Axial piston variable pump
A10VO series 52 and 53

Americas

RE-A 92703
Edition: 12.2016
Replaces: 03.2015

A10VO 63DRS/53...

- Sizes 10 to 100
- Nominal pressure 3600 psi (250 bar)
- Maximum pressure 4550 psi (315 bar)
- Open circuit

Features

- Variable pump with axial piston rotary group in swash-plate design for hydrostatic drives in open circuit.
- The flow is proportional to the drive speed and the displacement.
- The flow can be infinitely varied by adjusting the swash-plate angle.
- Stable bearing for long service life
- High permissible drive speed
- Favorable power-to-weight ratio – compact dimensions
- Low noise
- Excellent suction characteristics
- Electro-hydraulic pressure control
- Power control
- Electro-proportional swivel angle control
- Short response times

Inhalt

Ordering code series 52

01	02	03	04		05	06		07	08	09	10	11	12
A10V(S)	**O**			**/**	**52**		**–**	**V**					

Axial piston unit

						10	28	45	60	85	
01	Swashplate design, variable, nominal pressure 3600 psi (250 bar),					●	–	–	–	–	**A10VS**
	maximum pressure 4550 psi (315 bar)					–	●	●	●	●	**A10V**

Operation mode

02	Pump, open circuit	**O**

Size (NG)

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

Control devices

					10	28	45	60	85	
04	Pressure control	hydraulic			●	●	●	●	●	**DR**
	with flow controller	hydraulic	X-T open		●	●	●	●	●	**DFR**
			X-T plugged	with flushing function	●	●	●	●	●	**DFR1**
				without flushing function	–	●	●	●	●	**DRSC**
	with pressure cut-off	hydraulic	remotely operated		●	●	●	●	●	**DRG**
		electric	negative control	*U* = 12 V	–	●	●	●	●	**ED71**
				U = 24 V	–	●	●	●	●	**ED72**
		electric	positive control	*U* = 12 V	–	●	●	●	●	**ER71**
				U = 24 V	–	●	●	●	●	**ER72**
	Differential pressure control		electric control (negative control)		–	○	○	○	●	**EF..**[1]

Series

05	Series 5, Index 2	**52**

Direction of rotation

06	View on drive shaft	clockwise	**R**
		counter-clockwise	**L**

Sealing material

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

Drive shaft

				10	28	45	60	85	
08	splined shaft	standard shaft		●	●	●	●	●	**S**
	ANSI B92.1a	similar to shaft "S" however for higher input torque		–	●	●	●	●	**R**
		reduced diameter, limited suitability for through drive		●	●	●	●	●	**U**
		similar to shaft "U", however for higher torque		–	●	●	●	●	**W**
	Parallel keyed shaft ISO 3019-1 limited suitability for through drive			●	●	●	●	●	**K**
	Tapered with Woodruff key			–	●	●	●	●	**C**

Mounting flange

				10	28	45	60	85	
09	ISO 3019-1 (SAE)	2-hole		●	●	●	●	●	**C**
		4-hole		–	–	–	●	–	**D**

Note

- Observe the engineering notes regarding each control device

1) See data sheet 92709 for precise specification

01	02	03	04		05	06		07	08	09	10	11	12
A10V(S)	**O**			**/**	**52**		**–**	**V**					

Working port				**10**	**28**	**45**	**60**	**85**	
10	SAE flange port UNC fastening thread	rear	not for through drive	**–**	●	●	●	●	**61**
		at side, opposite	for through drive	**–**	●	●	●	●	**62**
	ISO threaded port	rear	not for through drive	●	**–**	**–**	**–**	**–**	**64**

Through drive (for attachment options, see page 62)

11	Flange ISO 3019-1 Diameter	Hub for splined shaft[2)] Diameter							
	without through drive			●	●	●	●	●	**N00**
	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	14T12/24DP	**–**	**–**	**–**	**–**	●	**K07**
		1 1/2 in	17T 12/24DP	**–**	**–**	**–**	**–**	●	**K24**

Connector for solenoids

12								
	Without connector (without solenoid, with hydraulic control only, without code)	●	●	●	●	●	
	DEUTSCH – molded connector, 2-pin – without suppressor diode (for electric controls)	**–**	●	●	●	●	**P**

● = Available ○ = On request **–** = Not available

Note

- ▶ Note the project planning notes on page 68.
- ▶ In addition to the ordering code, please specify the relevant technical data when placing your order.

2) According to ANSI B92.1a

Ordering code series 53

01	02	03	04		05	06		07	08	09	10	11	12
A10V(S)	**O**			**/**	**53**		**–**	**V**					

Axial piston unit

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

Operation mode

02	Pump, open circuit	**O**

Size (NG)

		18	28	45	63	72	85	100
03	Geometric displacement, see table of values on page 10	**18**	**28**	**45**	**63**	**72**	**85**	**100**

Control devices

04	Pressure control	hydraulic				●	●	●	●	●	●	●	**DR**
			X-T open			●	–	–	●	●	●	●	**DRF**
			X-T plugged	with flushing function		●	–	–	●	●	●	●	**DRS**
				without flushing function		●	●	●	●	●	●	●	**DRSC**
	with pressure cut-off	hydraulic	remotely operated			●	●	●	●	●	●	●	**DRG**
		electric	negative control		*U* = 12 V	●	●	●	●	●	●	●	**ED71**
					U = 24 V	●	●	●	●	●	●	●	**ED72**
		electric	positive control		*U* = 12 V	●	●	●	●	●	●	●	**ER71**
					U = 24 V	●	●	●	●	●	●	●	**ER72**
	Differential pressure control		electric control (negative control)			○	○	○	○	○	●	●	**EF.**[1]
	Power control with pressure cut-off	hydraulic	start of control	from	145 to 510 psi (10 to 35 bar)	●	●	●	●	●	●	●	**LA5D**
					520 to 1015 (36 to 70 bar)	●	●	●	●	●	●	●	**LA6D**
					1030 to 1520 psi (71 to 105 bar)	●	●	●	●	●	●	●	**LA7D**
					1535 to 2030 psi (106 to 140 bar)	●	●	●	●	●	●	●	**LA8D**
					2045 to 3335 psi (141 to 230 bar)	●	●	●	●	●	●	●	**LA9D**
	remotely operated	hydraulic	start of control	see LA.D		●	●	●	●	●	●	●	**LA.DG**
	flow control, X-T plugged	hydraulic	start of control	see LA.D		●	●	●	●	●	●	●	**LA.DS**
		electrically overridable (negative control)	start of control	see LA.D		●	●	●	●	●	●	●	**LA.S**

Note

- Observe the engineering notes regarding each control device

1) See data sheet 92709 for precise specification

01	02	03	04		05	06		07	08	09	10	11	12
A10V(S)	**O**			**/**	**53**		**–**	**V**					

				18	**28**	**45**	**63**	**72**	**85**	**100**	
04	Electro-proportional control	positive control									
	with pressure control		*U* = 12 V	●	●	●	●	●	●	●	**EP1D**
			U = 24 V	●	●	●	●	●	●	●	**EP2D**
	with pressure and flow control (load sensing)	X-T open	*U* = 12 V	●	●	●	●	●	●	●	**EP1DF**
			U = 24 V	●	●	●	●	●	●	●	**EP2DF**
	with pressure and flow control (load sensing)	X-T plugged	*U* = 12 V	●	●	●	●	●	●	●	**EP1DS**
			U = 24 V	●	●	●	●	●	●	●	**EP2DS**
	with electro-hydraulic pressure control		*U* = 12 V	●	●	●	●	●	●	●	**EP1ED**
			U = 24 V	●	●	●	●	●	●	●	**EP2ED**
	Electro-proportional control	positive control									
	with pressure control		*U* = 12 V	●	●	●	●	●	●	●	**EK1D**
			U = 24 V	●	●	●	●	●	●	●	**EK2D**
	Pressure and flow control with controller cut-off (load sensing)	X-T open	*U* = 12 V	●	●	●	●	●	●	●	**EK1DF**
			U = 24 V	●	●	●	●	●	●	●	**EK2DF**
	Pressure and flow control with controller cut-off (load sensing)	X-T plugged	*U* = 12 V	●	●	●	●	●	●	●	**EK1DS**
			U = 24 V	●	●	●	●	●	●	●	**EK2DS**
	Electro-hydraulic pressure control with controller cut-off		*U* = 12 V	●	●	●	●	●	●	●	**EK1ED**
			U = 24 V	●	●	●	●	●	●	●	**EK2ED**

Series

05	Series 5, index 3	**53**

Direction of rotation

06	View on drive shaft	clockwise	**R**
		counter clockwise	**L**

Sealing material

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

Drive shaft

			18	**28**	**45**	**63**	**72**	**85**	**100**	
08	Splined shaft	standard shaft	●	●	●	●	●	●	●	**S**
	ANSI B92.1a	similar to shaft “S” however for higher input torque	●	●	●	●	●	●	–	**R**
		reduced diameter, limited suitability for through drive	●	●	●	●	●	●	●	**U**
		similar to shaft “U”, however for higher torque	–	●	●	●	●	●	●	**W**
	Parallel keyed shaft ISO 3019-1 limited suitability for through drive		●	●	●	●	●	●	●	**K**

Mounting flange

09	ISO 3019-1 (SAE)	2-hole	●	●	●	●	●	●	●	**C**
		4-hole	–	–	–	●	●	●	●	**D**

Note

- Note the project planning notes on page 68.
- In addition to the ordering code, please specify the relevant technical data when placing your order.

01	02	03	04		05	06		07	08	09	10	11	12
A10V(S)	**O**			**/**	**53**		**–**	**V**					

Working port

				18	28	45	63	72	85	100	
10	SAE flange port UNC fastening thread	rear	not for through drive	●	●	●	●	●	●	●	**61**
		at side, opposite	for through drive	●	●	●	●	●	●	●	**62**

Through drive (for attachment options, see page 62)

				18	28	45	63	72	85	100	
11	Flange ISO 3019-1 Diameter	Hub for splined shaft[2)] Diameter									
	without through drive			●	●	●	●	●	●	●	**N00**
	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	14T12/24DP	–	–	–	–	–	●	●	**K07**
		1 1/2 in	17T 12/24DP	–		–	–	–	●	●	**K24**

Connector for solenoids

12	Without connector (without solenoid, with hydraulic control only, without code)	●	●	●	●	●	●	●	
	DEUTSCH – molded connector, 2-pin – without suppressor diode (for electric controls)	●	●	●	●	●	●	●	**P**

● = Available ○ = On request – = Not available

Note

- ▶ Note the project planning notes on page 68.
- ▶ In addition to the ordering code, please specify the relevant technical data when placing your order.

2) According to ANSI B92.1a

Hydraulic fluids

The A10VO variable pump is designed for operation with HLP mineral oil according to DIN 51524.
Application instructions and requirements for hydraulic fluids should be taken from the following data sheets before the start of project planning:

- 90220: Hydraulic fluids based on mineral oils and related hydrocarbons
- 90221: Environmentally acceptable hydraulic fluids

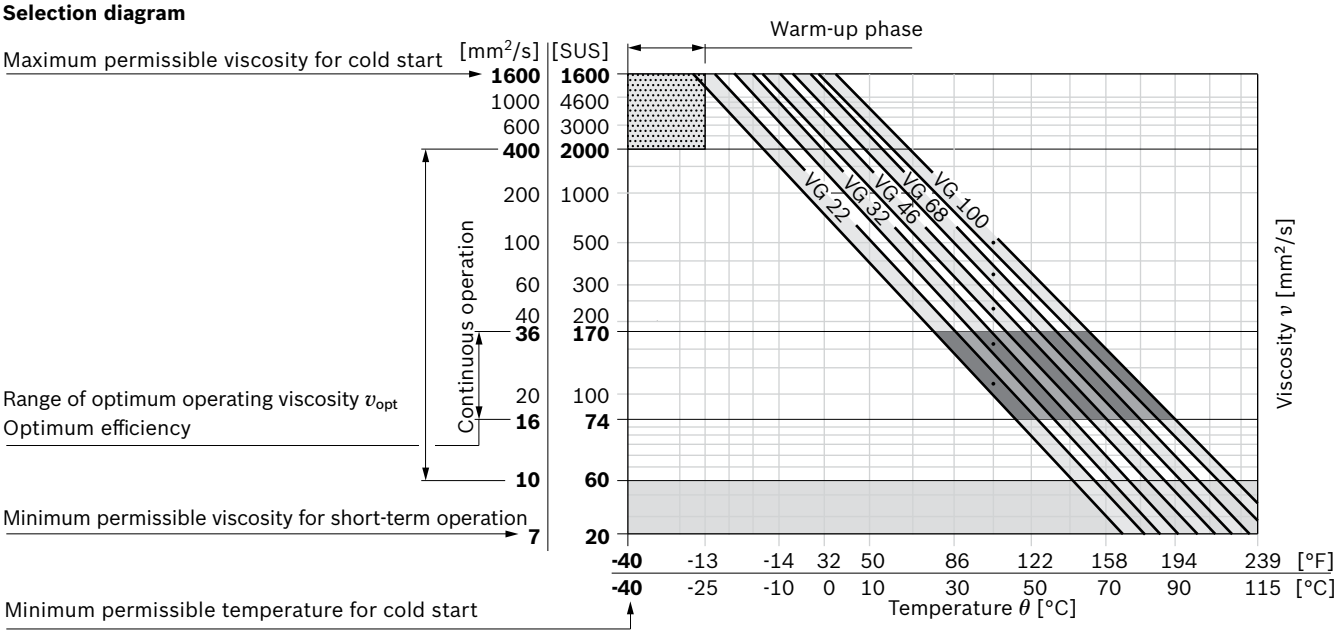
Notes on selection of hydraulic fluid
The hydraulic fluid should be selected such that the operating viscosity in the operating temperature range is within the optimum range (v_{opt} see selection diagram).

Note
At no point of the component may the temperature be higher than 239 °F (115 °C). The temperature difference specified in the table is to be taken into account when determining the viscosity in the bearing.
If the above conditions cannot be maintained due to extreme operating parameters, please contact the responsible member of staff at Bosch Rexroth.

Viscosity and temperature of hydraulic fluids

	Viscosity	Temperature	Comment
Cold start	v_{max} ≤ 7500 SUS (1600 mm²/s)	θ_{St} ≥ -40 °F (-40 °C)	t ≤ 1 min, without load (p ≤ 435 psi (30 bar)), n ≤ 1000 rpm
Permissible temperature difference		ΔT ≤ 45 °F (25 K)	between axial piston unit and hydraulic fluid
Warm-up phase	v < 7500 to 1850 SUS (1600 to 400 mm²/s)	θ = -40 °F to -13 °F (-40 °C to -25 °C)	Note the detailed information on operation with low temperatures, see data sheet 90300-03-B.
Continuous operation	v = 1850 to 60 SUS (400 to 10 mm²/s)		This corresponds, for example on the VG 46, to a temperature range of 41 °F (+5 °C) to 185 °F (+85 °C) (see selection diagram page 5)
		θ = -13 °F to +230 °F (-25 °C to +110 °C)	measured at port **L** Note the permissible temperature range of the shaft seal (ΔT = approx. 9 °F (5 K) between the bearing/shaft seal and port **L**)
	v_{opt} = 170 to 80 SUS (36 to 16 mm²/s)		Range of optimum operating viscosity and efficiency
Short-term operation	v_{min} ≥ 49 SUS (7 mm²/s)		t < 1 min, p < 0.3 • p_{nom}

▼ **Selection diagram**



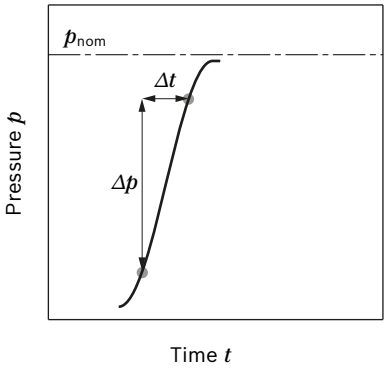
Filtration of the hydraulic fluid

Finer filtration improves the cleanliness level of the hydraulic fluid, which increases the service life of the axial piston unit.
A cleanliness level of at least 20/18/15 is to be maintained according to ISO 4406.
At very high hydraulic fluid temperatures (194 °F (90 °C) to maximum 239 °F (115 °C)), cleanliness level 19/17/14 according to at least ISO 4406 is necessary.
Please contact us if the above classes cannot be observed.

Operating pressure range

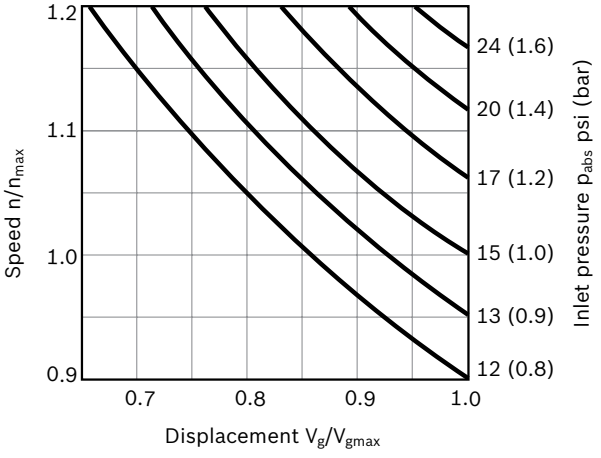
Pressure at working port B		**Definition**
Nominal pressure p_{nom}	3600 psi (250 bar) absolute	The nominal pressure corresponds to the maximum design pressure.
Maximum pressure p_{max}	4550 psi (315 bar) absolute	The maximum pressure corresponds the maximum operating pressure within the single operating period. The sum of the single operating periods must not exceed the total operating period.
Single operating period	2.5 ms	
Total operating period	300 h	
Minimum pressure $p_{B\,abs}$ (high pressure side)	145 psi (10 bar) absolute	Minimum pressure on the high-pressure side (**B**) which is required in order to prevent damage to the axial piston unit.
Rate of pressure change $R_{A\,max}$	232000 psi/s (16000 bar/s)	Maximum permissible rate of pressure build-up and pressure reduction during a pressure change over the entire pressure range.
Pressure at suction port S (Inlet)		
Minimum pressure $p_{S\,min}$ Standard	12 psi (0.8 bar) absolute	Minimum pressure at suction port **S** (inlet) that is required in order to avoid damage to the axial piston unit. The minimum pressure depends on the speed and displacement of the axial piston unit.
Maximum pressure $p_{S\,max}$	75 psi (5 bar) absolute	
Case drain pressure at port L_1, L_2		
Maximum pressure $p_{L\,max}$	30 psi (2 bar) absolute	Maximum 7.5 psi (0.5 bar) higher than inlet pressure at port **S**, but not higher than $p_{L\,max}$. A case drain line to the reservoir is required.

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

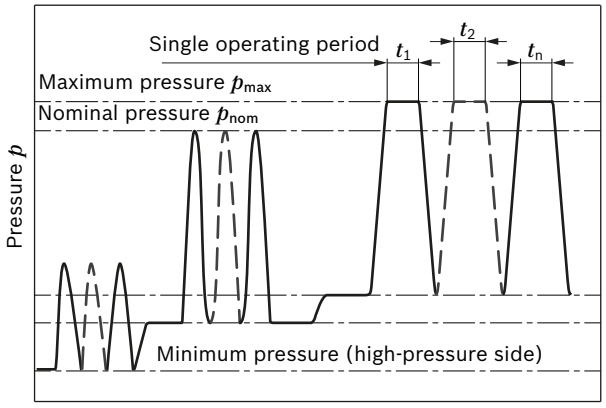


▼ **Maximum permissible speed (limit speed)**

Permissible speed by increasing inlet pressure p_{abs} at suction opening **S** or at $V_g \leq V_{gmax}$



▼ **Pressure definition**



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

Note

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

Technical data

Size		NG		10[1]	18[2]	28	45	60[1]	63[2]	72[2]	85	100[2]
Displacement, geometric, per revolution		$V_{g\,max}$	in³ (cm³)	0.64 (10.5)	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[3]	at $V_{g\,max}$	n_{nom}	rpm	3600	3300	3000	2600[4]	2700	2600	2600	2500	2300
	at $V_g < V_{g\,max}$	$n_{max\,perm}$	rpm	4320	3960	3600	3120	3140	3140	3140	3000	2500
Flow	at n_{nom} and $V_{g\,max}$	q_v	gpm (l/min)	9.7 (37)	15.6 (59)	22 (84)	31 (117)	42 (162)	43 (163)	49.4 (187)	55 (212)	60 (230)
	at n_E = 1500 rpm	q_{vE}	gpm (l/min)	4 (15)	7.1 (27)	1.1 (42)	18 (68)	24 (90)	25.1 (95)	28.5 (108)	34 (128)	39 (150)
Power	at n_{nom}, $V_{g\,max}$ and Δp =3600 psi (250 bar)	P	HP (kW)	22 (16)	34 (25)	47 (35)	65 (49)	88 (65)	90 (68)	103 (77)	119 (89)	130 (96)
	at n_E = 1500 rpm	P_E	HP (kW)	9.4 (7)	15 (11)	24 (18)	38 (28)	50 (37)	52 (39)	60 (45)	71 (53)	84 (62)
Torque	at $V_{g\,max}$ and Δp = 3600 psi (250 bar)	T	lb-ft (Nm)	31 (42)	52 (71)	82 (111)	132 (179)	175 (238)	184 (250)	211 (286)	247 (338)	293 (398)
	at $V_{g\,max}$ and Δp = 1440 psi (100 bar)	T	lb-ft (Nm)	13 (17)	21 (29)	33 (45)	53 (72)	70 (95)	74 (100)	84 (114)	102 (135)	117 (159)
Rotary stiffness of drive shaft	S	c	lb-ft/rad (Nm/rad)	6760 (9200)	8082 (11000)	16400 (22300)	27560 (37500)	48100 (65500)	48100 (65500)	48100 (65500)	105100 (143000)	105100 (143000)
	R	c	lb-ft/rad (Nm/rad)	– (–)	10870 (14800)	19400 (26300)	30240 (41000)	51200 (69400)	51200 (69400)	51200 (69400)	112773 (152900)	– (–)
	U	c	lb-ft/rad (Nm/rad)	5020 (6800)	5870 (8000)	12317 (16700)	22130 (30000)	36290 (49200)	36290 (49200)	36290 (49200)	75900 (102900)	75900 (102900)
	W	c	lb-ft/rad (Nm/rad)	– (–)	– (–)	14678 (19900)	25370 (34400)	39830 (54000)	39830 (54000)	39830 (54000)	86960 (117900)	86960 (117900)
	K	c	lb-ft/rad (Nm/rad)	7965 (10800)	9810 (13300)	19770 (26800)	32380 (43900)	54506 (73900)	54506 (73900)	54506 (73900)	120518 (163400)	120518 (163400)
	C	c	lb-ft/rad (Nm/rad)	– (–)	– (–)	[6]	[6]	[6]	– (–)	– (–)	[6]	– (–)
Moment of inertia for rotary group		J_{TW}	lbs-ft² (kgm²)	0.0142 (0.0006)	0.2207 (0.0009)	0.0403 (0.0017)	0.0783 (0.003)	0.1329 (0.0056)	0.1329 (0.0056)	0.1329 (0.0056)	0.2848 (0.012)	0.2848 (0.012)
Maximum angular acceleration[5]		α	rad/s²	8000	6800	5500	4000	3300	3300	3300	2700	2700
Case volume		V	gal (L)	0.05 (0.2)	0.06 (0.25)	0.08 (0.3)	0.13 (0.5)	0.21 (0.8)	0.21 (0.8)	0.21 (0.8)	0.26 (1)	0.26 (1)
Weight **without** through drive (approx.)		m	lbs (kg)	17 (8)	25 (11.5)	33 (15)	40 (18)	48.5 (22)	48.5 (22)	48.5 (22)	79 (36)	79 (36)
Weight **with** through drive (approx.)			lbs (kg)	– (–)	28.6 (13)	40 (18)	53 (24)	62 (28)	62 (28)	62 (28)	99 (45)	99 (45)

1) Only series 52
2) Only series 53
3) The values are applicable:
   – At absolute pressure p_{abs} = 15 psi (1 bar) at suction port **S**
   – For the optimal viscosity range of v_{opt} = 170 to 80 SUS (36 to 16 mm²/s)
   – For hydraulic fluid based on mineral oils
4) Please contact us regarding higher speeds
5) The scope of application lies between the minimum necessary and the maximum permissible drive speeds. It applies for external stimuli (e. g. engine 2 to 8 times rotary frequency, cardan shaft twice the rotary frequency). The limiting value is only valid for a single pump. The loading capacity of the connecting parts must be taken into account.
6) On request

Determining the operating characteristics					
Flow	q_v	= $\frac{V_g \times n \times \eta_v}{231\ (1000)}$			[gpm (l/min)]
Torque	T	= $\frac{V_g \times \Delta p}{24\ (20) \times \pi \times \eta_{mh}}$			[lb-ft (Nm)]
Power	P	= $\frac{2\ \pi \times T \times n}{33000\ (60000)}$	=	$\frac{q_v \times \Delta p}{1714\ (600) \times \eta_t}$	[HP (kW)]

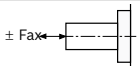
Key

V_g	=	Displacement per revolution [in^3 (cm^3)]
Δp	=	Differential pressure [psi (bar)]
n	=	Rotational speed [rpm]
η_v	=	Volumetric efficiency
η_{mh}	=	Mechanical-hydraulic efficiency
η_t	=	Total efficiency ($\eta_t = \eta_v \times \eta_{mh}$)

Note

- Theoretical values, without efficiency and tolerances; values rounded.
- Operation above the maximum values or below the minimum values may result in a loss of function, a reduced service life or in the destruction of the axial piston unit. Bosch Rexroth recommend testing the loads by means of experiment or calculation / simulation and comparison with the permissible values.

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		± $F_{q\ max}$	lbf (N)	56 (250)	78 (350)	270 (1200)	337 (1500)	382 (1700)	337 (1500)	450 (2000)	450 (2000)
Axial force maximum		+ $F_{ax\ max}$	lbf (N)	90 (400)	157 (700)	225 (1000)	337 (1500)	450 (2000)	337 (1500)	675 (3000)	675 (3000)

Note

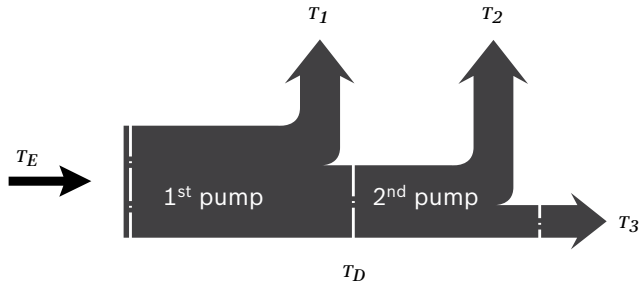
- The values given are maximum values and do not apply to continuous operation. For drives with radial loading (pinion, V-belt drives), please contact us!

Permissible input and through-drive torques

Size				10	18	28	45	60/63	72	85	100
Torque at $V_{g\,max}$ and Δp = 3600 psi (250 bar)[1]		T_{max}	lbft (Nm)	31 (42)	52 (71)	82 (111)	132 (179)	184 (250)	211 (286)	247 (338)	293 (398)
Input torque at drive shaft, maximum[2]											
	S	$T_{E\,max}$	lb-ft (Nm)	93 (126)	91 (124)	146 (198)	235 (319)	464 (630)	464 (630)	853 (1157)	814 (1104)
		DIA	in	3/4	3/4	7/8	1	1 1/4	1 1/4	1 1/2	1 1/2
	R	$T_{E\,max}$	lb-ft (Nm)	– (–)	118 (160)	184 (250)	295 (400)	479 (650)	479 (650)	895 (1215)	–
		DIA	in	–	3/4	7/8	1	1 1/4	1 1/4	1 1/2	–
	U	$T_{E\,max}$	lb-ft (Nm)	44 (60)	43 (59)	77 (105)	139 (188)	226 (306)	226 (306)	463 (628)	438 (595)
		DIA	in	5/8	5/8	3/4	7/8	1	1	1 1/4	1 1/4
	W	$T_{E\,max}$	lb-ft (Nm)	– (–)	– (–)	103 (140)	162 (220)	292 (396)	282 (383)	479 (650)	469 (636)
		DIA	in	–	–	3/4	7/8	1	1	1 1/4	1 1/4
	K	$T_{E\,max}$	lb-ft (Nm)	78 (106)	76 (104)	107 (145)	156 (212)	325 (441)	325 (441)	553 (750)	553 (750)
		DIA	in	3/4	3/4	7/8	1.000	1 1/4	1 1/4	1 1/2	1 1/2
	C	$T_{E\,max}$	lb-ft (Nm)	– (–)	– (–)	107 (145)	156 (212)	325 (441)	– (–)	553 (750)	– (–)
Maximum through-drive torque											
	S	$T_{D\,max}$	lb-ft (Nm)	– (–)	80 (108)	118 (160)	235 (319)	357 (484)	357 (484)	515 (698)	573 (778)
	R	$T_{D\,max}$	lb-ft (Nm)	– (–)	89 (120)	130 (176)	270 (365)	357 (484)	357 (484)	515 (698)	– (–)
	U	$T_{D\,max}$	lb-ft (Nm)	– (–)	43 (59)	77 (105)	139 (188)	226 (306)	226 (306)	463 (628)	438 (595)
	W	$T_{D\,max}$	lb-ft (Nm)	– (–)	– (–)	103 (140)	162 (220)	292 (396)	282 (383)	479 (650)	469 (636)
	K	$T_{D\,max}$	lb-ft (Nm)	– (–)	76 (104)	107 (145)	156 (212)	325 (441)	325 (441)	– (–)	553 (750)

1) Without considering efficiency
2) For drive shafts with no radial force
3) only size 60

▼ **Distribution of torques**



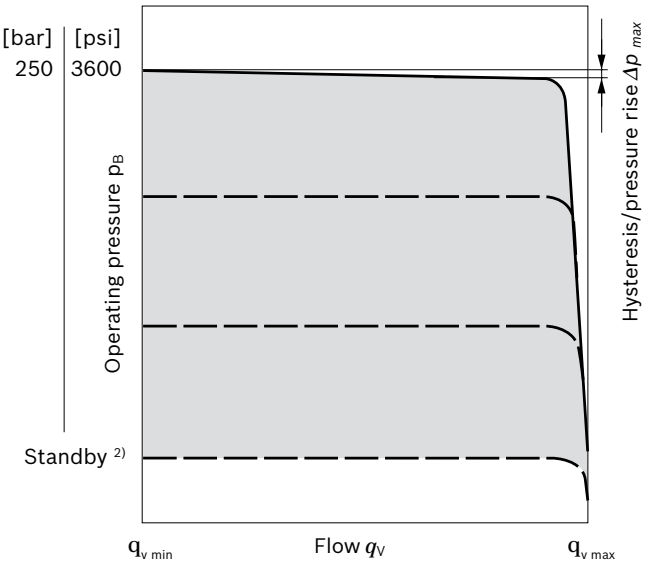
Torque at 1st pump	T_1		
Torque at 2nd pump	T_2		
Torque at 3rd pump	T_3		
Input torque	T_E	=	$T_1 + T_2 + T_3$
	T_E	<	$T_{E\,max}$
Through-drive torque	T_D	=	$T_2 + T_3$
	T_D	<	$T_{D\,max}$

DR – Pressure control

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

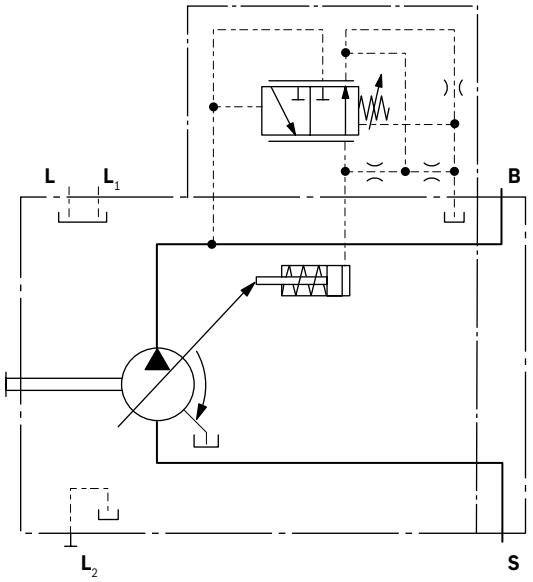
- Basic position in depressurized state: $V_{g\,max}$.
- Setting range[1)] for pressure control 510 to 3600 psi (35 to 250 bar). Standard is 3600 psi (250 bar).

▼ **Characteristic curve DR**



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

▼ **Circuit diagram DR**



Controller data

NG		10	18	28	45	60 63	72	85	100
Pressure increase	Δp [psi] [bar]	87 (6)	87 (6)	87 (6)	87 (6)	115 (8)	115 (8)	175 (12)	200 (14)
Hysteresis and re-peatability	Δp [psi (bar)]	maximum 45 (3)							
Control fluid con-sumption	gpm (l/min)	maximum approx. 0.8 (3)							

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

DRG – Pressure control, remotely operated

For the remote-controlled pressure control, the LS pressure limitation is performed using a separately arranged pressure relief valve. Therefore any pressure control value under the pressure set on the pressure controller can be regulated. Pressure controller DR see page 14.

