Rexroth
Bosch Group

Axial Piston Variable Pump A10V(S)O

RE 92701/01.12 **1/**52
Replaces: 06.09
and RE 92707/11.10

Data sheet

Series 31
Size 18 (A10VSO)
Sizes 28 to 140 (A10VO)
Nominal pressure 280 bar
Maximum pressure 350 bar
Open circuit

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Features

- Variable pump in axial piston swashplate design for hydrostatic drives in an open circuit
- The flow is proportional to the drive speed and the displacement.
- The flow can be steplessly varied by adjustment of the swashplate angle.
- 2 case drain ports
- Excellent suction characteristics
- 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.

Type code for standard program

		O			**/**	**31**		**–**	**V**					
01	02	03	04	05		06	07		08	09	10	11	12	13

Version

		18	28	45	71	100	140	
01	Standard version (without symbol)	●	●	●	●	●	●	
	High-speed version	–	–	●	●	●	●	**H**

Axial piston unit

02	Swashplate design, variable, nominal pressure 280 bar, maximum pressure 350 bar	●	–	–	–	–	–	**A10VS**
		–	●	●	●	●	●	**A10V**

Operation mode

03	Pump, open circuit	**O**

Size (NG)

04	Geometric displacement, see table of values on pages 6 and 7	**18**	**28**	**45**	**71**	**100**	**140**	

Control device

05	Two-point control, directly operated			●	●	●	●	●	●	**DG**
	Pressure control			●	●	●	●	●	●	**DR**
	with flow control, hydraulic									
		X-T open		●	●	●	●	●	●	**DFR**
		X-T closed		●	●	●	●	●	●	**DFR1**
	with flow and differential pressure control, electrically variable			❍	●	●	●	●	–	**EF[1)]**
	with pressure cut-off, remotely operated									
		hydraulic		●	●	●	●	●	●	**DRG**
		electrical	negative characteristic	12V	●	●	●	●	●	**ED71**
				24V	●	●	●	●	●	**ED72**
			positive characteristic	12V	●	●	●	●	●	**ER71[2)]**
				24V	●	●	●	●	●	**ER72[2)]**
	Pressure, flow and power control				–	●	●	●	●	●	**DFLR**

Series

06	Series 3, Index 1	**31**

Direction of rotation

07	Viewed on drive shaft	clockwise	**R**
		counter clockwise	**L**

Seals

08	FKM (fluor-caoutchouc)	**V**

1) See RE 92709

2) The following must be taken into account during project planning:
Excessive current levels (I > 1200 mA with 12 V or I > 600 mA with 24 V) to the ER solenoid can result in undesired increase of pressure which can lead to pump or system damage:
- Use I_{max} current limiter solenoids.
- A sandwich plate pressure reducing valve can be used to protect the pump in the event of overflow.
An accessory kit with sandwich plate pressure reducing valve can be ordered from Rexroth under part number R902490825.

● = available ❍ = on request – = not available

Type code for standard program

		O			/	31		–	V				
01	02	03	04	05		06	07		08	09	10	11	12	13

	Drive shaft		**18**	**28**	**45**	**71**	**100**	**140**	
09	Splined shaft ANSI B92.1a	standard shaft	●	●	●	●	●	●	**S**
		similar to shaft "S" however for higher input torque	●	●	●	●	–	–	**R**
		reduced diameter, not for through drive	●	●	●	●	●	❍	**U**
		same as "U", higher torque; not for through drive	–	●	●	●	●	❍	**W**

	Mounting flange		**18**	**28**	**45**	**71**	**100**	**140**	
10	ISO 3019-1 (SAE)	2-hole	●	●	●	●	●	●	**C**
		4-hole	–	–	–	–	–	●	**D**

	Service line port		**18**	**28**	**45**	**71**	**100**	**140**	
11	SAE flange ports at rear, metric fastening thread, not for through drive		–	●	●	–	●	●	**11**
			–	–	–	●	–	–	**41**
	SAE flange ports on opposite side, metric fastening thread		●	●	●	–	●	●	**12**
			–	–	–	●	–	–	**42**

	Through drive			**18**	**28**	**45**	**71**	**100**	**140**	
12	without through drive			●	●	●	●	●	●	**N00**
	Flange ISO 3019-1	coupling for splined shaft[1]								
	Diameter	diameter								
	82-2 (A)	5/8 in	9T 16/32DP	●	●	●	●	●	●	**K01**
		3/4 in	11T 16/32DP	●	●	●	●	●	●	**K52**
	101-2 (B)	7/8 in	13T 16/32DP	–	●	●	●	●	●	**K68**
		1 in	15T 16/32DP	–	–	●	●	●	●	**K04**
	127-2 (C)	1 1/4 in	14T 12/24DP	–	–	–	●	●	●	**K07**
		1 1/2 in	17T 12/24DP	–	–	–	–	●	●	**K24**
	152-4 (D)	1 3/4 in	13T 8/16DP	–	–	–	–	–	●	**K17**

	Connectors for solenoids[2]	**18**	**28**	**45**	**71**	**100**	**140**	
13	DEUTSCH - molded connector, 2-pin – without suppressor diode	●	●	●	●	●	●	**P**

1) Coupling for splined shaft as per ANSI B92.1a
2) Connectors for other electric components can deviate.

● = available ❍ = on request – = not available

Technical data

Hydraulic fluid

Before starting project planning, please refer to our data sheets RE 90220 (mineral oil), RE 90221 (environmentally acceptable hydraulic fluids) and RE 90222 (HFD hydraulic fluids) for detailed information regarding the choice of hydraulic fluid and application conditions.

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

Operating viscosity range

For optimum efficiency and service life we recommend that the operating viscosity (at operating temperature) be selected in the range

ν_{opt} = opt. operating viscosity 16 ... 36 mm²/s

referred to reservoir temperature (open circuit).

Limits of viscosity range

For critical operating conditions the following values apply:

n_{min} = 10 mm²/s
short-term (t ≤ 1 min)
at max perm. case drain temperature of 115 °C.

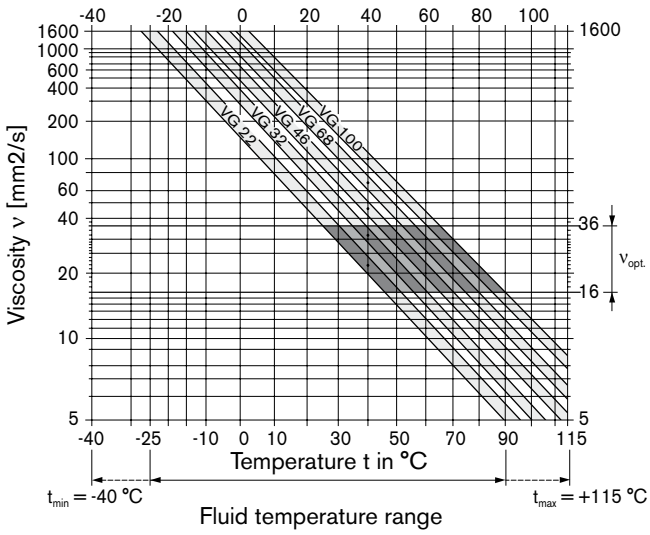
Please also ensure that the max. case drain temperature of 115 °C is not exceeded in localized areas (for instance, in the bearing area). The fluid temperature in the bearing area is approx. 5 K higher than the average case drain temperature.

n_{max} = 1600 mm²/s
short-term (t ≤ 1 min)
on cold start
(p ≤ 30 bar, n ≤ 1000 rpm, t_{min} -25 °C)

Depending on the installation situation, special measures are necessary at temperatures between -40°C and -25°C. Please contact us.

For detailed information on operation with low temperatures see data sheet RE 90300-03-B.

Selection diagram



Notes on the choice of hydraulic fluid

In order to select the correct hydraulic fluid, it is necessary to know the operating temperature in the reservoir (open circuit) in relation to the ambient temperature.

The hydraulic fluid should be selected so that within the operating temperature range, the viscosity lies within the optimum range (ν_{opt}), see shaded section of the selection diagram. We recommend to select the higher viscosity grade in each case.

Example: at an ambient temperature of X °C the operating temperature is 60 °C. In the optimum operating viscosity range (ν_{opt}; shaded area) this corresponds to viscosity grades VG 46 resp. VG 68; VG 68 should be selected.

Important:
The case drain temperature is influenced by pressure and input speed and is always higher than the reservoir temperature. However, at no point in the component may the temperature exceed 115 °C. The temperature difference specified on the left is to be taken into account when determining the viscosity in the bearing.

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

Filtration of the hydraulic fluid
The finer the filtration the better the cleanliness level of the hydraulic fluid and the longer the service life of the axial piston unit.

In order to guarantee the functional reliability of the axial piston unit it is necessary to carry out a gravimetric evaluation of the hydraulic fluid to determine the particle contamination and the cleanliness level according to ISO 4406. A cleanliness level of at least 20/18/15 must be maintained.
At very high hydraulic fluid temperatures (90 °C to maximum 115 °C), a cleanliness level of at least 19/17/14 according to ISO 4406 is necessary.

If the above cleanliness levels cannot be maintained, please contact us.

Technical data

Operating pressure range

(when using mineral oil)

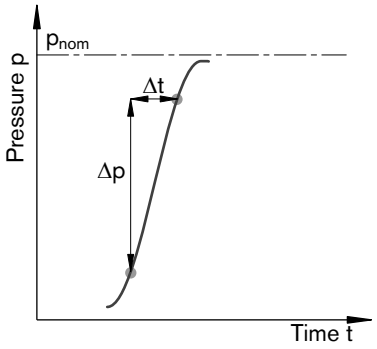
Pressure at service line port B

Nominal pressure p_{nom} _____ 280 bar absolute

Maximum pressure p_{max} _____ 350 bar absolute
Single operating period _____ 2.0 ms
Total operating period _____ 300 h

Minimum pressure (high-pressure side) _____ 10 bar absolute[1)]

Rate of pressure change $R_{A\ max}$ _____ 16000 bar/s



Pressure at suction port S (inlet)
Minimum pressure $p_{S\ min}$ _____ 0.8 bar absolute
Maximum pressure $p_{S\ max}$ _____ 10 bar absolute[1)]

Note
Please contact us for values for other hydraulic fluids.

Case drain pressure

Maximum permissible case drain pressure (at port L, L_1):
Maximum 0.5 bar higher than the inlet pressure at port S, however not higher than 2 bar absolute.

$p_{L\ max\ abs}$ _____ 2 bar absolute[1)]

1) Other values on request

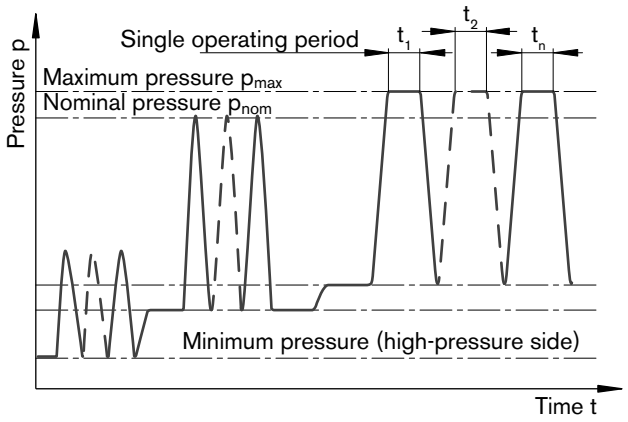
Definition

Nominal pressure p_{nom}
The nominal pressure corresponds to the maximum design pressure.

Maximum pressure p_{max}
The maximum pressure corresponds to the maximum operating pressure within the single operating period. The total of the single operating periods must not exceed the total operating period.

Minimum pressure (high-pressure side)
Minimum pressure in the high-pressure side (port B) that is required in order to prevent damage to the axial piston unit. The minimum pressure depends on the speed and displacement of the axial piston unit.

Rate of pressure change R_A
Maximum permissible pressure build-up and pressure reduction speed with a pressure change over the entire pressure range.



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

Technical data, standard unit

Table of values (theoretical values, without efficiencies and tolerances: values rounded)

Size		NG		18	28	45	71	100	140
Geometrical displacement per revolution									
		$V_{g\,max}$	cm^3	18	28	45	71	100	140
Maximum speed [1]									
at $V_{g\,max}$		n_{nom}	rpm	3300	3000	2600	2200	2000	1800
at $V_g < V_{g\,max}$		$n_{max\,perm}$	rpm	3900	3600	3100	2600	2400	2100
Flow									
at n_{nom} and $V_{g\,max}$		$q_{v\,max}$	l/min	59	84	117	156	200	252
at $n_E = 1500$ rpm and $V_{g\,max}$		$q_{vE\,max}$	l/min	27	42	68	107	150	210
Power at $\Delta p = 280$ bar									
at n_{nom}, $V_{g\,max}$		P_{max}	kW	30	39	55	73	93	118
at $n_E = 1500$ rpm and $V_{g\,max}$		$P_{E\,max}$	kW	12.6	20	32	50	70	98
Torque									
at $V_{g\,max}$ and	$\Delta p = 280$ bar	T_{max}	Nm	80	125	200	316	445	623
	$\Delta p = 100$ bar	T	Nm	30	45	72	113	159	223
Rotary stiffness, drive shaft	S	c	Nm/rad	11087	22317	37500	71884	121142	169537
	R	c	Nm/rad	14850	26360	41025	76545	–	–
	U	c	Nm/rad	8090	16695	30077	52779	91093	–
	W	c	Nm/rad	–	19898	34463	57460	101847	–
Moment of inertial rotary group		J_{TW}	kgm^2	0.00093	0.0017	0.0033	0.0083	0.0167	0.0242
Angular acceleration, maximum [2]		α	rad/s^2	6800	5500	4000	3300	2700	2700
Filling capacity		V	L	0.4	0.7	1.0	1.6	2.2	3.0
Weight (without through drive) approx.		m	kg	12	15	21	33	45	60

1) The values are applicable:
- for an absolute pressure $p_{abs} = 1$ bar at suction port S
- within the optimum viscosity range from $\nu_{opt} = 16$ to 36 mm^2/s
- for mineral-oil based hydraulic fluid.

2) The scope of application lies between the minimum necessary and the maximum permissible drive speeds.
Valid for external excitation (e.g. diesel engine 2- to 8-fold rotary frequency, cardan shaft 2-fold rotary frequency).
The limiting value is only valid for a single pump.
The loading capacity of the connecting parts must be taken into account.

Note

Exceeding the maximum or falling below the minimum permissible values can lead to a loss of function, a reduction in operational service life or total destruction of the axial piston unit. We recommend to check the loading through tests or calculation / simulation and comparison with the permissible values.

Calculation of characteristics

Flow $q_V = \dfrac{V_g \cdot n \cdot \eta_V}{1000}$ [l/min]

Torque $T = \dfrac{V_g \cdot \Delta p}{20 \cdot \pi \cdot \eta_{mh}}$ [Nm]

Power $P = \dfrac{2\pi \cdot T \cdot n}{60000} = \dfrac{q_V \cdot \Delta p}{600 \cdot \eta_t}$ [kW]

V_g = Displacement per revolution in cm^3
Δp = Pressure differential in bar
n = Speed in rpm
η_V = Volumetric efficiency
η_{mh} = Mechanical-hydraulic efficiency
η_t = Total efficiency ($\eta_t = \eta_V \cdot \eta_{mh}$)

Technical data, high-speed version

Table of values (theoretical values, without efficiencies and tolerances: values rounded)

Size		NG		45	71	100	140
Geometrical displacement per revolution							
		$V_{g\,max}$	cm^3	45	71	100	140
Maximum speed [1]							
at $V_{g\,max}$		n_{nom}	rpm	3000	2550	2300	2050
at $V_g < V_{g\,max}$		$n_{max\,perm}$	rpm	3300	2800	2500	2200
Flow							
at n_{nom} and $V_{g\,max}$		$q_{v\,max}$	l/min	135	178	230	287
Power at $\Delta p = 280$ bar							
at n_{nom}, $V_{g\,max}$		P_{max}	kW	63	83	107	134
Torque							
at $V_{g\,max}$ and	$\Delta p = 280$ bar	T_{max}	Nm	200	316	445	623
	$\Delta p = 100$ bar	T	Nm	72	113	159	223
Rotary stiffness, drive shaft	S	c	Nm/rad	37500	71884	121142	169537
	R	c	Nm/rad	41025	76545	–	–
	U	c	Nm/rad	30077	52779	91093	–
	W	c	Nm/rad	34463	57460	101847	–
Moment of inertial rotary group		J_{TW}	kgm^2	0.0033	0.0083	0.0167	0.0242
Angular acceleration, maximum [2]		α	rad/s^2	4000	3300	2700	2700
Filling capacity		V	L	1.0	1.6	2.2	3.0
Weight (without through drive) approx.		m	kg	21	33	45	60

1) The values are applicable:
- for an absolute pressure $p_{abs} = 1$ bar at suction port S
- within the optimum viscosity range from $\nu_{opt} = 16$ to 36 mm^2/s
- for mineral-oil based hydraulic fluid.

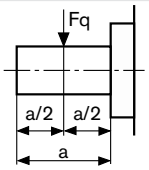
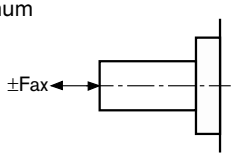
2) The scope of application lies between the minimum necessary and the maximum permissible drive speeds.
Valid for external excitation (e.g. diesel engine 2- to 8-fold rotary frequency, cardan shaft 2-fold rotary frequency).
The limiting value is only valid for a single pump.
The loading capacity of the connecting parts must be taken into account.

Note
Exceeding the maximum or falling below the minimum permissible values can lead to a loss of function, a reduction in operational service life or total destruction of the axial piston unit. We recommend to check the loading through tests or calculation / simulation and comparison with the permissible values.

Sizes 45, 71, 100 and 140 are optionally available in high-speed version.
External dimensions are not affected by this option.

Technical data

Permissible radial and axial loading on the drive shaft

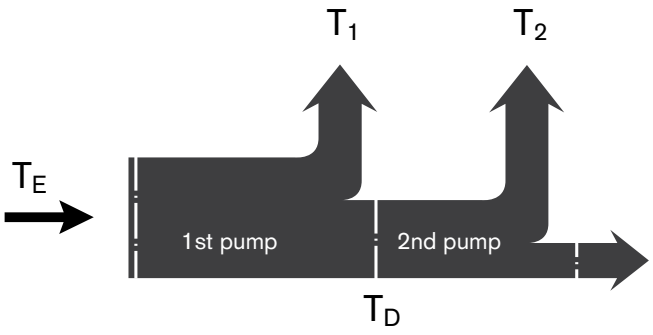
Size	NG		18	28	45	71	100	140
Radial force maximum at a/2 	$F_{q\,max}$	N	350	1200	1500	1900	2300	2800
Axial force maximum 	$+ F_{ax\,max}$	N	700	1000	1500	2400	4000	4800

Permissible input and through-drive torques

Size	NG		18	28	45	71	100	140
Torque at $V_{g\,max}$ and $\Delta p = 280$ bar[1)]	T_{max}	Nm	80	125	200	316	445	623
Input torque for drive shaft, maximum[2)]								
S	$T_{E\,max}$	Nm	124	198	319	626	1104	1620
	Ø	in	3/4	7/8	1	1 1/4	1 1/2	1 3/4
R	$T_{E\,max}$	Nm	160	250	400	644	–	–
	Ø	in	3/4	7/8	1	1 1/4	–	–
U	$T_{E\,max}$	Nm	59	105	188	300	595	–
	Ø	in	5/8	3/4	7/8	1	1 1/4	–
W	$T_{E\,max}$	Nm	–	140	220	394	636	–
	Ø	in	–	3/4	7/8	1	1 1/4	–
Maximum through-drive torque for drive shaft								
S	$T_{D\,max}$	Nm	108	160	319	492	778	1266
R	$T_{D\,max}$	Nm	120	176	365	548	–	–

1) Without considering efficiency
2) For drive shafts free of radial force

Distribution of torques



Technical data

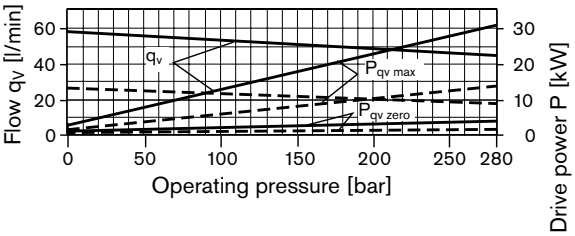
Drive power and flow

Operating material:
Hydraulic fluid ISO VG 46 DIN 51519, t = 50 °C

Size 18

_ _ _ _ n = 1500 rpm

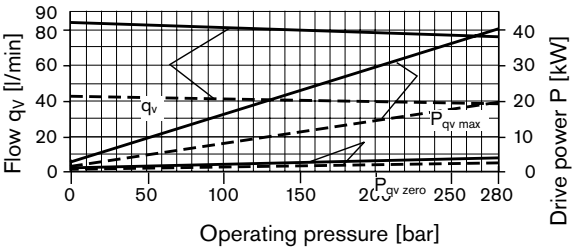
_____ n = 3300 rpm



Size 28

_ _ _ _ n = 1500 rpm

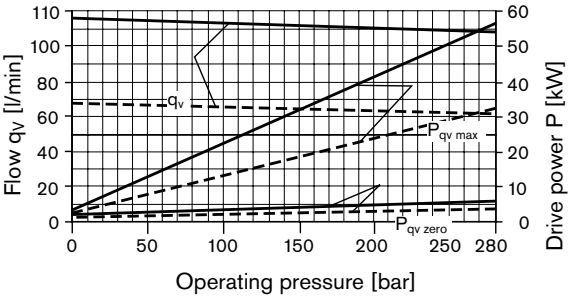
_____ n = 3000 rpm



Size 45

_ _ _ _ n = 1500 rpm

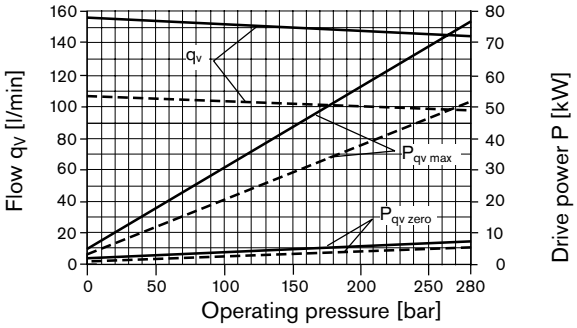
_____ n = 2600 rpm



Size 71

_ _ _ _ n = 1500 rpm

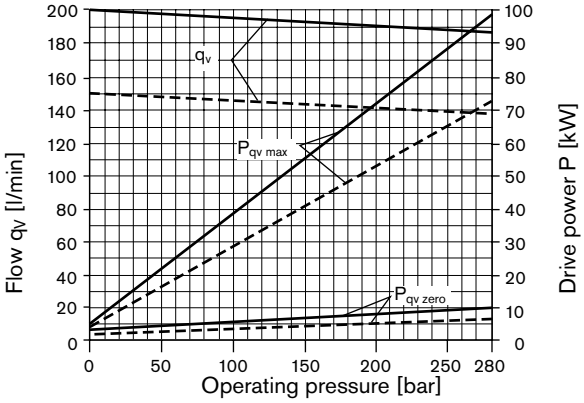
_____ n = 2200 rpm



Size 100

_ _ _ _ n = 1500 rpm

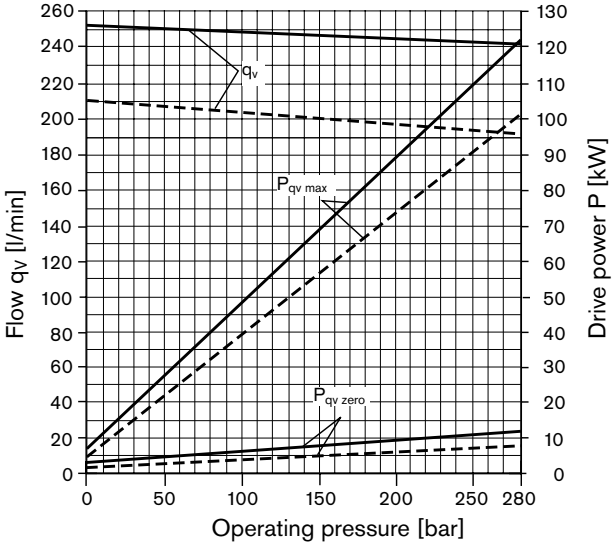
_____ n = 2000 rpm



Size 140

_ _ _ _ n = 1500 rpm

_____ n = 1800 rpm



DG – Two-point control, directly operated

The variable pump can be set to a minimum swivel angle by connecting an external control pressure to port X.

