thread	ASME B1.1	7/16-14 UNC-2B; 24 (0.94) deep		
L	Drain port	ISO 11926 ⁵⁾	3/4-16 UNF-2B; 15 (0.59) deep	2 (30)	O ⁶⁾
L ₁	Drain port	ISO 11926 ⁵⁾	3/4-16 UNF-2B; 15 (0.59) deep	2 (30)	X ⁶⁾
Х	Pilot pressure	ISO 11926	7/16-20 UNF-2B; 11.5 (0.45) deep	350 (5100)	0
Х	Pilot pressure with DG-control	DIN 3852-2	G1/4 in; 12 (0.47) deep	350 (5100)	0

- Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
- 2) Splines according to ANSI B92.1a, spline runout is a deviation from standard ISO 3019-1.
- 3) Thread according to ASME B1.1
- 4) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
- 5) The countersink may be deeper than specified in the standard.
- 6) Depending on the installation position, L or L_1 must be connected (also see installation instructions on page 55).
- 7) O = Must be connected (plugged on delivery)X = Plugged (in normal operation)

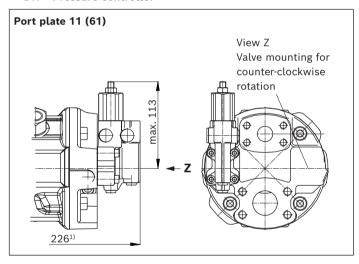
▼ DG - Two-point control, direct operated



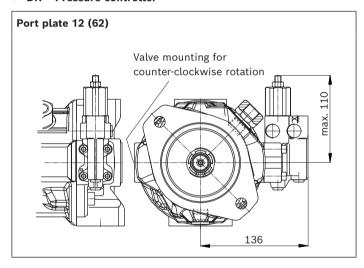
▼ DG - Two-point control, direct operated



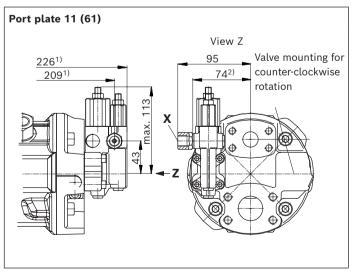
▼ DR - Pressure controller



▼ DR - Pressure controller

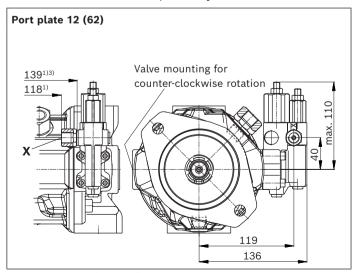


▼ DRG - Pressure controller, remotely controlled



- 1) To flange surface
- 2) For version with port plate 61

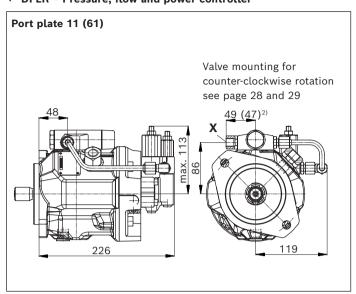
▼ DRG - Pressure controller, remotely controlled



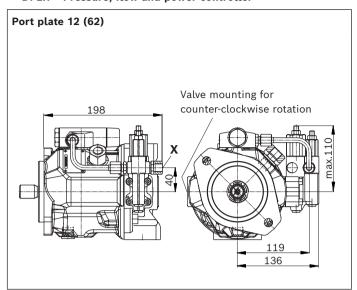
3) For version with port plate 62

▼ DFLR - Pressure, flow and power controller

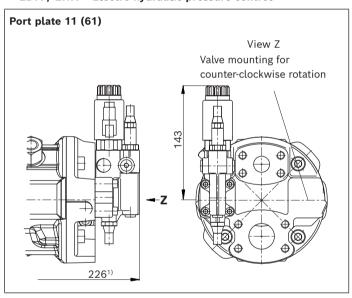
32



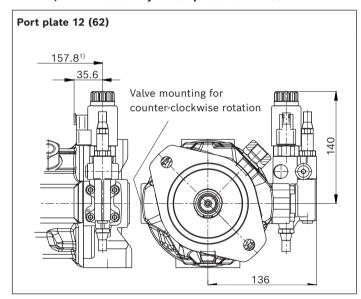
▼ DFLR - Pressure, flow and power controller



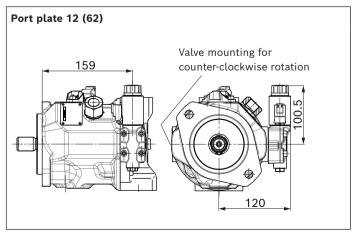
▼ ED7. / ER7. - Electro-hydraulic pressure control



▼ ED7. / ER7. - Electro-hydraulic pressure control



▼ EC4 - Electro-hydraulic control valve

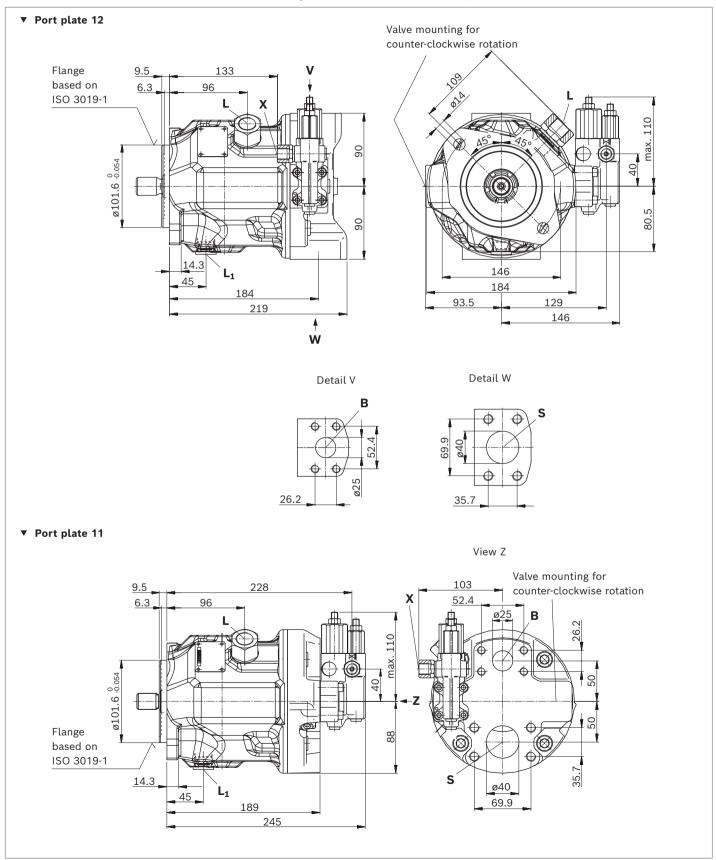


¹⁾ To flange surface

²⁾ For version with port plate 61

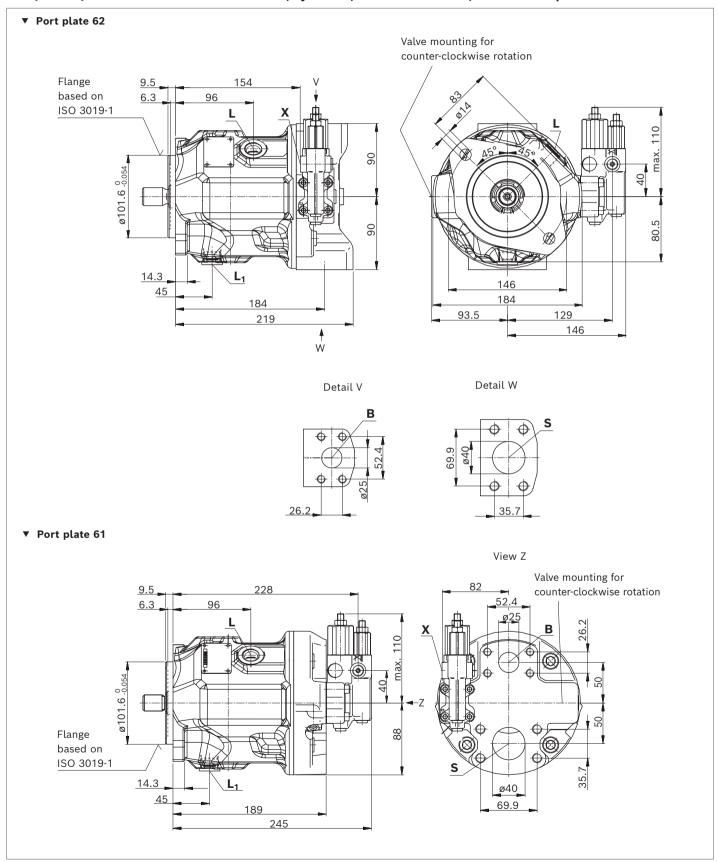
Dimensions, size 45

DFR / DFR1 / DRSC - Pressure flow controller, hydraulic; clockwise rotation, version: Ports metric