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

When there is differential pressure Δp at the control valve and with the standard setting on the remote-controlled pressure cut-off of 290 psi (20 bar), the amount of control fluid at the connection is **X** approx. 0.4 gpm (1.5 l/min). If a different setting (range from 145 to 320 psi (10 to 22 bar)) is required, please state in plain text.

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

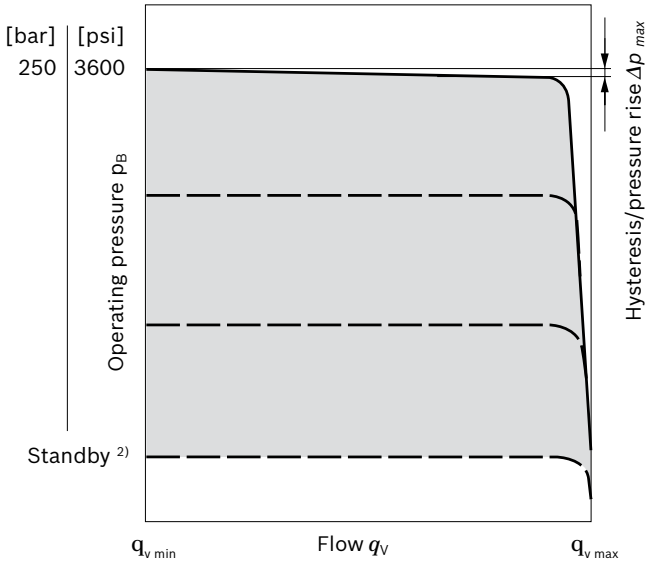
- a directly controlled, hydraulic or electric proportional one, suitable for the control fluid mentioned above.

The max. length of piping should not exceed 6.6 ft (2 m).

- Basic position in depressurized state: $V_{g\,max}$.
- Setting range[1)] for pressure control 501 to 3600 psi(35 to 250 bar) (**3**).
  Standard is 3600 psi (250 bar).
- Setting range for differential pressure 145 to 320 psi (10 to 22 bar) (**2**)
  Standard is 290 psi (20 bar).

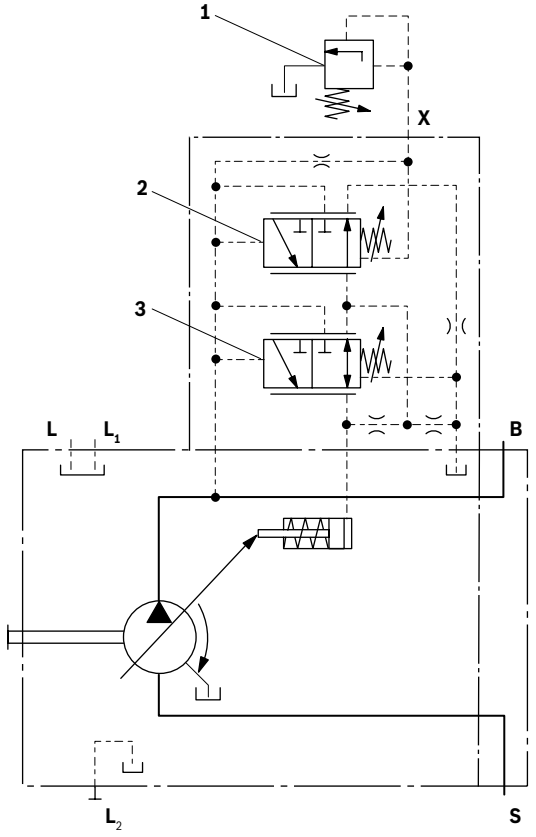
Unloading port **X** to the reservoir results in a zero stroke (standby) pressure which is approx. 15 to 30 psi (1 to 2 bar) higher than the defined differential pressure Δp, however system influences are not taken into account.

▼ **Characteristic curve DRG**



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

▼ **Circuit diagram DRG**



1 The separate pressure relief valve and the line are not included in the scope of delivery.

2 Remote-controlled pressure cut-off (**G**).

3 Pressure controller (**DR**)

Controller data

NG		10	18	28	45	60 63	72	85	100
Pressure increase	Δp [psi] [bar]	87 (6)	87 (6)	87 (6)	87 (6)	115 (8)	115 (8)	175 (12)	200 (14)
Hysteresis and repeatability	Δp [psi (bar)]	maximum 45 (3)							
Control fluid consumption	gpm (l/min)	maximum approx. 1.2 (4.5)							

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

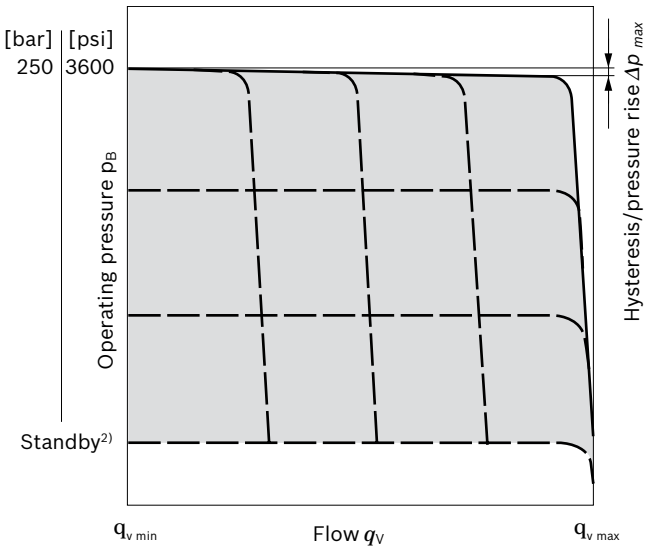
2) Zero stroke from pressure setting Δp on controller (**2**)

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

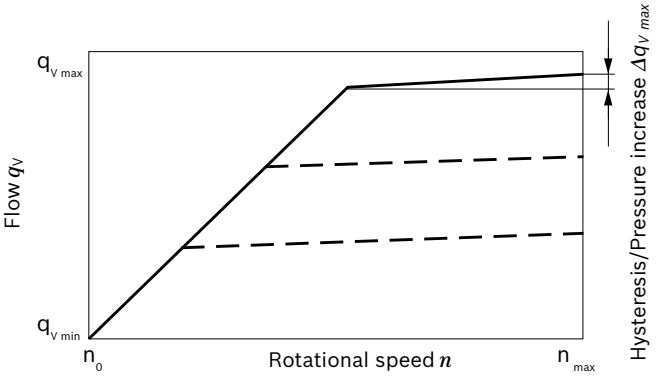
In addition to the pressure controller function (see page 14), a variable orifice (e.g. directional valve) is used to adjust the differential pressure upstream and downstream of the orifice. This is used to control the pump flow. The pump flow is equal to the actual hydraulic fluid quantity required by the consumer. With all controller combinations, the V_g reduction has priority.

- Basic position in depressurized state: $V_{g\,max}$.
- Setting range[1] to 3600 psi (250 bar).
- DR pressure controller data see page 14

▼ **Characteristic curve DRF (DFR) / DRS (DFR1) / DRSC**



▼ **Characteristic curve at variable speed**



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

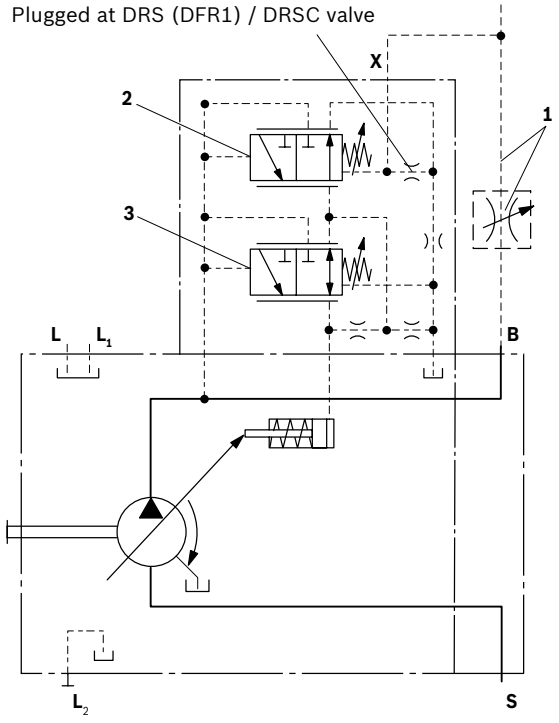
1) In order to prevent damage to the pump and the system, the permissible setting range must not be exceeded. The range of possible settings at the valve is higher.

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

Possible connections at port **B**
(not included in the delivery contents)

LS mobile control blocks	Data sheets
M4-12	64276
M4-15	64283
LUDV mobile control blocks	
M6-15	64284
M7-22	64295

▼ **Circuit diagram DRF (DFR)**



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

Note
The DRS and (DFR1) and DRSC valve versions have no pilot line 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 flow control in DRS (DFR1) control valve **X**-line must also be provided.
If this pilot line of the **X** line does not have to be guaranteed, the DRSC control valve must be used.

For further information see page 17

Differential pressure Δp:

- Standard setting: 200 psi (14 bar)
  If another setting is required, please state in clear text.
- Adjustment range: 200 to 320 psi (14 to 22 bar)

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

Controller data

- DR pressure controller data see page 14.
- Maximum flow deviation measured at drive speed n = 1500 rpm.

NG		**10**	**18**	**28**	**45**	**60 63**	**72**	**85**	**100**
Flow deviation	Δq_{vmax} [gpm (l/min)]	0.13 (0.5)	0.24 (0.9)	0.26 (1.0)	0.48 (1.8)	0.66 (2.5)	0.66 (2.5)	0.83 (3.1)	0.83 (3.1)
Hysteresis and repeatability	Δp [psi (bar)]	maximum 45 (3)							
Control fluid consumption	gpm (gpm (l/min))	maximum approx. 0.8 to 1.2 (3 to 4.5) (DRF (DFR)) maximum approx. 0.8 (3) (DRS (DFR1) / DRSC)							

LA... – Pressure, flow and power controller

Pressure control equipped as DR(G), see page 14 (15). Equipment of the flow control like DRS (DFR1), see page 16.

In order to achieve a constant drive torque with varying operating pressures, the swivel angle and with it the volume flow from the axial piston pump is varied so that the product of flow and pressure remains constant. Flow controller 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

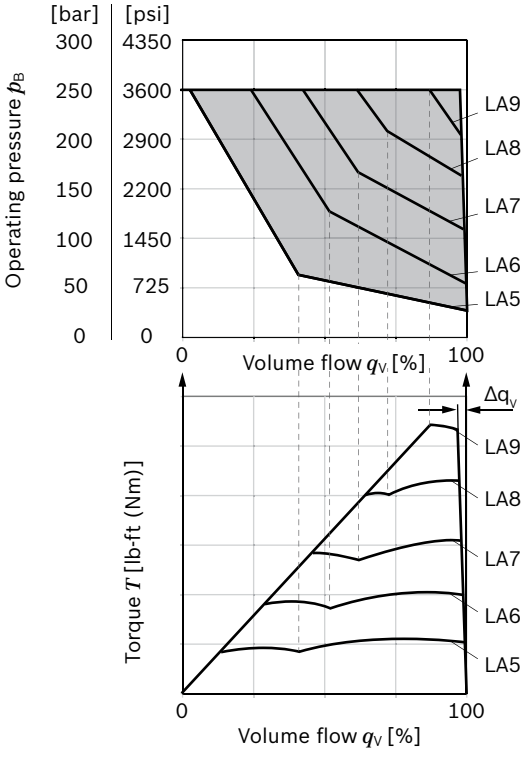
- Pressure controller DR see page 14.
- Pressure and flow controller DR see page 16.
- See data sheet 92709 for electric override LA.S
- Control fluid consumption max. approx. 1.45 gpm (5.5 l/min)

Start of control	Torque T [lb-ft (Nm)] for nominal size							Order 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)	18 – 49.5 (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)	49.5 – 97.1 (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)	97.1 – 139.4 (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)	139.4 – 183.6 (189.1 – 249)	**LA8**
2045 to 3335 (141 – 230)	33.2 – 55.2 (45.1 – 74.8)	51.7 – 86.3 (70.1 – 117)	83 – 139 (112.1 – 189)	116 – 195 (157.1 – 264)	132.4 – 222.5 (179.5 – 301.7)	156 – 263 (212.1 – 357)	183.3 – 309 (249.1 – 419)	**LA9**

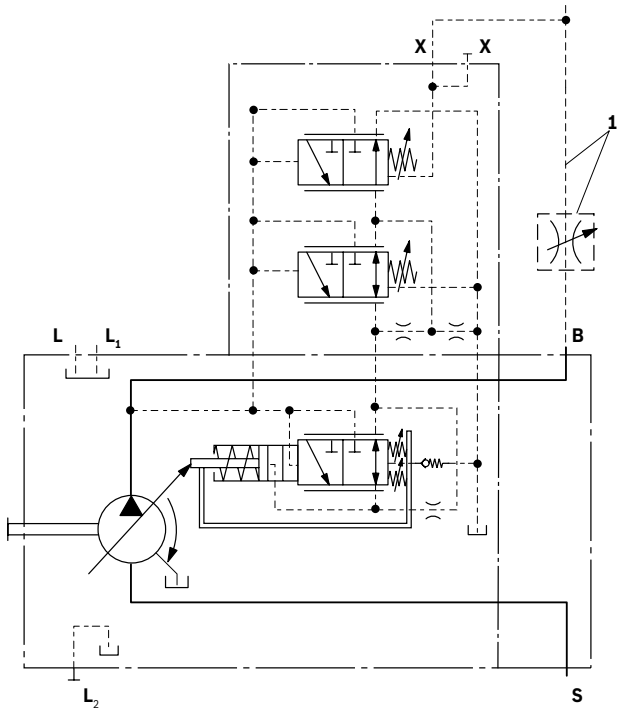
Conversion of the torque values in power [HP kW]

$P = \frac{T}{3.5\ (6.4)}$ [HP (kW)] (at 1500 rpm) or $P = \frac{2 \times T \times n}{33000\ (60000)}$ [HP (kW)] (rotational speeds, see table on page 10)

▼ **Characteristic curve LA.DS**



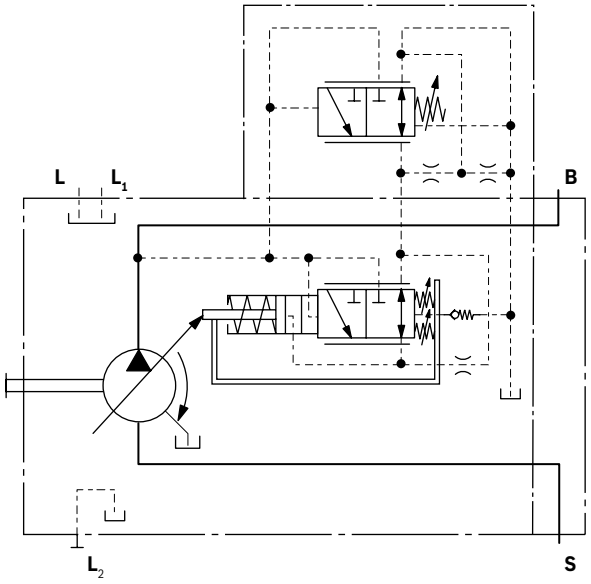
▼ **Circuit diagram LA.DS**
(for further combination options with LA.. see page 19)



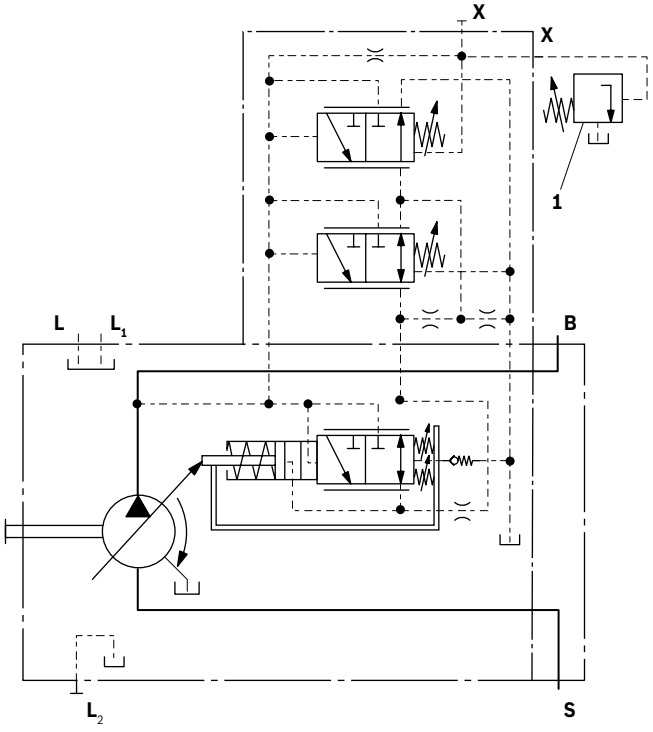
1 The metering orifice (control block) and the line is not included in the delivery contents.

LA... – Variations

▼ **Circuit diagram LA.D** with pressure cut-off

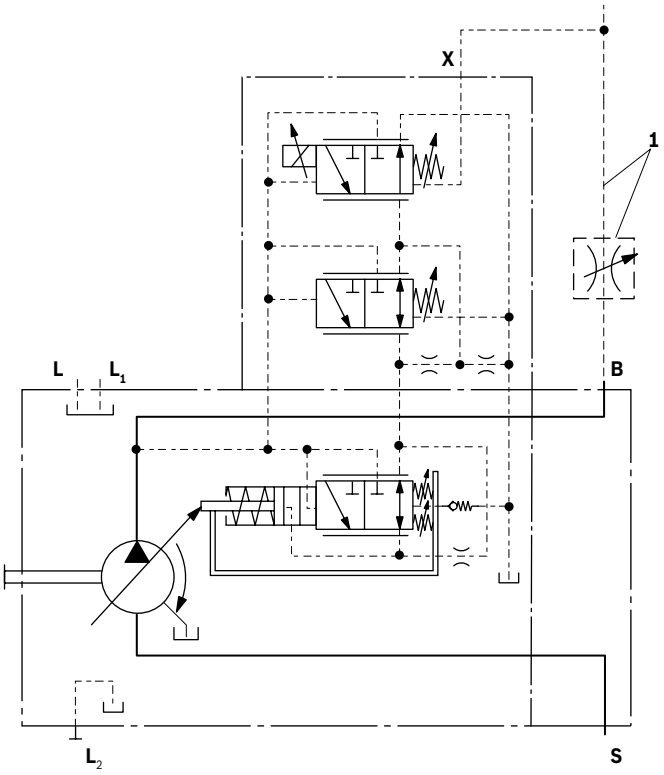


▼ **Circuit diagram LA.DG** with pressure cut-off, remotely operated



1 The pressure relief valve and the line are not included in the scope of delivery.

▼ **Circuit diagram LA.S** with separate flow control



1 The sensing orifice (control block) and the line is not included in the delivery contents.

Controller data

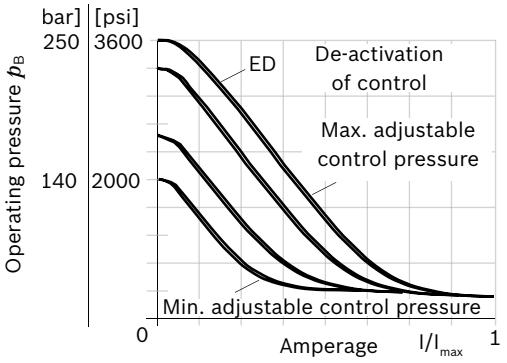
▶ See data sheet 92709 for electric override LA.S

ED – Electro-hydraulic pressure control

The ED valve is set to a certain pressure by a specified variable solenoid current.
Changing the consumer (load pressure) causes an increase or decrease in the pump swivel angle (flow) in order to maintain the electrically set pressure level.
Thus the pump only delivers as much hydraulic fluid as the consumers can take. The desired pressure level can be set steplessly by varying the solenoid current.
As the solenoid current signal drops towards zero, the pressure will be limited to p_{max} by an adjustable hydraulic pressure cut-off (secure fail safe function in case of a loss of power, e.g. for fan drives). The response time characteristic curve of the ED-control was optimized for the use as a fan drive system. When ordering, specify the type of application in clear text.

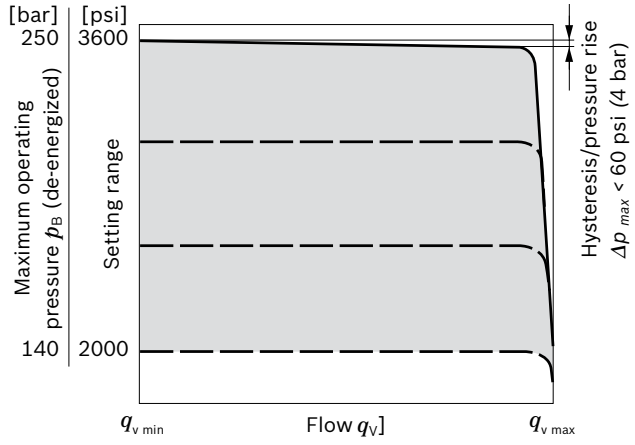
▼ **Static current-pressure characteristic curve ED**

(negative characteristic curve measured with pump in zero stroke)



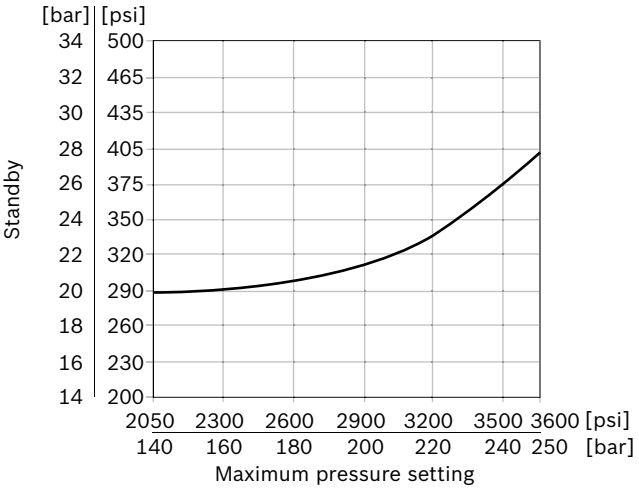
▶ Hysteresis static < 45 psi (3 bar).

▼ **Flow-pressure characteristic curve**

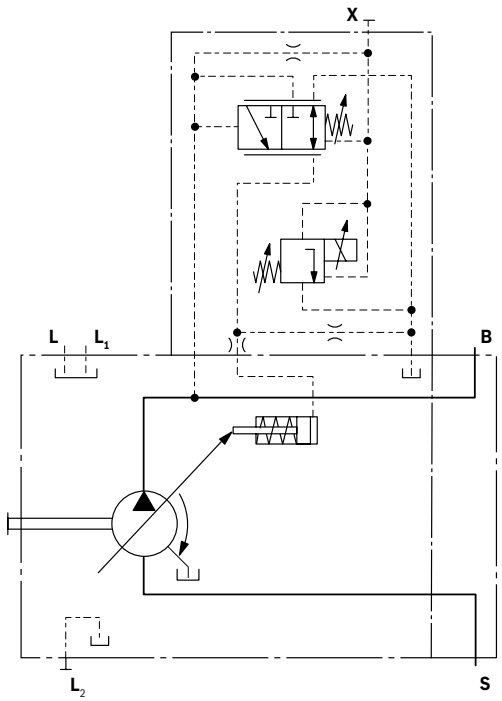


▶ Characteristic curves valid for n_1 = 1500 rpm and t_{fluid} = 120 °F (50 °C).
▶ Control fluid consumption: 0.8 to 1.2 gpm (3 to 4.5 l/min).
▶ For standby standard setting, see the following diagram, other values on request.

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



▼ **Circuit diagram ED71/ED72**

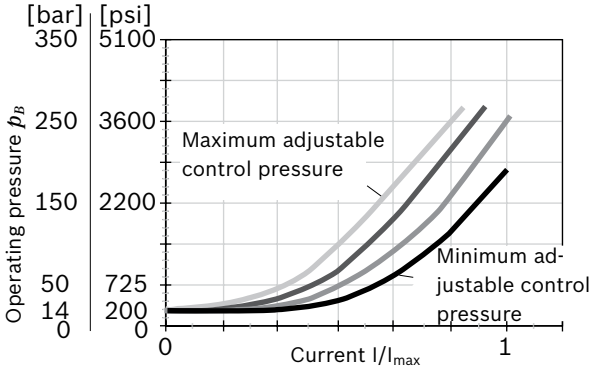


Technical data, solenoid	ED71	ED72
Voltage	12 V (±20%)	24 V (±20%)
Control current		
Start of control at p_{max}	100 mA	50 mA
End of control at p_{min}	1200 mA	600 mA
Limiting current	1.54 A	0.77 A
Nominal resistance (at 68 °F (20 °C))	5.5 Ω	22.7 Ω
Dither frequency	100 to 200 Hz	100 to 200 Hz
Duty cycle	100%	100%
Type of protection: see connector version page 67		
Operating temperature range at valve -4 °F to 239 °F (-20 °C to +115 °C)		

ER – Electro-hydraulic pressure control

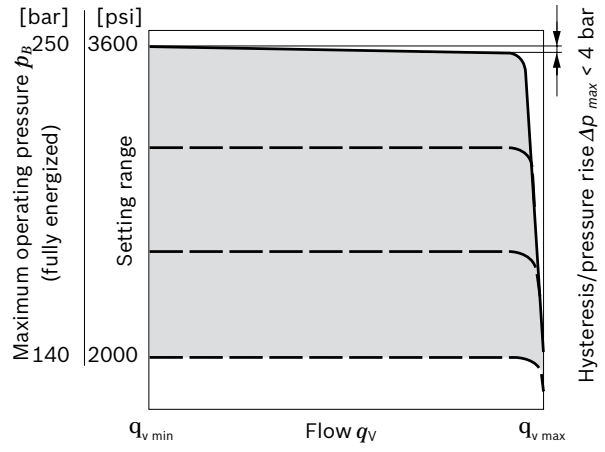
The ER valve is set to a certain pressure by a specified variable solenoid current.
Changing the consumer (load pressure) causes an increase or decrease in the pump swivel angle (flow) in order to maintain the electrically set pressure level.
Thus the pump only delivers as much hydraulic fluid as the consumers can take. The desired pressure level can be set steplessly by varying the solenoid current.
As the solenoid current signal drops towards zero, the pressure will be limited to $p$min (stand by).
Observe project planning notes.

▼ **Static current-pressure characteristic curve ER**
(positive characteristic curve measured with pump in zero stroke)



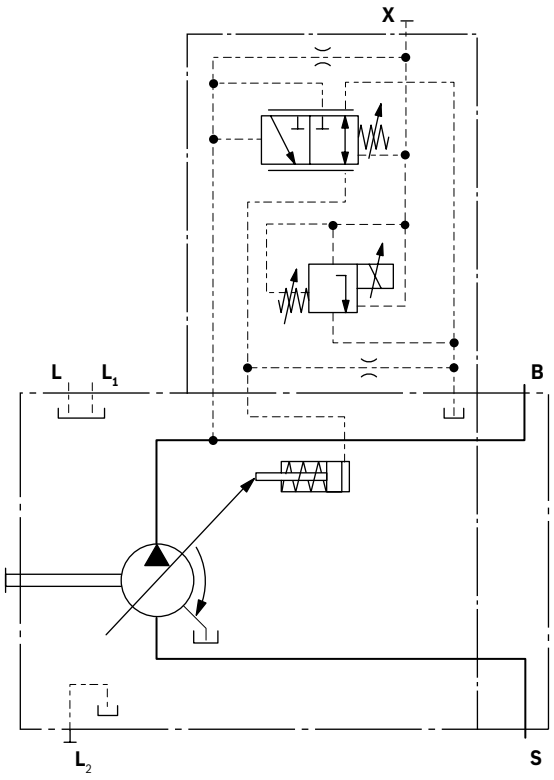
▶ Hysteresis static current-pressure characteristic curve < 3 bar.

▼ **Flow-pressure characteristic curve**



▶ Characteristic curves valid for n_1 = 1500 rpm and t_{fluid} = 120 °F (50 °C).
▶ Control fluid consumption: 0.8 to 1.2 gpm (3 to 4.5 l/min).
▶ Standby standard 200 psi (14 bar). Other values on request.
▶ Influence of pressure setting on stand-by ±30 psi (±2 bar).

▼ **Circuit diagram ER71/ER72**



Technical data, solenoid	ER71	ER72
Voltage	12 V (±20%)	24 V (±20%)
Control current		
Start of control at p_{min}	100 mA	50 mA
End of control at p_{max}	1200 mA	600 mA
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
Duty cycle	100%	100%
Type of protection: see connector version page 67		
Operating temperature range at valve -4 °F to 239 °F (-20 °C to +115 °C)		

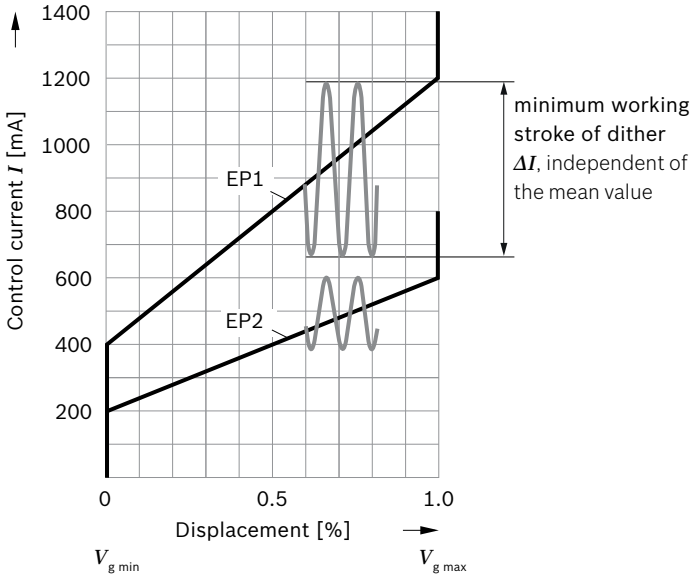
Project planning note!
Excessive current levels (I > 1200 mA at 12 V or I > 600 mA at 24 V) to the ER solenoid can result in undesired pressure increases which can lead to pump or system damage.
Therefore:
▶ Use I_{max} current limiter solenoids.
▶ A sandwich plate pressure reducing valve can be used to protect the pump in the event of overflow.
An accessory kit with intermediate plate pressure controller can be ordered from Bosch Rexroth under part number R902490825.

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 a limit value of approx. 60 psi (4 bar), the pump starts to swivel from $V_{g\,max}$ to $V_{g\,min}$ without control by the solenoid (control current < start of control). With a minimum swivel angle $V_{g\,min}$ and de-energized EP solenoids, a minimum pressure of 145 psi (10 bar) must be maintained, or alternatively a minimum amount of 5 % of the displacement.
A PWM signal is used to control the solenoid.

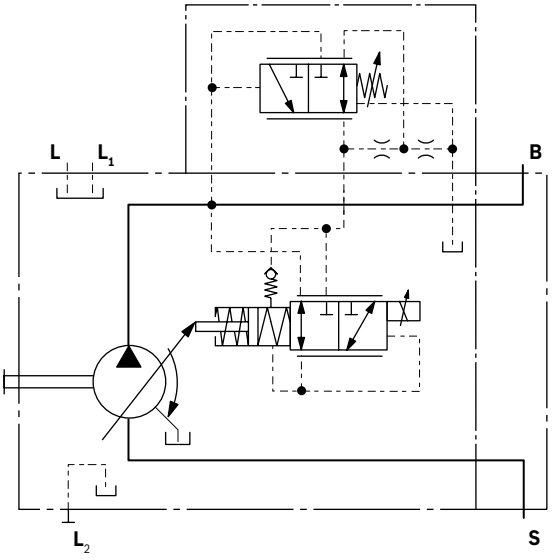
EP.D: The pressure control regulates the pump displacement back to $V_{g\,min}$ after the set target pressure has been reached. A minimum operating pressure of 200 psi (14 bar) is needed for safe and reproducible control. The necessary control fluid is taken from the high pressure.

▼ **Characteristic curve EP1/2**



▶ Hysteresis static current-displacement characteristic curve < 5%.

▼ **Circuit diagram EP.D**



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
Minimum working stroke of the dither within the control range[1)]	352 mA	176 mA
Dither frequency	100 to 200 Hz	100 to 200 Hz
Limiting current	1.54 A	0.77 A
Nominal resistance (at 68 °F (20 °C))	5.5 Ω	22.7 Ω
Duty cycle	100%	100%
Type of protection: see connector version page 67		
Operating temperature range at valve -4 °F to 239 °F (-20 °C to +115 °C)		

Note
We recommend the valve with flushing function for the EP.D control variant. Please contact us.