This will supply control fluid directly to the stroke piston; a minimum control pressure of $p_{st} \geq 50$ bar is required.

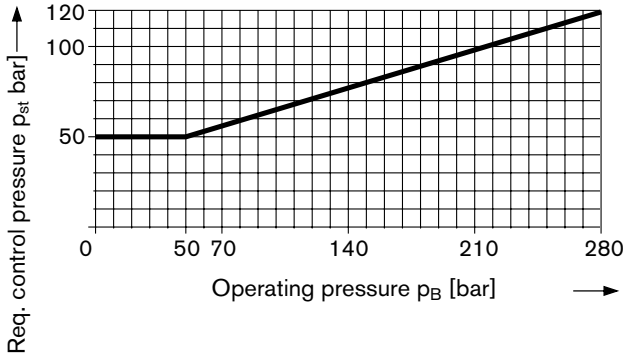
The variable pump can only be switched between $V_{g\,max}$ or $V_{g\,min}$.

Please note, that the required control pressure at port X is directly dependent on the actual operating pressure p_B in port B. (See control pressure characteristic).

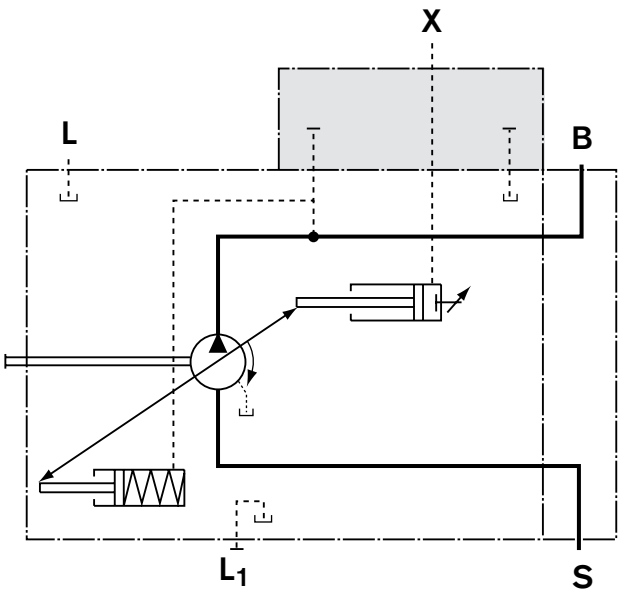
Control pressure p_{st} in X = 0 bar ≙ $V_{g\,max}$

Control pressure p_{st} in X ≥ 50 bar ≙ $V_{g\,min}$

Control pressure characteristic



Circuit diagram



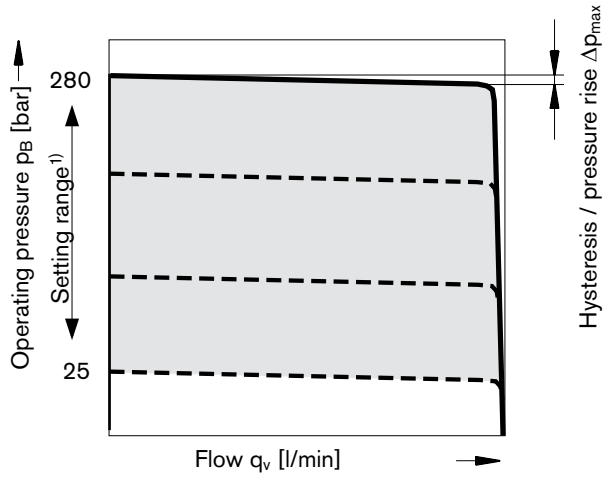
	Port for
B	Service line
S	Suction line
L, L_1	Case drain (L_1 plugged)
X	Pilot pressure

DR – Pressure control

The pressure control limits the maximum pressure at the pump output within the pump control range. The variable pump only supplies as much hydraulic fluid as is required by the consumers. If the operating pressure exceeds the pressure setpoint set at the integrated pressure valve, the pump will adjust towards a smaller displacement and the control deviation will be reduced. The pressure can be set steplessly at the control valve.

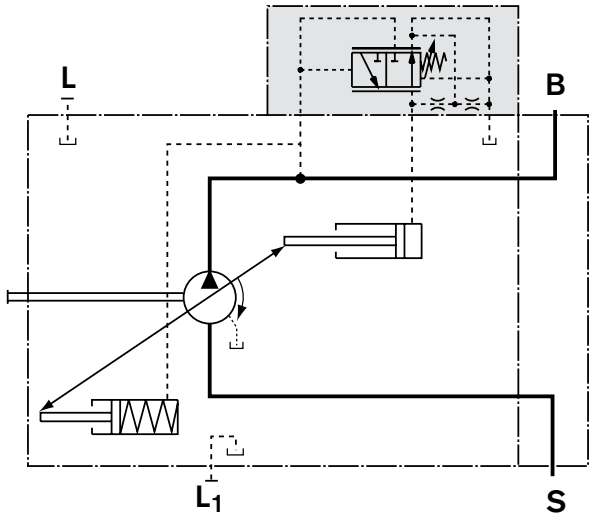
Static characteristic

(at n_1 = 1500 rpm; t_{fluid} = 50 °C)

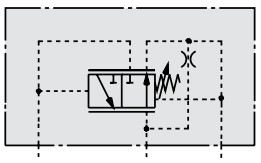


1) In order to prevent damage to the pump and the system, this setting range is the permissible setting range and must not be exceeded.
The range of possible settings at the valve are greater.

Circuit diagram, sizes 18 to 100



Circuit diagram, size 140



	Port for
B	Service line
S	Suction line
L, L_1	Case drain (L_1 plugged)

Control data

Hysteresis and repeatability Δp _____ maximum 3 bar

Pressure rise, maximum

NG		18	28	45	71	100	140
Δp	bar	4	4	6	8	10	12

Control fluid consumption_____ maximum approx. 3 l/min

Flow losses at q_{Vmax} see page 9.

DRG – Pressure control, remotely operated

The DR-control valve (see page 11) is overriding this DRG-remote setting of max. outlet pressure.

A pressure relief valve can be externally piped to port X for remote setting of pressure below the setting of the DR control valve spool. This relief valve is not included in the delivery contents of the DRG control.

The differential pressure at the DRG control valve is set as standard to 20 bar. This results in a pilot oil flow to the relief valve of approx. 1.5 l/min at port X. If another setting is required (range from 10-22 bar) please state in clear text.

As a separate pressure relief valve we can recommend:

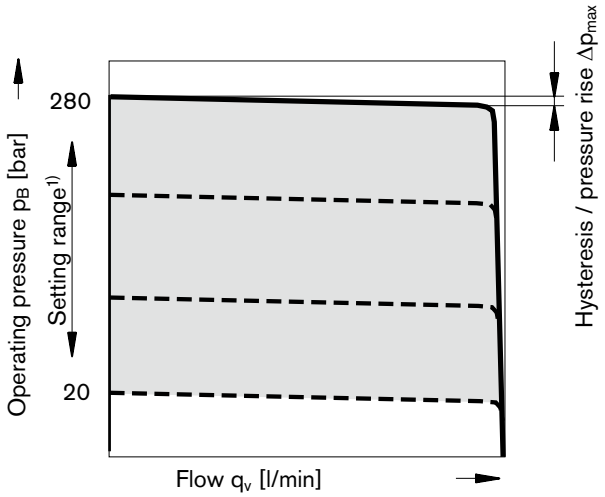
DBDH 6 (hydraulic) to RE 25402 or

DBETR-SO 381 with orifice Ø 0.8 mm in P (electric) to RE 29166.

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

Static characteristic

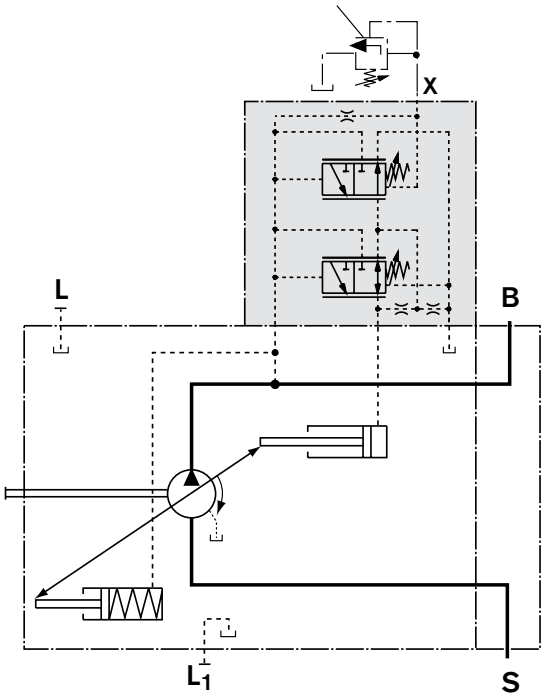
(at $n_1 = 1500$ rpm; $t_{fluid} = 50$ °C)



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

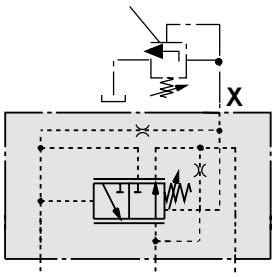
Circuit diagram, sizes 18 to 100

Not included in the delivery contents



Circuit diagram, size 140

Not included in the delivery contents



		Port for
B		Service line
S		Suction line
L, L_1		Case drain (L_1 plugged)
X	NG 18 to 100 **with** adapter	Pilot pressure
X	NG 140 **without** adapter	Pilot pressure

Control data

Hysteresis and repeatability Δp _____ maximum 3 bar

Pressure rise, maximum

NG		18	28	45	71	100	140
Δp	bar	4	4	6	8	10	12

Control fluid consumption_____ maximum approx. 4.5 l/min

Flow losses at q_{Vmax} see page 9.

DFR/DFR1 – Pressure and flow control

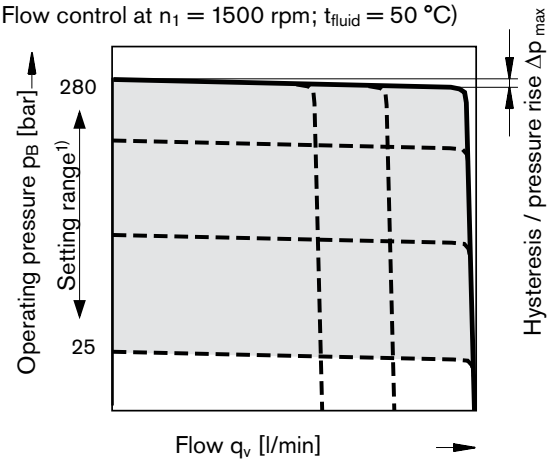
In addition to the pressure control function (see page 11), the pump flow may be varied by means of a differential pressure over an adjustable orifice (e.g. directional valve) installed in the service line to the actuator. The pump flow is equal to the actual required flow by the actuator, regardless of changing pressure levels.

The pressure control overrides the flow control function.

Note
The DFR1 version has no connection between X and the reservoir. Unloading the LS-pilot line must be possible in the valve system.
Because of the flushing function sufficient unloading of the X-line must also be provided.

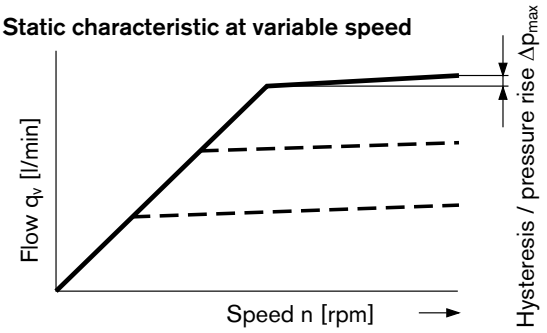
Static characteristic

Flow control at $n_1 = 1500$ rpm; $t_{fluid} = 50$ °C)



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

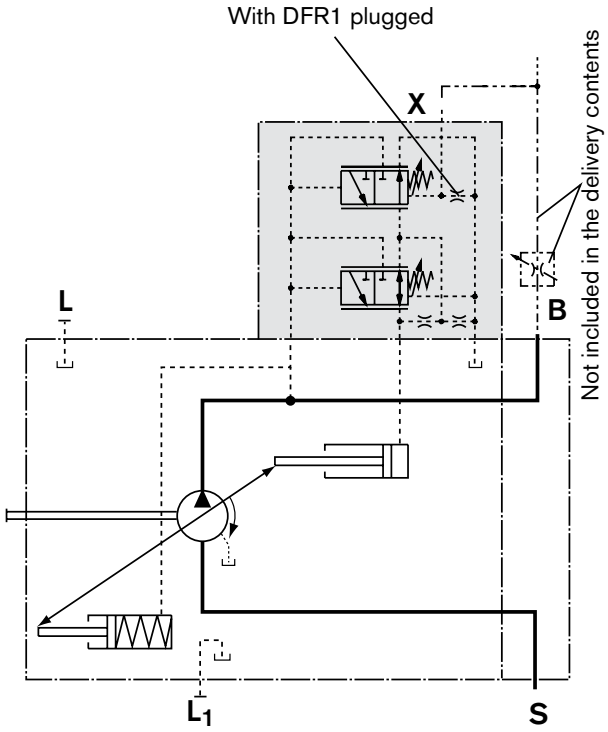
Static characteristic at variable speed



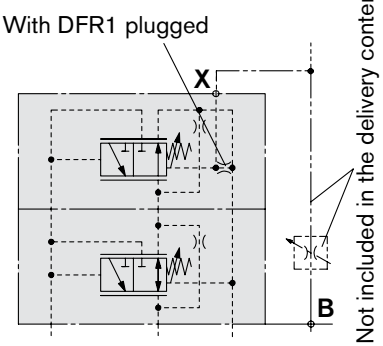
Differential pressure Δp

Standard setting: 14 to 22 bar.
If another setting is required, please state in clear text.
Relieving the load on port X to the reservoir results in a zero stroke ("standby") pressure which lies about 1 to 2 bar higher than the differential pressure Δp. System influences are not taken into account.

Circuit diagram, sizes 18 to 100



Circuit diagram, size 140



	Port for
B	Service line
S	Suction line
L, L_1	Case drain (L_1 plugged)
X	Pilot pressure

Control data

Data for pressure control DR, see page 11.
Maximum flow deviation measured with drive speed n = 1500 rpm.

NG		**18**	**28**	**45**	**71**	**100**	**140**
$\Delta q_{v\,max}$	l/min	0.9	1.0	1.8	2.8	4.0	6.0

Control fluid consumption DFR maximum approx. 3 to 4.5 l/min
Control fluid consumption DFR1 ____ maximum approx. 3 l/min
Volume flow loss at q_{Vmax}, see page 9.

DFLR – Pressure, flow and power control

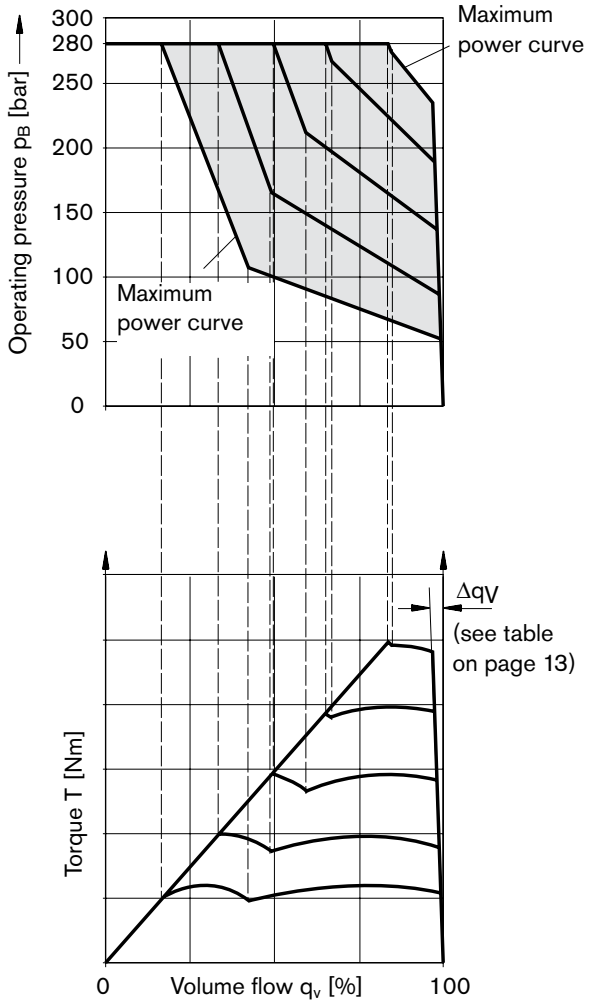
Execution of the pressure control like DR(G), see page 11 (12).
Execution of the flow control like DFR, DFR1, see page 13.

In order to achieve a constant drive torque with varying operating 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.

The power characteristic is set in the factory; when ordering, please state in clear text, e.g. 20 kW at 1500 rpm.

Static curves and torque characteristic



Control data

Beginning of control _____ 50 bar
Control fluid consumption_____ maximum approx. 5.5 l/min

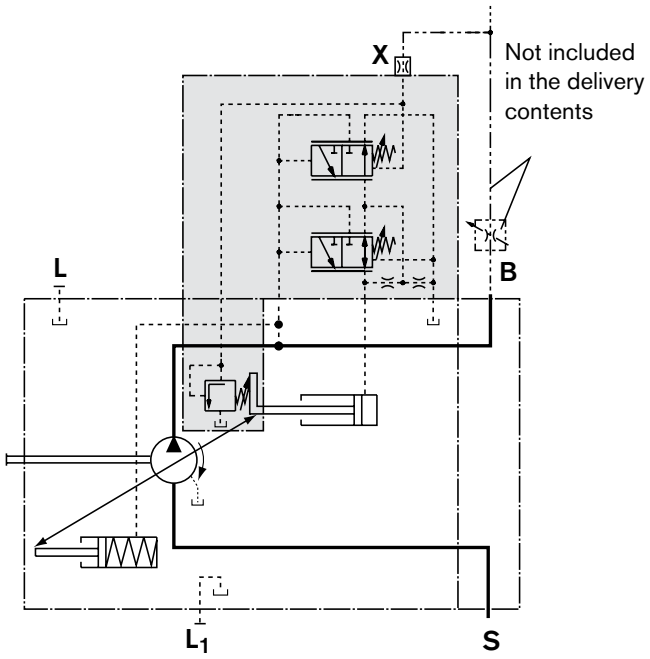
Flow loss at qv max, see page 9.

	Port for
B	Service line
S	Suction line
L, L_1	Case drain (L_1 plugged)
X	Pilot pressure

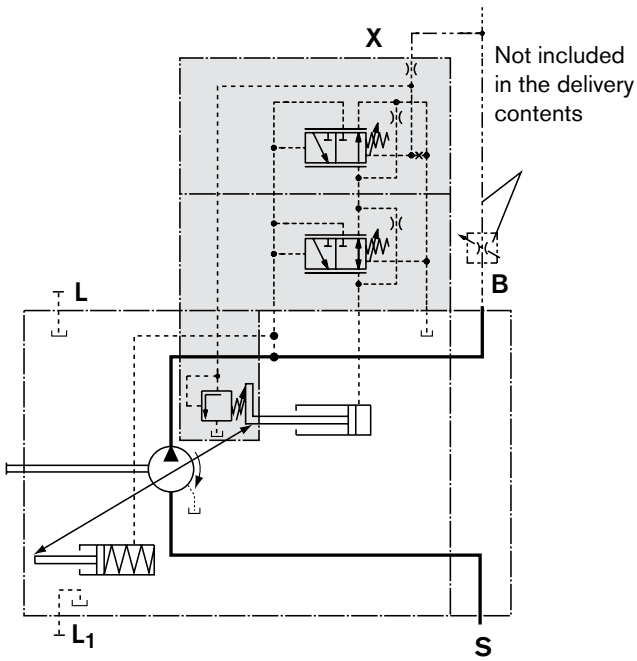
Control data

For pressure control DR data, see page 11.
For flow control FR data, see page 13.

Circuit diagram, sizes 28 to 100



Circuit diagram, size 140



ED – Electro-hydraulic pressure control

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

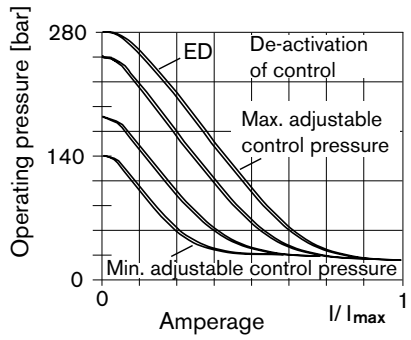
If there is a change at the consumer (load pressure), the position of the control piston changes.

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.

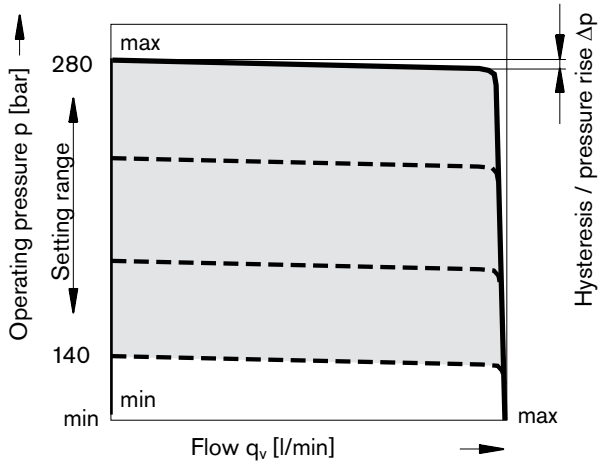
When the solenoid current signal drops towards a zero value, the maximum output pressure is limited to p_{max} by an adjustable hydraulic pressure cut-off (secure fail safe function in case of a loss of power e.g. for use as fan drives).
The response time characteristic of the ED-control was optimized for the use as a fan drive system.
When ordering, state the type of application in clear text.

Static current-pressure characteristic ED
(measured at pump in zero stroke – negative characteristic)



Hysteresis of the static current-pressure characteristic < 3 bar

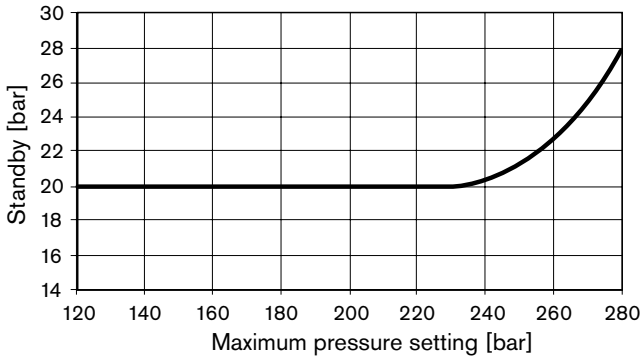
Static flow-pressure characteristic
(at n= 1500 rpm; t_{fluid} = 50 °C)



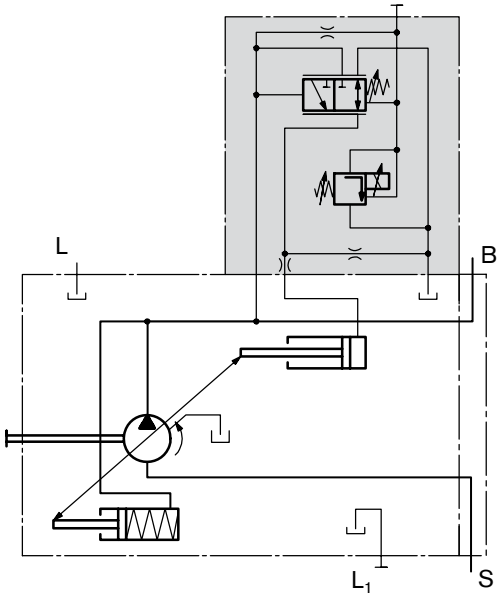
Control data
Standby standard settings (see diagram at right), other values on request.