Dimensions, size 45

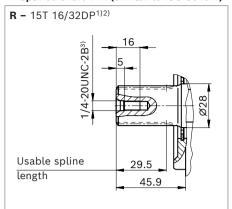
DFR / DFR1 / DRSC - Pressure flow controller, hydraulic; clockwise rotation, version: SAE ports



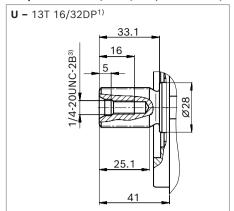
▼ Splined shaft 1 in (25-4, ISO 3019-1)

S - 15T 16/32DP¹⁾ 38 16 5 30 45.9

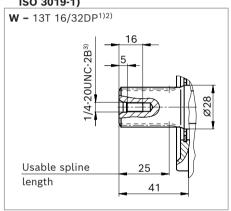
▼ Splined shaft 1 in (similar to ISO 3019-1)



▼ Splined shaft 7/8 in (22-4, ISO 3019-1)



▼ Splined shaft 7/8 in (similar to ISO 3019-1)

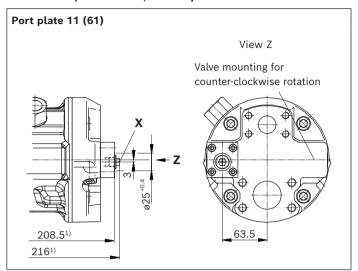


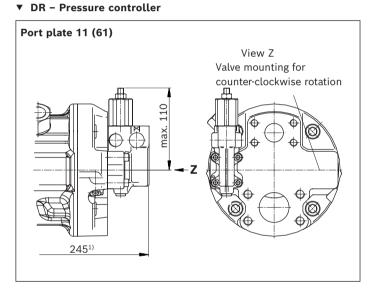
Ports -	Ports - version metric port plate 11/12		Size	p_{max} [bar (psi)] $^{4)}$	State ⁷⁾
В	Working port (standard pressure series)	ISO 6162-1	1 in	350 (5100)	0
	Fastening thread	DIN 13	M10 × 1.5; 17 (0.67) deep		
S	Suction port (standard pressure series)	ISO 6162-1	1 1/2 in	10 (145)	0
	Fastening thread	DIN 13	M12 × 1.75; 20 (0.79) deep		
L	Drain port	DIN 3852 ⁵⁾	M22 × 1.5; 14 (0.55) deep	2 (30)	O ₆)
L ₁	Drain port	ISO 11926 ⁵⁾	7/8-14 UNF-2B; 17 (0.67) deep	2 (30)	X ⁶⁾
Х	Pilot pressure	DIN 3852	M14 × 1.5; 12 (0.47) deep	350 (5100)	0
Х	Pilot pressure with DG-control	DIN 3852-2	G1/4 in; 12 (0.47) deep	350 (5100)	0

Ports - version SAE port plate 61/62		plate 61/62 Standard Size		$p_{\sf max}$ [bar (psi)] $^{4)}$	State ⁷⁾
В	Working port (standard pressure series)	ISO 6162-1	1 in	350 (5100)	0
	Fastening thread	ASME B1.1	3/8-16 UNC-2B; 17 (0.67) deep		
S	Suction port (standard pressure series)	ISO 6162-1	1 1/2 in	10 (145)	0
	Fastening thread	ASME B1.1	1/2-13 UNC-2B; 20 (0.79) deep		
L	Drain port	ISO 11926 ⁵⁾	7/8-14 UNF-2B; 17 (0.67) deep	2 (30)	O ⁶⁾
L ₁	Drain port	ISO 11926 ⁵⁾	7/8-14 UNF-2B; 17 (0.67) deep	2 (30)	X ⁶⁾
Х	Pilot pressure	ISO 11926	7/16-20 UNF-2B; 11.5 (0.45) deep	350 (5100)	0
Х	Pilot pressure with DG-control	DIN 3852-2	G1/4 in; 12 (0.47) deep	350 (5100)	0

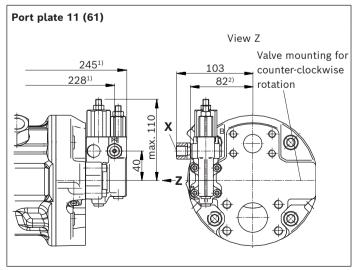
- $_{\rm 1)}$ Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
- 2) Splines according to ANSI B92.1a, spline runout is a deviation from standard ISO 3019-1.
- 3) Thread according to ASME B1.1
- 4) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
- 5) The countersink may be deeper than specified in the standard.
- 6) Depending on the installation position, L or L_1 must be connected (also see installation instructions on page 55).
- 7) O = Must be connected (plugged on delivery)X = Plugged (in normal operation)

▼ DG - Two-point control, direct operated



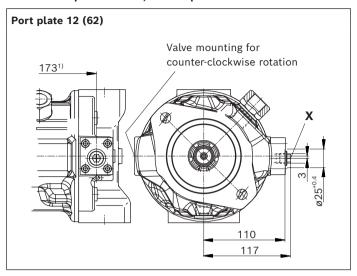


▼ DRG - Pressure controller, remotely controlled

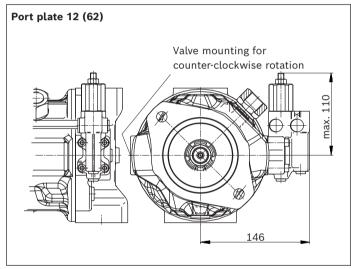


- 1) To flange surface
- 2) For version with port plate 61

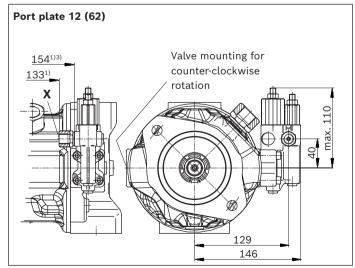
▼ DG - Two-point control, direct operated



▼ DR - Pressure controller

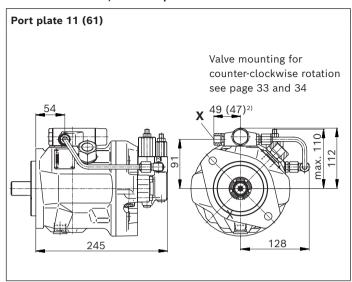


▼ DRG - Pressure controller, remotely controlled

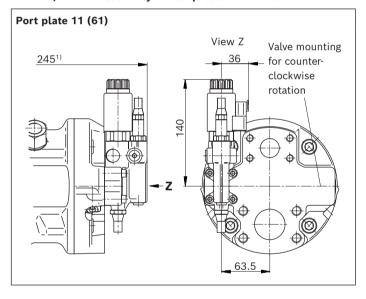


3) For version with port plate 62

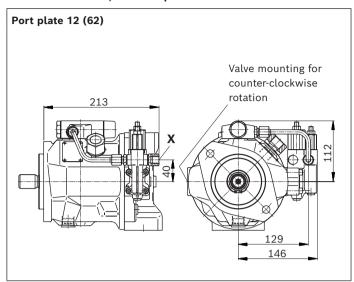
▼ DFLR - Pressure, flow and power controller



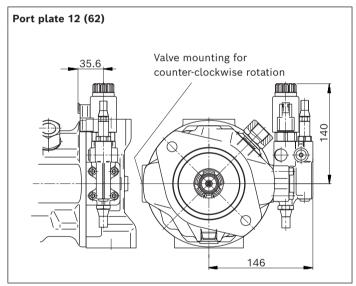
▼ ED7. / ER7. - Electro-hydraulic pressure control



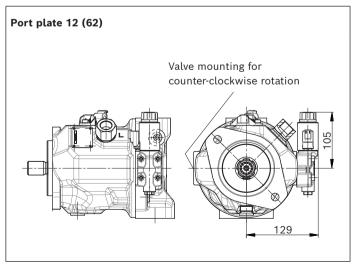
▼ DFLR - Pressure, flow and power controller



