Axial piston variable pump
A7VO Series 63

RE 92202
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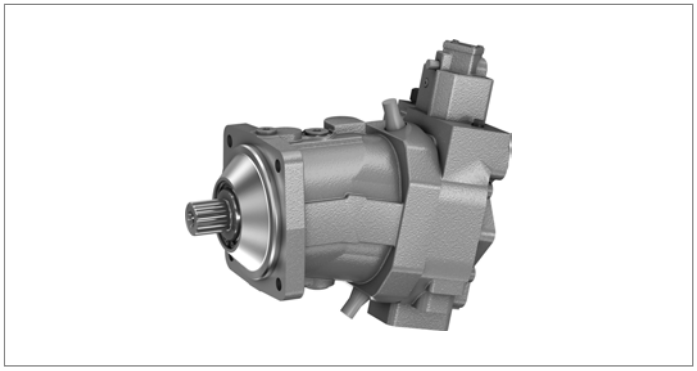

- Sizes 28 to 160
- Nominal pressure 350 bar
- Maximum pressure 400 bar
- Open circuit

Characteristics

- Variable pump with axial tapered piston rotary group of bent-axis design, for hydrostatic drives in open circuit
- For use in mobile and stationary applications
- Flow is proportional to the drive speed and displacement.
- The flow can be steplessly changed by adjusting the bent axis.
- Wide selection of control devices
- Compact, robust pump with a long service life

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Ordering code

01	02	03	04		05	06		07	08	09	10	11	12	13
A7V	**O**			**/**	**63**		**–**	**V**		**B**	**01**			

Axial piston unit

01	Bent-axis design, variable, nominal pressure 350 bar, maximum pressure 400 bar	**A7V**

Operating mode

02	Pump, open circuit	**O**

Size (NG)

03	Geometric displacement V_g (cm³), see “Technical data” on page 7	**28**	**55**	**80**	**107**	**160**
	For sizes 250, 355 and 500, see data sheet 92203					

Control device				**28**	**55**	**80**	**107**	**160**	
04	Power controller without power override			●	●	●	●	●	**LR**
	with pressure cut-off			●	●	●	●	●	**LRD**
	with stroke limiter	negative control	Δp = 25 bar	–	●	●	●	●	**LRH1**
	with pressure cut-off and stroke limiter	negative control	Δp = 25 bar	–	●	●	●	●	**LRDH1**
	with pressure cut-off and load sensing			–	●	●	●	●	**LRDS**
	Power controller with hydraulically proportional power override (only available for clockwise rotation and with port plate 02)								
	with load sensing			–	●	●	–	–	**LA1S**
	with load sensing and hydraulically proportional LS-override			–	●	●	–	–	**LA1S5**
	Pressure controller			●	●	●	●	●	**DR**
	remotely controlled			●	●	●	●	●	**DRG**
	with load sensing			–	●	●	●	●	**DRS**
	Proportional control hydraulic	Positive control	Δp = 10 bar	●	●	●	●	●	**HD1**
	with pressure cut-off, remotely controlled	Positive control	Δp = 10 bar	●	●	●	●	●	**HD1G**
	Proportional control electrical	Positive control	U = 24 V	●	●	●	●	●	**EP2**

Series

05	Series 6, index 3	**63**

Direction of rotation			**28 to 160**	
06	Viewed on drive shaft	clockwise	●	**R**
		counter-clockwise	●	**L**

Sealing material

07	FKM (fluoroelastomer)	**V**

Drive shaft		**28 to 160**	
08	Splined shaft DIN 5480	●	**Z**
	Parallel keyed shaft according to DIN 6885	●	**P**

Mounting flange

09	ISO 3019-2; 4-hole	**B**

Port plate for working lines

10	SAE flange ports A and S at rear (metric fastening thread)	**01**
	SAE flange ports A and S at side (available for power controllers LA1S and LA1S5 only, metric fastening thread)	**02**

● = Available – = Not available ☐ = Preferred program

01	02	03	04		05	06		07	08	09	10	11	12	13
A7V	**O**			**/**	**63**		**–**	**V**		**B**	**01**			

Connector for solenoids[1] (see page 40)

11	Without connector (without solenoid, with hydraulic control only; without code)	
	DEUTSCH molded connector, 2-pin – without suppressor diode	**P**

Standard / special version

12	Standard version (without code)	
	Special version	**-S**

● = Available **–** = Not available ☐ = Preferred program

Notes

- ▶ Note the project planning notes on page 42!
- ▶ Preservation:
  - – Up to 12 months as standard
  - – Up to 24 months long-term
    (state in plain text when ordering)

