YEOSHE

PA10VO Series

Hydraulic Piston Pump

www.yeoshehydraulic.com

Efficient Performance

Innovative Technology

Reliable Quality and Service

YEOSHE HYDRAULICS CO.,LTD.

Type code series 52

- **For machines with medium pressure requirements**
- **Sizes 10 to 140**
- **Nominal pressure 250 bar (3600 psi)**
- **Maximum pressure 315 bar (4550 psi)**
- **Open circuit**

Features

1. Variable pump with axial piston rotary group in
2. swashplate design for hydrostatic drives in open circuit.
3. Flow is proportional to drive speed and displacement.
4. The flow can be infinitely varied by adjusting the
5. swashplate angle.
6. Stable bearing for long service life
7. High permissible drive speed
8. Favorable power-to-weight ratio – compact dimensions
9. Low noise
10. Excellent suction characteristics
11. Electrohydraulic pressure control
12. Power control
13. Electro proportional swivel angle control
14. Short control times

P	A10V	O	60	/	DRF	52	-	R	V	U	C	14	K01		
1	2	3	4		5	6		7	8	9	10	11	12	13	14

type

1	Axial piston	P

Axial piston unit

		10	28	45	60[1]	85	
2	Swashplate design, variable, nominal pressure 250 bar (3600 psi), maximum pressure 315 bar (4550 psi)	■	■	■	■	■	A10V

Operating mode

3	Pump, open circuit	O

Size (NG)

		10	28	45	60	85
4	Geometric displacement, see table of values on page 10	10	28	45	60	85

Control device

			10	28	45	60[1]	85	
5	Pressure controller		■	■	□[2]	■	■	DR
	With flow controller							
		X-T open	■	■	□[3]	■	■	DFR
			–	–	□	□	□	DRF
		X-T plugged	■	■	□[2]	■	■	DFR1
			–	–	□	□	□	DRS
		Electrically coverable (negative characteristics)	–	–	–	–	–	E.F.D.

■ = Available □ = On request – = Not available

[1] Series 52 units are delivered as standard with 3.66 in³ (60 cm³). Higher values on request.
[2] Use data sheet 92706 for pressure flow controller DR, DFR, DFR1, DRSC A10VO 45 series 60.

Type code series 52

P	A10V	O	60	/	DRF	52	-	R	V	U	C	14	K01		
1	2	3	4		5	6		7	8	9	10	11	12	13	14

					10	28	45	60[1]	85	
5	With pressure cut-off									
	Hydraulic				■	■	■	■	■	DRG
	Electric	Negative control		U =12V	–	■	■	■	■	ED71
				U =24V	–	■	■	■	■	ED72
		Positive control		U =12V	–	■	■	■	■	ER71
				U =24V	–	■	■	■	■	ER72
	Power control with pressure cut-off									
		Start of control		10 to 35 bar	□	–	■	□	□	LA5D
				36 to 70 bar	□	–	■	□	□	LA6D
				71 to 105 bar	□	–	■	□	□	LA7D
				106 to 140 bar	□	–	■	□	□	LA8D
				141 to 230 bar	□	–	■	□	□	LA9D
	Remote control	Start of control		Refer to LA.D	□	□	■	□	□	LA7D
	Flow control, X-T plugged	Start of control		Refer to LA.D	□	□	■	□	□	LA8D
	Flow control, electrically overridable (negative characteristic), X-T plugged	Start of control		Refer to LA.D	□	□	■	□	□	LA9D
	Electro-hydraulic control valve	Positive control		U = 12 V to 24 V	–	■	–	–	–	EC4
		Negative control			–	□	–	–	–	EB4
	Electric proportional control (positive characteristic, with				□	–	□	□	□	
	Pressure control			U =12V	□	–	□	□	□	EP1D
				U =24V	□	–	□	□	□	EP2D
	Pressure and flow control, X-T opening (load sensing)			U =12V	□	–	□	□	□	EP1DF
				U =24V	□	–	□	□	□	EP2DF
	Pressure and Flow Control, X-T Blockage (Load Sensing)			U =12V	□	–	□	□	□	EP1DS
				U =24V	□	–	□	□	□	EP2DS
	Electrohydraulic control			U =12V	□	–	□	□	□	EP1ED
				U =24V	□	–	□	□	□	EP2ED
	Pressure and flow control with controller cut-off, X-T open (load sensing)			U =12V	□	–	□	□	□	EK1DF
				U =24V	□	–	□	□	□	EK2DF
	Pressure and flow control with controller cut-off, X-T plugged (load sensing)			U =12V	□	–	□	□	□	EK1DS
				U =24V	□	–	□	□	□	EK2DS
	Electrohydraulic control with controller cut-off			U =12V	□	–	□	□	□	EK1ED
				U =24V	□	–	□	□	□	EK2ED

Series		10	28	45	60[1]	85	
6	Series 5, index 2	■	■	■	■	■	52[2]

■ = Available □ = On request – = Not available

[1] Series 52 units are delivered as standard with 3.66 in³ (60 cm³). Higher values on request.
[2] Control DR, DFR,DFR1, DRG, ED and ER: delivery with size 10, 28, 45, 60 and 85% only in series 52

Type code series 52

P	A10V	O	60	/	DRF	52	-	R	V	U	C	14	K01		
1	2	3	4		5	6		7	8	9	10	11	12	13	14

Direction of rotation

7	Viewed on drive shaft	Clockwise	R
		Counter-clockwise	L

Sealing material

8	FKM (fluorocarbon rubber)	V

Drive shaft

			10	28	45	60[1]	85	
9	Splined shaft ISO 3019-1	Standard shaft	■	■	■	■	■	S
		Similar to shaft "S" however for higher torque	–	■	■	■	■	R
		Reduced diameter, limited suitability for through drive	■	■	■	■	■	U
		Like shaft "U" but for higher torque, only conditionally suitable for mounting with through-drive. For mounting options, see page 76	–	■	■	■	■	W
	Parallel keyed shaft DIN 6885 not for through-drive		■[2]	–	–	–	–	P
	Parallel keyed shaft ISO 3019-1 not for through-drive		■[3]	■	■	■	■	K
	Tapered keyed shaft and UNF threaded bolt not for through-drive		–	■	■	■	■	C

Mounting flange

			10	28	45	60[1]	85	
10	ISO 3019-2 (DIN)	2-hole	■	–	–	–	–	A
	ISO 3019-1 (SAE)	2-hole	■	■	■	■	■	C
		4-hole	–	–	–	■[3]	–	D

Working port

				10	28	45	60[1]	85	
11	SAE flange ports according to ISO 6162 **metric**	Fastening thread **metric** rear	Not for through drive	–	■	■	■	■	11
		Fastening thread **metric** laterally opposite	For through drive	–	■	■	■	■	12
		Fastening thread **metric** laterally offset 90°	Not for through drive ; available for counter - clockwise rotation only	–	■	■	–	–	13
	Threaded port **metric**	Rear	Not for through drive	■[4]	■	■	–	–	14
	SAE flange ports according to ISO 6162 **UNC**	Fastening thread **UNC** rear	Not for through drive	–	■	■	■	■	61
		Fastening thread **UNC** laterally opposite	For through drive	–	■	■	■	■	62
	Threaded port **UNC**	Rear	Not for through drive	■[5]	■	■	–	–	64

■ = Available ▫ = On request – = Not available

1) Series 52 elements are delivered in a standard size of 60 cm3. Higher values available on request.

2) Control DR, DFR, DFR1, DRG, ED and ER: Available in sizes 10, 28, 45, 60 and 85 , only for series 52.

3) Control DFR, DFR1: Supply specification is 85, only for series 52 C flange.

4) Only with mounting flange A; order item 09

5) Only with mounting flange C; order item 09

Type code series 52

P	A10V	O	60	/	DRF	52	-	R	V	U	C	14	K01		
1	2	3	4		5	6		7	8	9	10	11	12	13	14

Through drive *(for mounting options, see page 76)*

				10	28	45	60[1]	85	
12	Does not include through drive, standard on models 11, 13 and 14			□	□	■	□	□	N00
	SAE J744 flange Diameter	Spline shaft coupling 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
	127-4 (C)	1 1/4 in	14T 12/24DP	–	□	■	□	□	K15
		1 1/2 in	17T 12/24DP	–	–	–	□	□	K16
	127-2 (C)	1 1/4 in	14T 12/24DP	–	–	–	□	□	K07
		1 1/2 in	17T 12/24DP	–	–	–	□	□	K24

Connector for solenoids

		10	28	45	60[1]	85	
13	Without connector (without solenoid, only for hydraulic controls, without signs)	■	■	■	■	■	
	DEUTSCH – molded connector, 2-pin – without suppressor diode (for electric controls)	–	■	■	■	■	P

Swivel angle sensor

				10	28	45	60[1]	85	
14	Without swivel angle sensor (without code)			■	■	■	■	■	
	With electric swivel angle sensor PAL (as per data sheet 95161) [4]	Ratiometric	Power supply U = 5V DC	–	■	■	■	■	H
		SENT/SENT		–	■	■	■	■	P

Notice

- Observe the general project planning notes on page 84 and the project planning notes regarding each control device.
- In addition to the type code, please specify the relevant technical data.

■ = Available □ = On request – = Not available

[1] Series 52 elements are delivered in a standard size of 60 cm3. Higher values available on request.

[2] Control DR, DFR, DFR1, DRG, ED and ER: Available in sizes 10, 28, 45, 60 and 85 , only for series 52.

[3] Control DFR, DFR1: Supply specification is 85, only for series 52 C flange.

[4] Also see page 79 for further details.

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Type code series 53

P	A10V	O	60	/	DRF	53	-	R	V	U	C	14	K01		
1	2	3	4		5	6		7	8	9	10	11	12	13	14

type

1	Axial piston	P

Axial piston unit

		18	28	45	63	72	85	100	
2	Swashplate design, variable, nominal pressure 250 bar (3600 psi), maximum pressure 315 bar (4550 psi)	■	■	■	■	■	■	■	A10V

Operating mode

3	Pump, open circuit	O

Size (NG)

		18	28	45	63	72	85	100
4	Geometric displacement, see table of values on page 7	18	28	45	63	72	85	100

Control device

				18	28	45	63	72	85	100	
5	Pressure controller			■	■	▲ 2)	■	■	■	■	DR
	With flow controller										
		X-T open		■	■	▲ 2)	■	■	■	■	DFR
				■	■	▲ 2)	■	■	■	■	DRF
		X-T plugged		–	□	□	□	–	□	–	DFR1
				■	■	▲ 2)	■	■	■	■	DRS
		Electrically coverable (negative characteristics)		–	–	–	–	–	–	–	E.F.D.
	With pressure cut-off										
	Hydraulic			■	■	■	■	■	■	■	DRG
	Electric	Negative control	U =12V	■	■	■	■	■	■	■	ED71
			U =24V	■	■	■	■	■	■	■	ED72
		Positive control	U =12V	■	■	■	■	■	■	■	ER71
			U =24V	■	■	■	■	■	■	■	ER72
	Electro-hydraulic control valve	Positive control	U = 12 V to 24 V	–	–	–	■ 1)	–	–	–	EC4
		Negative control		–	–	–	□ 1)	–	–	–	EB4
	Power control with pressure cut-off										
		Start of control	10 to 35 bar	■	■	□	■	■	■	■	LA5D
			36 to 70 bar	■	■	□	■	■	■	■	LA6D
			71 to 105 bar	■	■	□	■	■	■	■	LA7D
			106 to 140 bar	■	■	□	■	■	■	■	LA8D
			141 to 230 bar	■	■	□	■	■	■	■	LA9D
	remotely operated	Start of control	Refer to LA.D	■	■	□	■	■	■	■	LA.DG
	Flow control, X-T plugged	Start of control	Refer to LA.D	■	■	□	■	■	■	■	LA.DS
	Flow control, electrically overridable (negative characteristic), X-T plugged	Start of control	Refer to LA.D	■	■	□	■	■	■	■	LA.DC

■ = Available □ = On request – = Not available ▲ = Not for new projects

1) Only available with mounting flange C (order item 09).
2) Use data sheet 92706 for pressure flow controller DR, DRF, DRS, DRSC A10VO 45 series 60

Type code series 53

P	A10V	O	60	/	DRF	53	-	R	V	U	C	14	K01		
1	2	3	4		5	6		7	8	9	10	11	12	13	14

			18	28	45	63	72	85	100	
5	Electro proportional control (Positive control									
	With pressure control	U =12V	■	■	□	■	■	■	■	EP1
		U =24V	■	■	□	■	■	■	■	EP2
	Pressure and flow control, (load sensing) X-T open	U =12V	□	□	□	–	□	□	□	EP1I
		U =24V	□	□	□	–	□	□	□	EP2I
	Pressure and flow control, (load sensing) X-T plugged	U =12V	□	□	□	–	□	□	□	EP1I
		U =24V	□	□	□	–	□	□	□	EP2I
	Electrohydraulic control	U =12V	□	□	□	–	□	□	□	EP1I
		U =24V	□	□	□	–	□	□	□	EP2I
	Pressure and flow control with controller cut-off (load sensing) X-T open	U =12V	■	■	□	■	■	■	■	EK1I
		U =24V	■	■	□	■	■	■	■	EK2I
	Pressure and flow control with controller cut-off (load sensing) X-T plugged	U =12V	■	■	□	■	■	■	■	EK1I
		U =24V	■	■	□	■	■	■	■	EK2I
	Electrohydraulic pressure control with controller cut-off	U =12V	■	■	□	■	■	■	■	EK1I
		U =24V	■	■	□	■	■	■	■	EK2I

Series

		18	28	45	63	72	85	100	
6	Series 5, index 3	■	■	■	■	■	■	■	53

Direction of rotation

7	Viewed on drive shaft	Clockwise	R
		Counter-clockwise	L

Sealing material

8	FKM (fluorocarbon rubber)	V

Drive shaft

			18	28	45	63	72	85	100	
9	Splined shaft ANSI B92.1 a	standard shaft	■	■	■	■	■	■	■	S
		similar to shaft , S" however for higher input torque	■	■	■	■	■	■	■	R
		reduced diameter, not for through drive	■	■	■	■	■	■	■	U
		similar to shaft "U", however for higher torque	–	■	■	■	■	■	■	W
	Parallel keyed shaft DIN68885 not for through-drive		■	■	■	■	■	■	■	K

Mounting flange

			18	28	45	63	72	85	100	
10	ISO 3019-1 (SAE)	2-hole	■	■	■	■	■	■	■	C
		4-hole	–	–	–	■	■	■	■	D

■ = Available □ = On request – = Not available

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Type code series 53

P	A10V	O	60	/	DRF	53	-	R	V	U	C	14	K01		
1	2	3	4		5	6		7	8	9	10	11	12	13	14

Working port

				18	28	45	63	72	85	100	
11	SAE flange ports according to ISO 6162 **metric**	Fastening thread **metric** rear	Not for through drive	■	■	■	■	■	■	■	11
		Fastening thread **metric** laterally opposite	For through drive	■	■	■	■	■	■	■	12
		Fastening thread **metric** laterally offset 90°	Not for through drive ; available for counter - clockwise rotation only	–	–	■	–	–	–	–	13
	SAE flange ports according to ISO 6162 **UNC**	Fastening thread **UNC** rear	Not for through drive	■	■	■	■	■	■	■	61
		Fastening thread **UNC** laterally opposite	For through drive	■	■	■	■	■	■	■	62

Through drive *(for mounting options, see page 76)*

				18	28	45	63	72	85	100	
12	Does not include through drive, standard on models 11, 13 and 14			■	■	■	■	■	■	■	N00
	SAE J744 flange Diameter	Hub for splined shaft[1] 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
	127-4 (C)	1 1/4 in	14T 12/24DP	–	–	–	■	■	■	■	K15
		1 1/2 in	17T 12/24DP	–	–	–	–	–	■	■	K16
	127-2 (C)	1 1/4 in	14T 12/24DP	–	–	–	–	–	■	■	K07
		1 1/2 in	17T 12/24DP	–	–	–	–	–	■	■	K24

Connector for solenoids

		18	28	45	63	72	85	100	
13	Without connector (without solenoid, only for hydraulic controls, without signs)	■	■	■	■	■	■	■	
	DEUTSCH – molded connector, 2-pin – without suppressor diode (for electric controls)	■	■	■	■	■	■	■	P

Swivel angle sensor

				18	28	45	63	72	85	100	
14	Without swivel angle sensor (without code)			■	■	■	■	■	■	■	
	With electric swivel angle sensor PAL (as per data sheet 95161)[3]	Ratiometric	Power supply U = 5V DC	–	–	–	■[2]	■[2]	–	–	H
		SENT/SENT		–	–	–	□[2]	□[2]	–	–	P

Notice

- Note the project planning notes on page 84.
- In addition to the type code, please specify the relevant technical data when placing your order.

■ = Available □ = On request – = Not available

1) In accordance with ANSI B92.1a
2) Only available with mounting flange C (order item 09)
3) Also see page 79 for further details

Technical data

Hydraulic fluids

When using environmentally friendly hydraulic fluids, the relevant technical data and seal limitations must be observed. Please contact us for details. When ordering, please specify the hydraulic fluid to be used.

Operating Viscosity Range

For optimal efficiency and service life, we recommend selecting the operating viscosity (at operating temperature) within the following optimal range.

vopt = Optimal operating viscosity : 16 to 36 mm²/s

Please refer to the tank temperature (open circuit).

Viscosity Limits

Under critical operating conditions, the following values apply:

v_{min} = 10 mm²/s

– Permissible for short periods (t ≤ 1 min)
– Maximum permissible case drain temperature: 115 °C

Please note that certain areas (e.g., the bearing area)

must also not exceed the maximum case drain fluid temperature of 115 °C.
The oil temperature in the bearing area is approximately 5K higher than the average case drain fluid temperature.

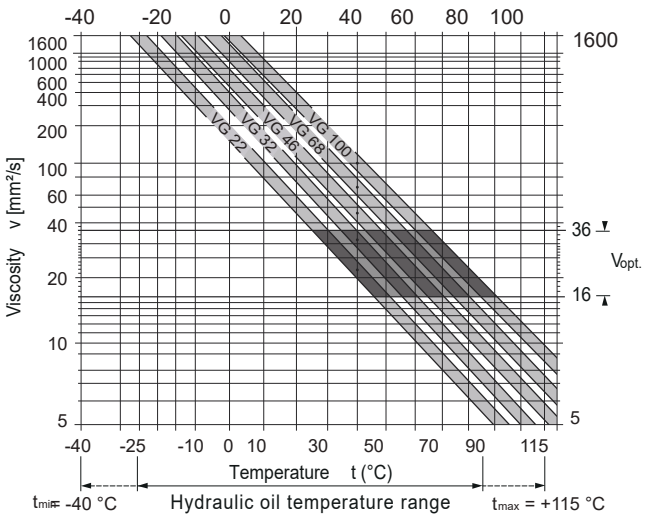
v_{max} = 1600 mm²/s

– Permissible for short periods (t ≤ 1 min)
– During cold start
(p ≤ 30 bar, n ≤ 1000 rpm, tmin -25 °C)

Depending on the installation, special measures must be taken when operating between -40 °C and -25 °C.

For more information on low-temperature operation, please contact YEOSHE.

Selection diagram



Notes on Selecting Hydraulic Fluid

To select the proper hydraulic fluid, it is necessary to determine the operating temperature based on the ambient temperature. In an open circuit, this refers to the tank temperature.

Hydraulic fluid should be selected so that it operates within

the optimal viscosity range (vopt) at the expected operating temperature. Please refer to the shaded area in the selection chart. We recommend choosing a fluid with a higher viscosity grade appropriate for the given conditions.

Example :
At an ambient temperature of X °C, the operating temperature in the tank is 60 °C.
Within the optimal viscosity range (vopt; shaded area), this corresponds to viscosity grades VG 46 to VG 68; in this case, VG 68 should be selected.

Hydraulic Fluid Filtration

The finer the filter element, the higher the fluid cleanliness—and the longer the service life of the axial piston unit.

To ensure the reliable performance of the axial piston unit, it is essential to perform a comprehensive analysis of the hydraulic fluid to determine the level of solid particle contamination. This assessment should confirm whether the cleanliness meets the ISO 4406 standard.
A minimum cleanliness level of ISO 4406 class 20/18/15 is required.

When operating hydraulic fluid at elevated temperatures (from 90 °C up to a maximum of 115 °C), a higher cleanliness level of at least ISO 4406 class 19/17/14 is required.
If the specified cleanliness levels cannot be achieved, please contact us.

Important Note

The case drain temperature is influenced by pressure and input speed and is always higher than the tank temperature. However, the temperature at any point on the component must not exceed 115 °C.
When determining bearing viscosity, the specified temperature difference on the left side must be taken into account.

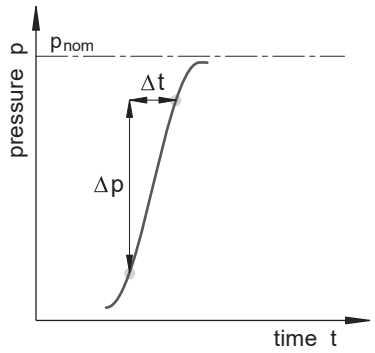
If the above conditions cannot be met due to extreme operat-

ing parameters, please consult us.

Technical data

Operating Pressure Specifications

- Pressure at service line port B
- Nominal pressure p_{nom} — 250 bar
- Maximum pressure p_{max} — 315 bar
  - Single operation duration — 2.5 ms
  - Total operating time — 300 hours
- Minimum pressure (high-pressure side) — 10 bar (absolute pressure) [1)]
- Pressure change rate $R_{A\,max}$ — 16,000 bar/s



Suction port S (inlet) pressure

Minimum pressure $P_{S\,min}$ — 0.8 bar (absolute pressure)

Maximum pressure $P_{S\,max}$ — 5 bar [1)]

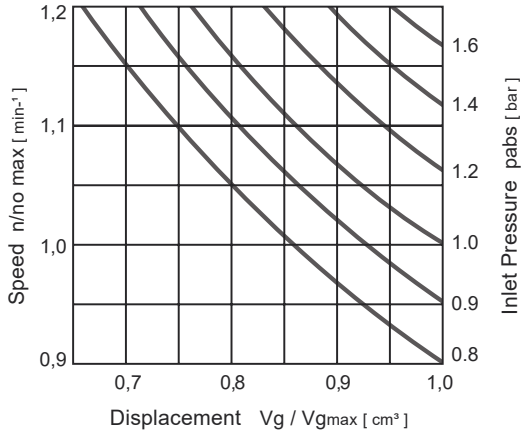
Case Drain Pressure

The maximum allowable case drain pressure (at ports L, L1) must not exceed 0.5 bar above the inlet pressure at port S, and in any case not more than 2 bar.

$P_{L\,max\,abs}$ — 2 bar

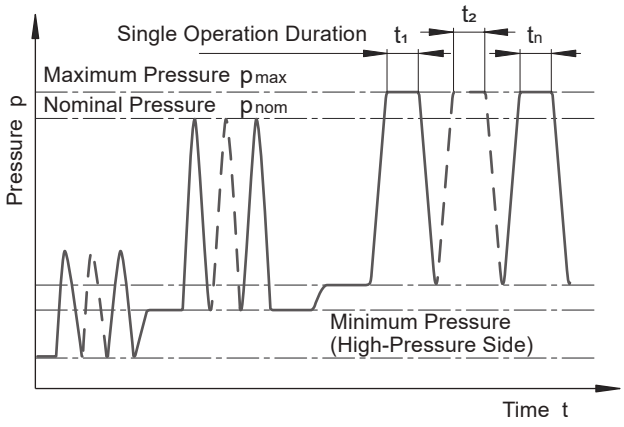
Maximum Permissible Speed (Speed Limitation)

An increase in the inlet pressure p_{abs} at suction port S is required, or operation must be within $Vg \leq Vg_{max}$.



Definition

- Nominal pressure Pnom
  The nominal pressure corresponds to the maximum design pressure.
- Maximum pressure pmax
  The maximum pressure corresponds to the 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 on the high pressure side (B) that is required in order to prevent damage to the axial piston unit.
- Minimum pressure (inlet) open circuit
  Minimum pressure at suction port S (inlet) that is required 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 RA
  Maximum permissible pressure build-up and pressure reduc-tion speed with a pressure change over the entire pressure range.



Total Operating Time = t1 + t2 + … + tn

Technical data

Table of values

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

Size		NG		10	18	28	45	60	63	72	85	100
Geometrical displacement per revolution		$V_{g\,max}$	in³ cm³	0.64 10	1.10 18	1.75 28	2.75 45	3.66 60	3.84 63	4.39 72	5.18 85	6.10 100
Maximum rotational speed 1)	at $V_{g\,max}$	n_{nom}	rpm	3600	3300	3000	2600 4)	2700	2600	2600	2500	2300
	at $V_g < V_{g\,max}$ 2)	$n_{max\,perm}$	rpm	4320	3960	3600	3120	3140	3140	3140	3000	2500
Flow	at n_{nom} and $V_{g\,max}$	$q_{vE\,max}$	l/min	37	59	84	117	162	163	187	212	230
	at n_E =1500 rpm	$q_{vE\,max}$	l/min	15	27	42	68	90	95	108	128	150
Power	at n_{nom} , $V_{g\,max}$ and Δp = 250 bar (3600 psi)	P_{max}	kW	16	25	35	49	65	68	77	89	96
	at n_E =1500 rpm	$P_{E\,max}$	kW	7	11	18	28	37	39	45	53	62
Torque	at $V_{g\,max}$ and Δp = 250 bar (3600 psi)	T_{max}	Nm	42	71	111	179	238	250	286	338	398
	at $V_{g\,max}$ and Δp = 100 bar (1450 psi)	T	Nm	17	29	45	72	95	100	114	135	159
Rotary stiffness of drive shaft	S	c	lb-ft/rad kNm/rad	6760 9.2	8082 11.0	16400 22.3	27560 37.5	48100 65.5	48100 65.5	48100 65.5	105100 143.0	105100 143.0
	R	c	lb-ft/rad kNm/rad	– –	14800 10870	26300 19400	41000 30240	69400 51200	69400 51200	69400 51200	152900 112773	152900 112773
	U	c	lb-ft/rad kNm/rad	6.8 5020	8.0 5870	16.7 12317	30.0 22130	49.2 36290	49.2 36290	49.2 36290	102.9 75900	102.9 75900
	W	c	lb-ft/rad kNm/rad	– –	– –	19.9 14678	34.4 25270	54.0 39830	54.0 39830	117.9 39830	117.9 86960	117.9 86960
	P	c	lb-ft/rad kNm/rad	10.7 7892	– –	– –	– –	– –	– –	– –	– –	– –
	K	c	lb-ft/rad kNm/rad	10.8 7965	13.3 9810	26.8 19770	43.9 32380	73.9 54506	73.9 54506	73.9 54506	163.4 120518	163.4 120518
Moment of inertia of the rotary group		J_{TW}	kgm²	0.0006	0.0009	0.0017	0.003	0.0056	0.0056	0.0056	0.012	0.012
Maximum angular acceleration 3)		α	rad/s²	8000	6800	5500	4000	3300	3300	3300	2700	2700
Case volume		V	L	0.2	0.25	0.3	0.5	0.8	0.8	0.8	1	1
Weight (**without** through drive) approx.		m	kg	8	11.5	15	18	22	22	22	36	36
Weight **with** through drive (approx.		m	kg	–	13	18	24	28	28	28	45	45

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_{opt} = 36 to 16 mm²/s (cSt)
– with hydraulic fluid based on mineral oils

2) See diagram on page 11 at speed increase up to $n_{max\,adm.}$

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

4) Higher rotational speeds on request.

Notice

Exceeding the maximum permissible values or falling below the minimum permissible values may result in loss of function, shortened service life or complete destruction of the axial piston unit. We recommend checking the loads by testing or calculation/simulation and comparing with the permissible values.

Specifications calculation

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

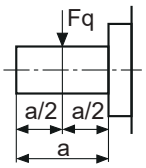
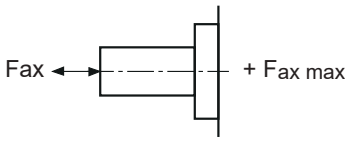
Torque $T = \dfrac{V_g \cdot \Delta p}{20 \cdot p \cdot h_{mh}}$ [Nm]

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 (cm³)
Δp = Pressure difference (bar)
n = Speed (rpm)
η_V = Volumetric efficiency
η_{mh} = Mechanical - hydraulic efficiency
η_t = Total efficiency ($\eta_t = \eta_V \cdot \eta_{mh}$)

Technical data

Permissible radial and axial forces on the drive shaft

Size	NG		10	18	28	45	60/63	72	85	100
Radial force maximum at a/2 		lbf	56	78	270	337	382	337	450	450
		(N)	(250)	(350)	(1200)	(1500)	(1700)	(1500)	(2000)	(2000)
Axial force maximum 		lbf	90	157	225	337	450	337	675	675
		(N)	(400)	(700)	(1000)	(1500)	(2000)	(1500)	(3000)	(3000)

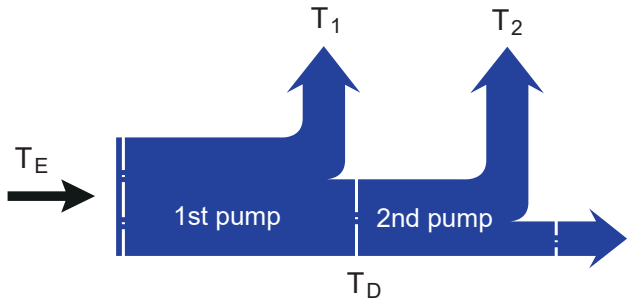
Permissible input and through-drive torques

Size	NG		10	18	28	45	60/63	72	85	100
Torque at $V_{g\,max}$ and Δp = 250 bar (3600 psi) [1]	T_{max}	lb-ft	31	52	82	132	184	211	247	293
		(Nm)	(42)	(71)	(111)	(179)	(250)	(321)	(338)	(398)
Max. input torque on drive shaft [2]										
S	$T_{E\,max}$	in	3/4	3/4	7/8	1	1 1/4	1 1/4	1 1/2	1 1/2
	Ø	(Nm)	126	124	198	319	630	630	1157	1157
R	$T_{E\,max}$	in	–	3/4	7/8	1	1 1/4	1 1/4	1 1/2	1 1/2
	Ø	(Nm)	–	160	250	400	650	650	1215	1215
U	$T_{E\,max}$	in	5/8	5/8	3/4	7/8	1	1 1/4	1 1/4	1 1/4
	Ø	(Nm)	60	59	105	188	306	306	628	628
W	$T_{E\,max}$	in	–	–	3/4	7/8	1	1	1 1/4	1 1/4
	Ø	(Nm)	–	–	140	220	396	383	650	650
P	$T_{E\,max}$	in	0.71	–	–	–	–	–	–	–
	Ø	(Nm)	90	–	–	–	–	–	–	–
Maximum through-drive torque										
S	$T_{D\,max}$	Nm	–	108	160	319	484	484	698	698
R	$T_{D\,max}$	Nm	–	120	176	365	484	484	698	–

[1] Efficiency not considered.

[2] For drive shafts with no radial force.

Distribution of torques



Technical data

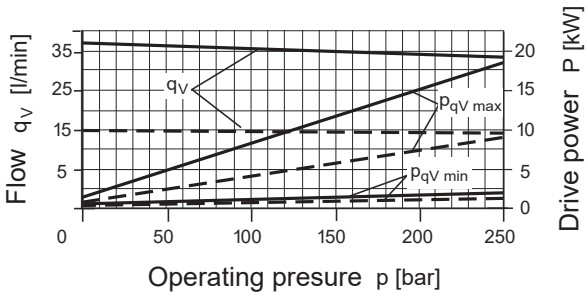
Drive power and flow

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

Size 10

_ _ _ _ n = 1500 rpm

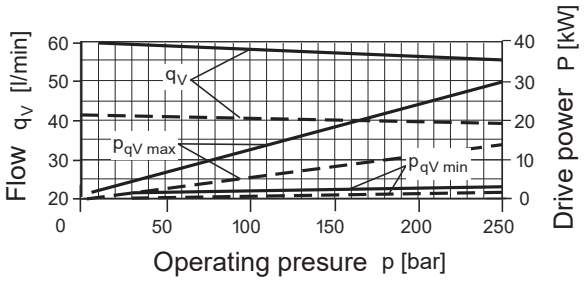
_____n = 3600 rpm



Size 18

_ _ _ _ n = 1500 rpm

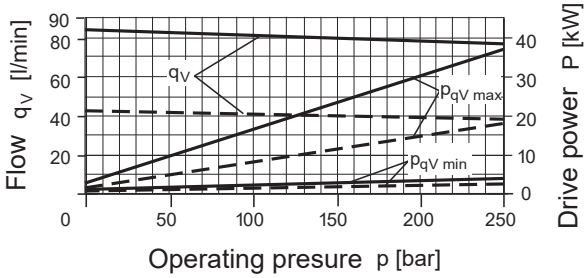
_____n = 3300 rpm



Size 28

_ _ _ _ n = 1500 rpm

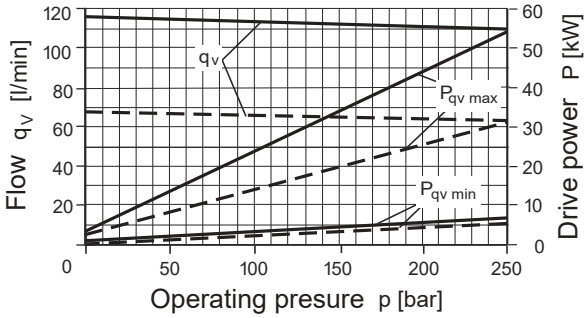
_____n = 3000 rpm



Size 45

_ _ _ _ n = 1500 rpm

_____n = 2600 rpm



Technical data

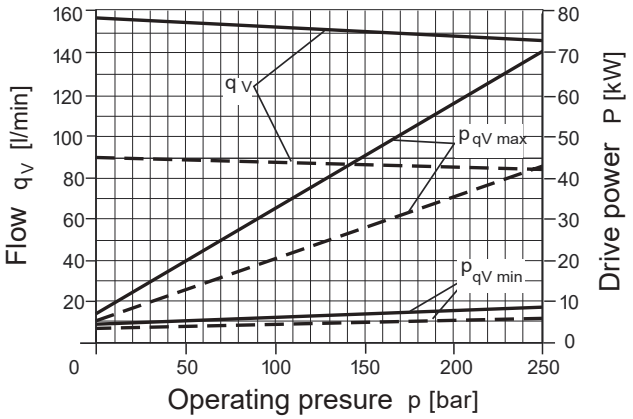
Drive power and flow

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

Size 60/63

_ _ _ _ n = 1500 rpm

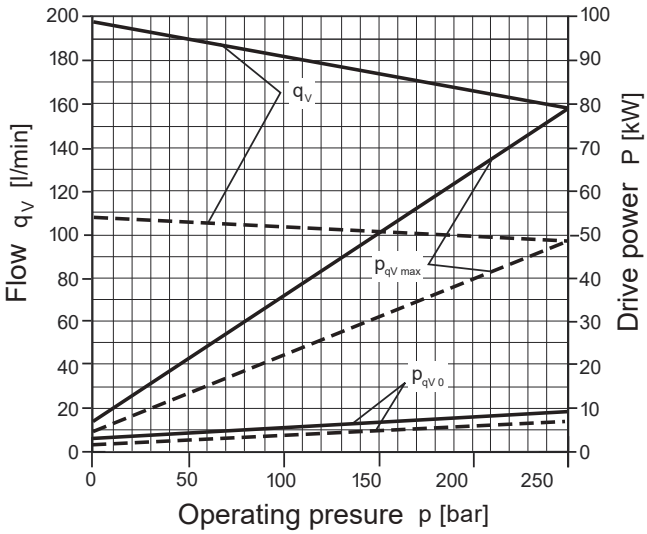
_____n = 2600 rpm



Size 72

_ _ _ _ n = 1500 rpm

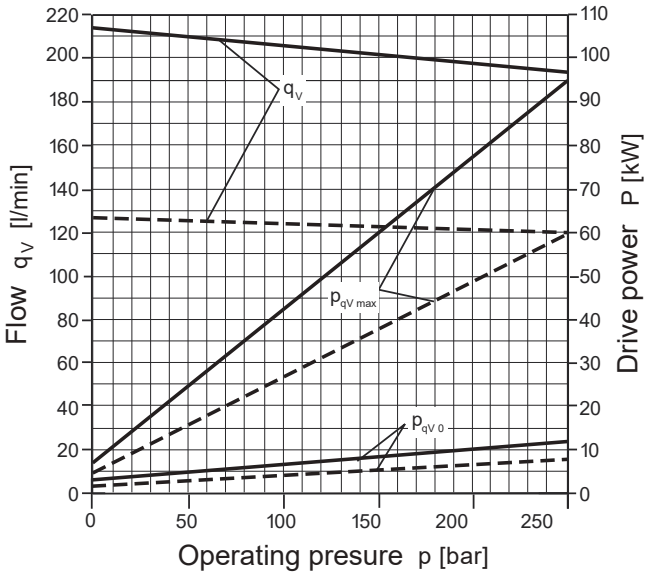
_____n = 2500 rpm



Size 85

_ _ _ _ n = 1500 rpm

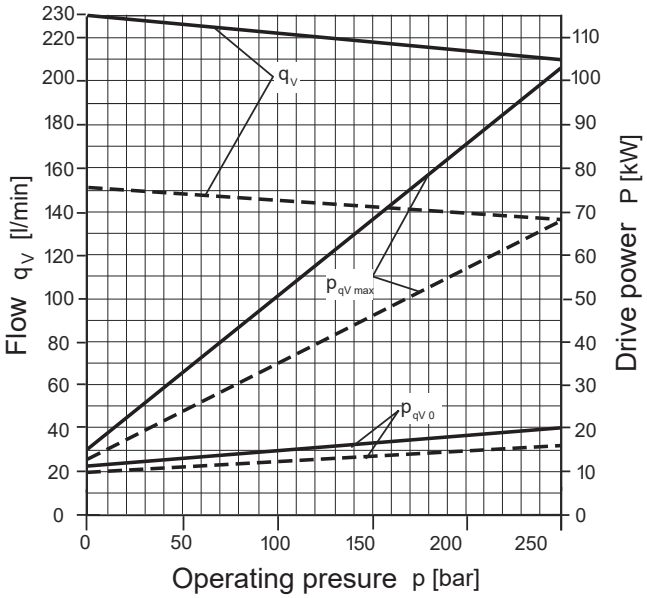
_____n = 2500 rpm



Size 100

_ _ _ _ n = 1500 rpm

_____n = 2300 rpm

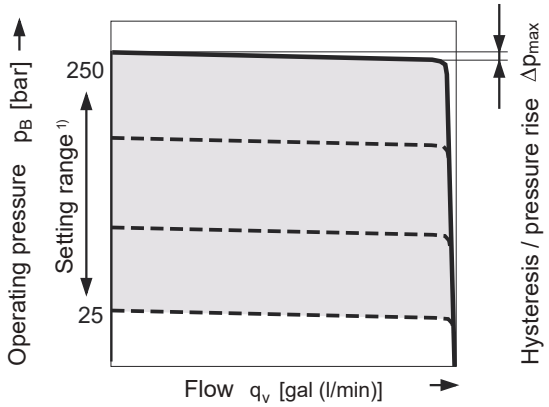


DR – Pressure controller

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 consu-mers. If the operating pressure exceeds the target pressure set at the pressure valve, the pump will regulate towards a smaller displacement. The pressure can be set steplessly at the control valve.