▼ ED7. / ER7. - Electro-hydraulic pressure control



▼ EC4 - Electro-hydraulic control valve

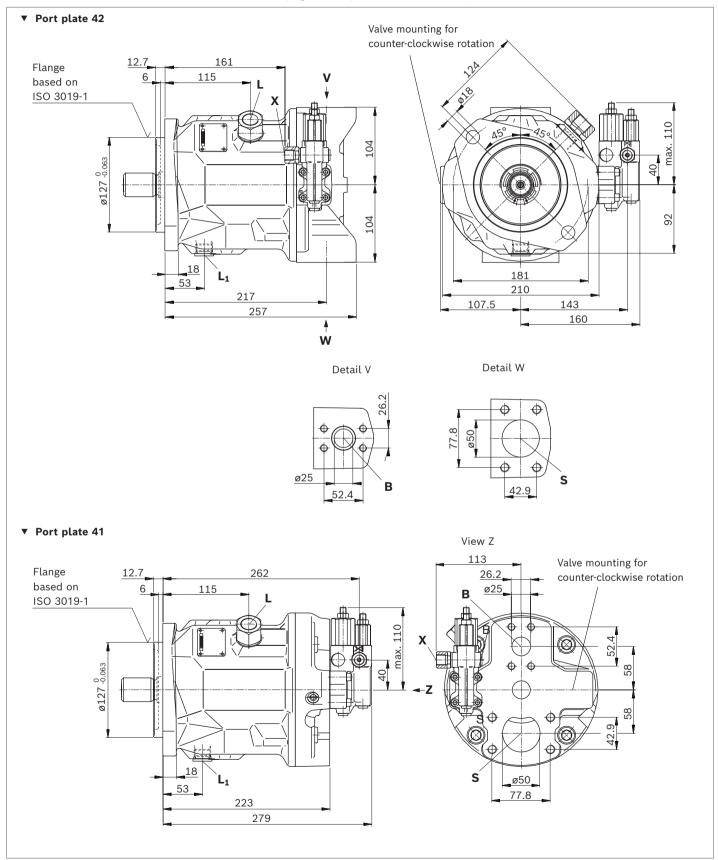


¹⁾ To flange surface

²⁾ For version with port plate 61

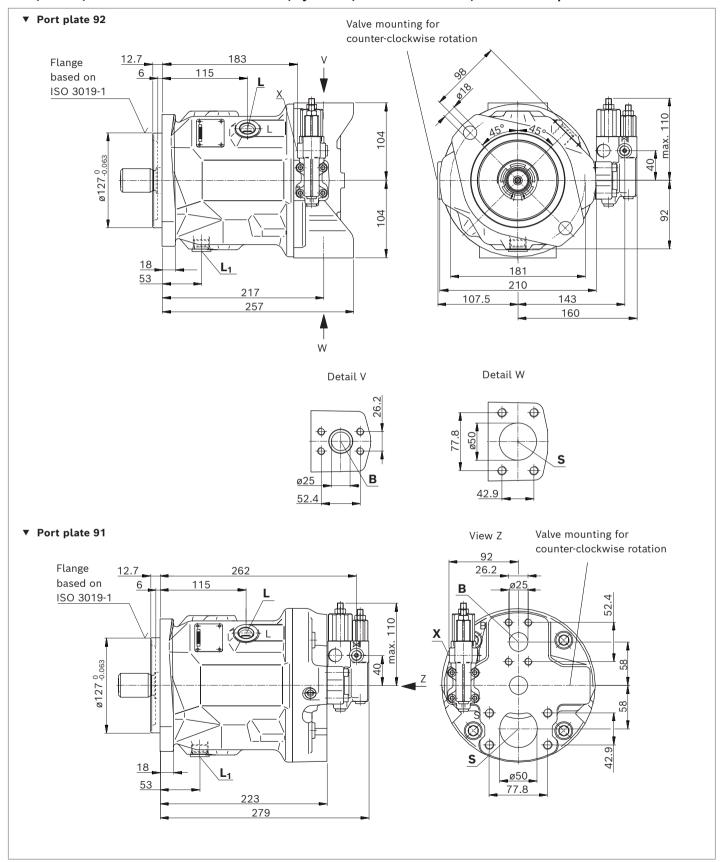
Dimensions, sizes 71 and 88

DFR / DFR1 / DRSC - Pressure flow controller, hydraulic; clockwise rotation, version: Ports metric



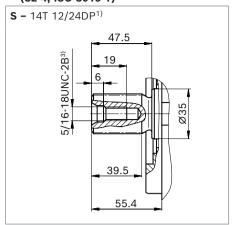
Dimensions, sizes 71 and 88

DFR / DFR1 / DRSC - Pressure flow controller, hydraulic; clockwise rotation, version: SAE ports

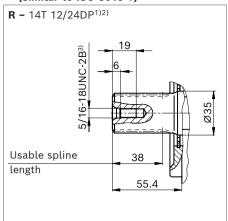


▼ Splined shaft 1 1/4 in (32-4, ISO 3019-1)

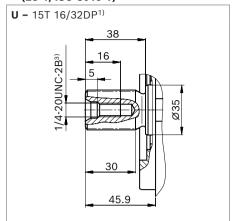
40



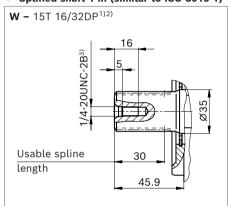
▼ Splined shaft 1 1/4 in (similar to ISO 3019-1)



▼ Splined shaft 1 in (25-4, ISO 3019-1)



▼ Splined shaft 1 in (similar to ISO 3019-1)

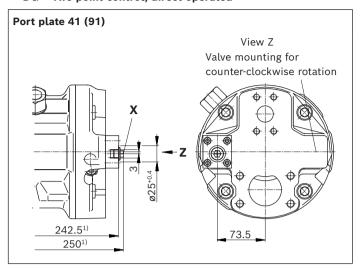


Ports -	version metric port plate 41/42	metric port plate 41/42 Standard Size			
В	Working port (standard pressure series) Fastening thread	ISO 6162-1 DIN 13	1 in M10 × 1.5; 17 (0.67) deep	350 (5100)	0
S	Suction port (standard pressure series) Fastening thread	ISO 6162-1 DIN 13	2 in M12 × 1.75; 20 (0.79) deep	10 (145)	0
L	Drain port	DIN 3852 ⁵⁾	M22 × 1.5; 14 (0.55) deep	2 (30)	O ⁶⁾
L ₁	Drain port	ISO 11926 ⁵⁾	7/8-14 UNF-2B; 17 (0.67) deep	2 (30)	X ⁶⁾
Х	Pilot pressure	DIN 3852	M14 × 1.5; 12 (0.47) deep	350 (5100)	0
X	Pilot pressure with DG-control	DIN 3852-2	G1/4 in; 12 (0.47) deep	350 (5100)	0

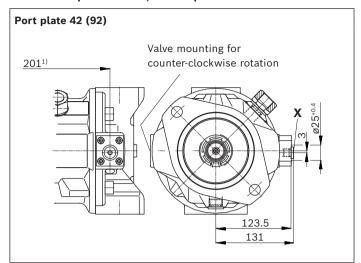
Ports - ve	rsion SAE port plate 91/92	Standard	Size ⁴⁾	$p_{\sf max}$ [bar (psi)] $^{4)}$	State ⁷⁾
В	Working port (standard pressure series)	ISO 6162-1	1 in	350 (5100)	0
	Fastening thread	ASME B1.1	3/8-16 UNC-2B; 18 (0.71) deep		
S	Suction port (standard pressure series)	ISO 6162-1	2 in	10 (145)	0
	Fastening thread	ASME B1.1	1/2-13 UNC-2B; 22 (0.87) deep		
L	Drain port	ISO 11926 ⁵⁾	7/8-14 UNF-2B; 17 (0.67) deep	2 (30)	O ⁶⁾
L ₁	Drain port	ISO 11926 ⁵⁾	7/8-14 UNF-2B; 17 (0.67) deep	2 (30)	X ⁶⁾
Х	Pilot pressure	ISO 11926	7/16-20 UNF-2B; 11.5 (0.45) deep	350 (5100)	0
Х	Pilot pressure with DG-control	DIN 3852-2	G1/4 in; 12 (0.47) deep	350 (5100)	0

- 1) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
- $_{
 m 2)}$ Splines according to ANSI B92.1a, spline runout is a deviation from standard ISO 3019-1.
- 3) Thread according to ASME B1.1
- 4) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
- $_{\mbox{\scriptsize 5)}}$ The countersink may be deeper than specified in the standard.
- $^{6)}$ Depending on the installation position, L or L₁ must be connected (also see installation instructions on page 55).
- 7) O = Must be connected (plugged on delivery)
 X = Plugged (in normal operation)