Hysteresis and pressure increase _____ Δp < 4 bar
Control fluid consumption_____ 3 to 4.5 l/min.

Influence of pressure setting on standby level



Circuit diagram ED..



	Port for
B	Service line
S	Suction line
L, L1	Case drain (L_1 plugged)

Technical data, solenoid	ED71	ED72
Voltage	12 V (±20 %)	24 V (±20 %)
Control current		
Start of control at $V_{g\,min}$	100 mA	50 mA
End of control at $V_{g\,max}$	1200 mA	600 mA
Limiting current	1.54 A	0.77 A
Nominal resistance (at 20 °C)	5.5 Ω	22.7 Ω
Dither frequency	100 to 200 Hz	100 to 200 Hz
Actuated time	100 %	100 %

For type of protection, see plug design on page 47
For details on the control electronics, see page 16

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

ER – Electro-hydraulic pressure control

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

If there is a change at the consumer (load pressure), the position of the control piston changes.

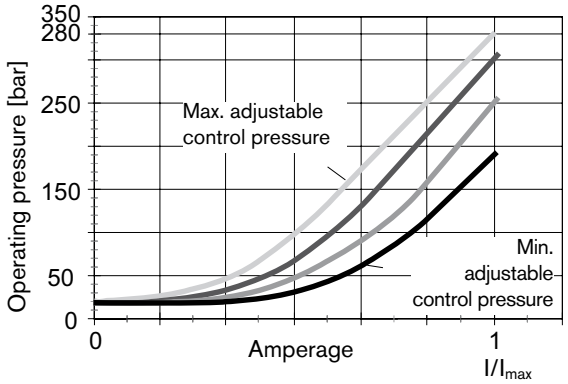
This causes an increase or decrease in the pump swivel angle (flow) in order to maintain the electrically set pressure level.

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 to zero, the pressure is limited to p_{min} (stand-by).

Observe the project planning note on page 2.

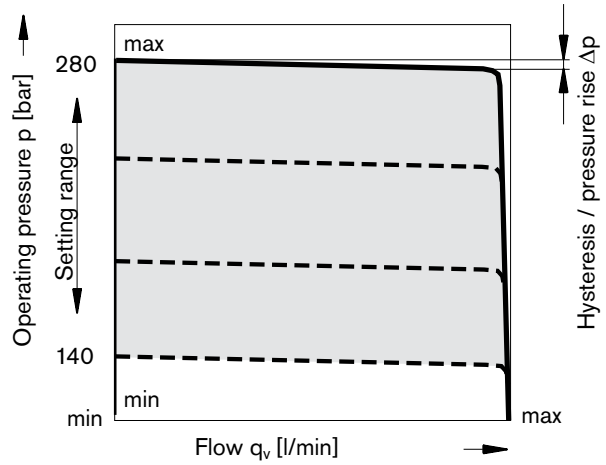
Static current-pressure characteristic ER
(measured at pump in zero stroke – positive characteristic)



Hysteresis of the static current-pressure characteristic < 3 bar

Influence of pressure setting on stand-by ±2 bar

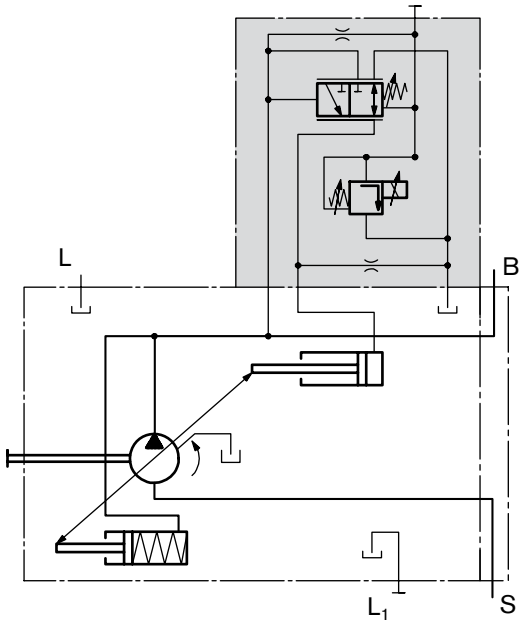
Static flow-pressure characteristic
(at n= 1500 rpm; t_{fluid} = 50 °C)



Control data
Standby standard setting 20 bar, other values on request.

Hysteresis and pressure increase _____ Δp < 4 bar
Control fluid consumption_____ 3 to 4.5 l/min.

Circuit diagram ER..



	Port for
B	Service line
S	Suction line
L, L1	Case drain (L_1 plugged)

Technical data, solenoid	ED71	ED72
Voltage	12 V (±20 %)	24 V (±20 %)
Control current		
Start of control at $V_{g\,min}$	100 mA	50 mA
End of control at $V_{g\,max}$	1200 mA	600 mA
Limiting current	1.54 A	0.77 A
Nominal resistance (at 20 °C)	5.5 Ω	22.7 Ω
Dither frequency	100 to 200 Hz	100 to 200 Hz
Actuated time	100 %	100 %
For type of protection, see plug design on page 47		

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

The following electric controllers and amplifiers are available for controlling the proportional solenoids:

Analog amplifier RA	RE 95230
Digital controller RC2-2/21[1)]	RE 95201
Analog amplifier VT2000[2)]	RE 29904
Analog amplifier VT 11029/11030[2)]	RE 29741

1) Power outlets for 2 valves, can be actuated separately
2) Only 24V nominal voltage

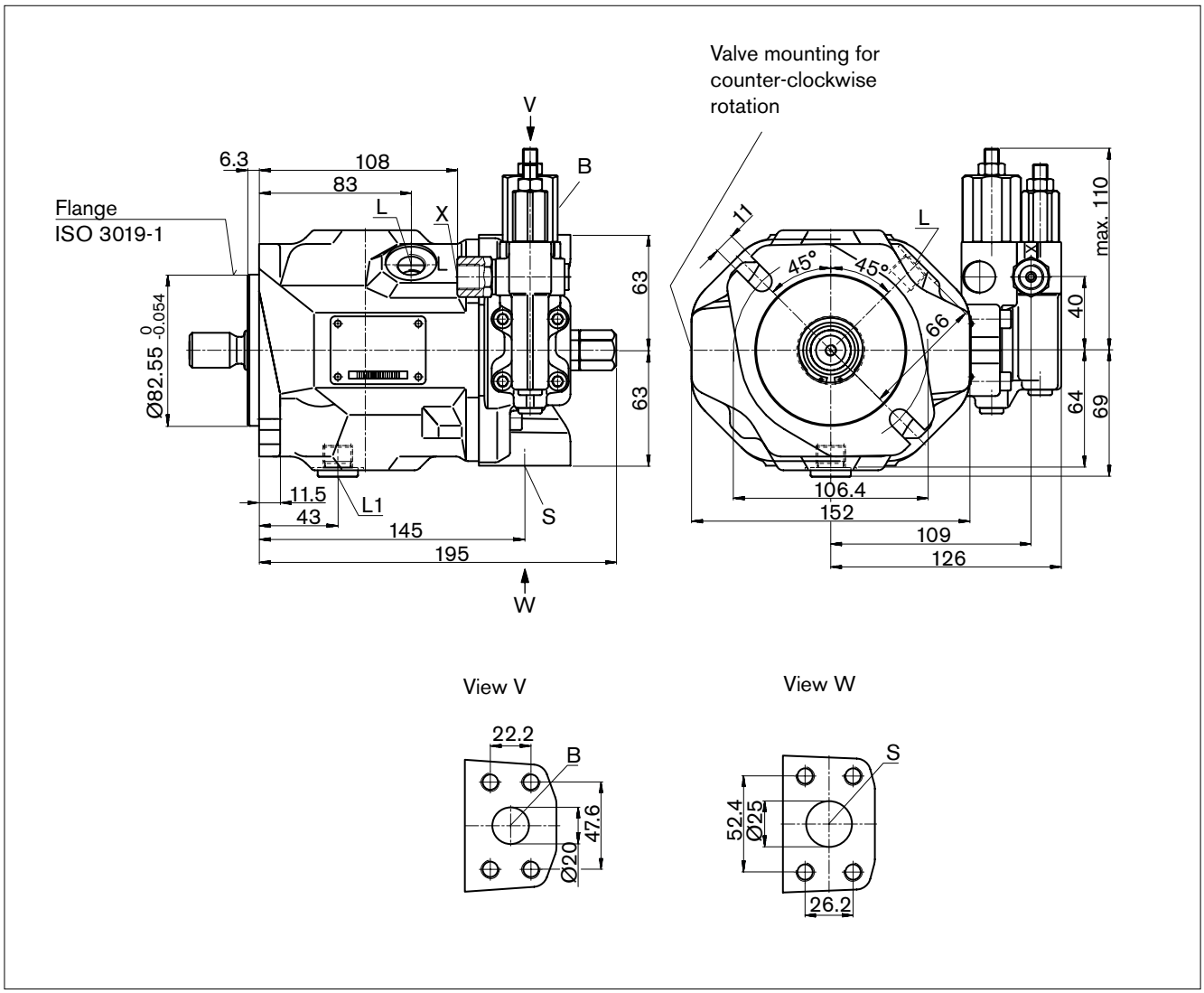
Notes

Dimensions size 18

Before finalizing your design request a certified installation drawing. Dimensions in mm.

DFR, DFR1 – Pressure and flow control, hydraulic

Clockwise rotation



Ports

Designation	Port for	Standard	Size[1)]	Maximum pressure [bar][2)]	State
B	Service line, fastening thread	SAE J518[3)] DIN 13	3/4 in M10 x 1.5; 17 deep[6)]	350	O
S	Suction line, fastening thread	SAE J5183[)] DIN 13	1 in M10 x 1.5; 17 deep[6)]	10	O
L	Case drain fluid	DIN 3852[4)]	M16 x 1.5; 12 deep	2	O[5)]
L_1	Case drain fluid	DIN 3852[4)]	M16 x 1.5; 12 deep	2	X[5)]
X	Pilot pressure	DIN 3852[4)]	M14 x 1.5; 12 deep	350	O
X	Pilot pressure with DG-control	DIN ISO 228[4)]	G 1/4 in; 12 deep	350	O

1) For the maximum tightening torques the general instructions on page 52 must be observed.
2) Depending on the application, short-term pressure spikes can occur. Consider this when selecting measuring equipment and fittings. Pressure values in bar absolute
3) Only dimensions according to SAE J518, metric fastening thread deviating from the standard
4) The spot face can be deeper than as specified in the standard
5) Depending on the installation position, L or L_1 must be connected (see also installation instructions on pages 48, 49)
6) For version with UNC fastening thread, see RA-A 92701

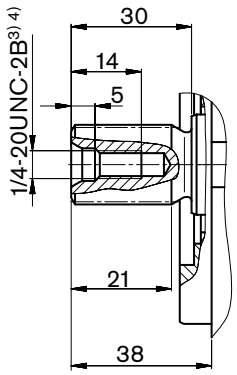
O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

Dimensions size 18

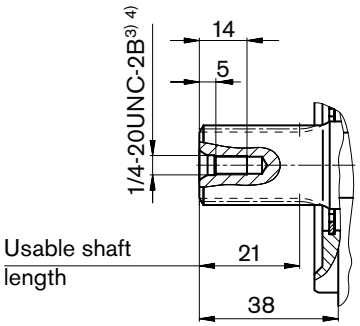
Before finalizing your design request a certified installation drawing. Dimensions in mm.

Drive shaft

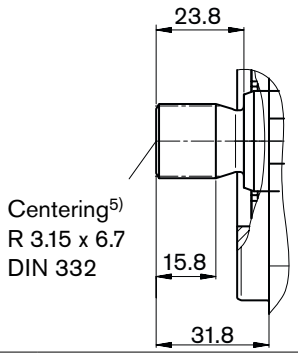
S Splined shaft 3/4 in
11T 16/32DP[1] (SAE J744)



R Splined shaft 3/4 in
11T 16/32DP[1)2)] (SAE J744)



U Splined shaft 5/8 in
9T 16/32DP[1)2)] (SAE J744)



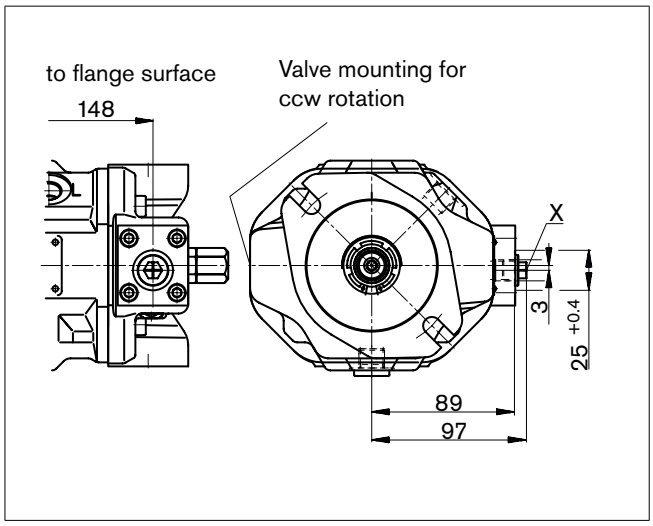
1) ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Splines according to ANSI B92.1a, run out of spline is a deviation from standard
3) Thread according to ASME B1.1
4) For the maximum tightening torques the general instructions on page 52 must be observed
5) Coupling axially secured, e.g. with a clamp coupling or radially mounted clamping screw

Dimensions size 18

Before finalizing your design request a certified installation drawing. Dimensions in mm.

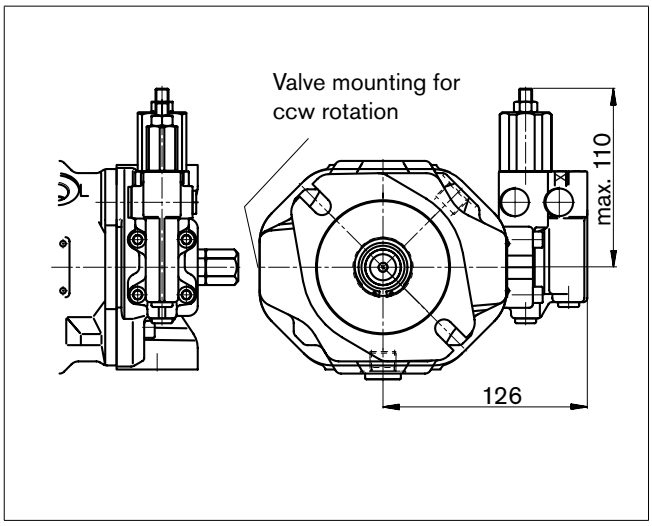
DG

Two-point control, directly operated



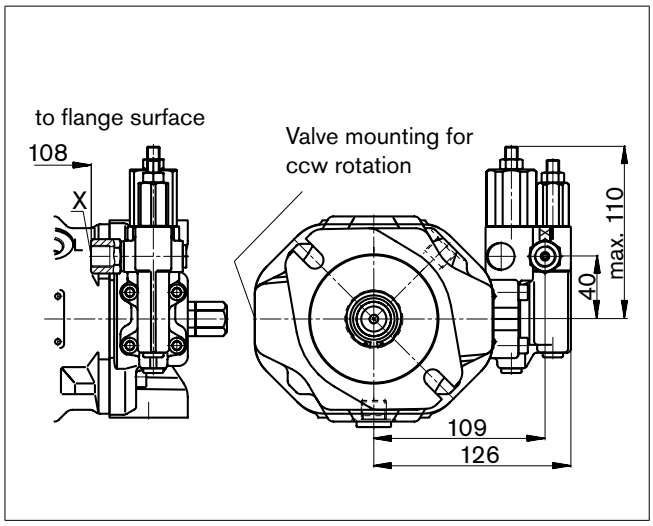
DR

Pressure control



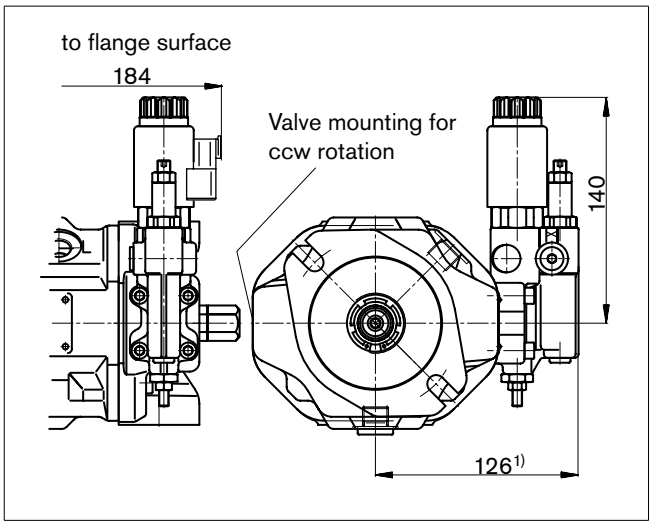
DRG

Pressure control, remotely operated



ED7., ER7.

Electro-hydraulic pressure control



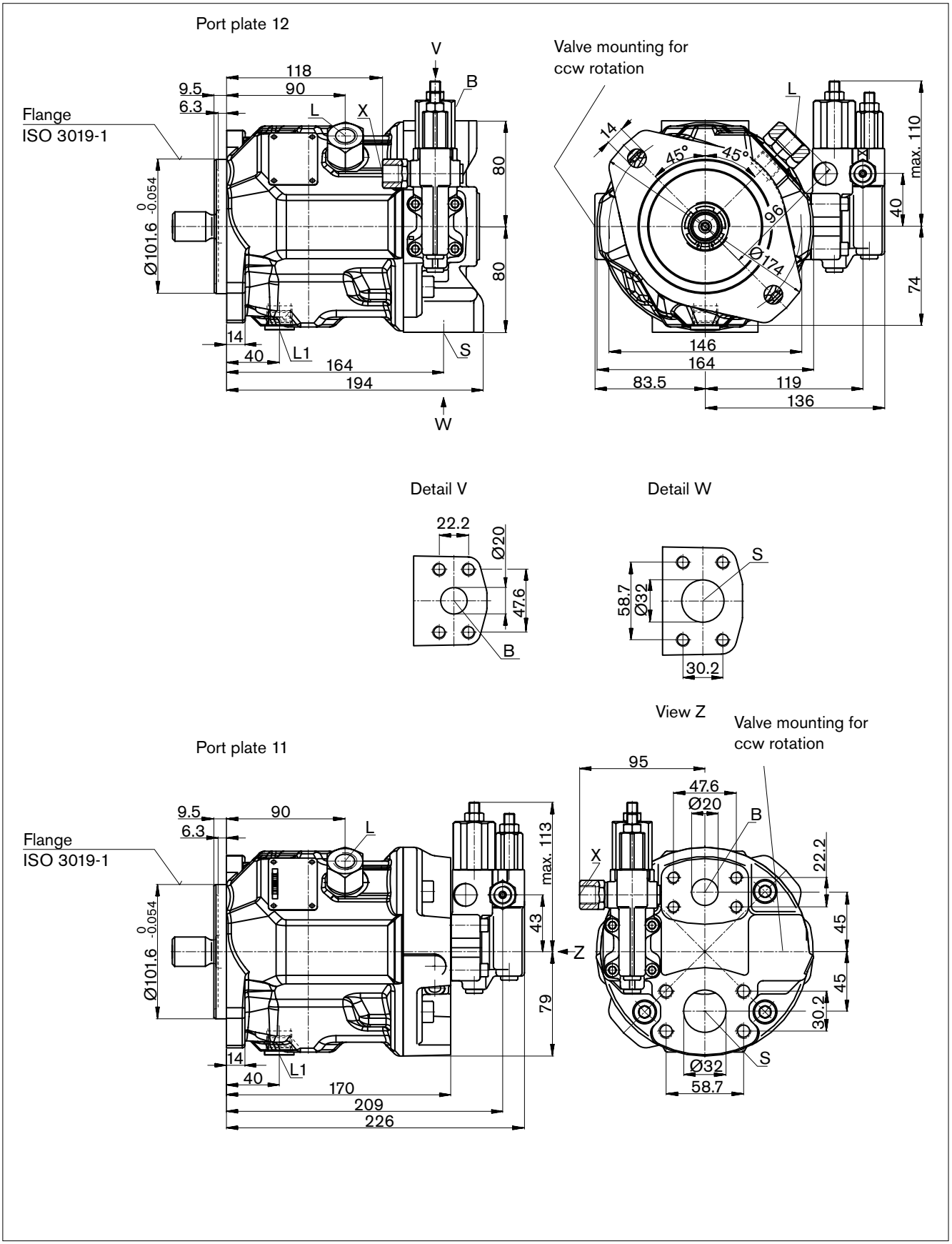
1) ER7.: 161 mm if using a sandwich plate pressure reducing valve.

Dimensions size 28

Before finalizing your design request a certified installation drawing. Dimensions in mm.

DFR/DFR1 – Pressure and flow control, hydraulic

Clockwise rotation



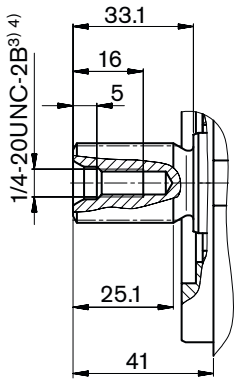
Details on connection options and shaft ends can be found on page 22

Dimensions size 28

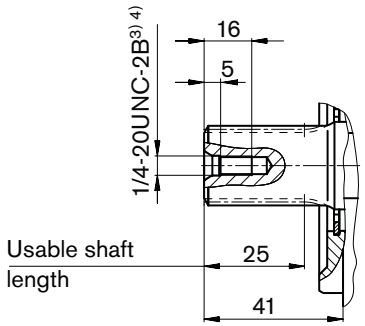
Before finalizing your design request a certified installation drawing. Dimensions in mm.

Drive shaft

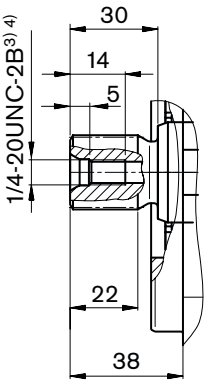
S Splined shaft 7/8 in
13T 16/32DP[1] (SAE J744)



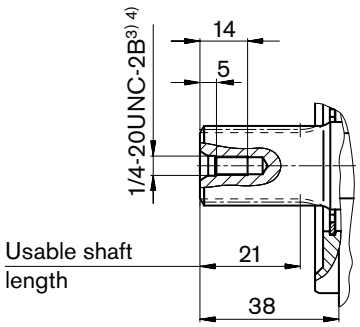
R Splined shaft 7/8 in
13T 16/32DP[1][2] (SAE J744)



U Splined shaft 3/4 in
11T 16/32DP[1] (SAE J744)



W Splined shaft 3/4 in
11T 16/32DP[1][2] (SAE J744)



1) ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Spline according to ANSI B92.1a, run out of spline is a deviation from standard.
3) Thread according to ASME B1.1
4) For the maximum tightening torques the general instructions on page 52 must be observed.