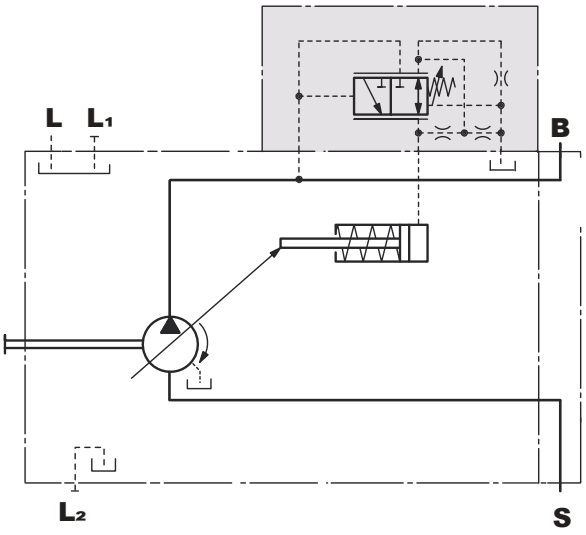
Static characteristic

(at n_1 = 1500 rpm; t_{fluid} = 120°F (50 °C))



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

Circuit diagram



	Port for
B	Service line
S	Suction line
L、L1、2	Case drain fluid (L1、2 plugged)

Controller data

Hysteresis and repeatability Δp _____ maximum 45 psi (3 bar)

Pressure rise, maximum

NG	10	18	28	45	60/63	72	85	100
Δp bar	90	90	90	90	115	115	175	200
(bar)	(6)	(6)	(6)	(6)	(8)	(8)	(12)	(14)

Control fluid consumption _____ max. approx. 0.8 gpm (3 l/min)

DRG – Pressure control remotely operated

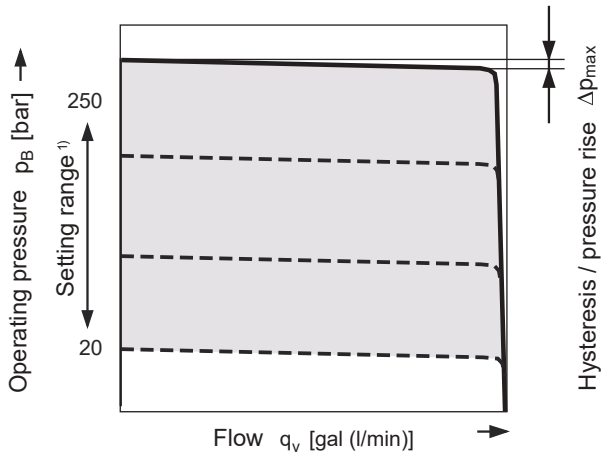
The DRG control valve overrides the function of the DR pressure controller .

A pressure relief valve can be externally piped toport 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 pump.

The differential pressure at the control valve is set as standard to 290 psi (20 bar). The control fluid volume at port X is approx. 0.4 gpm (1.5 l/min). If another setting is required (range from 145 to 320 psi (10 to 22 bar)) please state this in clear text.

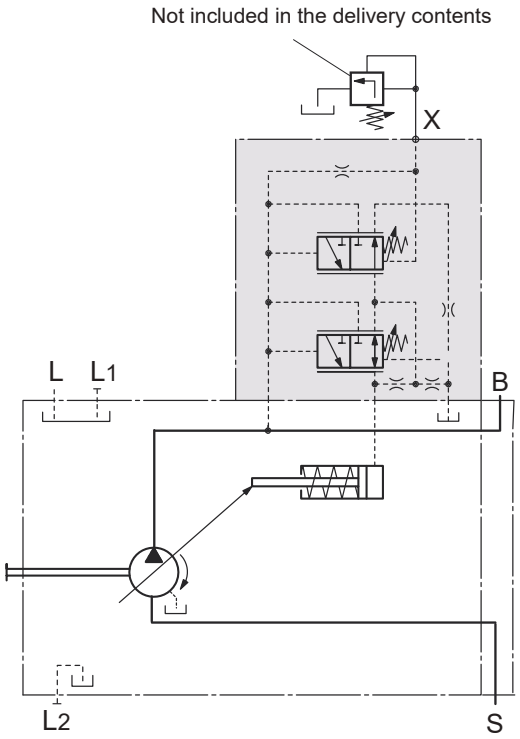
Static characteristic

(at n_1 = 1500 rpm; t_{fluid} = 120°F (50 °C))



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

Circuit diagram



	油口用途
B	Service line
S	Suction line
L、L1、2	Case drain fluid (L1、2 plugged)
X	Pilot pressure

Controller data

Hysteresis and repeatability Δp _____ maximum 45 psi (3 bar)

Pressure rise, maximum

NG	10	18	28	45	60/63	72	85	100
Δp bar	87	87	87	90	115	115	175	200
(bar)	(6)	(6)	(6)	(6)	(8)	(8)	(12)	(14)

Control fluid consumption _____ max. approx. 1.2 gpm (4.5 l/min)

DRF (DFR) DRS (DFR1) – Pressure and flow control

In addition to the pressure control function, 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 required flow by the consumer, regardless of changing pressure levels.

The pressure control overrides the flow control function.

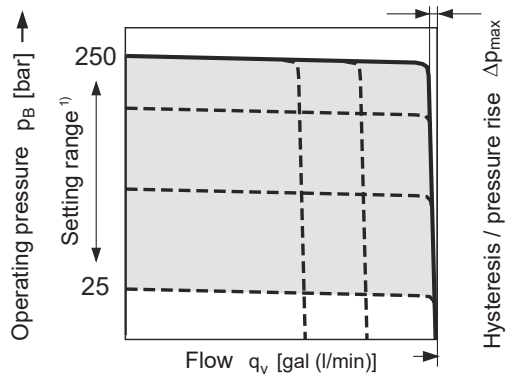
Note

The DRS (DFR1) valve 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.

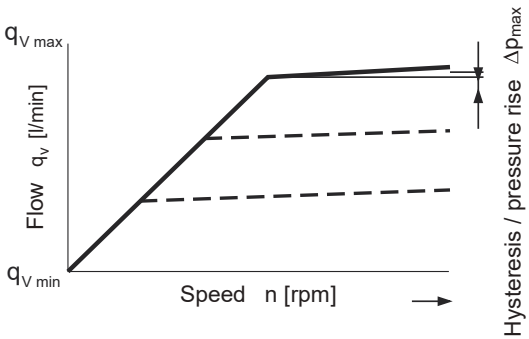
Static characteristic

(Flow control at n_1 = 1500 rpm;
t_{fluid} = 120°F (50 °C))



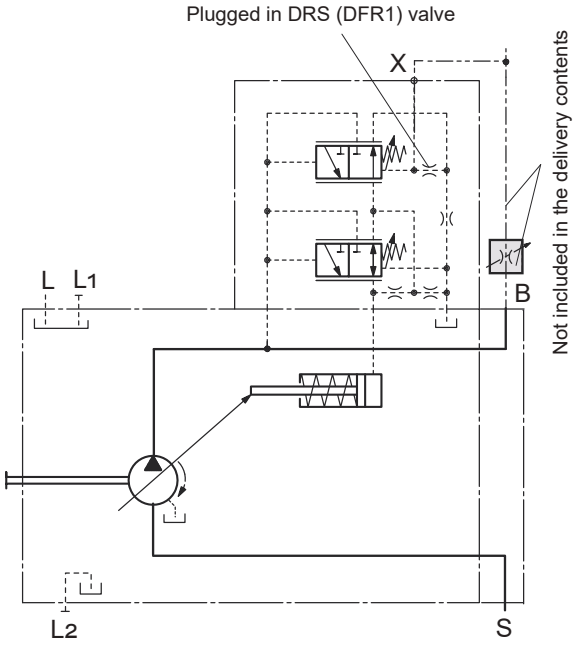
1) In order to prevent damage to the pump and the system, this setting range is the permissible setting range and it is not allowed to be exceeded.
The range of possible settings at the valve is higher.

Static characteristic at variable speed



Possible connections at port B
(not included in the delivery, order separately)

Circuit diagram



	Port for
B	Service line
S	Suction line
L、L1、2	Case drain fluid (L1、2 plugged)
X	Pilot pressure

Differential pressure Δp

Standard setting: 200 to 320 psi (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 15 to 30 psi (1 to 2 bar) higher than the differential pressure Δp). No account is taken of system influences.

Controller data

Data pressure control DR, see page 12.
Maximum flow deviation measured with drive speed n = 1500 rpm.

NG		10	18	28	45	60/63	72	85	100
$\Delta q_{V\,max}$	gpm	0.13	0.24	0.26	0.48	0.66	0.66	0.83	0.83
	(l/min)	(0.5)	(0.9)	(1.0)	(1.8)	(2.5)	(2.5)	(3.1)	(3.1)

Control fluid consumption
DRF (DFR) ___ maximum approx. 0.8 gpm (3 l/min)
DRS (DFR1) _____maximum approx. 0.8 to 1.2 gpm (3 to 4.5 l/min)

LA... – Pressure, flow and power control

Pressure control equipped as DR(G), see page 12 (13). Flow control equipped as DRF, DRS.

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.

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

Controller data

For pressure controller DR data, see page 12.
For flow control FR data, see page 13.

Controller data

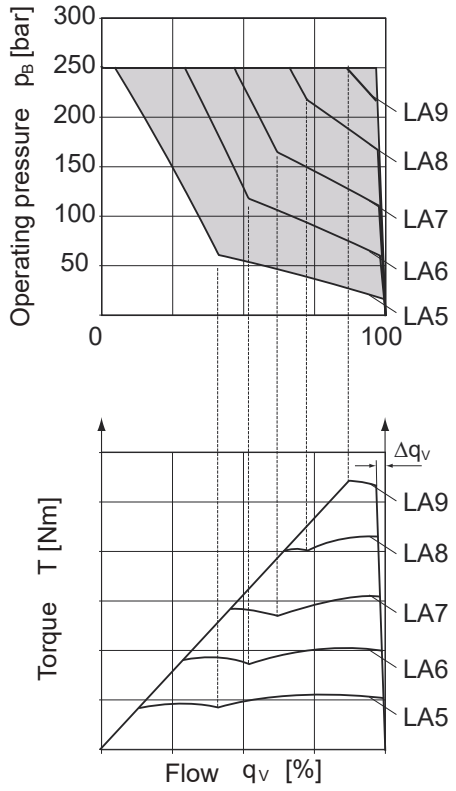
Maximum control fluid consumption, see page 1

Beginning of control	Torque T [lb-ft (Nm)] for size							Code
[psi (bar)]	18	28	45	63	72	85	100	
145 to 510 (10 to 35)	2.80 – 8.92 (3.8 – 12.1)	4.4 – 14 (6 - 19)	7.4 – 22.1 (10 - 30)	11 – 32 (15 - 43)	12.5 – 36.3 (17 – 49.2)	15 – 42 (20 - 57)	24 - 68 (24 - 68)	**LA5**
520 to 1015 (36 to 70)	8.92 – 17.2 (12.2 – 23.3)	14 – 26.5 (19.1 - 36)	22.2 – 43.5 (30.1 - 59)	32 – 61 (43.1 – 83)	36.4 – 69.9 (49.3 – 94.9)	42 – 83 (57.1 - 112)	68.1 - 132 (68.1 - 132)	**LA6**
1030 to 1520 (71 to 105)	17.2 –24.9 (23.4 – 33.7)	26.6 – 38.4 (36.1 -52)	43.6 – 62 (59.1 - 84)	61 – 88 (83.1 – 119)	70 – 100.3 (95.0 – 136.0)	83 – 118 (112.1 - 160)	132.1 - 189 (132.1 - 189)	**LA7**
1535 to 2030 (106 to 140)	24.9 –33.2 (33.8 – 45)	38.4 – 51.6 (52.1 - 70)	62 – 83 (84.1 - 112)	88 – 116 (119.1 – 157)	100.4 – 132.3 (136.1 – 179.4)	118 – 156 (160.1 – 212)	189.1 - 249 (189.1 - 249)	**LA8**
2045 to 3335 (141 to 230)	33.2 – 55.2 (45.1 - 74.8)	51.7 – 82.4 (70.1 - 117)	83 – 128 (112.1 - 189)	116 – 178 (157.1 – 240)	132.4 – 203 (179.5 – 274)	156 – 189 (212.1 – 255)	249.1 - 419 (249.1 - 419)	**LA9**

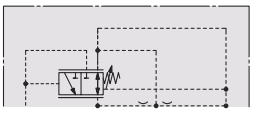
Conversion of the torque values in power [kW] :

$$P = \frac{T}{6.4}\ [kW]\ (\text{at } 1500 \text{ rpm}) \quad \text{or} \quad P = \frac{2\pi \cdot T \cdot n}{60000}\ [kW]$$

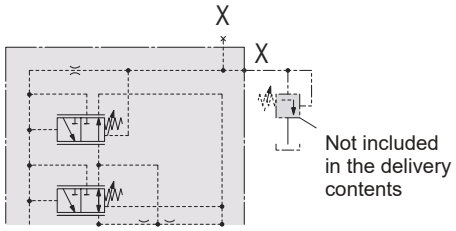
Static curves and torque characteristic



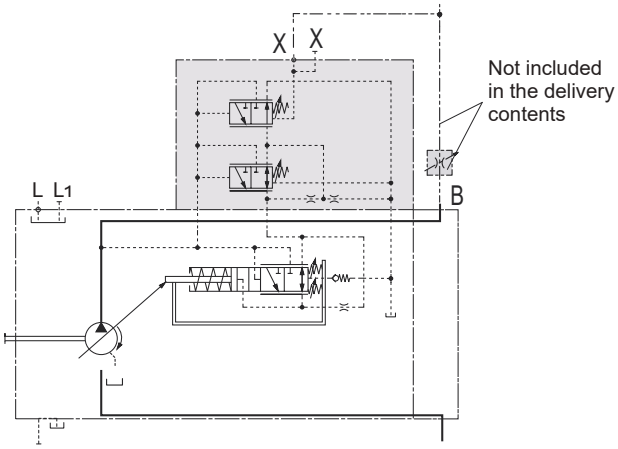
Circuit diagram (LAXD) with pressure cut-off



Circuit diagram (LAXDG) with pressure cut-off, remotely operated



Circuit diagram (LAXDS) with pressure and flow control



EP – Electro-proportional control

Electro-proportional control makes a stepless and reproducible setting of the pump displacement possible directly via the swashplate. The control force of the control piston is applied by a proportional solenoid. The control is proportional to the current (for start of control, see table right).

In a depressurized state, the pump is swiveled to its initial position ($V_{g\,max}$) by an adjusting spring. If the operating pressure exceeds 200 psi (14 bar), the pump will swivel from $V_{g\,max}$ to $V_{g\,min}$ without control by the solenoid (control current < start of control). A PWM signal is used to control the solenoid.

EP.D: The pressure control regulates the pump displacement back to Vg min after the set target pressure has been reached.

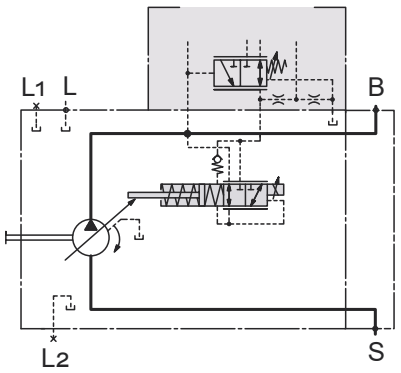
A minimum operating pressure of 200 psi (14 bar) is needed for control. The necessary control fluid is taken from the high pressure.

Technical data, solenoid	EP1	EP2
Voltage	12 V (±20 %)	24 V (±20 %)
Control current		
Start of control at $V_{g\,min}$	400 mA	200 mA
End of control at $V_{g\,max}$	1200 mA	600 mA
Limiting current	1.54 A	0.77 A
Nominal resistance (at 68 °F (20 °C))	5.5 Ω	22.7 Ω
Dither frequency	100 to 200 Hz	100 to 200 Hz
Actuated time	100 %	100 %

For protection rating, please refer to "Socket version" on page 55

Operating temperature range at valve -4 °F to 239 °F (-20 °C to +115 °C).

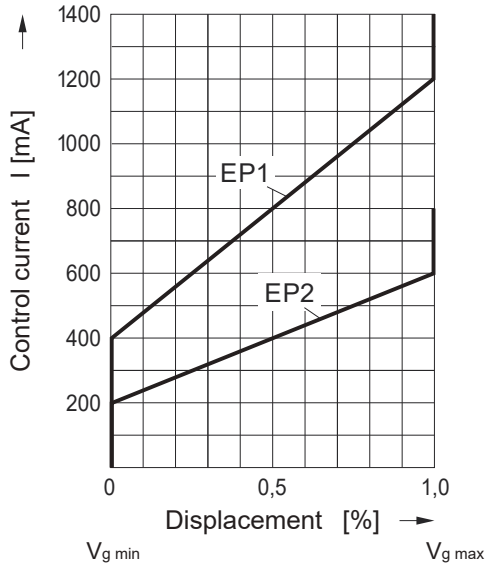
Circuit diagram EP.D



	Port for
B	Service line
S	Suction line
L、L1、2	Case drain fluid (L1、2 plugged)
X	Control pressure

Characteristic EP1/2

Hysteresis < 5 %



Note

The spring return at the controller is not a safety device.

Dirt contamination (contaminated hydraulic fluid, wear or residual dirt from system components) could cause the controller to stick in an undefined position. The volume flow of the axial piston unit will then no longer follow the commands of the operator.

Check whether remedial measures for your application are needed on your machine in order to put the driven consumer in a safe state (e.g. immediate stop).

EK – Electro-proportional control with controller cut-off

The variant EK... is based completely on the variant EP...

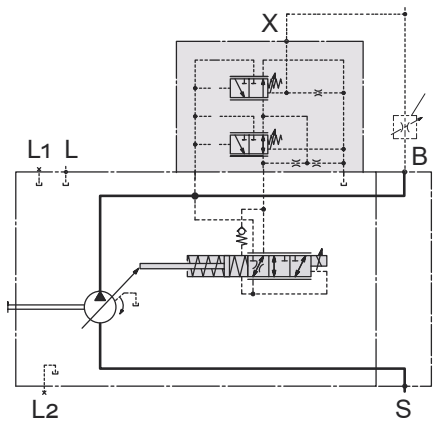
In addition to the electro-proportional control function, a controller cut-off is integrated in the electric characteristic.

The pump then swivels to $V_{g\,max}$ if the control signal is lost (e.g. cable break) and then works with the DRF settings (see page 14). The controller cut-off is only intended for short-term use and not for permanent use if the control signal is lost. If the control signal is lost, the pump swivel times will be reduced by the EK valve.
A PWM signal is used to control the solenoid.

A minimum operating pressure of 200 psi (14 bar) is needed for control. The necessary control fluid is taken from the high pressure.

The $V_{g\,max}$ position is maintained by the force of the adjusting spring. To overcome the force of this spring, the solenoid must be subjected to excessive current (I_{res}).

Circuit diagram EK.DF



	Port for
B	Service line
S	Suction line
L、L1、2	Case drain fluid (L1、2 plugged)
X	Control pressure

Note

The spring return at the controller is not a safety device.

Dirt contamination (contaminated hydraulic fluid, wear or residual dirt from system components) could cause the controller to stick in an undefined position. The volume flow of the axial piston unit will then no longer follow the commands of the operator.

Check whether remedial measures for your application are needed on your machine in order to put the driven consumer in a safe state (e.g. immediate stop).

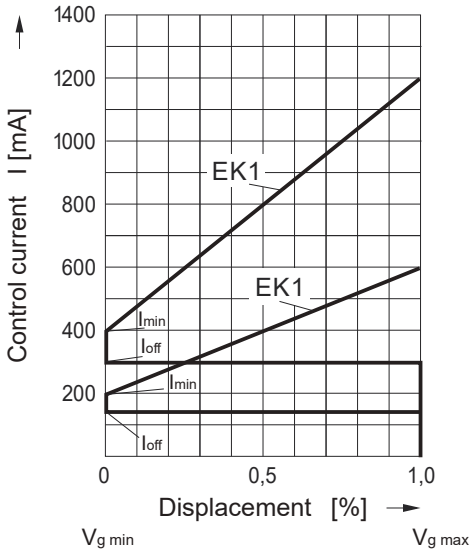
Technical data, solenoid	EK1	EK2
Voltage	12 V (±20 %)	24 V (±20 %)
Control current		
Start of control at $V_{g\,min}$	400 mA	200 mA
End of control at $V_{g\,max}$	1200 mA	600 mA
Limiting current	1.54 A	0.77 A
Nominal resistance (at 68 °F (20 °C))	5.5 Ω	22.7 Ω
Dither frequency	100 to 200 Hz	100 to 200 Hz
Actuated time	100 %	100 %

For protection rating, please refer to "Socket version" on page 55

Operating temperature range at valve -4 °F to 239 °F (-20 °C to +115 °C).

Characteristic EK

Hysteresis < 5 %



	EK1.	EK2.
I_{min} [mA]	400	200
I_{max} [mA]	1200	600
I_{off} [mA]	< 300	< 150
I_{res} [mA]	> 1200	> 600

For changes in current, ramp times of > 200 ms must be observed.

EP(K).DF / EP(K).DS – EP(K) with pressure and flow control

A hydraulic pressure flow control is superimposed on the electro-proportional control.

The pressure control regulates the pump displacement back to $V_{g\,min}$ after the set target pressure has been reached.

This function is super-imposed on the EP or EK control, i.e. the control-current dependent function is executed below the target pressure.

Setting range from 290 to 3600 psi (20 to 250 bar).

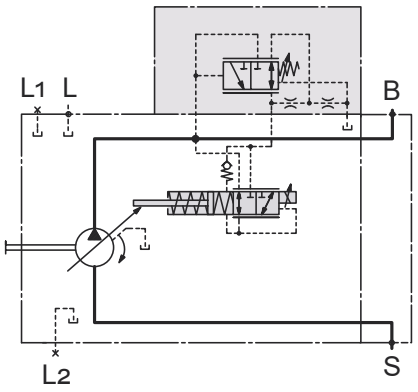
For the pressure flow control.

Pressure control has priority over electro-proportional control and flow control.

With flow control, the pump flow can be influenced in addition to pressure control. The pump flow is thus equal to the actual amount of hydraulic fluid required by the consumer. This is achieved using the differential pressure at the consumer (e.g. orifice).

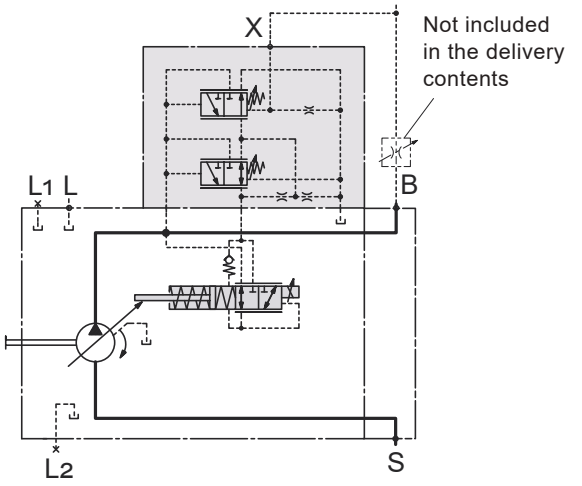
The EP.DS or EK.DS version has no connection between X and the reservoir (load sensing).

Circuit diagram EP.D



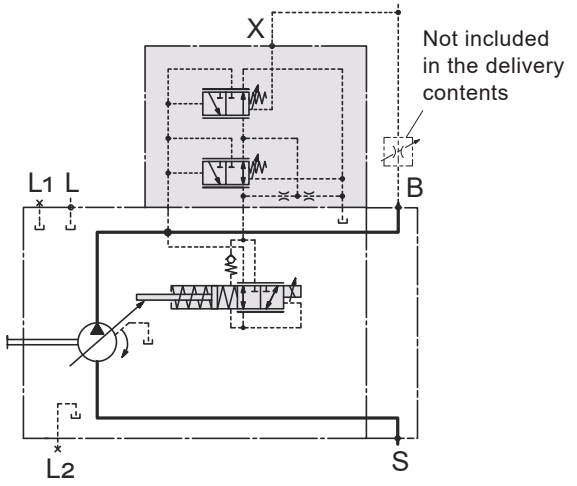
	Port for
B	Service line
S	Suction line
L、L1、2	Case drain fluid (L1、2 plugged)

Circuit diagram EP.DF



	Port for
B	Service line
S	Suction line
L、L1、2	Case drain fluid (L1、2 plugged)
X	Control pressure

Circuit diagram EP.DS



	Port for
B	Service line
S	Suction line
L、L1、2	Case drain fluid (L1、2 plugged)
X	Control pressure

EP(K).ED – EP(K) with electro-hydraulic pressure control

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

When a change is made at the consumer (load pressure), the position of the control piston will shift.

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

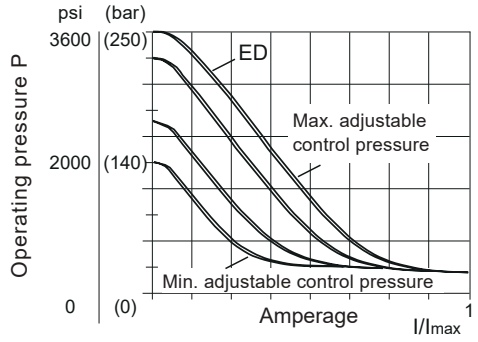
The pump thus only delivers as much hydraulic fluid as the consumers can take. The pressure can be set steplessly by the solenoid current.

As the solenoid current signal drops towards zero, the pressure will be limited to pmax by an adjustable hydraulic pressure cut-off (negative characteristic, e.g. for fan drives). A PWM signal is used to control the solenoid.

Static current-pressure characteristic ED

(negative characteristic)

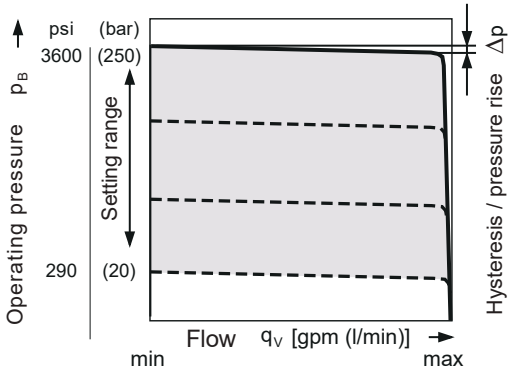
(measured with pump in zero stroke)



Hysteresis static current-pressure characteristic < 45 psi (3 bar).

Static flow-pressure characteristic

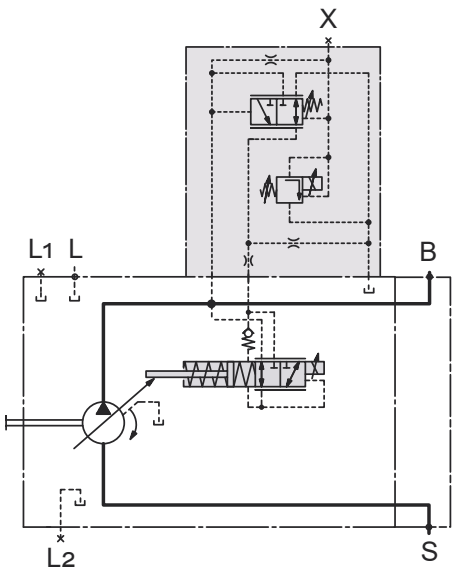
(at n= 1500 rpm; tfluid = 120 °F (50 °C))



Controller data

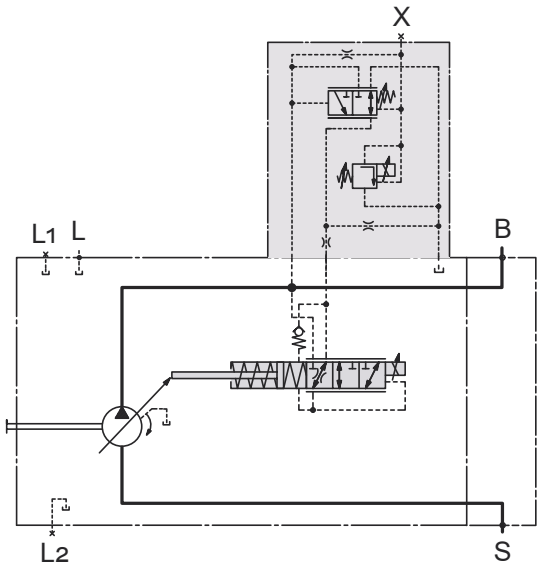
Standby standard setting :
290 psi (20 bar). Other values on request.
Hysteresis / pressure rise Δp 60 psi (4 bar)

Circuit diagram EP.ED



	Port for
B	Service line
S	Suction line
L、L1、2	Case drain fluid (L1、2 plugged)
X	Control pressure

Circuit diagram EK.ED



	Port for
B	Service line
S	Suction line
L、L1、2	Case drain fluid (L1、2 plugged)
X	Control pressure

ED – Electro-hydraulic pressure control

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

When a change is made at the consumer (load pressure), the position of the control piston will shift.

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

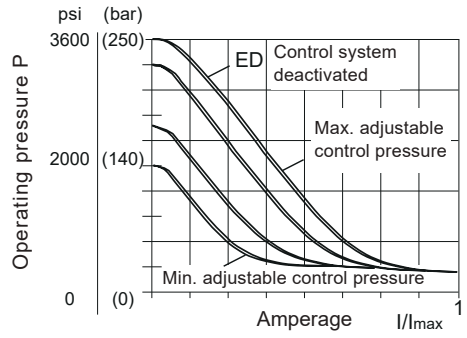
The pump thus only delivers as much hydraulic fluid as the consumers can take. The desired pressure level can be set steplessly by varying the solenoid current.

As the solenoid current signal drops towards zero, the pressure will be limited to pmax by an adjustable hydraulic pressure cut-off (secure fail safe function in case of a loss of power, e.g. for 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

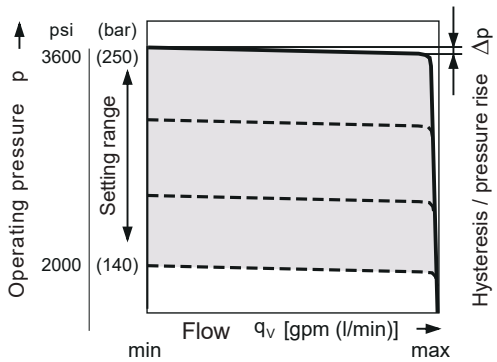
(measured at pump in zero stroke – negative characteristic)



Hysteresis static current-press. characteristic < 45 psi (3 bar)

Static flow-pressure characteristic

(at n= 1500 rpm; t_{fluid} = 120 °F (50 °C))

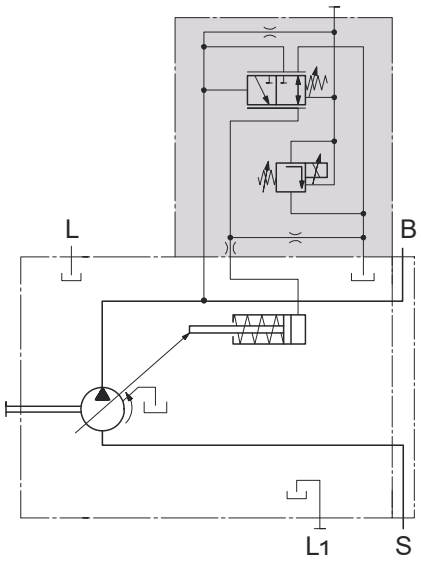


Controller data

Standby standard setting 290 psi (20 bar), other values on request.

Hysteresis and pressure rise_____ Δp < 60 psi (4 bar).
Control flow consumption__0.8 to 1.2 gpm (3 to 4.5 l/min).

Circuit diagram ED..



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

Technical data, solenoid	ED71	ED72
Voltage	12 V (±20 %)	24 V (±20 %)
Control current		
Control begin at $q_{g\,min}$	100 mA	50 mA
End of control at $q_{g\,max}$	1200 mA	600 mA
Limiting current	1.54 A	0.77 A
Nominal resistance (at 68 °F (20 °C))	5.5 Ω	22.7 Ω
Dither frequency	100 to 200 Hz	100 to 200 Hz
Actuated time	100 %	100 %

Operating temperature range at valve
-4 °F to 239 °F (-20 °C to +115 °C)

ER – Electro-hydraulic pressure control

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

When a change is made at the consumer (load pressure), the position of the control piston will shift.

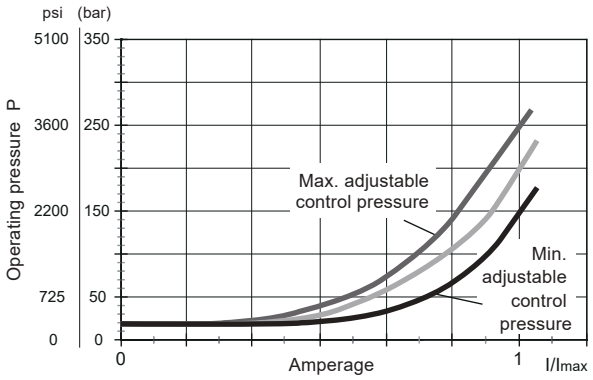
This causes an increase or decrease in the pump swivel angle (flow) in order to maintain the electrically set pressure level.

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 pmin (stand by).