1) ΔI = 44% of the current difference within the control range, regardless of the mean value of the current

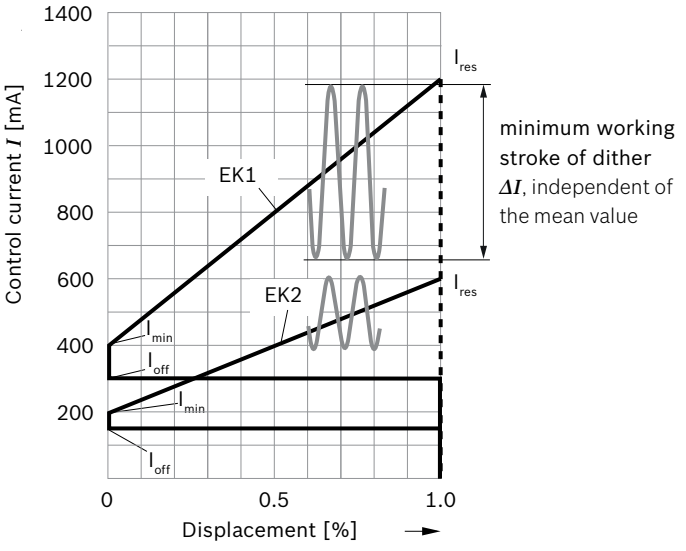
EK – Electro-proportional control with controller cut-off

Variant EK... is based completely on the variant EP... (see page 22).
In addition to the electro-proportional control function, a controller cut-off is integrated in the electric characteristic curve. The pump then swivels to $V_{g\,max}$ if the pilot signal is lost (e.g., cable break) and then works with the DRF settings if necessary (see page 16). 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 are increased by the EK valve.
A PWM signal is used to control the solenoid.

Note
A minimum operating pressure of 725 psi (50 bar) is needed for safe and reproducible electro-proportional control with controller cut-off. For lower pressures, a pilot signal of > 500 mA (EK2) or > 1000 mA (EK1) is required in order to avoid undesired controller cut-off. The necessary control fluid is taken from the high pressure.

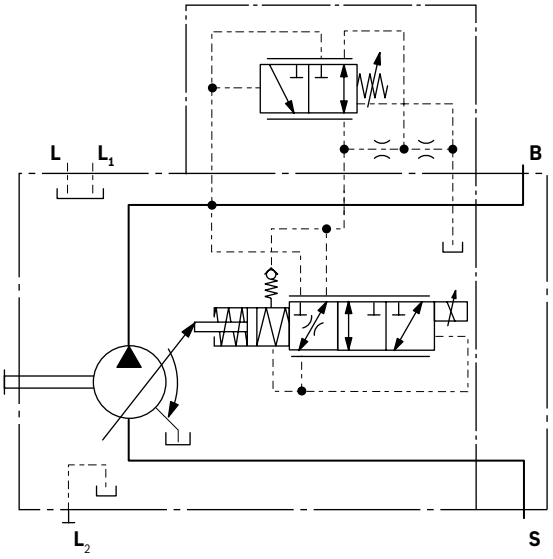
In the $V_{g\,max}$ the spring force of the return spring is maximum. To overcome the force of this spring, the solenoid must be subjected to excessive current (I_{res}).

▼ **Characteristic EK1/2**



- Hysteresis static current-displacement characteristic curve < 5%.
- For changes in current, ramp times of > 200 ms must be observed.

▼ **Circuit diagram EK.D**



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
Minimum working stroke of the dither within the control range[1)]	352 mA	176 mA
Dither frequency	100 to 200 Hz	100 to 200 Hz
Limiting current	1.54 A	0.77 A
Nominal resistance (at 68 °F (20 °C))	5.5 Ω	22.7 Ω
Duty cycle	100%	100%
Type of protection: see connector version page 64		
Operating temperature range at valve -4 °F to 239 °F (-20 °C to +115 °C)		

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

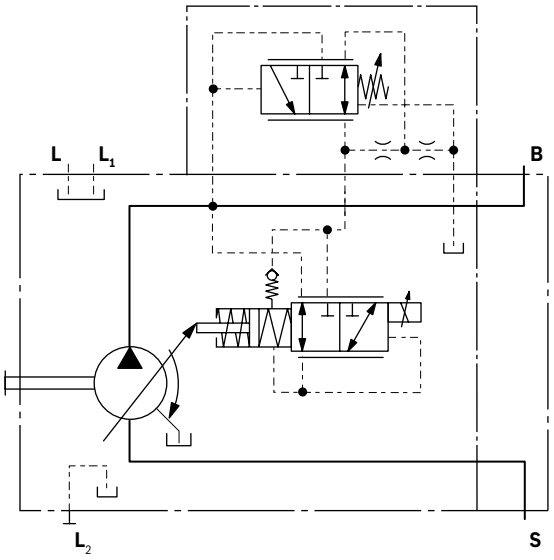
Note
We recommend the valve with flushing function for the EK.D control variant. Please contact us.

1) ΔI = 44% of the current difference within the control range, regardless of the mean value of the current

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

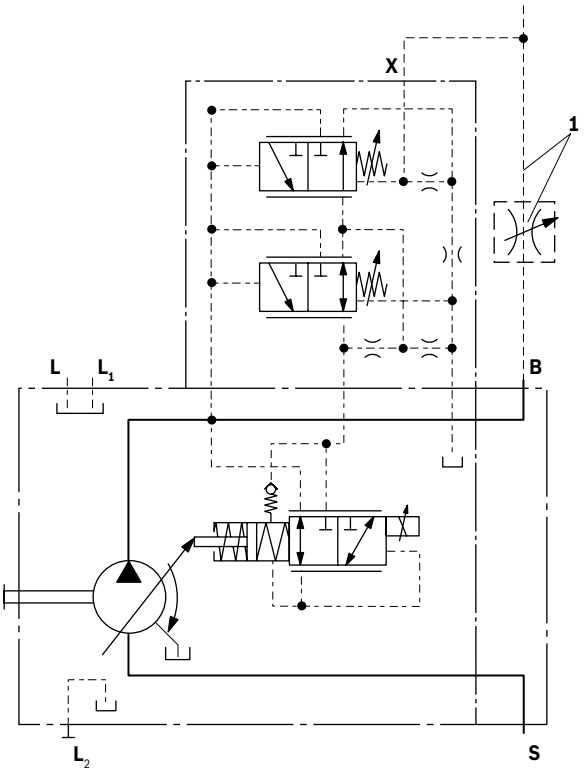
A hydraulic pressure flow control is superimposed on the electro-proportional control.
The pressure control regulates the pump displacement infinitely varied back to $V_{g\,min}$ after the set target pressure has been reached.
This function is super-imposed on the EP or EK control, i.e. the control-current dependent EP or EK function is executed below the target pressure.
For the adjustment range of the pressure flow control, see page 14 to 16.
With all controller combinations, the V_g reduction has priority.
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). Please refer to the notes on page 16.

▼ **Circuit diagram EP.D**

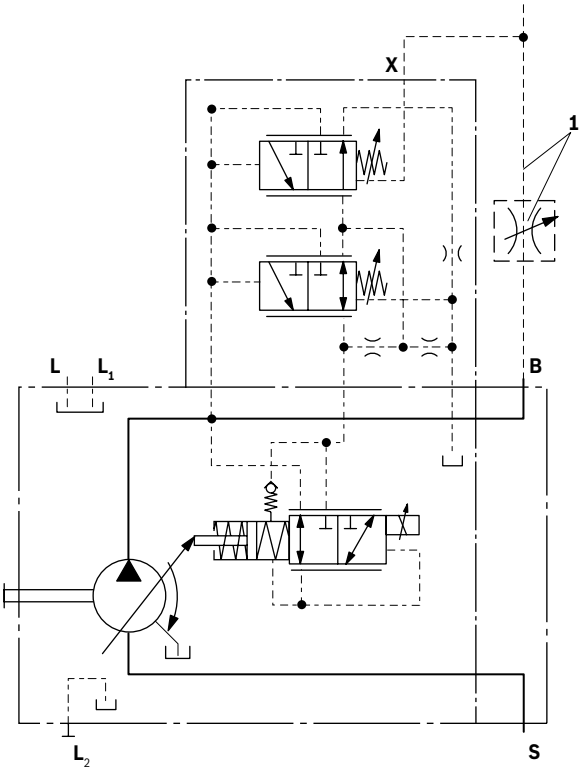


1 The sensing orifice (control block) and the line is not included in the delivery contents.

▼ **Circuit diagram EP.DF**



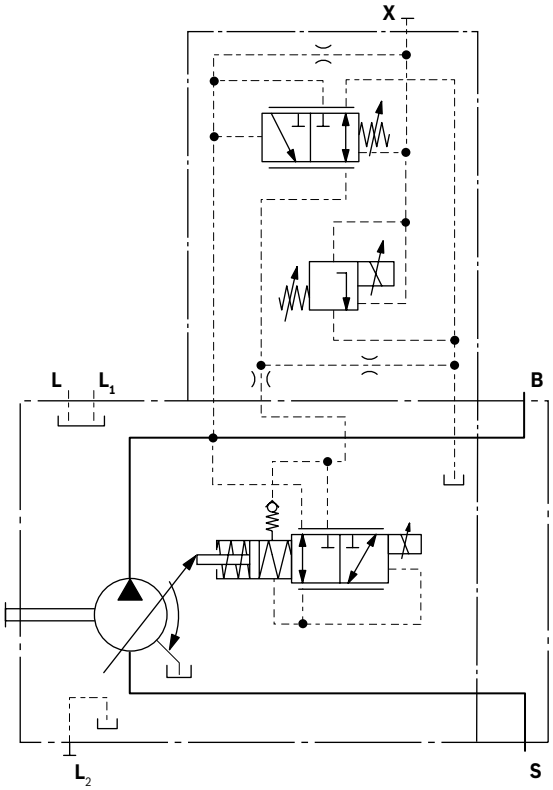
▼ **Circuit diagram EP.DS**



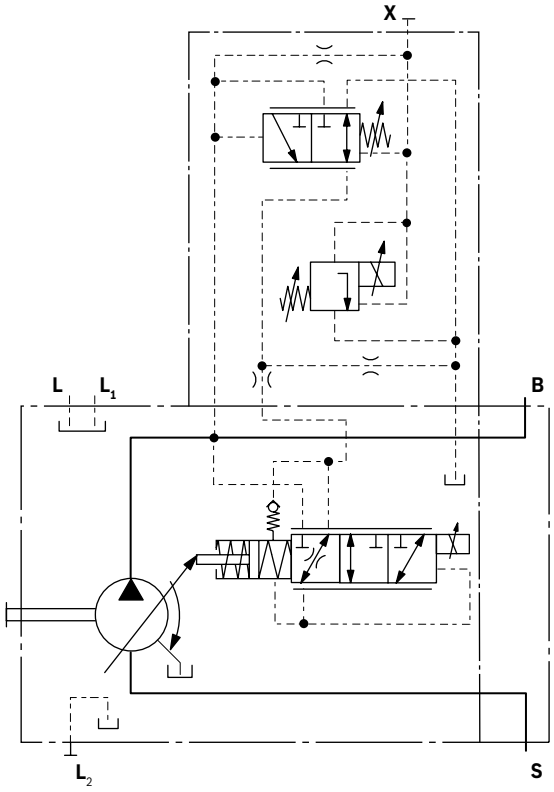
EP.ED / EK.ED – with electro-hydraulic pressure control

The ED valve is set to a certain pressure by a specified variable solenoid current.
When changing the consumer (load pressure), this causes an increase or decrease in the pump swivel angle (flow) in order to maintain the electrically set pressure level.
The pump thus only delivers as much hydraulic fluid as the consumers can take. The pressure can be set steplessly by the solenoid current.
As the solenoid current signal drops towards zero, the pressure will be limited to p_{max} by an adjustable hydraulic pressure cut-off (negative characteristic curve, e.g. for fan drives). A PWM signal is used to control the solenoid.
For further information and technical data of the solenoids for ED(ER) control please refer to pages 20 to 23.

▼ **Circuit diagram EP.ED**

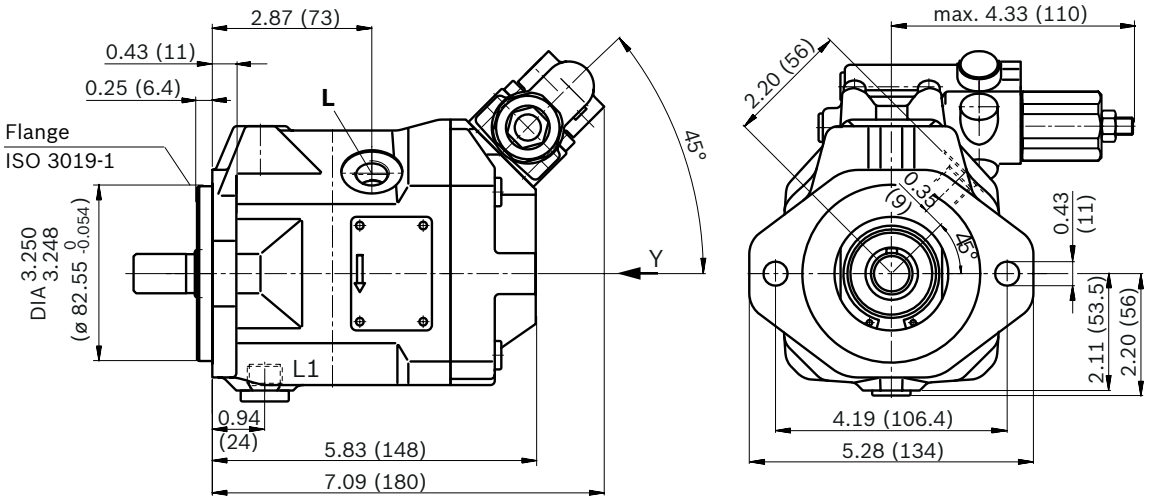


▼ **Circuit diagram EK.ED**

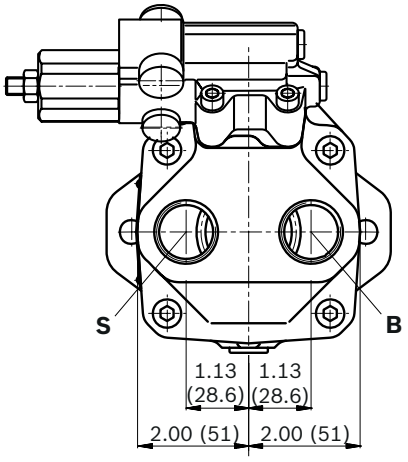


Dimensions size 10

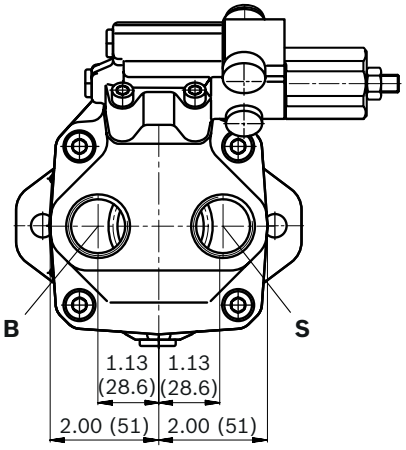
DR – Pressure controller; mounting flange C version SAE; series 52



View **Y**
Valve mounting for
clockwise rotation

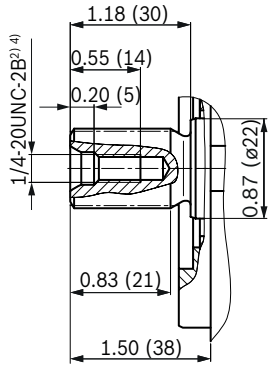


View **Y**
Valve mounting for
counter-clockwise rotation



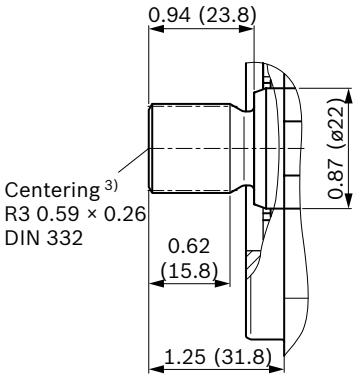
▼ **Splined shaft 3/4 in (SAE J744)**

S – 11T 16/32DP[1)]



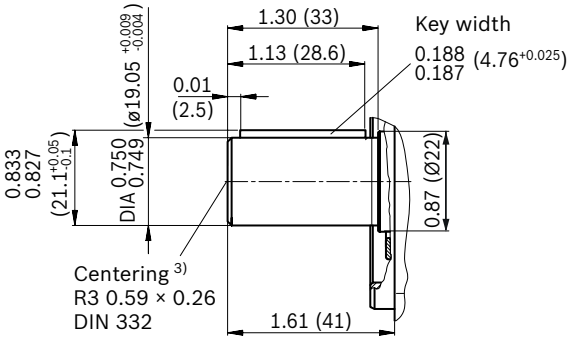
▼ **Splined shaft 5/8 in (SAE J744)**

U – 9T 16/32DP[1)]



▼ **Parallel keyed shaft DIN 6885**

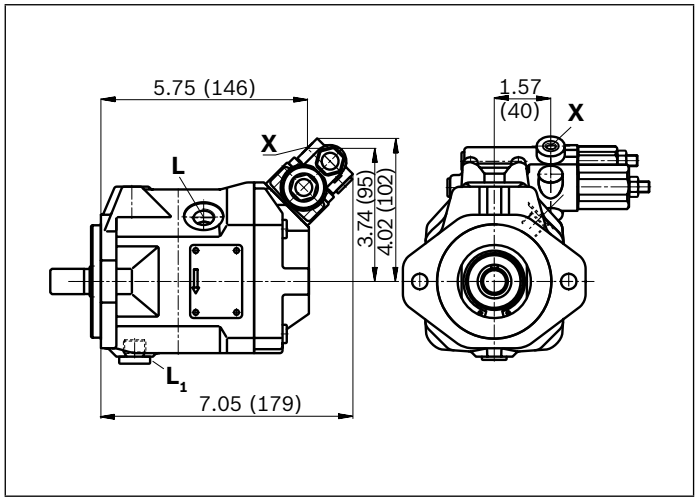
K – 19-1



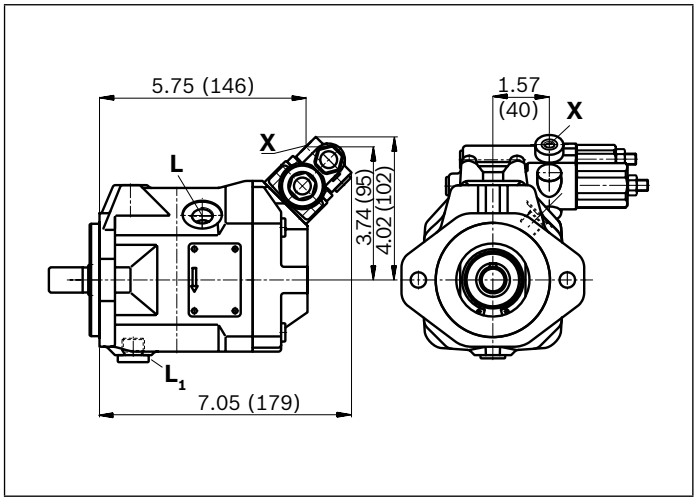
Ports		Standard	Size[4)]	$p_{max\ abs}$ [psi (bar)][5)]	State[8)]
B	Working port	ISO 11926	1 1/16-12UNF-2B; 0.79 (20) deep	4550 (315)	O
S	Suction port	ISO 11926	1 1/16-12UNF-2B; 0.79 (20) deep	75 (5)	O
L	Drain port	ISO 11926[6)]	9/16-18UNF-2B; 0.39 (10) deep	30 (2)	O[7)]
L_1	Drain port	ISO 11926[6)]	9/16-18UNF-2B; 0.39 (10) deep	30 (2)	X[7)]
X without adapter	Control pressure	ISO 11926	7/16-20UNF-2B; 0.45 (11.5) deep	4550 (315)	O

1) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Thread according to ASME B1.1
3) Coupling axially secured, e.g. with a clamp coupling or radially mounted clamping screw
4) Observe the instructions in the operating instructions concerning the maximum tightening torques.
5) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
6) The spot face can be deeper than as specified in the standard.
7) Depending on the installation position, **L** or **L_1** must be connected (also see installation instructions starting on page 68).
8) O = Must be connected (plugged when delivered)
X = Plugged (in normal operation)

▼ **DRG – Pressure control, remotely operated (SAE)[1)]**



▼ **DFR/DFR1 – Pressure, flow control (SAE)[1)]**

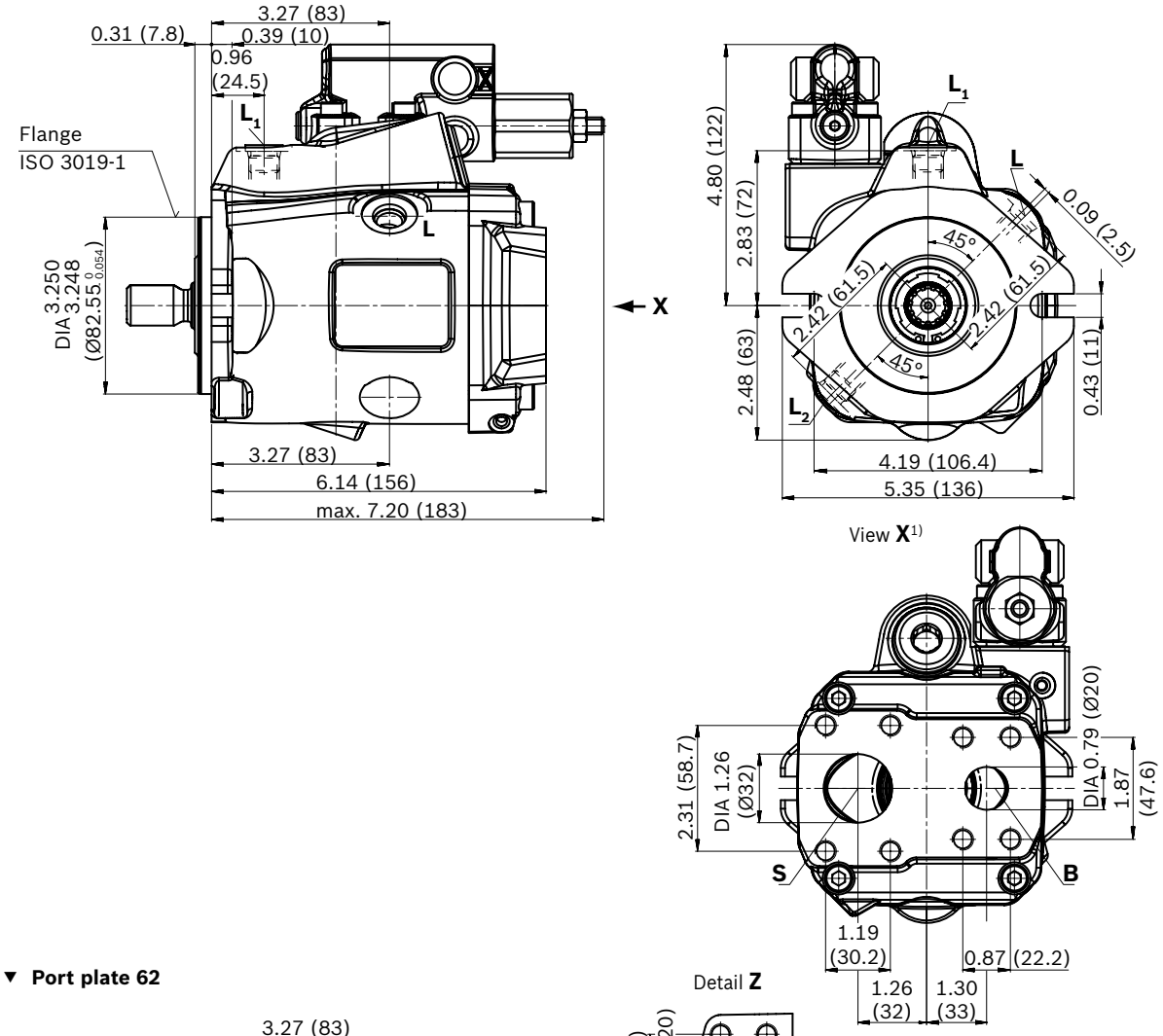


1) Valve mounting for clockwise or counter-clockwise rotation see page 26

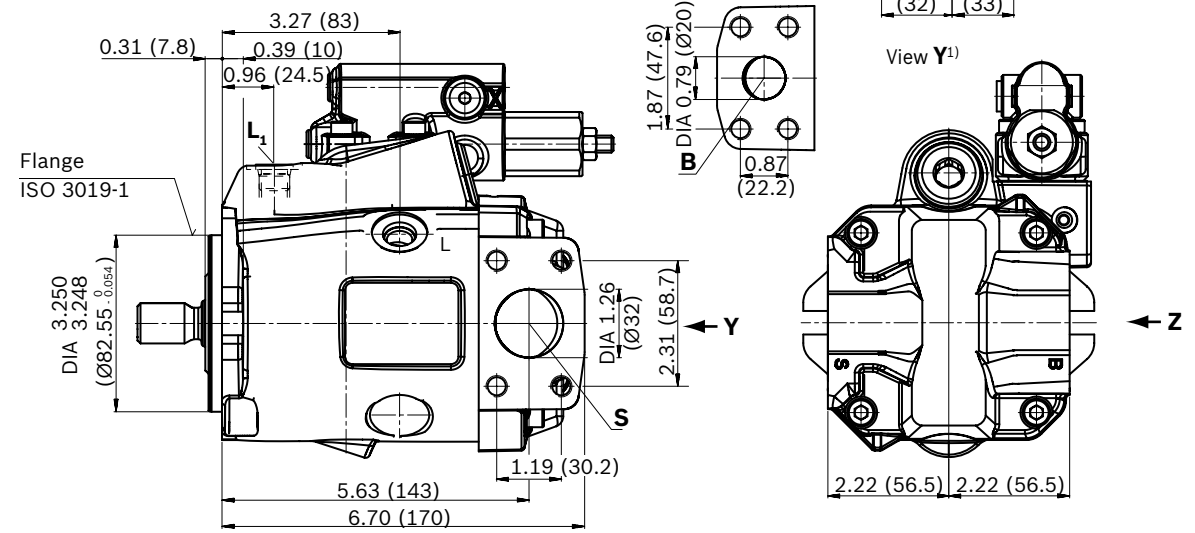
Dimensions size 18

DR – Hydraulic pressure controller, clockwise rotation, series 53

▼ **Port plate 61**



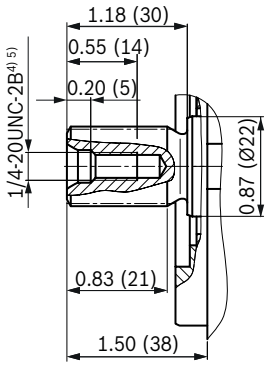
▼ **Port plate 62**



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

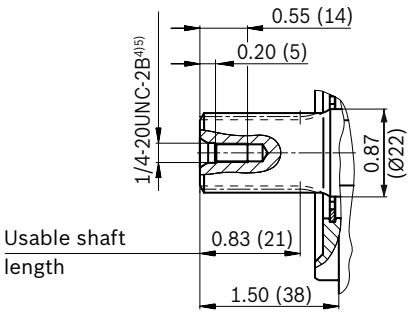
▼ **Splined shaft 3/4 in (SAE J744)**

S – 11T 16/32DP[1)]



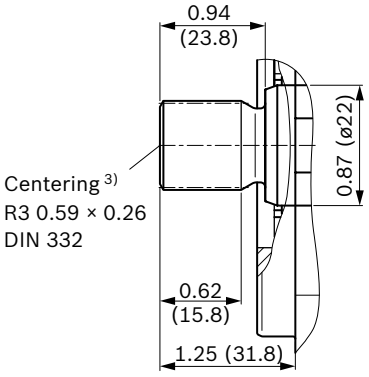
▼ **Splined shaft 3/4 in (SAE J744)**

R – 11T 16/32DP[1)2)]



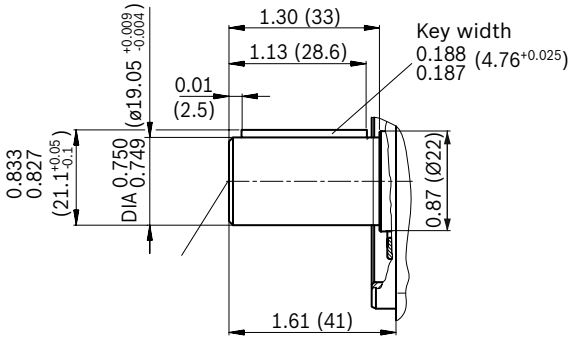
▼ **Splined shaft 5/8 in (SAE J744)**

U – 9T 16/32DP[1)]



▼ **Parallel keyed shaft DIN 6885**

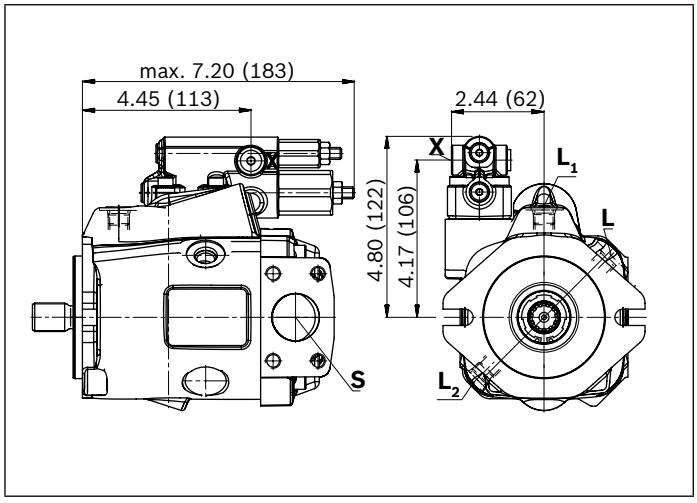
K – 19-1



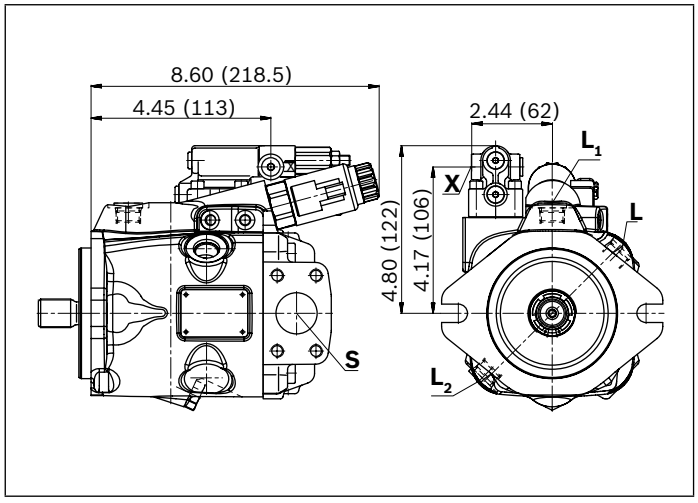
Ports		Standard	Size[5)]	$p_{max\ abs}$ [psi (bar)][6)]	State[10)]
B	Working port (Standard pressure series) Fastening thread	SAE J518 ASME B1.1	3/4 in 3/8-16UNC-2B; 0.75 (19) deep	4550 (315)	O
S	Suction port (standard pressure series) Fastening thread	SAE J518 ASME B1.1	1 1/4 in 7/16-14UNC-2B; 0.79 (20) deep	75 (5)	O
L	Drain port	DIN 11926[7)]	3/4-16UNF-2B; 0.47 (12) deep	30 (2)	O[8)]
L_1, **L_2**[9)]	Drain port	DIN 11926[7)]	3/4-16UNF-2B; 0.47 (12) deep	30 (2)	X[8)]
X	Control pressure	DIN 11926	7/16-20UNF-2A; 0.45 (11.5) deep	4550 (315)	O

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, run out of spline is a deviation from standard.
3) Center bore according to DIN 332
4) Thread according to ASME B1.1
5) Observe the instructions in the operating instructions concerning the maximum tightening torques.
6) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
7) The spot face can be deeper than as specified in the standard.
8) Depending on the installation position, **L**, **L_1** or **L_2** must be connected (also see installation instructions starting on page 68).
9) Only series 53
10) O = Must be connected (plugged when delivered)
X = Plugged (in normal operation)

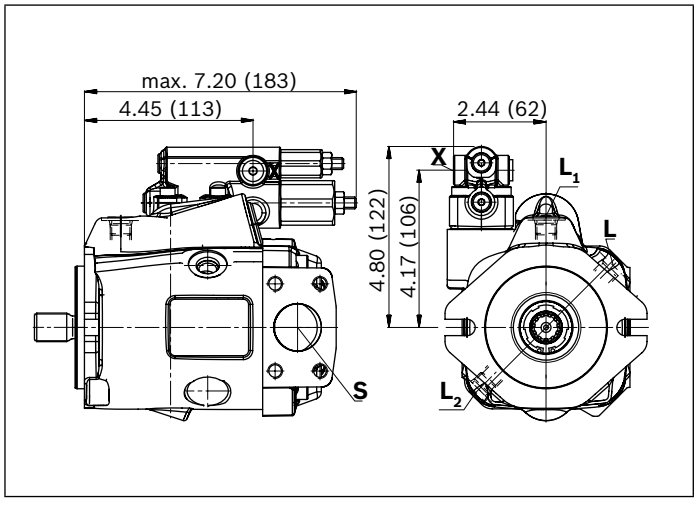
▼ **DRG – Pressure controller, remote controlled, series 53**