Ports

Designation	Port for	Standard	Size[5]	Maximum pressure [bar][6]	State
B	Service line, fastening thread	SAE J518[7] DIN 13	3/4 in M10 x 1.5; 17 deep[10]	350	O
S	Suction line, fastening thread	SAE J518[7] DIN 13	1 1/4 in M10 x 1.5; 17 deep[10]	10	O
L	Case drain fluid	DIN 3852[8]	M18 x 1.5; 12 deep	2	O[9]
L_1	Case drain fluid	ISO 11926[8]	3/4-16 UNF-2B; 14 deep	2	X[9]
X	Pilot pressure	DIN 3852[8]	M14 x 1.5; 12 deep	350	O
X	Pilot pressure with DG-control	DIN ISO 228[8]	G 1/4in; 12 deep	350	O

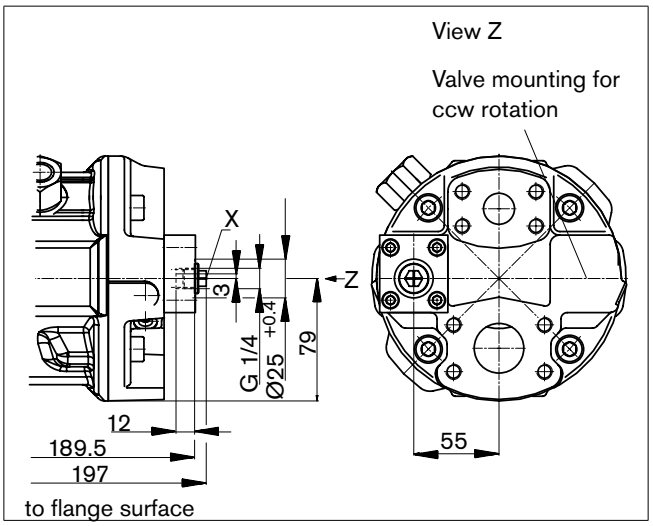
5) For the maximum tightening torques the general instructions on page 52 must be observed.
6) Depending on the application, short-term pressure spikes can occur. Consider this when selecting measuring equipment and fittings. Pressure values in bar absolute.
7) Only dimensions according to SAE J518, metric fastening thread deviating from the standard.
8) The spot face can be deeper than as specified in the standard.
9) Depending on the installation position, L or L_1 must be connected (see also installation instructions on pages 48, 49)
10) For version with UNC fastening thread, see RA-A 92701
O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

Dimensions size 28

Before finalizing your design request a certified installation drawing. Dimensions in mm.

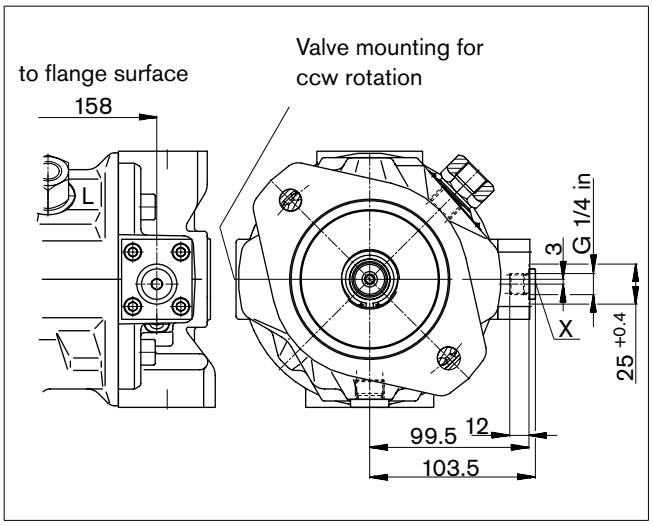
DG

Two-point control, directly operated, **port plate 11**



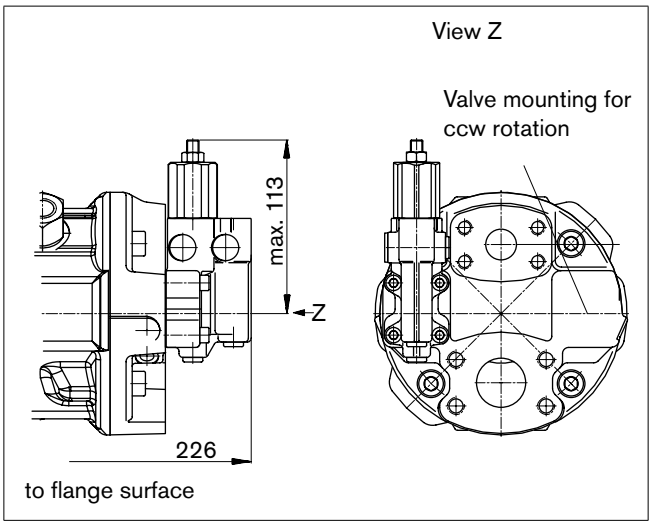
DG

Two-point control, directly operated, **port plate 12**



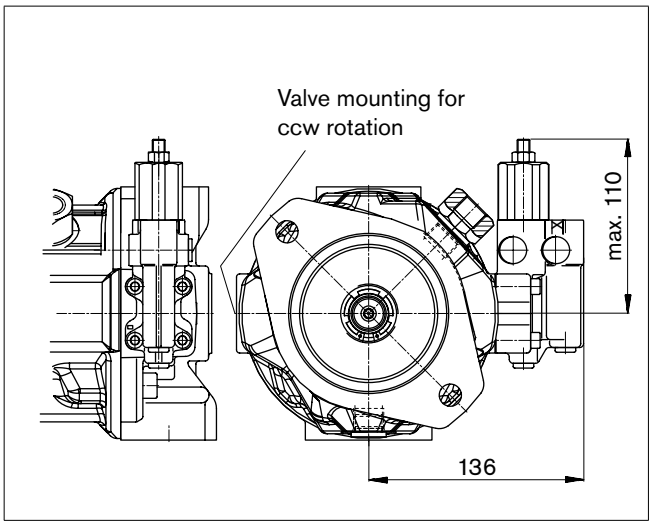
DR

Pressure control, **port plate 11**



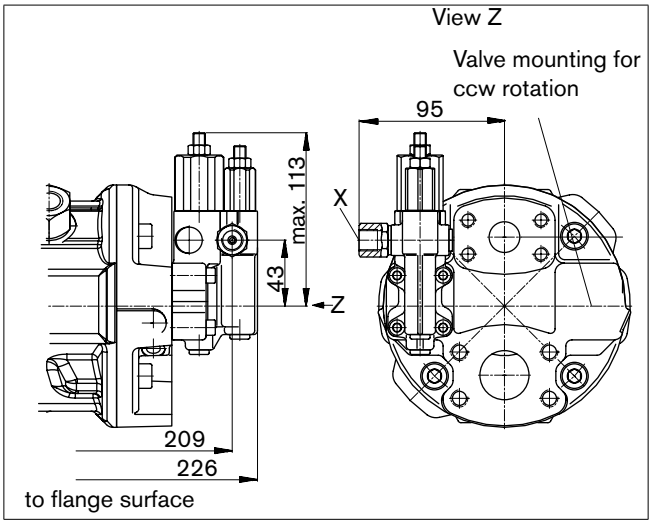
DR

Pressure control, **port plate 12**



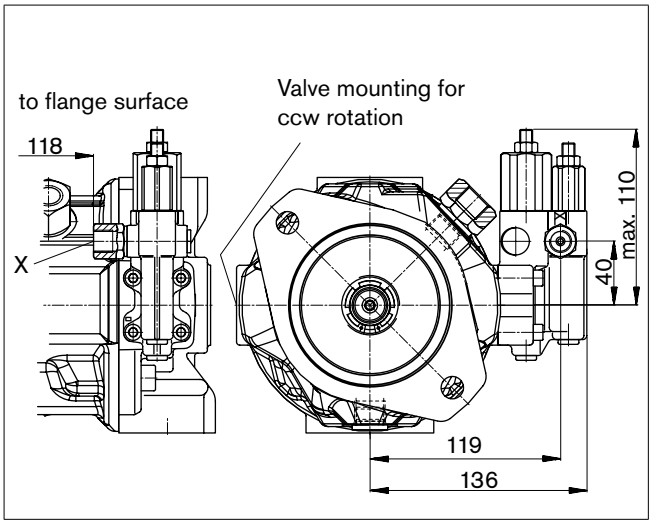
DRG

Pressure control, remotely operated, **port plate 11**



DRG

Pressure control, remotely operated, **port plate 12**



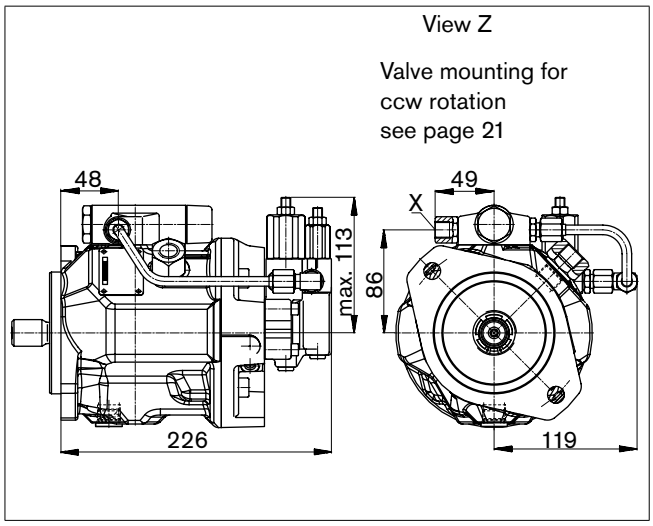
For details of connection options and drive shafts, see also pages 21 and 22

Dimensions size 28

Before finalizing your design request a certified installation drawing. Dimensions in mm.

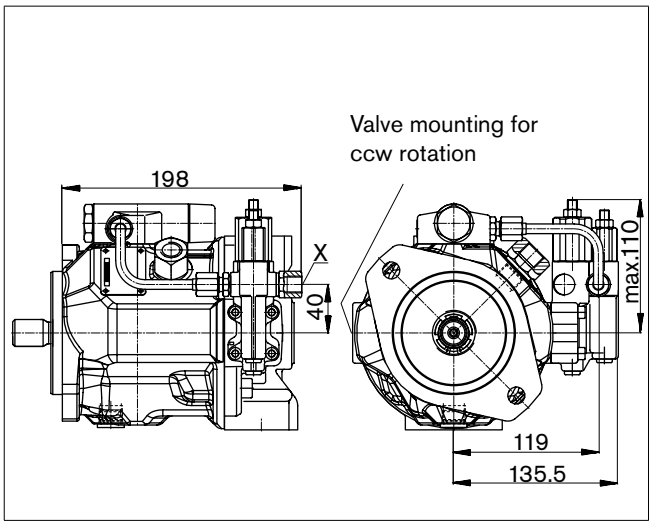
DFLR

Pressure, flow and power control, **port plate 11**



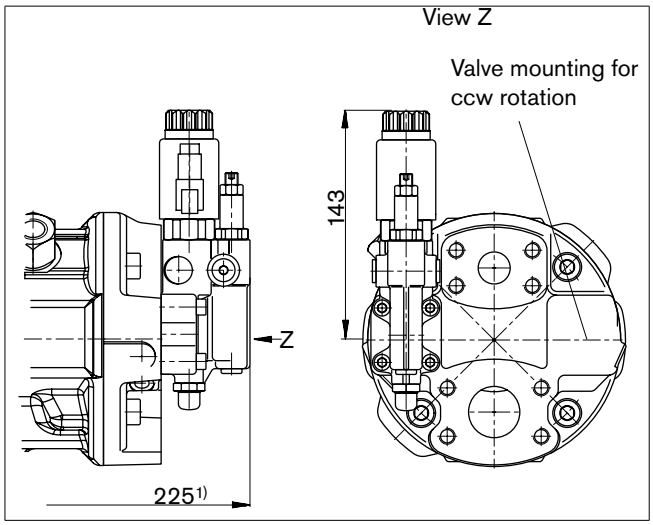
DFLR

Pressure, flow and power control, **port plate 12**



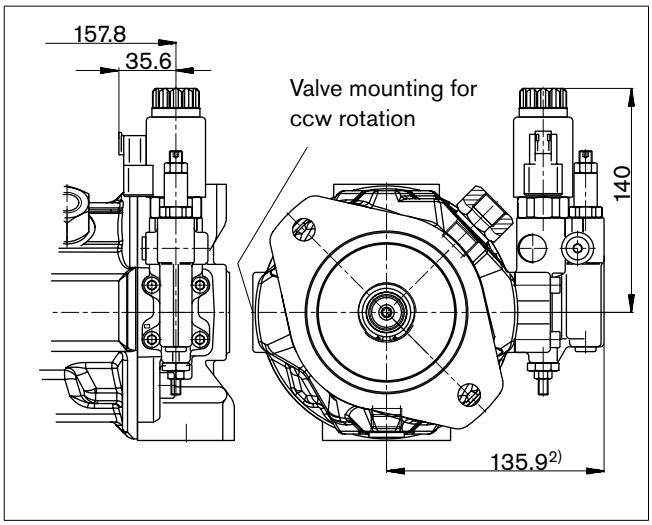
ED7. / ER7.

Electro-hydraulic pressure control, **port plate 11**



ED7. / ER7.

Electro-hydraulic pressure control, **port plate 12**



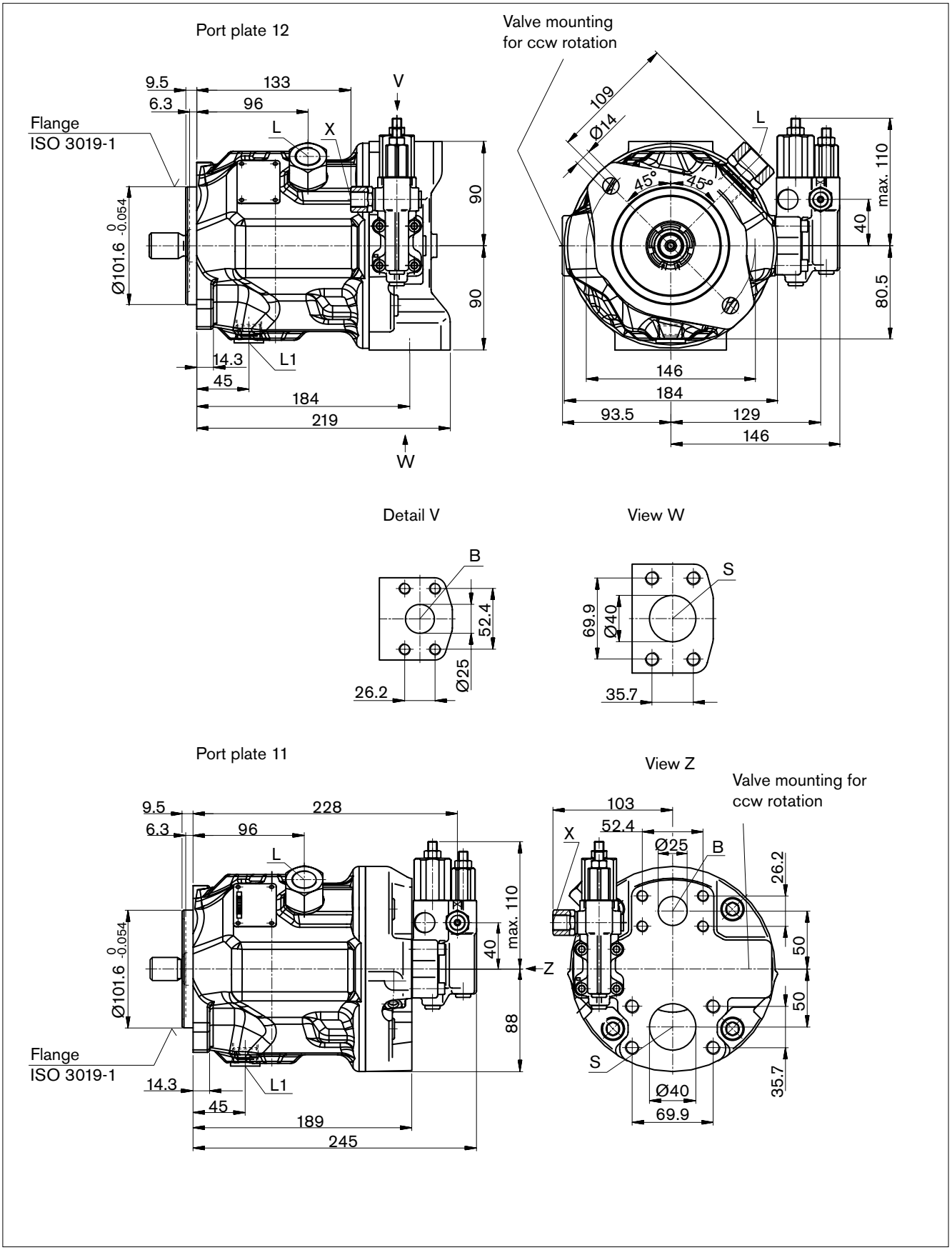
1) ER7.: 260 mm when using a sandwich plate pressure reducing valve.
2) ER7.: 170.9 mm when using a sandwich plate pressure reducing valve.
For details of connection options and drive shafts, see also pages 21 and 22

Dimensions size 45

Before finalizing your design request a certified installation drawing. Dimensions in mm.

DFR/DFR1 – Pressure and flow control, hydraulic

Clockwise rotation



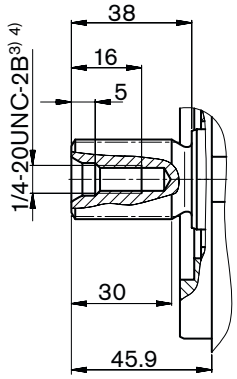
Details on connection options and shaft ends can be found on page 26

Dimensions size 45

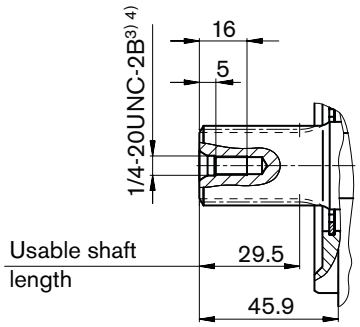
Before finalizing your design request a certified installation drawing. Dimensions in mm.

Drive shaft

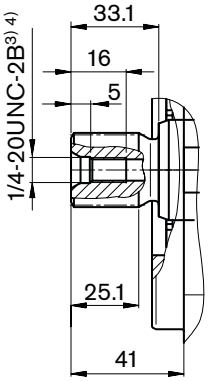
S Splined shaft 1 in
15T 16/32DP[1] (SAE J744)



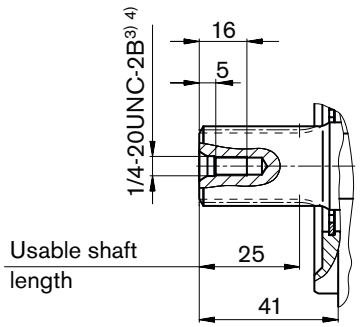
R Splined shaft 1 in
15T 16/32DP[1][2] (SAE J744)



U Splined shaft 7/8 in
13T 16/32DP[1] (SAE J744)



W Splined shaft 7/8 in
13T 16/32DP[1][2] (SAE J744)



1) ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Spline according to ANSI B92.1a, run out of spline is a deviation from standard.
3) Thread according to ASME B1.1
4) For the maximum tightening torques the general instructions on page 52 must be observed.

Ports

Designation	Port for	Standard	Size[5]	Maximum pressure [bar][6]	State
B	Service line, fastening thread	SAE J518[7] DIN 13	1 in M10 x 1.5; 17 deep[10]	350	O
S	Suction line, fastening thread	SAE J518[7] DIN 13	1 1/2 in M12 x 1.75; 20 deep[10]	10	O
L	Case drain fluid	DIN 3852[8]	M22 x 1.5; 14 deep	2	O[9]
L_1	Case drain fluid	ISO 11926[8]	7/8-14 UNF-2B; 16 deep	2	X[9]
X	Pilot pressure	DIN 3852[8]	M14 x 1.5; 12 deep	350	O
X	Pilot pressure with DG-control	DIN ISO 228[8]	G 1/4 in; 12 deep	350	O

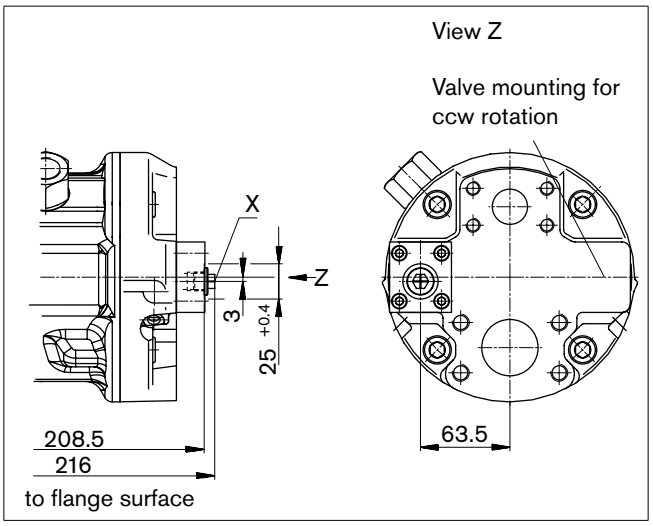
5) For the maximum tightening torques the general instructions on page 52 must be observed.
6) Depending on the application, short-term pressure spikes can occur. Consider this when selecting measuring equipment and fittings. Pressure values in bar absolute.
7) Only dimensions according to SAE J518, metric fastening thread deviating from the standard.
8) The spot face can be deeper than as specified in the standard.
9) Depending on the installation position, L or L_1 must be connected (see also installation instructions on pages 48, 49)
10) For version with UNC fastening thread, see RA-A 92701
O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

Dimensions size 45

Before finalizing your design request a certified installation drawing. Dimensions in mm.