Static current-pressure characteristic ER

(measured with pump in zero stroke – positive characteristic)

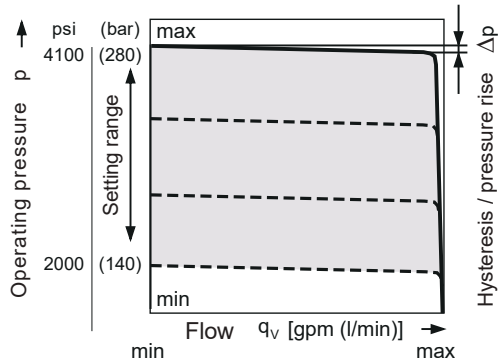


Hysteresis static current-pressure characteristic
< 45 psi (3 bar)

Influence of pressure setting on stand by
± 30 psi (2 bar)

Static flow-pressure characteristic

(at n= 1500 rpm; t_{fluid} = 120 °F (50°C))



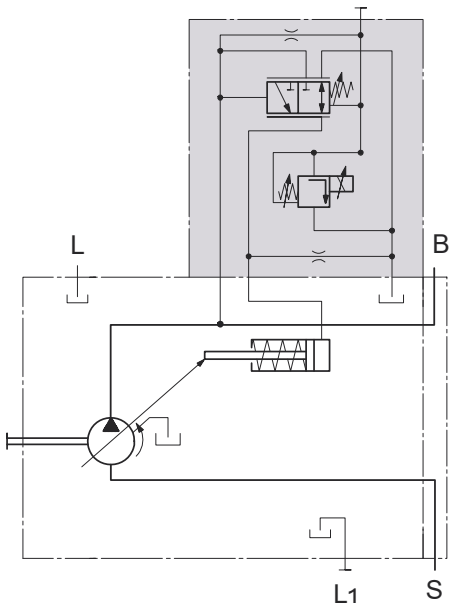
Controller data

Standby standard setting 200 psi (14 bar), other values on request.

Hysteresis and pressure rise
Δp < 60 psi (4 bar).

Control flow consumption
0.8 to 1.2 gpm (3 to 4.5 l/min).

Circuit diagram ER..



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

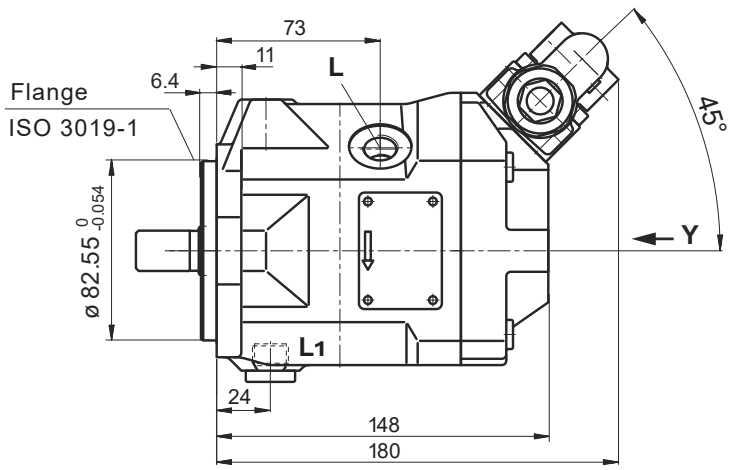
Technical data, solenoid	ED71	ED72
Voltage	12 V (±20 %)	24 V (±20 %)
Control current Control begin at $q_{g\,min}$	100 mA	50 mA
End of control at $q_{g\,max}$	1200 mA	600 mA
Limiting current	1.54 A	0.77 A
Nominal resistance (at 68 °F (20 °C))	5.5 Ω	22.7 Ω
Dither frequency	100 to 200 Hz	100 to 200 Hz
Actuated time	100 %	100 %

Operating temperature range at valve
-4 °F to 239 °F (-20 °C to +115 °C)

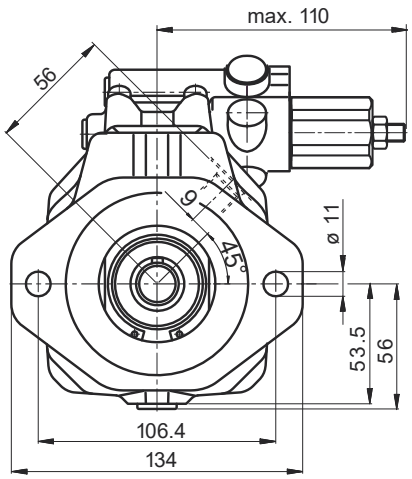
Dimensions, size 10

DR – Hydraulic pressure controller
Centering flange SAE version; series 52

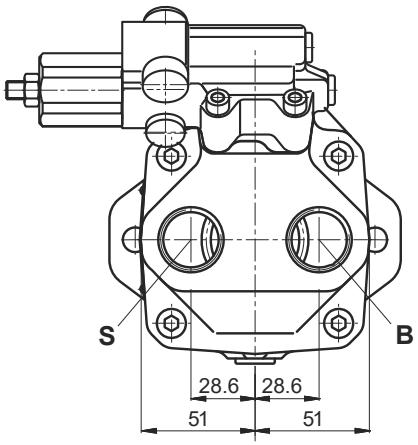
Before finalizing your design request a certified installation drawing.
Dimensions in mm.

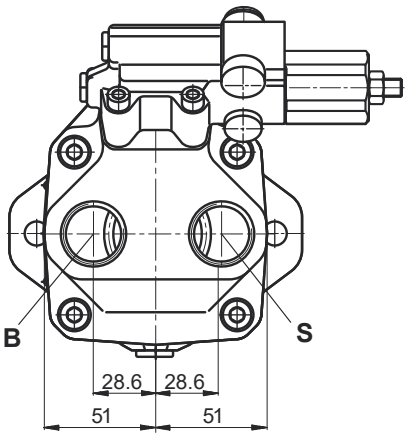


View Y clockwise rotation



View Y counter-clockwise rotation



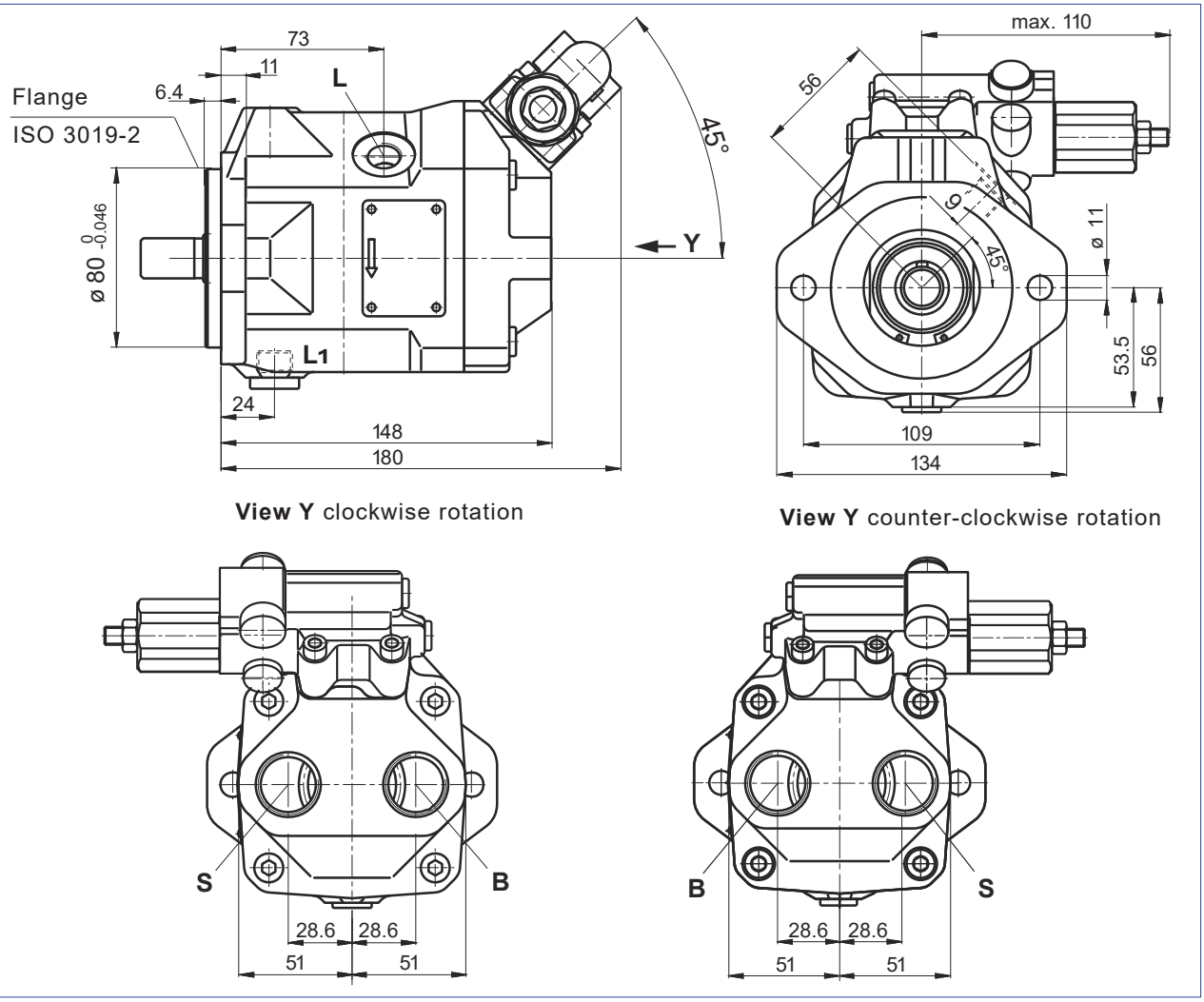


Dimensions, size 10

DR – Hydraulic pressure controller

Centring Flange, Metric Version

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



Ports

Designation	Port for	Standard	Size [1]	p_{max} [psi (bar)] [2]	State
B	Working port	DIN 3852	M27 × 2; 16 (0.63) deep	4550 (315)	O
S	Suction port	DIN 3852	M27 × 2; 16 (0.63) deep	75 (5)	O
L (metric)	Drain port	DIN 3852 [3]	M16 × 1.5; 12 (0.47) deep	30 (2)	O [4]
L1 (metric)	Drain port	DIN 3852 [3]	M16 × 1.5; 12 (0.47) deep	30 (2)	X [4]
L (SAE)	Drain port	ISO 11926 [3]	9/16-18UNF-2B; 12 (0.47) deep	30 (2)	O [4]
L1 (SAE)	Drain port	ISO 11926 [3]	9/16-18UNF-2B; 12 (0.47) deep	30 (2)	X [4]
X (with adapter)	Pilot pressure	DIN 3852	M14 × 1.5; 12 (0.47) deep	4550 (315)	O
X (without adapter)	Pilot pressure	ISO 11926 [2]	7/16-20UNF-2B; 11.5 (0.45) deep	4550 (315)	O

[1] Regarding the maximum tightening torque, safety instructions must be observed.

[2] Depending on the application, momentary pressure spikes can occur. Consider this when selecting measuring equipment and fittings.

[3] The spot face can be deeper than as specified in the standard.

[4] Depending on the installation position, L or L1 must be connected
O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

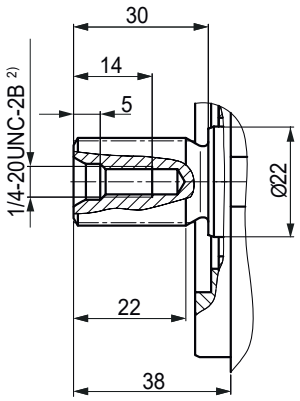
Dimensions, size 10

Drive shaft

Dimensions [mm]

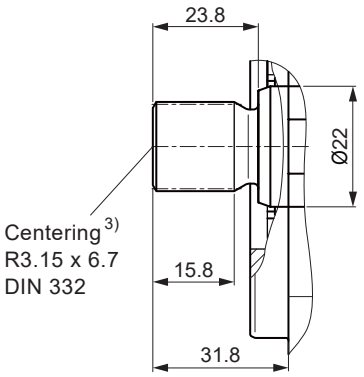
S

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



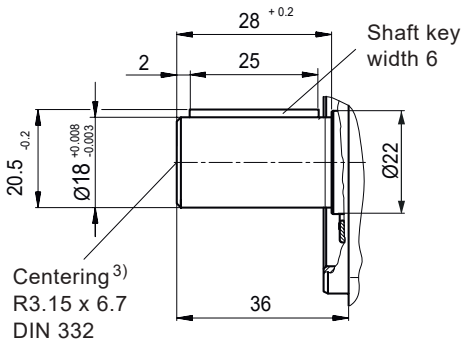
U

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



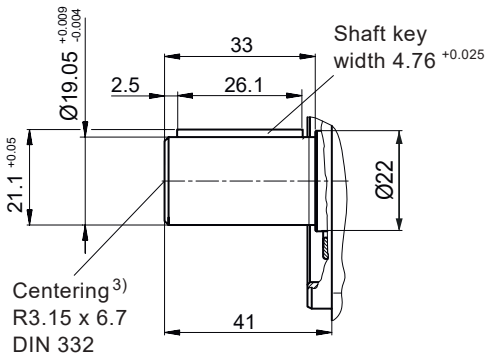
P

Parallel keyed shaft
DIN 6885，A6x6x25



K

Parallel keyed shaft
ISO 3019-1，19-1

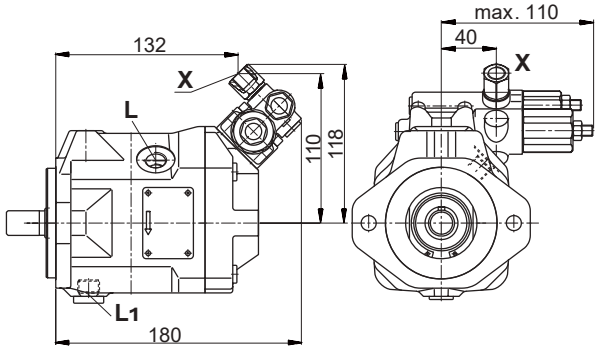


[1] ANSI B92.1a, 30° Pressure Angle, Flat Root, Side Fit, Class 5.
[2] Threads conforming to ASME B1.1 Unified Inch Screw Thread Standard.
[3] Observe safety instructions regarding maximum tightening torque.
[4] Axial coupling fixation, e.g., using a clamping coupling or radially mounted locking screw.

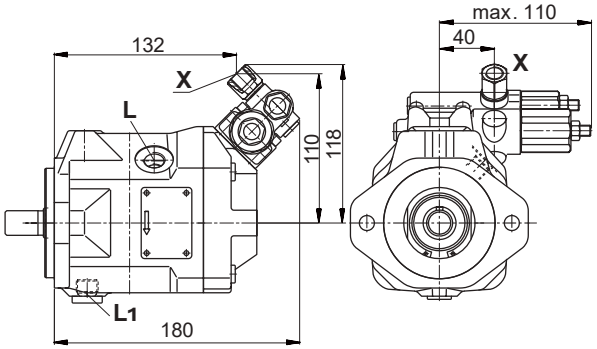
Dimensions, size 10

Dimensions [mm]

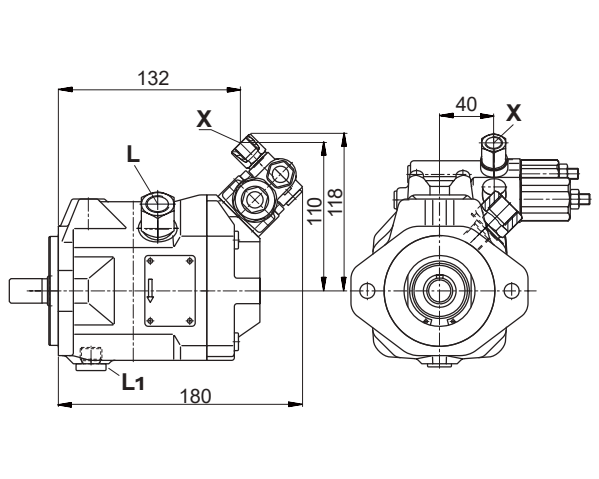
DRG – Pressure controller, remote controlled (mounting flange A) [1)]



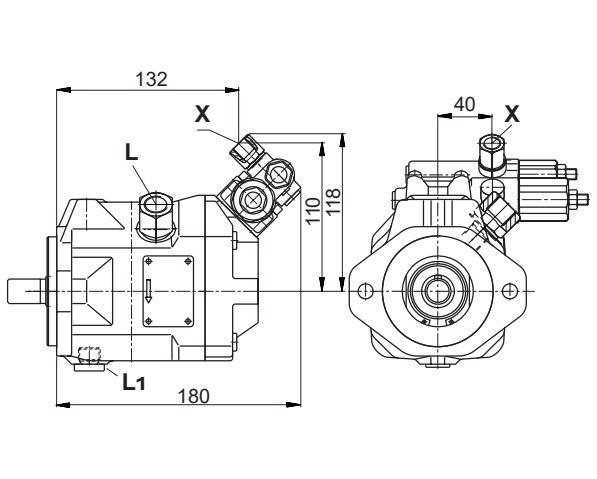
DFR / DFR1 - Pressure, flow controller (mounting flange A) [1)]



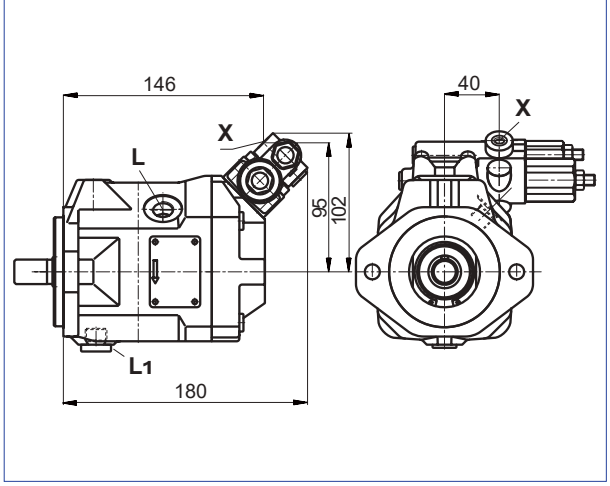
DRG – Pressure controller, remote controlled (mounting flange C) [1) 2)]



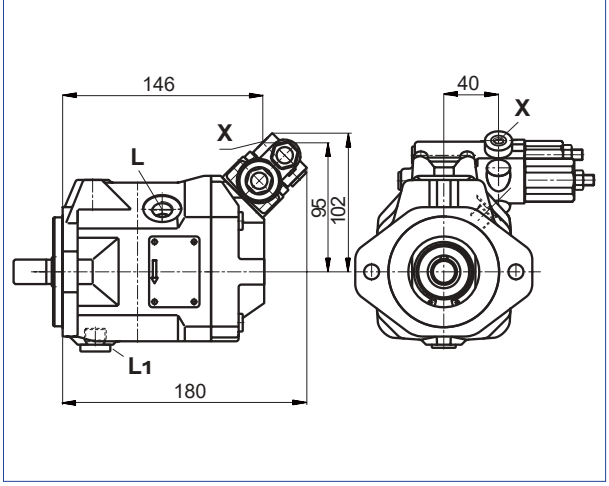
DFR / DFR1 - Pressure, flow controller (mounting flange C) [1) 2)]



DRG – Pressure controller, remote controlled (mounting flange C) [1) 3)]



DFR / DFR1 - Pressure, flow controller (mounting flange C) [1) 3)]



1) Valve mounting for clockwise or counter-clockwise rotation see page 29 and 30.
2) With metric adapter.
3) Version complete SAE without adapter.

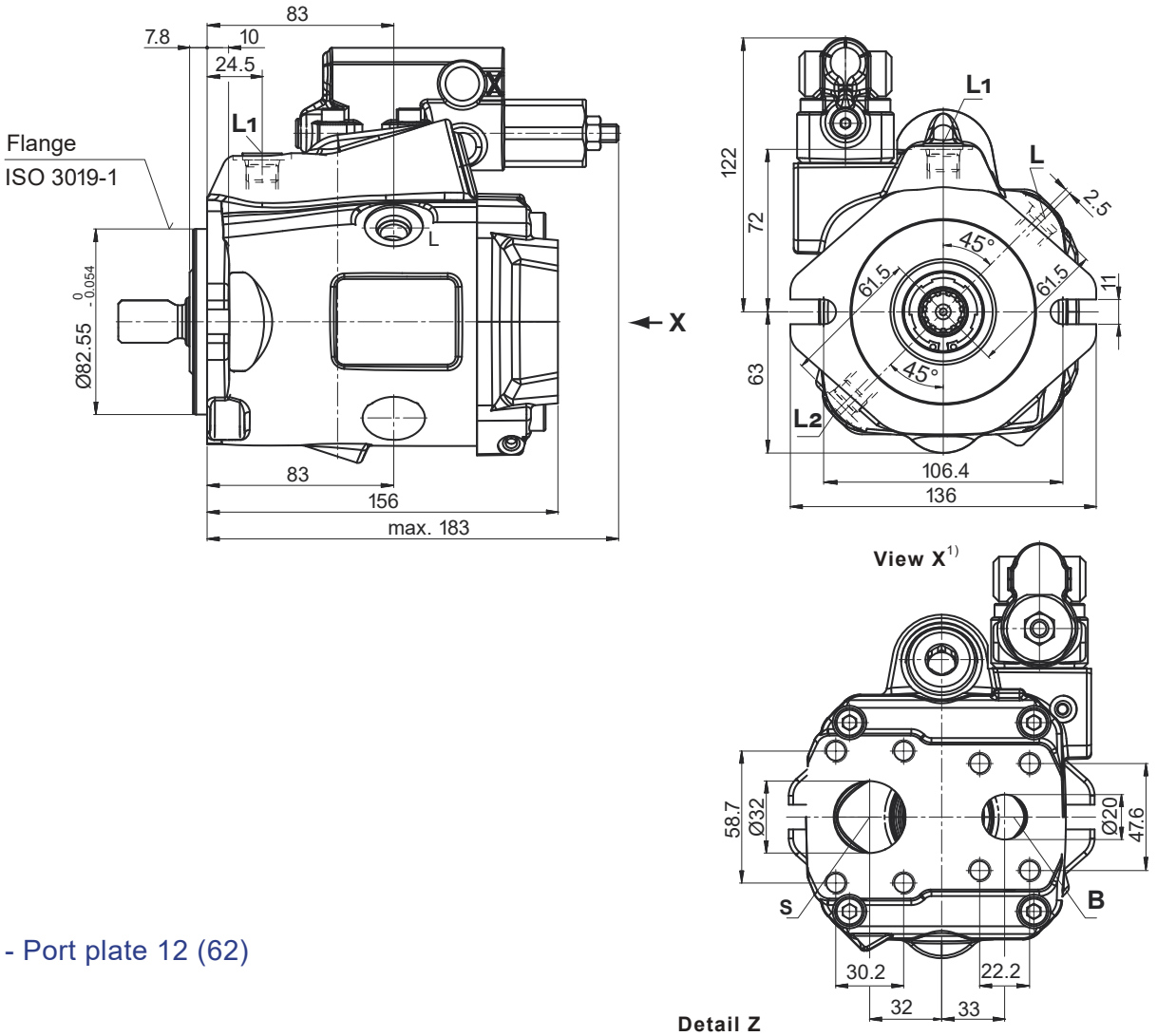
Dimensions, size 18[1)]

DR – Hydraulic pressure controller

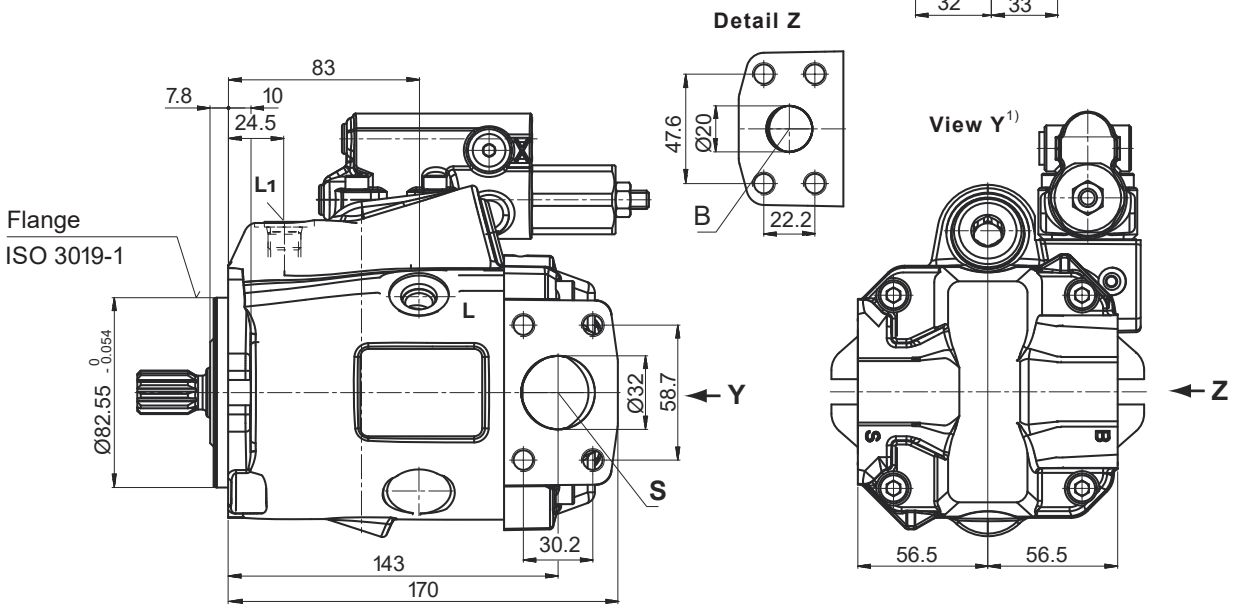
Clockwise rotation, series 53

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

- Port plate 11 (61)



- Port plate 12 (62)



1) Dimensions of working ports turned through 180° for counter-clockwise rotation

Dimensions, size 18

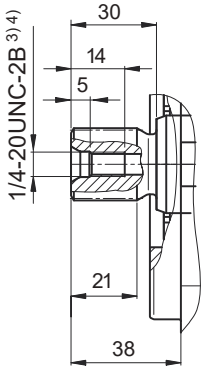
Ports

Designation	Port for	Standard	Size [4]	p_{max} [psi (bar)] [6]	State
B	Service line, fixing thread	SAE J518 ASME B1.1	3/4 in 3/8-16UNC-2B; 0.75 (19) deep	4550 (315)	O
S	Suction line, fixing thread	SAE J518 ASME B1.1	1 1/4 in 7/16-14UNC-2B; 0.79 (20) deep	75 (5)	O
L	Case drain fluid	ISO 11926 [7]	3/4-16UNF-2B; 0.47 (12) deep	30 (2)	O [8]
L_1	Case drain fluid	ISO 11926 [7]	3/4-16UNF-2B; 0.47 (12) deep	30 (2)	X [8]
X	Pilot pressure	ISO 11926 [7]	7/16-20UNF-2A; 0.45 (11.5) deep	4550 (315)	O

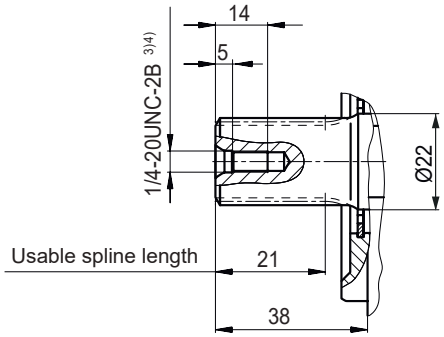
Drive shaft

Dimensions [mm]

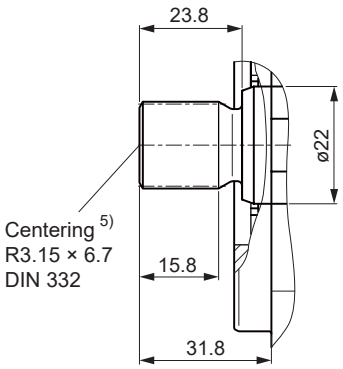
S
Splined shaft 3/4 in
11T 16/32DP [1] (SAE J744)



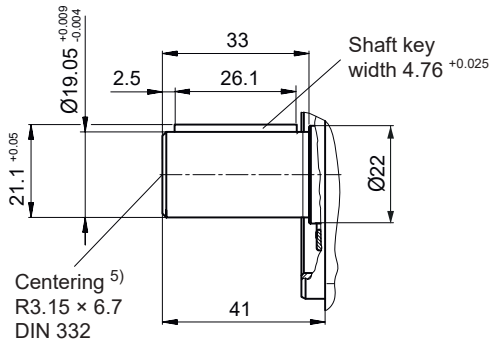
R
Splined shaft 3/4 in
11T 16/32DP [1][2] (SAE J744)



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



K
Parallel keyed shaft
ISO 3019-1，19-1

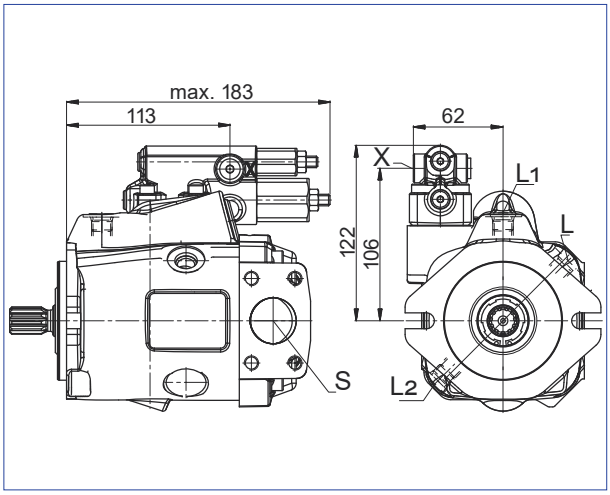


[1] Spline per ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5.
[2] Spline (according to ANSI B92.1a) may have deviations in runout compared to the standard.
[3] Threads conform to ASME B1.1 standard.
[4] Observe safety instructions regarding maximum tightening torque.
[5] Axial coupling fixation, e.g., using a clamping coupling or radially mounted locking screw.
[6] Depending on the application, momentary pressure peaks may occur. Keep this in mind when selecting measuring devices and accessories.
[7] Metric fastening threads may deviate from standard values.
[8] The port face may be deeper than the standard specification.

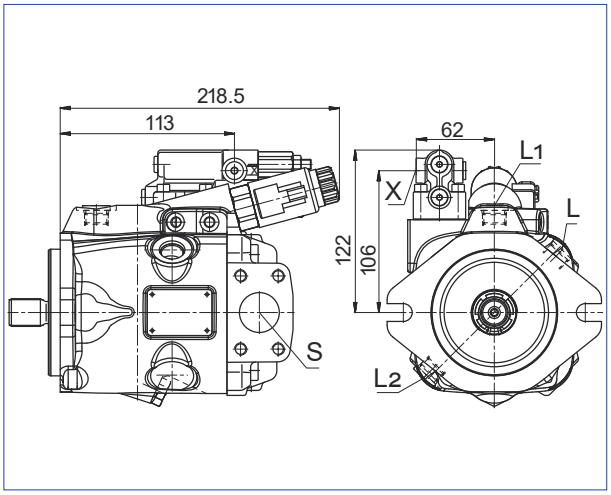
Dimensions, size 18[1)]

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

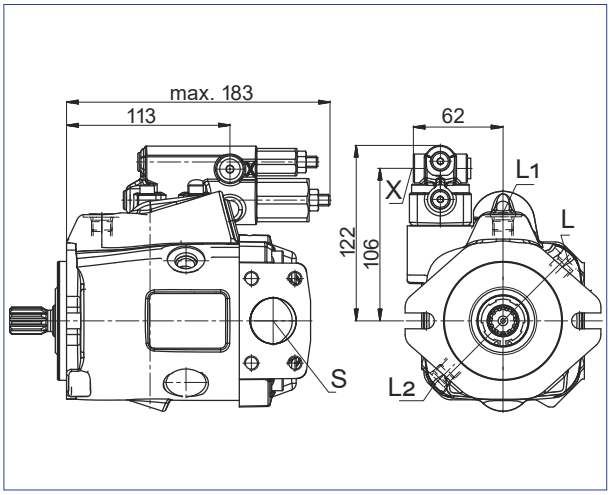
DRG
Pressure controller, remote controlled, series 53



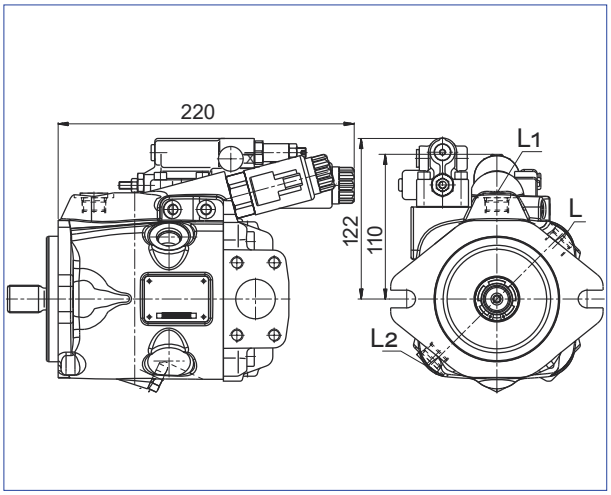
EP.D. / EK.D.
Electro-proportional control, series 53



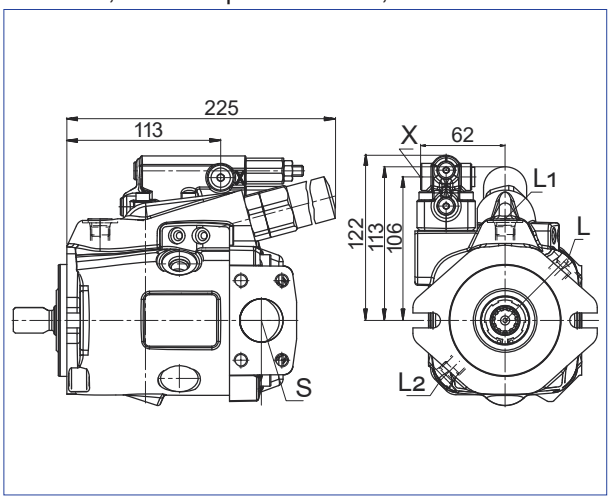
DRF / DRS
Pressure and flow control, series 53



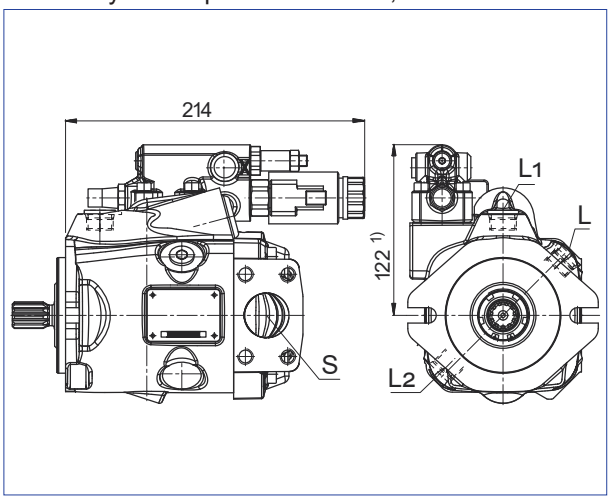
EP.ED / EK.ED
Electro-proportional control, series 53



LA.D.
Pressure, flow and power control, series 53



ED7. / ER7.
Electro-hydraulic pressure control, series 53



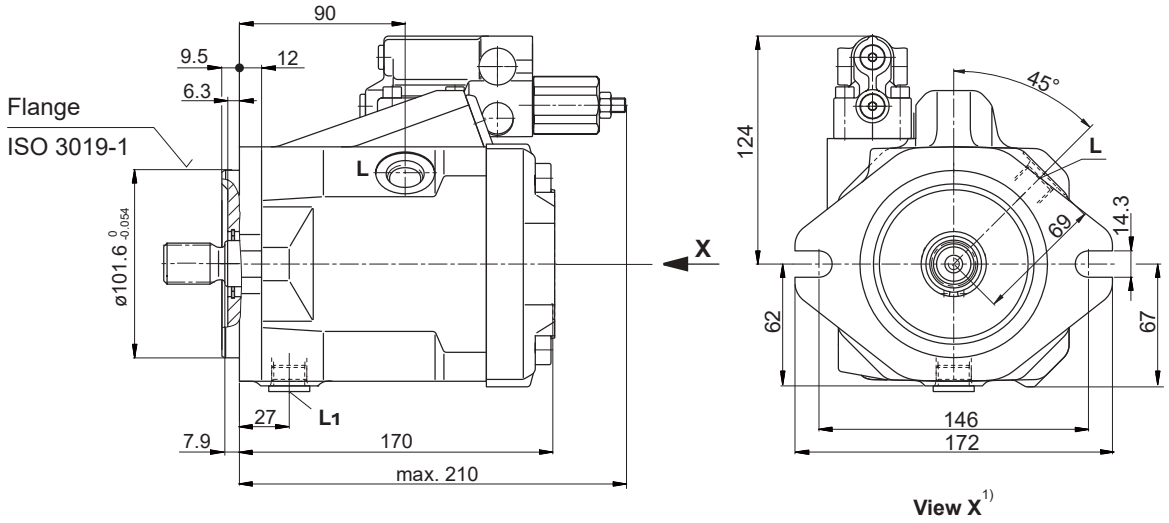
[1)] ER7.: 6.18 inches (157 mm) if using an intermediate plate pressure controller.