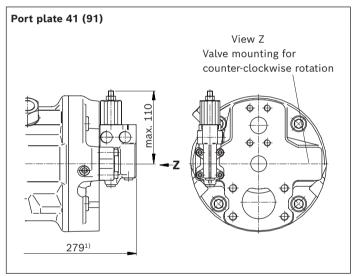
▼ DG - Two-point control, direct operated



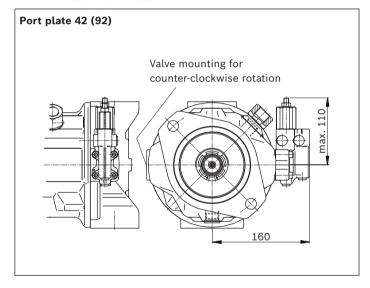
▼ DG - Two-point control, direct operated



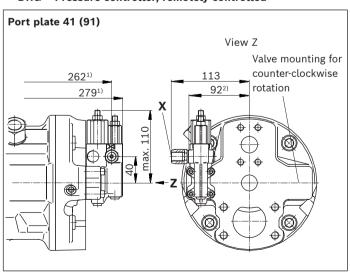
▼ DR - Pressure controller



▼ DR - Pressure controller

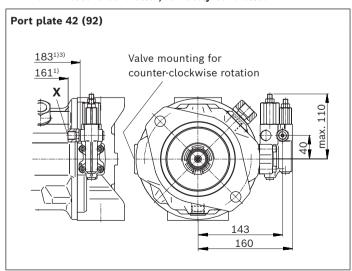


▼ DRG - Pressure controller, remotely controlled



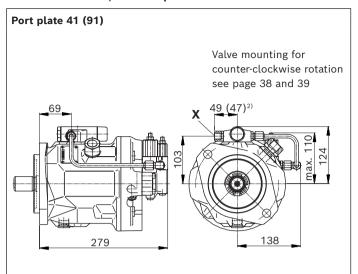
- 1) To flange surface
- 2) For version with port plate 91

▼ DRG - Pressure controller, remotely controlled

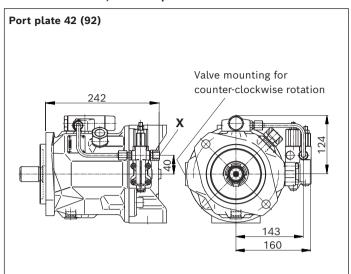


3) For version with port plate 92

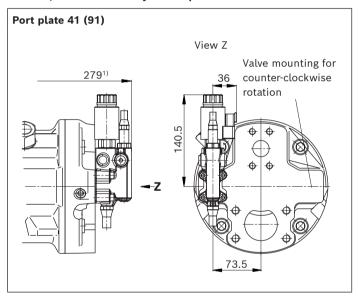
▼ DFLR - Pressure, flow and power controller



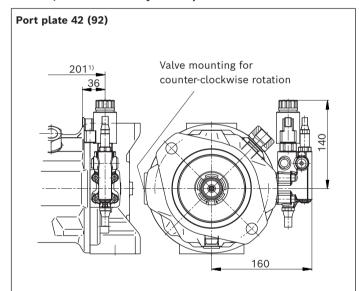
▼ DFLR - Pressure, flow and power controller



▼ ED7. / ER7. - Electro-hydraulic pressure control



▼ ED7. / ER7. - Electro-hydraulic pressure control

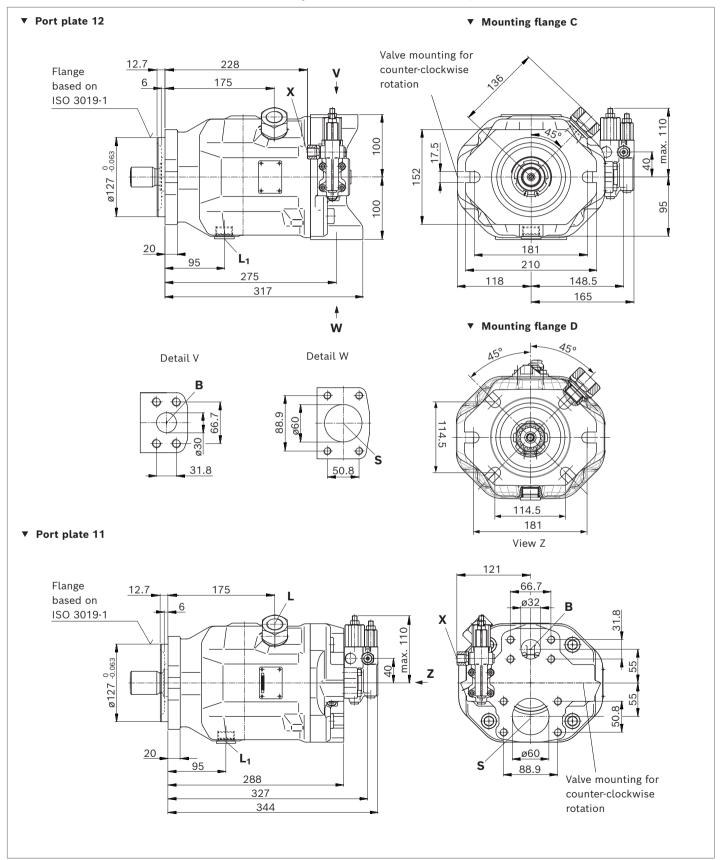


¹⁾ To flange surface

²⁾ For version with port plate 91

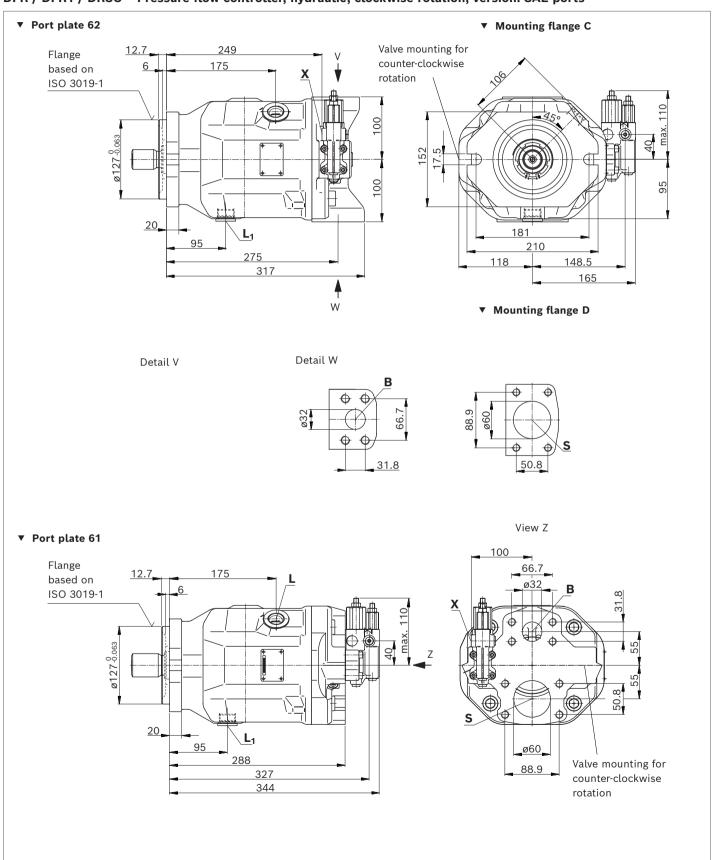
Dimensions, size 100

DFR / DFR1 / DRSC - Pressure flow controller, hydraulic; clockwise rotation, version: Ports metric

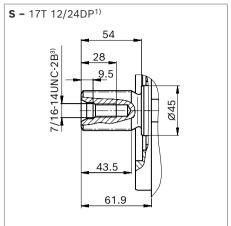


Dimensions, size 100

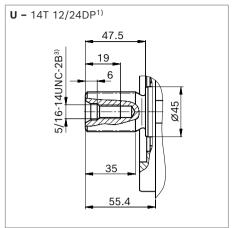
DFR / DFR1 / DRSC - Pressure flow controller, hydraulic; clockwise rotation, version: SAE ports



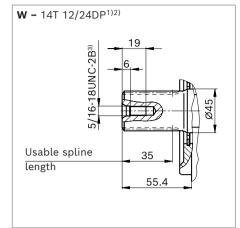
▼ Splined shaft 1 1/2 in (38-4, ISO 3019-1)