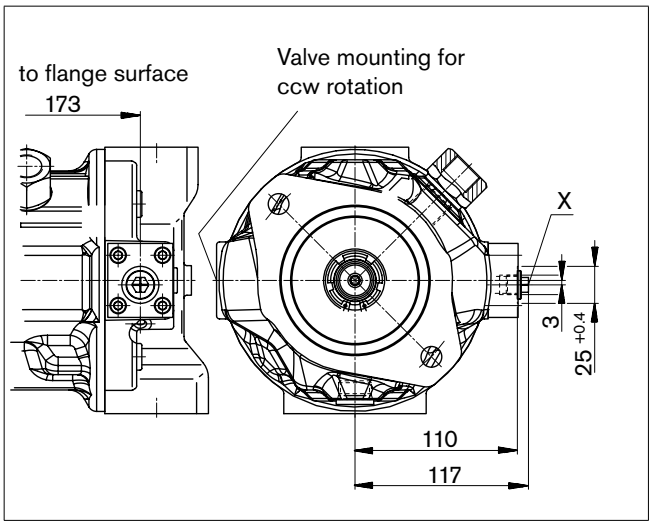
DG

Two-point control, directly operated, **port plate 11**



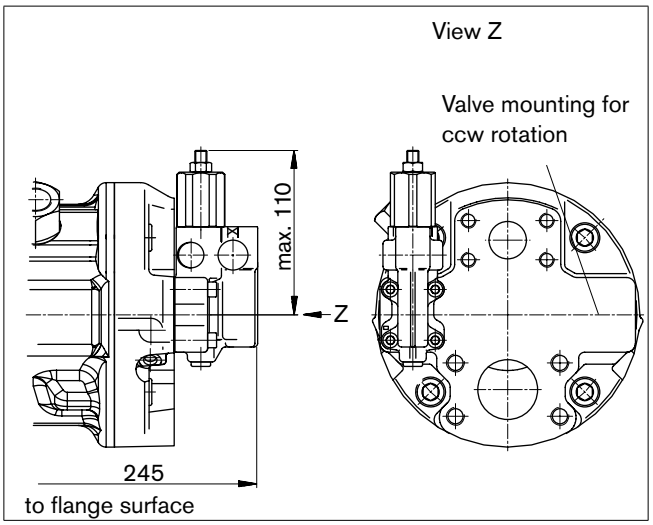
DG

Two-point control, directly operated, **port plate 12**



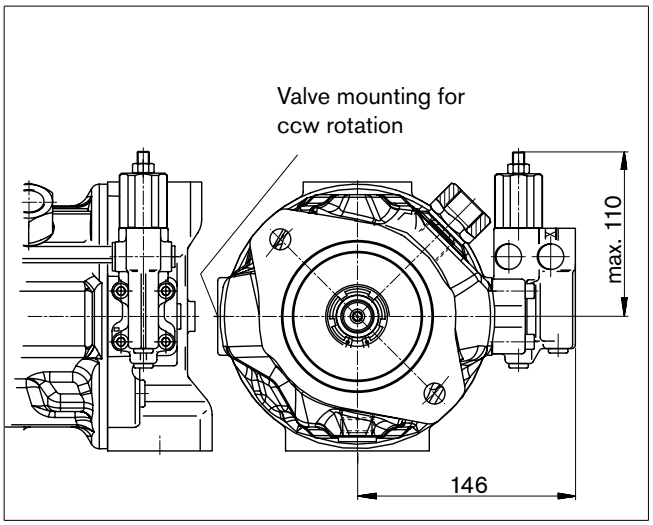
DR

Pressure control, **port plate 11**



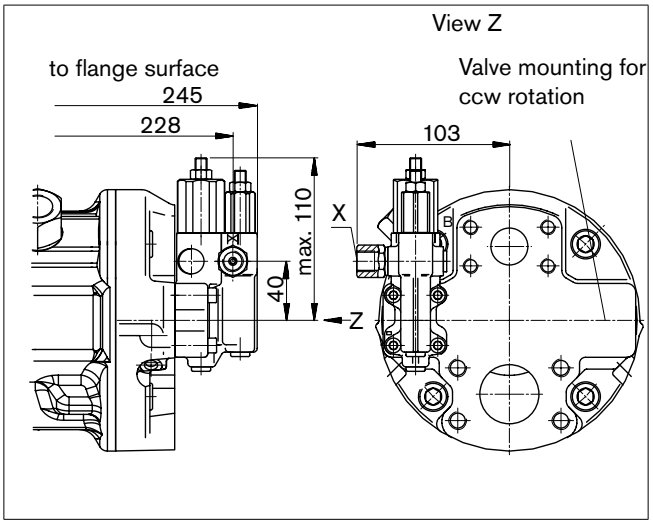
DR

Pressure control, **port plate 12**



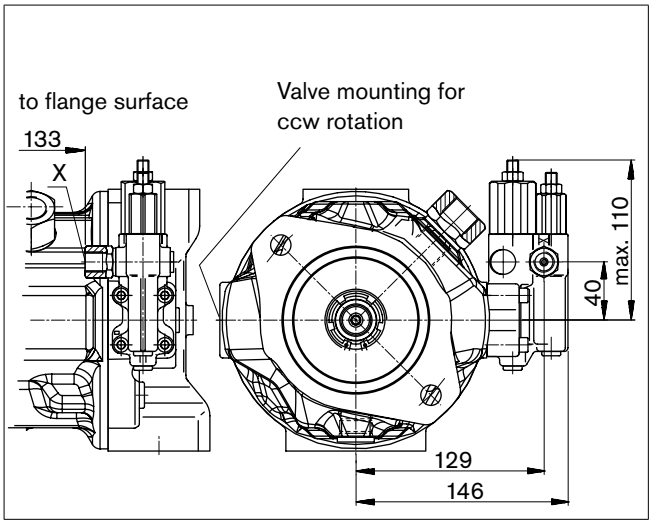
DRG

Pressure control, remotely operated, **port plate 11**



DRG

Pressure control, remotely operated, **port plate 12**



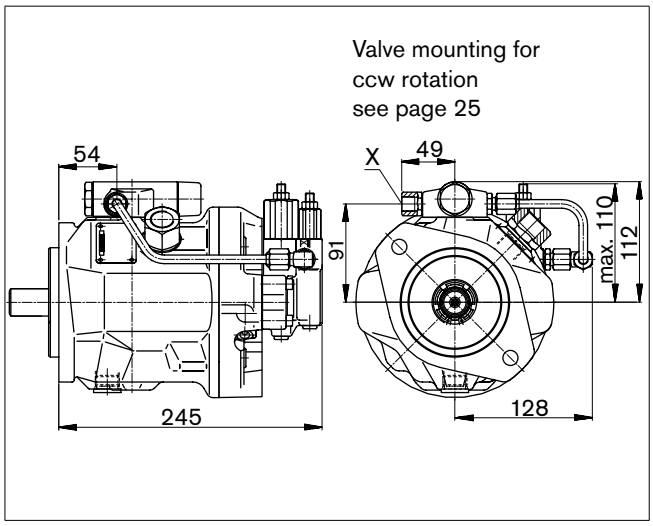
For details of connection options and drive shafts, see pages 25 and 26

Dimensions size 45

Before finalizing your design request a certified installation drawing. Dimensions in mm.

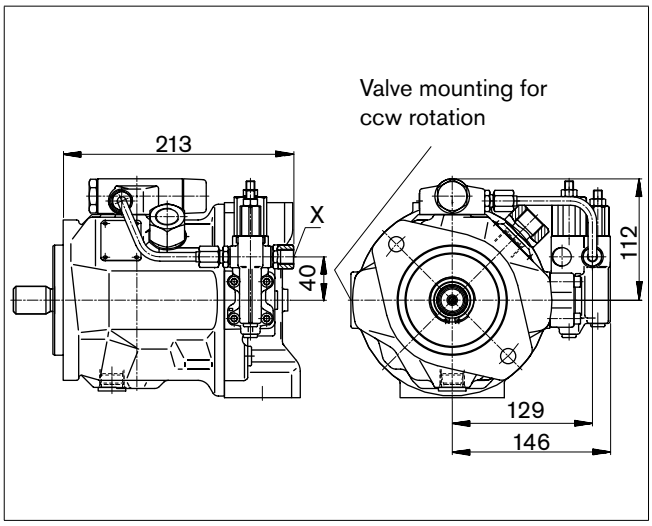
DFLR

Pressure, flow and power control, **port plate 11**



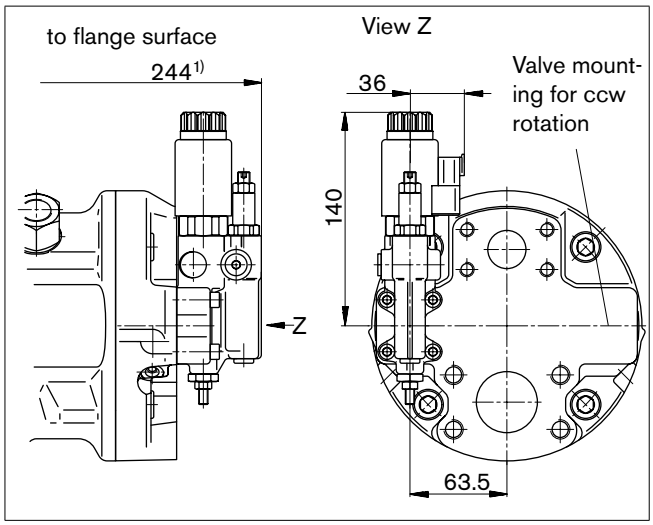
DFLR

Pressure, flow and power control, **port plate 12**



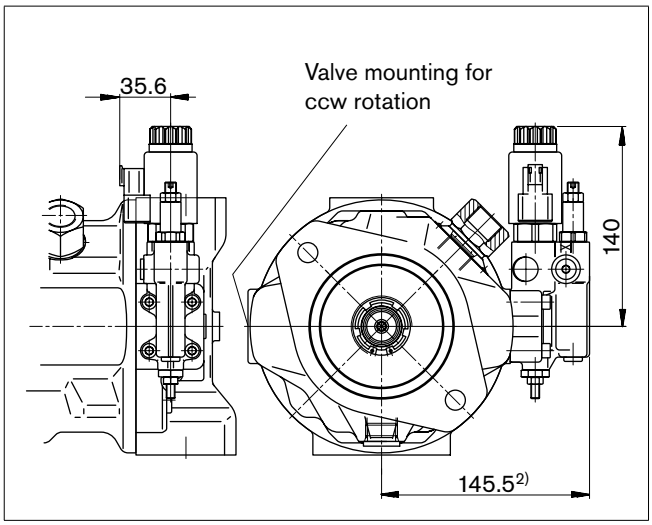
ED7. / ER7.

Electro-hydraulic pressure control, **port plate 11**



ED7. / ER7.

Electro-hydraulic pressure control, **port plate 12**



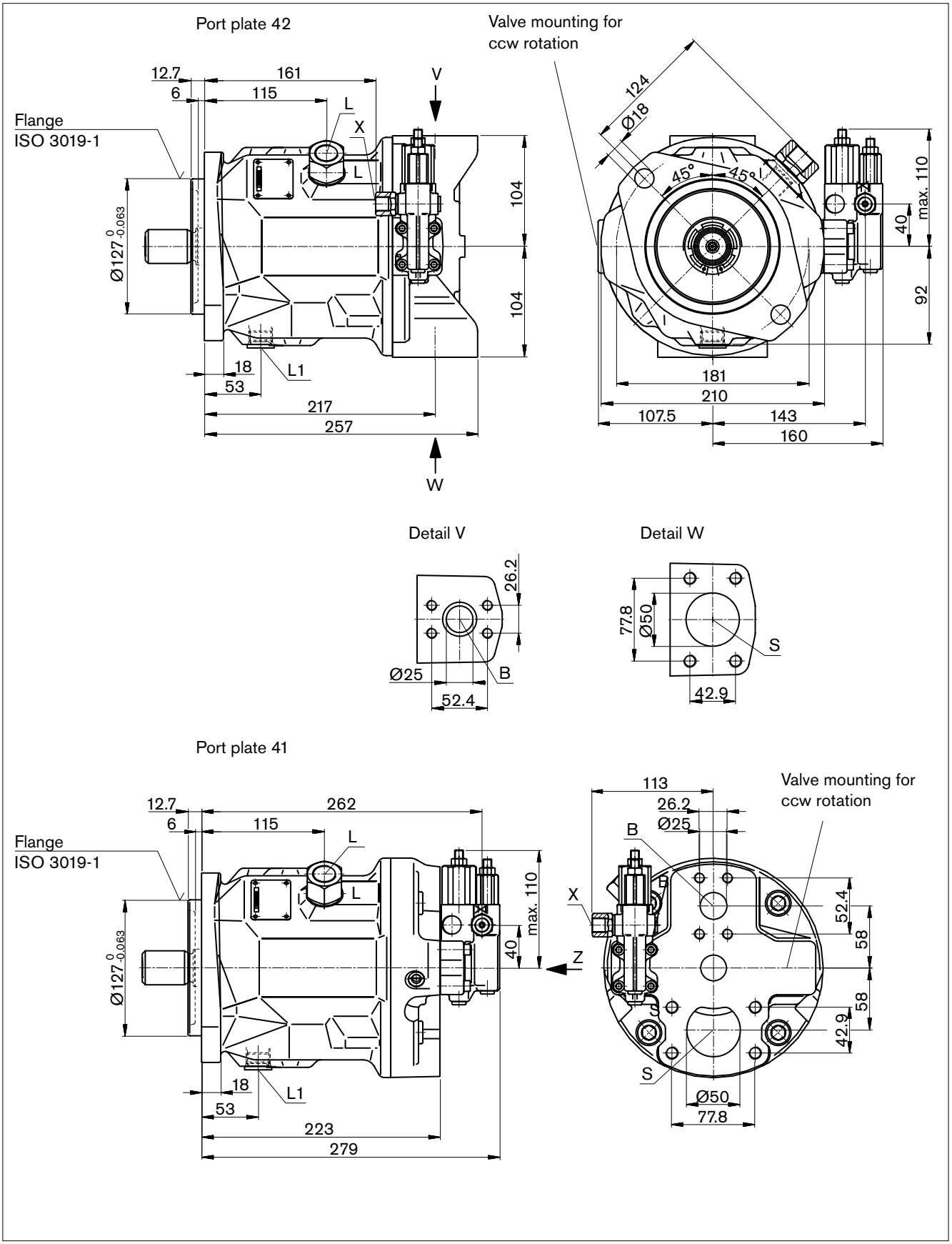
1) ER7.: 279 mm when using a sandwich plate pressure reducing valve
2) ER7.: 180.5 mm when using a sandwich plate pressure reducing valve.
For details of connection options and drive shafts, see also pages 21 and 22

Dimensions size 71

Before finalizing your design request a certified installation drawing. Dimensions in mm.

DFR/DFR1 – Pressure and flow control, hydraulic

Clockwise rotation



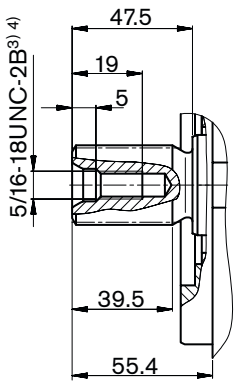
Details on connection options and shaft ends can be found on page 30

Dimensions size 71

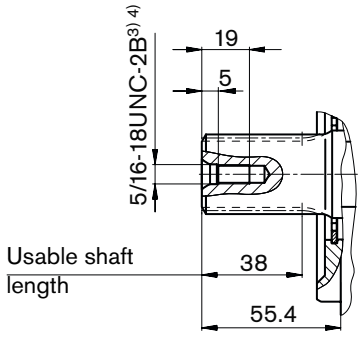
Before finalizing your design request a certified installation drawing. Dimensions in mm.

Drive shaft

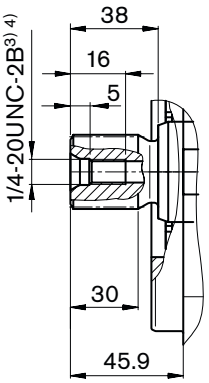
S Splined shaft 1 1/4 in
14T 12/24DP[1] (SAE J744)



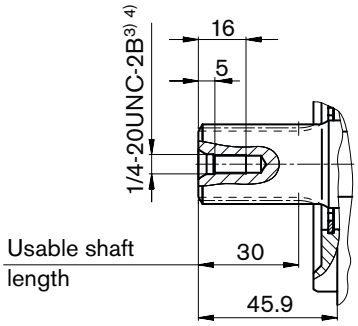
R Splined shaft 1 1/4 in
14T 12/24DP[1][2] (SAE J744)



U Splined shaft 1 in
15T 16/32DP[1] (SAE J744)



W Splined shaft 1 in
15T 16/32DP[1][2] (SAE J744)



1) ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Spline according to ANSI B92.1a, run out of spline is a deviation from standard.
3) Thread according to ASME B1.1
4) For the maximum tightening torques the general instructions on page 52 must be observed.

Ports

Designation	Port for	Standard	Size[5]	Maximum pressure [bar][6]	State
B	Service line, fastening thread	SAE J518[7] DIN 13	1 in M10 x 1.5; 17 deep[10]	350	O
S	Suction line, fastening thread	SAE J518[7] DIN 13	2 in M12 x 1.75; 20 deep[10]	10	O
L	Case drain fluid	DIN 3852[8]	M22 x 1.5; 14 deep	2	O[9]
L_1	Case drain fluid	ISO 11926[8]	7/8-14 UNF-2B; 16 deep	2	X[9]
X	Pilot pressure	DIN 3852[8]	M14 x 1.5; 12 deep	350	O
X	Pilot pressure with DG-control	DIN ISO 228[8]	G 1/4 in; 12 deep	350	O

5) For the maximum tightening torques the general instructions on page 52 must be observed.
6) Depending on the application, short-term pressure spikes can occur. Consider this when selecting measuring equipment and fittings. Pressure values in bar absolute.
7) Only dimensions according to SAE J518, metric fastening thread deviating from the standard.
8) The spot face can be deeper than as specified in the standard.
9) Depending on the installation position, L or L_1 must be connected (see also installation instructions on pages 48, 49)
10) For version with UNC fastening thread, see RA-A 92701.

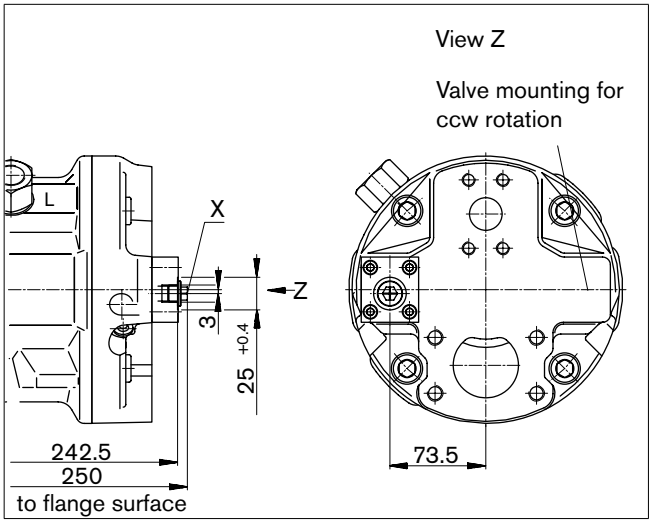
O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

Dimensions size 71

Before finalizing your design request a certified installation drawing. Dimensions in mm.

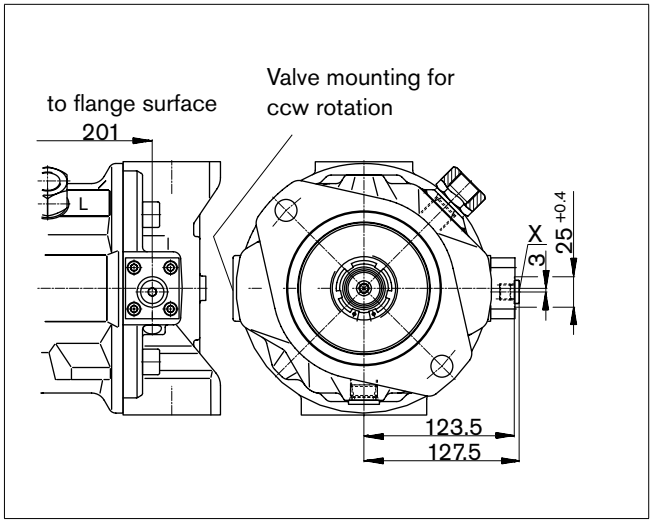
DG

Two-point control, directly operated, **port plate 41**



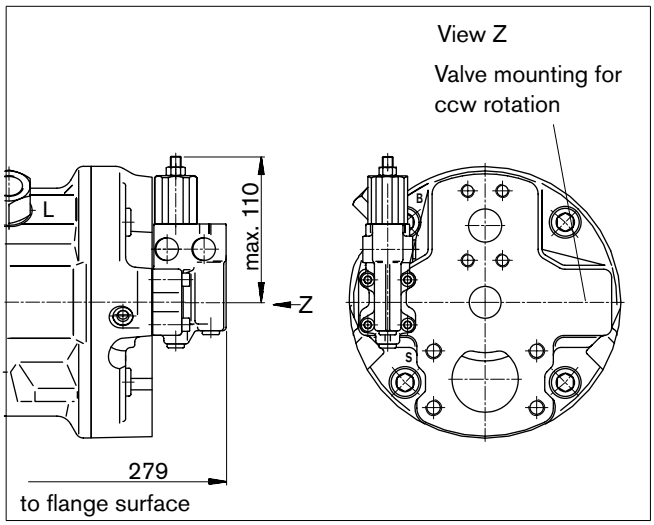
DG

Two-point control, directly operated, **port plate 42**



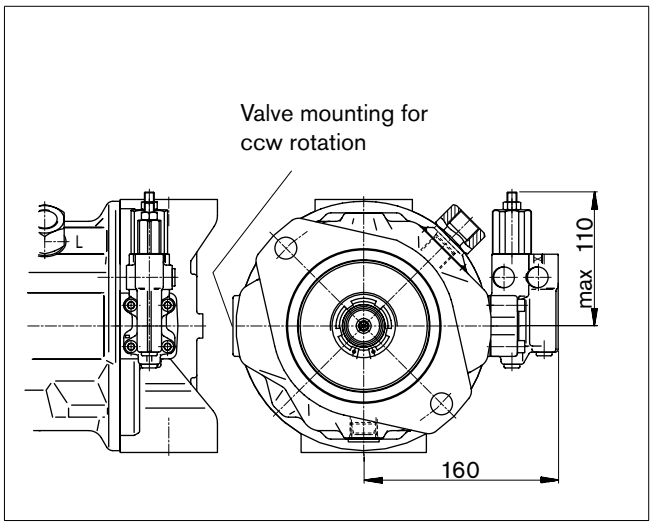
DR

Pressure control, **port plate 41**



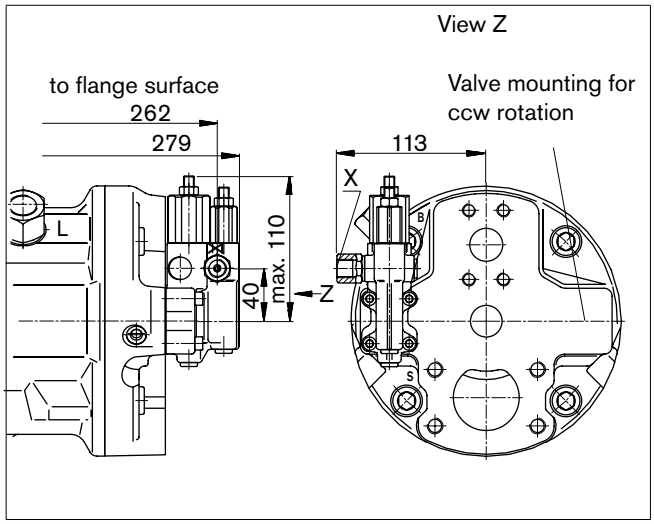
DR

Pressure control, **port plate 42**



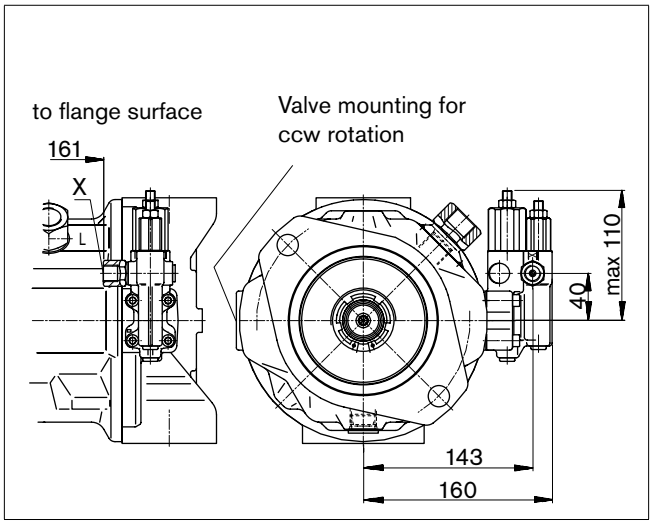
DRG

Pressure control, remotely operated, **port plate 41**



DRG

Pressure control, remotely operated, **port plate 42**



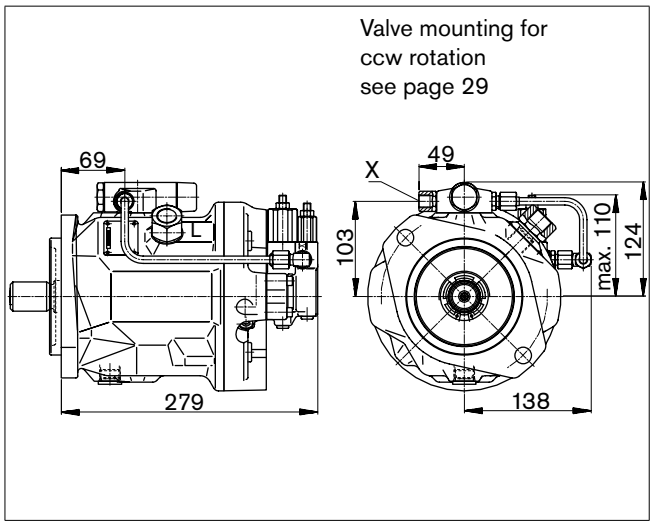
Details on connection options can be found on pages 29 and 30

Dimensions size 71

Before finalizing your design request a certified installation drawing. Dimensions in mm.