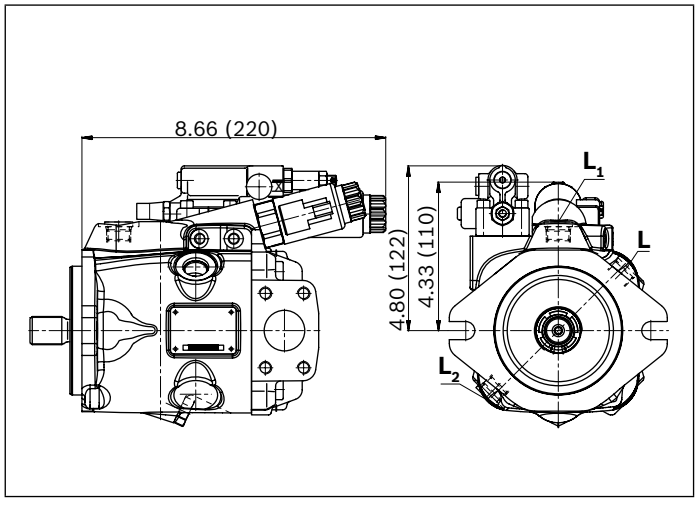
▼ **EP.D. / EK.D. – Electro-proportional control, series 53**



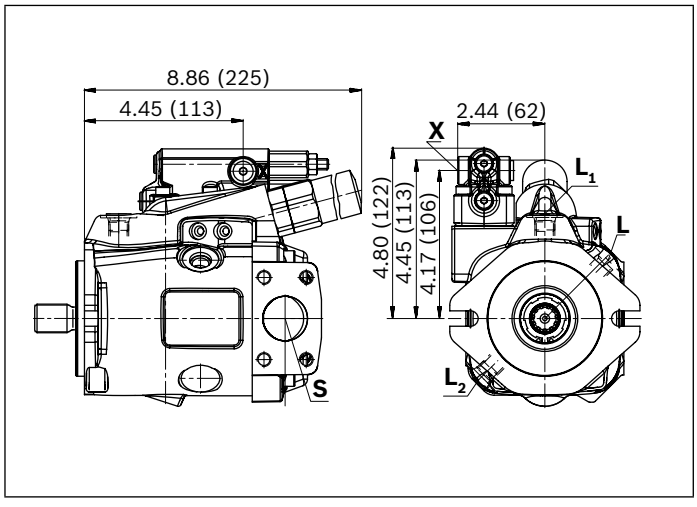
▼ **DRF/DRS/DRSC – Pressure and flow control, series 53**



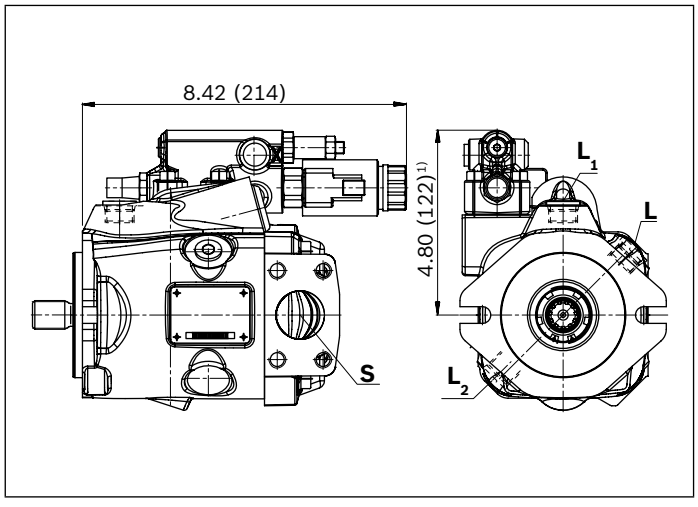
▼ **EP.ED. / EK.ED. – Electro-proportional control, series 53**



▼ **LA.D. – Pressure, flow and power control, series 53**



▼ **ED7. / ER7. – Electro-proportional Pressure control, series 53**

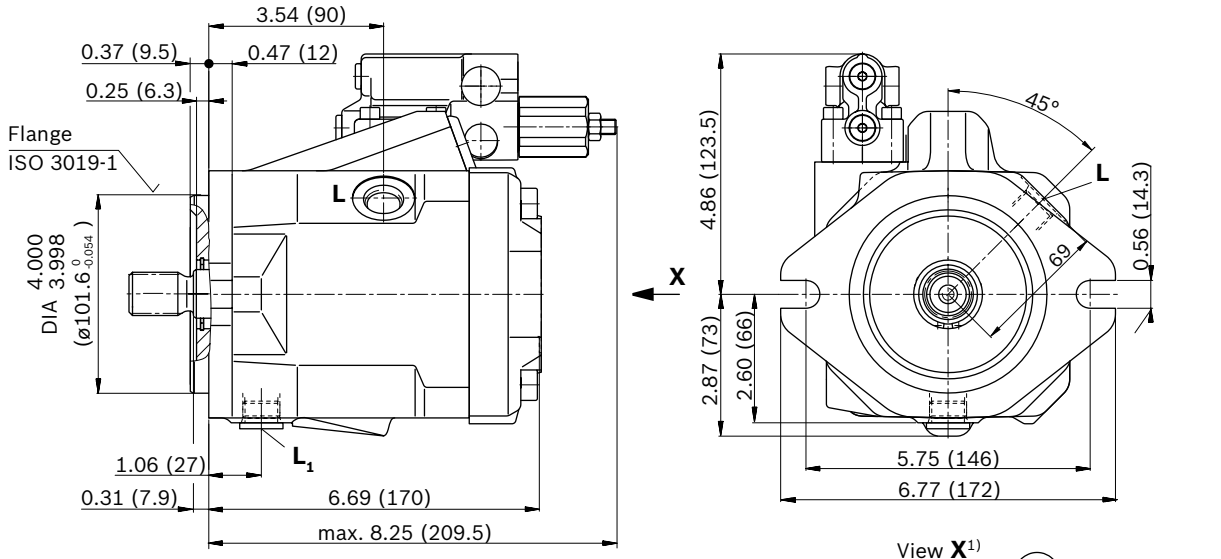


1) ER7.: 6.18 inch (157 mm) if using an intermediate plate pressure controller

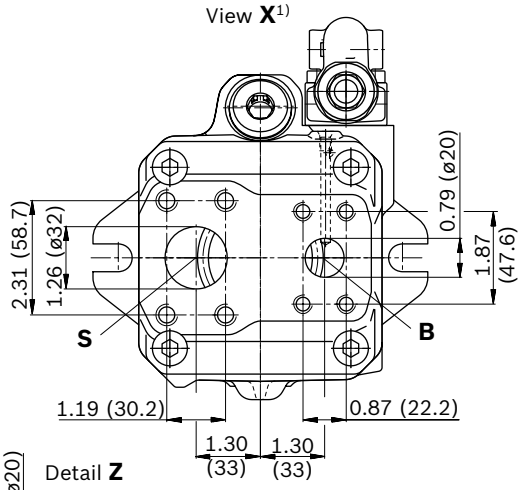
Dimensions size 28

DR – Hydraulic pressure controller, clockwise rotation, series 52[2)]

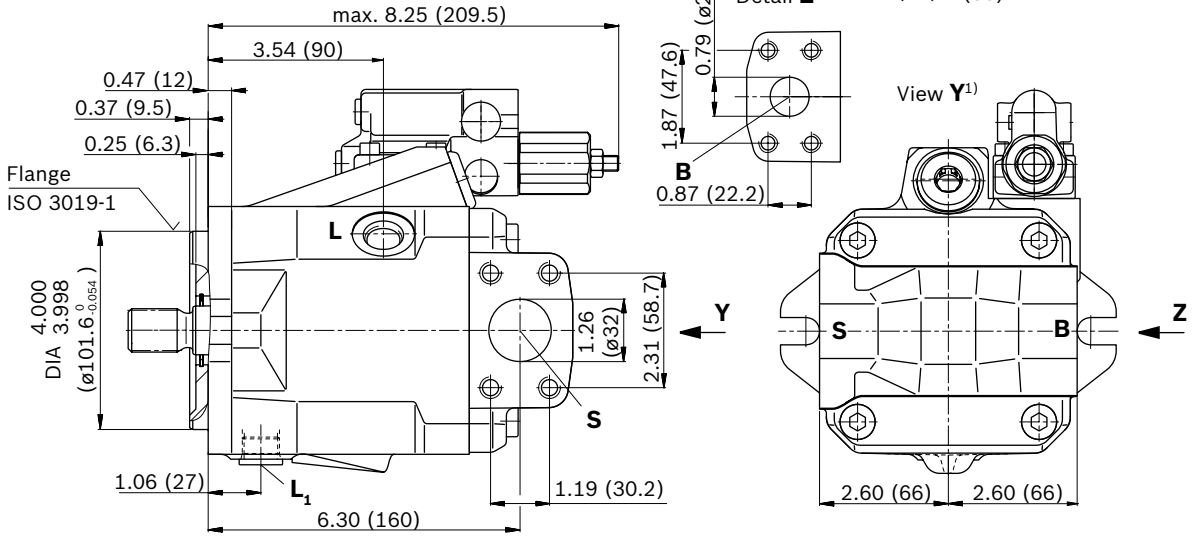
▼ **Port plate 61**



View **X**[1)]



▼ **Port plate 62**



Detail **Z**

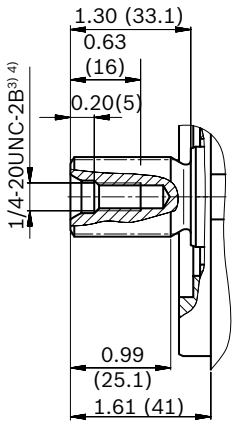
View **Y**[1)]

1) Dimensions of working ports turned through 180° for counter-clockwise rotation
2) Primary dimensions for pump apply to series 52 and 53

Ports see page 34

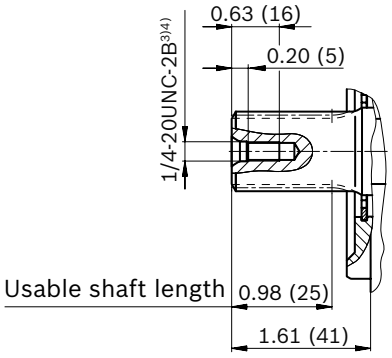
▼ **Splined shaft 7/8 in (SAE J744)**

S – 13T 16/32DP[1)]



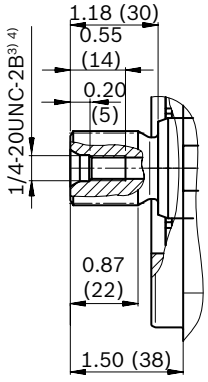
▼ **Splined shaft 7/8 in (SAE J744)**

R – 13T 16/32DP[1)2)]



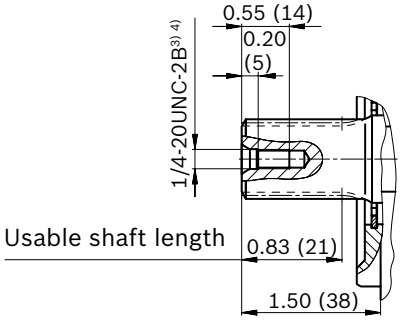
▼ **Splined shaft 3/4 in (SAE J744)**

U – 11T 16/32DP[1)]



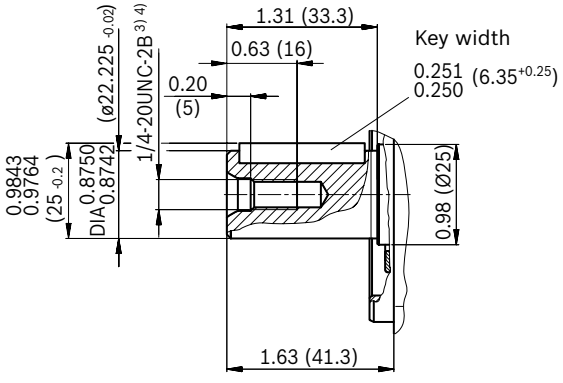
▼ **Splined shaft 3/4 in (SAE J744)**

W – 11T 16/32DP[1)2)]



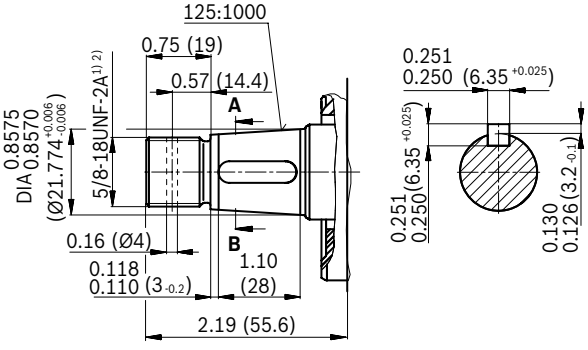
▼ **Parallel keyed shaft (ISO 3019-1)**

K – 22-1



▼ **Tapered with woodruff key (ISO 3019-1)**

C



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, run out of spline is a deviation from standard.

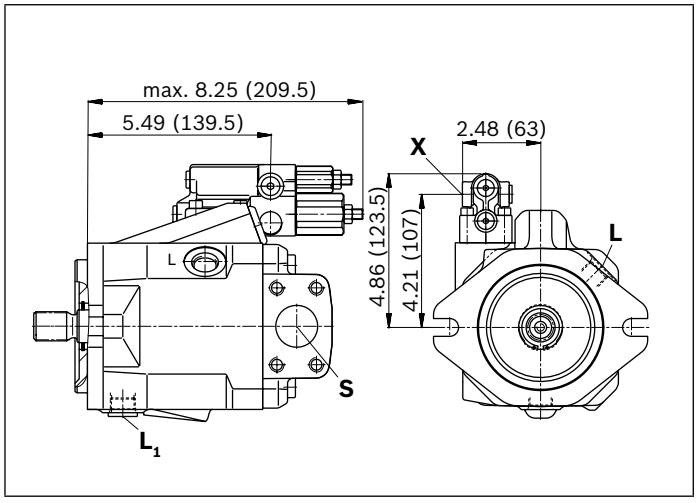
3) Thread according to ASME B1.1

4) Observe the instructions in the operating instructions concerning the maximum tightening torques.

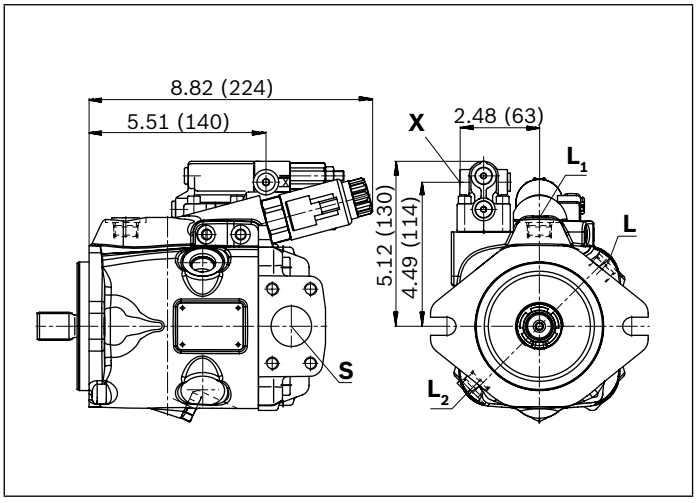
Ports		Standard	Size[1]	$p_{max\ abs}$ [psi (bar)][2]	State[6]
B	Working port (Standard pressure series) Fixing thread	SAE J518 ASME B1.1	3/4 in 3/8-16UNC-2B; 0.75 (19) deep	4550 (315)	O
S	Suction port (standard pressure series) Fastening thread	SAE J518 ASME B1.1	1 1/4 in 7/16-14UNC-2B; 0.79 (20) deep	75 (5)	O
L	Drain port	ISO 11926[3]	3/4-16UNF-2B; 12 deep	30 (2)	O[4]
L_1, **L_2**[5]	Drain port	ISO 11926[3]	3/4-16UNF-2B; 12 deep	30 (2)	X[4]
X	Control pressure	ISO 11926	7/16-20UNF-2B; 11.5 deep	4550 (315)	O

1) Observe the instructions in the operating instructions concerning the maximum tightening torques.
2) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
3) The spot face can be deeper than as specified in the standard.
4) Depending on the installation position, **L**, **L_1** or **L_2** must be connected (also see installation instructions starting on page 68).
5) Only for series 53
6) O = Must be connected (plugged when delivered)
X = Plugged (in normal operation)

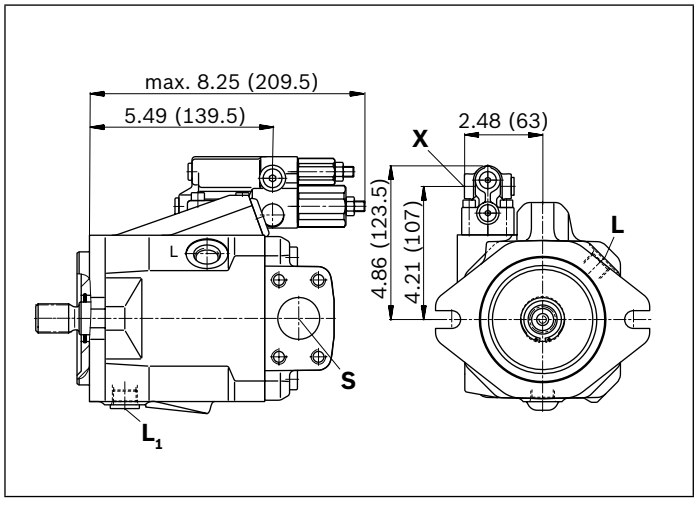
▼ **DRG – Pressure controller, remote controlled, series 52 (53)**



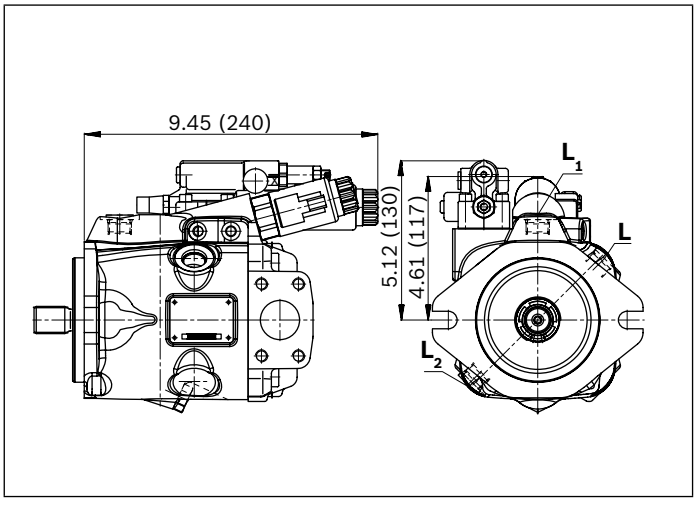
▼ **EP.D. / EK.D. – Electro-proportional control, series 53**



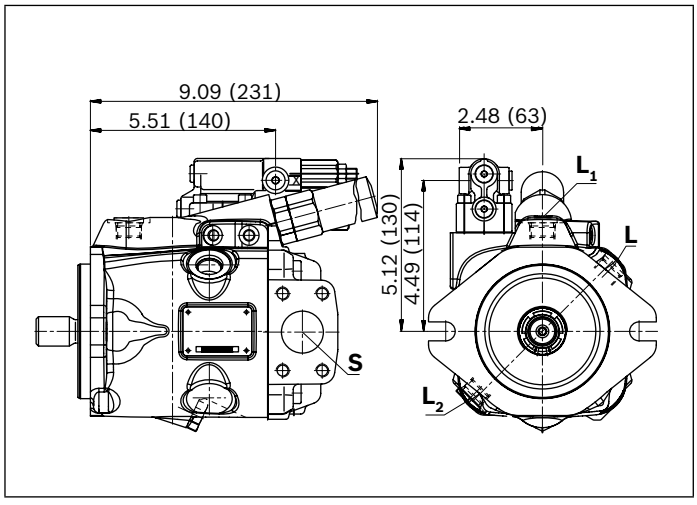
▼ **DFR/DFR1/DRSC – Pressure and flow control, series 52 (53)**



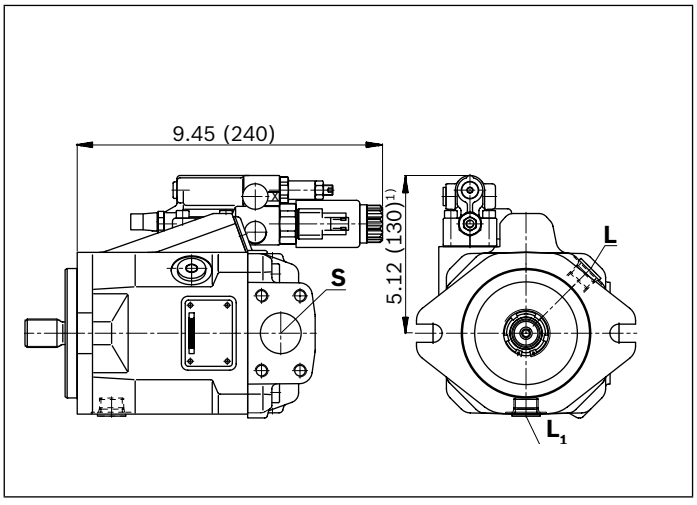
▼ **EP.ED. / EK.ED. – Electro-proportional control, series 53**



▼ **LA.D. – Pressure, flow and power control, series 53**



▼ **ED7. / ER7. – Electro-proportional Pressure control, series 52 (53)**

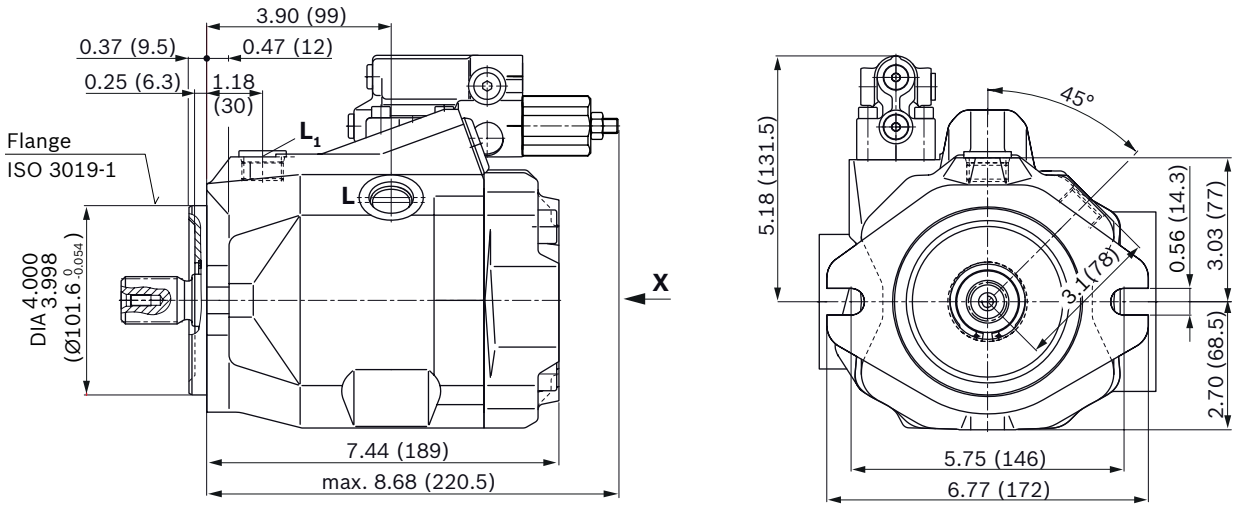


1) ER7.: 6.26 inch (159 mm) if using an intermediate plate pressure controller

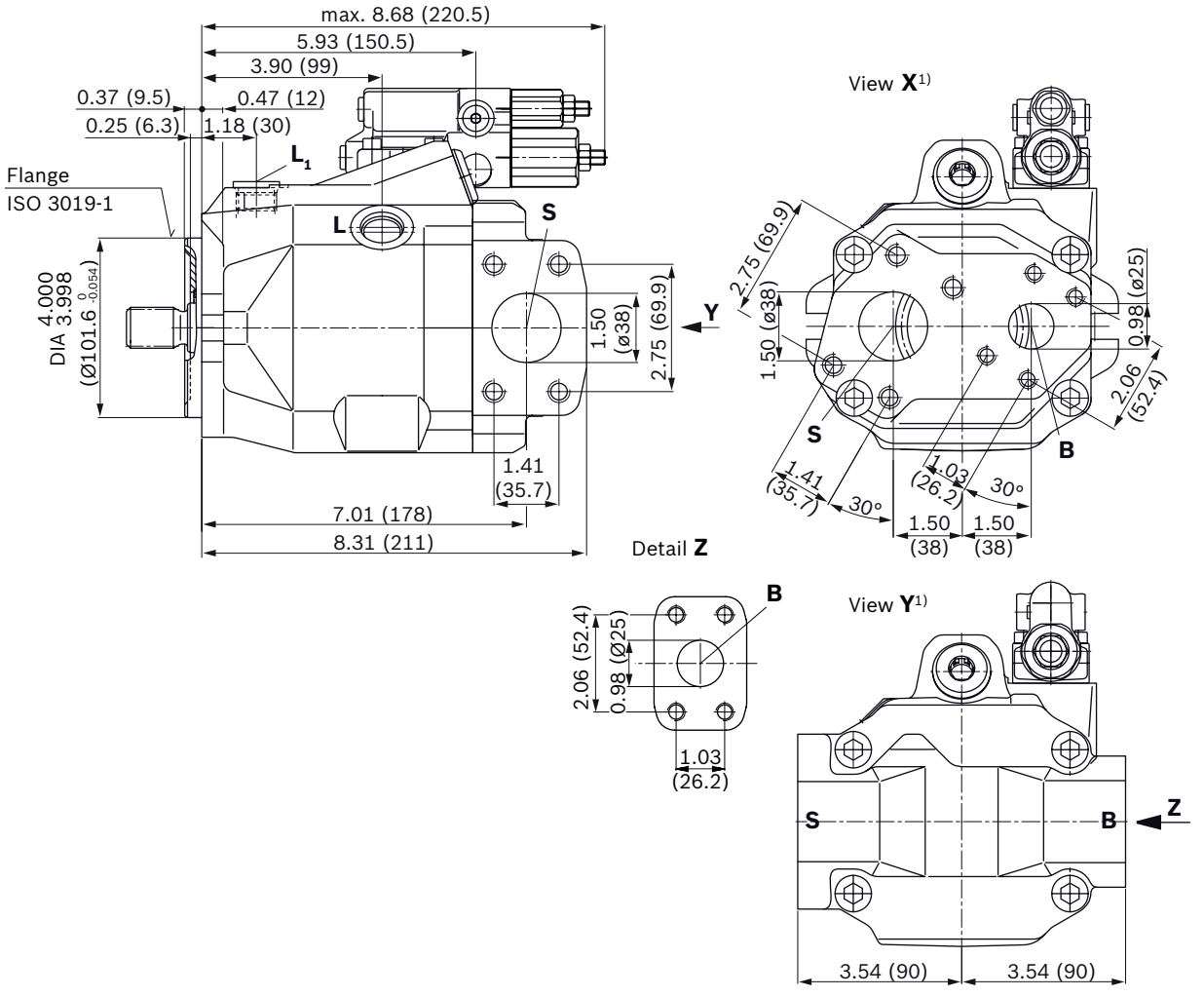
Dimensions size 45

DR – Hydraulic pressure controller, clockwise rotation, series 52[3)]

▼ **Port plate 61**



▼ **Port plate 62**

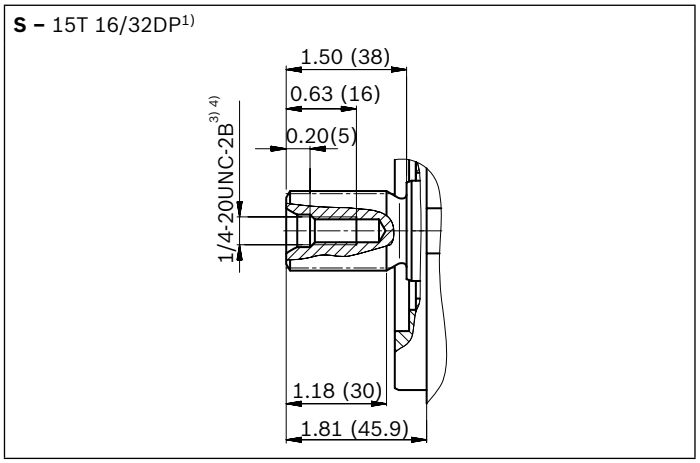


1) Dimensions of working ports turned through 180° for counter-clockwise rotation
2) Primary dimensions for pump apply to series 52 and 53

Ports see page 38

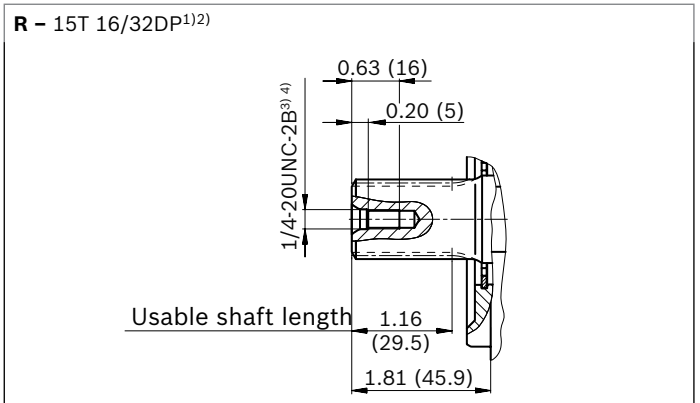
▼ **Splined shaft 1 in SAE J744**

S – 15T 16/32DP[1)]



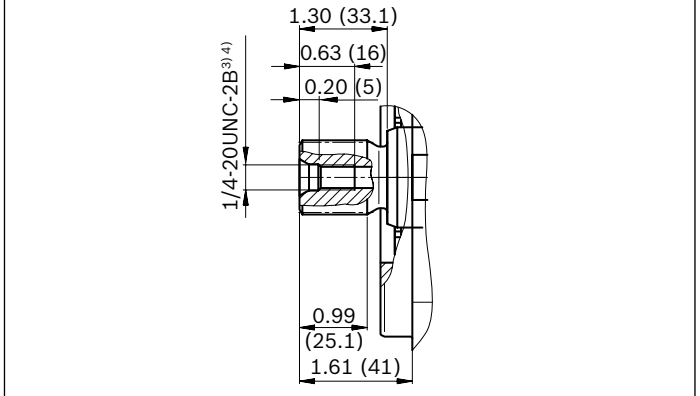
▼ **Splined shaft 1 in SAE J744**

R – 15T 16/32DP[1)2)]



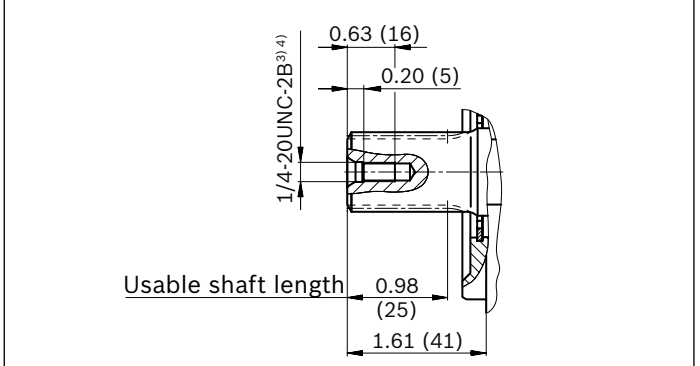
▼ **Splined shaft 7/8 in SAE J744**

U – 13T 16/32DP[1)]



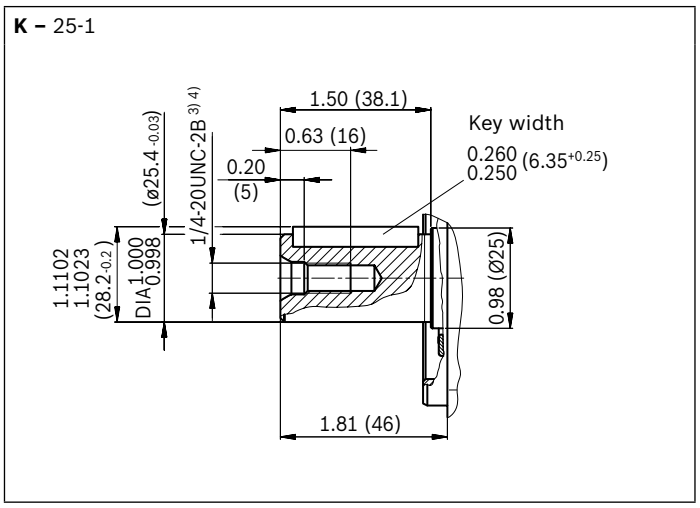
▼ **Splined shaft 7/8 in SAE J744**

W – 13T 16/32DP[1)]