▼ Splined shaft 1 1/4 in (32-4, ISO 3019-1)



▼ Splined shaft 1 1/4 in (similar to ISO 3019-1)



Ports - version metric port plate 11/12		Standard Size		$p_{\sf max}$ [bar (psi)] $^{4)}$	State ⁷⁾	
В	Working port (high-pressure series) Fastening thread	ISO 6162-2 DIN 13	1 1/4 in M14 × 2; 19 (0.75) deep	350 (5100)	0	
S	Suction port (standard pressure series) Fastening thread	ISO 6162-1 DIN 13	2 1/2 in M12 × 1.75; 17 (0.67) deep	10 (145)	0	
L	Drain port	DIN 3852 ⁵⁾	M27 × 2; 16 (0.63) deep	2 (30)	O ⁶⁾	
L ₁	Drain port	ISO 11926 ⁵⁾	1 1/16-12 UNF-2B; 20 (0.79) deep	2 (30)	X ⁶⁾	
X	Pilot pressure	DIN 3852	M14 × 1.5; 12 (0.47) deep	350 (5100)	0	
Х	Pilot pressure with DG-control	DIN 3852-2	G1/4 in; 12 (0.47) deep	350 (5100)	0	

Ports - version SAE port plate 61/62		Standard	Size	$p_{\sf max}$ [bar (psi)] $^{4)}$	State ⁷⁾
В	Working port (high-pressure series)	ISO 6162-2	1 1/4 in	350 (5100)	0
	Fastening thread	ASME B1.1	1/2-13 UNC-2B; 19 (0.75) deep		
S	Suction port (standard pressure series)	ISO 6162-1	2 1/2 in	10 (145)	0
	Fastening thread	ASME B1.1	1/2-13 UNC-2B; 27 (1.06) deep		
L	Drain port	ISO 11926 ⁵⁾	1 1/16-12 UNF-2B; 20 (0.79) deep	2 (30)	O ⁶⁾
L ₁	Drain port	ISO 11926 ⁵⁾	1 1/16-12 UNF-2B; 20 (0.79) deep	2 (30)	X ⁶⁾
Х	Pilot pressure	ISO 11926	7/16-20 UNF-2B; 11.5 (0.45) deep	350 (5100)	0
Х	Pilot pressure with DG-control	DIN 3852-2	G1/4 in; 12 (0.47) deep	350 (5100)	0

Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5

²⁾ Splines according to ANSI B92.1a, spline runout is a deviation from standard ISO 3019-1.

³⁾ Thread according to ASME B1.1

⁴⁾ Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.

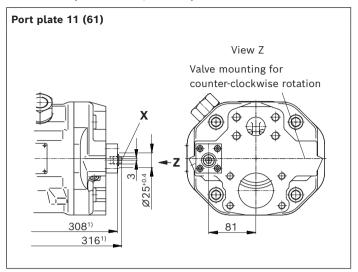
⁵⁾ The countersink may be deeper than specified in the standard.

⁶⁾ Depending on the installation position, L or L_1 must be connected (also see installation instructions on page 55).

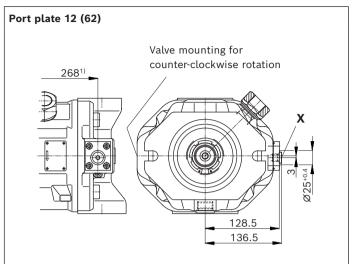
⁷⁾ O = Must be connected (plugged on delivery)X = Plugged (in normal operation)

▼ DG - Two-point control, direct operated

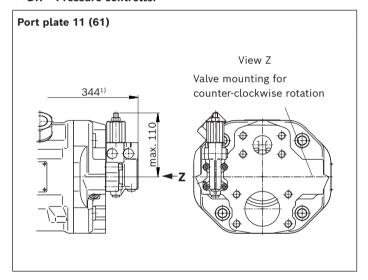
46



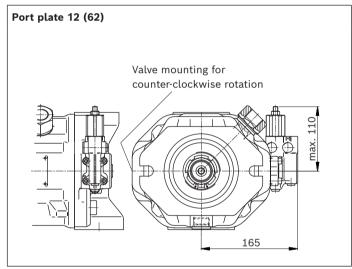
▼ DG - Two-point control, direct operated



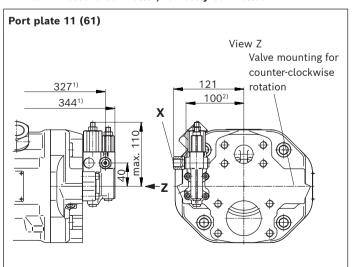
▼ DR - Pressure controller



▼ DR - Pressure controller



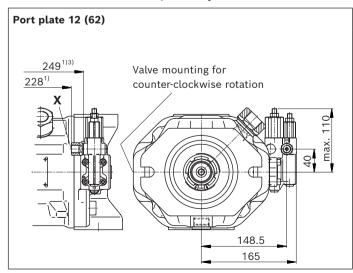
▼ DRG - Pressure controller, remotely controlled



1) To flange surface

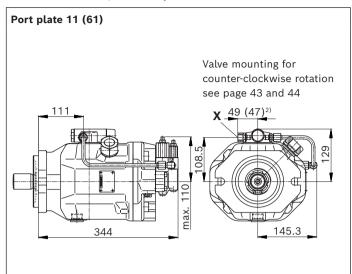
2) For version with port plate 61

▼ DRG - Pressure controller, remotely controlled

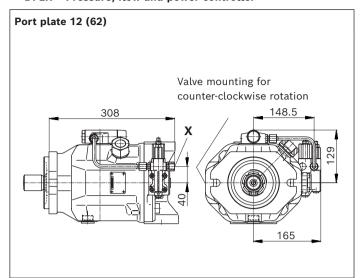


3) For version with port plate 62

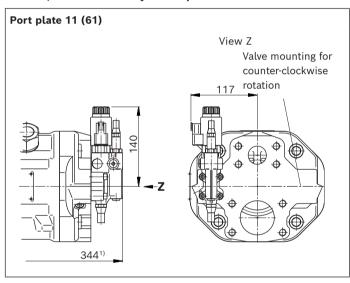
▼ DFLR - Pressure, flow and power controller



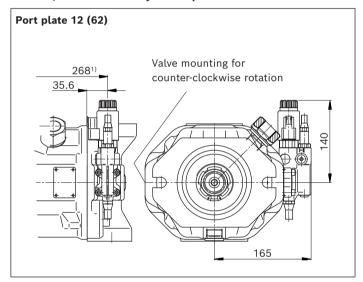
▼ DFLR - Pressure, flow and power controller



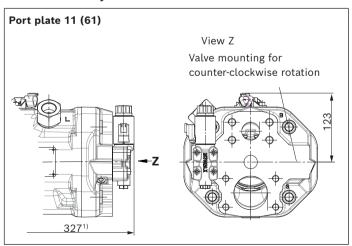
▼ ED7. / ER7. - Electro-hydraulic pressure control



▼ ED7. / ER7. - Electro-hydraulic pressure control

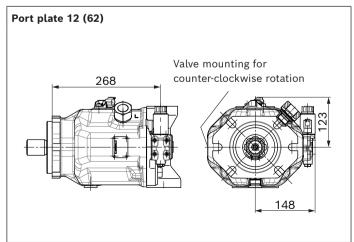


▼ EC4 - Electro-hydraulic control valve



1) To flange surface

▼ EC4 - Electro-hydraulic control valve



²⁾ For version with port plate 61

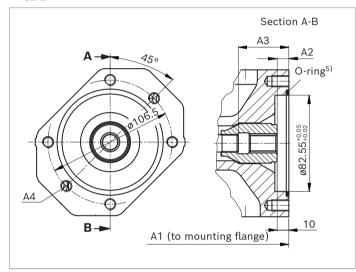
Dimensions, through drive

For flanges and shafts according to ISO 3019-1

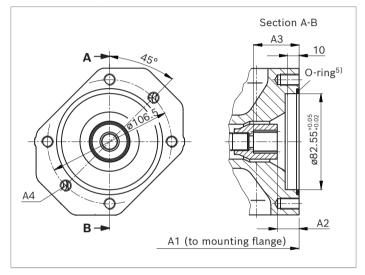
Flange		Hub for splined shaft ¹⁾	Availability across sizes					Code	
Diameter	Mounting ⁴⁾	Diameter	18	28	45	71	88	100	
82-2 (A)	8, 0°, ∞	5/8 in 9T 16/32DP	•	•	•	•	•	•	K01
		3/4 in 11T 16/32DP	•	•	•	•	•	•	K52