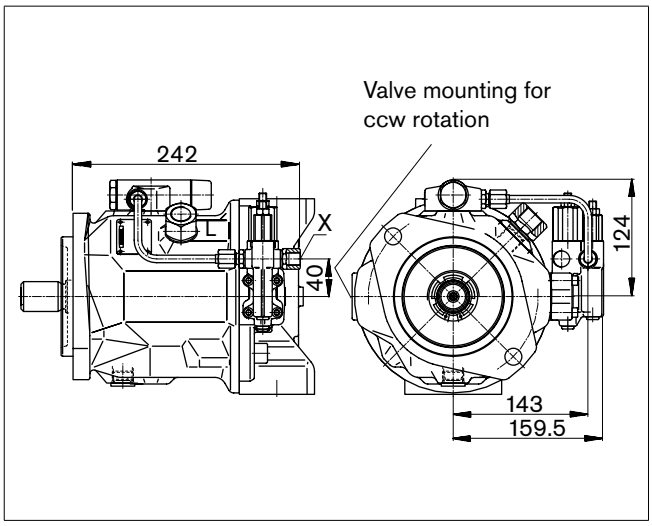
DFLR

Pressure, flow and power control, **port plate 41**



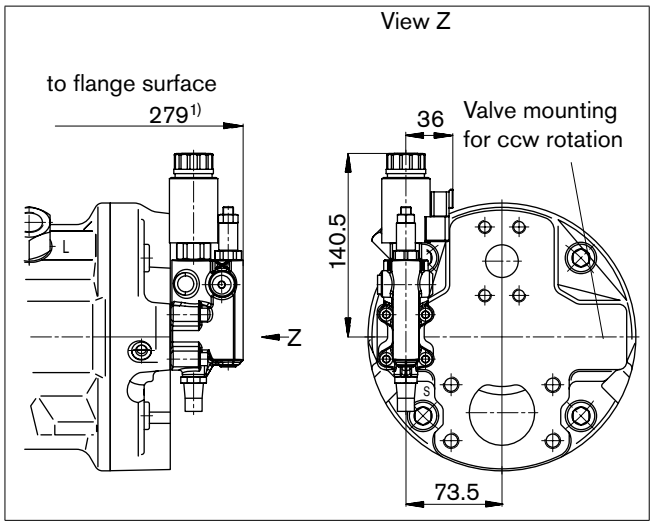
DFLR

Pressure, flow and power control, **port plate 42**



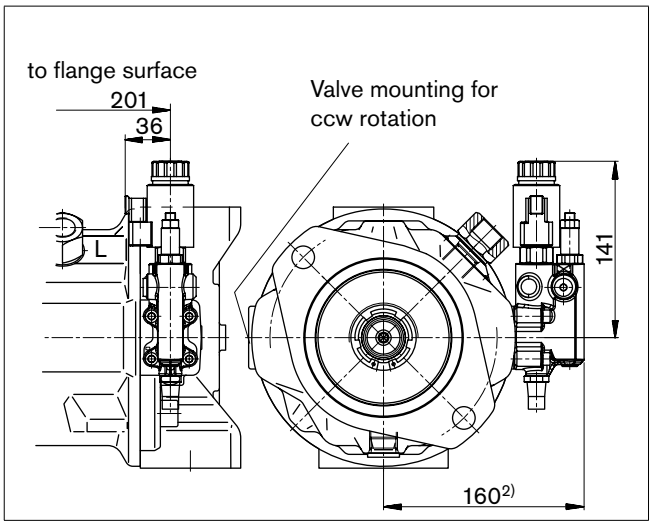
ED7. / ER7.

Electro-hydraulic pressure control, **port plate 41**



ED7. / ER7.

Electro-hydraulic pressure control, **port plate 42**



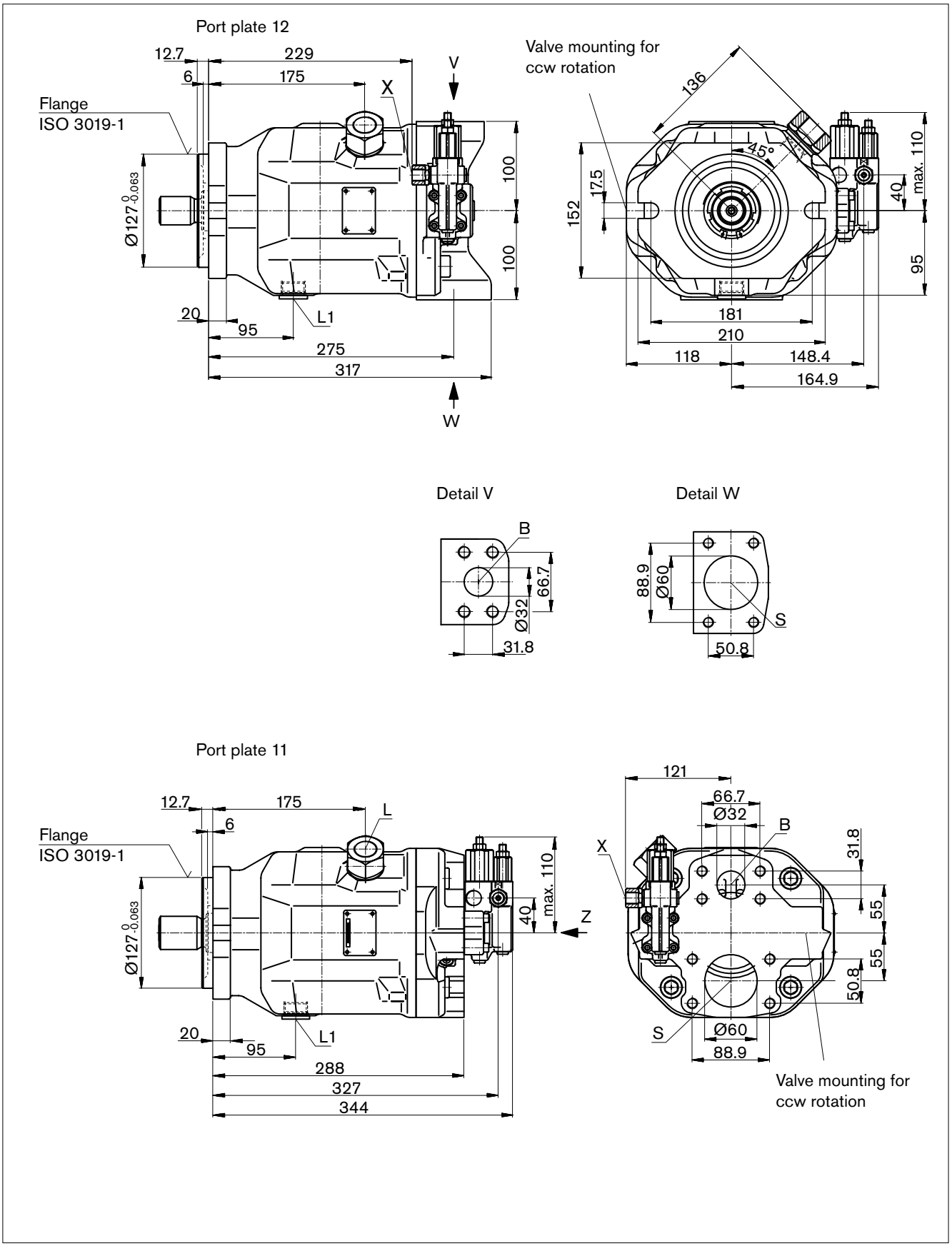
1) ER7.: 314 mm when using a sandwich plate pressure reducing valve.
2) ER7.: 195 mm when using a sandwich plate pressure reducing valve.
For details of connection options and drive shafts, see also pages 21 and 22

Dimensions size 100

Before finalizing your design request a certified installation drawing. Dimensions in mm.

DFR/DFR1 – Pressure and flow control, hydraulic

Clockwise rotation



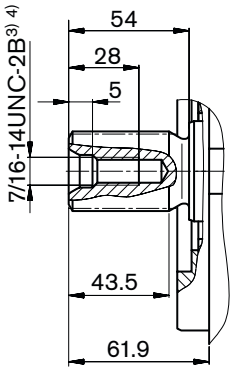
Details on connection options and shaft ends can be found on page 34

Dimensions size 100

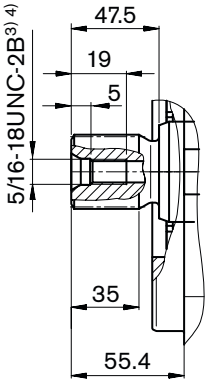
Before finalizing your design request a certified installation drawing. Dimensions in mm.

Drive shaft

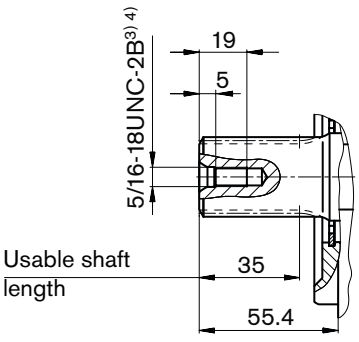
S Splined shaft 1 1/2 in
17T 12/24DP[1] (SAE J744)



U Splined shaft 1 1/4 in
14T 12/24DP[1] (SAE J744)



W Splined shaft 1 1/4 in
14T 12/24DP[1][2] (SAE J744)



1) ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Spline according to ANSI B92.1a, run out of spline is a deviation from standard.
3) Thread according to ASME B1.1
4) For the maximum tightening torques the general instructions on page 52 must be observed.

Ports

Designation	Port for	Standard	Size[5]	Maximum pressure [bar][6]	State
B	Service line, fastening thread	SAE J518[7] DIN 13	1 1/4 in M14 x 2; 19 deep[10]	350	O
S	Suction line, fastening thread	SAE J518[7] DIN 13	2 1/2 in M12 x 1.75; 17 deep[10]	10	O
L	Case drain fluid	DIN 3852[8]	M27 x 2; 16 deep	2	O[9]
L_1	Case drain fluid	ISO 11926[8]	1 1/16-12 UNF-2B; 18 deep	2	X[9]
X	Pilot pressure	DIN 3852[8]	M14 x 1.5; 12 deep	350	O
X	Pilot pressure with DG-control	DIN ISO 228[8]	G 1/4 in; 12 deep	350	O

5) For the maximum tightening torques the general instructions on page 52 must be observed.
6) Depending on the application, short-term pressure spikes can occur. Consider this when selecting measuring equipment and fittings. Pressure values in bar absolute.
7) Only dimensions according to SAE J518, metric fastening thread deviating from the standard.
8) The spot face can be deeper than as specified in the standard.
9) Depending on the installation position, L or L_1 must be connected (see also installation instructions on pages 48, 49)
10) For version with UNC fastening thread, see RA-A 92701

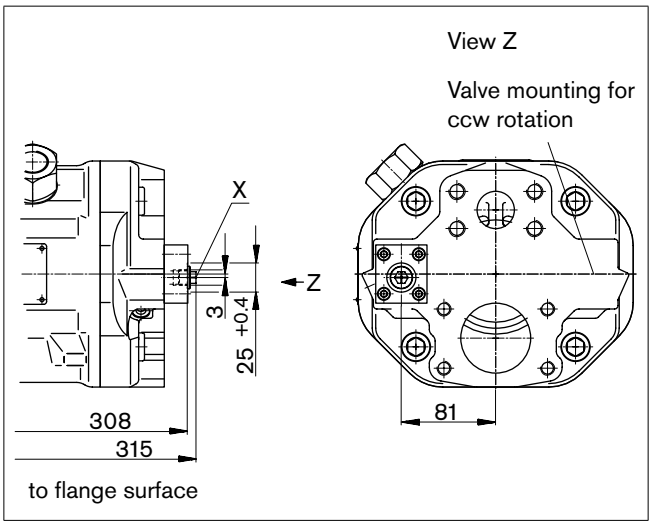
O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

Dimensions size 100

Before finalizing your design request a certified installation drawing. Dimensions in mm.

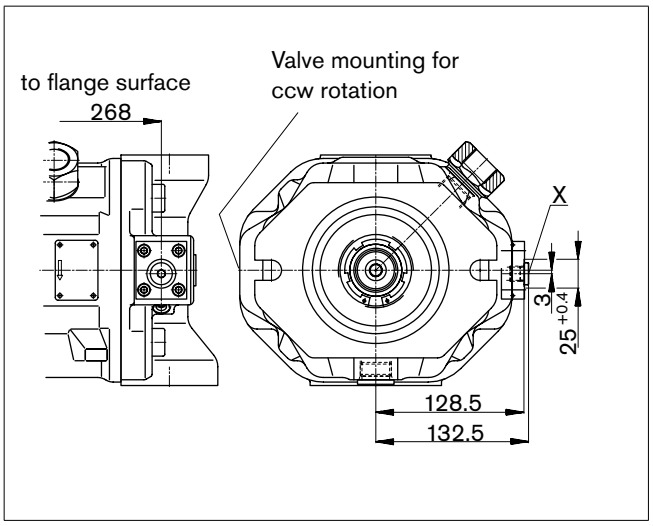
DG

Two-point control, directly operated**, port plate 11**



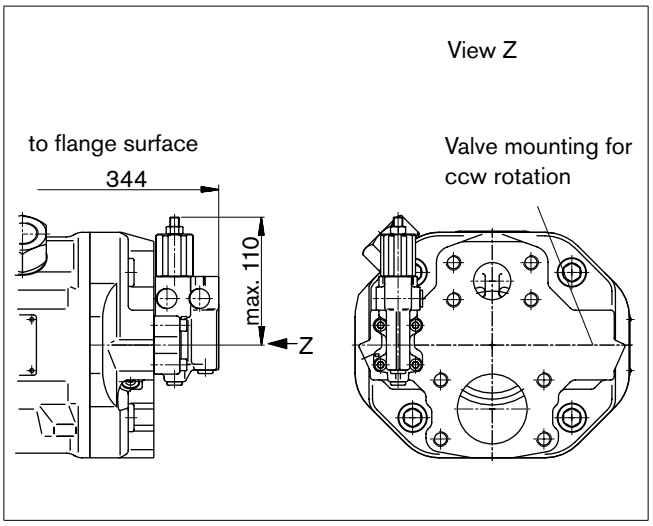
DG

Two-point control, directly operated**, port plate 12**



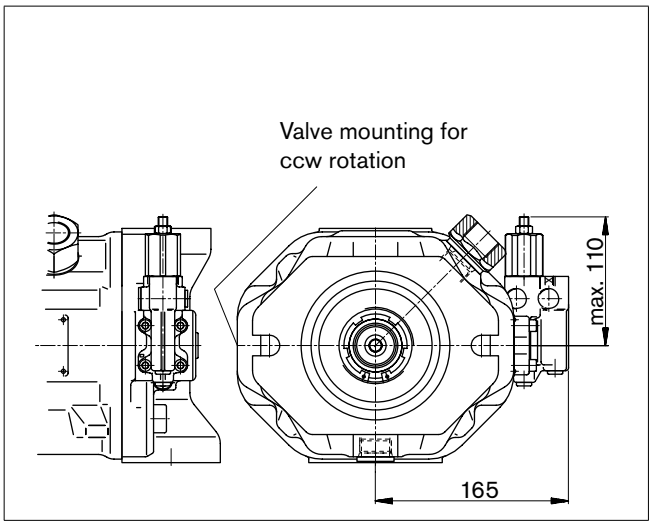
DR

Pressure control**, port plate 11**



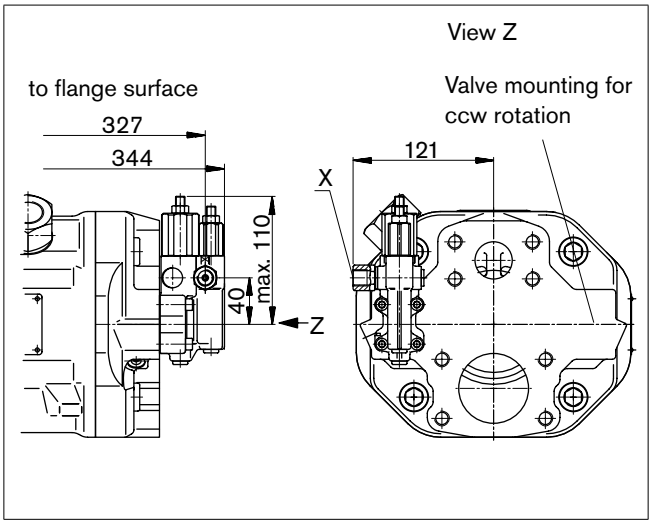
DR

Pressure control**, port plate 12**



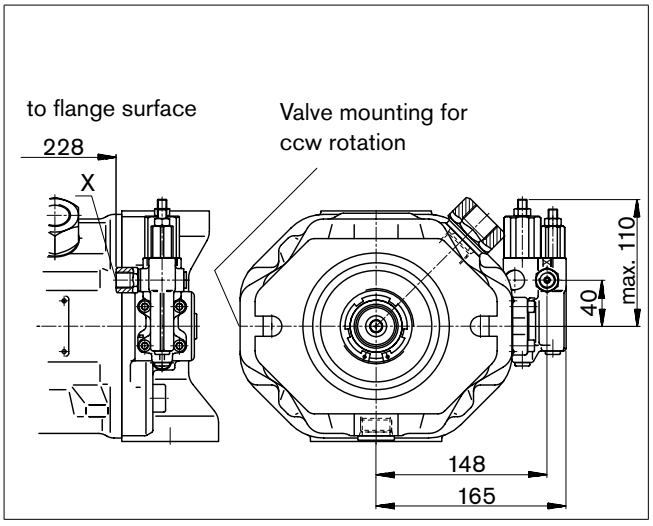
DRG

Pressure control, remotely operated**, port plate 11**



DRG

Pressure control, remotely operated**, port plate 12**



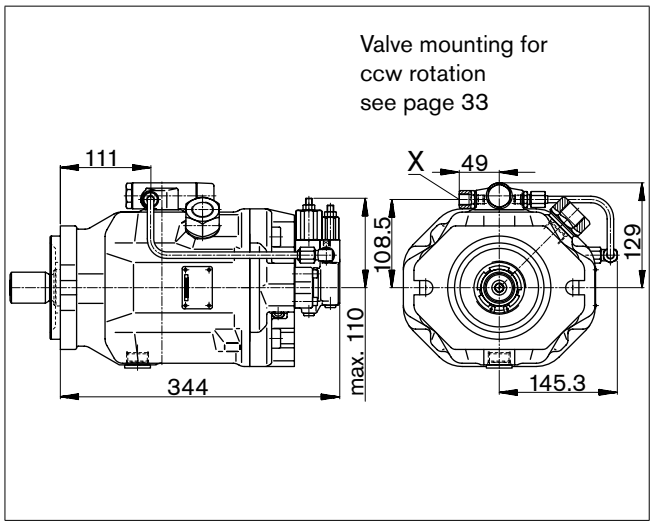
Details on connection options and shaft ends can be found on pages 33 and 34

Dimensions size 100

Before finalizing your design request a certified installation drawing. Dimensions in mm.

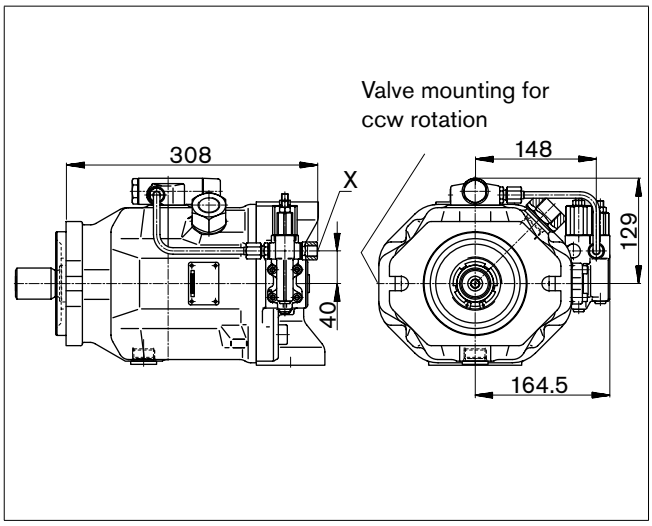
DFLR

Pressure, flow and power control, **port plate 11**



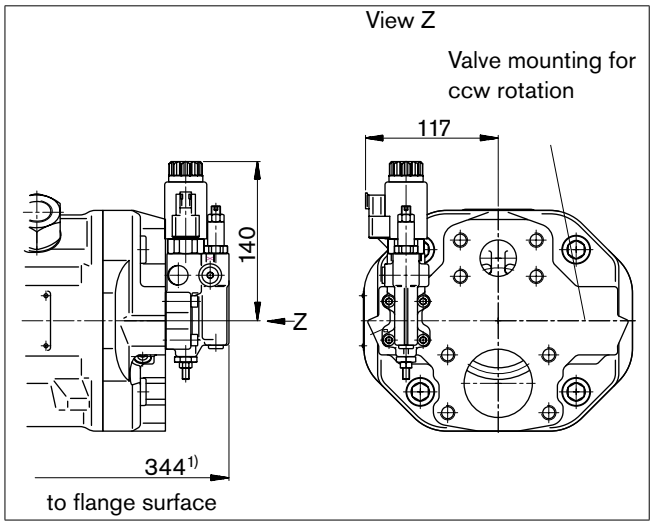
DFLR

Pressure, flow and power control, **port plate 12**



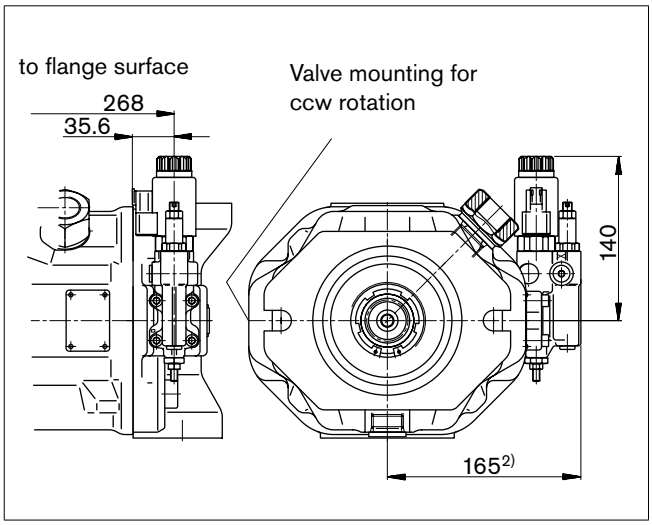
ED7./ER7.

Electro-hydraulic pressure control, **port plate 11**



ED7./ER7.

Electro-hydraulic pressure control, **port plate 12**



1) ER7.: 379 mm when using a sandwich plate pressure reducing valve.
2) ER7.: 200 mm when using a sandwich plate pressure reducing valve.

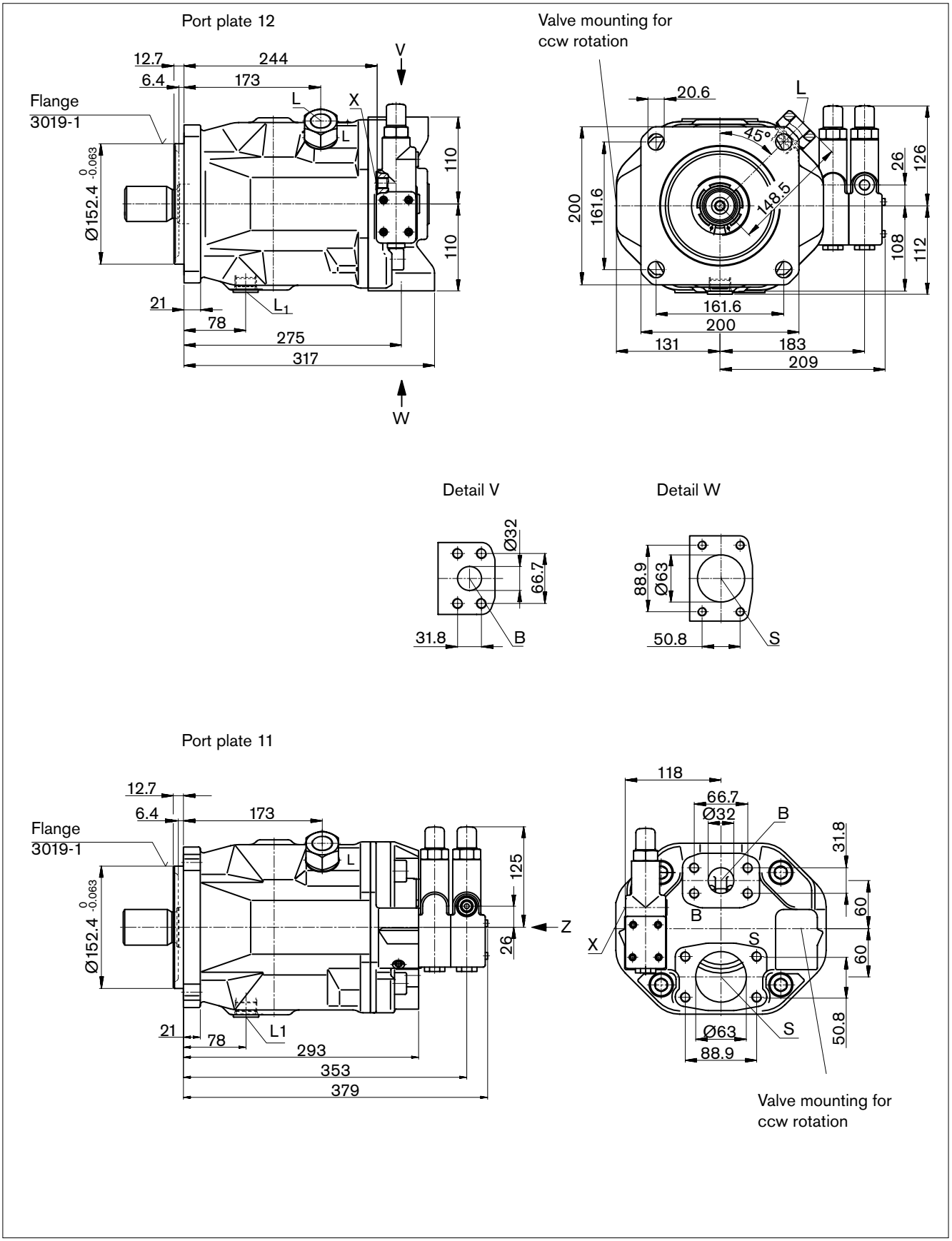
Details on connection options and shaft ends can be found on pages 33 and 34

Dimensions size 140

Before finalizing your design request a certified installation drawing. Dimensions in mm.