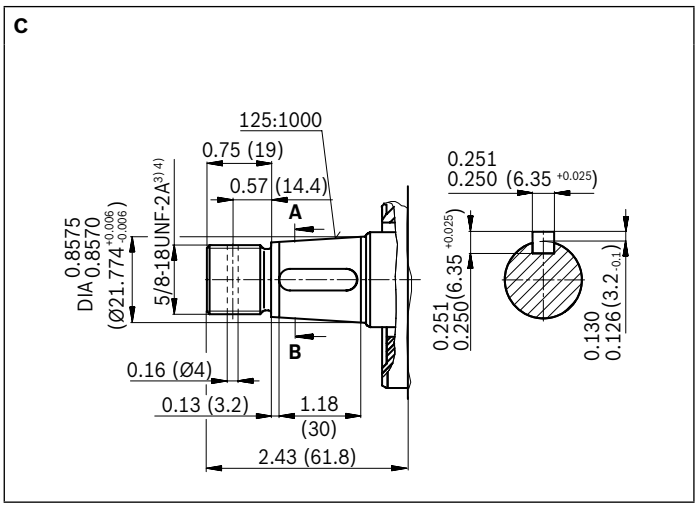
▼ **Parallel keyed shaft (ISO 3019-1)**

K – 25-1



▼ **Tapered with woodruff key (ISO 3019-1)**

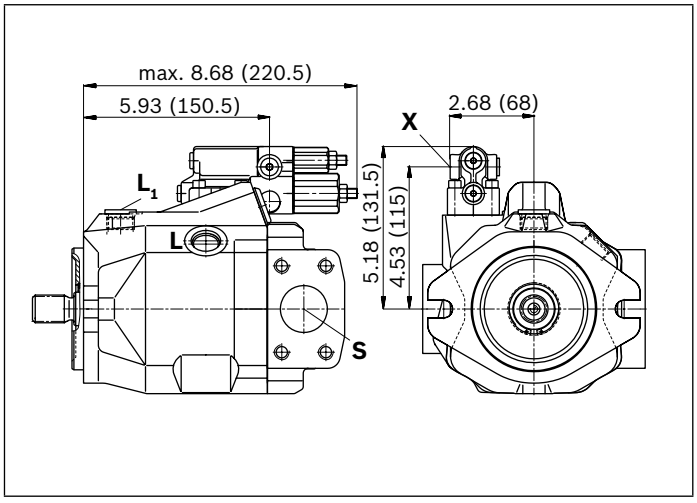
C



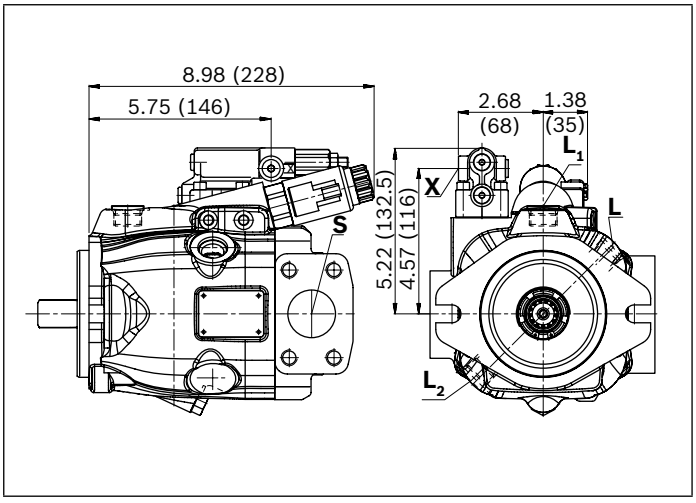
Ports		Standard	Size[4]	$p_{max\ abs}$ [psi (bar)][5]	State[9]
B	Working port (Standard pressure series) Fastening thread	SAE J518 ASME B1.1	1 in 3/8-16UNC-2B; 0.71 (18) deep	4550 (315)	O
S	Suction port (standard pressure series) Fastening thread	SAE J518 ASME B1.1	1 1/2 in 1/2-13UNC-2B; 0.87 (22) deep	75 (5)	O
L	Drain port	ISO 11926[6]	7/8-14UNF-2B; 0.51 (13) deep	30 (2)	O[7]
L_1, L_2[8]	Drain port	ISO 11926[6]	7/8-14UNF-2B; 0.51 (13) deep	30 (2)	X[7]
X	Control pressure	ISO 11926	7/16-20UNF-2A; 0.45 (11.5) deep	4550 (315)	O

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, run out of spline is a deviation from standard.
3) Thread according to ASME B1.1
4) Observe the instructions in the operating instructions concerning the maximum tightening torques.
5) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
6) The spot face can be deeper than as specified in the standard.
7) Depending on the installation position, **L**, **L_1** or **L_2** must be connected (also see installation instructions starting on page 68).
8) Only series 53
9) O = Must be connected (plugged when delivered)
X = Plugged (in normal operation)

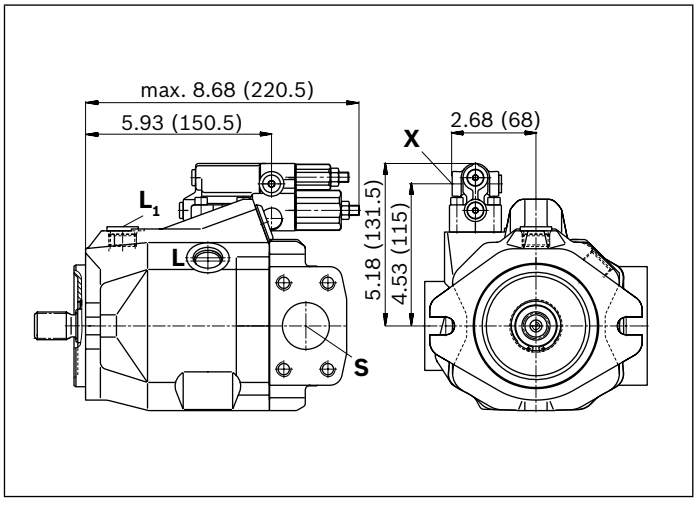
▼ **DRG – Pressure controller, remote controlled, series 52 (53)**



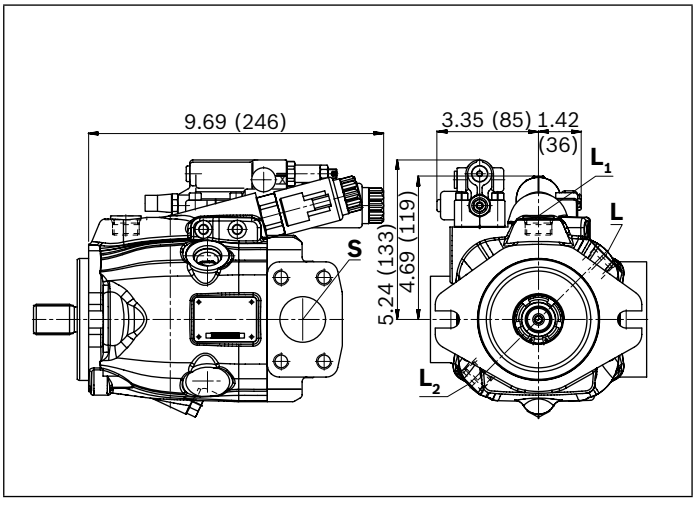
▼ **EP.D. / EK.D. – Electro-proportional control, series 53**



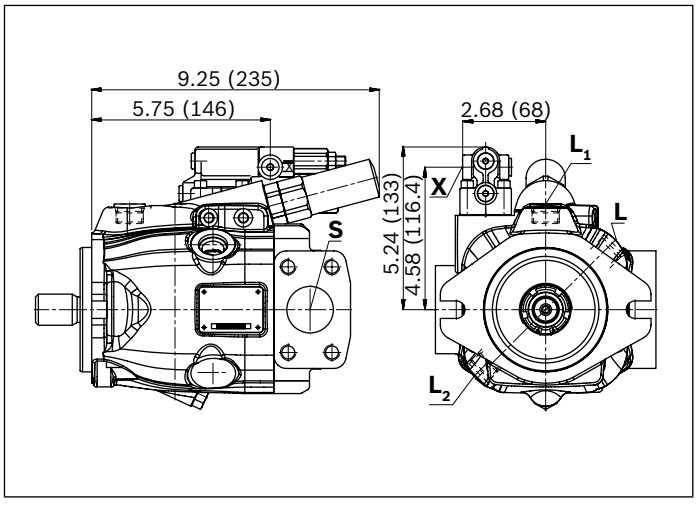
▼ **DFR/DFR1/DRSC – Pressure and flow control, series 52 (53)**



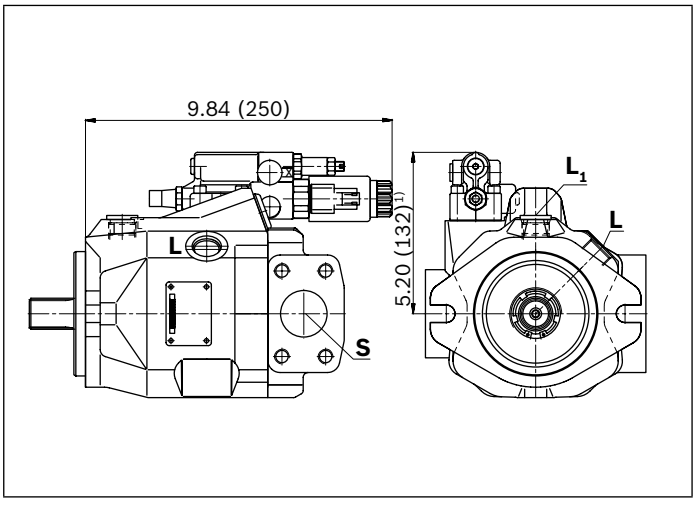
▼ **EP.ED. / EK.ED. – Electro-proportional control, series 53**



▼ **LA.D. – Pressure, flow and power control, series 53**



▼ **ED7. / ER7. – Electro-proportional Pressure control, series 52 (53)**

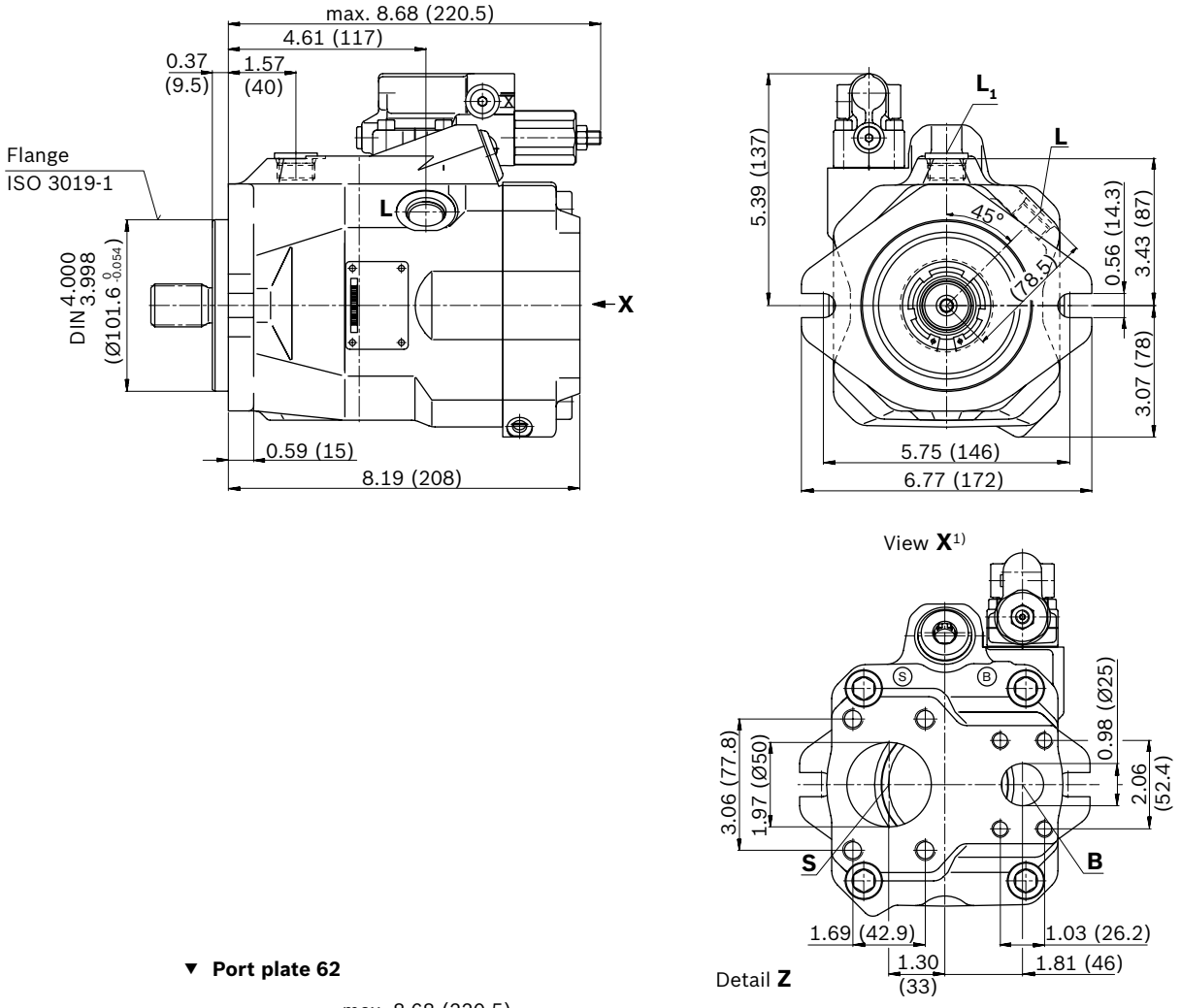


1) ER7.: 6.57 inch (167 mm) if using an intermediate plate pressure controller

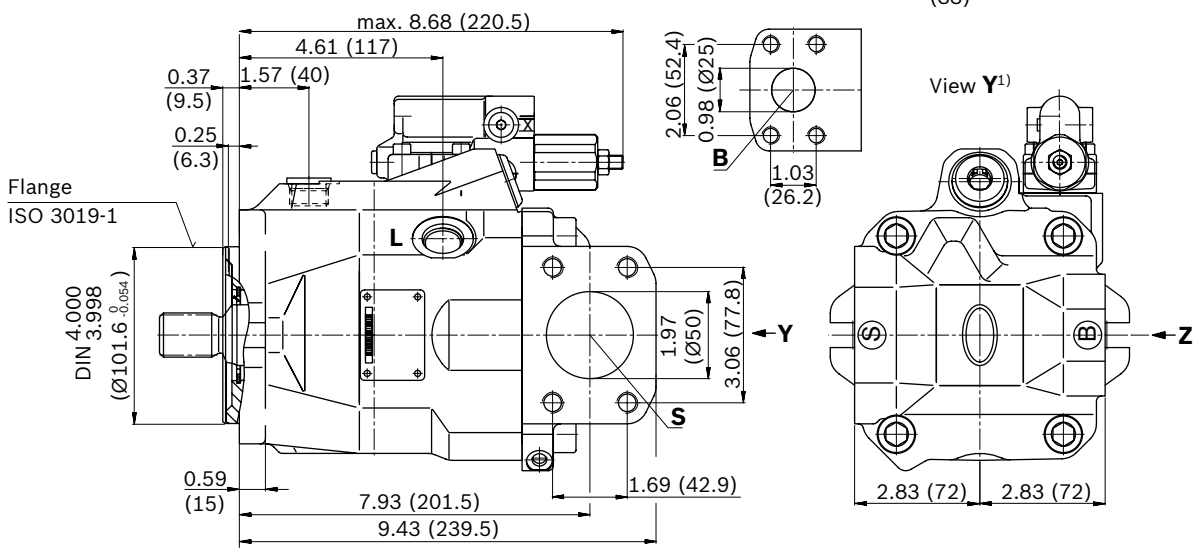
Dimensions size 60

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

▼ **Port plate 61**



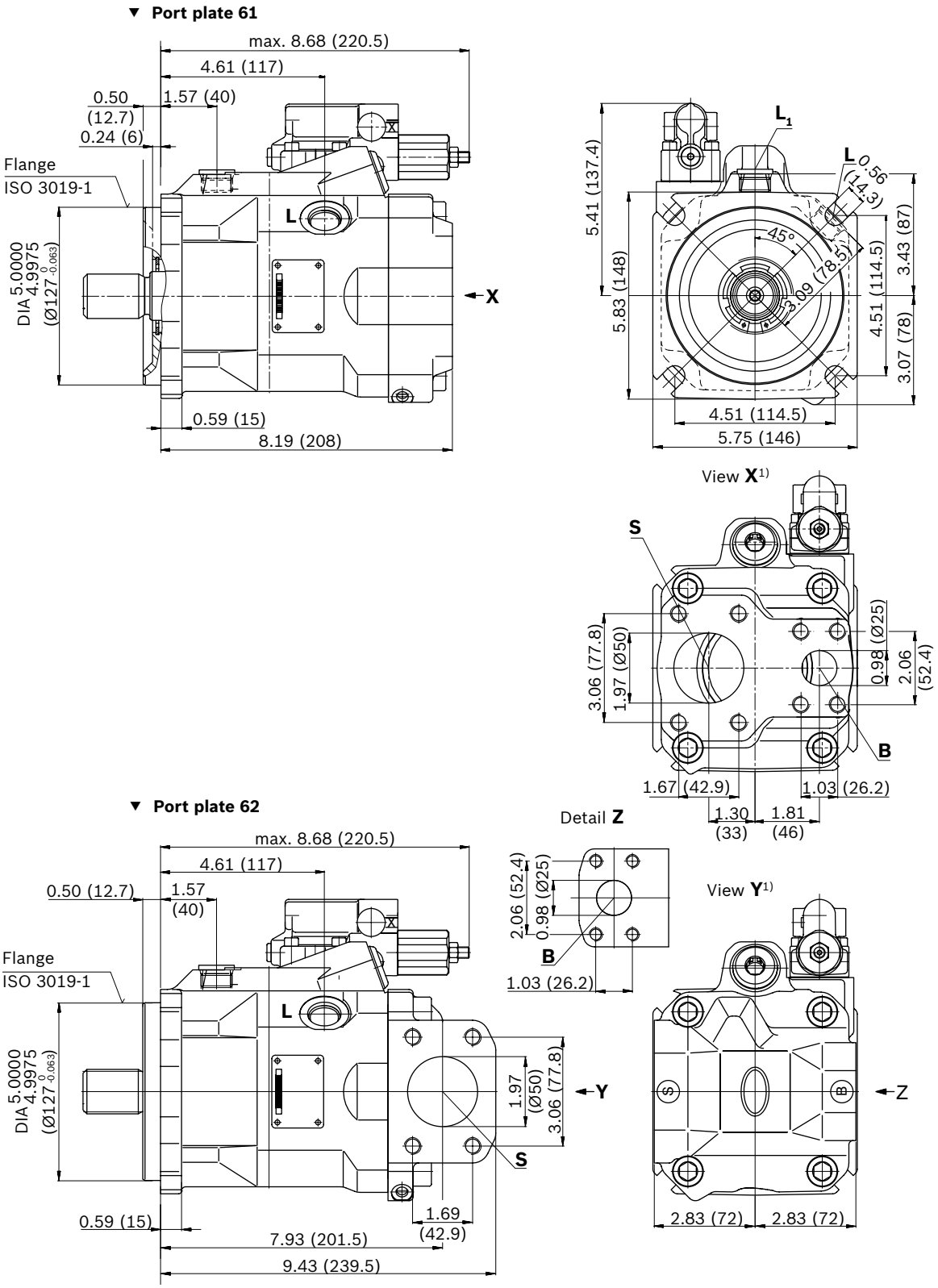
▼ **Port plate 62**



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

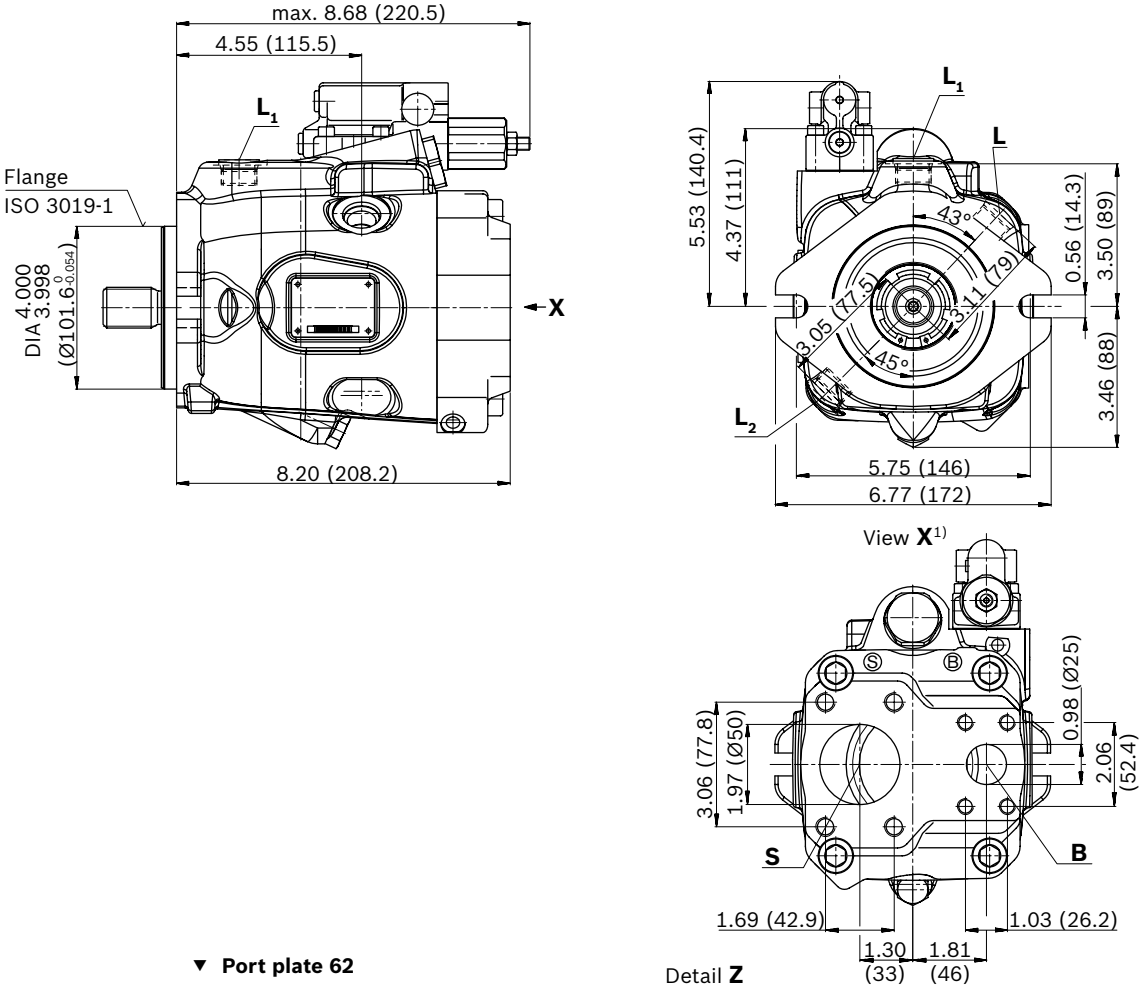


1) Dimensions of working ports turned through 180° for counter-clockwise rotation

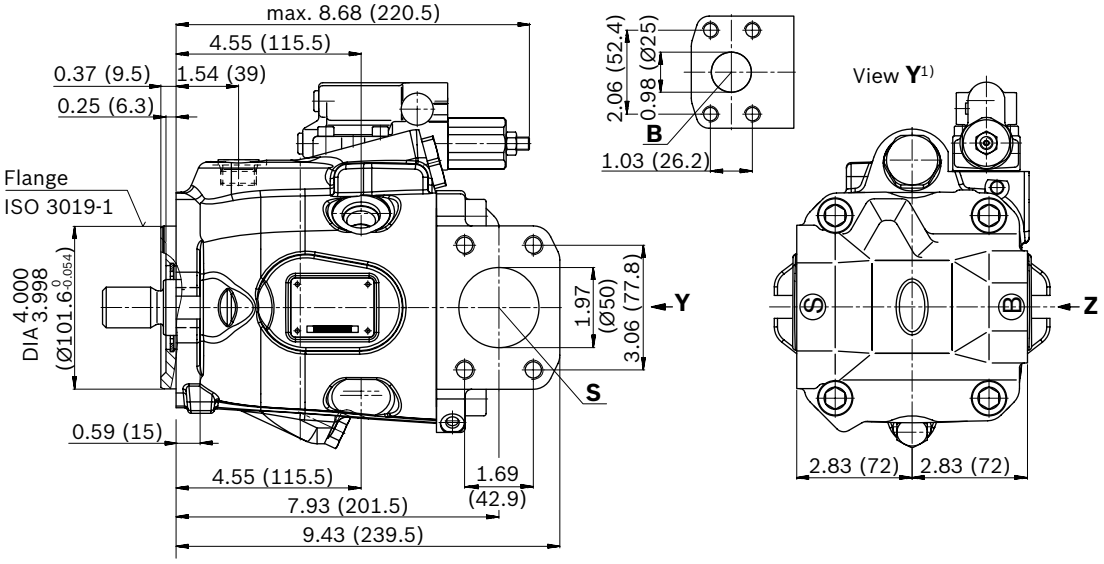
Dimensions size 63

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

▼ **Port plate 61**



▼ **Port plate 62**

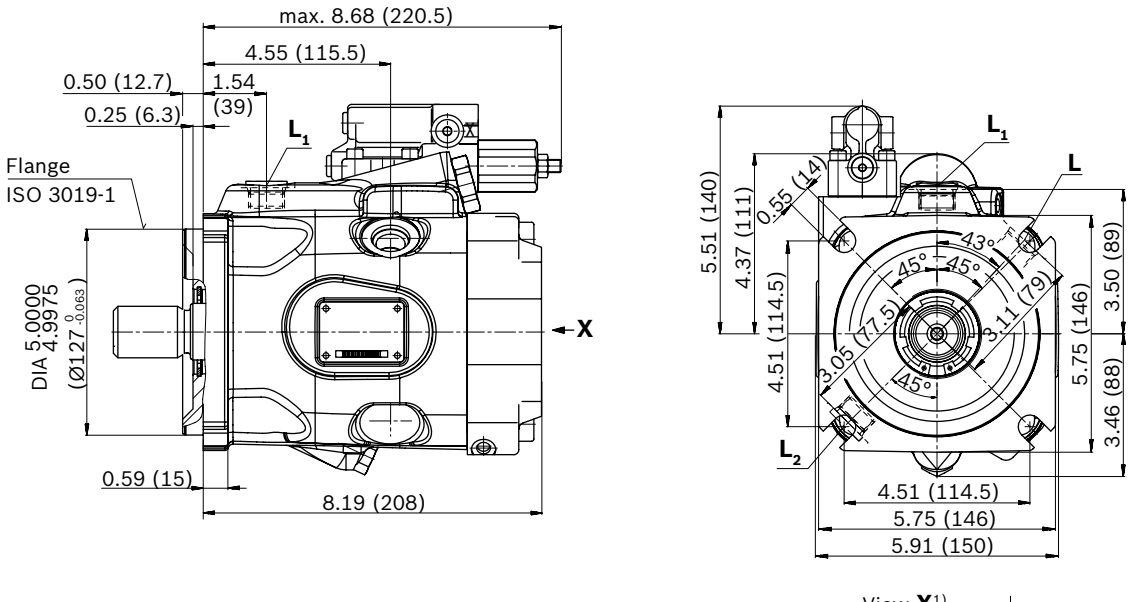


1) Dimensions of working ports turned through 180° for counter-clockwise rotation

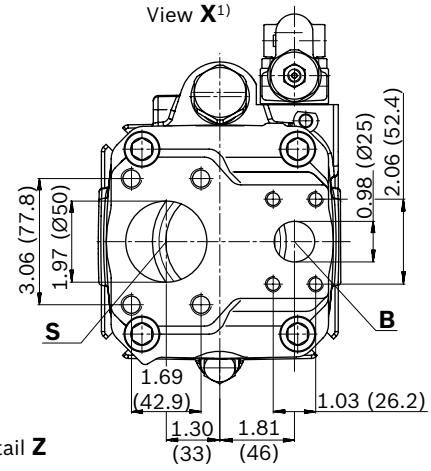
Dimensions size 63

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

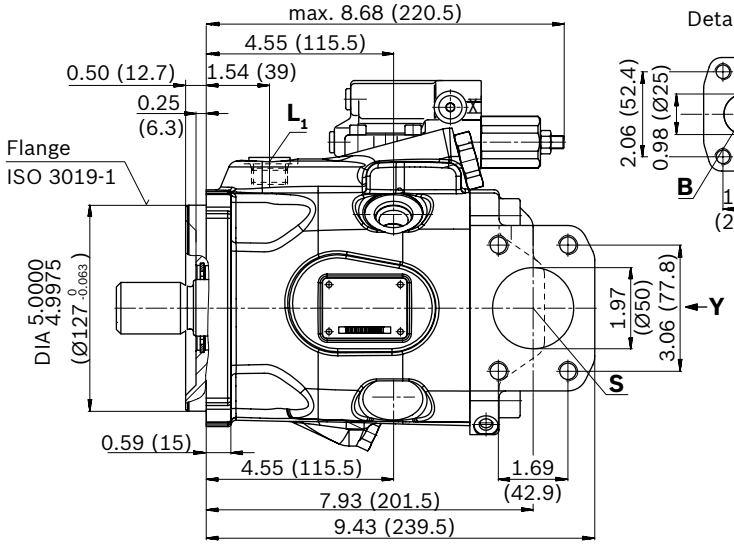
▼ **Port plate 61**



View **X**[1)]

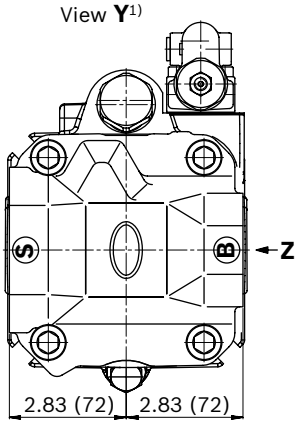


▼ **Port plate 62**



Detail **Z**

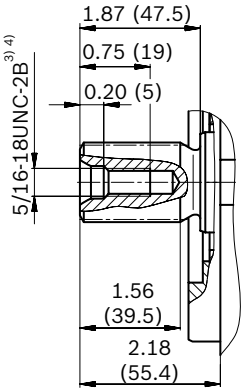
View **Y**[1)]



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

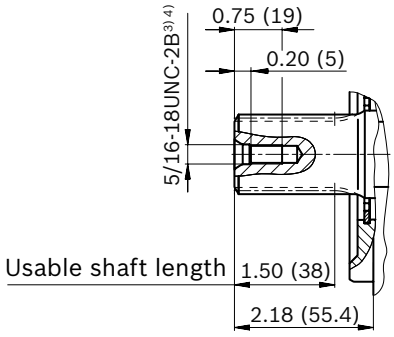
▼ **Splined shaft 1 1/4 in SAE J744**

S – 14T 12/24DP[1)]



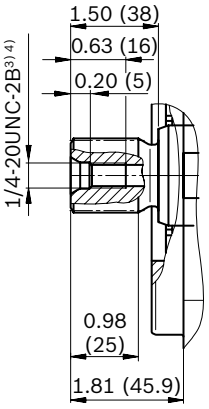
▼ **Splined shaft 1 1/4 in SAE J744**

R – 14T 12/24DP[1)2)]



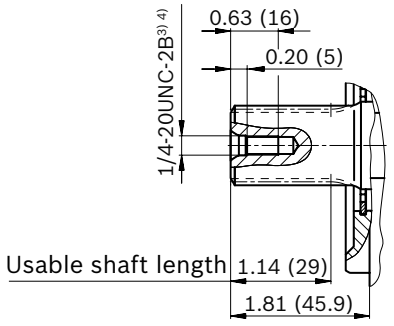
▼ **Splined shaft 1 in SAE J744**

U – 15T 16/32DP[1)]



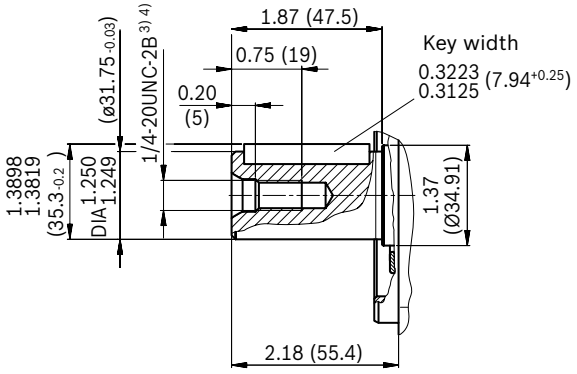
▼ **Splined shaft 1 in SAE J744**

W – 15T 16/32DP[1)]