• = Available - = Not available

▼ 82-2



▼ 82-2



K01 (16-4 (A))	NG	A1	A2 ³⁾	A3 ³⁾	A4 ²⁾
	18	182	9.3	42.5	M10×1.5;
		(7.17)	(0.37)	(1.67)	14.5 (0.57) deep
	28	204	9.2	36.2	M10×1.5;
		(8.03)	(0.36)	(1.43)	16 (0.63) deep
	45	229	10.1	52.7	M10×1.5;
		(9.02)	(0.40)	(2.07)	16 (0.63) deep
	71	267	11.2	60.6	M10×1.5;
		(10.50)	(0.44)	(2.39)	20 (0.79) deep
	88	267	11.2	60.6	M10×1.5;
		(10.50)	(0.44)	(2.39)	20 (0.79) deep
	100	338	10.0	64.3	M10×1.5;
		(13.30)	(0.39)	(2.53)	16 (0.63) deep

K52	NG	A1	A2 ³⁾	A3 ³⁾	A4 ²⁾
(19-4 (A-B))					
	18	182	18.3	39.2	M10×1.5;
		(7.17)	(0.72)	(1.54)	14.5 (0.57) deep
	28	204	18.4	39.4	M10×1.5;
		(8.03)	(0.72)	(1.55)	16 (0.63) deep
	45	229	18.4	38.8	M10×1.5;
		(9.02)	(0.72)	(1.53)	16 (0.63) deep
	71	267	20.8	41.2	M10×1.5;
		(10.50)	(0.82)	(1.62)	20 (0.79) deep
	88	267	20.8	41.2	M10×1.5;
		(10.50)	(0.82)	(1.62)	20 (0.79) deep
	100	338	18.6	39.6	M10×1.5;
		(13.30)	(0.73)	(1.56)	16 (0.63) deep

According to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5

²⁾ Thread according to DIN 13

³⁾ Minimum dimensions

⁴⁾ Mounting holes pattern viewed on through drive with control at top

⁵⁾ O-ring included in the scope of delivery

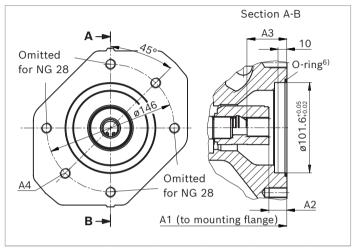
For flanges and shafts according to ISO 3019-1

Flange		Hub for splined shaft ¹⁾	Availability across sizes			Code			
Diameter	Mounting ⁵⁾	Diameter	18	28	45	71	88	100	
101-2 (B)	8, 0°, 00	7/8 in 13T 16/32DP	-	•	•	•	•	•	K68
		1 in 15T 16/32DP	-	_	•	•	•	•	K04

▼ 101-2

• = Available - = Not available

▼ 101-2



	Section A-B
A - 450 A1 (to m	O-ring ⁶ O-ring ⁶ O-ring ⁶ A2 nounting flange)

K68 (22-4 (B))	NG	A1	A2 ⁴⁾	A3 ⁴⁾	A4 ²⁾
	28	204	17.4	42.4	M12×1.75 ³⁾
		(8.03)	(0.68)	(1.67)	
	45	229	17.4	41.8	M12×1.75;
		(9.02)	(0.68)	(1.65)	18 (0.71) deep
	71	267	19.8	44.2	M12×1.75;
		(10.50)	(0.78)	(1.74)	20 (0.79) deep
	88	267	19.8	44.2	M12×1.75;
		(10.50)	(0.78)	(1.74)	20 (0.79) deep
	100	338	17.6	41.9	M12×1.75;
		(13.30)	(0.69)	(1.65)	20 (0.79) deep

K04 (25-4 (B-B))	NG	A1	A2 ⁴⁾	A3 ⁴⁾	A4 ²⁾
	45	229	17.9	47.4	M12×1.75;
		(9.02)	(0.70)	(1.87)	18 (0.71) deep
	71	267	20.3	49.2	M12×1.75;
		(10.50)	(0.80)	(1.94)	20 (0.79) deep
	88	267	20.3	49.2	M12×1.75;
		(10.50)	(0.80)	(1.94)	20 (0.79) deep
	100	338	17.8	46.6	M12×1.75;
		(13.30)	(0.70)	(1.83)	20 (0.79) deep
		-			

According to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5

²⁾ Thread according to DIN 13

³⁾ Continuous

⁴⁾ Minimum dimensions

⁵⁾ Mounting holes pattern viewed on through drive with control at top

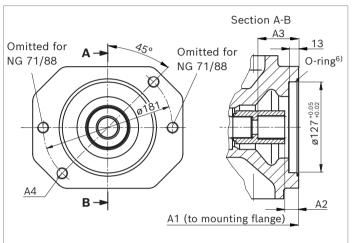
⁶⁾ O-ring included in the scope of delivery

For flanges and shafts according to ISO 3019-1

Flange		Hub for splined shaft ¹⁾	Availability across sizes			Code			
Diameter	Mounting ⁵⁾	Diameter	18	28	45	71	88	100	
127-2 (C)	σ⁰, ₀⊷	1 1/4 in 14T 12/24DP	_	-	-	•	•	•	K07
		1 1/2 in 17T 12/24DP	-	-	-	_	_	•	K24

• = Available - = Not available

▼ 127-2

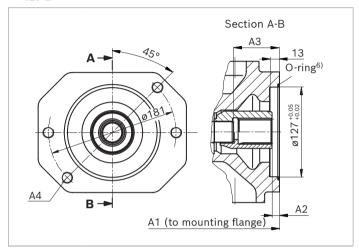


		•	A1 (to	mounting	flange)
K07 (32-4 (C))	NG	A1	A2 ⁴⁾	A3 ⁴⁾	A4 ²⁾
	71	267	20.3	58.3	M16×2; ³⁾
		(10.50)	(0.80)	(2.30)	
	88	267	20.3	58.3	M16×2; ³⁾
		(10.50)	(0.80)	(2.30)	
	100	338	19.1	57.1	M16×2; ³⁾

(13.30) (0.75)

(2.25)

▼ 127-2



K24 (38-4 (C-C))	NG	A1	A2 ⁴⁾	A3 ⁴⁾	A4 ²⁾
	100	338	10.0	64.3	M16×2; ³⁾
		(13.30)	(0.39)	(2.53)	

According to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5

²⁾ Thread according to DIN 13

³⁾ Continuous

⁴⁾ Minimum dimensions

⁵⁾ Mounting holes pattern viewed on through drive with control at top

⁶⁾ O-ring included in the scope of delivery

Overview of mounting options

SAE - Mounting flange

Through dri	ve		Mounting opti	ons – 2nd pump				
Flange ISO 3019-1	Hub for splined shaft	Code	A10V(S)O/31 NG (shaft)	A10V(S)O/5x NG (shaft)	A10VO/60 NG (shaft)	A1VO/10 NG (shaft)	External gear pump design (NG)	Through drive available for NG
82-2 (A)	5/8 in	K01	18 (U)	10 (U), 18 (U)			Series F	18 to 100
	3/4 in	K52	18 (S, R)	10 (S) 18 (S, R)		18, 28 (S3)	-	18 to 100
101-2 (B)	7/8 in	K68	28 (S, R) 45 (U, W) ¹⁾	28 (S, R) 45 (U, W) ¹⁾	45 (S4)	28, 35 (S4)	Series N/G	28 to 100
	1 in	K04	45 (S, R) -	45 (S, R) 60, 63, 72 (U, W) ²⁾	45 (S5)	35 (S5)	-	45 to 100
127-2 (C)	1 1/4 in	K07	71 (S, R) 88 (S, R) 100 (U) ³⁾	60, 63 (S, R) 85 (U) ³⁾ 100 (U) ³⁾			-	71 to 100
	1 1/2 in	K24	100 (S)	85 (S) 100 (S)			-	100

 $_{\rm 1)}\,$ Not for main pump NG28 with K68

²⁾ Not for main pump NG45 with K04

³⁾ Not for main pump NG71 and NG88 with K07

Combination pumps A10VO + A10VO

By using combination pumps, it is possible to have independent circuits without the need for splitter gearboxes.

When ordering combination pumps the type designations for the 1st and the 2nd pump must be joined by a "+".

Order example:

A10VO100DFR1/31R-VSC12K04+ A10VO45DFR/31R-VSC12N00

If no further pumps are to be mounted at the factory, the simple type designation is sufficient.