DFR/DFR1 – Pressure and flow control, hydraulic

Clockwise rotation, mounting flange D



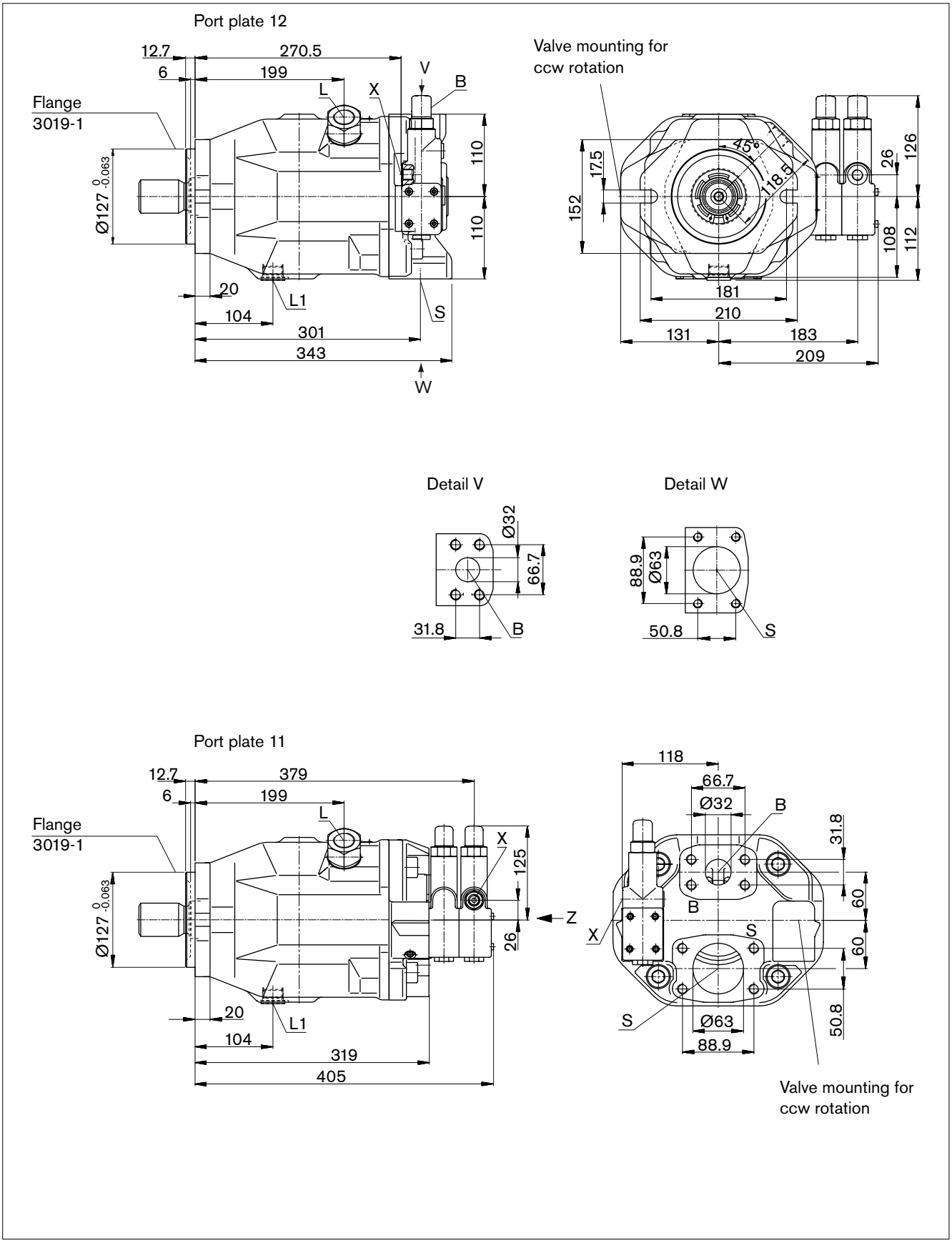
Details on connection options and shaft ends can be found on page 39

Dimensions size 140

Before finalizing your design request a certified installation drawing. Dimensions in mm.

DFR/DFR1 – Pressure and flow control, hydraulic

Clockwise rotation, mounting flange C

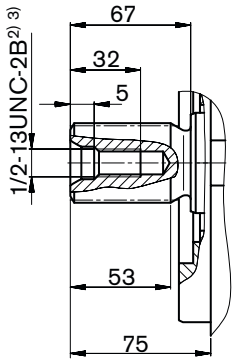


Dimensions size 140

Before finalizing your design request a certified installation drawing. Dimensions in mm.

Drive shaft

S Splined shaft 1 3/4 in
13T 8/16DP[1] (SAE J744)



1) ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Thread according to ASME B1.1
3) For the maximum tightening torques the general instructions on page 52 must be observed.

Ports

Designation	Port for	Standard	Size[4]	Maximum pressure [bar][5]	State
B	Service line, fastening thread	SAE J518[6] DIN 13	1 1/4 in M14 x 2; 19 deep[9]	350	O
S	Suction line, fastening thread	SAE J518[6] DIN 13	2 1/2 in M12 x 1.75; 17 deep[9]	10	O
L	Case drain fluid	DIN 3852[7]	M27 x 2; 16 deep	2	O[8]
L_1	Case drain fluid	ISO 11926[7]	1 1/16-12 UNF-2B; 18 deep	2	X[8]
X	Pilot pressure	DIN 3852[7]	M14 x 1.5; 12 deep	350	O
X	Pilot pressure with DG-control	DIN ISO 228[7]	M14 x 1.5; 12 deep	350	O
M_H	Gauge port, high pressure	DIN 3852	M14 x 1.5, 12 deep	350	X

4) For the maximum tightening torques the general instructions on page 52 must be observed.
5) Depending on the application, short-term pressure spikes can occur. Consider this when selecting measuring equipment and fittings. Pressure values in bar absolute.
6) Only dimensions according to SAE J518, metric fastening thread deviating from the standard.
7) The spot face can be deeper than as specified in the standard.
8) Depending on the installation position, L or L_1 must be connected (see also installation instructions on pages 48, 49)
9) For version with UNC fastening thread, see RA-A 92701.

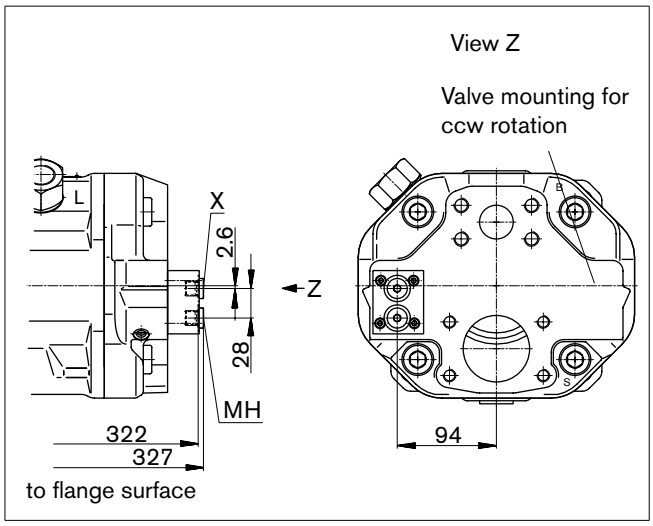
O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

Dimensions size 140

Before finalizing your design request a certified installation drawing. Dimensions in mm.

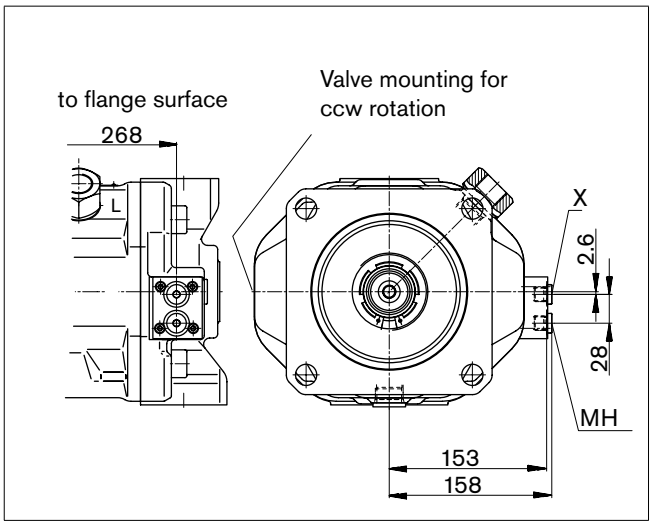
DG

Two-point control, directly operated, **port plate 11**



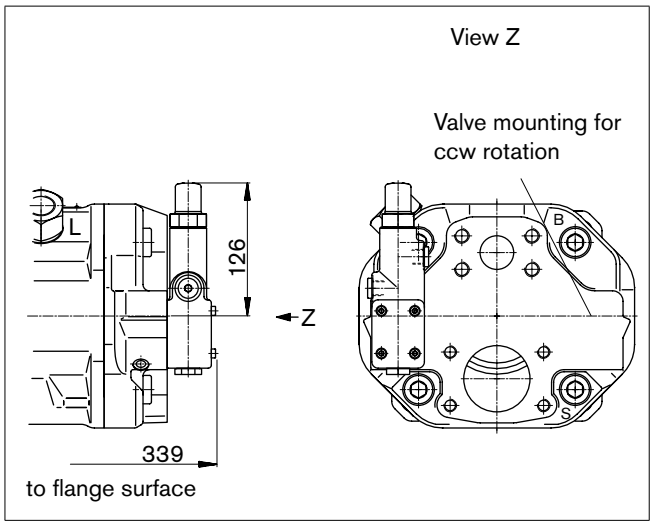
DG

Two-point control, directly operated, **port plate 12**



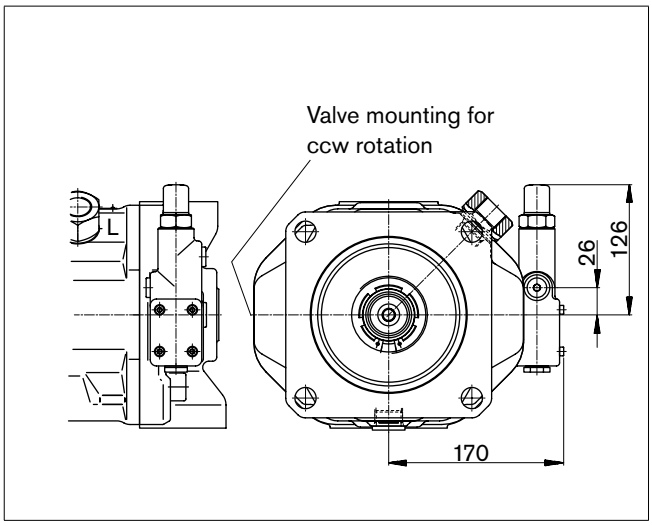
DR

Pressure control, **port plate 11**



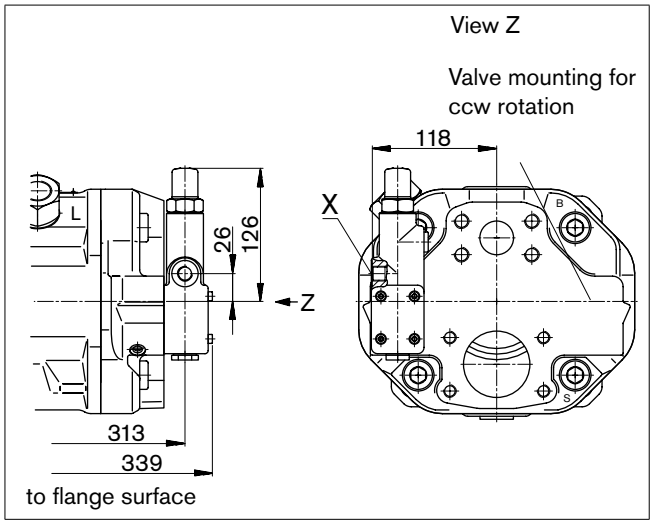
DR

Pressure control, **port plate 12**



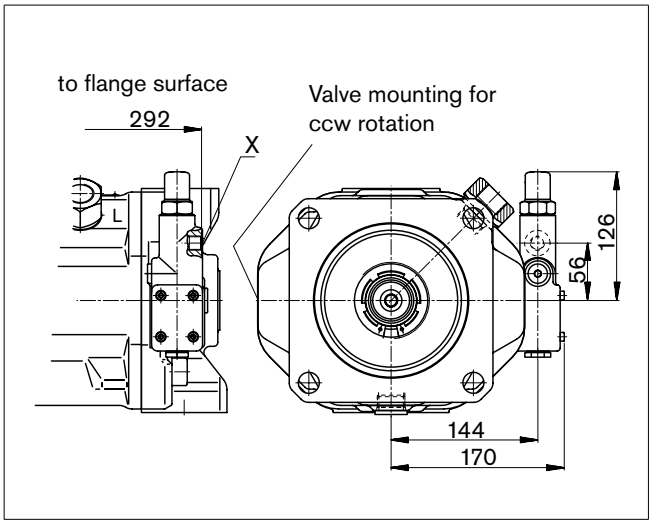
DRG

Pressure control, remotely operated, **port plate 11**



DRG

Pressure control, remotely operated, **port plate 12**



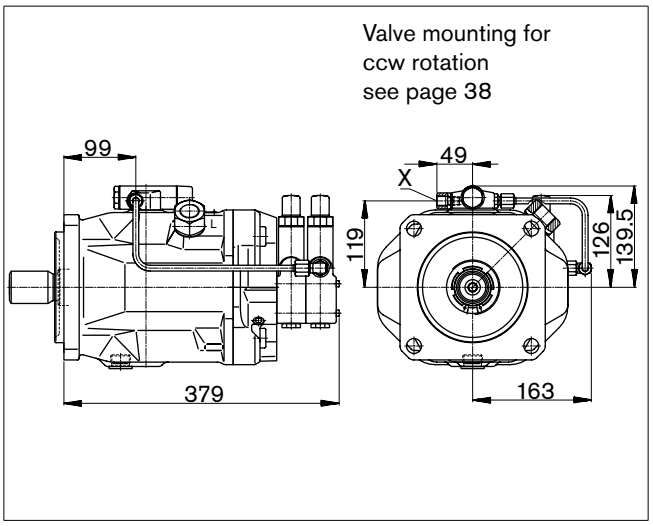
Details on connection options can be found on pages 37, 38 and 39

Dimensions size 140

Before finalizing your design request a certified installation drawing. Dimensions in mm.

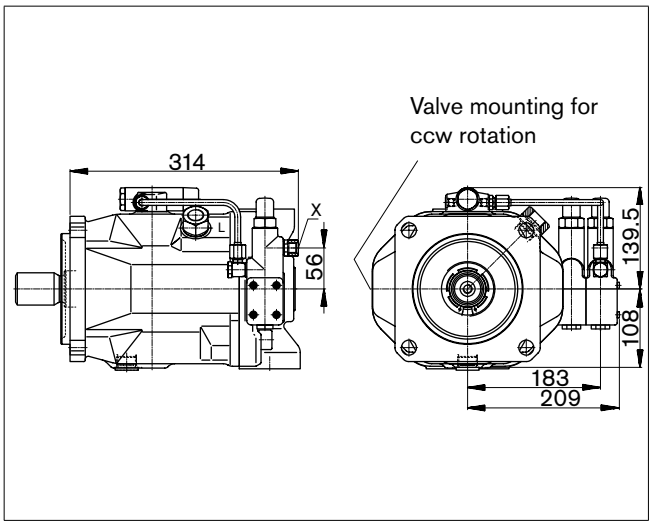
DFLR

Pressure, flow and power control, **port plate 11**



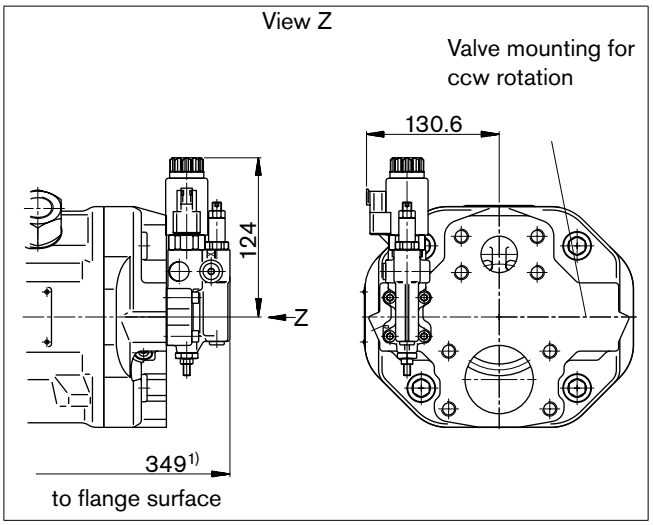
DFLR

Pressure, flow and power control, **port plate 12**



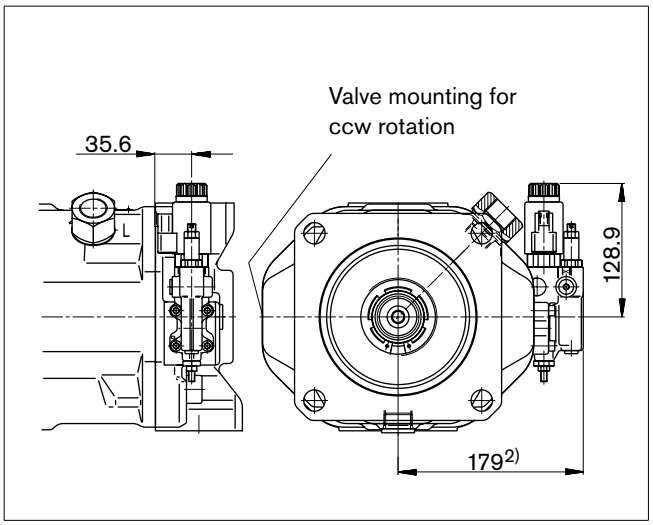
ED7. / ER7.

Electro-hydraulic pressure control, **port plate 11**



ED7. / ER7.

Electro-hydraulic pressure control, **port plate 12**

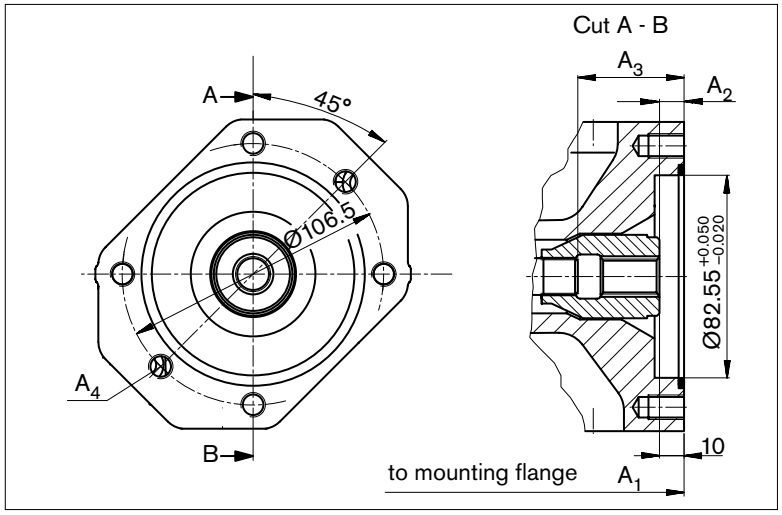


1) ER7.: 384 mm when using a sandwich plate pressure reducing valve.
2) ER7.: 214 mm when using a sandwich plate pressure reducing valve.
Details on connection options can be found on pages 37, 38 and 39

Dimensions through drive

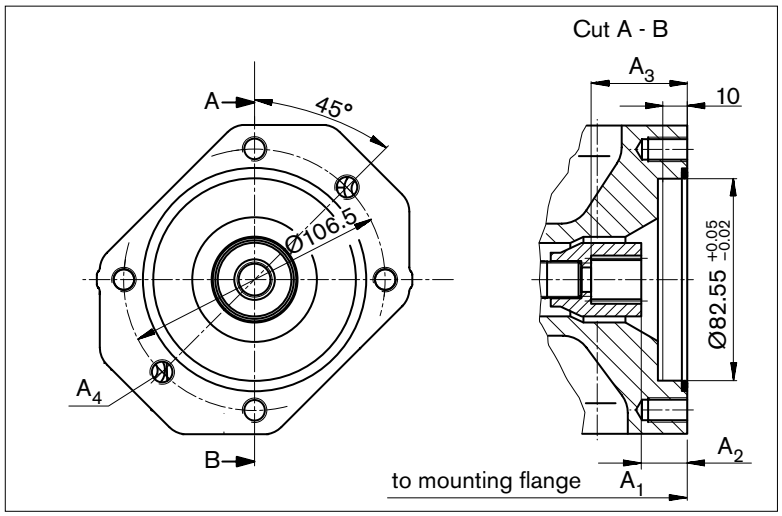
Before finalizing your design request a certified installation drawing. Dimensions in mm.