Dimensions, size 28[1) 2)]

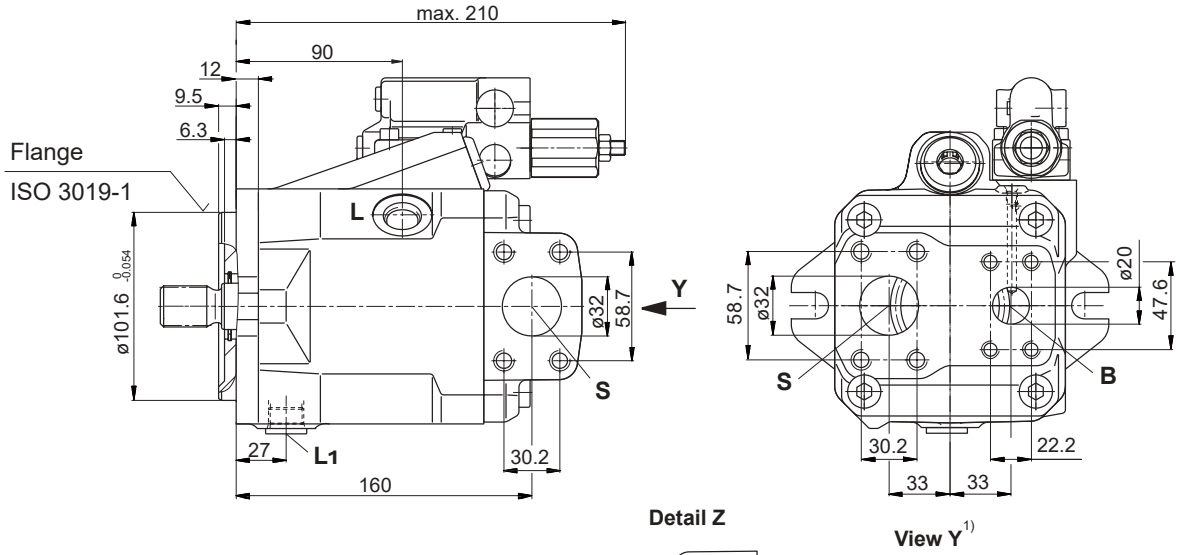
DR – Hydraulic pressure controller
clockwise rotation, series 53

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

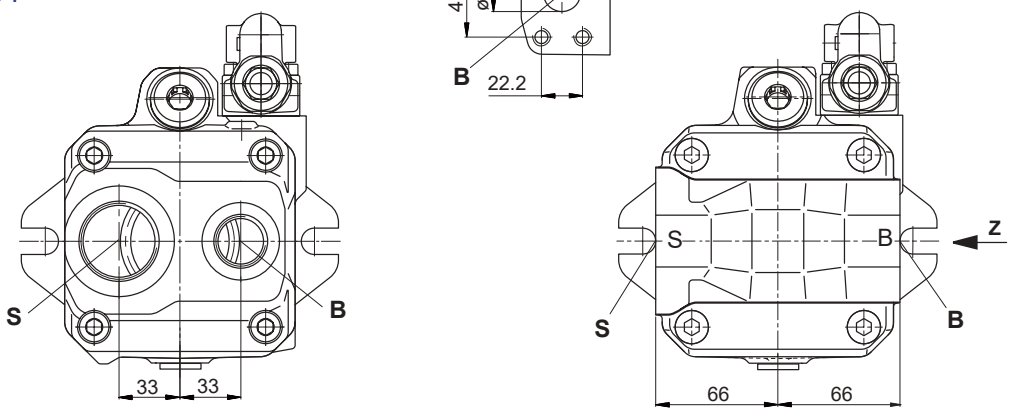
- Port plate 11 (61)



- Port plate 12 (62)



- Port plate 64



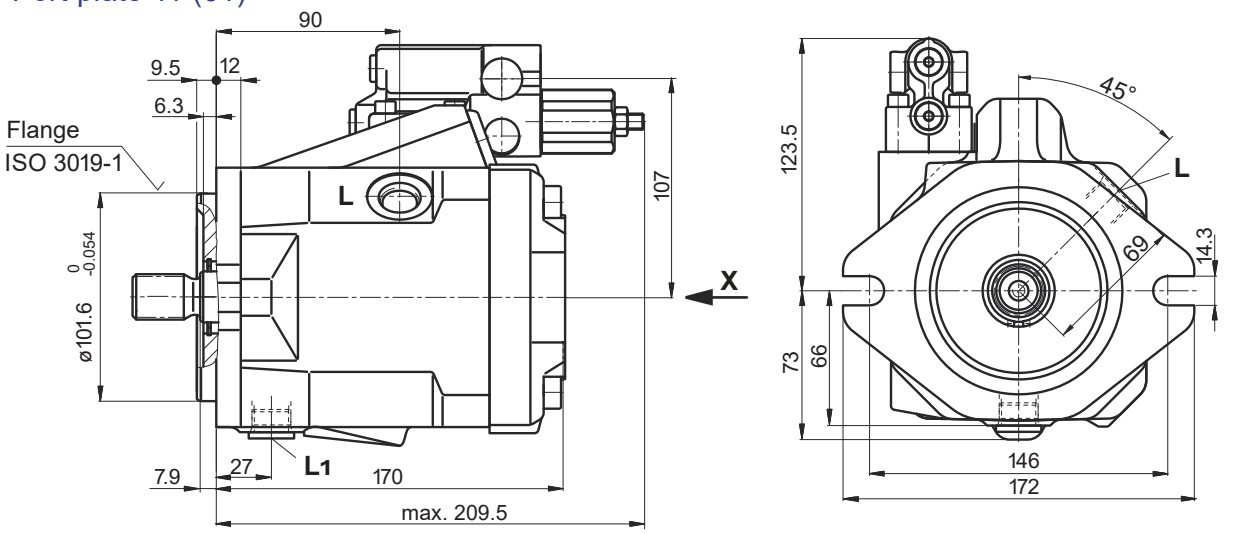
1) Dimensions of service line ports turned through 180° for counter-clockwise rotation.

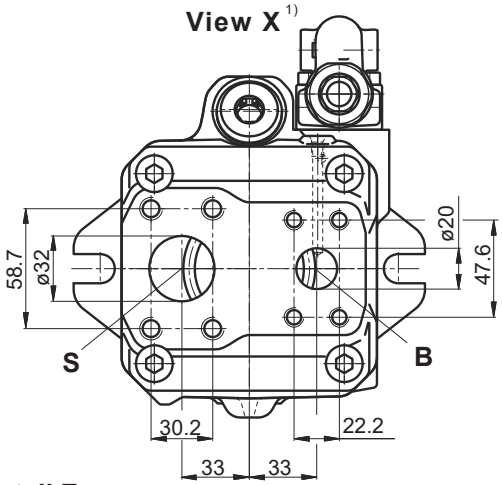
Dimensions, size 28[1) 2)]

DR – Hydraulic pressure controller
clockwise rotation, series 52

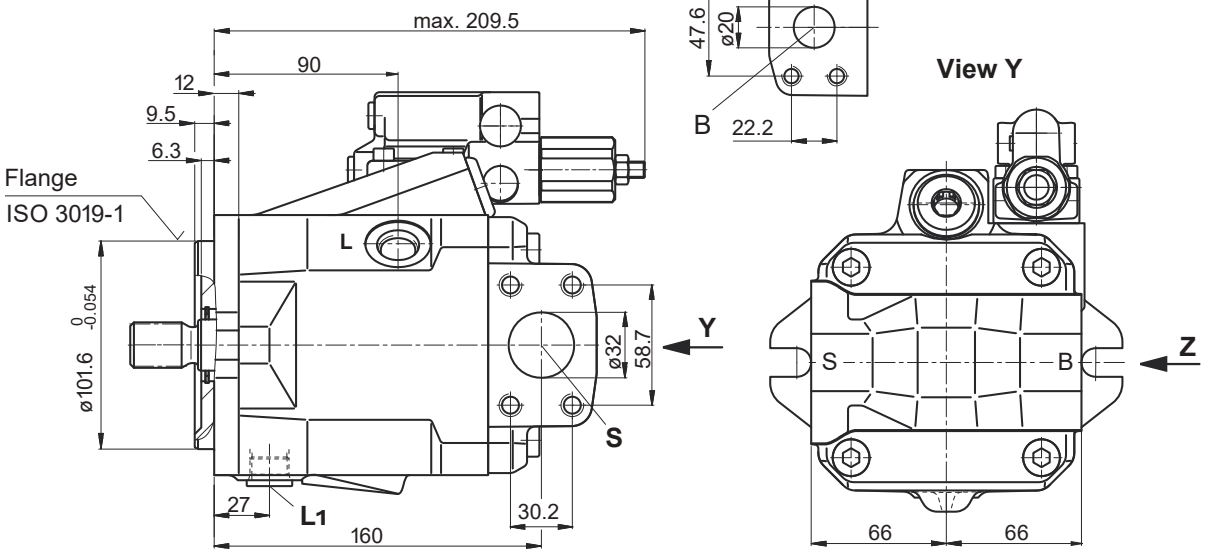
Before finalizing your design request a certified installation drawing.
Dimensions in mm.

- Port plate 11 (61)





- Port plate 12 (62)



1) Dimensions of service line ports turned through 180° for counter-clockwise rotation

Dimensions, size 28

Ports

Port plate 11, 12		Standard	Size	p_{max} [psi (bar)][1]	State[5]
B	Working port (standard pressure series) Fastening thread	ISO 6162-1 DIN 13	3/4 in M10 × 1.5; 17 (0.67) deep	4550 (315)	O
S	Suction port (standard pressure series) Fastening thread	ISO 6162-1 DIN 13	1 1/4 in M10 × 1.5; 17 (0.67) deep	75 (5)	O
Port plate 61, 62		**Standard**	**Size**	p_{max} [psi (bar)][1]	State[5]
B	Working port (standard pressure series) Fastening thread	ISO 6162-1 ASME B1.1	3/4 in 3/8-16UNC-2B 19 (0.75) deep	4550 (315)	O
S	Suction port (standard pressure series) Fastening thread	ISO 6162-1 ASME B1.1	1 1/4 in 7/16-14UNC-2B; 24 (0.94) deep	75 (5)	O
Port plate 64		**Standard**	**Size**	p_{max} [psi (bar)][1]	State[5]
B	Working port	ISO 11926	1 1/16 12 UN-2B; 20 (0.79) deep	4550 (315)	O
S	Suction port	ISO 11926	1 5/8 12UN-2B; 17 (0.67) deep	75 (5)	O
Other ports		**Standard**	**Size**	p_{max} [psi (bar)][1]	State[5]
L	Drain port	ISO 11926[2]	3/4-16UNF-2B; 12 (0.47) deep	30 (2)	O[3]
L_1 、L_2[4]	Drain port	ISO 11926[2]	3/4-16UNF-2B; 12 (0.47) deep	30 (2)	X[3]
X	Pilot pressure	ISO 11926	7/16-20UNF-2B; 11.5 (0.45) deep	4550 (315)	O

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

2) The countersink may be deeper than specified in the standard.

3) Depending on the installation position, L, L1 or L2 must be connected (also see installation instructions starting on page 80).

4) Only for series 53

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

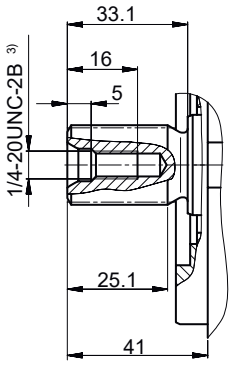
Dimensions, size 28

Dimensions [mm]

Drive shaft

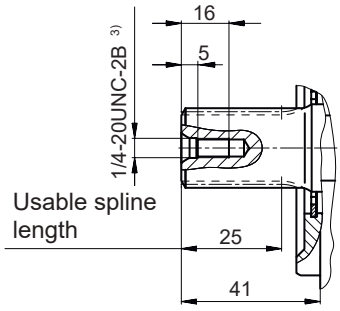
S

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



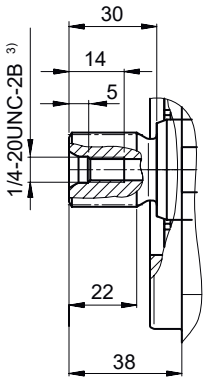
R

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



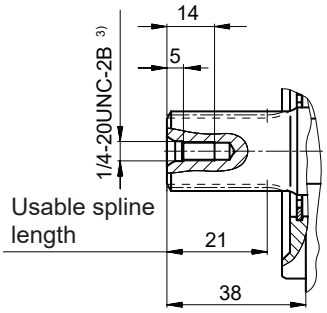
U

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



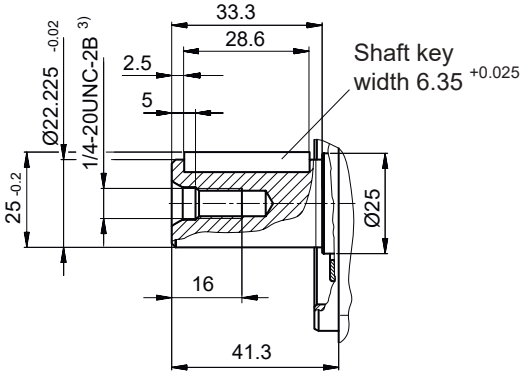
W

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



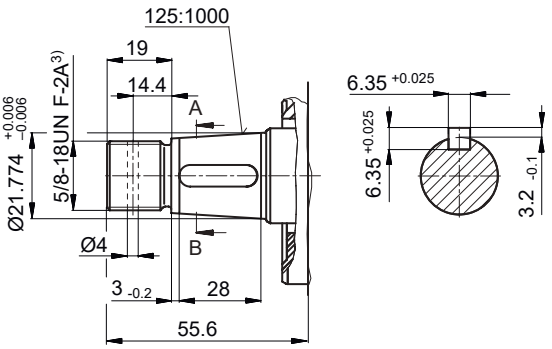
K

Parallel keyed shaft
22-1 [1) 2)] (SAE J744)



C

Tapered keyed shaft
(ISO 3019-1)



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

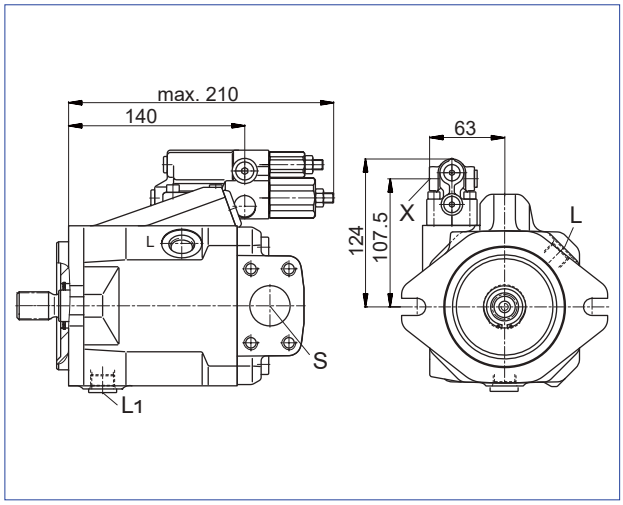
2) Splines according to ANSI B92.1a, spline runout is a deviation from standard ISO 3019-1.

3) Thread according to ASME B1.1

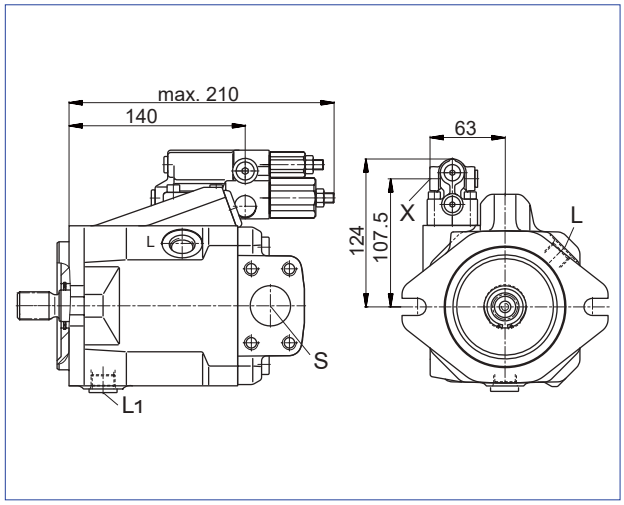
Dimensions, size 28

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

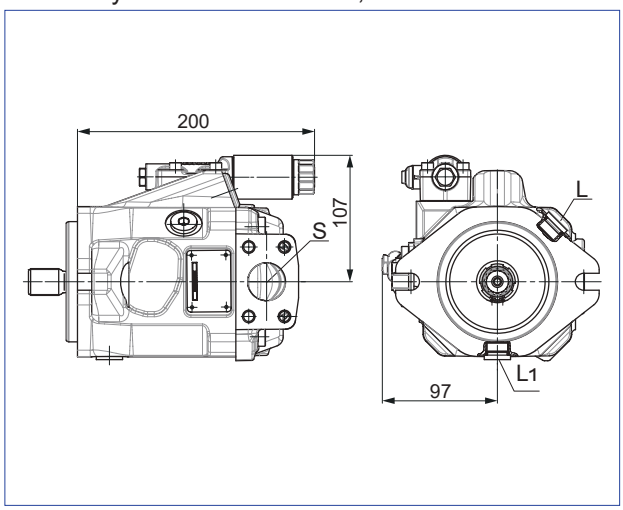
DRG
Pressure controller, remote controlled, series 52



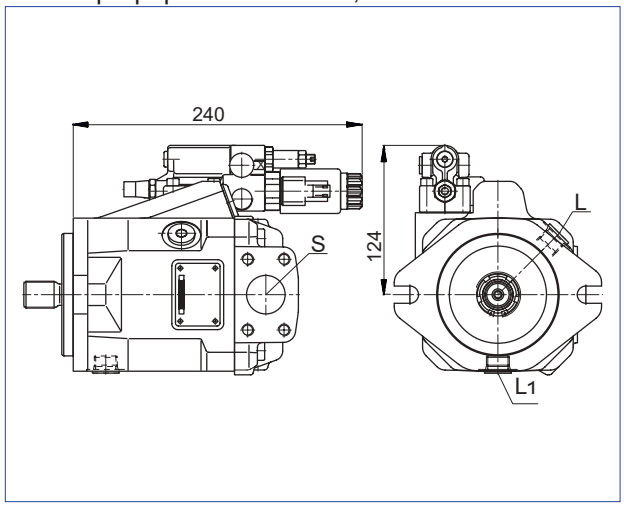
DFR / DFR1
Pressure flow controller, series 52



EC4
Electro-hydraulic control valve, series 52



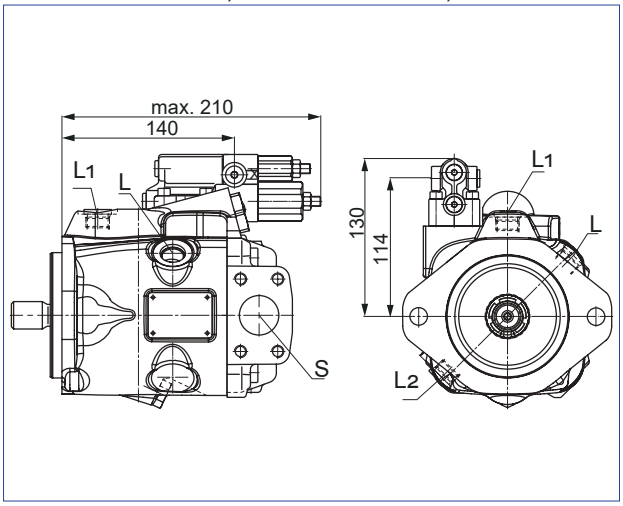
ED7. / ER7.
Electro-prop. pressure control, series 5



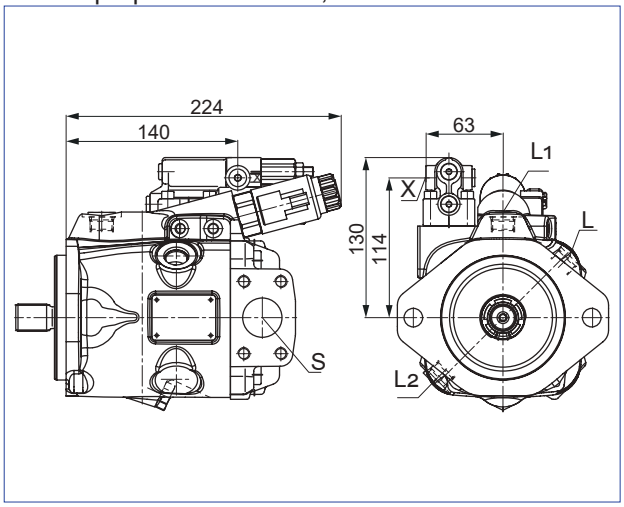
Dimensions, size 28

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

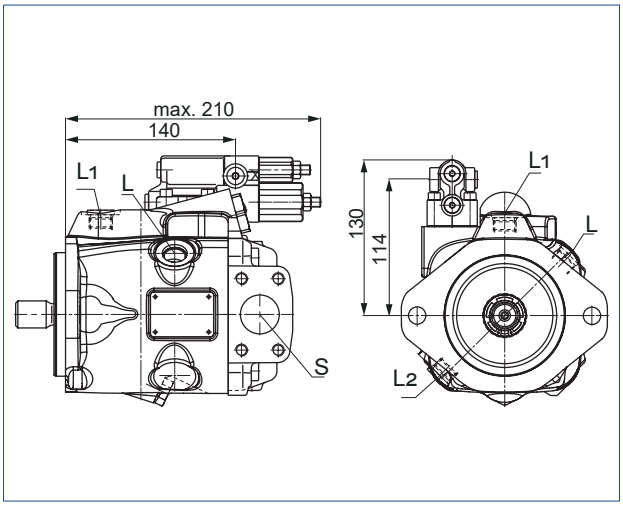
DRG
Pressure controller, remote controlled, series 53



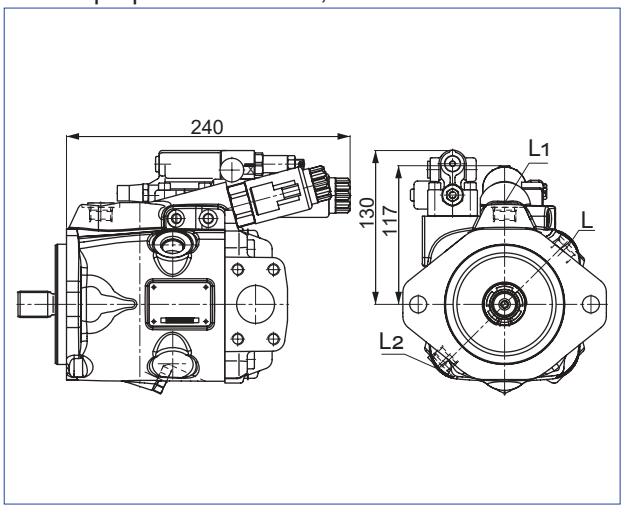
EP.D. / EK.D.
Electro proportional control, series 53



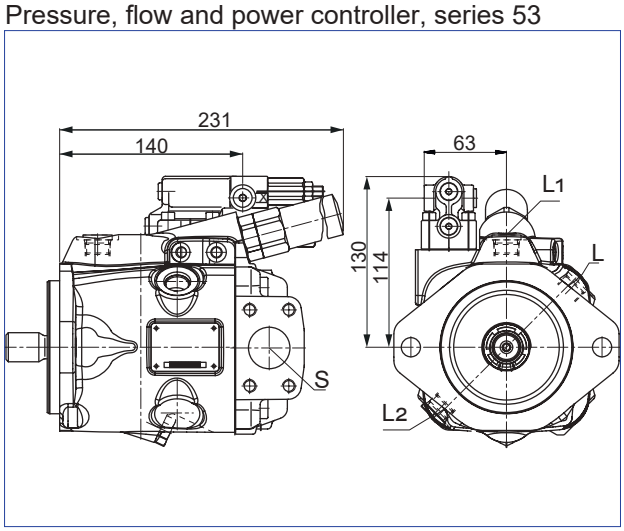
DRF / DRS / DRSC
Pressure flow controller, series 53



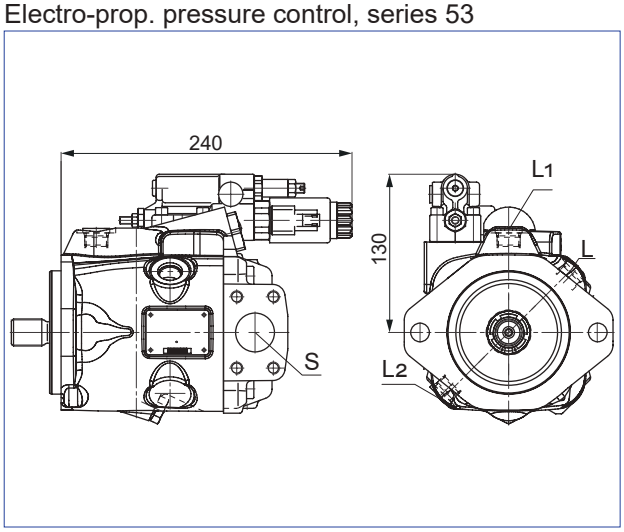
EP.ED. / EK.ED.
Electro proportional control, series 53



LA.D.
Pressure, flow and power controller, series 53



ED7. / ER7.
Electro-prop. pressure control, series 53

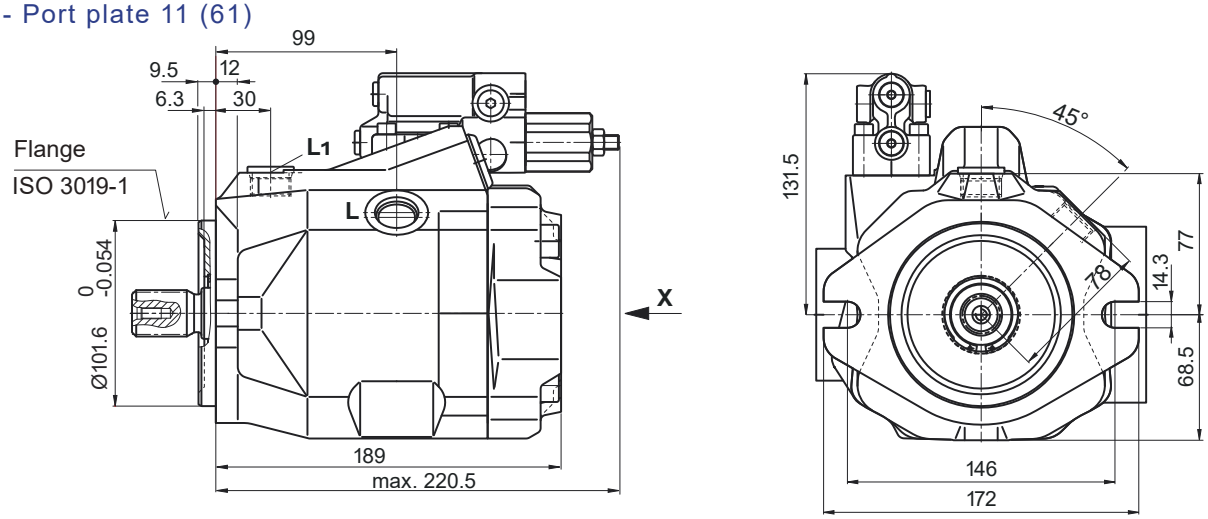


Dimensions, size 45[1)]

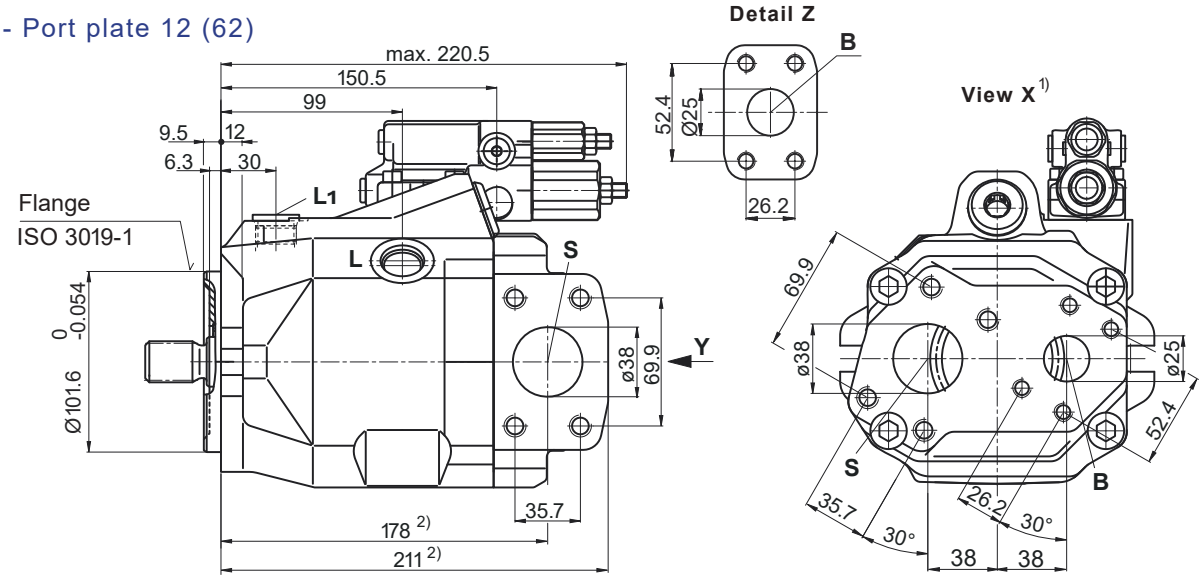
DR – Hydraulic pressure controller
with pressure cut-off, remote controlled,clockwise rotation, series 52

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

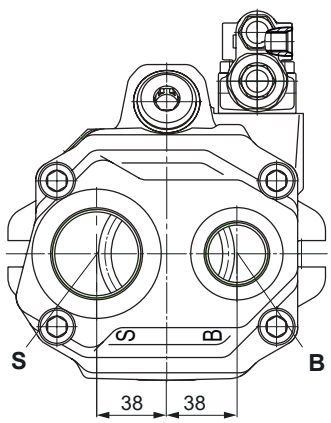
- Port plate 11 (61)



- Port plate 12 (62)

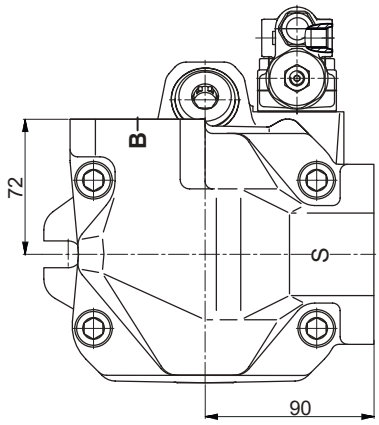


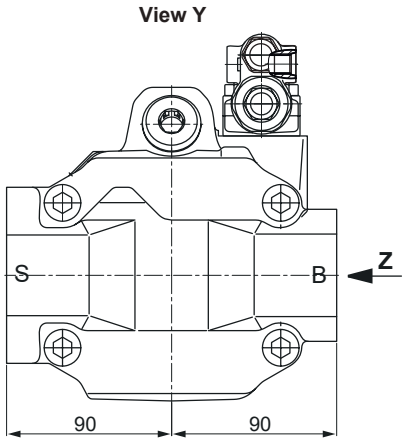
- Port plate 64



- Port plate 13

Counter-clockwise rotation 2)





1) Dimensions of working ports turned through 180° for counter-clockwise rotation.

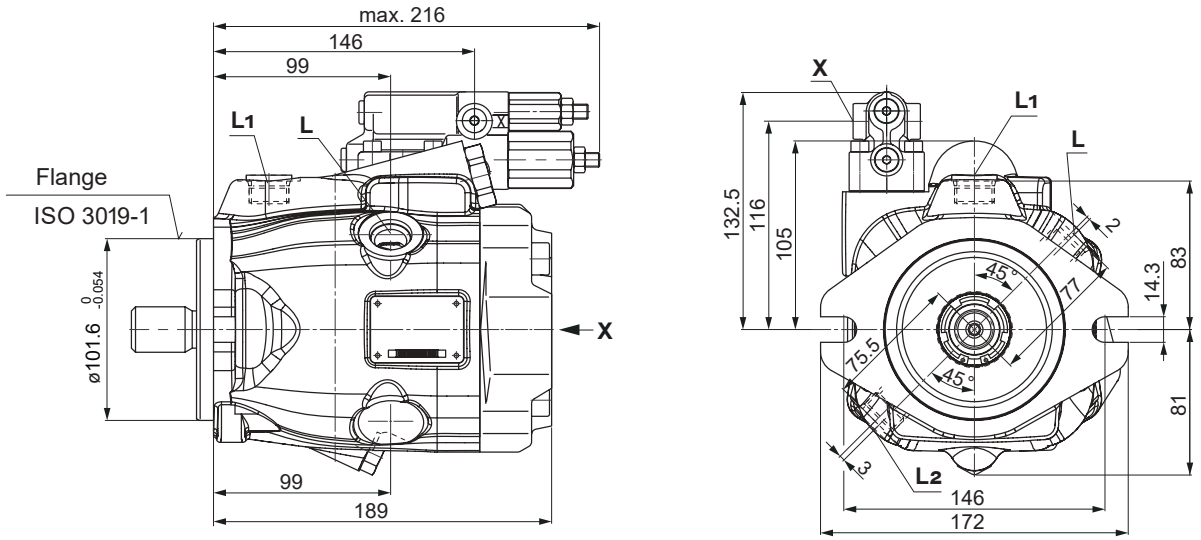
2) For dimensions of working ports S and B for port plate 13 identical as for port plate 12.