A tandem pump, with two pumps of equal size, is permissible without additional supports, assuming that the dynamic mass acceleration does not exceed maximum 10 g (= 98.1 m/s^2).

For combination pumps consisting of more than two pumps, a calculation of the mounting flange regarding the permissible mass torque is required (please contact us).

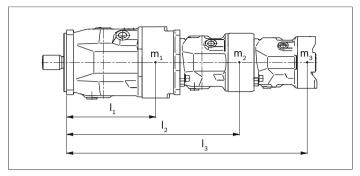
Through drives are plugged with a **non-pressure-resistant** cover. Therefore, single pumps must be equipped with a pressure-resistant cover before commissioning.

Through drives can also be ordered with a pressure-resistant cover, please specify in plain text.

Notice

Through drives with installed hub are supplied with a spacer.

The spacer must be removed before installation of the 2nd pump and before commissioning. For information, please refer to instruction manual 92701-01-B.



m_1, m_2, m_3	Weight of pump	[kg (lbs)]
l_1, l_2, l_3	Distance from center of gravity	[mm (inch)]
$T_m = (m_1 \times l_1)$	$+ m_2 \times l_2 + m_3 \times l_3) \times \frac{1}{102 (12)}$	- [Nm (lb-ft)]

Calculation for multiple pumps

- l_1 = Front pump distance from center of gravity (values from "Permissible moments of inertia" table)
- l_2 = Dimension "A1" from through drive drawings (page 48 to 50) + l_1 of the 2nd pump
- I_3 = Dimension "A1" from through drive drawings (page 48 to 50) of the 1st pump + "A1" of the 2nd pump + I_1 of the 3rd pump

Permissible moments of inertia

Size			18	28	45	71	88	100
Static	T_m	Nm	500	880	1370	2160	2160	3000
		lb-ft	369	649	1010	1593	1593	2213
Dynamic at 10 g (98.1 m/s²)	T_m	Nm	50	88	137	216	216	300
		lb-ft	37	65	101	159	159	221
Weight without through drive N00	m	kg	12.9	18	23.5	35.2	35.2	49.5
		lbs	28	40	52	78	78	109
Weight with through drive K	m	kg	13.8	19.3	25.1	38	38	55.4
		lbs	30	43	55	84	84	122
Distance, center of gravity without through drive N00	l_1	mm	92	100	113	127	127	161
		inch	3.62	3.94	4.45	5.00	5.00	6.34
Distance, center of gravity with through drive K	l_1	mm	98	107	120	137	137	178
		inch	3.86	4.21	4.72	5.39	5.39	7.01

Connector for solenoids

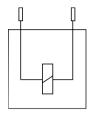
DEUTSCH DT04-2P

Molded connector, 2-pin, without bidirectional suppressor diode ${\bf P}$

With correctly mounted mating connector, the following type of protection can be achieved:

- ▶ IP67 (DIN/EN 60529) and
- ► IP69K (DIN 40050-9)

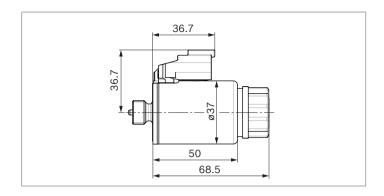
▼ Switching symbol



▼ Mating connector DEUTSCH DT06-2S-EP04

Consisting of	DT designation
1 housing	DT06-2S-EP04
1 wedge	W2S
2 sockets	0462-201-16141

The mating connector is not included in the scope of delivery. This can be supplied by Bosch Rexroth on request (material number R902601804).



Notice

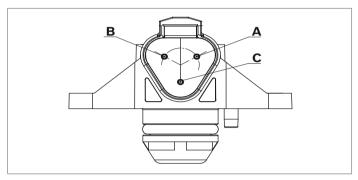
- ► If necessary, you can change the position of the connector by turning the solenoid body.
- ► The procedure is defined in the instruction manual 92701-01-B.
- ► Only the dead weight (<1 N (0.22 lbf)) of the connection cable with a length of 150 mm (5.91 inch) may act on the plug-in connection and the solenoid coil with coil nut.

Other forces and vibrations are not permissible. For example, this can be realized by suspension of the cable at the same vibration system.

Swivel angle sensor

Description

The swivel angle sensor serves the contactless detection of the swivel angle of axial piston units in the swivel axis using a Hall-effect based sensor IC with a supply voltage of 5 V. The measured value determined is converted into an analog signal corresponding to the output characteristic shown below.



▼ Pin assignment

PIN	Port	
В	Supply voltage Ub	
А	Ground GND	
С	Sensor signal OUT	

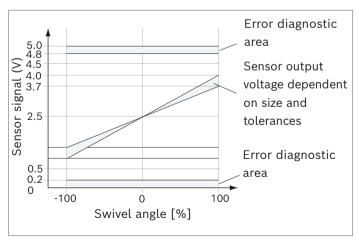
▼ Mating connector DEUTSCH DT06-3S

Consisting of	DT designation
1 housing, 3-pin	DT06-3S-EP04
1 wedge	W3S
3 sockets	0462-201-16141

The mating connector is not included in the scope of delivery.

This can be supplied by Bosch Rexroth on request.

▼ Output curve for A10VO series 31



Features

- ► Contactless angle sensor for contactless detection of the swivel angle of axial piston units in the pivot axis using the Hall effect
- ► The determined angle value is output as an analog voltage signal
- ▶ High temperature stability of the output signal
- ▶ Shock and vibration resistance
- ► Type of protection (with plugged mating connector and cable) IPx9k, IP6kx, IPx6 and IPx7 (ISO 20653)

Туре	SWS25
Supply voltage U_{B}	4.75 to 5.25 V DC
Nominal voltage	5 V DC
Current consumption without load	Normal operation ≤20 mA
Output signal	0.5 V to 4.5 V, ratiometric
Load resistance	Minimum 5 kΩ
Operation and storage temperature	-40 °C to +110 °C (-40 °F to +230 °F)
Supply overvoltage resistance	16 V DC
Type of protection (with plugged mating connector and cable)	IPx9k, IP6kx, IPx6 and IPx7 (ISO 20653)

Notice

- ► Information on environmental and EMC conditions upon request.
- ► Further information such as type codes, technical data, dimensions and safety instructions for the swivel angle sensor can be found in the associated data sheet 95153.
- ▶ Painting the sensor with electrostatic charge is not permitted (danger: ESD damage).

Electrostatic discharge (ESD)

According to ISO 10605: 2008

- Contact discharge (probe touches the sensor)
 ±8 kV (sensor operated actively and passively)
- ▶ Air discharge (arc between probe and sensor)
 ±15 kV (sensor operated actively and passively)

Installation instructions

General

The axial piston unit must be filled with hydraulic fluid and vented during commissioning and operation. This must also be observed during longer standstills, as the axial piston unit can empty itself via the hydraulic lines.

Particularly with the "drive shaft up/down" installation position, filling and air bleeding must be carried out completely as there is, for example, a danger of dry running. The leakage in the housing area must be directed to the reservoir via the highest available drain port (\mathbf{L} , \mathbf{L}_1). For combination pumps, the leakage must be drained off at each single pump.

If a shared drain line is used for several units, make sure that the respective case pressure in each unit is not exceeded. The shared drain line must be dimensioned to ensure that the maximum permissible case pressure of all connected units is not exceeded in any operating condition, particularly at cold start. If this is not possible, separate drain lines must be laid if necessary. To prevent the transmission of structure-borne noise, use elastic elements to decouple all connecting lines from all vibration-capable components (e.g. reservoir, frame parts). Under all operating conditions, the suction lines and the drain lines must flow into the reservoir below the minimum fluid level. The permissible suction height hs results from the total pressure loss, but must not be higher than $h_{S \text{ max}} = 800 \text{ mm}$ (31.5 inch). The minimum suction pressure at port S of 0.8 bar (12 psi) absolute must not be fallen below during operation and cold start. When designing the reservoir, ensure that there is adequate distance between the suction line and the drain line. This minimizes oil turbulence and carries out degassing, which prevents the heated hydraulic fluid from being sucked directly back in again.

Notice

In certain installation positions, an influence on the adjustment or control can be expected. Gravity, dead weight and case pressure can cause minor characteristic shifts and changes in actuating time.