K01 flange ISO 3019-2 (SAE J744 - 82-2 (A))
Coupling for splined shaft according to ANSI B92.1a-1996 5/8 in 9T 16/32 DP[1] (SAE J744 - 16-4 (A))



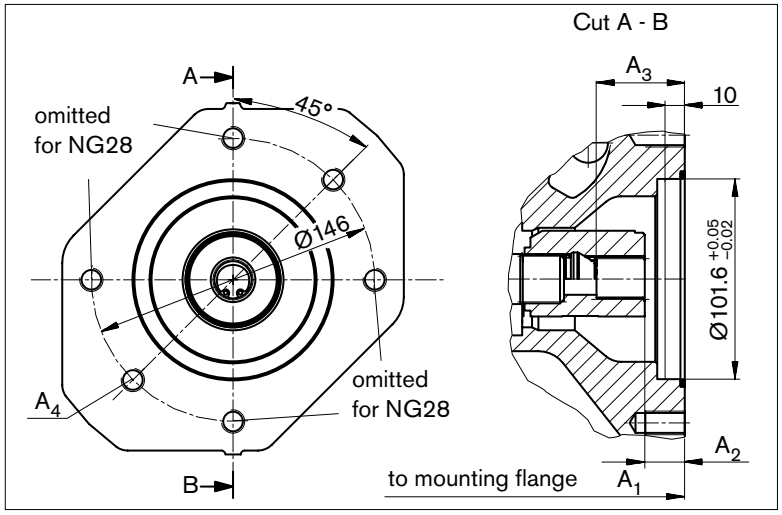
NG	A_1	A_2	A_3	A_4[2]
18	182	10	43.3	M10 x 1.5, 14.5 deep
28	204	10	33.7	M10 x 1.5, 16 deep
45	229	10.7	53.4	M10 x 1.5, 16 deep
71	267	11.8	61.3	M10 x 1.5, 20 deep
100	338	10.5	65	M10 x 1.5, 16 deep
140	350	10.8	77.3	M10 x 1.5, 16 deep

K52 flange ISO 3019-2 (SAE J744 - 82-2 (A))
Coupling for splined shaft according to ANSI B92.1a-1996 3/4 in 11T 16/32 DP[1] (SAE J744 - 19-4 (A-B))



NG	A_1	A_2	A_3	A_4[2]
18	182	18.8	38.7	M10 x 1.5, 14.5 deep
28	204	18.8	38.7	M10 x 1.5, 16 deep
45	229	18.9	38.7	M10 x 1.5, 16 deep
71	267	21.3	41.4	M10 x 1.5, 20 deep
100	338	19	38.9	M10 x 1.5, 16 deep
140	350	18.9	38.6	M10 x 1.5, 16 deep

K68 flange ISO 3019-2 (SAE J744 - 101-2 (B))
Coupling for splined shaft according to ANSI B92.1a-1996 7/8 in 13T 16/32 DP[1] (SAE J744 - 22-4 (B))



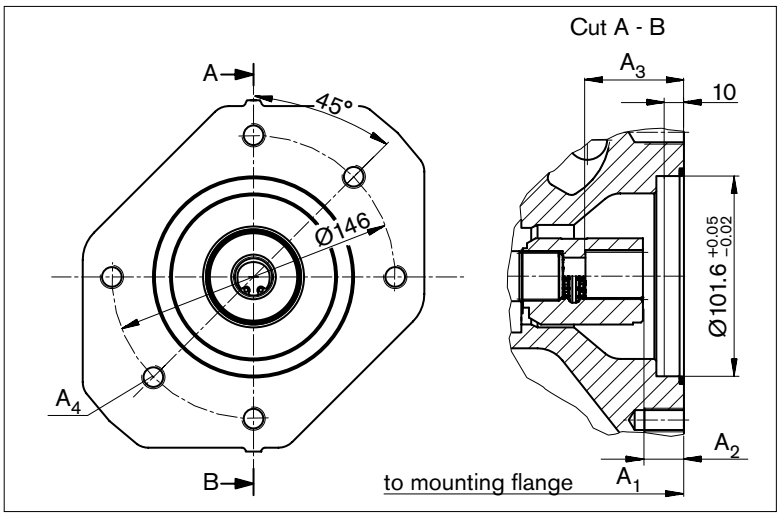
NG	A_1	A_2	A_3	A_4[2]
28	204	17.8	41.7	M12 x 1.75, continuous
45	229	17.9	41.7	M12 x 1.75, 18 deep
71	267	20.3	44.1	M12 x 1.75, 20 deep
100	338	18	41.9	M12 x 1.75, 20 deep
140	350	17.8	41.6	M12 x 1.75, 20 deep

1) 30° pressure angle, flat root, side fit, tolerance class 5
2) Thread according to DIN 13, observe the general instructions on page 52 for the maximum tightening torques.

Dimensions through drive

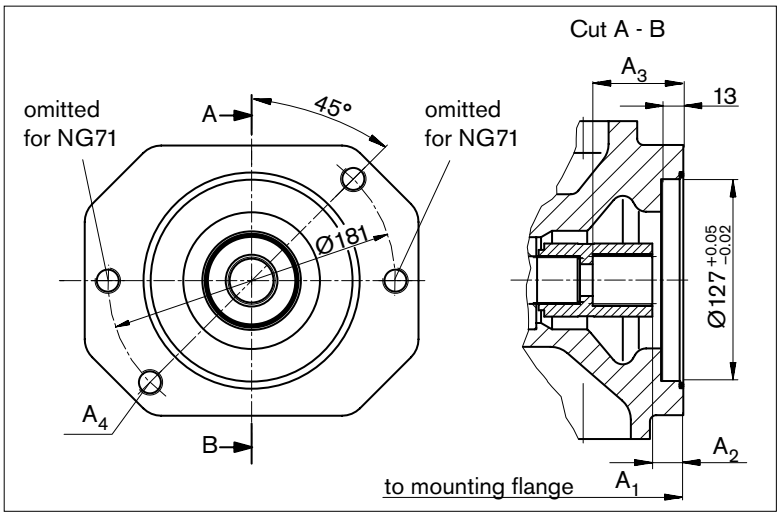
Before finalizing your design request a certified installation drawing. Dimensions in mm.

K04 flange ISO 3019-2 (SAE J744 - 101-2 (B))
Coupling for splined shaft according to ANSI B92.1a-1996 1 in 15T 16/32 DP[1] (SAE J744 - 25-4 (B-B))



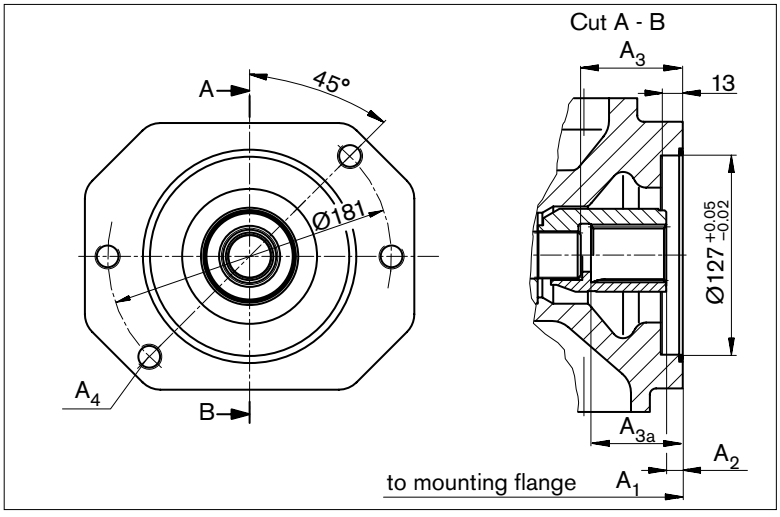
NG	A_1	A_2	A_3	A_4[2]
45	229	18.4	46.7	M12 x 1.75, 18 deep
71	267	20.8	49.1	M12 x 1.75, 20 deep
100	338	18.2	46.6	M12 x 1.75, 20 deep
140	350	18.3	45.9	M12 x 1.75, 20 deep

K07 flange ISO 3019-2 (SAE J744 - 127-2 (C))
Coupling for splined shaft according to ANSI B92.1a-1996 1 1/4 in 14T 12/24 DP[1] (SAE J744 - 32-4 (C))



NG	A_1	A_2	A_3	A_4[2]
71	267	21.8	58.6	M16 x 2, continuous
100	338	19.5	56.4	M16 x 2, continuous
140	350	19.3	56.1	M16 x 2, 24 deep

K24 flange ISO 3019-2 (SAE J744 - 127-2 (C))
Coupling for splined shaft according to ANSI B92.1a-1996 1 1/2 in 17T 12/24 DP[1] (SAE J744 - 38-4 (C-C))



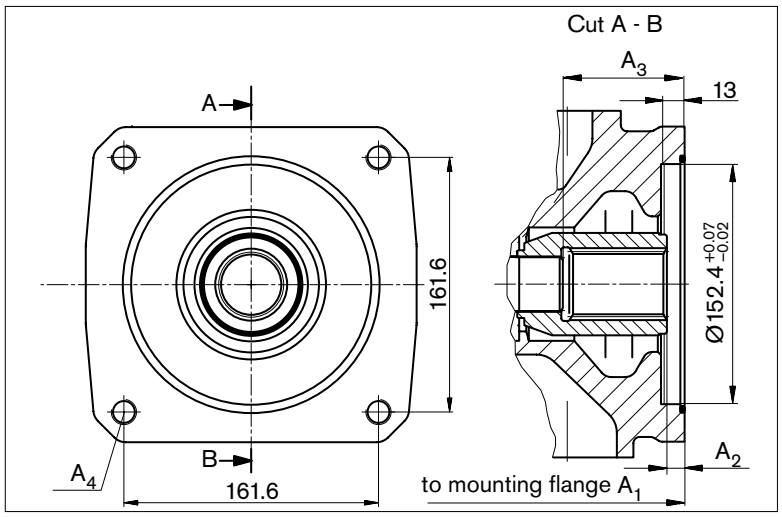
NG	A_1	A_2	A_3[3]	A_{3a}[4]	A_4[2]
100	338	10.5	65	–	M16 x 2, continuous
140	350	10.8	75	–	M16 x 2, 24 deep
	350	10.3	–	69.1	M16 x 2, 24 deep

1) 30° pressure angle, flat root, side fit, tolerance class 5
2) Thread according to DIN 13, observe the general instructions on page 52 for the maximum tightening torques.
3) Coupling **without** stop
4) Coupling **with** stop

Dimensions through drive

Before finalizing your design request a certified installation drawing. Dimensions in mm.

K17 flange ISO 3019-2 (SAE J744 - 152-4 (A))
Coupling for splined shaft according to ANSI B92.1a-1996 1 3/4 in 13T 8/16 DP[1] (SAE J744 - 44-4 (D))



NG	A_1	A_2	A_3	A_4[2]
140	350	11	77.3	M6 x 2, continuous

1) 30° pressure angle, flat root, side fit, tolerance class 5
2) Thread according to DIN 13, observe the general instructions on page 52 for the maximum tightening torques.

Summary mounting options

SAE – mounting flange

Through-drive[1]			Mounting option – 2nd pump			
Flange ISO 3019-1	Coupling for splined shaft	Short des.	A10VO/31 NG (shaft)	A10V(S)O/5x NG (shaft)	External gear pump design (NG)	Through drive available for NG
82-2 (A)	5/8 in	**K01**	18 (U)	10 (U)	F (5 to 22)	18 to 140
	3/4 in	**K52**	18 (S, R)	10 (S) 18 (U) 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]	N/G (26 to 49)	28 to 140
	1 in	**K04**	45 (S, R) –	45 (S, R) 60, 63 (U, W) [2]	–	45 to 140
127-2 (C)	1 1/4 in	**K07**	71 (S, R) 100 (U)[3]	85 (U, W)[3] 100 (U, W)	–	71 to 140
	1 1/2 in	**K24**	100 (S)	85 (S) 100 (S)	–	100 to 140
152-4 (4-hole D)	1 3/4 in	**K17**	140 (S)	–	–	140

1) Not for main pump NG28 with K68
2) Not for main pump NG45 with K04
3) Not for main pump NG71 with K07

Combination pumps A10VO + A10VO

Before finalizing your design request a certified installation drawing. Dimensions in mm.

When using combination pumps it is possible to have multiple, mutually independent circuits without the need for a splitter gearbox.

When ordering combination pumps the model codes for the first and the second pump must be joined by a "**+**".

Order example:
A10VSO100DFR1/31R-VSB12K04+
A10VSO45DFR/31R-VSA12N00

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

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

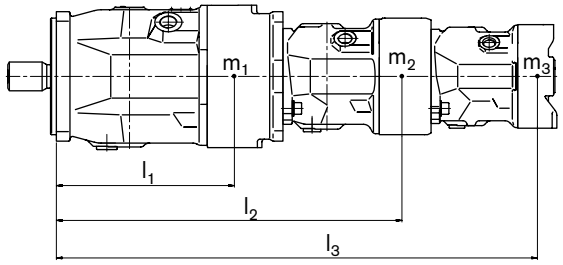
Each through drive is plugged with a **non-pressure-resistant** cover. Before commissioning the units, they must therefore be equipped with a pressure-resistant cover.
Through drives can also be ordered with pressure-resistant covers. Please specify in clear text.

For combination pumps comprising more than two pumps, the mounting flange must be calculated for the permissible moment of inertia.

Permissible mass moment of inertia

NG			18	28	45	71	100	140
Permissible moment of inertia								
static	T_m	Nm	500	880	1370	2160	3000	4500[1)] 3000[2)]
dynamic at 10 *g* (98.1 m/s²)	T_m	Nm	50	88	137	216	300	450[1)] 300[2)]
Mass with through-drive plate	m	kg	14	19	25	39	54	68
Mass without through drive (e.g. 2nd pump)	m	kg	12	15	21	33	45	60
Distance center of gravity	l	mm	90	110	130	150	160	160

1) 4-hole flange (D)
2) 2-hole flange (C)



m_1, m_2, m_3 Mass of pumps [kg]

l_1, l_2, l_3 Distance center of gravity [mm]

$$T_m = (m_1 \cdot l_1 + m_2 \cdot l_2 + m_3 \cdot l_3) \cdot \frac{1}{102}\ [Nm]$$

Connector for solenoids

DEUTSCH DT04-2P-EP04, 2-pin

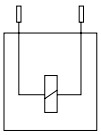
Molded, without bidirectional suppressor diode _____ **P**

The following type of protection is provided with installed mating connector:

IP67 _____ DIN/EN 60529
and IP69K _____ DIN 40050-9

Circuit symbol

Without bidirectional suppressor diode

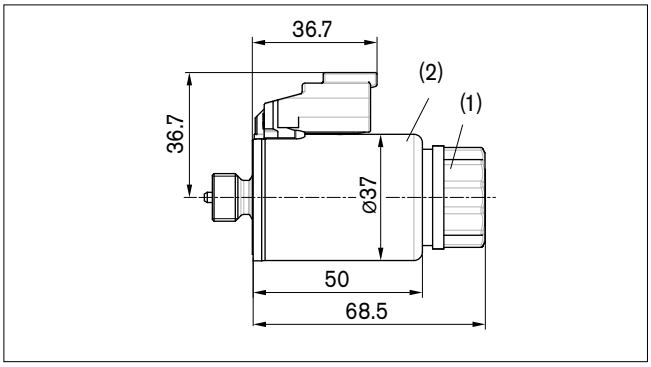


Mating connector

DEUTSCH DT06-2S-EP04
Bosch Rexroth Mat. No. R902601804

Consisting of:	DT designation
– 1 case	DT06-2S-EP04
– 1 wedge	W2S
– 2 sockets	0462-201-16141

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



Before finalizing your design request a certified installation drawing. Dimensions in mm.

Changing connector position

If necessary, you can change the position of the connector by turning the solenoid.

To do this, proceed as follows:

1. Loosen the mounting nut (1) of the solenoid. To do this, turn the mounting nut (1) one revolution counter-clockwise.
2. Turn the solenoid body (2) to the desired position.
3. Retighten the mounting nut of the solenoid. Tightening torque: 5+1 Nm (size WAF 26, 12-pt DIN 3124).

On delivery, the position of the connector may differ from that shown in the brochure or drawing.

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 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 case drain fluid in the motor housing must be directed to the reservoir via the highest case drain port (L_1, L_2, L_3).

For combinations of multiple units, make sure that the respective case pressure in each unit is not exceeded. In the event of pressure differences at the case drain ports of the units, the shared case drain line must be changed so that the minimum permissible case pressure of all connected units is not exceeded in any situation. If this is not possible, separate case drain lines must be laid 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 line and case drain line must flow into the reservoir below the minimum fluid level . The permissible suction height h_S is a result of the overall pressure loss, but may not be greater than $h_{S\ max} = 800$ mm. The minimum suction pressure at port S must also not fall below 0.8 bar absolute during operation.

Installation position

See the following examples 1 to 12.
Additional installation positions are available upon request.

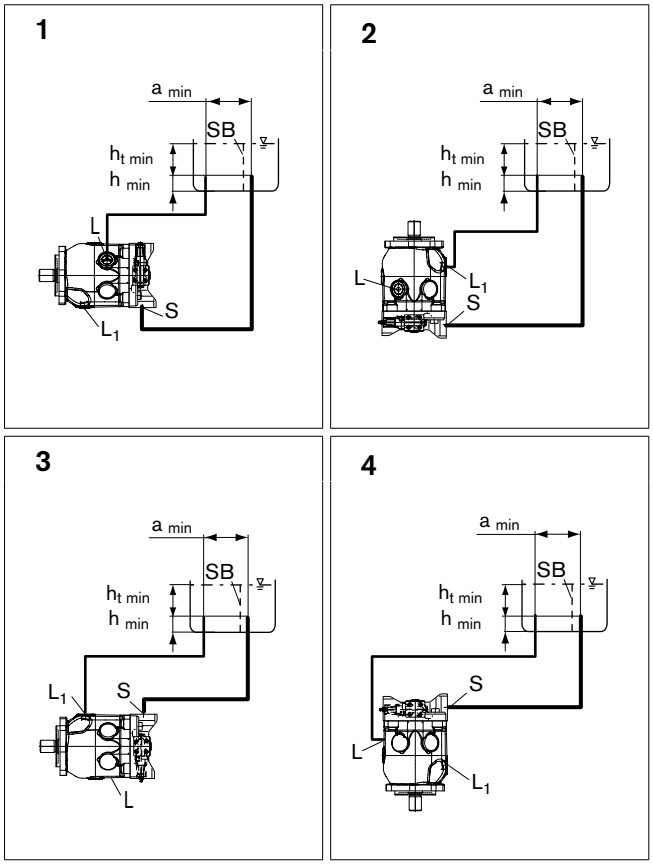
Recommended installation positions: 1 and 3.

Note

– You can expect certain installation positions to affect the control device. Because of gravity, unit weight and case pressure, minor characteristic displacements and response time changes may occur.

Below-reservoir installation (standard)

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



Installation position	Air bleed	Filling
1	L	S + L_1
2	L_1	S + L
3	L_1	S + L
4	L	S + L_1

Key, see page 49.

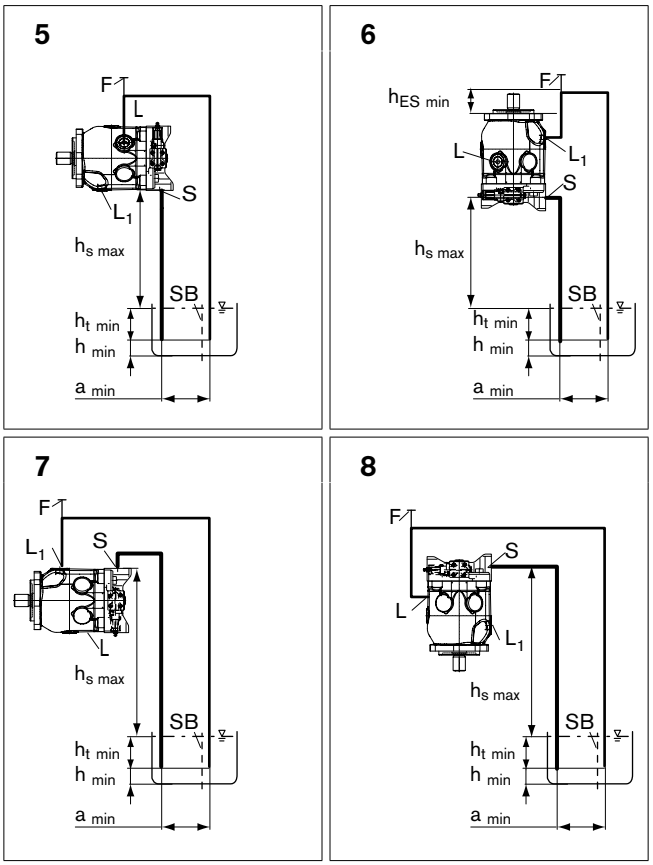
Installation instructions

Above-reservoir installation

Above-reservoir installation means 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 at port L_1 is required in installation position 6.

Observe the maximum permissible suction height $h_{S\ max} = 800$ mm.

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



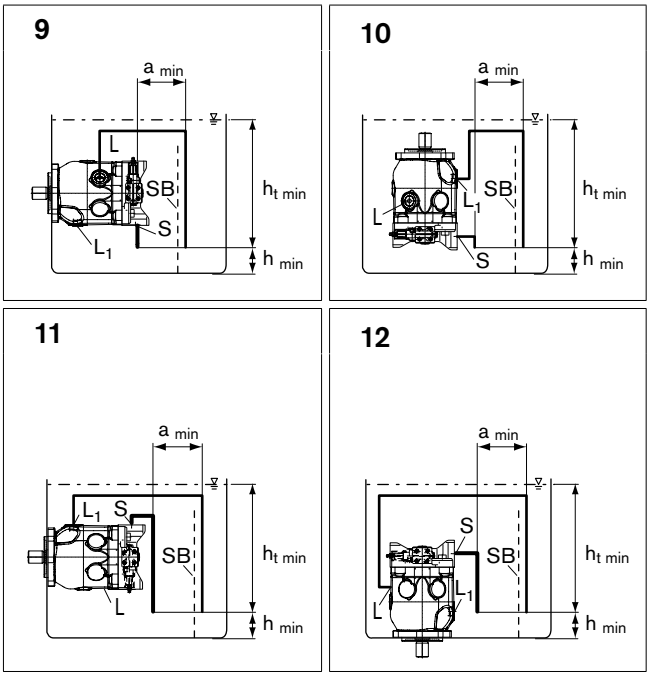
Installation position	Air bleed	Filling
5	F	L (F)
6	F	L_1 (F)
7	F	S + L_1 (F)
8	F	S + L (F)

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.



Installation position	Air bleed	Filling
9	L	L, L_1
10	L_1	L, L_1
11	L_1	S + L, L_1
12	L	S + L, L_1

S	Suction port
F	Filling / air bleeding
L, L_1	Case drain port
SB	Baffle (baffle plate)
$h_{t\ min}$	Minimum necessary immersion depth (200 mm)
h_{min}	Minimum necessary spacing to reservoir bottom (100 mm)
$h_{ES\ min}$	Minimum necessary height needed to protect the axial piston unit from draining (25 mm).
$h_{S\ max}$	Maximum permissible suction height (800 mm)
a_{min}	When designing the reservoir, ensure adequate distance between the suction line and the case drain line. This prevents the heated, return flow from being drawn directly back into the suction line.

Notes

Notes

General instructions

– The A10VO / A10VSO pump is designed to be used in open circuit.

– Project planning, installation and commissioning of the axial piston unit require the involvement of qualified personnel.

– Before operating the axial piston unit, please read the appropriate instruction manual thoroughly and completely. If necessary, request these from Bosch Rexroth.

– During and shortly after operation, there is a risk of burns on the axial piston unit and especially on the solenoids. Take appropriate safety measures (e.g. by wearing protective clothing).

– Depending on the operating conditions of the axial piston unit (operating pressure, fluid temperature), the characteristics may shift.

– Service line ports:

- The ports and fastening threads are designed for the specified maximum pressure. The machine or system manufacturer must ensure that the connecting elements and lines correspond to the specified application conditions (pressure, flow, hydraulic fluid, temperature) with the necessary safety factors.

- The service line ports and function ports are only designed to accommodate hydraulic lines.

– Pressure cut-off and pressure control do not provide security against pressure overload. A separate pressure relief valve is to be provided in the hydraulic system.

– The data and notes contained herein must be adhered to.

– The product is not approved as a component for the safety concept of a general machine according to ISO 13849.

– The following tightening torques apply:

- Fittings:
  Observe the manufacturer‘s instruction regarding the tightening torques of the used fittings.

- Mounting bolts:
  For mounting bolts with metric ISO thread according to DIN 13 or thread according to ASME B1.1, we recommend checking the tightening torque individually according to VDI 2230.

- Female threads in axial piston unit:
  The maximum permissible tightening torques $M_{G\ max}$ are maximum values for the female threads and must not be exceeded. For values, see the following table.

- Threaded plugs:
  For the metal threaded plugs supplied with the axial piston unit, the required tightening torques of the threaded plugs M_V apply. For values, see the following table.

Ports		Maximum permissible tightening torque for female threads $M_{G\ max}$	Required tightening torque for threaded plugs M_V	Size of hexagon socket of threaded plugs
Standard	Thread size			
DIN 3852	M14 x 1.5	80 Nm	35 Nm[1)]	6 mm
	M16 x 1.5	100 Nm	50 Nm[1)]	8 mm
	M18 x 1.5	140 Nm	60 Nm[1)]	8 mm
	M22 x 1.5	210 Nm	80 Nm[1)]	10 mm
	M27 x 2	330 Nm	135 Nm[1)]	12 mm
DIN ISO 228	G 1/4 in	70 Nm	–	–
ISO 11926	7/8-14 UNF-2B	240 Nm	110 Nm	3/8 in
	1 1/16-12 UNF-2B	360 Nm	170 Nm	9/16 in

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

Bosch Rexroth AG
Axial piston units
An den Kelterwiesen 14
72160 Horb a. N., Germany
Tel.: +49-7451-92-0
Fax: +49-7451-82-21
info.brm-ak@boschrexroth.de
www.boschrexroth.com/axial-piston-pumps