Dimensions, size 45[1)]

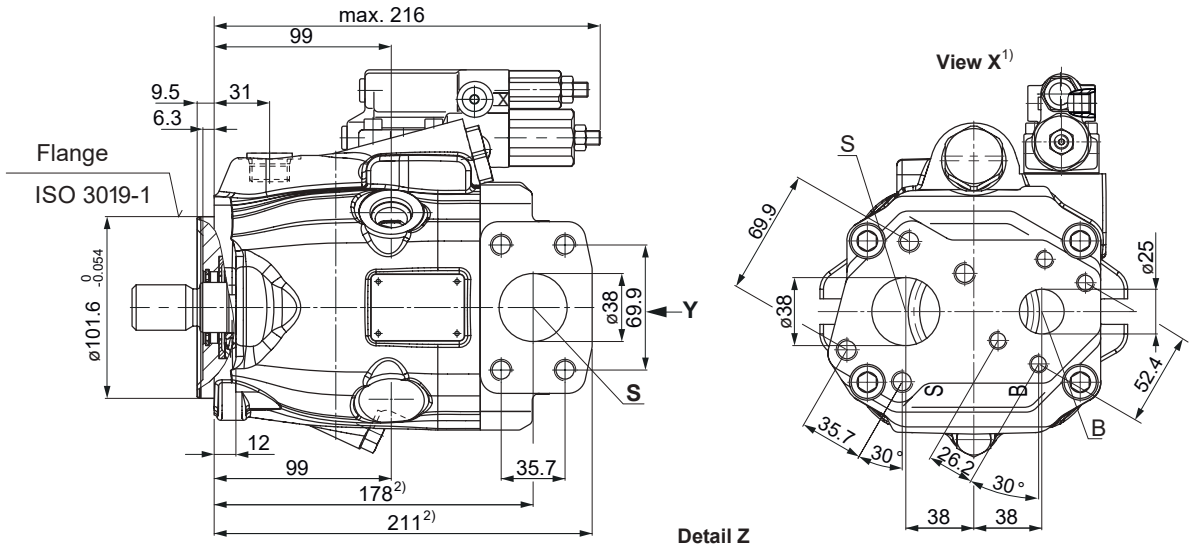
DRG – hydraulic pressure controller
with pressure cut-off, remote controlled, clockwise rotation, series 53

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

- Port plate 11 (61)

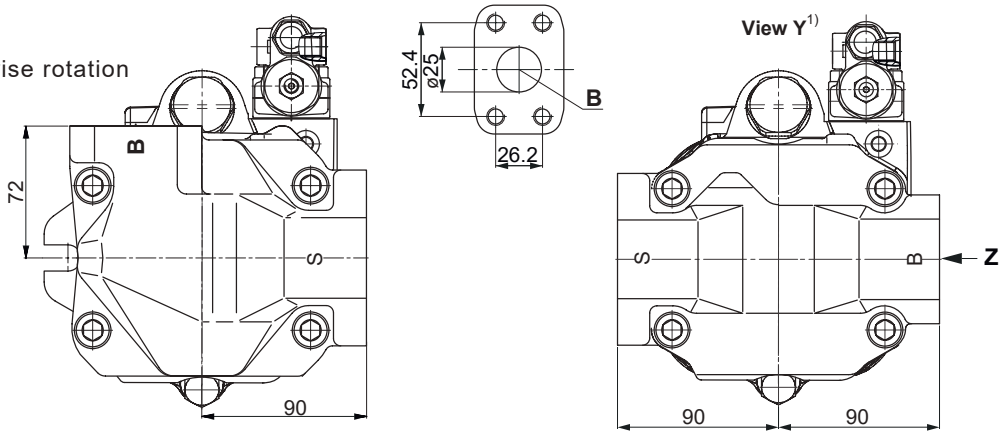


- Port plate 12 (62)



- Port plate 13

Counter-clockwise rotation



[1)] Dimensions of working ports turned through 180° for counter-clockwise rotation.
[2)] For dimensions of working ports S and B for port plate 13 identical as for port plate 12.

Dimensions, size 45

Ports

Port plate 11, 12, 13		Standard	Size	p_{max} [psi (bar)][1]	State[5]
B	Working port (standard pressure series) Fastening thread	ISO 6162-1 DIN 13	1 in M10 × 1.5; 17 (0.67) deep	4550 (315)	O
S	Suction port (standard pressure series) Fastening thread	ISO 6162-1 DIN 13	1 1/2 in M12 × 1.75; 20 (0.79) deep	75 (5)	O
Port plate 61, 62		**Standard**	**Size**	p_{max} [psi (bar)][1]	State[5]
B	Working port (standard pressure series) Fastening thread	ISO 6162-1 ASME B1.1	1 in 3/8-16UNC-2B 18 (0.71) deep	4550 (315)	O
S	Suction port (standard pressure series) Fastening thread	ISO 6162-1 ASME B1.1	1 1/2 in 1/2-13 UNC-2B; 22 (0.87) deep	75 (5)	O
Port plate 64		**Standard**	**Size**	p_{max} [psi (bar)][1]	State[5]
B	Working port	ISO 11926	1 5/16 12UN-2B; 20 (0.79) deep	4550 (315)	O
S	Suction port	ISO 11926	1 7/8 12UN-2B; 20 (0.79) deep	75 (5)	O
Other ports		**Standard**	**Size**	p_{max} [psi (bar)][1]	State[5]
L	Drain port	ISO 11926[2]	7/8-14UNF-2B; 13 (0.51) deep	30 (2)	O[3]
L_1 、L_2[4]	Drain port	ISO 11926[2]	7/8-14UNF-2B; 13 (0.51) deep	30 (2)	X[3]
X	Pilot pressure	ISO 11926	7/16-20UNF-2B; 11,5 (0.45) deep	4550 (315)	O

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

2) The countersink may be deeper than specified in the standard.

3) Depending on the installation position, L, L1 or L2 must be connected (also see installation instructions starting on page 80).

4) Only for series 53

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

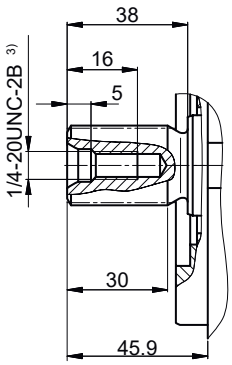
Dimensions, size 45

Dimensions [mm]

Drive shaft

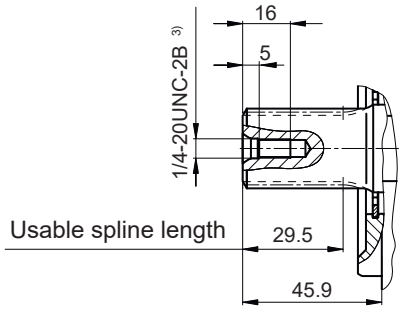
S

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



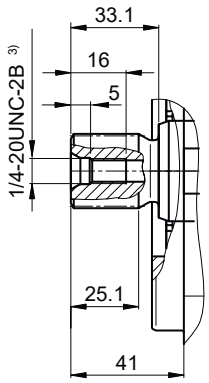
R

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



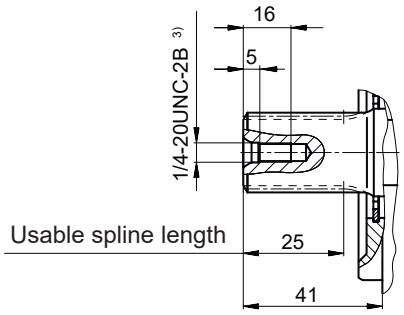
U

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



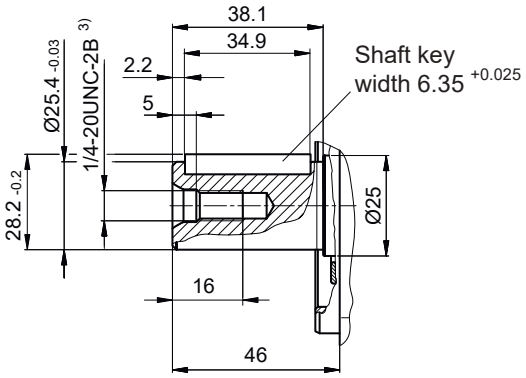
W

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



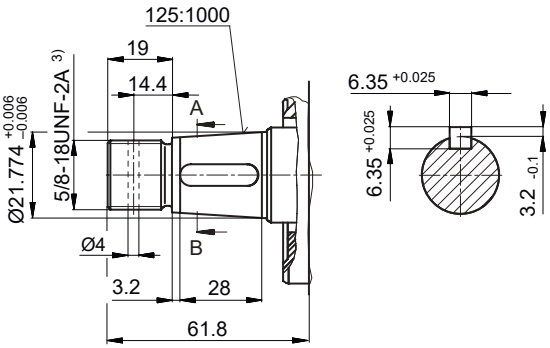
K

Parallel keyed shaft
25-1



C

Tapered keyed shaft
(ISO 3019-1)



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

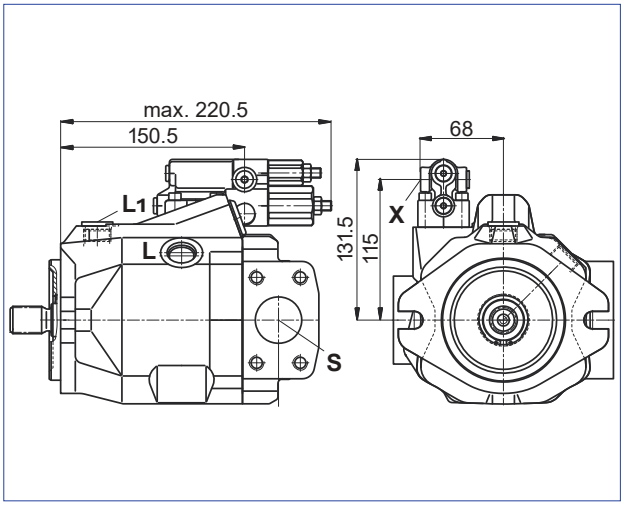
2) Splines according to ANSI B92.1a, spline runout is a deviation from standard ISO 3019-1.

3) Thread according to ASME B1.1

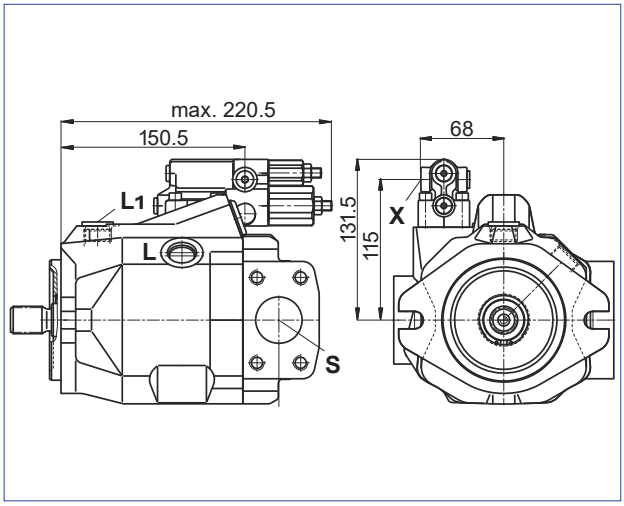
Dimensions, size 45

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

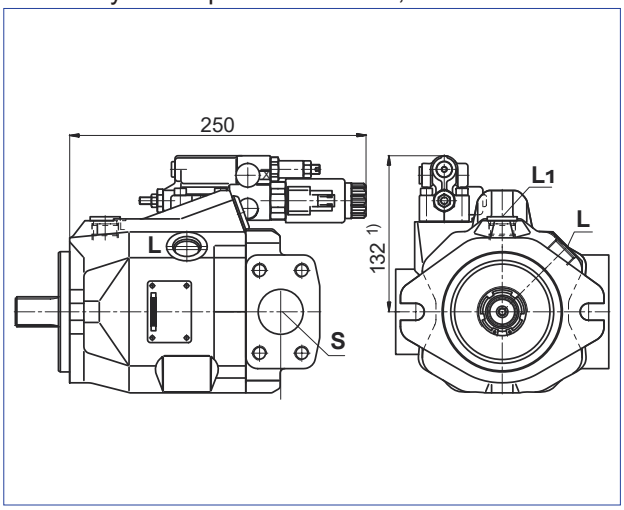
DRG
Pressure controller, remote controlled, series 52



DFR / DFR1
Pressure and flow control, series 52



ED7. / ER7.
Electro-hydraulic pressure control, series 52

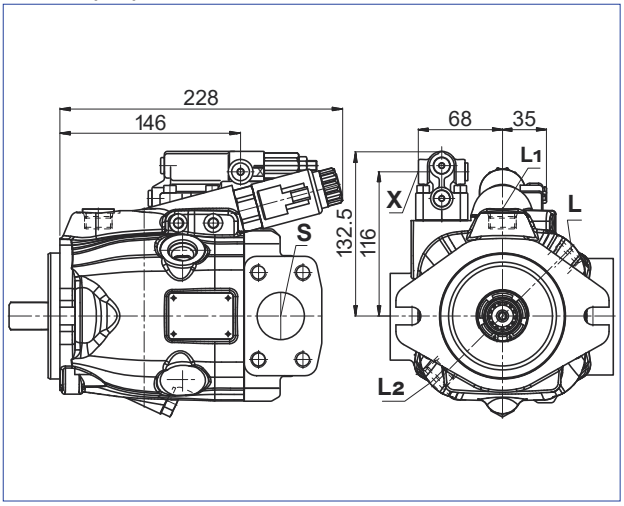


[1] ER7.: 167 mm if using an intermediate plate pressure controller.

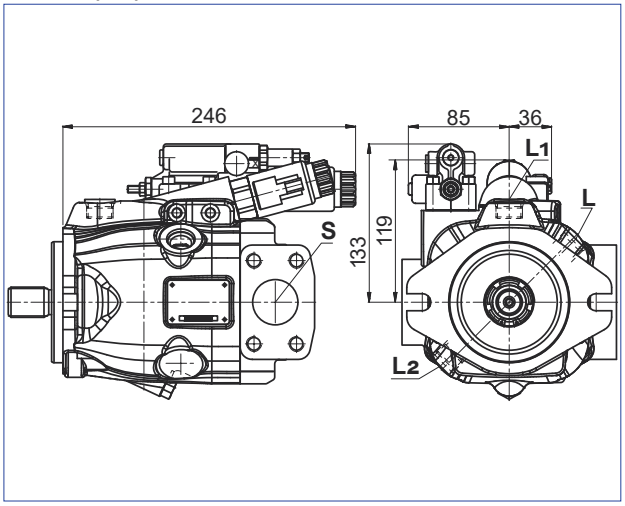
Dimensions, size 45

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

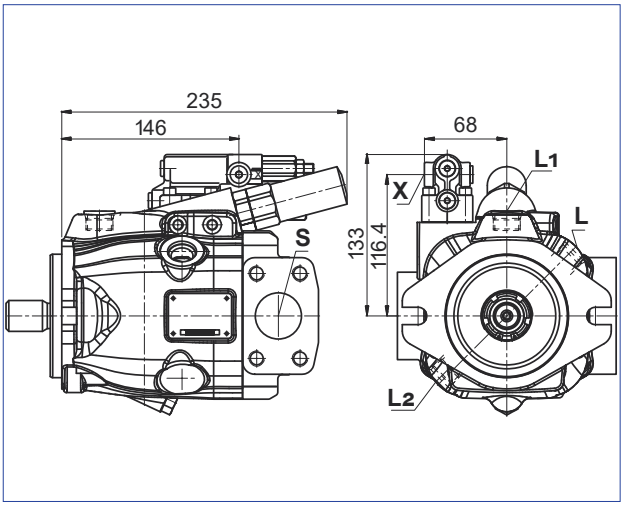
EP.D. / EK.D.
Electro proportional control, series 53



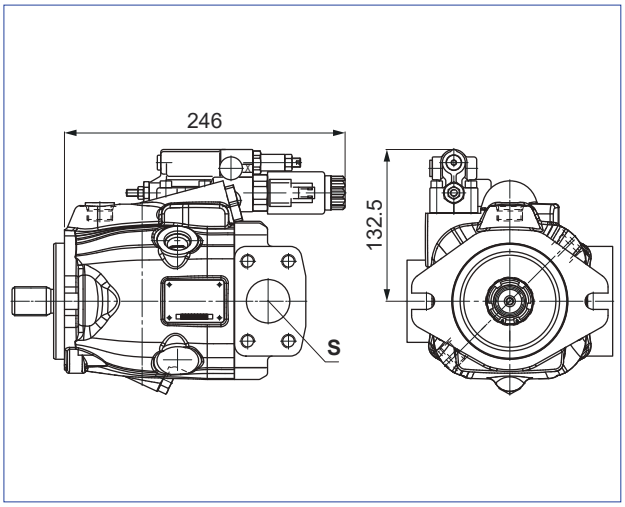
EP.ED. / EK.ED.
Electro-prop. control, series 53



LA.D.
Pressure, flow and power controller, series 53



ED7. / ER7.
Electro-prop. pressure control, series 53



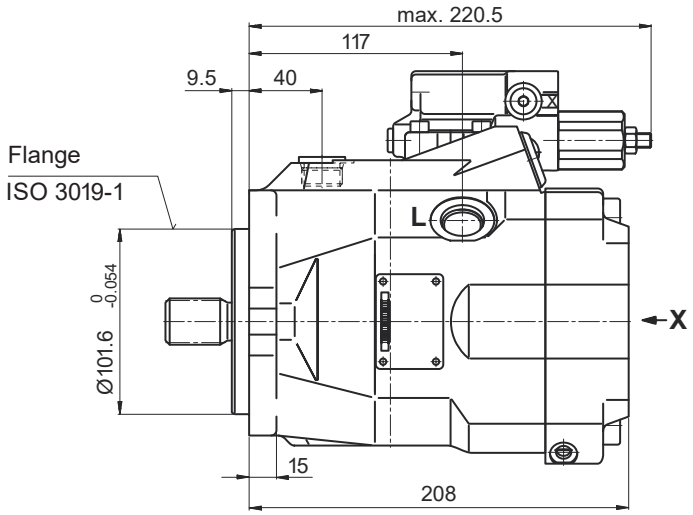
Dimensions, size 60

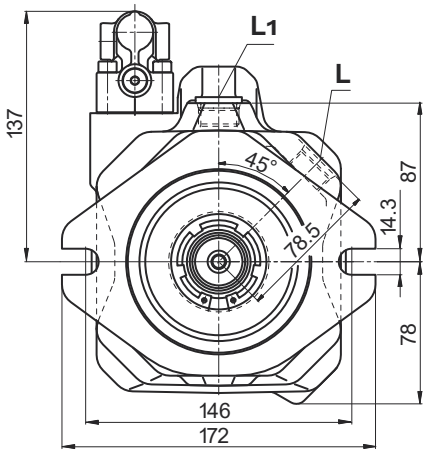
DR – Hydraulic pressure controller

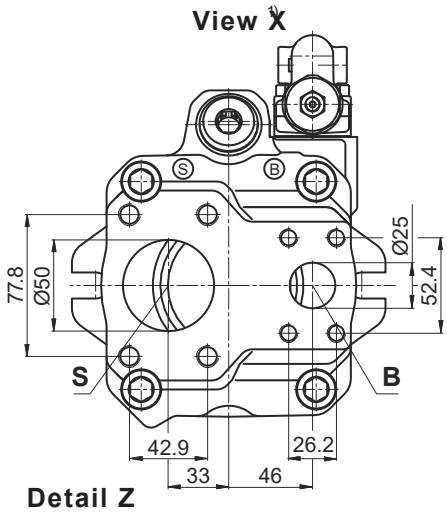
clockwise rotation, mounting flange C series 52

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

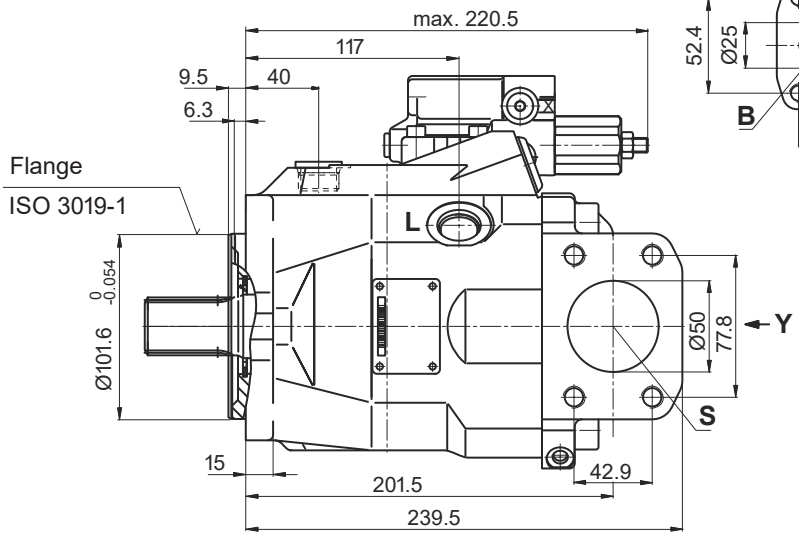
- Port plate 11 (61)

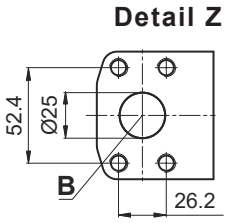


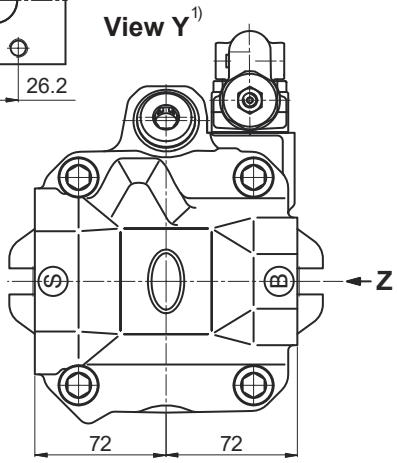




- Port plate 12 (62)







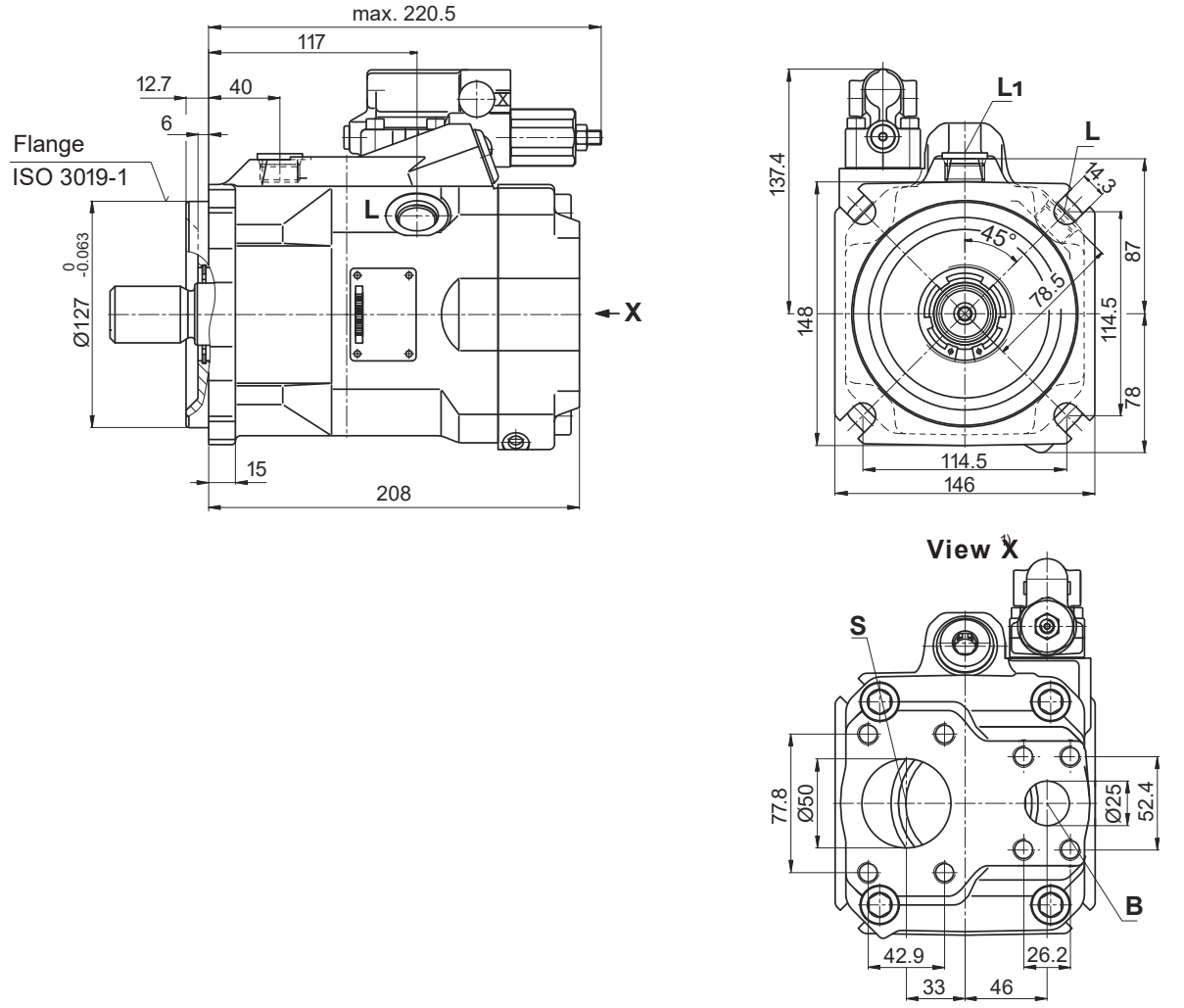
1) Dimensions of working ports turned through 180° for counter-clockwise rotation.

Dimensions, size 60

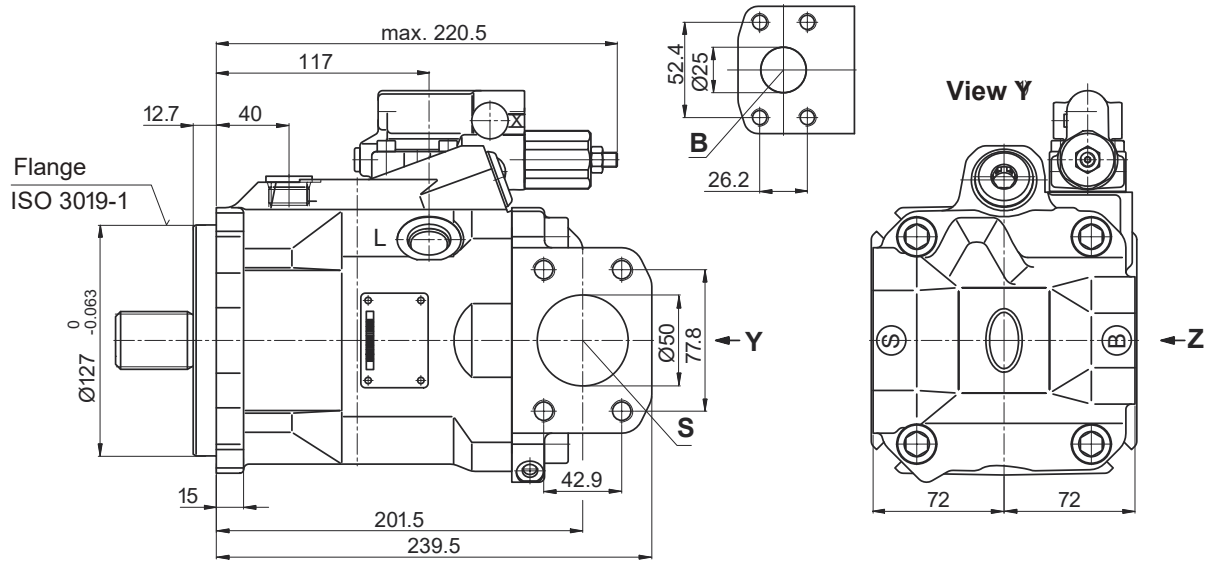
DR – Hydraulic pressure controller
clockwise rotation, mounting flange D series 52

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

- Port plate 11 (61)



- Port plate 12 (62)



1) Dimensions of working ports turned through 180° for counter-clockwise rotation.

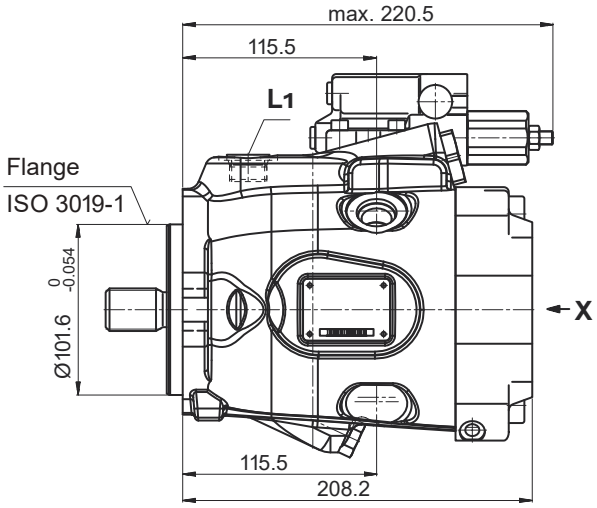
Dimensions, size 63

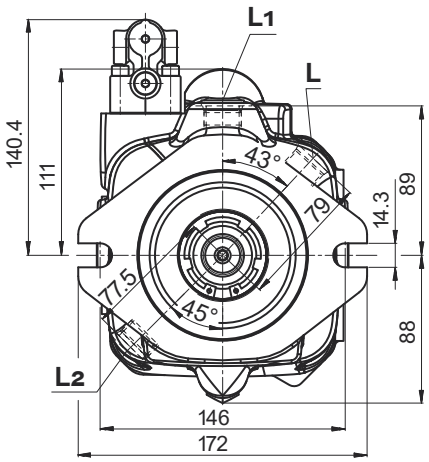
DR – Hydraulic pressure controller

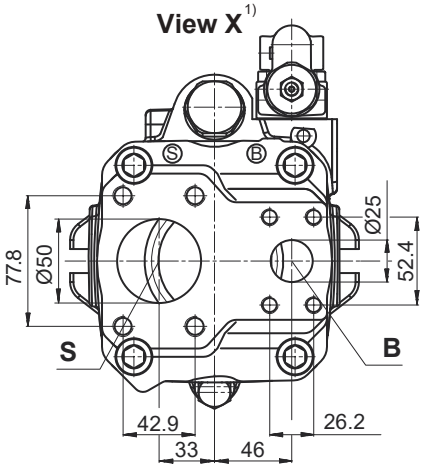
clockwise rotation, mounting flange C series 53

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

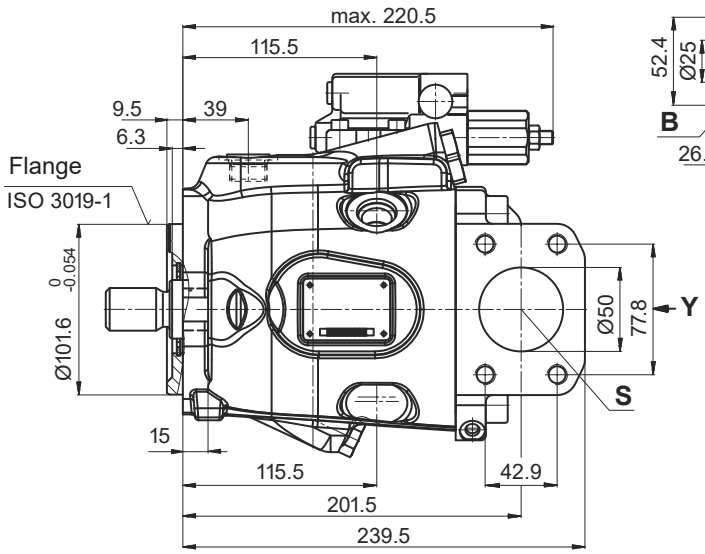
- Port plate 11 (61)

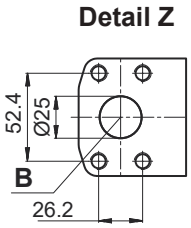


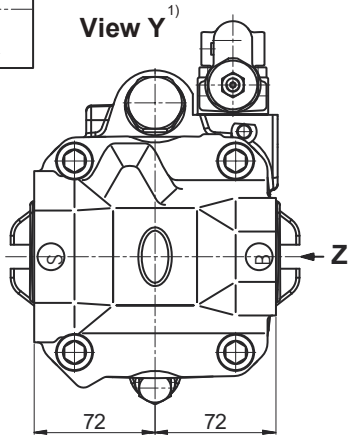




- Port plate 12 (62)







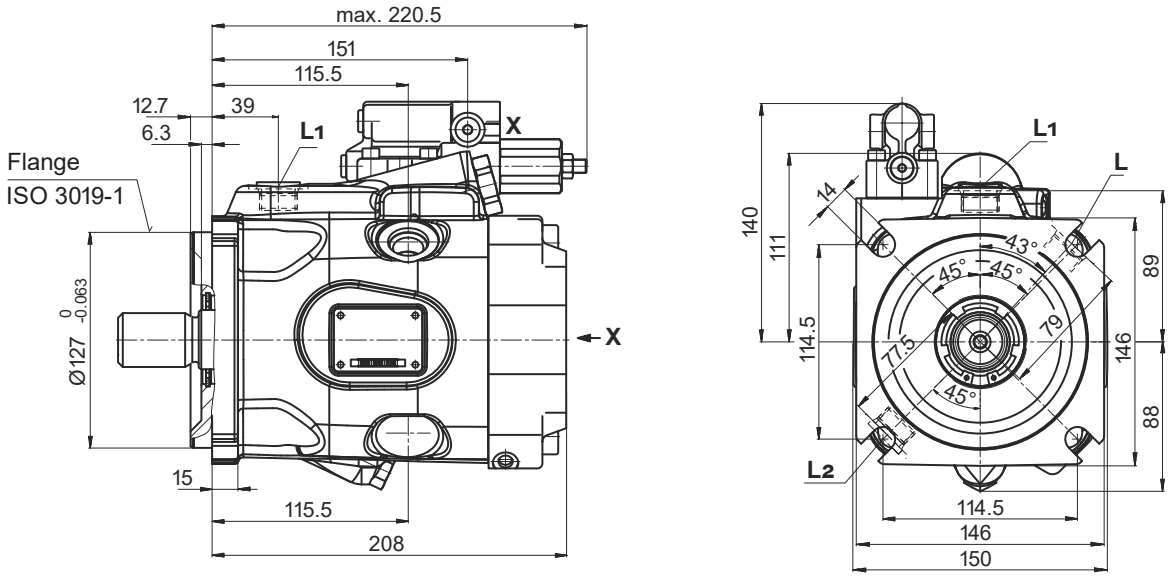
1) Dimensions of working ports turned through 180° for counter-clockwise rotation.

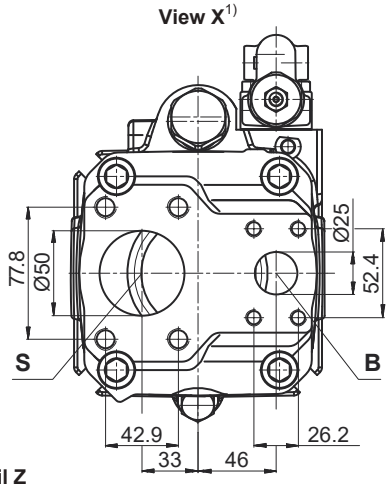
Dimensions, size 63

DR – Hydraulic pressure controller
clockwise rotation, mounting flange D series 53

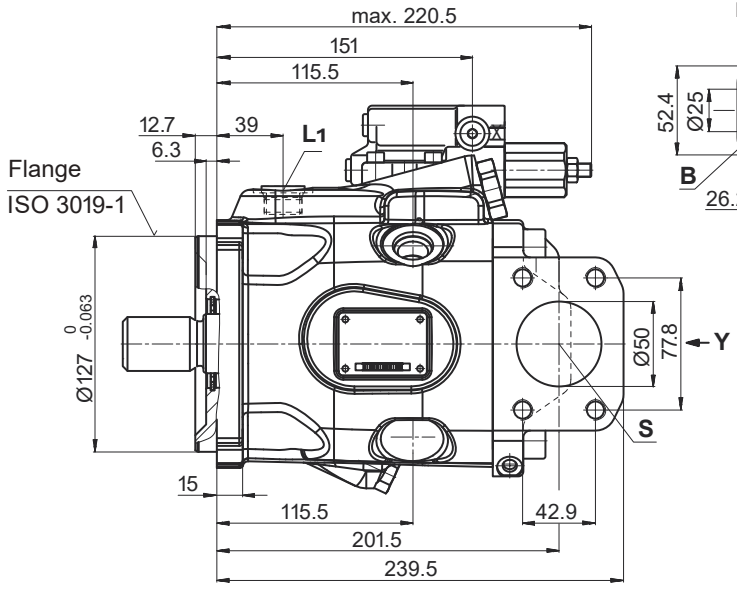
Before finalizing your design request a certified installation drawing.
Dimensions in mm.

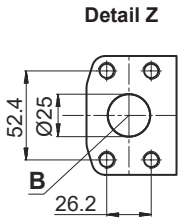
- Port plate 11 (61)

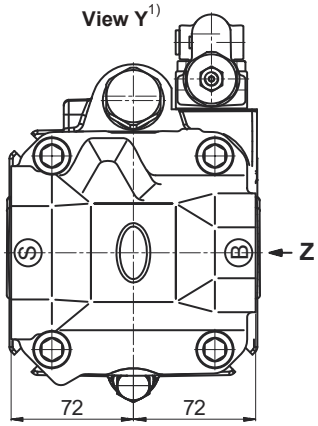




- Port plate 12 (62)







1) Dimensions of working ports turned through 180° for counter-clockwise rotation.