Installation position

See the following examples 1 to 12.
Further installation positions are available upon request.
Recommended installation position: 1 and 3

Key	
F	Filling / Air bleeding
S	Suction port
L; L ₁	Drain port
SB	Baffle (baffle plate)
h _{t min}	Minimum required immersion depth (200 mm (7.87 inch))
h _{min}	Minimum required distance to reservoir bottom (100 mm (3.94 inch))
h _{ES min}	Minimum height required to prevent axial piston unit from draining (25 mm (0.98 inch))
h _{S max}	Maximum permissible suction height (800 mm (31.5 inch))

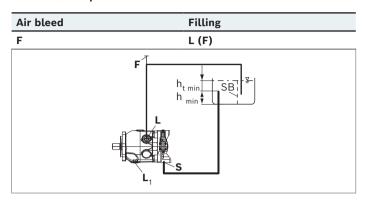
Notice

Port \mathbf{F} is part of the external piping and must be provided on the customer side to simplify the filling and air bleeding.

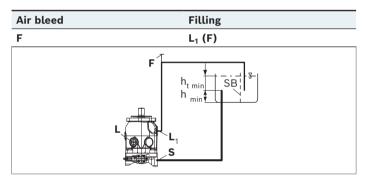
Below-reservoir installation (standard)

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

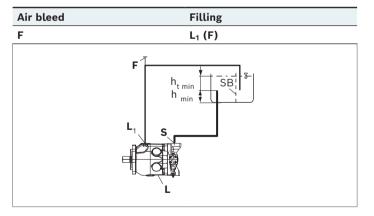
▼ Installation position 1



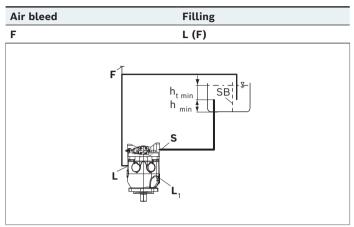
▼ Installation position 2¹⁾



▼ Installation position3



▼ Installation position 4¹⁾



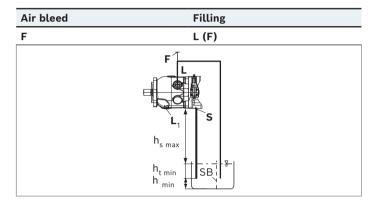
For key, see page 55.

¹⁾ Because complete air bleeding and filling are not possible in this position, the pump should be air bled and filled in a horizontal position before installation.

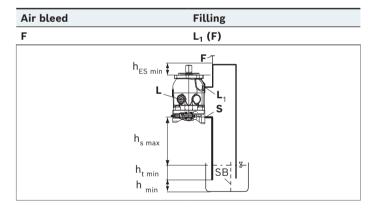
Above-reservoir installation

Above-reservoir installation means that the axial piston unit is installed above the minimum fluid level of the reservoir. To prevent the axial piston unit from draining, a height difference $h_{ES\ min}$ of at least 25 mm (0.98 inch) is required in position 6. Observe the maximum permissible suction height $h_{S\ max}$ = 800 mm (31.5 inch). A check valve in the drain line is only permissible in individual cases. Consult us for approval.

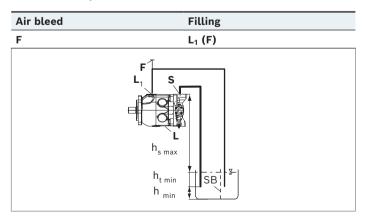
▼ Installation position 5



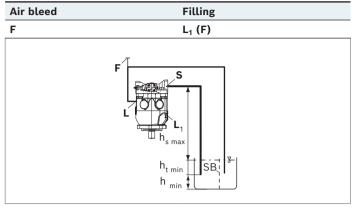
▼ Installation position 6¹⁾



▼ Installation position 7



▼ Installation position 8



For key, see page 55.

¹⁾ Because complete air bleeding and filling are not possible in this position, the pump should be air bled and filled in a horizontal position before installation.

Inside-reservoir installation

Inside-reservoir installation is when the axial piston unit is installed in the reservoir below the minimum fluid level. The axial piston unit is completely below the hydraulic fluid. If the minimum fluid level is equal to or below the upper edge of the pump, see chapter "Above-reservoir installation".

Axial piston units with electrical components (e.g. electric control, sensors) may not be installed in a reservoir below the fluid level.

Notice

▶ Our advice is to fit a suction pipe to the suction port S and to fit a pipe to case drain port L or L₁.
 In this case, the other drain port must be plugged.
 The housing of the axial piston unit is to be filled via L or L₁ (see installation position 9 to 12) before the pipework is fitted and the reservoir is filled with hydraulic fluid.

▼ Installation position 9

Air bleed	Filling	
L (F)	L (F)	
	L SB SB L William 14	

▼ Installation position 10¹)

Air bleed	Filling	
L ₁ (F)	L ₁ (F)	
	SB uim 1 uim 4	

▼ Installation position 11

Air bleed	Filling	
L ₁ (F)	L ₁ (F)	
	SB uim	

▼ Installation position 12¹)

Air bleed	Filling	
L (F)	L (F)	
	S uim u uim u	

¹⁾ Because complete air bleeding and filling are not possible in this position, the pump should be air bled and filled in a horizontal position before installation.

Project planning notes

- ► The axial piston variable pump A10VO is designed to be used in an open circuit.
- ► The project planning, installation and commissioning of the axial piston unit requires the involvement of skilled personnel.
- ▶ Before using the axial piston unit, please read the corresponding instruction manual completely and thoroughly. If necessary, this can be requested from Bosch Rexroth.
- ► Before finalizing your design, please request a binding installation drawing.
- ► The specified data and notes contained herein must be observed.
- ► Depending on the operating conditions of the axial piston unit (working pressure, fluid temperature), the characteristic curve may shift.
- ► The characteristic curve may also shift due to the dither frequency or control electronics.
- ▶ Preservation: Our axial piston units are supplied as standard with preservation protection for a maximum of 12 months. If longer preservation protection is required (maximum 24 months), please specify this in plain text when placing your order. The preservation periods apply under optimal storage conditions, details of which can be found in the data sheet 90312 or the instruction manual.
- Not all versions of the product are approved for use in a safety function according to ISO 13849.
 Please consult the proper contact at Bosch Rexroth if you require reliability parameters (e.g., MTTF_d) for functional safety.
- ▶ Depending on the type of control used, electromagnetic effects can be produced when using solenoids. Applying a direct voltage signal (DC) to solenoids does not create electromagnetic interference (EMI) nor is the solenoid affected by EMI. Electromagnetic interference (EMI) potential exists when operating and controlling a solenoid with a modulated direct voltage signal (e.g. PWM signal) Appropriate testing and measures should be taken by the machine manufacturer to ensure other components or operators (e.g. with pacemaker) are not affected by this potential.

- ▶ Pressure controllers are not safeguards against pressure overload. Be sure to add a pressure relief valve to the hydraulic system.
- ▶ Please note that a hydraulic system is an oscillating system. This can lead, for example, to the stimulation the natural frequency within the hydraulic system during operation at constant rotational speed over a long period of time. The excitation frequency of the pump is 9 times the rotational speed frequency. This can be prevented, for example, with suitably designed hydraulic lines.
- ► Please note the details regarding the tightening torques of port threads and other threaded joints in the instruction manual.
- ▶ The ports and fastening threads are designed for the p_{max} permissible pressures of the respective ports, see the connection tables. 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 ports and function ports are only intended to accommodate hydraulic lines.

Safety instructions

- ▶ During and shortly after operation, there is a risk of getting burnt on the axial piston unit and especially on the solenoids. Take the appropriate safety measures (e.g. by wearing protective clothing).
- Moving parts in control equipment (e.g. valve spools) can, under certain circumstances, get stuck in position as a result of contamination (e.g. contaminated hydraulic fluid, abrasion, or residual dirt from components). As a result, the hydraulic fluid flow and the build-up of torque in the axial piston unit can no longer respond correctly to the operator's specifications. Even the use of various filter elements (external or internal flow filtration) will not rule out a fault but merely reduce the risk.

The machine/system manufacturer must test whether remedial measures are needed on the machine for the application concerned in order to bring the driven consumer into a safe position (e.g., safe stop) and ensure any measures are properly implemented.

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2315 City Line Road Bethlehem, PA 18017-2131, USA Phone (610) 694-8300 Fax (610) 694-8467 www.boschrexroth-us.com © Bosch Rexroth AG 1987. All rights reserved, also regarding any disposal, exploitation, reproduction, editing, distribution, as well as in the event of applications for industrial property rights. The data specified within only serves to describe the product. No statements concerning a particular condition or suitability for a certain application can be derived from our information. The information given does not release the user from the obligation of own judgment and verification. It must be remembered that our products are subject to a natural process of wear and aging.