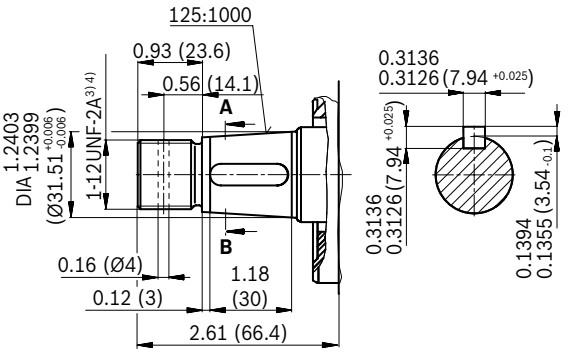
▼ **Parallel keyed shaft (ISO 3019-1)**

K – 32-1



▼ **Tapered with woodruff key (ISO 3019-1)**

C

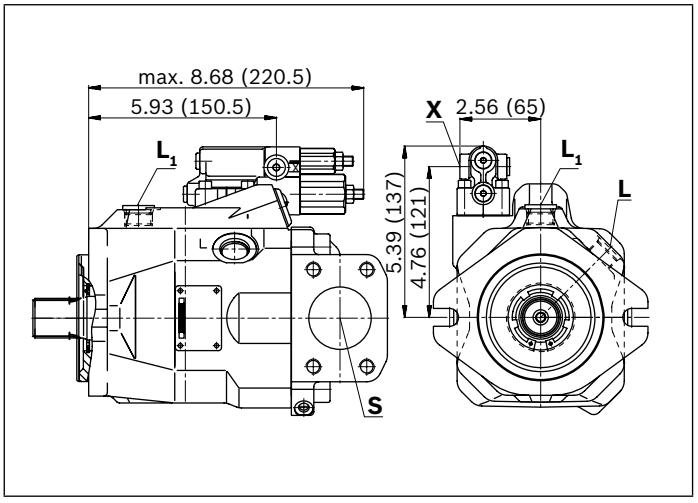


Footnote see page 46

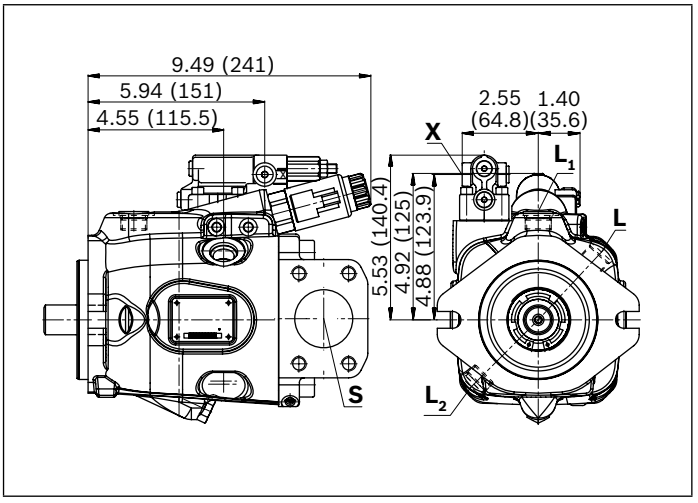
Ports		Standard	Size[4]	$p_{max\ abs}$ [psi (bar)][5]	State[9]
B	Working port (Standard pressure series) Fastening thread	SAE J518 ASME B1.1	1 in 3/8-16UNC-2B; 0.71 (18) deep	4550 (315)	O
S	Suction port (standard pressure series) Fastening thread	SAE J518 ASME B1.1	2 in 1/2-13UNC-2B; 0.87 (22) deep	75 (5)	O
L	Drain port	ISO 11926[6]	7/8-14UNF-2B; 0.51 (13) deep	30 (2)	O[7]
L_1, L_2[8]	Drain port	ISO 11926[6]	7/8-14UNF-2B; 0.51 (13) deep	30 (2)	X[7]
X	Control pressure	ISO 11926	7/16-20UNF-2A; 0.45 (11.5) deep	4550 (315)	O

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, run out of spline is a deviation from standard.
3) Thread according to ASME B1.1
4) Observe the instructions in the operating instructions concerning the maximum tightening torques.
5) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings..
6) The spot face can be deeper than as specified in the standard.
7) Depending on the installation position, **L**, **L_1** or **L_2** must be connected (also see installation instructions starting on page 68).
8) Only series 53
9) O = Must be connected (plugged when delivered)
X = Plugged (in normal operation)

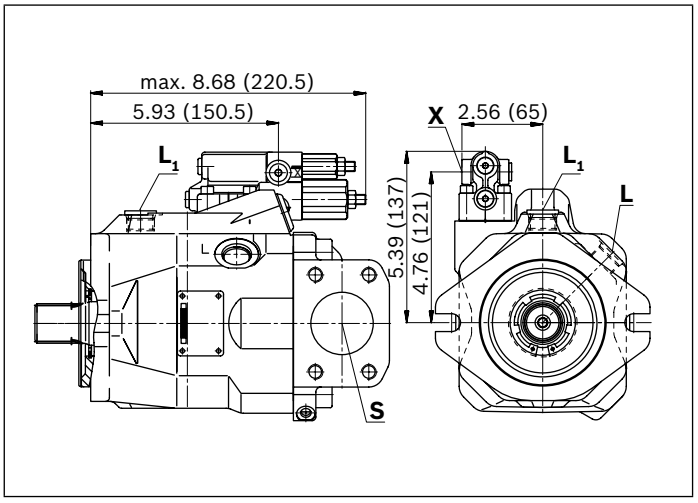
▼ **DRG – Pressure controller, remote controlled, series 53 (52)**



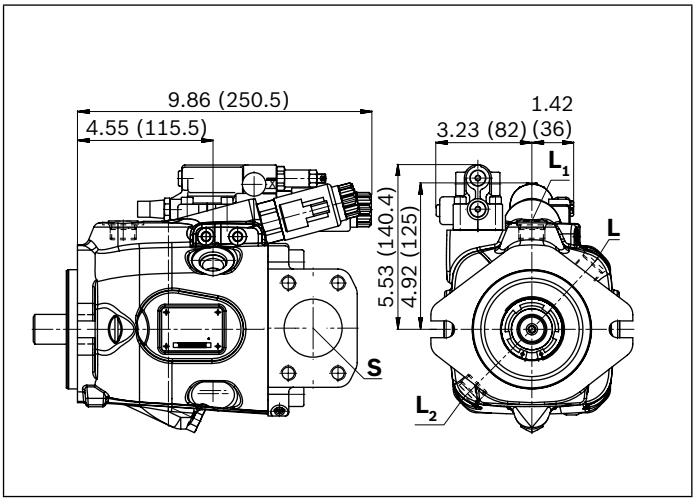
▼ **EP.D. / EK.D. – Electro-proportional control, series 53**



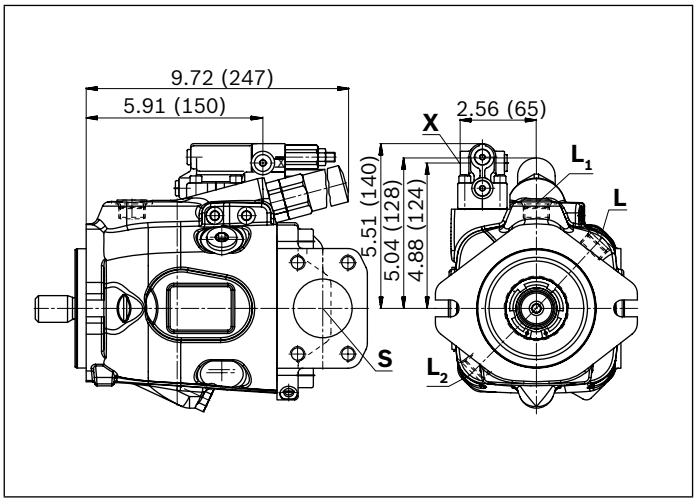
▼ **DFR/DFR1/DRSC – Pressure and flow control, series 53 (52)**



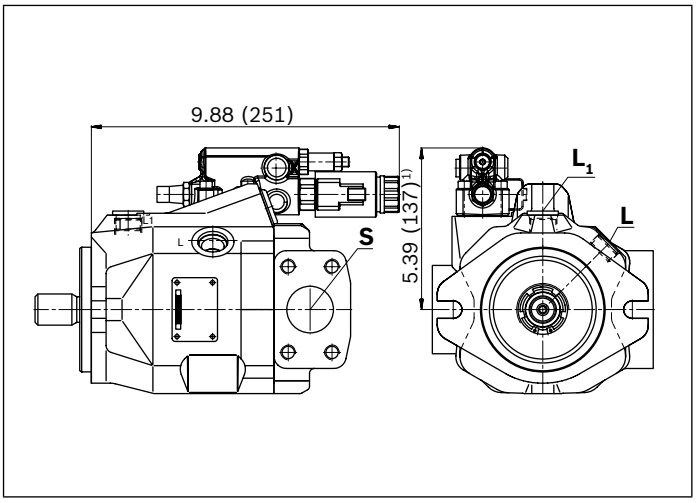
▼ **EP.ED. / EK.ED. – Electro-proportional control, series 53**



▼ **LA.D. – Pressure, flow and power control, series 53**



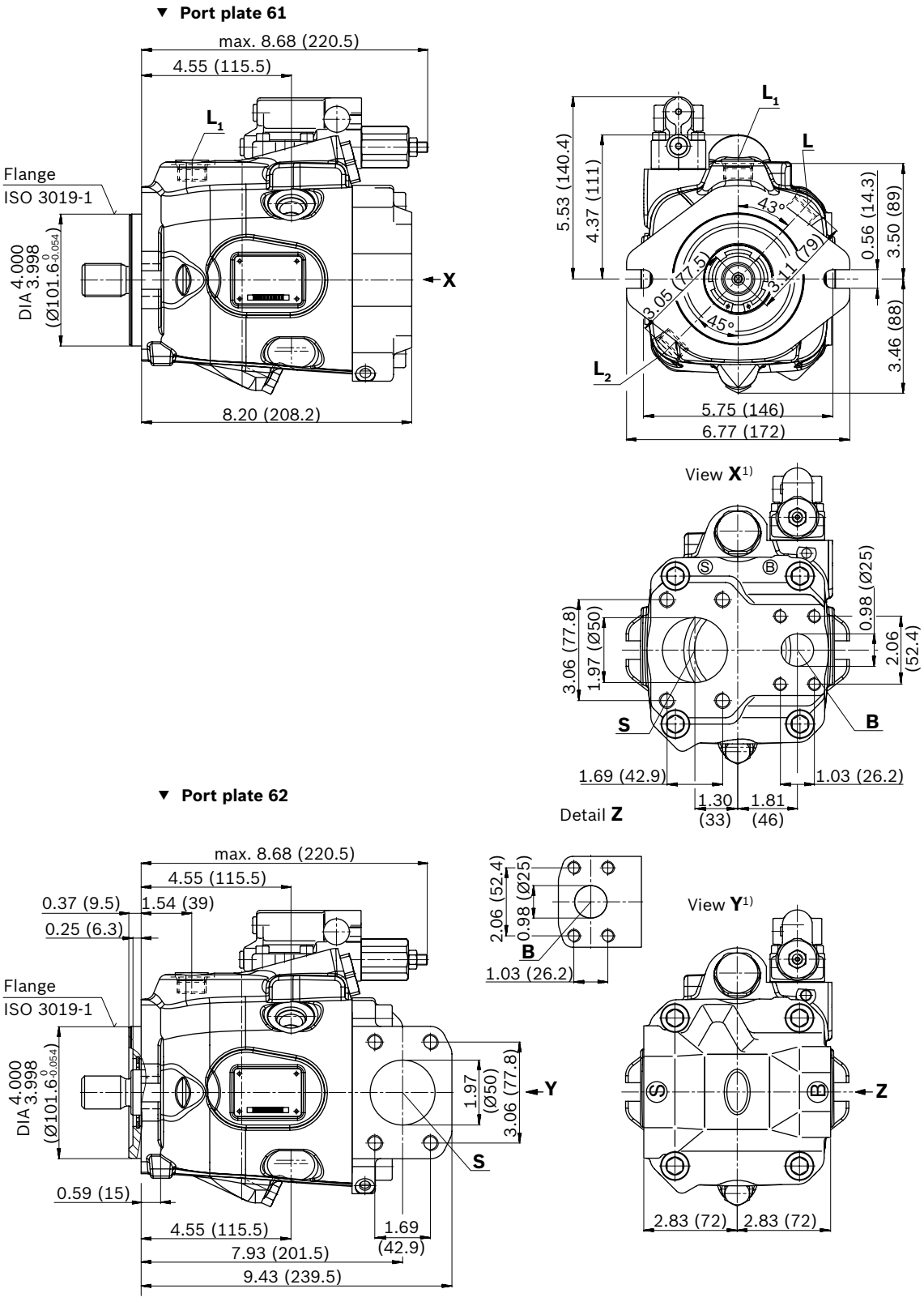
▼ **ED7. / ER7. – Electro-proportional Pressure control, series 53 (52)**



1) ER7.: 6.77 inch (172 mm) if using an intermediate plate pressure controller

Dimensions size 72

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

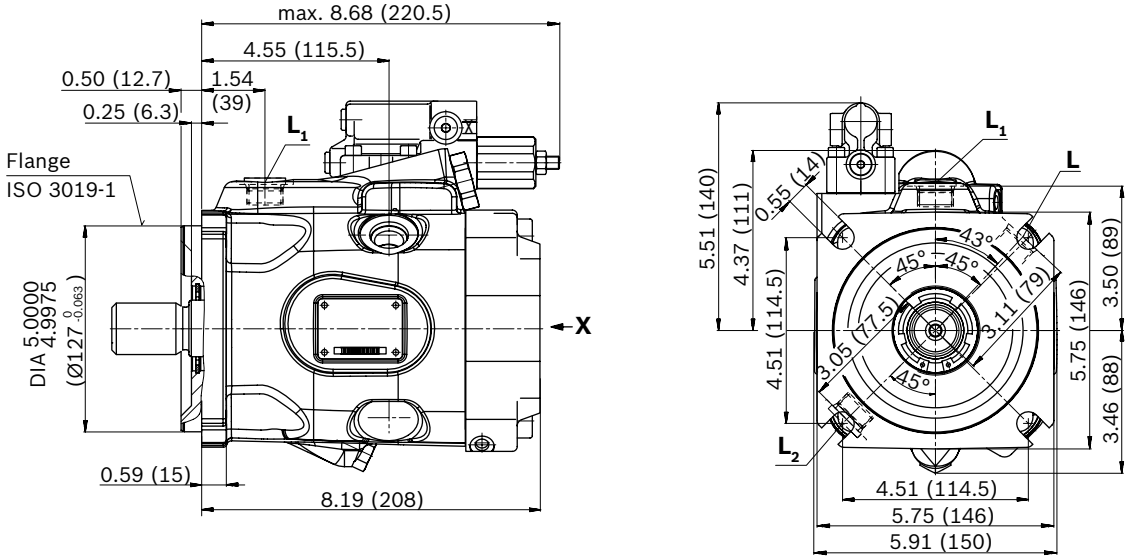


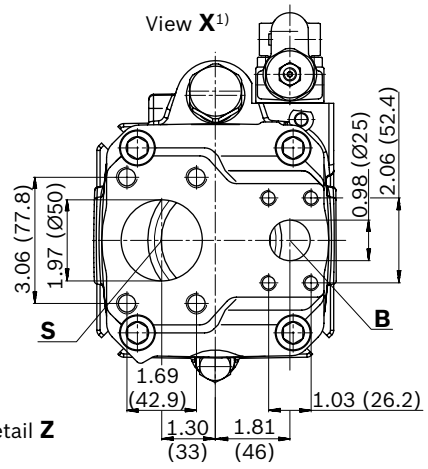
1) Dimensions of working ports turned through 180° for counter-clockwise rotation

Dimensions size 72

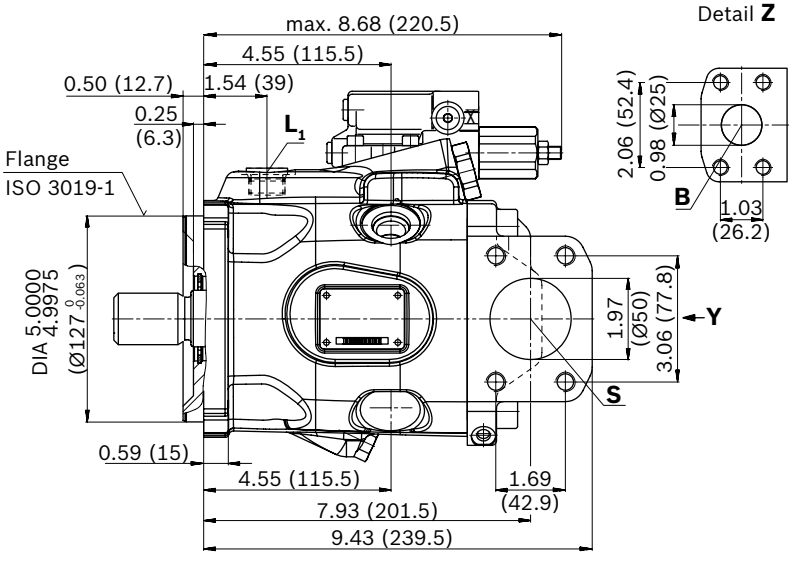
DR – Hydraulic pressure controller, clockwise rotation, mounting flange D series 53

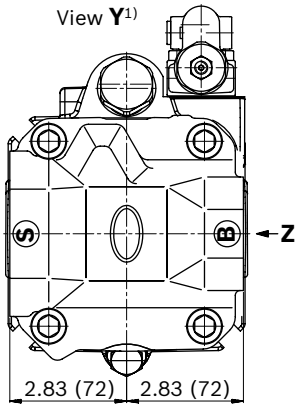
▼ **Port plate 61**





▼ **Port plate 62**



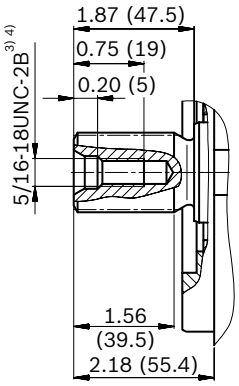


1) Dimensions of working ports turned through 180° for counter-clockwise rotation

Ports see page 50

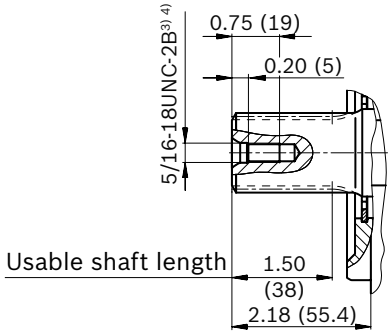
▼ **Splined shaft 1 1/4 in SAE J744**

S – 14T 12/24DP[1)]



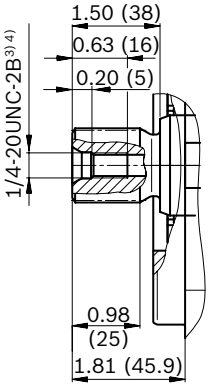
▼ **Splined shaft 1 1/4 in SAE J744**

R – 14T 12/24DP[1)2)]



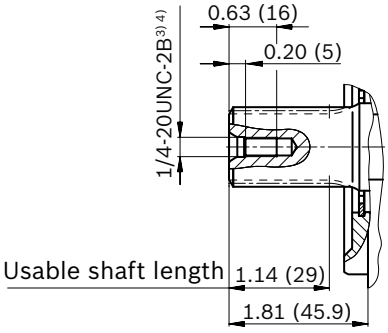
▼ **Splined shaft 1 in SAE J744**

U – 15T 16/32DP[1)]



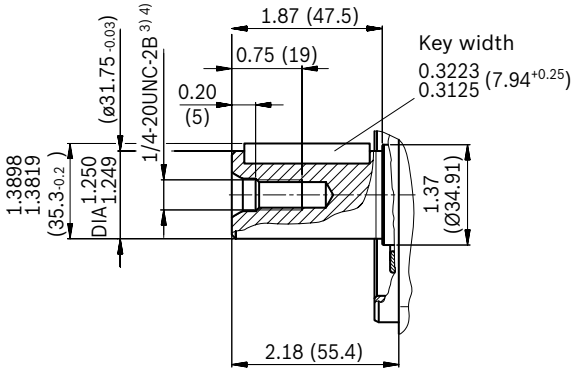
▼ **Splined shaft 1 in SAE J744**

W – 15T 16/32DP[1)]



▼ **Parallel keyed shaft (ISO 3019-1)**

K – 32-1

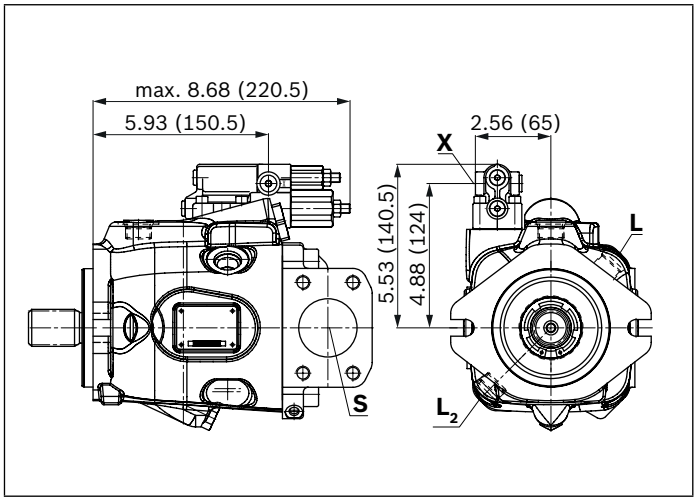


1) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Splines according to ANSI B92.1a, run out of spline is a deviation from standard.
3) Thread according to ASME B1.1
4) Observe the instructions in the operating instructions concerning the maximum tightening torques.

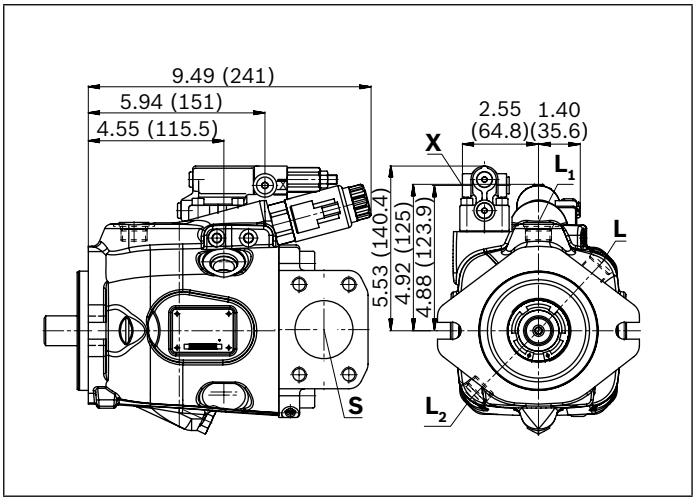
Ports		Standard	Size[1)]	$p_{max\ abs}$ psi [bar][2)]	State[6)]
B	Working port (Standard pressure series) Fastening thread	SAE J518 ASME B1.1	1 in 3/8-16UNC-2B; 0.71 (18) deep	4550 (315)	O
S	Suction port (standard pressure series) Fastening thread	SAE J518 ASME B1.1	2 in 1/2-13UNC-2B; 0.87 (22) deep	75 (5)	O
L	Drain port	ISO 11926[3)]	7/8-14UNF-2B; 0.51 (13) deep	30 (2)	O[4)]
L_1, L_2 [5)]	Drain port	ISO 11926[3)]	7/8-14UNF-2B; 0.51 (13) deep	30 (2)	X[4)]
X	Control pressure	ISO 11926	7/16-20UNF-2A; 0.45 (11.5) deep	4550 (315)	O

1) Observe the instructions in the operating instructions concerning the maximum tightening torques.
2) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
3) The spot face can be deeper than as specified in the standard.
4) Depending on the installation position, **L**, **L_1** or **L_2** must be connected (also see installation instructions starting on page 68).
5) Only series 53
6) O = Must be connected (plugged when delivered)
X = Plugged (in normal operation)

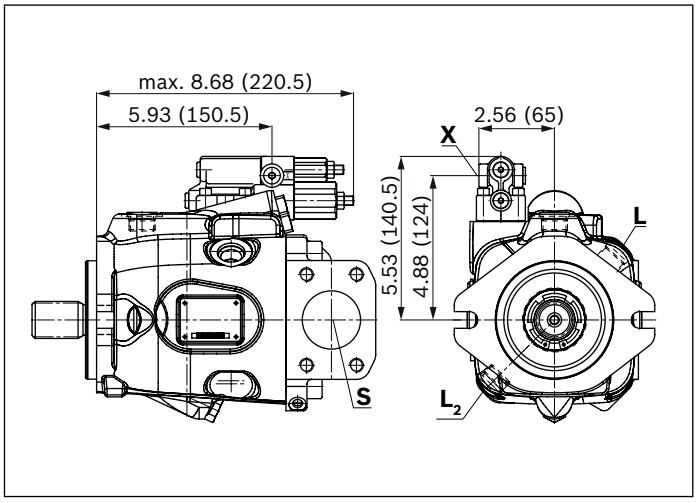
▼ **DRG – Pressure controller, remote controlled, series 53**



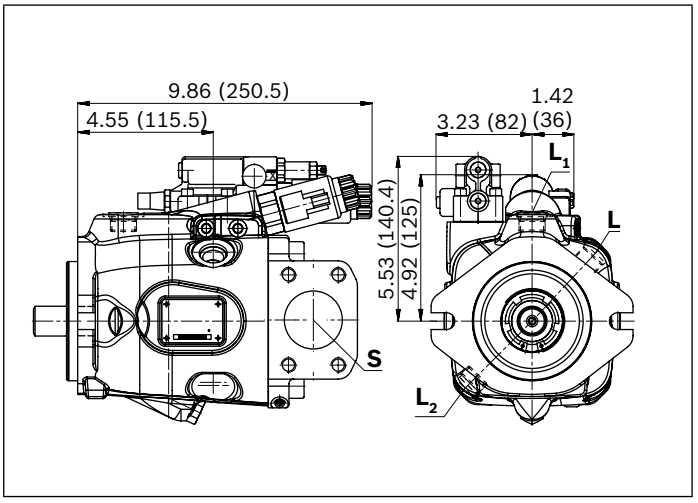
▼ **EP.D. / EK.D. – Electro-proportional control, series 53**



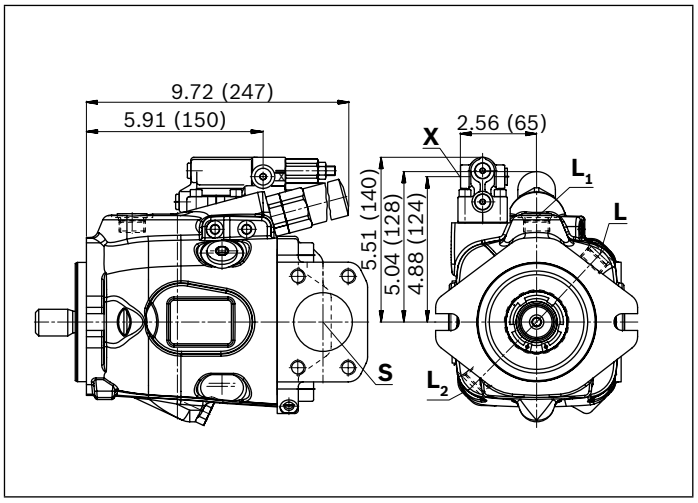
▼ **DRF/DRS/DRSC – Pressure and flow control, series 53**



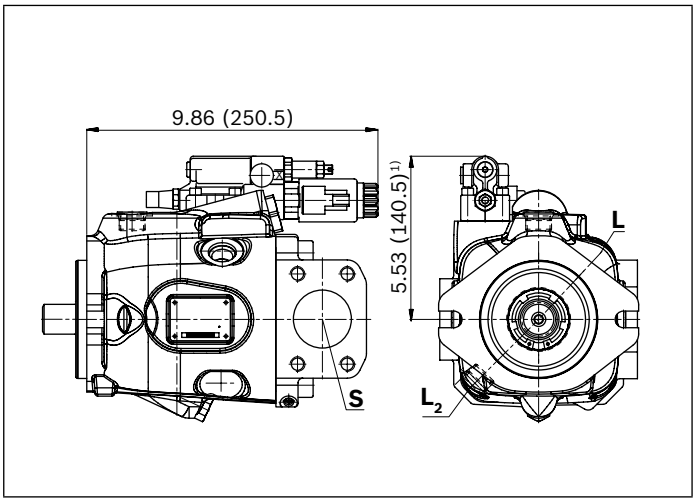
▼ **EP.ED. / EK.ED. – Electro-proportional control, series 53**



▼ **LA.D. – Pressure, flow and power control, series 53**



▼ **ED7. / ER7. – Electro-proportional Pressure control, series 53**

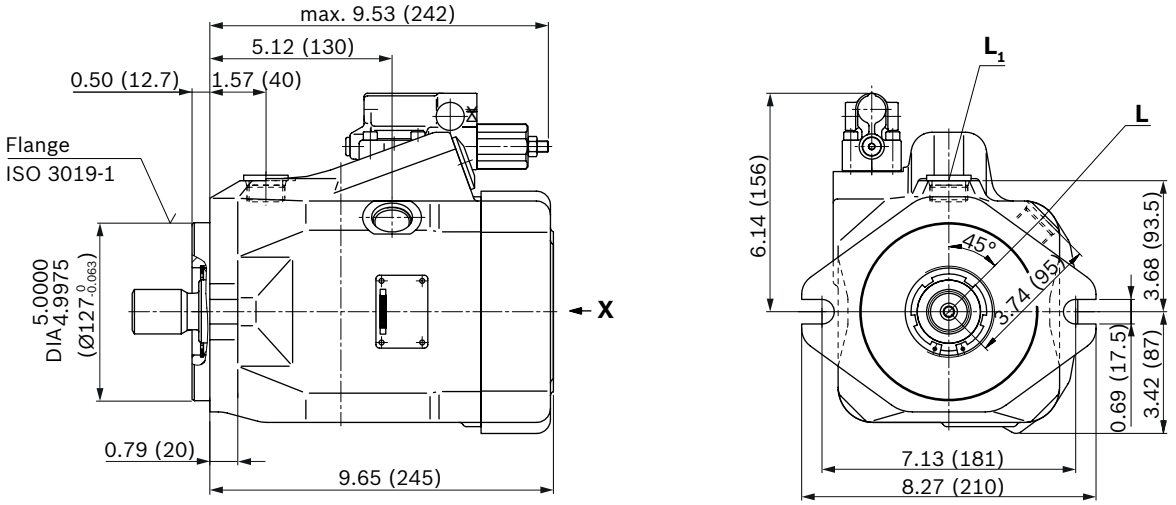


1) ER7.: 6.91 inch (175.5 mm) if using an intermediate plate pressure controller

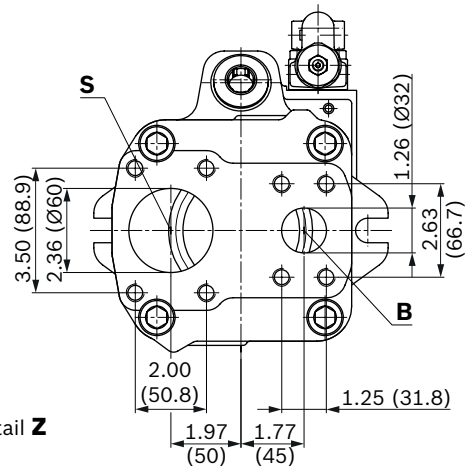
Dimensions size 85

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

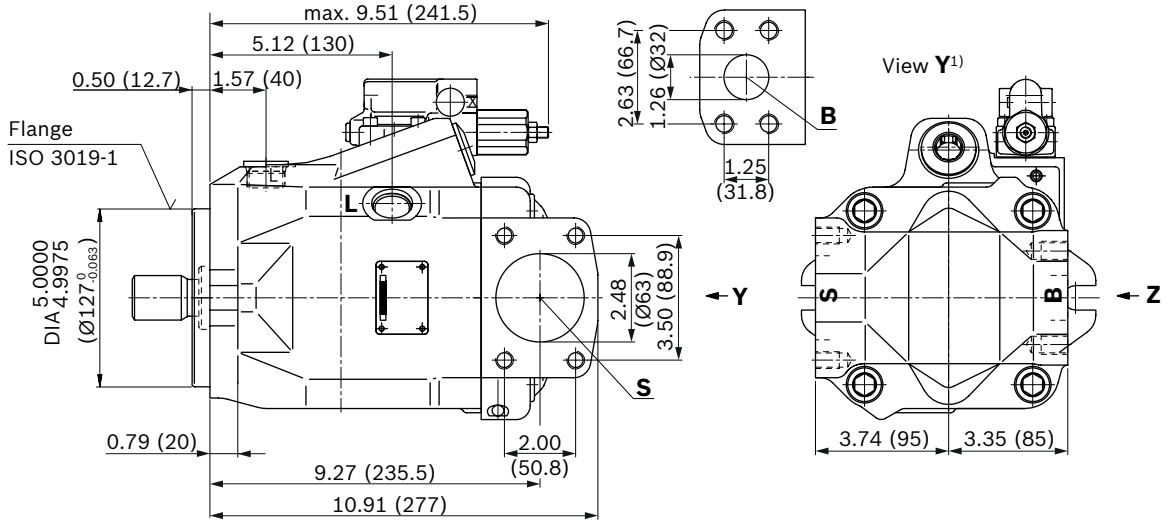
▼ **Port plate 61**



View **X**[1)]



▼ **Port plate 62**



Detail **Z**

View **Y**[1)]