Dimensions, size 60 / 63

Ports

Port plate 11, 12		Standard	Size	p_{max} [psi (bar)][1]	State[5]
B	Working port (standard pressure series) Fastening thread	ISO 6162-1 DIN 13	1 in M10 × 1.5; 17 deep	4550 (315)	O
S	Suction port (standard pressure series) Fastening thread	ISO 6162-1 DIN 13	2 in M12 × 1.75; 20 deep	75 (5)	O
Port plate 61, 62		**Standard**	**Size**	p_{max} [psi (bar)][1]	State[5]
B	Working port (standard pressure series) Fastening thread	ISO 6162-1 ASME B1.1	1 in 3/8-16UNC-2B; 18 (0.71) deep	4550 (315)	O
S	Suction port (standard pressure series) Fastening thread	ISO 6162-1 ASME B1.1	2 in 1/2-13 UNC-2B; 22 (0.87) deep	75 (5)	O
Other ports		**Standard**	**Size**	p_{max} [psi (bar)][1]	State[5]
L	Drain port	ISO 11926[2]	7/8-14UNF-2B; 13 deep	30 (2)	O[3]
L_1 、L_2[4]	Drain port	ISO 11926[2]	7/8-14UNF-2B; 13 deep	30 (2)	X[3]
X	Pilot pressure	ISO 11926	7/16-20UNF-2B; 11.5 deep	4550 (315)	O

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

2) The countersink may be deeper than specified in the standard.

3) Depending on the installation position, L, L1 or L2 must be connected (also see installation instructions starting on page 80).

4) Only for series 53

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

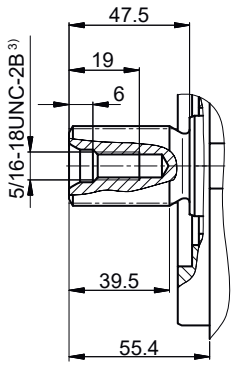
Dimensions, size 60 / 63

Dimensions [mm]

Drive shaft

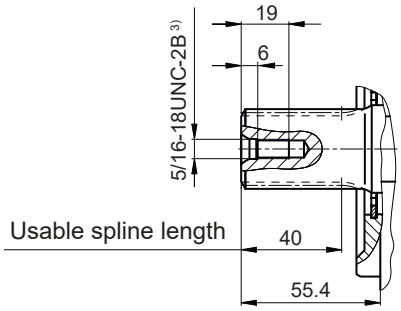
S

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



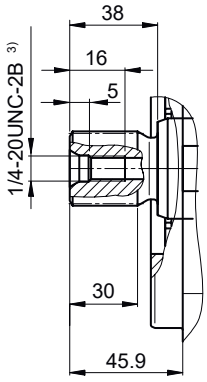
R

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



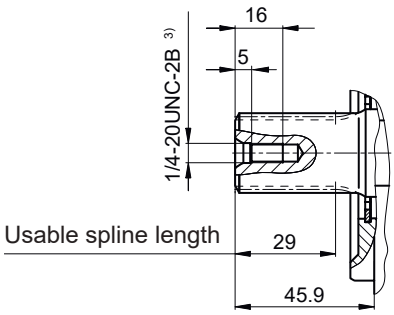
U

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



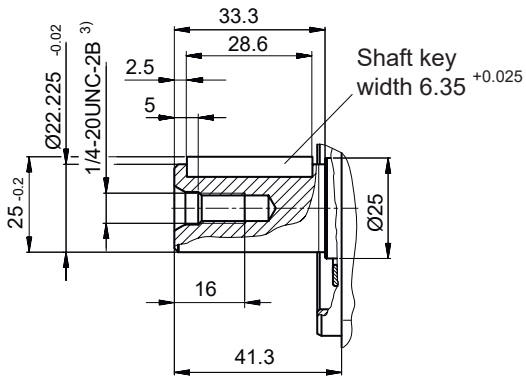
W

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



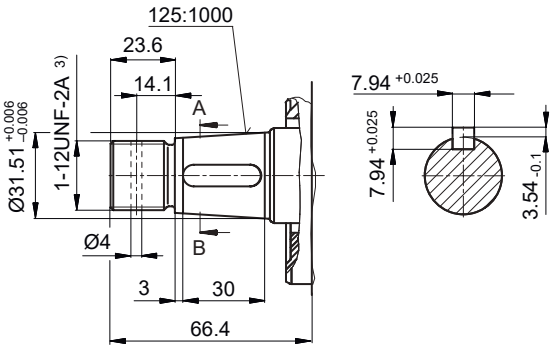
K

Parallel keyed shaft
32-1



C

Tapered keyed shaft
(ISO 3019-1)



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.

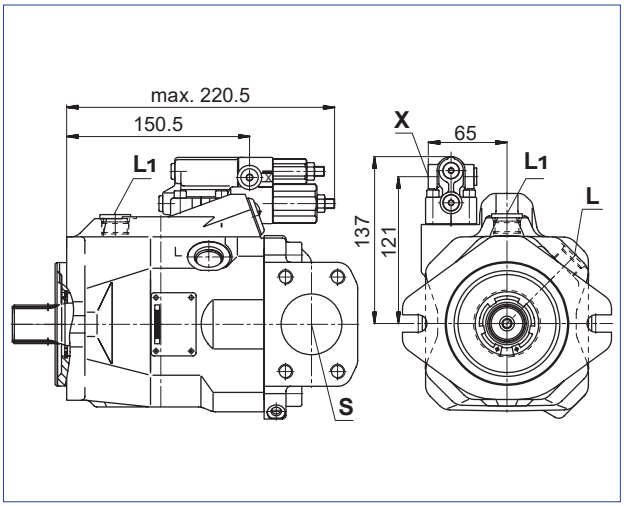
3) Thread according to ASME B1.1

Dimensions, size 60 / 63

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

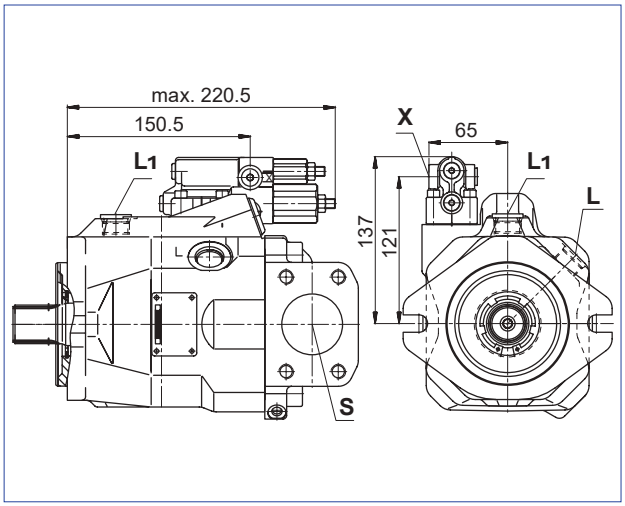
DRG

Pressure controller, remote controlled, series 52



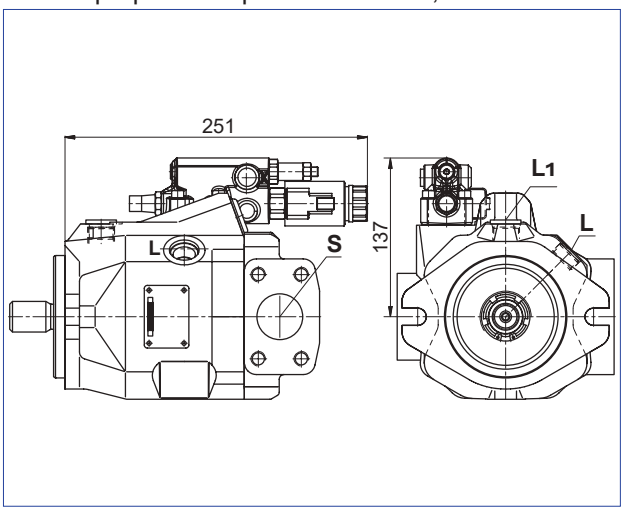
DFR / DFR1 / DRSC

Pressure flow controller, series 52



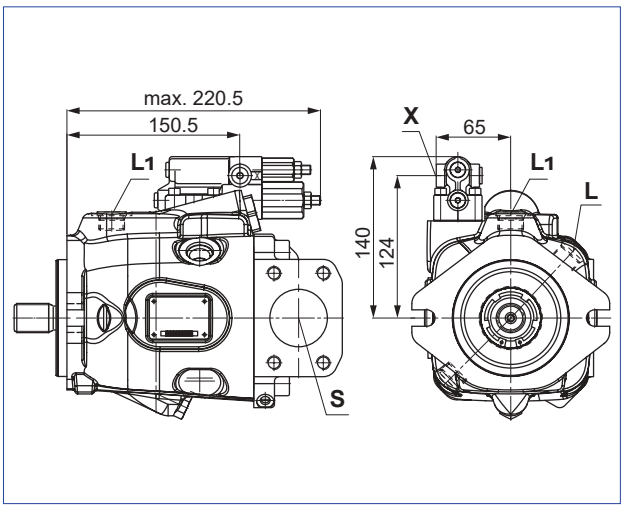
ED7. / ER7.

Electro-proportional pressure control, series 52



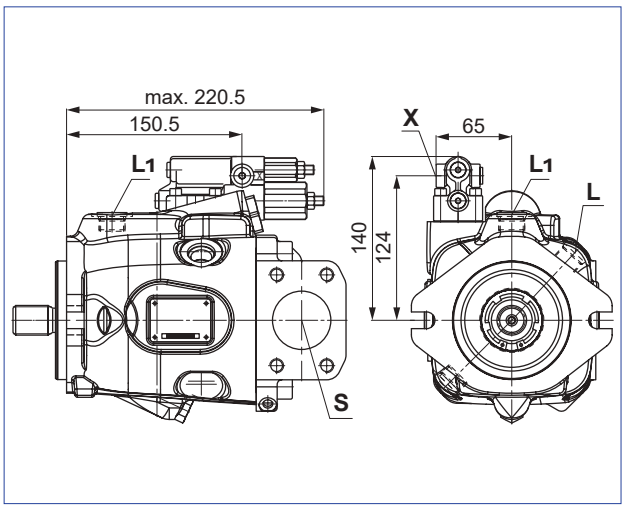
DRG

Pressure controller, remote controlled, series 53



DRF / DRS / DRSC

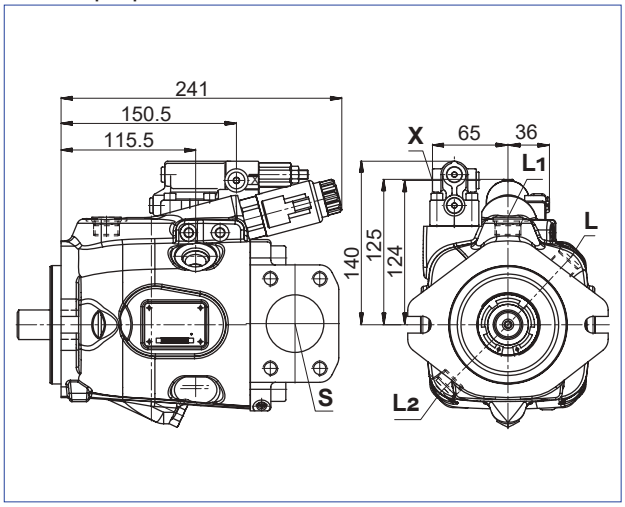
Pressure flow controller, series 53



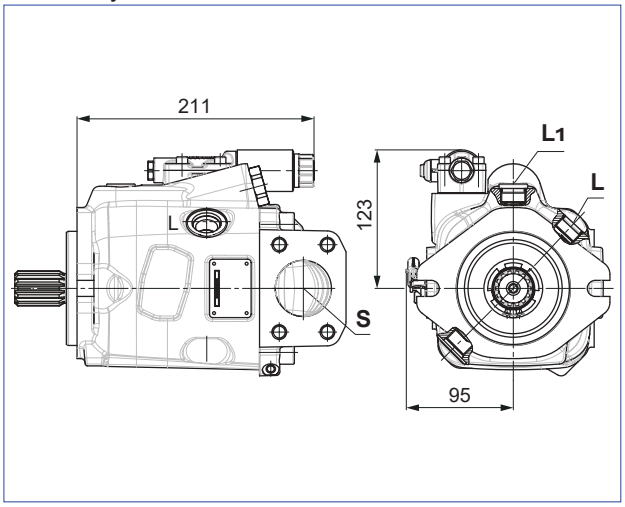
Dimensions, size 60 / 63

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

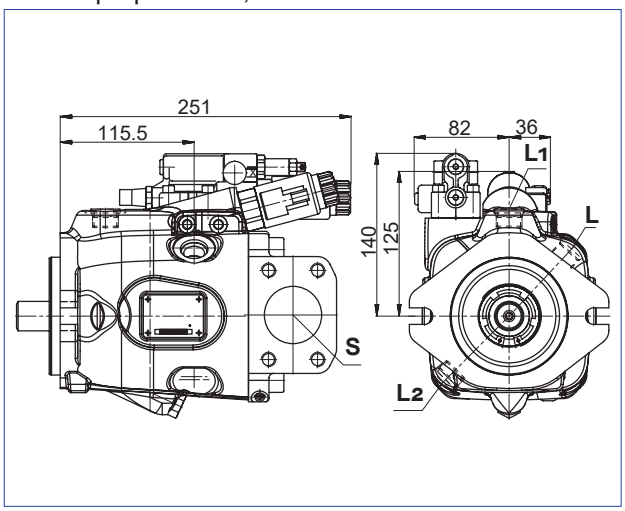
EP.D. / EK.D.
Electro proportional control, series 53



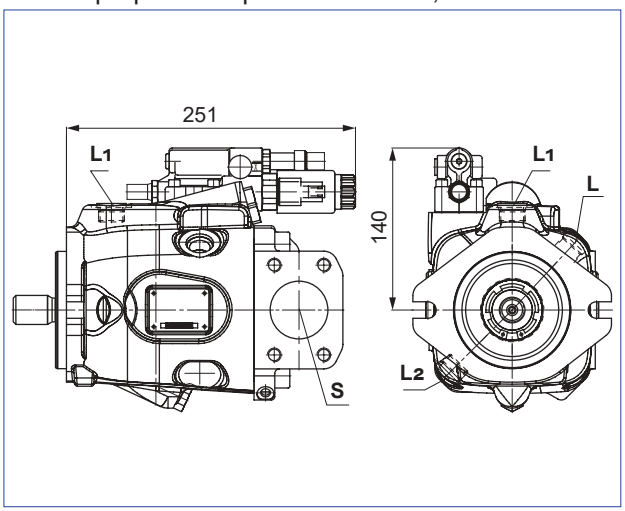
EC4
Electro-hydraulic control valve, series 53



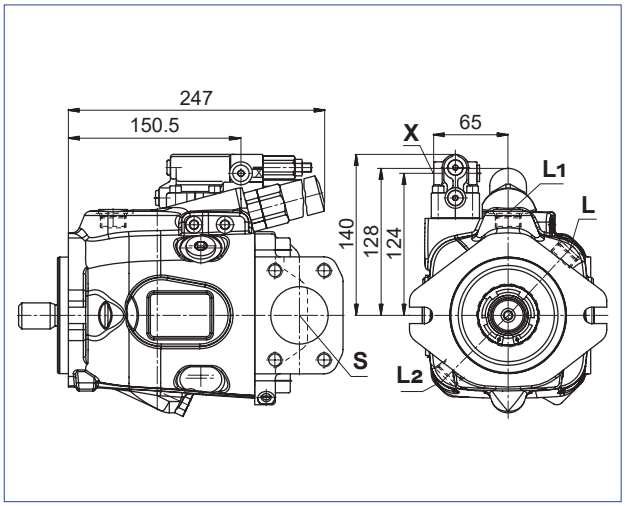
EP.ED. / EK.ED.
Electro-prop. control, series 53



ED7. / ER7.
Electro-proportional pressure control, series 53



LA.D.
Pressure, flow and power controller, series 53

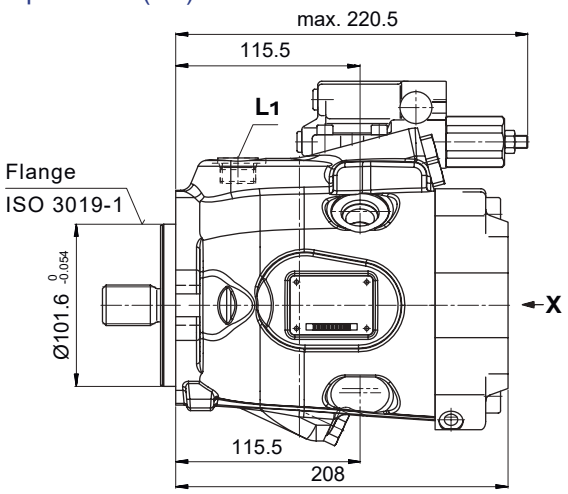


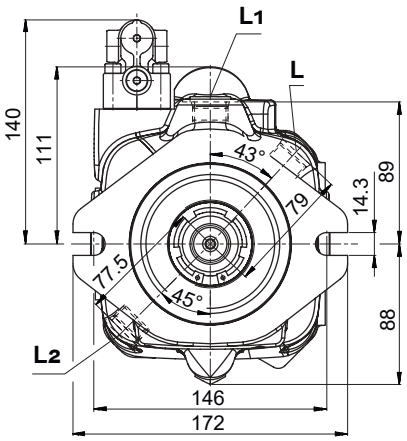
Dimensions, size 72

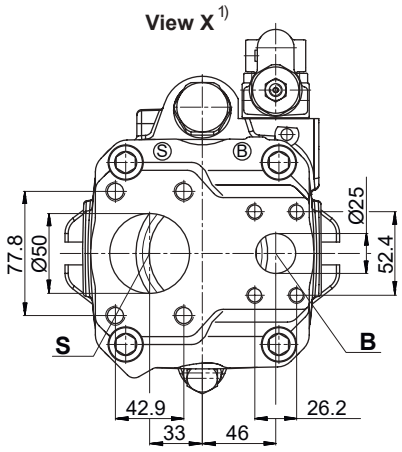
DR – Hydraulic pressure controller
clockwise rotation, mounting flange C series 53

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

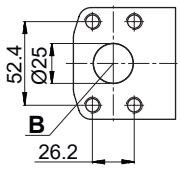
- Port plate 11 (61)



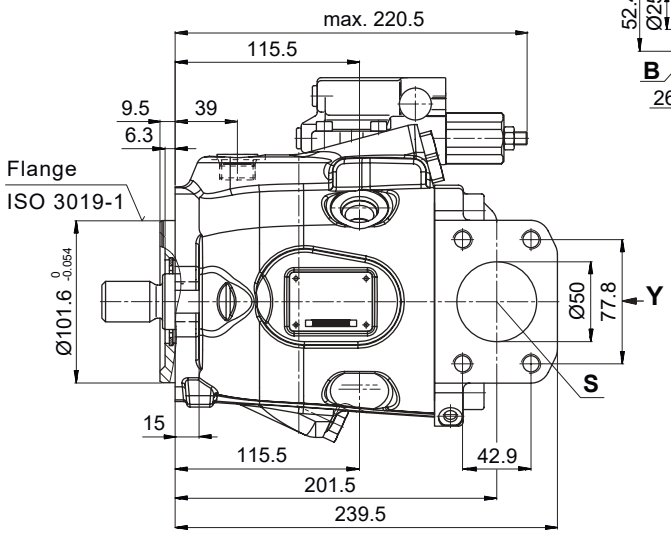


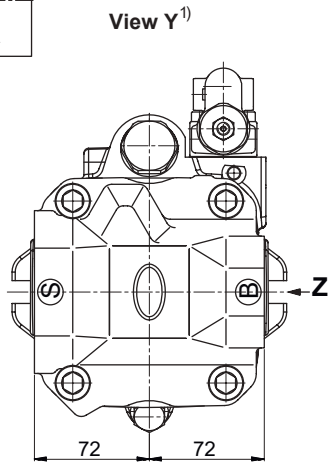


Detail Z



- Port plate 12 (62)





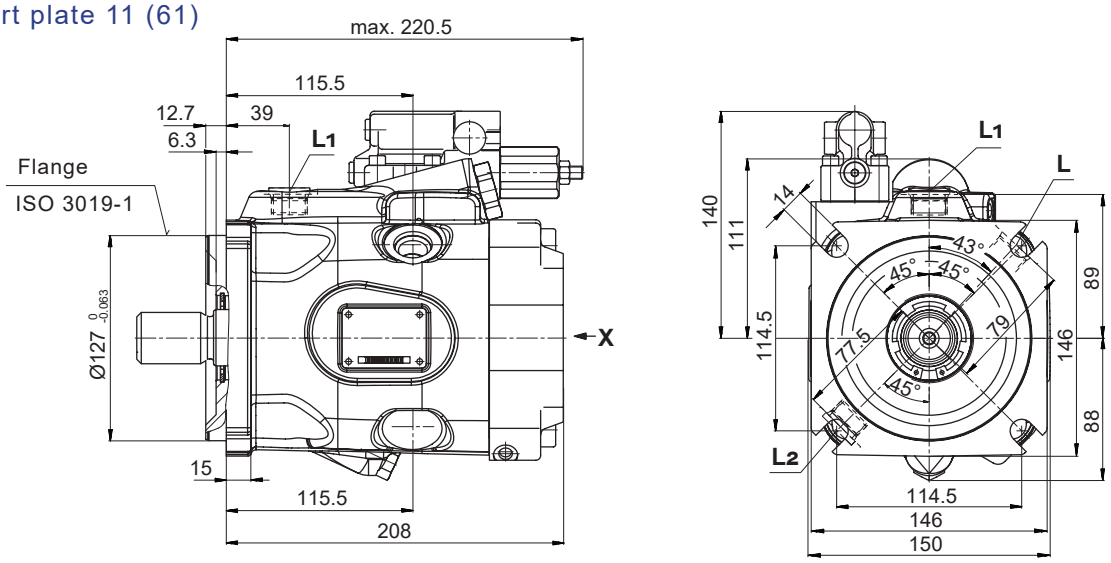
1) Dimensions of working ports turned through 180° for counter-clockwise rotation.

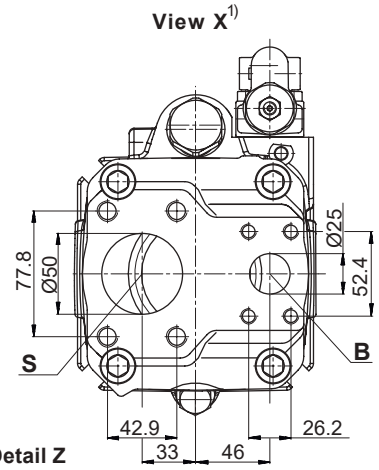
Dimensions, size 72

DR – Hydraulic pressure controller
clockwise rotation, mounting flange D series 53

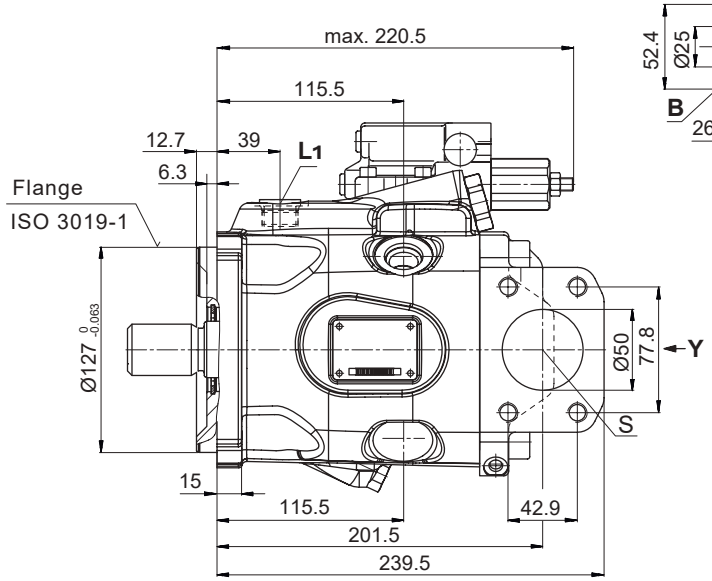
Before finalizing your design request a certified installation drawing. Dimensions in mm.

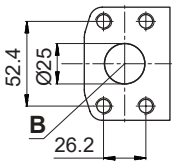
- Port plate 11 (61)

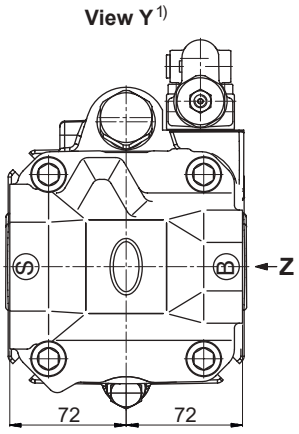




- Port plate 12 (62)







1) Dimensions of working ports turned through 180° for counter-clockwise rotation.

Dimensions, size 72

Ports

Port plate 11, 12		Standard	Size	p_{max} [psi (bar)][1]	State[5]
B	Working port (standard pressure series) Fastening thread	ISO 6162-1 DIN 13	1 in M10 × 1.5; 17 (0.67) deep	4550 (315)	O
S	Suction port (standard pressure series) Fastening thread	ISO 6162-1 DIN 13	2 in M12 × 1.75; 20 (0.79) deep	75 (5)	O
Port plate 61, 62		**Standard**	**Size**	p_{max} [psi (bar)][1]	State[5]
B	Working port (standard pressure series) Fastening thread	ISO 6162-1 ASME B1.1	1 in 3/8-16UNC-2B; 18 (0.71) deep	4550 (315)	O
S	Suction port (standard pressure series) Fastening thread	ISO 6162-1 ASME B1.1	2 in 1/2-13 UNC-2B; 22 (0.87) deep	75 (5)	O
Other ports		**Standard**	**Size**	p_{max} [psi (bar)][1]	State[5]
L	Drain port	ISO 11926[2]	7/8-14UNF-2B; 13 (0.51) deep	30 (2)	O[3]
L_1、L_2[4]	Drain port	ISO 11926[2]	7/8-14UNF-2B; 13 (0.51) deep	30 (2)	X[3]
X	Pilot pressure	ISO 11926	7/16-20UNF-2B; 11.5 (0.45) deep	4550 (315)	O

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

2) The countersink may be deeper than specified in the standard.

3) Depending on the installation position, L, L1 or L2 must be connected (also see installation instructions starting on page 80).

4) Only for series 53

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

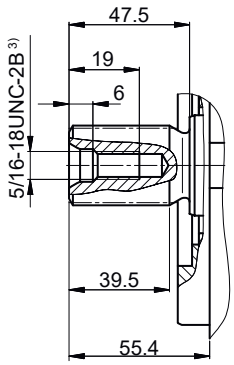
Dimensions, size 72

Dimensions [mm]

Drive shaft

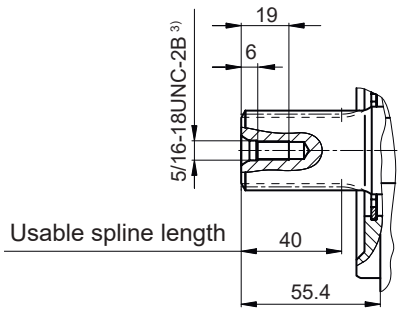
S

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



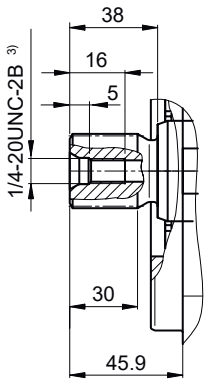
R

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



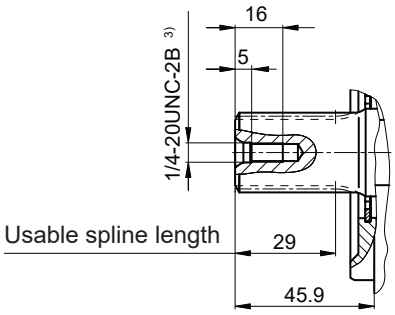
U

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



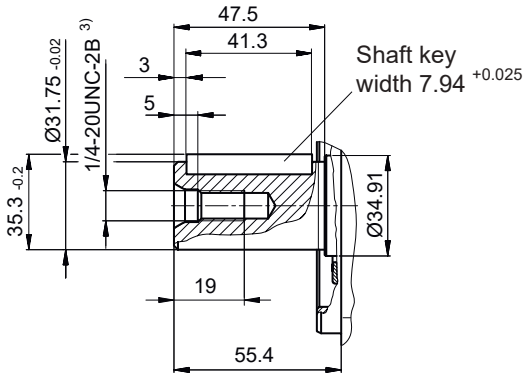
W

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



K

Parallel keyed shaft
32-1



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

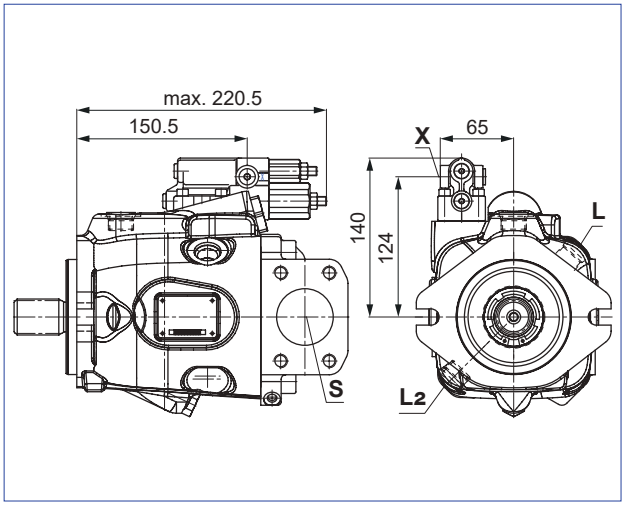
2) Splines according to ANSI B92.1a, spline runout is a deviation from standard ISO 3019-1.

3) Thread according to ASME B1.1

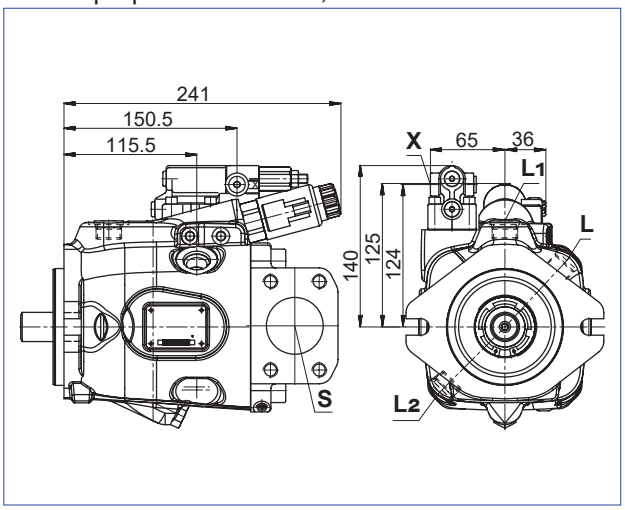
Dimensions, size 72

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

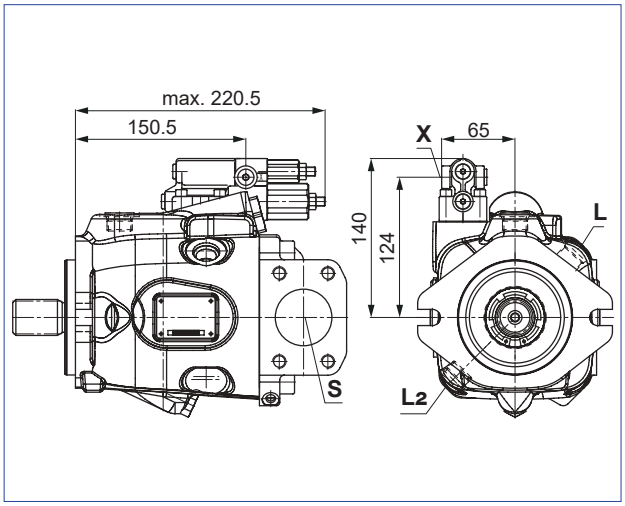
DRG
Pressure controller, remote controlled, series 53



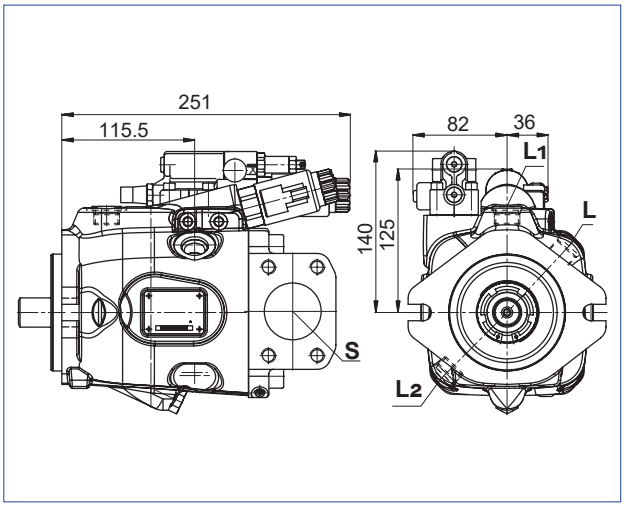
EP.D. / EK.D.
Electro proportional control, series 53



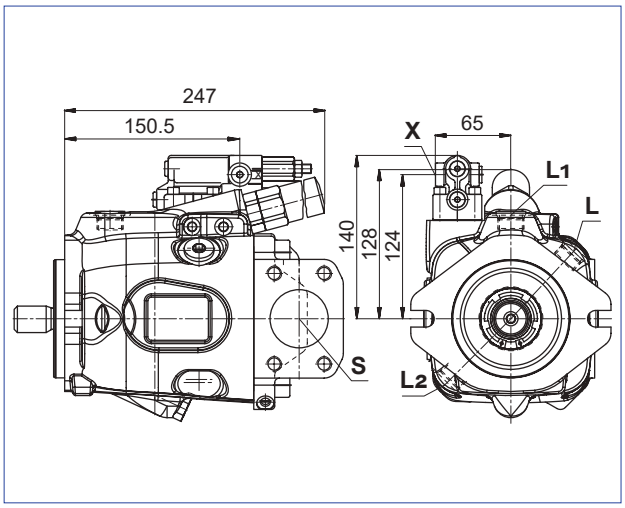
DRF / DRS / DRSC
Pressure flow controller, series 53



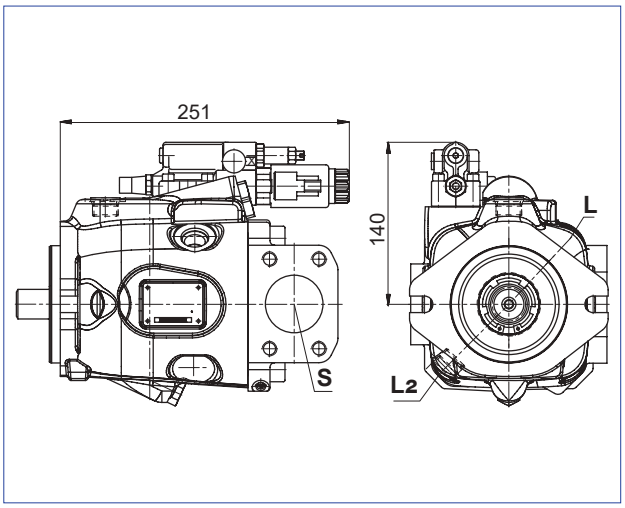
EP.ED. / EK.ED.
Electro-prop. control, series 53



LA.D.
Pressure, flow and power controller, series 53



ED7. / ER7.
Electro-prop. pressure control, series 53

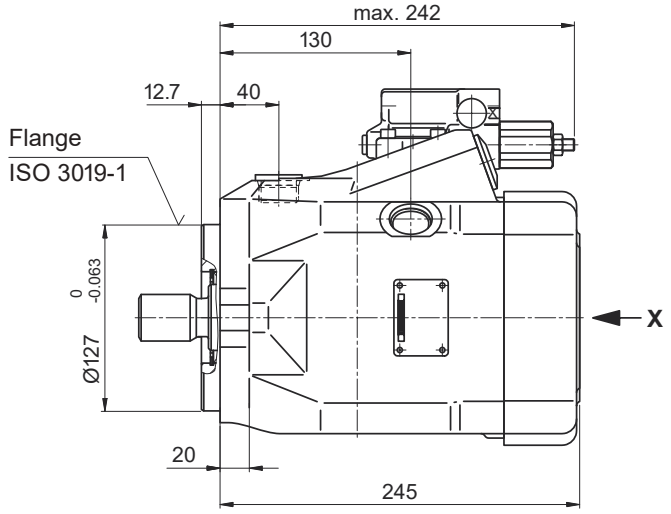


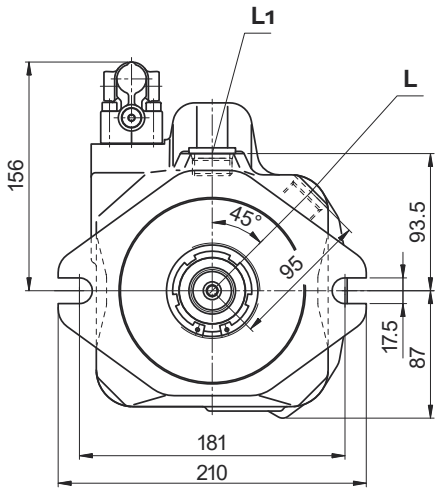
Dimensions, size 85[1)]