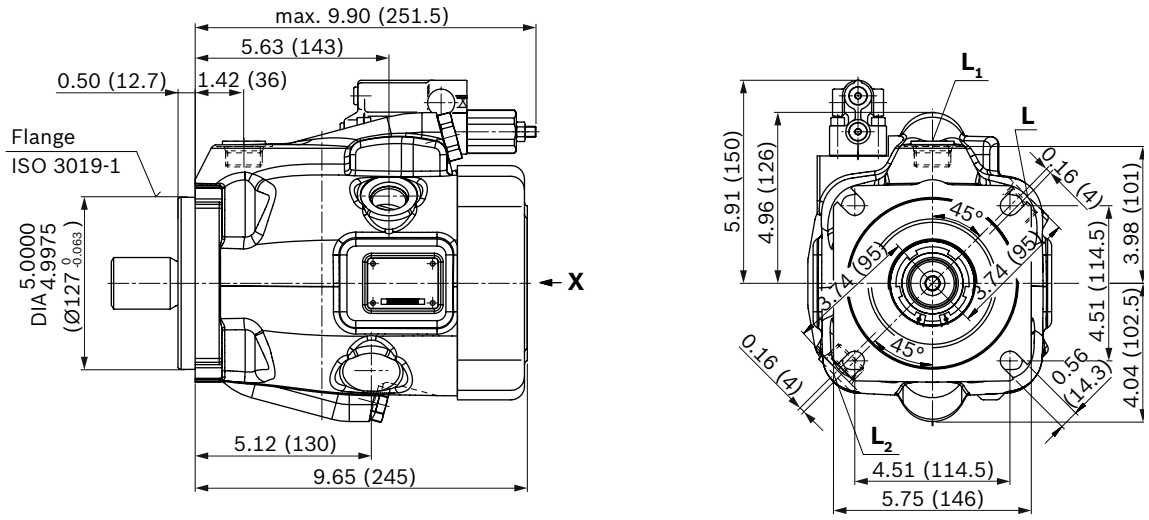
1) Dimensions of working ports turned through 180° for counter-clockwise rotation

Ports see page 55

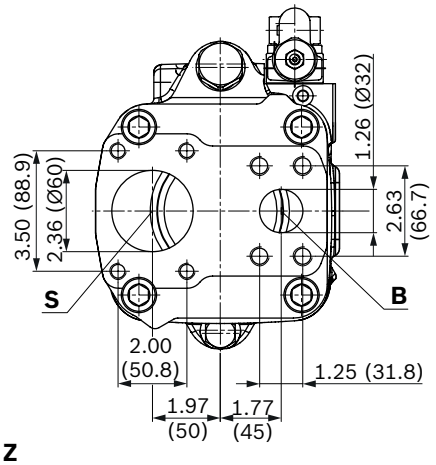
Dimensions size 85

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

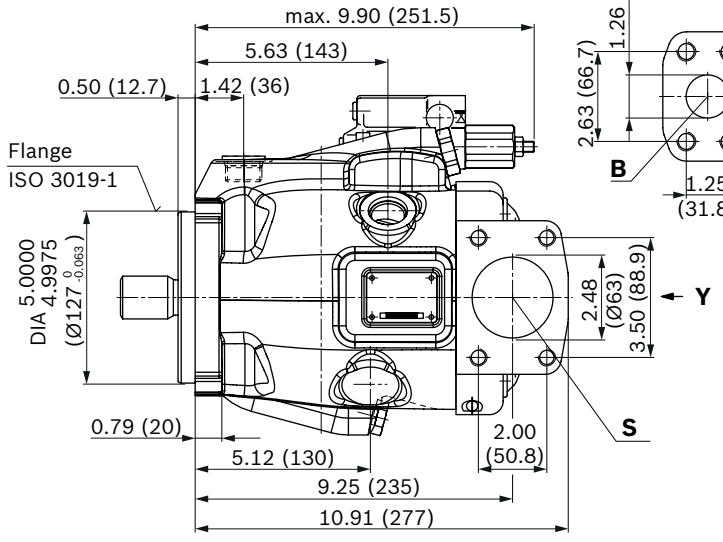
▼ **Port plate 61**



View **X**[1)]

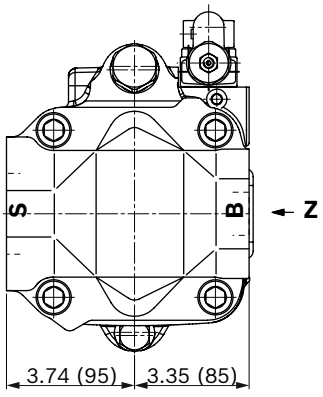


▼ **Port plate 62**



Detail **Z**

View **Y**[1)]

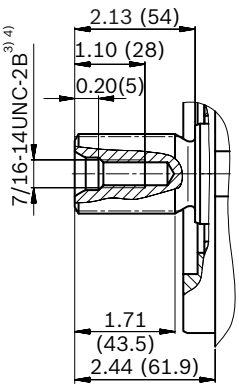


1) Dimensions of working ports turned through 180° for counter-clockwise rotation

Ports see page 55

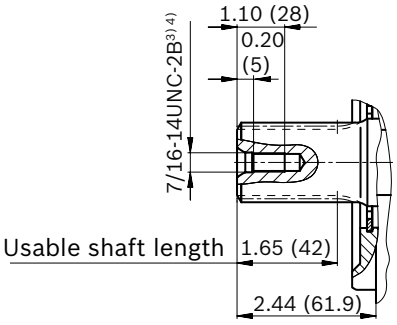
▼ **Splined shaft 1 1/2 in SAE J744**

S – 17T 12/24DP[1)]



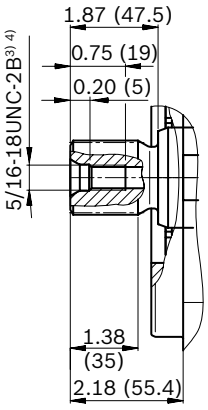
▼ **Splined shaft 1 1/2 in SAE J744**

R – 17T 12/24DP[1)]



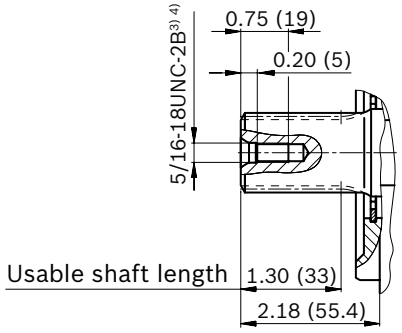
▼ **Splined shaft 1 1/4 in SAE J744**

U – 14T 12/24DP[1)]



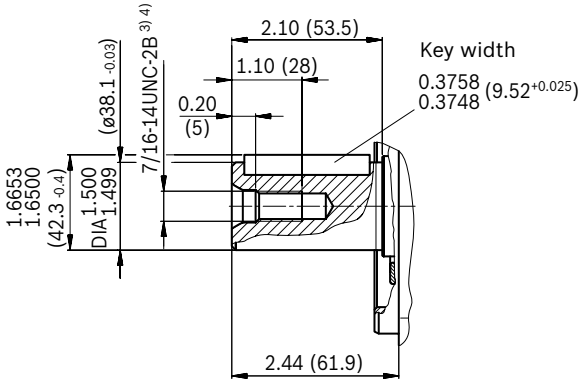
▼ **Splined shaft 1 1/4 in SAE J744**

W – 14T 12/24DP[1)]



▼ **Parallel keyed shaft (ISO 3019-1)**

K – 38-1

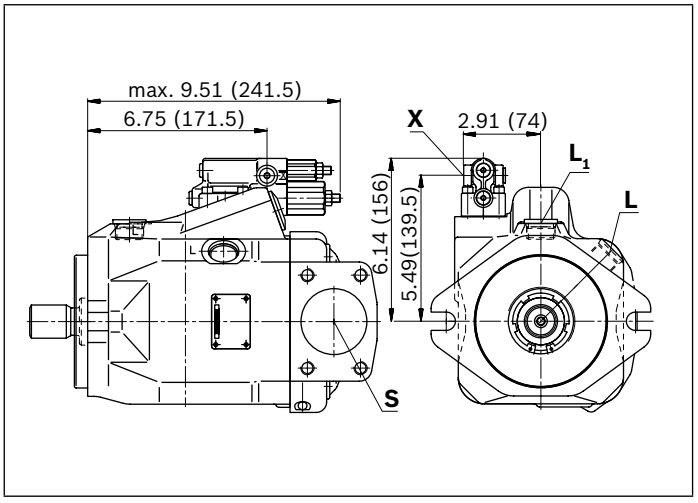


1) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Splines according to ANSI B92.1a, run out of spline is a deviation from standard.
3) Thread according to ASME B1.1
4) Observe the instructions in the operating instructions concerning the maximum tightening torques

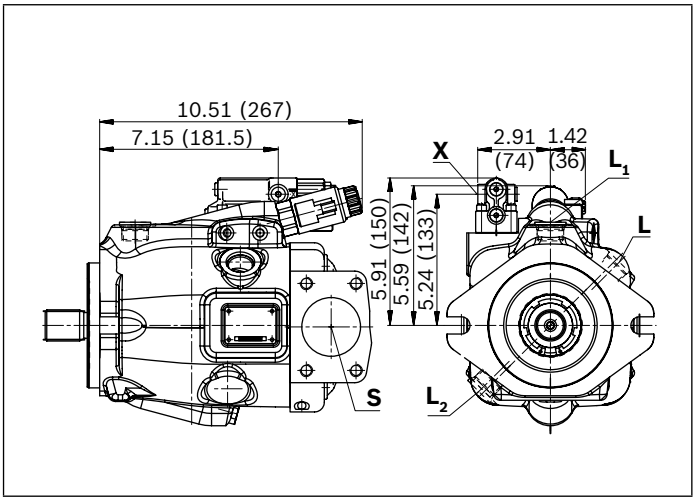
Ports		Standard	Size[4]	$p_{max\ abs}$ psi [bar][5]	State[8]
B	Working port (Standard pressure series) Fastening thread	SAE J518 ASME B1.1	1 1/4 in 1/2-13UNC-2B; 0.75 (19) deep	4550 (315)	O
S	Suction port (standard pressure series) Fastening thread	SAE J518 ASME B1.1	2 1/2 in 1/2-13UNC-2B; 1.07 (27) deep	75 (5)	O
L	Drain port	ISO 11926[6]	1 1/16-12UNF-2B; 0.59 (15) deep	30 (2)	O[7]
L_1, L_2	Drain port	ISO 11926[6]	1 1/16-12UNF-2B; 0.59 (15) deep	30 (2)	X[7]
X	Control pressure	ISO 11926	7/16-20UNF-2A; 0.45 (11.5) deep	4550 (315)	O

1) Observe the instructions in the operating instructions concerning the maximum tightening torques.
2) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
3) The spot face can be deeper than as specified in the standard.
4) Depending on the installation position, **L**, **L_1** or **L_2** must be connected (also see installation instructions starting on page 68).
5) Only series 53
6) O = Must be connected (plugged when delivered)
X = Plugged (in normal operation)

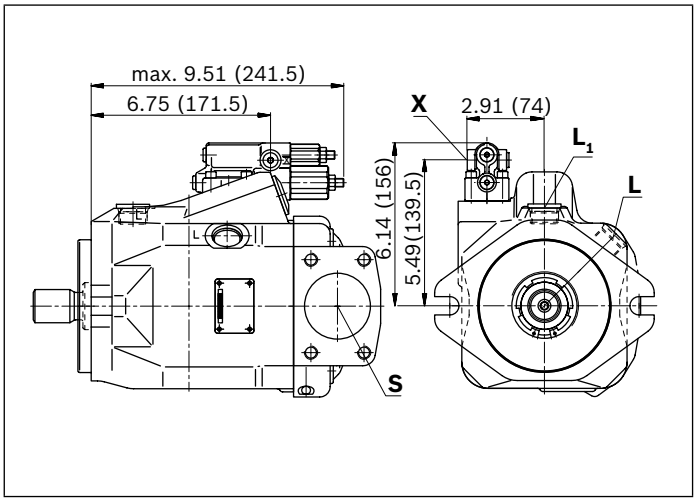
▼ **DRG – Pressure controller, remote controlled, series 52 (53)**



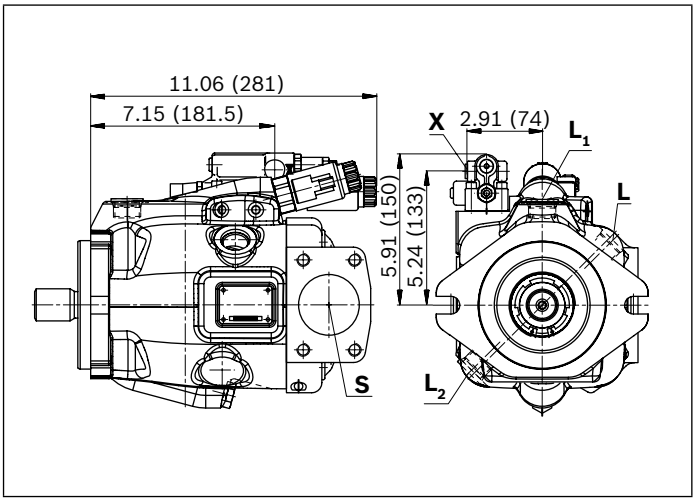
▼ **EP.D. / EK.D. – Electro-proportional control, series 53**



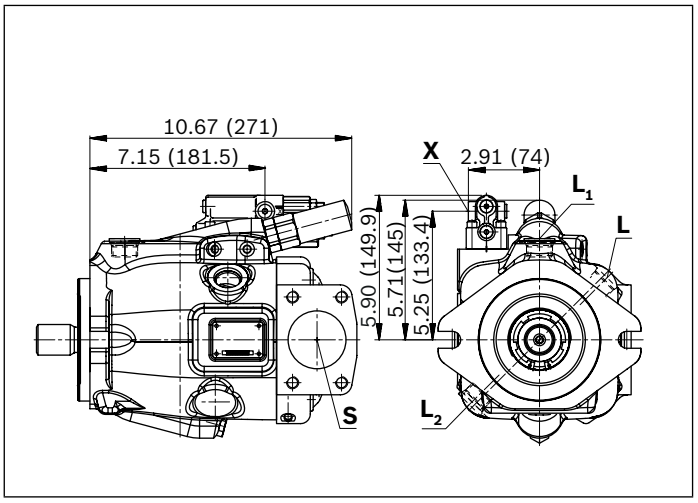
▼ **DRF/DRS/DRSC – Pressure and flow control, series 52 (53)**



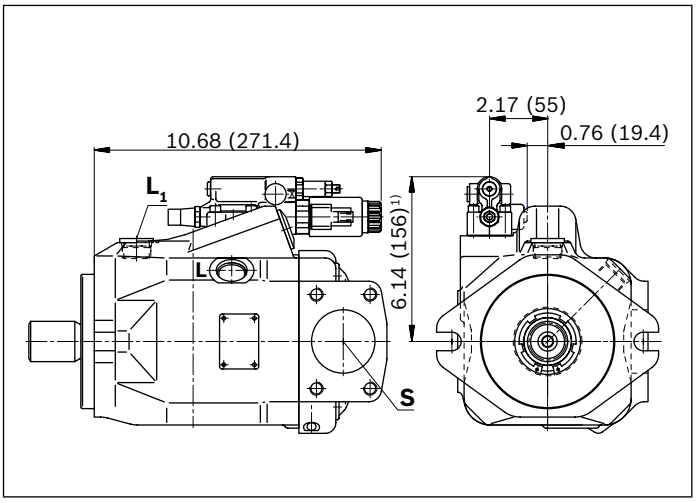
▼ **EP.ED. / EK.ED. – Electro-prop. control, series 53**



▼ **LA.D. – Pressure, flow and power control, series 53**



▼ **ED7. / ER7. – Electro-prop. Pressure control, series 52 (53)**

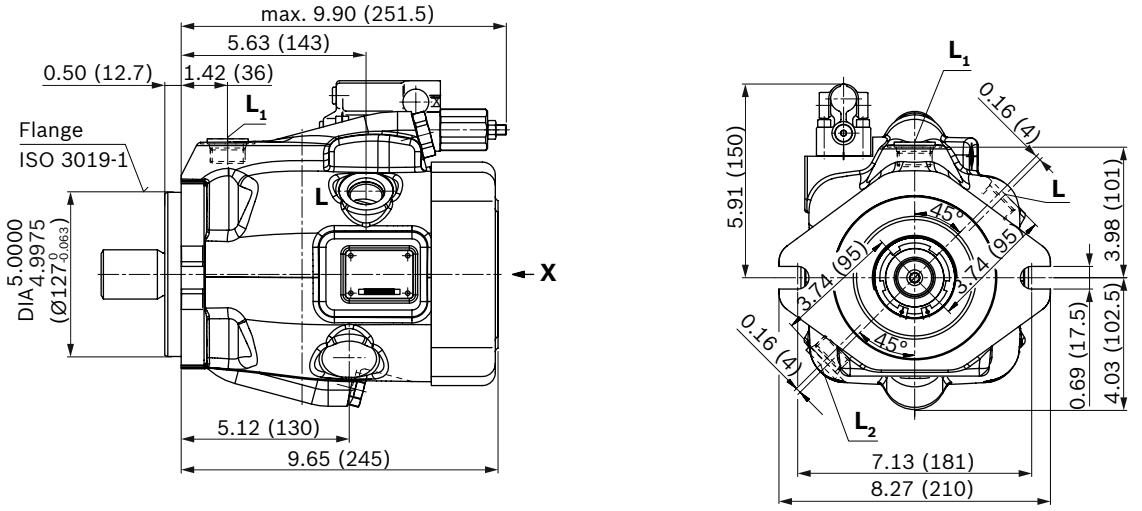


1) ER7.: 7.52 inch (191 mm) if using an intermediate plate pressure controller

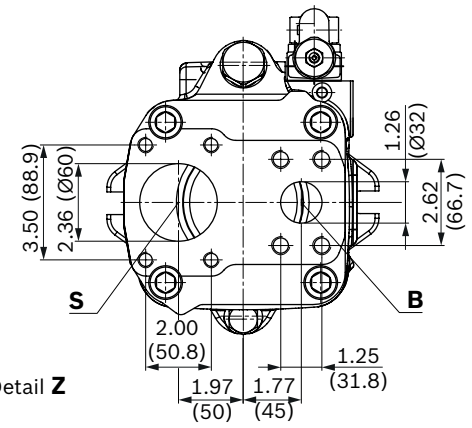
Dimensions size 100

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

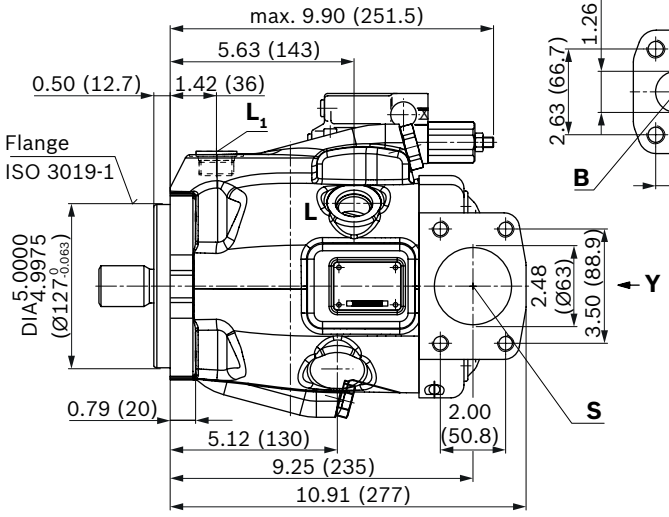
▼ **Port plate 61**



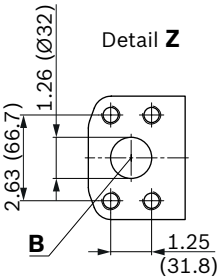
View **X**[1)]



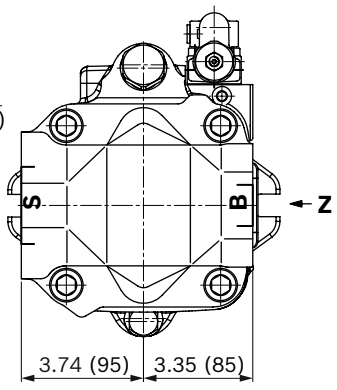
▼ **Port plate 62**



Detail **Z**



View **Y**[1)]

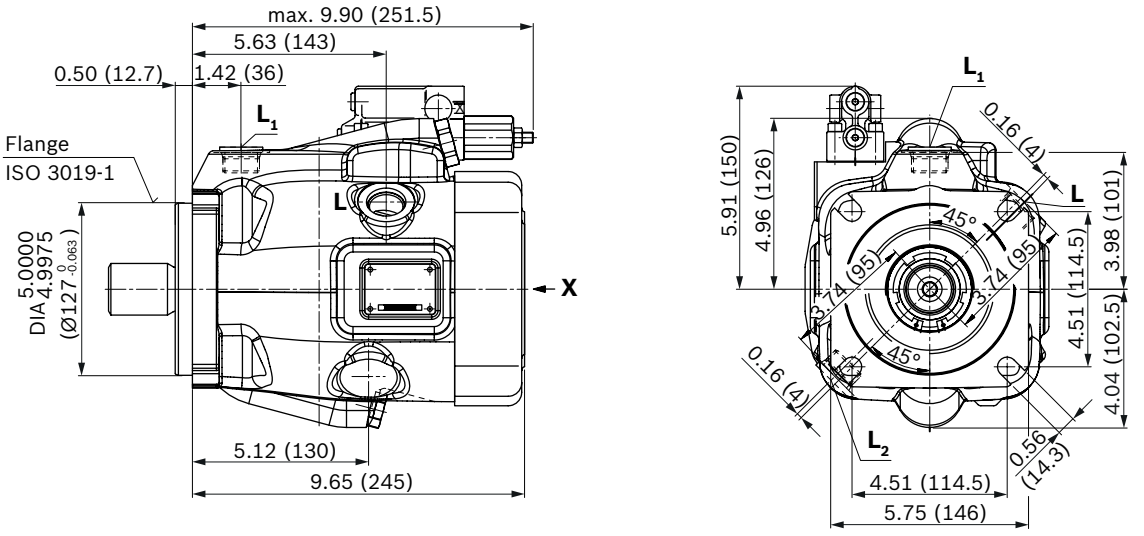


1) Dimensions of working ports turned through 180° for counter-clockwise rotation

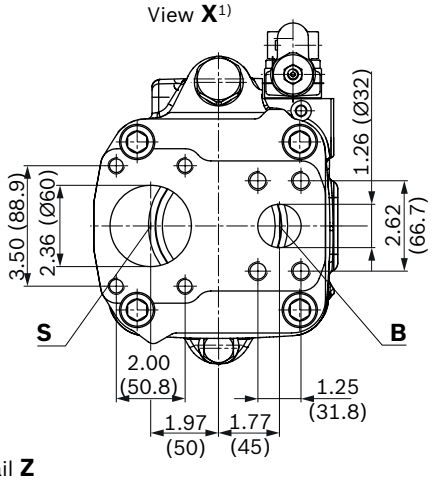
Dimensions size 100

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

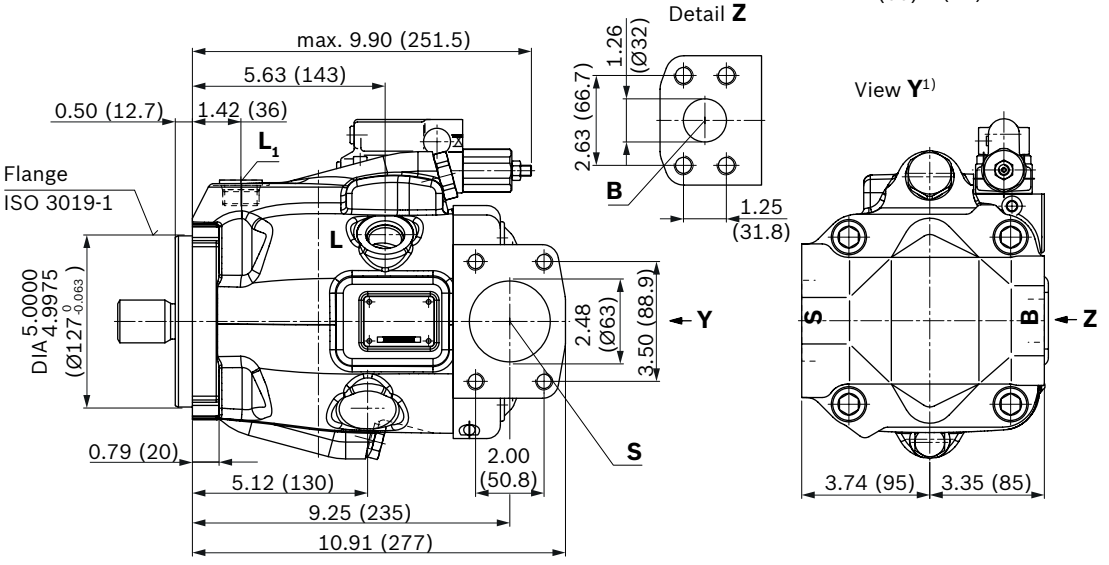
▼ **Port plate 61**



View **X**[1)]



▼ **Port plate 62**



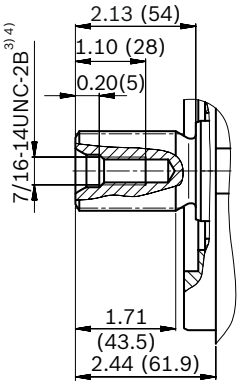
Detail **Z**

View **Y**[1)]

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

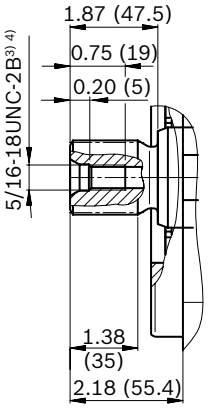
▼ **Splined shaft 1 1/2 in SAE J744**

S – 17T 12/24DP[1)]



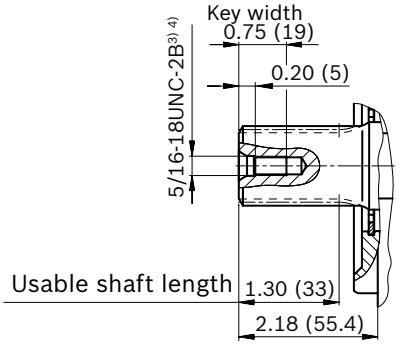
▼ **Splined shaft 1 1/4 in SAE J744**

U – 14T 12/24DP[1)]



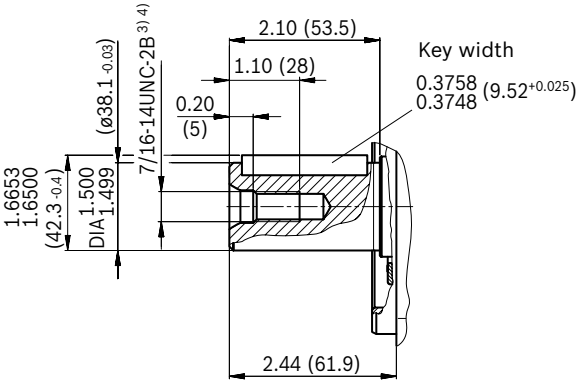
▼ **Splined shaft 1 1/4 in SAE J744**

W – 14T 12/24DP[1)]



▼ **Parallel keyed shaft (ISO 3019-1)**

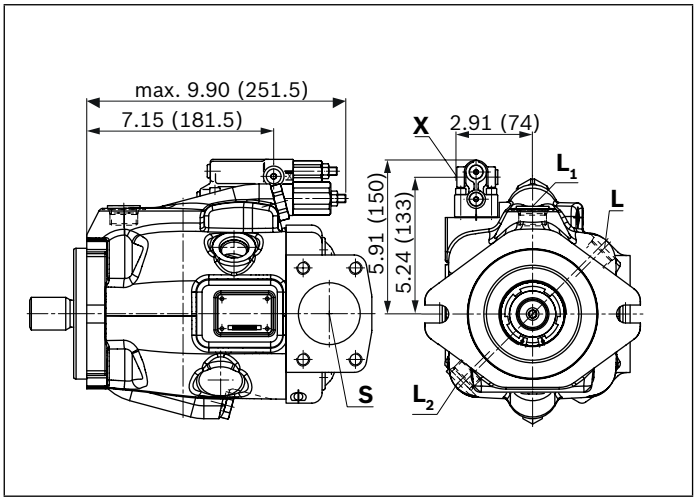
K – 38-1



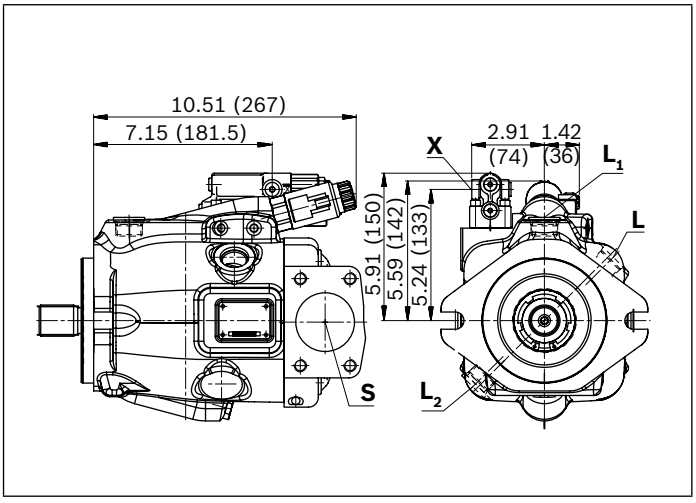
Ports		Standard	Size[4)]	$p_{max\ abs}$ [psi (bar)][5)]	Status[9)]
B	Working port (high-pressure line) Fastening thread	SAE J518 ASME B1.1	1 1/4 in 1/2-13UNC-2B; 0.75 (19) deep	4550 (315)	O
S	Suction port (standard pressure series) Fastening thread	SAE J518 ASME B1.1	2 1/2 in 1/2-13UNC-2B; 1.07 (27) deep	75 (5)	O
L	Drain port	ISO 11926[6)]	1 1/16-12UNF-2B; 0.59 (15) deep	30 (2)	O[7)]
L_1, L_2[8)]	Drain port	ISO 11926[6)]	1 1/16-12UNF-2B; 0.59 (15) deep	30 (2)	X[7)]
X	Control pressure	ISO 11926	7/16-20UNF-2A; 0.45 (11.5) deep	4550 (315)	O

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, run out of spline is a deviation from standard.
3) Thread according to ASME B1.1
4) Observe the instructions in the operating instructions concerning the maximum tightening torques.
5) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
6) The spot face can be deeper than as specified in the standard.
7) Depending on the installation position, **L**, **L_1** or **L_2** must be connected (also see installation instructions starting on page 68).
8) Only series 53
9) O = Must be connected (plugged when delivered)
X = Plugged (in normal operation)

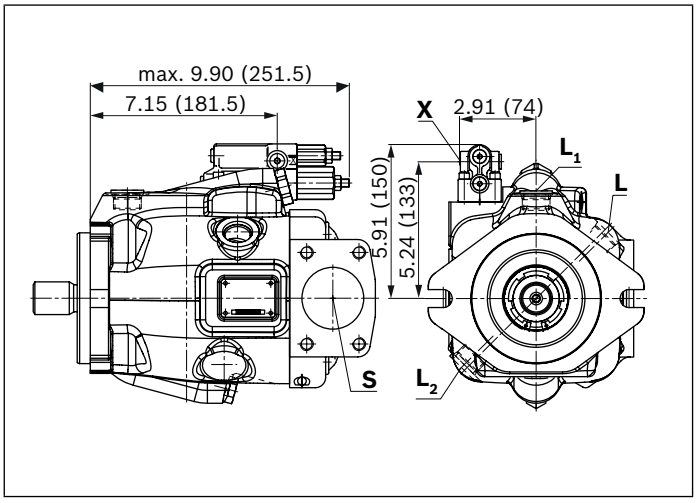
▼ **DRG – Pressure controller, remote controlled, series 53**



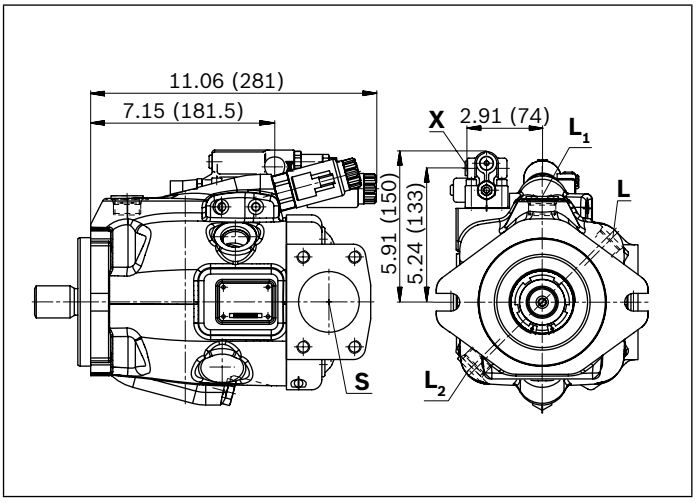
▼ **EP.D. / EK.D. – Electro-proportional control, series 53**



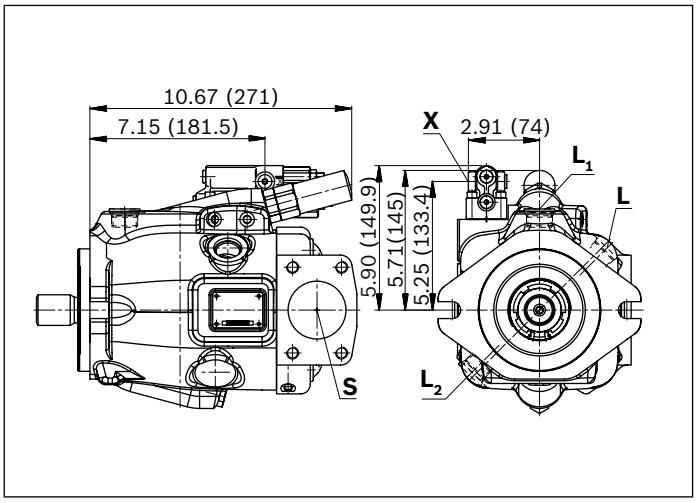
▼ **DRF/DRS/DRSC – Pressure and flow control, series 53**



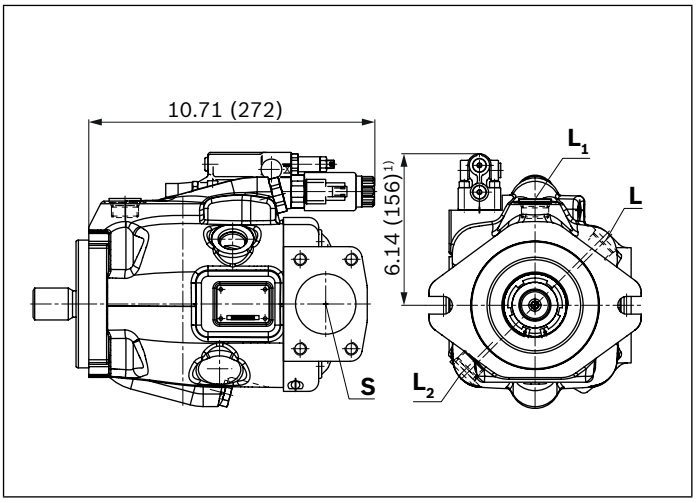
▼ **EP.ED. / EK.ED. – Electro-proportional control, series 53**



▼ **LA.D. – Pressure, flow and power control, series 53**



▼ **ED7. / ER7. – Electro-proportional Pressure control, series 53**



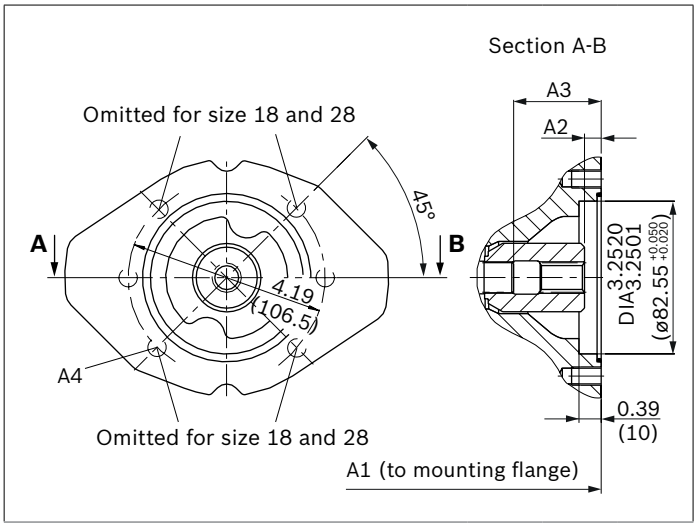
1) ER7.: 7.52 inch (191 mm) if using an intermediate plate pressure controller

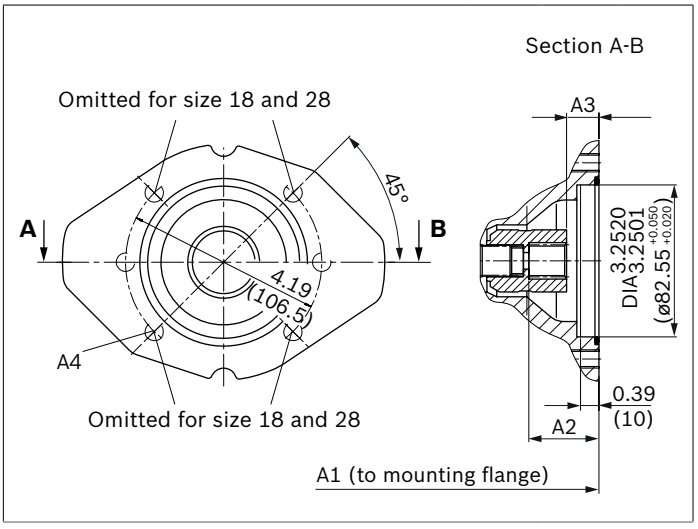
Dimensions through drive

Flange ISO 3019-1 (SAE)		Hub for splined shaft[1]		Availability over sizes							Code
Diameter	**Attachment[2]**	**Diameter**		**18**	**28**	**45**	**60/63**	**72**	**85**	**100**	
82-2 (A)	☍, ☌	5/8 in	9T 16/32DP	●	●	●	●	●	●	●	K01
		3/4 in	11T 16/32DP	●	●	●	●	●	●	●	K52

● = Available ○ = On request

▼ **82-2**





K01 (SAE J744 16-4 (A))	**NG**	**A1**	**A2**	**A3**	**A4[3]**
	18	7.17 (182)	0.37 (9.3)	1.70 (43.3)	M10; 0.57 (14.5) deep
	28	8.03 (204)	0.39 (9.9)	1.85 (47)	M10; 0.63 (16) deep
	45	9.02 (229)	0.42 (10.7)	2.09 (53)	M10; 0.63 (16) deep
	60/63	10.04 (255)	0.37 (9.5)	2.32 (59)	M10; 0.63 (16) deep
	72	10.04 (255)	0.37 (9.5)	2.32 (59)	M10; 0.63 (16) deep
	85	11.89 (302)	0.53 (13.4)	2.68 (68)	M10; 0.79 (20) deep
	100	11.89 (302)	0.53 (13.4)	2.68 (68)	M10; 0.79 (20) deep

K52 (SAE J744 19-4 (A-B))	**NG**	**A1**	**A2**	**A3**	**A4[3]**
	18	7.17 (182)	1.54 (39)	0.74 (18.8)	M10; 0.57 (14.5) deep
	28	8.03 (204)	1.54 (39.3)	0.74 (18.8)	M10; 0.63 (16) deep
	45	9.02 (229)	1.55 (39.4)	0.75 (18.9)	M10; 0.63 (16) deep
	60/63	10.04 (255)	1.55 (39.4)	0.75 (18.9)	M10; 0.63 (16) deep
	72	10.04 (255)	1.55 (39.4)	0.75 (18.9)	M10; 0.63 (16) deep
	85	11.89 (302)	1.74 (44.1)	0.93 (23.6)	M10; 0.79 (20) deep
	100	11.89 (302)	1.74 (44.1)	0.93 (23.6)	M10; 0.79 (20) deep

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

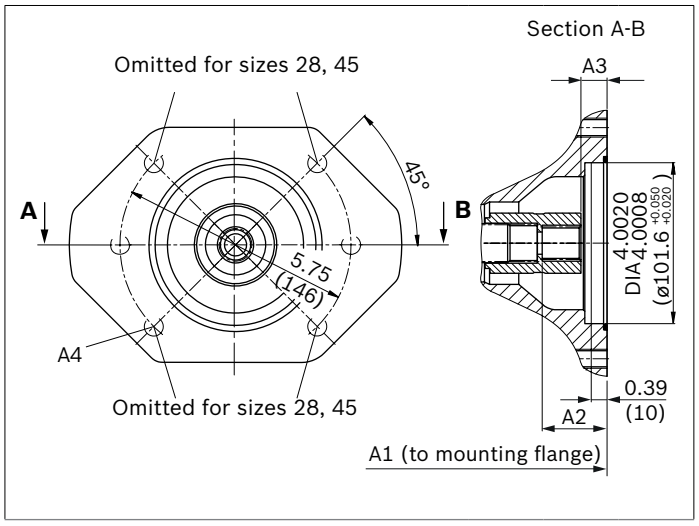
2) Mounting bores pattern viewed from through drive with control at top

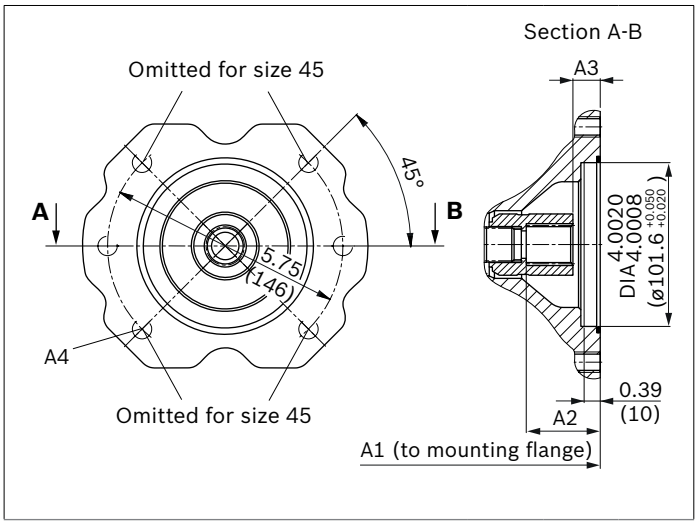
3) Thread according to DIN 13, observe the instructions in the instruction manual for the maximum tightening torques.

Flange ISO 3019-1 (SAE)		Hub for splined shaft[1]		Availability over sizes							Code
Diameter	Attachment[2]	Diameter		18	28	45	60/63	72	85	100	
101-2 (B)	⚬, ⚬⚬	7/8 in	13T 16/32DP	–	●	●	●	●	●	●	K68
		1 in	15T 16/32DP	–	–	●	●	●	●	●	K04

● = Available ○ = On request

▼ **101-2**





K68 (SAE J744 22-4 (B))	NG	A1	A2	A3	A4[3]
	28	8.03 (204)	1.66 (42.3)	0.70 (17.8)	M12; 0.71 (18) deep
	45	9.02 (229)	1.67 (42.4)	0.71 (17.9)	M12×1.75; 0.71 18 deep
	60/63	10.04 (255)	1.67 (42.4)	0.71 (17.9)	M12; 0.71 (18) deep
	72	10.04 (255)	1.67 (42.4)	0.71 (17.9)	M12; 0.71 (18) deep
	85	11.89 (302)	1.83 (46.5)	0.87 (22)	M12; 0.79 (20) deep
	100	11.89 (302)	1.83 (46.5)	0.87 (22)	M12; 0.79 (20) deep

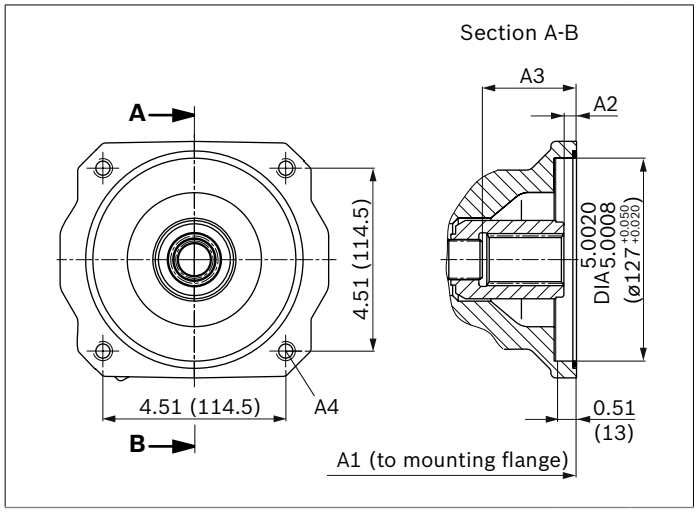
K04 (SAE J744 25-4 (B-B))	NG	A1	A2	A3	A4[3]
	45	9.02 (229)	1.88 (47.9)	0.74 (18.9)	M12; 0.71 (18) deep
	60/63	10.04 (255)	1.87 (47.4)	0.72 (18.4)	M12; 0.71 (18) deep
	72	10.04 (255)	1.87 (47.4)	0.72 (18.4)	M12; 0.71 (18) deep
	85	11.89 (302)	2.02 (51.2)	0.87 (22.2)	M12; 0.79 (20) deep
	100	11.89 (302)	2.02 (51.2)	0.87 (22.2)	M12; 0.79 (20) deep

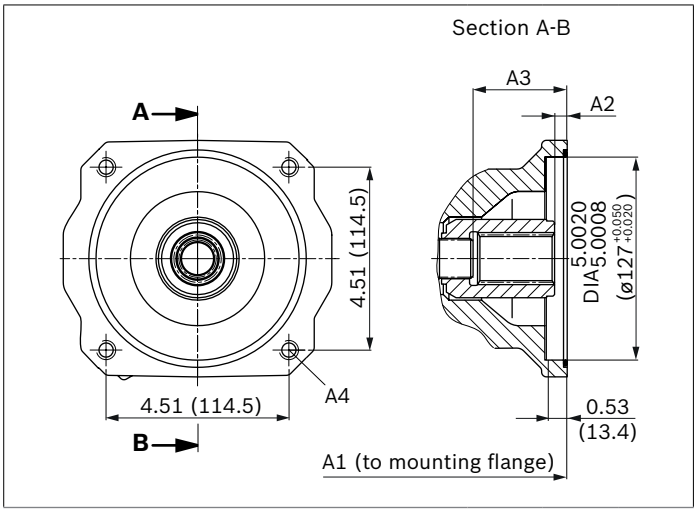
1) According to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Mounting bores pattern viewed from through drive with control at top
3) Thread according to DIN 13, observe the instructions in the instruction manual for the maximum tightening torques.

Flange ISO 3019-1 (SAE)		Hub for splined shaft[1]		Availability over sizes							Code
Diameter	**Attachment[2]**	**Diameter**		**18**	**28**	**45**	**60/63**	**72**	**85**	**100**	
127-4 (C)	⌘	1 1/4 in	14T 12/24DP	–	–	–	●	●	●	●	K15
		1 1/2 in	17T 12/24DP	–	–	–	–	–	●	●	K16

● = Available ○ = On request

▼ **127-4**





K15 (SAE J744 32-4 (C))	NG	A1	A2	A3	A4[3]
	60/63	10.04 (255)	0.31 (8)	2.32 (59)	M12; 0.63 (16) deep
	72	10.04 (255)	0.31 (8)	2.32 (59)	M12; 0.63 (16) deep
	85	11.87 (301.5)	0.51 (13)	2.67 (67.9)	M12; through
	100	11.87 (301.5)	0.51 (13)	2.67 (67.9)	M12; through

K16 (SAE J744 32-4 (C))	NG	A1	A2	A3	A4[3]
	85	11.87 (301.5)	0.51 (13)	2.67 (67.9)	M12; through
	100	11.87 (301.5)	0.51 (13)	2.67 (67.9)	M12; through

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

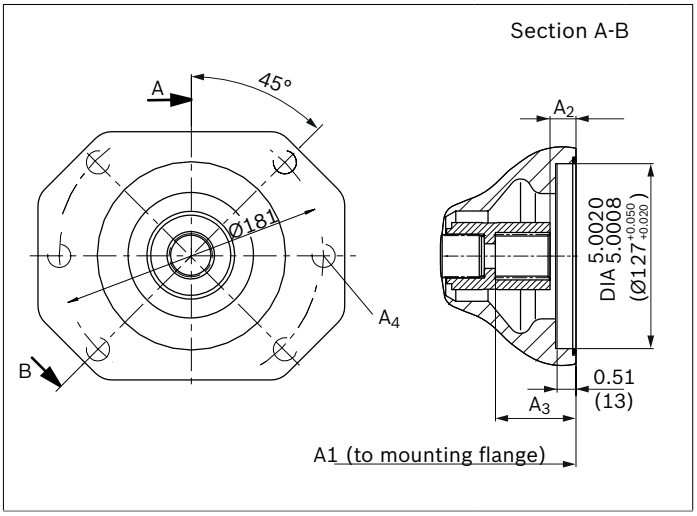
2) Mounting bores pattern viewed from through drive with control at top

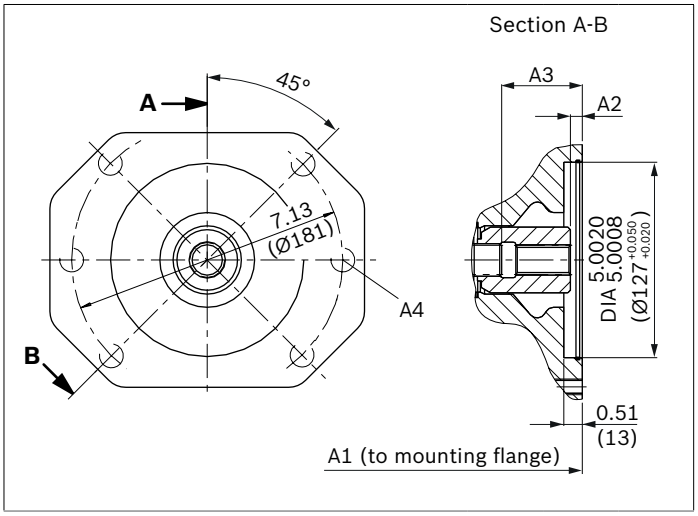
3) Thread according to DIN 13, observe the instructions in the instruction manual for the maximum tightening torques.

Flange ISO 3019-1 (SAE)		Hub for splined shaft[1]	Availability over sizes							Code
Diameter	Attachment[2]	**Diameter**	**18**	**28**	**45**	**60/63**	**72**	**85**	**100**	
127-2 (B)	☍, ⊶	1 1/4 in 14T 12/24DP	–	–	–	–	–	●	●	K07
		1 1/2 in 17T 12/24DP	–	–	–	–	–	●	●	K24

● = Available ○ = On request

▼ **127-2**





K07 (SAE J744 32-4 (C))	NG	A1	A2	A3	A4[3]
	85	11.87 (301.5)	0.86 (21.8)	2.33 (59.3)	M16;0.94 (24) deep
	100	11.87 (301.5)	0.86 (21.8)	2.33 (59.3)	M16;0.94 (24) deep

K24 (SAE J744 38-4 (C-C))	NG	A1	A2	A3	A4[3]
	85	11.89 (302)	0.31 (8)	2.68 (68)	M16; 0.94 (24) deep
	100	11.89 (302)	0.31 (8)	2.68 (68)	M16; 0.94 (24) deep

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

2) Mounting bores pattern viewed from through drive with control at top

3) Thread according to DIN 13, observe the instructions in the instruction manual for the maximum tightening torques.

Overview of attachment options

Through drive			**Attachment options – 2nd pump**			
Flange ISO 3019-1	**Hub for splined shaft**	**Code**	**A10V(S)O/5x NG (shaft)**	**A10VO/31 NG (shaft)**	**A1VO/10 NG (shaft)**	**External gear**
82-2 (A)	5/8 in	K01	10 (U), 18 (U)	18 (U)	18 (S2)	AZPF
	3/4 in	K52	10 (S), 18 (S, R)	18 (S, R)	18 (S3)	
101-2 (B)	7/8 in	K68	28 (S, R) 45 (U, W)[1)]	28 (S, R) 45 (U,W)	35 (S4)	AZPN/AZPG
	1 in	K04	45 (S, R) 60, 63 (U, W)[2)] 72 (U, W)[2)]	45 (S, R)	35 (S5)	–
127-4 (C)	1 1/4 in	K15	60, 63 (S, R) 72 (S, R)	–	–	–
	1 1/2 in	K16	85 (S) 100 (S)	–	–	–
127-2 (C)	1 1/4 in	K07	85 (U,W) 100 (U,W)	71 (S, R)	–	PGH5
	1 1/2 in	K24	85 (S) 100 (S)	–	–	–

1) Not for NG28 with K68
2) Not for NG45 with K04

Combination pumps A10VO + A10VO

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

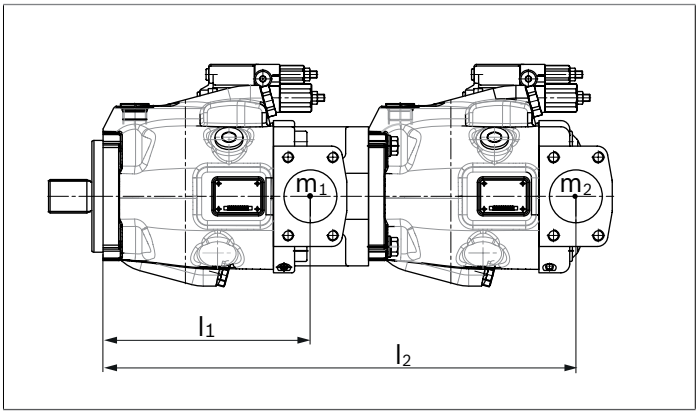
Order example:

A10VO85DRS/53R-VSC62K04+

A10VO45DRF/53R-VSC61N00

It is permissible to use a combination of two single pumps of the same nominal size (tandem pump) considering a dynamic mass acceleration of maximum 10 g (= 98.1 m/s^2) without additional support brackets.

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



m_1, m_2, m_3	Weight of pump	[lbs (kg)]
l_1, l_2, l_3	Distance, center of gravity	[in (mm)]

$$T_m = (m_1 \times l_1 + m_2 \times l_2 + m_3 \times l_3) \times \frac{1}{12\ (102)}$$ [lb-ft (Nm)]

Permissible mass moment of inertia

NG				10	18	28	45	60/63	72	85	100
static	T_m	lb-ft (Nm)	–	369 (500)	656 (890)	664 (900)	1010 (1370)	1010 (1370)	2270 (3080)	2270 (3080)
dynamic at 10 g (98.1 m/s^2)	T_m	lb-ft (Nm)	–	37 (50)	65 (89)	66 (90)	101 (137)	101 (137)	227 (308)	227 (308)
Weight with through-drive plate Weight without through-drive plate (e.g. 2nd pump)	m	lbs (kg)	– (–) 8 (18)	29 (13) 25 (11.5)	40 (18) 33 (15)	53 (24) 40 (18)	62 (28) 49 (22)	62 (28) 49 (22)	99 (45) 79 (36)	99 (45) 79 (36)
Distance, center of gravity **without** through drive	l_1	in (mm)	–	3.07 (78)	3.35 (85)	3.78 (96)	4.13 (105)	4.13 (105)	4,80 (122)	4.80 (122)
Distance, center of gravity **with** through drive	l_1	in (mm)	–	3.43 (87)	3.90 (99)	4.53 (115)	5.00 (127)	5.00 (127)	5.90 (150)	5.90 (150)

Connector for solenoids

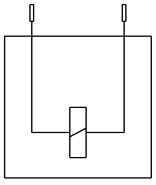
DEUTSCH DT04-2P

Molded connector, 2-pin, without bidirectional suppressor diode

The following type of protection ensues with a mounted mating connector:

- IP67 (DIN/EN 60529) and
- IP69K (DIN 40050-9)

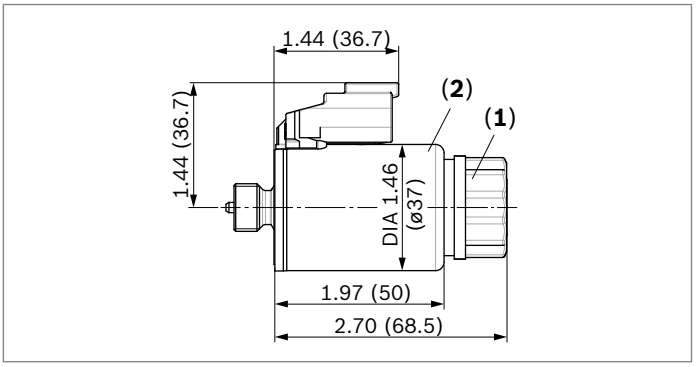
▼ **Circuit diagram symbol**



▼ **Mating connector DEUTSCH DT06-2S-EP04**

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

The mating connector is not included in the scope of delivery. This can be supplied by Bosch Rexroth on request (material number R902601804).



Changing plug position

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

To do this, proceed as follows:

- Loosen the mounting nut (**1**) of the solenoid. To do this, turn the mounting nut (**1**) one revolution counter-clockwise.
- Turn the solenoid body (**2**) to the desired orientation.
- Re-tighten the mounting nut.
  Tightening torque: $3.7^{+0.75}$ lb-ft (5^{+1} Nm).
  (WAF 26, 12-sided DIN 3124)

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

Electronic controls

Control	Electronics function	Electronics		Data sheet
Electric pressure control	Controlled power outlet	RA	analog	95230
		RC4-5/30	digital	95205

Installation instructions

General

The axial piston unit must be filled with hydraulic fluid and air bled during commissioning and operation. This must also be observed following a longer standstill as the axial piston unit may empty via the hydraulic lines.
Particularly with the "drive shaft up/down" installation position, filling and air bleeding must be carried out completely as there is, for example, a danger of dry running.
The case drain fluid in the pump housing must be directed to the reservoir via the highest available drain port (**L**, $\mathbf{L_1}$[2)], $\mathbf{L_2}$[3)]).
For combinations of multiple units, the case drain fluid must be drained off at each pump. If a shared reservoir line is used for several units, make sure that the case pressure in each pump is not exceeded. The shared drain line must be dimensioned to ensure that the maximum permissible case pressure of all connected units is not exceeded in any operational circumstances, particularly at cold start. 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 drain line must flow into the reservoir below the minimum fluid level. The permissible suction height h_S results from the overall loss of pressure. However, it must not be higher than $h_{S\ max}$ = 31.5 in (800 mm). The minimum suction pressure at port **S** must also not fall below 12 psi (0.8 bar) absolute during operation and during cold start.
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.

Note

In certain installation positions, an influence on the control characteristic can be expected. Gravity, dead weight and case pressure can cause minor shifts in control characteristic curves and changes in response time.

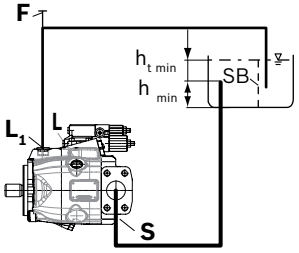
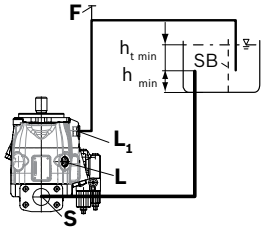
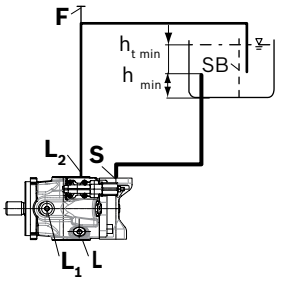
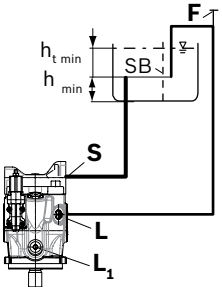
For key, see page 70.

Installation position

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

Below-reservoir installation (standard)

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

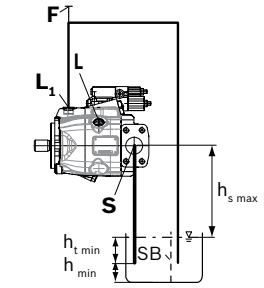
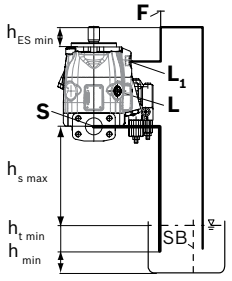
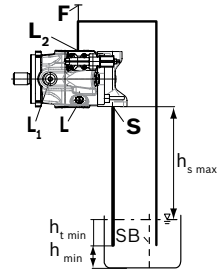
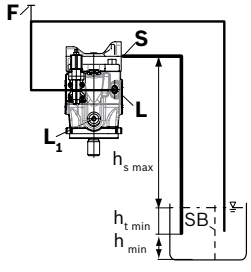
Installation position	Air bleeding	Filling
1 [2)] 	**F**	**S** + **L** or $\mathbf{L_1}$
2 [1)] 	**F**	**S** + $\mathbf{L_1}$
3 [3)] 	**F**	**S** + **L** or $\mathbf{L_1}$
4 	**F**	**S** + **L** or $\mathbf{L_1}$

1) Because complete air bleeding and filling are not possible in this position, the pump should be air bled and filled in a horizontal position before installation.
2) For NG10 and NG28 series 52, $\mathbf{L_1}$ is opposite, L must then be connected if necessary.
3) Only series 53

Above-reservoir installation

Above-reservoir installation means that the axial piston unit is installed above the minimum fluid level of the reservoir. To prevent the axial piston unit from draining, a height difference $h_{ES\ min}$ of at least 1 in (25 mm) is required in position 6

Observe the maximum permissible suction height $h_{S\ max}$ = 31.5 in (800 mm).

Installation position	Air bleeding	Filling
5 [2] 	**F**	**L_1** or **L**
6 [1][2] 	**F**	**L_1**
7 [3] 	**F**	**L_2**
8 [1] 	**F**	**S** or **L**

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

2) For NG10 and NG28 series 52, **L_1** is opposite, **L** must then be connected if necessary.

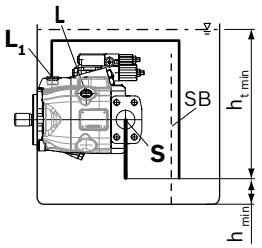
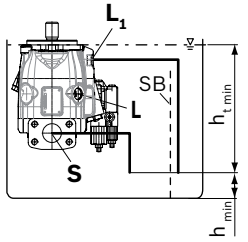
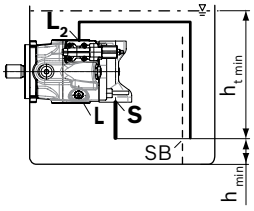
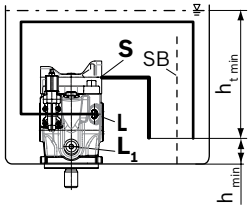
3) Only series 53

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

For key, see page 70.

Reservoir installation

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

Installation position	Air bleeding	Filling
9 [2] 	Via the highest available port **L**	Automatically via the open port **L** or **L_1** due to the position under the hydraulic fluid level
10 	Via the highest available port **L_1**	Automatically via the open port **L**, **L_1** or **S** due to the position under the hydraulic fluid level
11 [3] 		
12 	Via the highest available port **L**	Automatically via the open port **L**, **L_1** or **S** due to the position under the hydraulic fluid level

Key and assembly note

Key	
F	Filling / air bleeding
S	Suction port
L; L_1	Drain port
SB	Baffle (baffle plate)
$h_{t\ min}$	Minimum required immersion depth (7.87 in (200 mm)
h_{min}	Minimum required distance to reservoir bottom 3.94 in (100 mm)
$h_{ES\ min}$	Minimum necessary height required to protect the axial piston unit from draining (1 in (25 mm)
$h_{S\ max}$	Maximum permissible suction height 21.50 in (800 mm)

Note

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

1) Because complete air bleeding and filling are not possible in this position, the pump should be air bled and filled in a horizontal position before installation.
2) For NG10 and NG28 series 52, **L_1** is opposite, **L** must then be connected if necessary.
3) Only series 53

Project planning notes

- The A10VO axial piston variable pump is designed to be used in open circuit.
- The project planning, installation and commissioning of the axial piston unit requires the involvement of qualified personnel.
- Before using the axial piston unit, please read the corresponding instruction manual completely and thoroughly. If necessary, request it from Bosch Rexroth.
- Before finalizing your design, please request a binding installation drawing.
- The specified data and notes must be observed.
- Depending on the operating conditions of the axial piston unit (operating pressure, fluid temperature), the characteristic may shift.
- Preservation: Our axial piston units are supplied as standard with protection to preserve for a maximum of 12 months. If longer preservative protection is required (maximum 24 months), please specify this in plain text when placing your order. The preservation periods apply under optimal storage conditions, details of which can be found in the data sheet 90312 or the instruction manual.
- Not all variants of the product are approved for use in safety functions according to ISO 13849. Please consult the responsible contact person at Bosch Rexroth if you require reliability parameters (e.g. $MTTF_d$) for functional safety.
- Depending on the type of control used, electromagnetic effects can be produced when using solenoids. When a direct current is applied, solenoids do not cause electromagnetic interference nor is their operation impaired by electromagnetic interference.
  Other behavior can result when a modulated direct current (e.g. PWM signal) is applied. Potential electromagnetic interference for persons (e.g. persons with a pacemaker) and other components must be tested by the machine manufacturer.
- Pressure controllers are not safeguards against pressure overload. Be sure to add a pressure relief valve to the hydraulic system.
- Working ports:
  - The ports and fastening threads are designed for the specified maximum pressure. The machine or system manufacturer must ensure that the connecting elements and lines correspond to the intended operating conditions (pressure, flow, hydraulic fluid, temperature) with allowance for the necessary safety margins.
  - The working ports and function ports can only be used to accommodate hydraulic lines.

Safety instructions

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

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