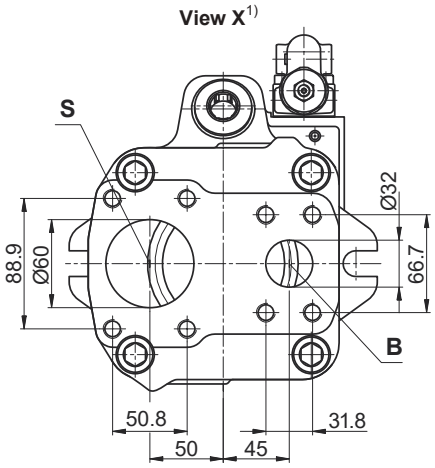
DR – Hydraulic pressure controller
clockwise rotation, mounting flange C series 52

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

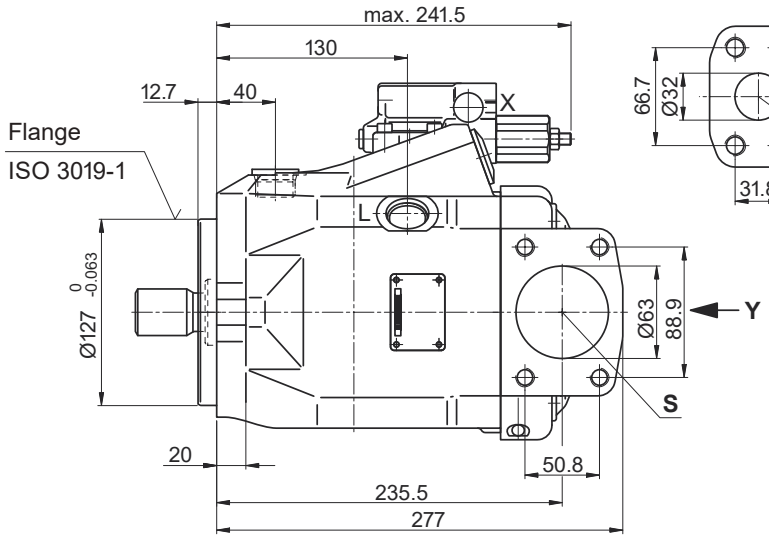
- Port plate 11 (61)

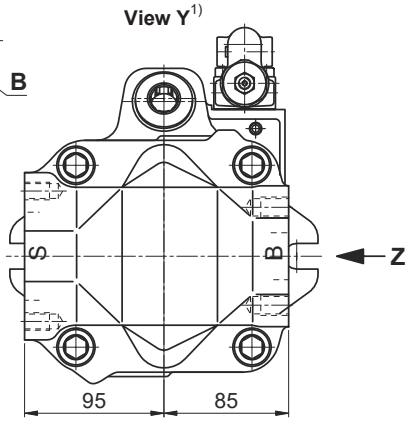






- Port plate 12 (62)





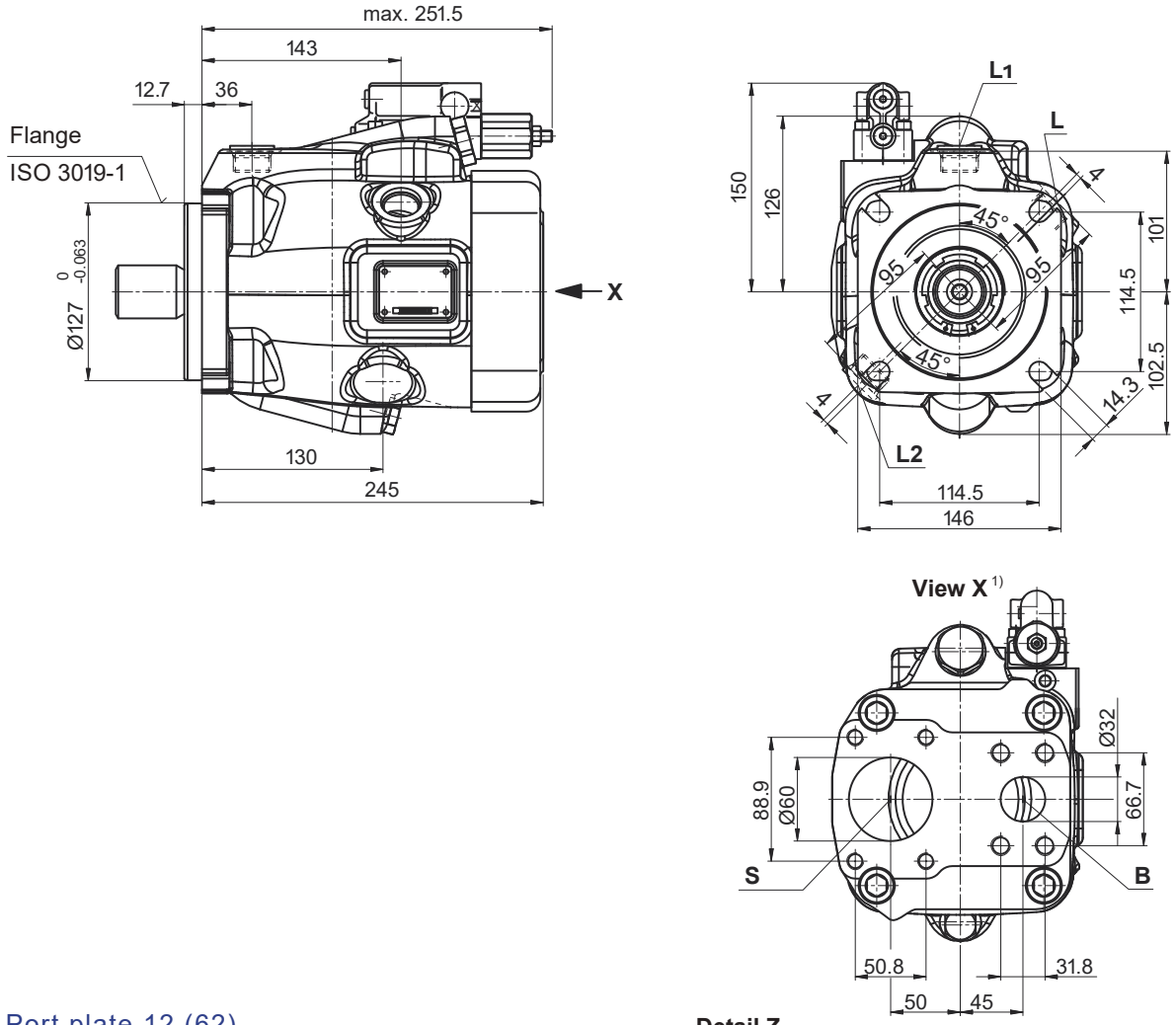
1) Dimensions of working ports turned through 180° for counter-clockwise rotation.

Dimensions, size 85[1)]

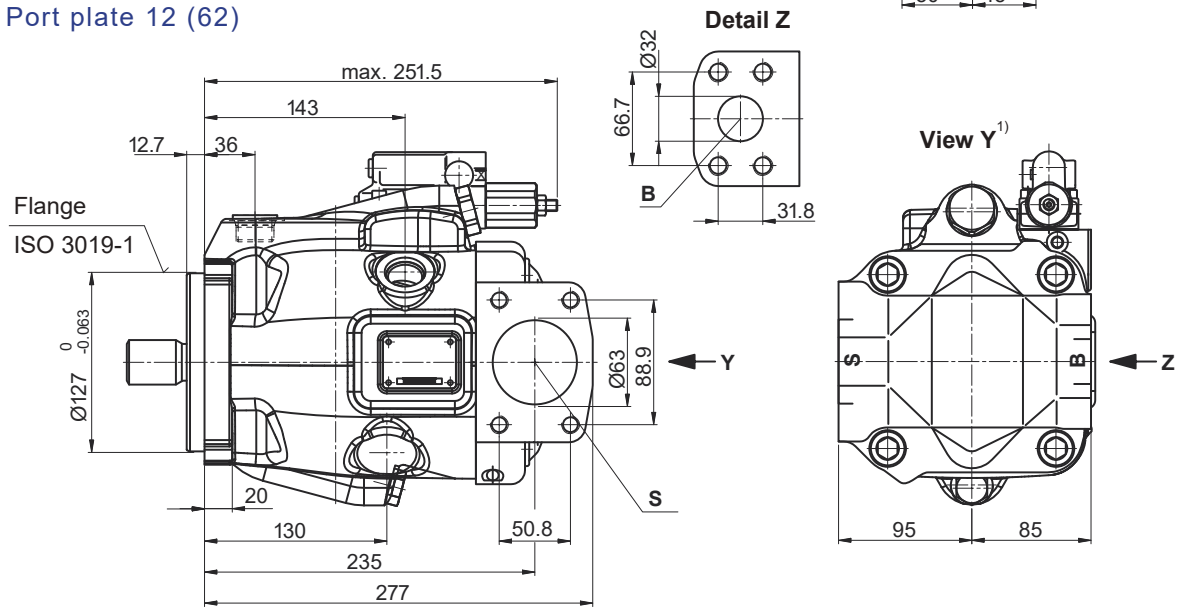
DR – Hydraulic pressure controller
clockwise rotation, mounting flange C and D series 53

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

- Port plate 11 (61)



- Port plate 12 (62)



1) Dimensions of working ports turned through 180° for counter-clockwise rotation.

Dimensions, size 85

Ports

Port plate 11, 12		Standard	Size	p_{max} [psi (bar)][1]	State[5]
B	Working port (high-pressure series) Fastening thread	ISO 6162-2 DIN 13	1 1/4 in M14 × 2; 19 (0.75) deep	4550 (315)	O
S	Suction port (standard pressure series) Fastening thread	ISO 6162-1 DIN 13	2 1/2 in M12 × 1.75; 17 (0.67) deep	75 (5)	O
Port plate 61, 62		**Standard**	**Size**	p_{max} [psi (bar)][1]	State[5]
B	Working port (high-pressure series) Fastening thread	ISO 6162-2 ASME B1.1	1 1/4 in 1/2-13UNC-2B; 19 (0.75) deep	4550 (315)	O
S	Suction port (standard pressure series) Fastening thread	ISO 6162-1 ASME B1.1	2 1/2 in 1/2-13UNC-2B; 27 (1.06) deep	75 (5)	O
Other ports		**Standard**	**Size**	p_{max} [psi (bar)][1]	State[5]
L	Drain port	ISO 11926[2]	1 1/16-12UNF-2B; 15 (0.59) deep	30 (2)	O[3]
L1、L2[4]	Drain port	ISO 11926[2]	1 1/16-12UNF-2B; 15 (0.59) deep	30 (2)	X[3]
X	Pilot pressure	ISO 11926	7/16-20UNF-2B; 11.5 (0.45) deep	4550 (315)	O

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

2) The countersink may be deeper than specified in the standard.

3) Depending on the installation position, L, L1 or L2 must be connected (also see installation instructions starting on page 80).

4) Only for series 53

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

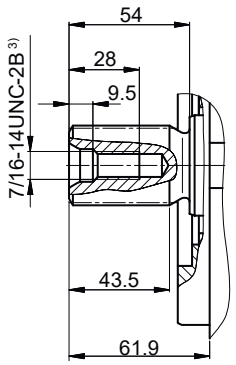
Dimensions, size 85

Dimensions [mm]

Drive shaft

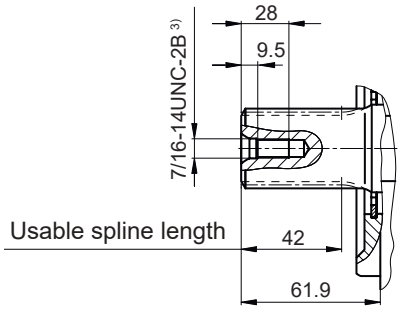
S

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



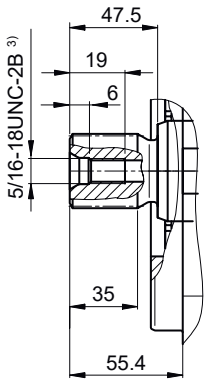
R

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



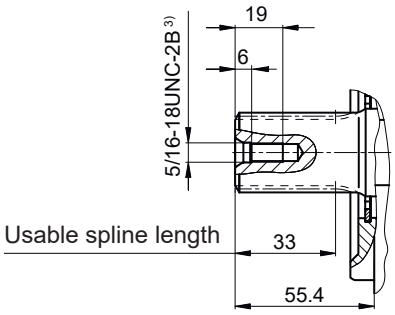
U

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



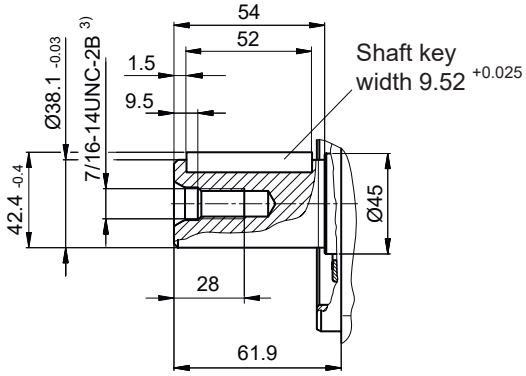
W

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



K

Parallel keyed shaft
38-1



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

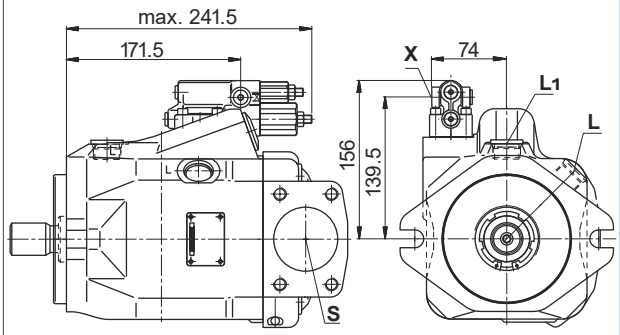
2) Splines according to ANSI B92.1a, spline runout is a deviation from standard ISO 3019-1.

3) Thread according to ASME B1.1

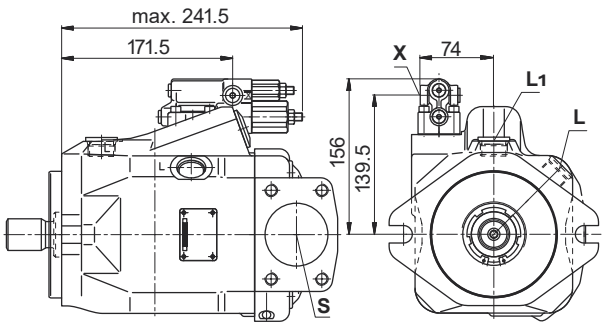
Dimensions, size 85

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

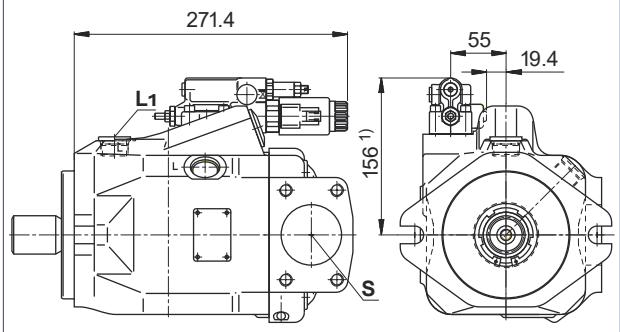
DRG
Pressure controller, remote controlled, series 52



DFR / DFR1 / DRSC
Pressure flow controller, series 52



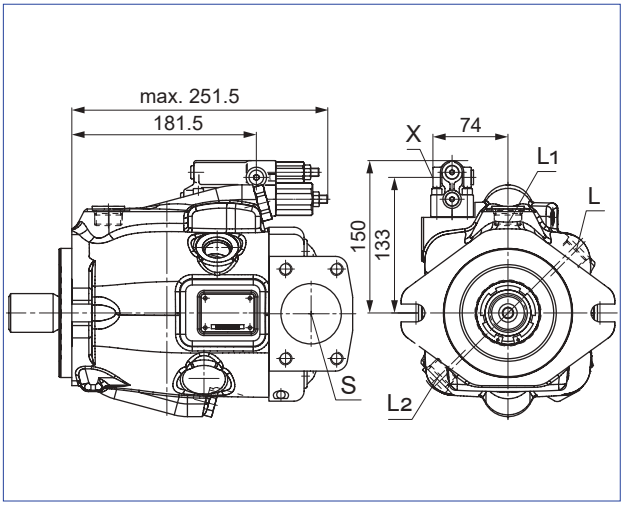
ED7. / ER7.
Electro-prop. pressure control, series 52



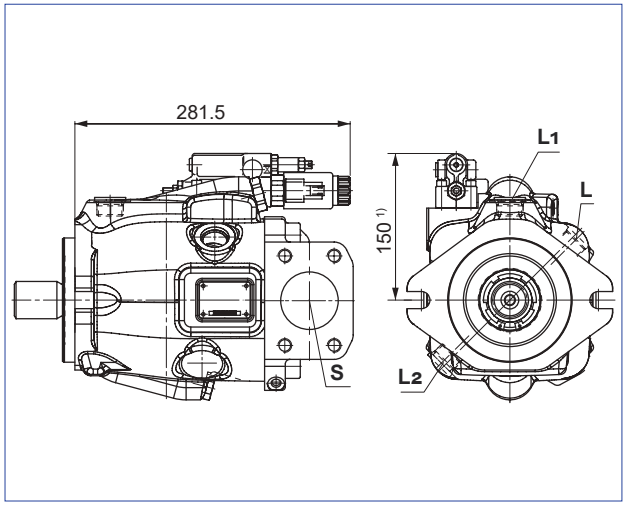
Dimensions, size 85

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

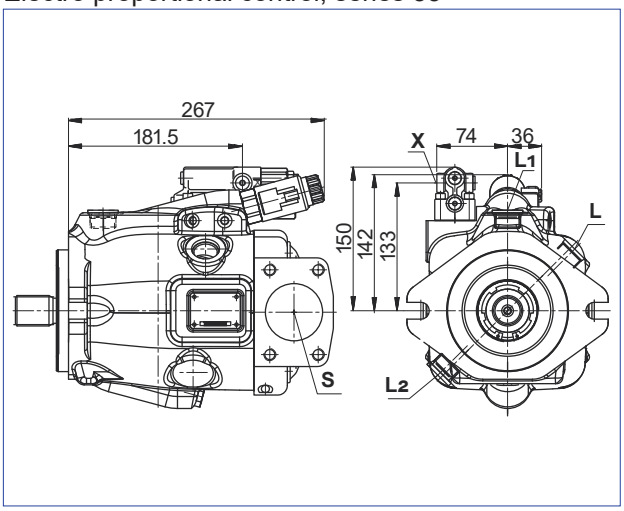
DRG
Pressure controller, remote controlled, series 53



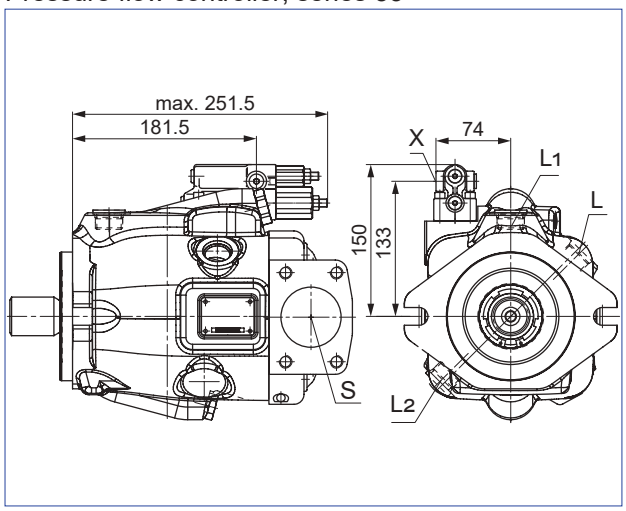
ED7. / ER7.
Electro-prop. pressure control, series 53



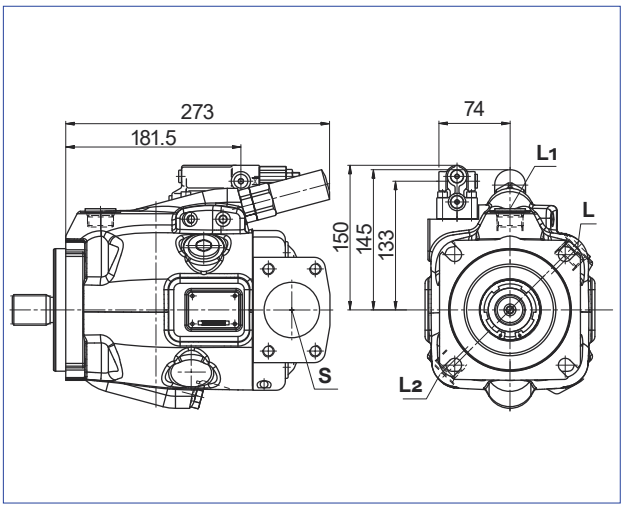
EP.D. / EK.D.
Electro proportional control, series 53



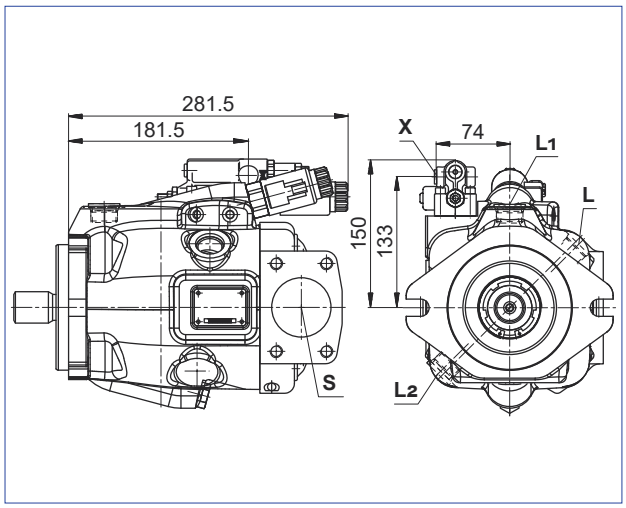
DRF / DRS / DRSC
Pressure flow controller, series 53



LA.D.
Pressure, flow and power controller, series 53



EP.ED. / EK.ED.
Electro-prop. control, series 53

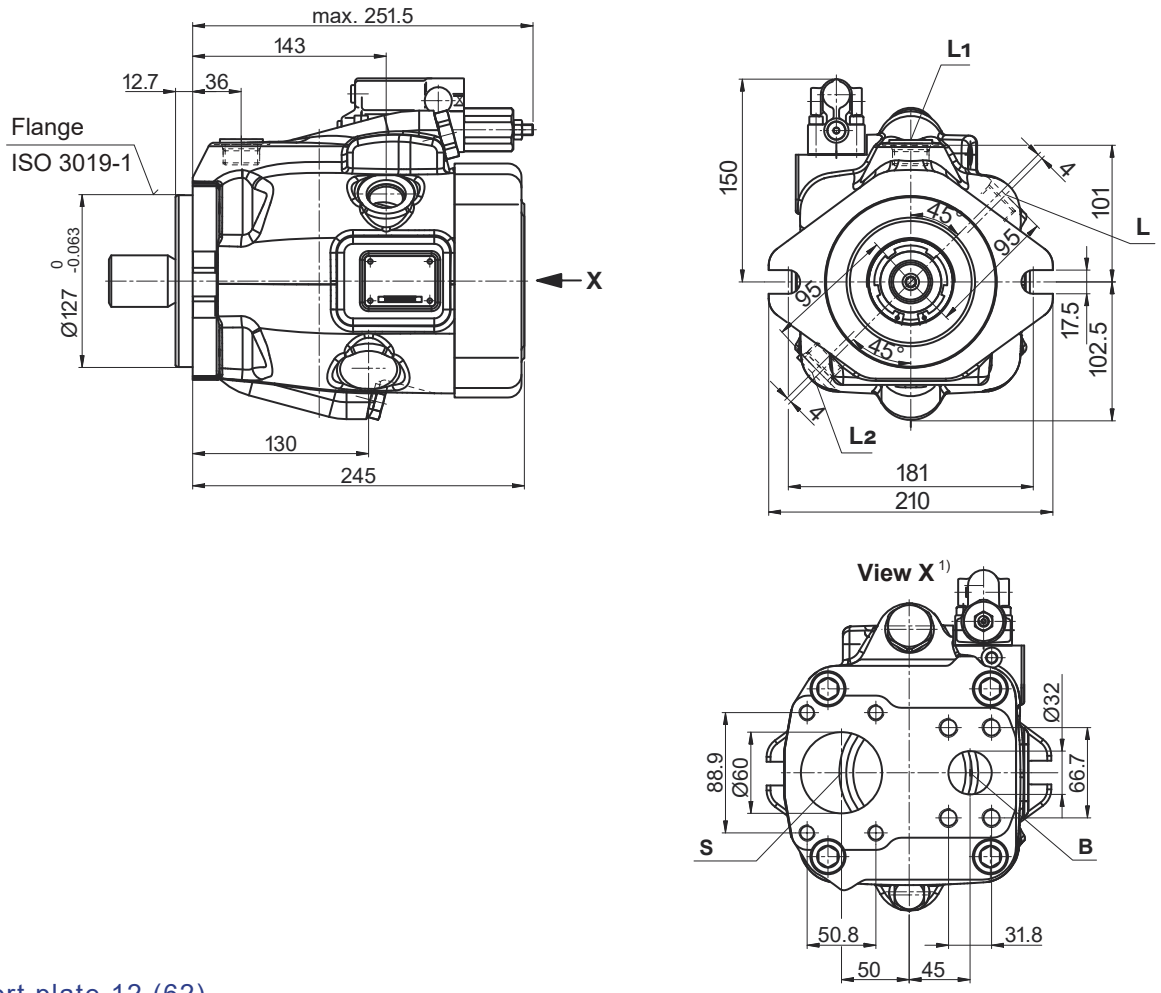


Dimensions, size 100 [1)]

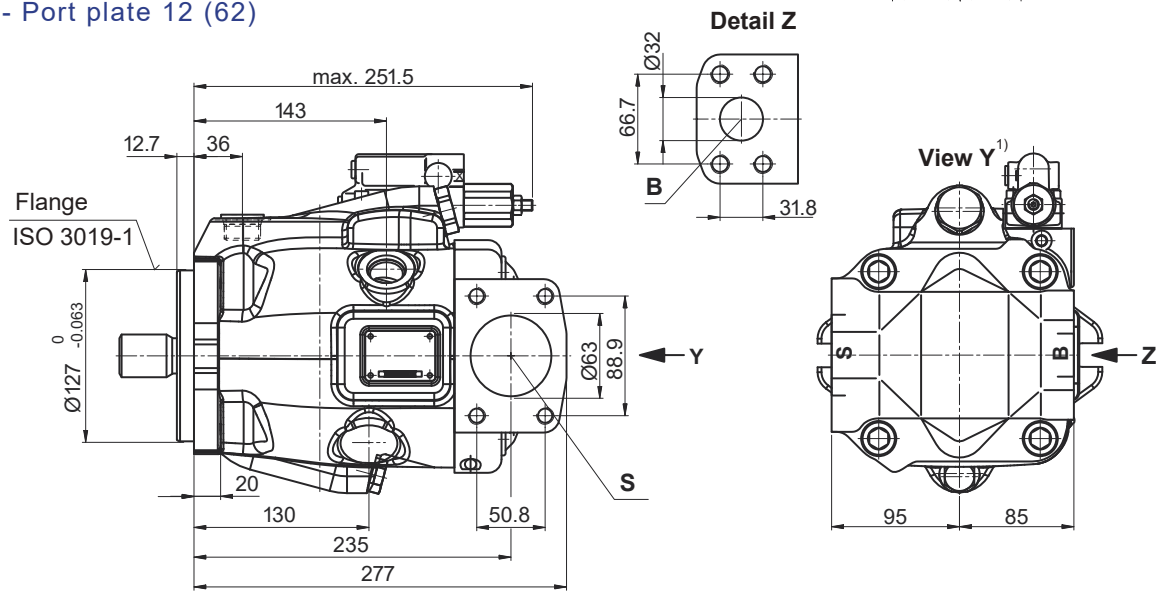
DR – Hydraulic pressure controller
clockwise rotation, mounting flange C series 53

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

- Port plate 11 (61)



- Port plate 12 (62)



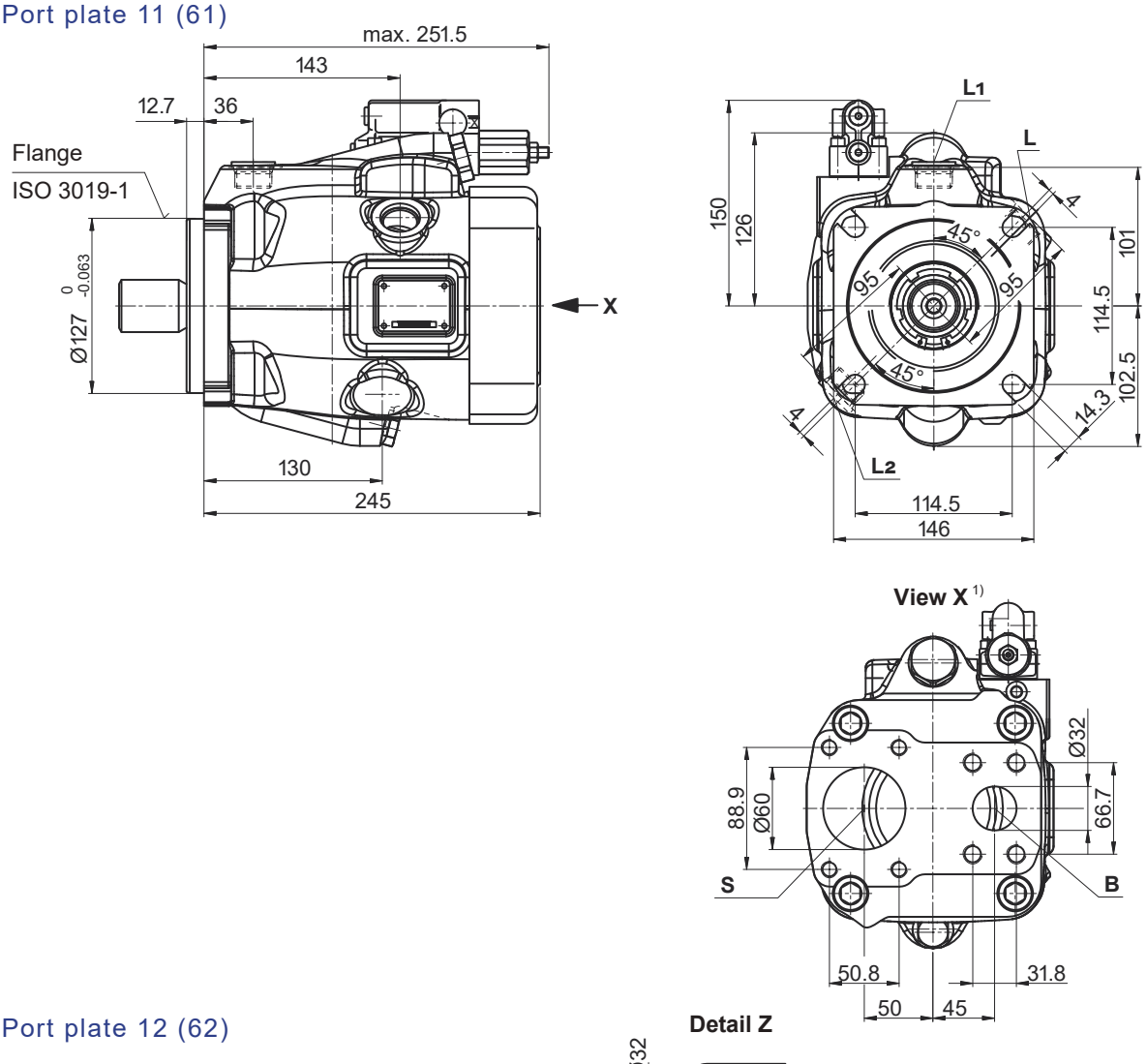
1) Dimensions of working ports turned through 180° for counter-clockwise rotation.

Dimensions, size 100 [1)]

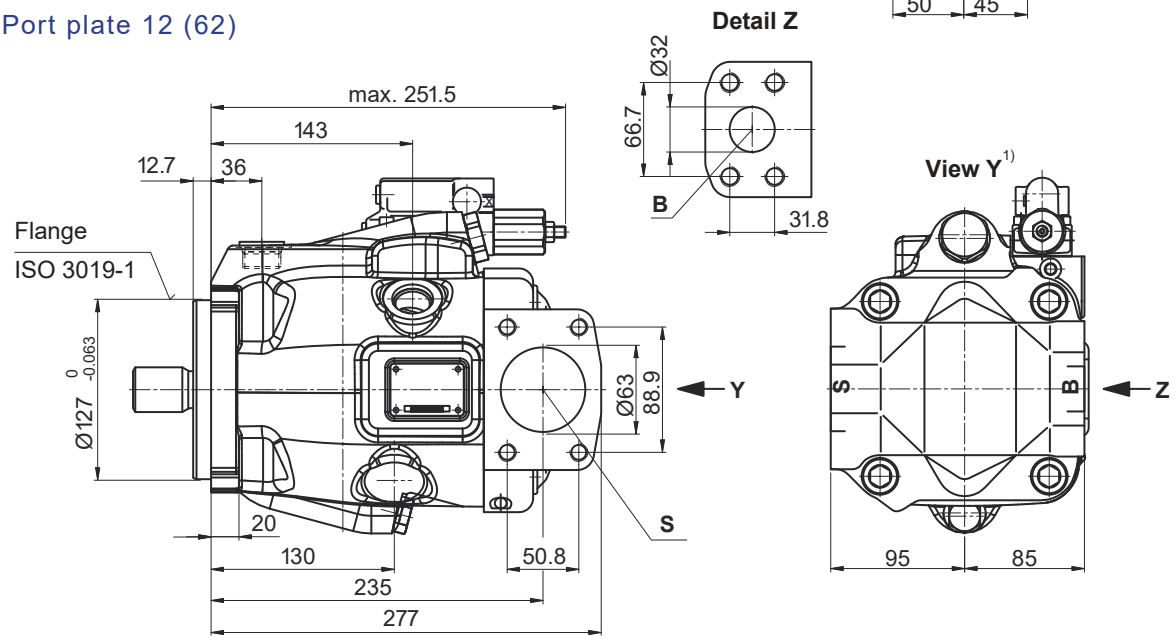
DR – Hydraulic pressure controller
clockwise rotation, mounting flange D series 53

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

- Port plate 11 (61)



- Port plate 12 (62)



1) Dimensions of working ports turned through 180° for counter-clockwise rotation.

Dimensions, size 100

Ports

Port plate 11, 12		Standard	Size	p_{max} [psi (bar)][1]	State[5]
B	Working port (high-pressure series) Fastening thread	ISO 6162-2 DIN 13	1 1/4 in M14 × 2; 19 (0.75) deep	4550 (315)	O
S	Suction port (standard pressure series) Fastening thread	ISO 6162-1 DIN 13	2 1/2 in M12 × 1.75; 17 (0.67) dee	75 (5)	O
Port plate 61, 62		**Standard**	**Size**	p_{max} [psi (bar)][1]	State[5]
B	Working port (high-pressure series) Fastening thread	ISO 6162-2 ASME B1.1	1 1/4 in 1/2-13UNC-2B; 19 (0.75) deep	4550 (315)	O
S	Suction port (standard pressure series) Fastening thread	ISO 6162-1 ASME B1.1	2 1/2 in 1/2-13UNC-2B; 27 (1.06) deep	75 (5)	O
Other ports		**Standard**	**Size**	p_{max} [psi (bar)][1]	State[5]
L	Drain port	ISO 11926[2]	1 1/16-12UNF-2B; 15 (0.59) deep	30 (2)	O[3]
L_1、L_2[4]	Drain port	ISO 11926[2]	1 1/16-12UNF-2B; 15 (0.59) deep	30 (2)	X[3]
X	Pilot pressure	ISO 11926	7/16-20UNF-2B; 11.5 (0.45) deep	4550 (315)	O

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

2) The countersink may be deeper than specified in the standard.

3) Depending on the installation position, L, L1 or L2 must be connected (also see installation instructions starting on page 80).

4) Only for series 53

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

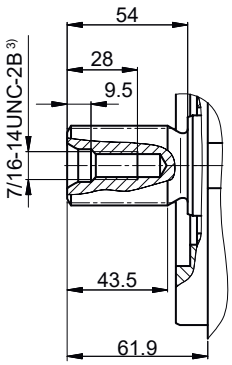
Dimensions, size 100

Dimensions [mm]

Drive shaft

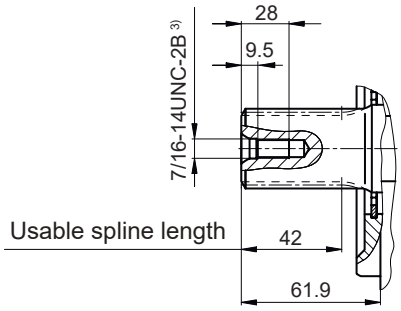
S

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



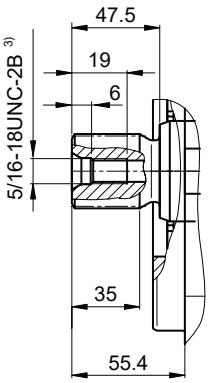
R

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



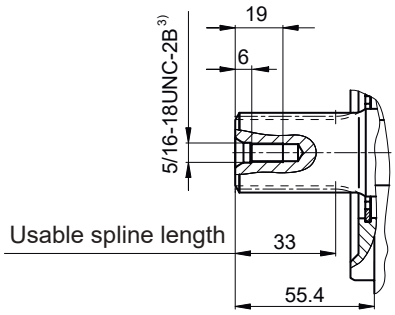
U

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



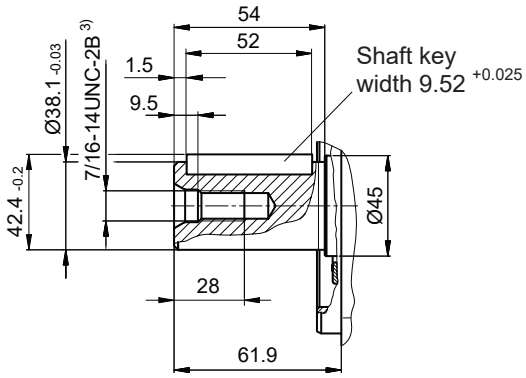
W

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



K

Parallel keyed shaft
38-1



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

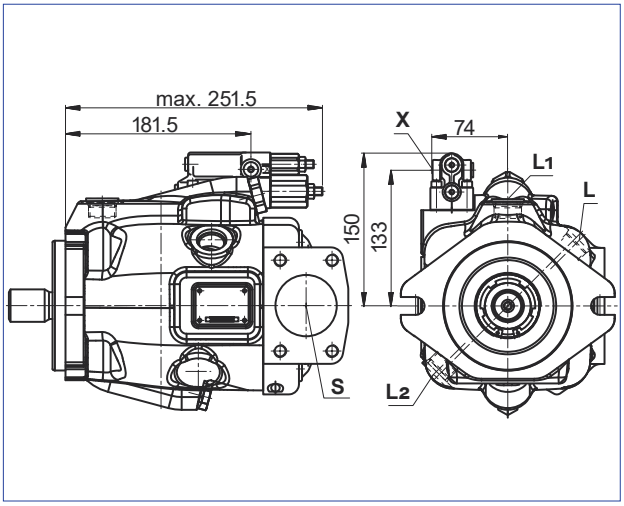
2) Splines according to ANSI B92.1a, spline runout is a deviation from standard ISO 3019-1.

3) Thread according to ASME B1.1

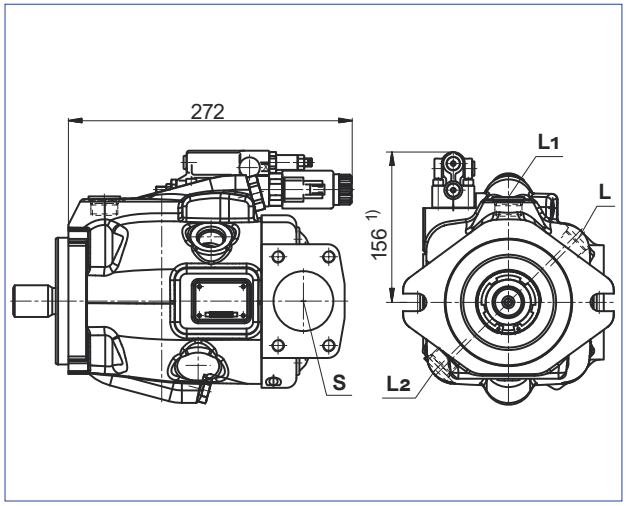
Dimensions, size 100

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

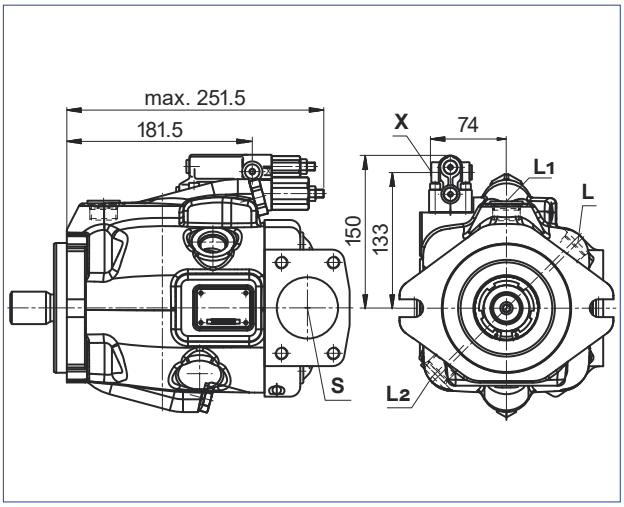
DRG
Pressure controller, remote controlled, series 53



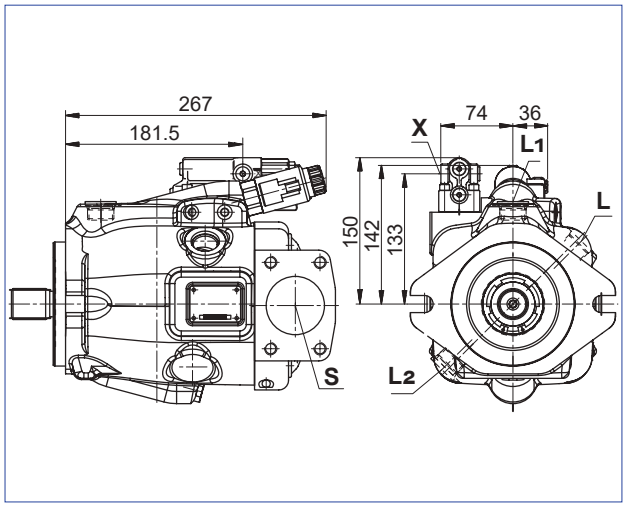
ED7. / ER7.
Electro-prop. pressure control, series 53



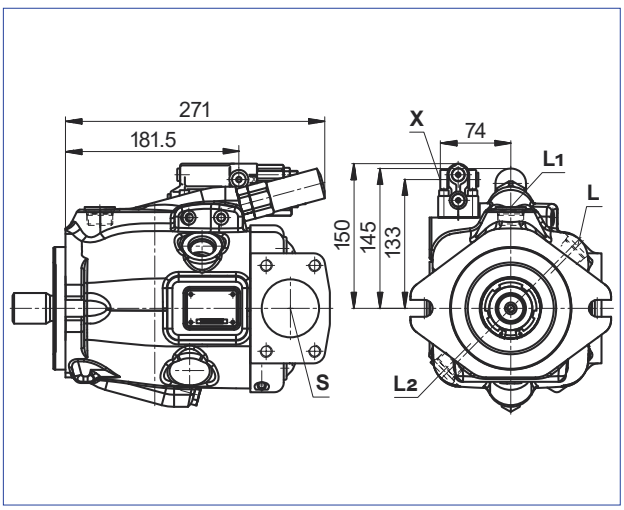
DRF / DRS / DRSC
Pressure flow controller, series 53



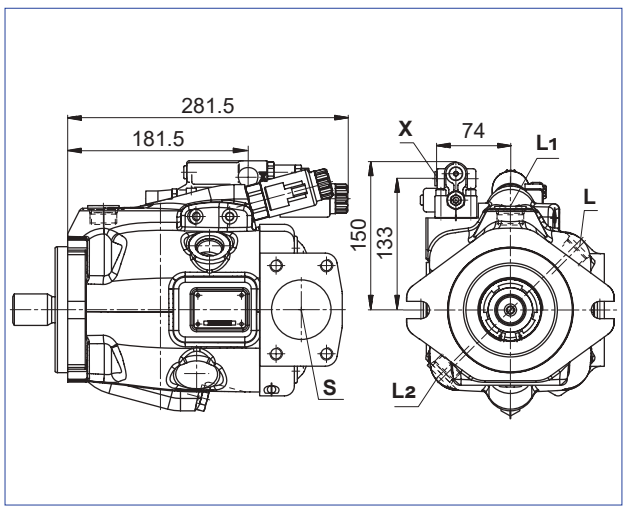
EP.D. / EK.D.
Electro proportional control, series 53



LA.D.
Pressure, flow and power controller, series 53



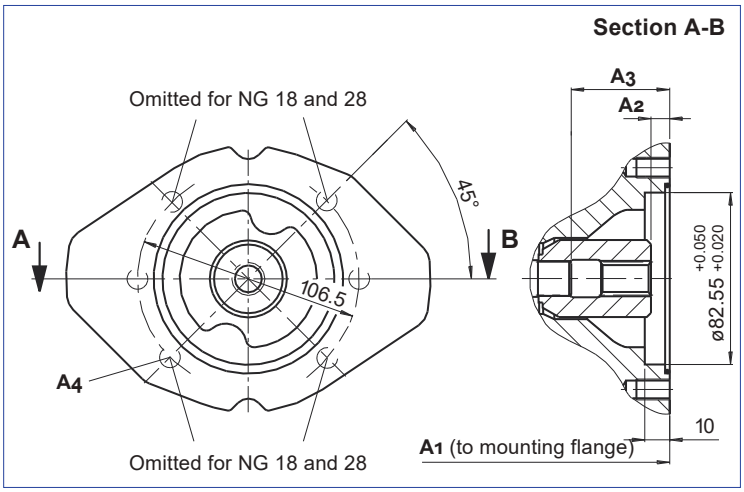
EP.ED. / EK.ED.
Electro-prop. control, series 53



Dimensions, through drive

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

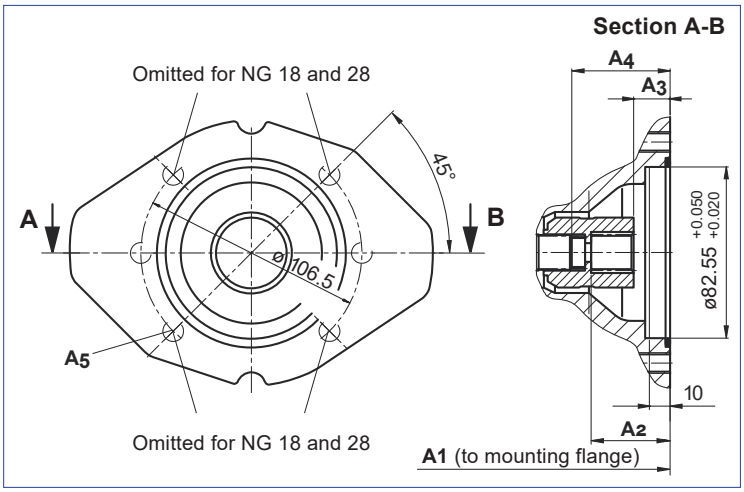
K01 flange SAE J744 - 82-2 (A)
Coupling for splined shaft in accordance with ANSI B92.1a-1996



5/8 in 9T 16/32 DP[1] (SAE J744 - 16-4 (A))

NG	A1	A2	A3	A4[2]
18	182	9.3	42.5	M10 x 1.5, 0.57 (14.5) deep
28	204	9.2	36.2	M10 x 1.5, 0.63 (16) deep
45	229	10	52.7	M10 x 1.5, 0.63 (16) deep
60 / 63	255	8.7	58.2	M10 x 1.5, 0.63 (16) deep
72	255	8.7	58.2	M10 x 1.5, 0.63 (16) deep
85	302	12.5	67.2	M10 x 1.5, 0.79 (20) deep
100	302	12.5	67.2	M10 x 1.5, 0.79 (20) deep

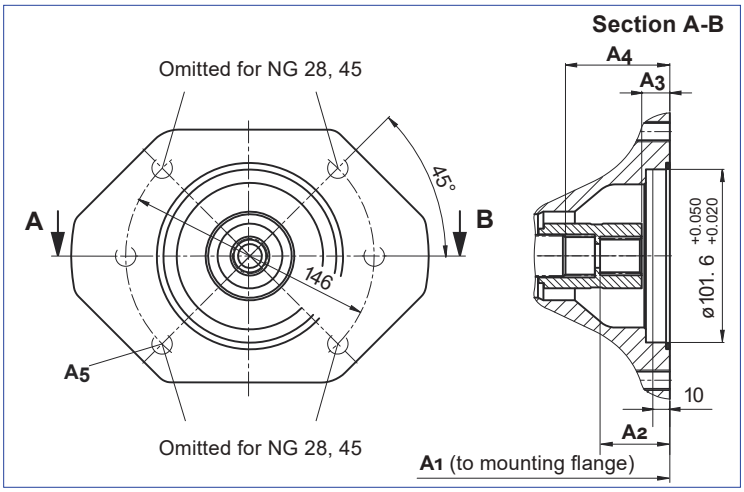
K52 flange SAE J744 - 82-2 (A)
Coupling for splined shaft in accordance with ANSI B92.1a-1996



3/4 in 11T 16/32 DP[1] (SAE J744 - 19-4 (A-B))

NG	A1	A2	A3	A4	A5[2]
18	182		9.3	43.3	M10 x 1.5, 0.57 (14.5) deep
28	204	39.3	18.8	47	M10 x 1.5, 0.63 (16) deep
45	229	39.4	18.9	53	M10 x 1.5, 0.63 (16) deep
60 / 63	255	39.4	18.9	61	M10 x 1.5, 0.63 (16) deep
72	255	38.8	18.4	000	M10 x 1.5, 0.63 (16) deep
85	302	44.1	23.6	65	M10 x 1.5, 0.79 (20) deep
100	302	44.1	23.6	65	M10 x 1.5, 0.79 (20) deep

K68 flange SAE J744 - 101-2 (B)
Coupling for splined shaft in accordance with ANSI B92.1a-1996



7/8 in 13T 16/32 DP[1] (SAE J744 - 22-4 (B))

NG	A1	A2	A3	A4	A5[2]
28	204	42.3	17.8	47	M12 × 1.75; 0.71 (18) deep
45	229	42.4	17.9	53	M12 × 1.75; 0.71 (18) deep
60 / 63	255	42.4	17.9	59	M12 × 1.75; 0.71 (18) deep
72	255	41.8	17.4	000	M12 × 1.75; 0.71 (18) deep
85	302	46.5	22	69	M12 × 1.75; 0.79 (20) deep
100	302	46.5	22	69	M12 × 1.75; 0.79 (20) deep

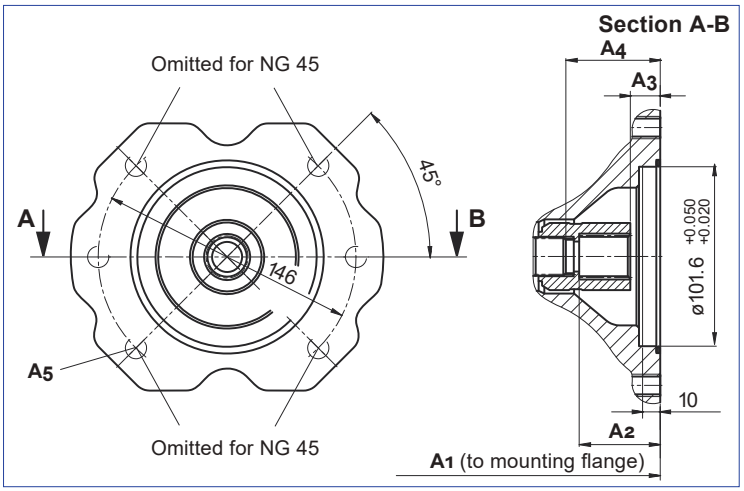
1) 30° pressure angle, flat base, flank centering, tolerance class 5

2) Thread according to DIN 13, observe the general instructions on FINAL PAGE must be observed.

Dimensions, through drive

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

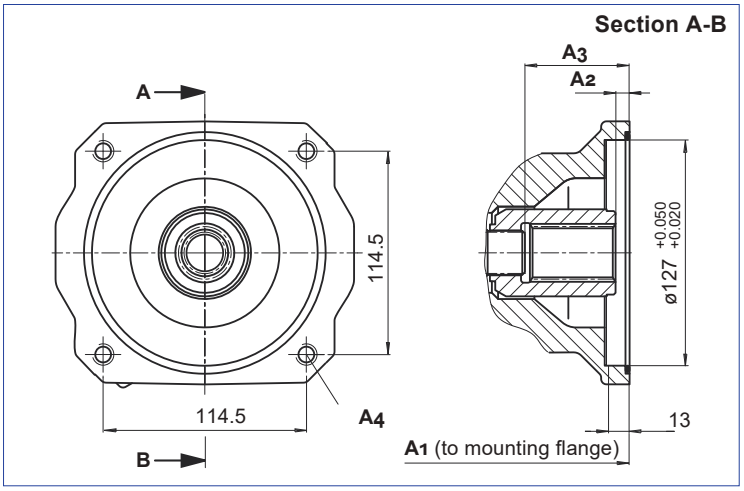
K04 flange SAE J744 - 101-2 (B)
Coupling for splined shaft in accordance with ANSI B92.1a-1996



1 in 15T 16/32 DP[1] (SAE J744 - 25-4 (B-B))

NG	A1	A2	A3	A4	A5 [2]
45	229	47.9	18.9	53.4	M12 × 1.75; 0.71 (18) deep
60 / 63	255	47.4	18.9	58.9	M12 × 1.75; 0.71 (18) deep
72	255	46.8	17.9	000	M12 × 1.75; 0.71 (18) deep
85	302	51.2	22.2	69	M12 × 1.75; 0.79 (20) deep
100	302	51.2	22.2	69	M12 × 1.75; 0.79 (20) deep

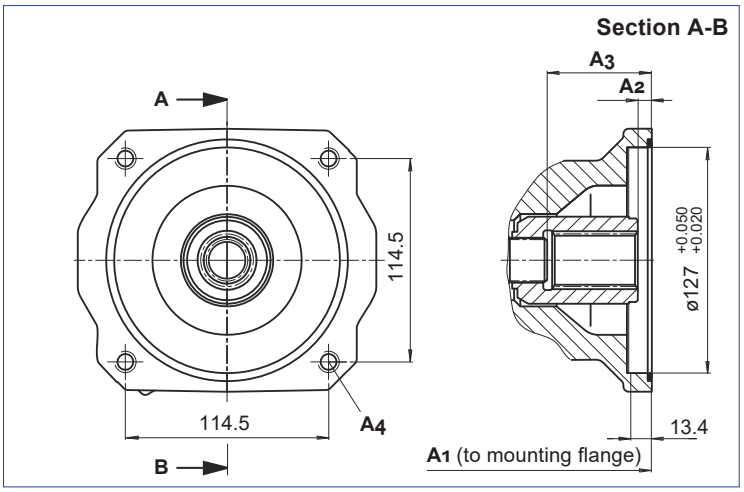
K15 flange SAE J744 - 127-4 (C)
Coupling for splined shaft in accordance with ANSI B92.1a-1996



1 1/4 in 14T 12/24 DP[1] (SAE J744 - 32-4 (C))

NG	A1	A2	A3	A4 [2]
60 / 63	255	17.9	55.9	M12 x 1.75, 0.63 (16) deep
72	255	17.9	55.9	M12 x 1.75, 0.63 (16) deep
85	301.5	22	60	M12 x 1.75, through
100	301.5	22	60	M12 x 1.75, through

K16 flange SAE J744 - 127-4 (C)
Coupling for splined shaft in accordance with ANSI B92.1a-1996



1 1/2 in 17T 12/24 DP[1] (SAE J744 - 32-4 (C))

NG	A1	A2	A3	A4 [2]
85	301.5	13	67.9	M12 × 1.75; through
100	301.5	13	67.9	M12 × 1.75; through

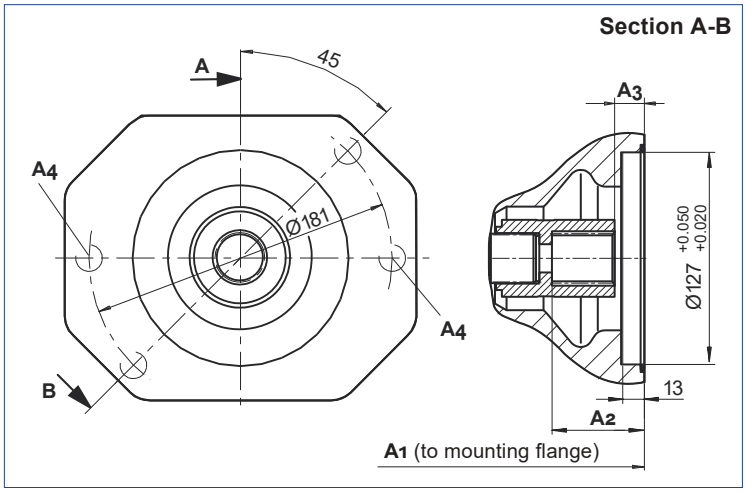
1) 30° pressure angle, flat base, flank centering, tolerance class 5

2) Thread according to DIN 13, observe the general instructions on FINAL PAGE must be observed.

Dimensions, through drive

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

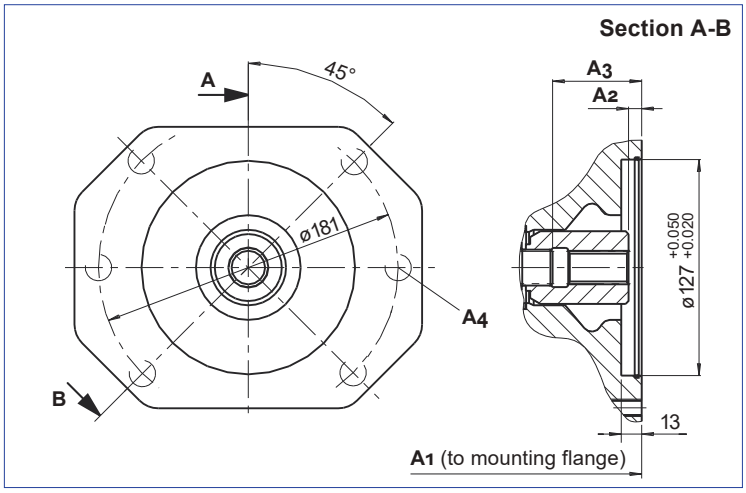
K07 flange SAE J744 - 127-2 (C
Coupling for splined shaft in accordance with ANSI B92.1a-1996



1 1/4 in 14T 12/24 DP[1] (SAE J744 - 32-4 (C))

NG	A1	A2	A3	A4 [2]
85	301.5	60	22	M16×2; 24 (0.94) deep
100	301.5	60	22	M16×2; 24 (0.94) deep

K24 flange SAE J744 - 127-2 (C)
Coupling for splined shaft in accordance with ANSI B92.1a-1996



1 1/2 in 17T 12/24 DP[1] (SAE J744 - 38-4 (C-C))

NG	A1	A2	A3	A4 [2]
85	302	12.8	67.2	M16 x 2, 0.94 (24) deep
100	302	12.8	67.2	M16 x 2, 0.94 (24) deep

[1] 30° pressure angle, flat base, flank centering, tolerance class 5

[2] Thread according to DIN 13, observe the general instructions on FINAL PAGE must be observed.

Overview of mounting options

Through drive			Mounting options – 2nd pump			
Flange	Hub for splined shaft	Code	**PA10V(S)O/5x** NG (shaft)	**PA10VO/31** NG (shaft)	Gear pump design (NG)	Through drive available for NG
82-2 (A)	5/8 in	**K01**	10 (U)	18 (U)	F (5 to 22)	18 to 100
	3/4 in	**K52**	10 (S) 18 (U) 18 (S、R)	18 (S、R)	–	18 to 100
101-2 (B)	7/8 in	**K68**	28 (S、R) 45 (U、W)[1]	28 (S、R) 45 (U、W)	N/G (26 to 49)	28 to 100
	1 in	**K04**	45 (S、R) 60、63 (U、W)[2]	45 (S、R) –	–	45 to 100
127-4 (C)	1 1/4 in	**K15**	60、63 (S、R)	–	–	63 to 100
	1 1/2 in	**K16**	85 (S) 100 (S)	–	–	85 to 100
127-2 (C)	1 1/4 in	**K07**	85 (U、W) 100 (U、W)	71 (S、R)	–	85 to 100
	1 1/2 in	**K24**	85 (S) 100 (S)	–	–	85 to 100

[1] Not for NG28 with K68.

[2] Not for NG28 with K04.

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

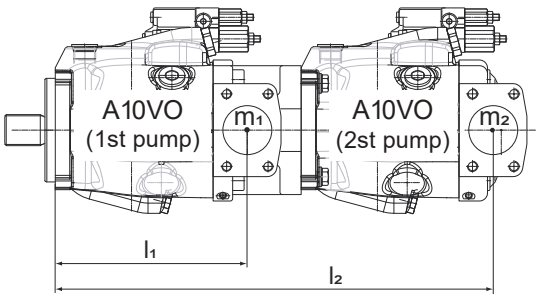
PA10VO85DRS/53R-VSC12K04+
PA10VO45DRF/53R-VSC11N00

The tandem pump comprising two identical sizes is permissible without additional supports taking into account a maximum dynamic mass acceleration of 10*g* (= 98.1 m/s²) .

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

Permissible moment of inertia

NG			10	18	28	45	60/63	85	100
Permissible moment of inertia									
static	Tm	Nm	–	–	890	900	1370	3080	3080
dynamic at 10*g* (98.1 m/s²)	Tm	Nm	–	–	89	90	137	308	308
Mass with through-drive plate	m	kg	–	–	17	24	28	45	45
Mass without through drive (e.g. 2nd pump)	m	kg	8	11.5	14	18	22	34	34
Distance center of gravity	l	mm	–	82	81	95	100	122	122



m_1 、m_2 、m_3	Mass of pumps	[kg]
l_1 、l_2 、l_3	Distance center of gravity	[mm]

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

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.

Especially with the installation position "drive shaft upwards" or "drive shaft downward", attention must be paid to a complete filling and air bleeding since there is a risk, for example, of dry running.

The case drain fluid in the case interior 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 drain ports of the units, the shared 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 drain lines must be laid if necessary.

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

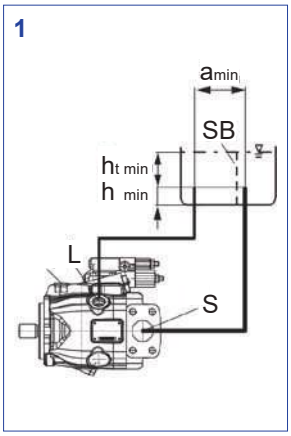
In all operating conditions, the suction line and case drain line must flow into the reservoir below the minimum fluid level. The permissible suction height h_S is a result of the overall pressure loss, but may not be greater than $h_{S\,max}$ = 31.50 in (800 mm). The minimum suction pressure at port S must also not fall below 12 psi (0.8 bar) absolute during operation.

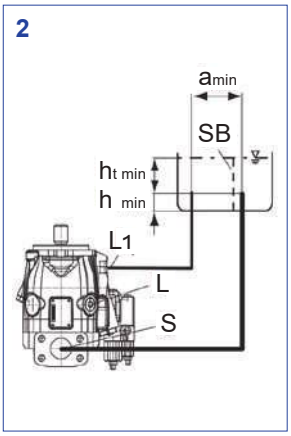
Installation position

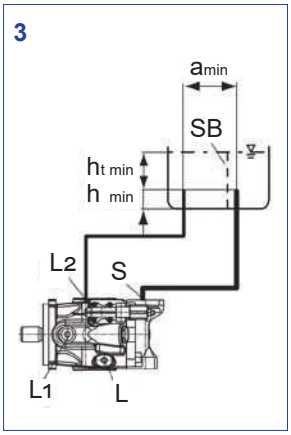
See the following examples 1 to 12.
Additional installation positions are available upon request.
Recommended installation positions : 1 and 3.

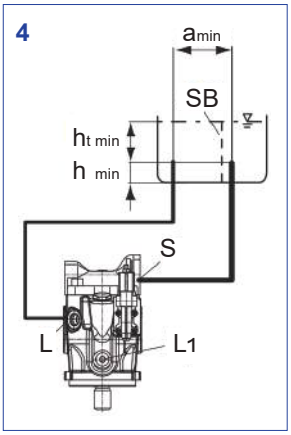
Below-reservoir installation (standard)

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









Installation position	Air bleed	Filling
1	L	S+L
2	L_1	S+L_1
3 [1)]	L_2	S+L_2
4	L	S+L

[1)] Only series 53

Installation instructions

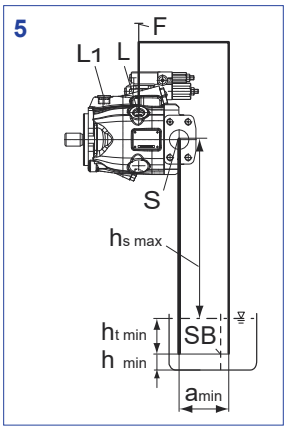
Above-reservoir installation

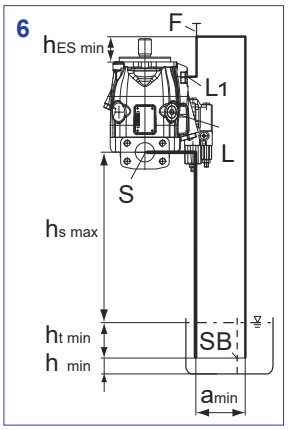
Above-reservoir installation means the axial piston unit is installed above the minimum fluid level of the reservoir.

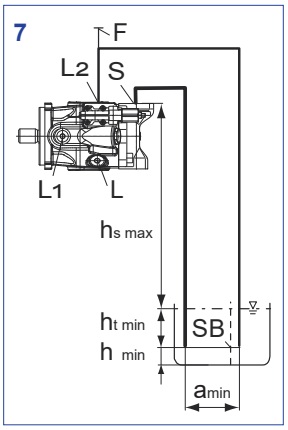
To prevent the axial piston unit from draining, a height difference $h_{ES\ min}$ of at least in 25 mm is required in installati-on position 6.

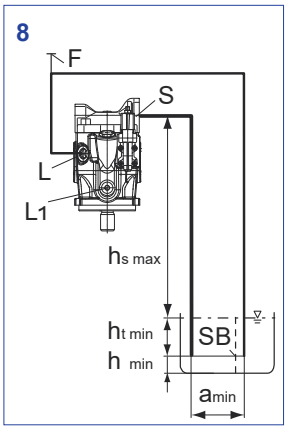
Observe the maximum permissible suction height $h_{s\ max}$ = 31.50 in (800 mm).

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









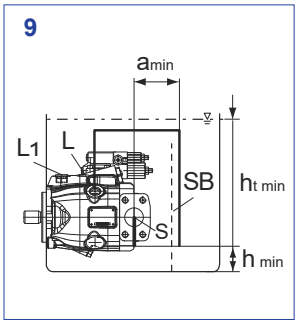
Installation position	Air bleed	Filling
5	F	L、L1 (F)
6	F	L1 (F)
7 [1)]	F	S+L2 (F)
8	F	S+L (F)

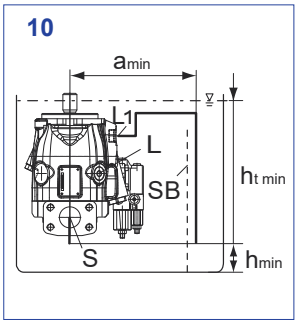
1) Only series 53

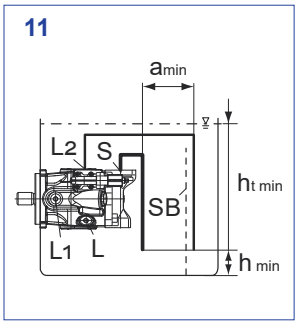
Inside-reservoir installation

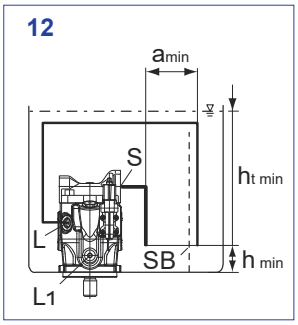
Inside-reservoir installation means the pump is insta-lled within the minimum reservoir fluid level.

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	L1	L、L1
10	L1	L、L1
11 [1)]	L2	S
12	L	S+L

S	Suction port
F	Filling / air bleeding
L、L1	Case drain port
SB	Baffle (baffle plate)
$h_{t\ min}$	Minimum necessary immersion depth (7.87 in (200 mm))
h_{min}	Minimum necessary spacing to reservoir base (3.94 in (100 mm))
$h_{ES\ min}$	Minimum necessary height needed to protect the axial piston unit from draining (0.98 in (25 mm)).
$h_{s\ max}$	Maximum permissible suction height (21.50 in (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.

Installation instructions

- The PA 10VO pump is designed to be used in open circuit.
- Project planning, installation and commissing of the axial piston unit require the involvemenf qualifed personnel.
- Before operating the axial piston unit, please the appropriate instruction manual thoughly and completely.
  If necessary, request these from YEOSHE.
- Duning 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 characteri-steristics myyc shift.

Service line ports

- The ports and fixing threads are designed for the specified maximum pressure. The machine or system manufa-cturer must ensure that the connecting elements and lines correspond to the specified application conditions (pressu-re, flow, hydraulic fiuidii 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 DIN EN ISO 13849.

The following tightening torques apply

Fittings

Observe the manufacturer's instruction regarding the tightening torques of the used fittings.

Fixing screws

For fxing screws with metric ISO thread according to DIN thread according to ASME B1.1, we recommend thecking the tightening torque individually according to VDI 2230.

Female threads in axial piston unit

- The maximum permissible tightening torques M6 may are maximum values for the female threads and must not be excedededed.
- For values, see the following table.

Threaded plugs

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

Ports Standard	Thread size	Maximum permissible tightening torque for female threads $M_{G\ max}$	Required tightening torque forthreaded plugs M_V	Size of hexagon socket of threaded plugs
ISO 11926	7/16-20UNF-2B	40 Nm	18 Nm	3/16 in
	9/16-18UNF-2B	80 Nm	35 Nm	1/4 in
	3/4-16UNF-2B	160 Nm	70 Nm	5/16 in
	7/8-14UNF-2B	240 Nm	110 Nm	3/8 in
	1 1/16-12UNF-2B	360 Nm	170 Nm	9/16 in

YEOSHE HYDRAULICS CO.,LTD
No.68 Wukong 1set Rd, Wufong Dist 413,Taichung Taiwan
Tel : +886-4-23332339 Fax :+886-4-23333817
E-mail : yeoshe@ms36.hinet.net Website : www.yeoshe.com.tw

Dongguan branch
Cell phone : +86-10600266957
Tel : +86-769-85962158 Fax : +86-769-81635359
E-mail : CNA523@yeoshe.com.cn Website : www.yeoshe.com.cn

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油聖液壓科技有限公司
YEOSHE HYDRAULICS TECHNOLOGY CO.,LTD.

413 台灣台中市霧峰區霧工一路68號
No.68, Wugong 1st Rd., Wufong Dist., Taichung City, Taiwan, 413
TEL +886-4-23332339 FAX +886-4-23333817 E-mail yeoshe@yeoshe.com.tw

東莞辦事處 Dongguan
CP +86-13600266957 (Miss Zhong) E-mail yeoshe@yeoshe.com.tw

上海辦事處 Shanghai
CP +86-15021931394 (Mr. Wu)
CP +86-18939716986 (Mr. Chen)

經銷商 Distributor

www.yeoshehydraulic.com