1) Connectors for other electric components may differ

Hydraulic fluids

The A7VO 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
- 90222: Fire-resistant, water-free hydraulic fluids (HFDR/HFDU)
- 90223: Fire-resistant, water-containing hydraulic fluids (HFC, HFB, HFAE, HFAS)

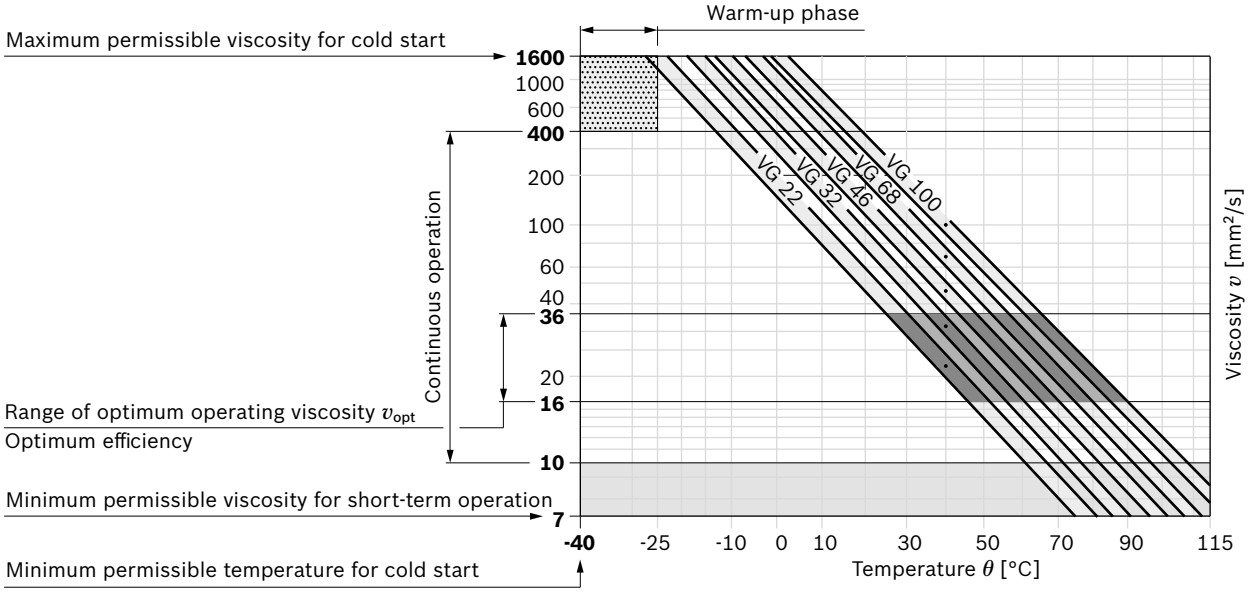
Details regarding the selection of hydraulic fluid
The hydraulic fluid should be selected such that the operating viscosity in the operating temperature range is within the optimum range (v_{opt}, see selection diagram).

Note
At no point of the component may the temperature be higher than 115 °C. The temperature difference specified in the table is to be taken into account when determining the viscosity in the bearing.
If it is not possible to maintain the conditions above due to extreme operating parameters, we recommend flushing the case at port **U.**

Viscosity and temperature of hydraulic fluids

	Viscosity	Temperature	Comment
Cold start	v_{max} ≤ 1600 mm²/s	θ_{St} ≥ -40 °C	t ≤ 3 min, n ≤ 1000 rpm, without load p ≤ 50 bar
Permissible temperature difference		ΔT ≤ 25 K	between axial piston unit and hydraulic fluid in the system
Warm-up phase	v < 1600 to 400 mm²/s	θ = -40 °C to -25 °C	at p ≤ 0.7 × p_{nom}, n ≤ 0.5 × n_{nom} and t ≤ 15 min
Continuous operation	v = 400 to 10 mm²/s		This corresponds, for example on the VG 46, to a temperature range of +5 °C to +85 °C (see selection diagram)
		θ = -25 °C to +103 °C	measured at port **R**$_1$/**R**$_2$ Note the permissible temperature range of the shaft seal (ΔT = approx. 12 K between the bearing/shaft seal and port **R**$_1$/**R**$_2$)
	v_{opt} = 36 to 16 mm²/s		Range of optimum operating viscosity and efficiency
Short-term operation	v_{min} ≥ 7 mm²/s		t < 3 min, p < 0.3 × p_{nom}

▼ **Selection diagram**



Filtration of the hydraulic fluid

Finer filtration improves the cleanliness level of the hydraulic fluid, which in turn 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 (90 °C to maximum 103 °C, measured at port $\mathbf{R}_1/\mathbf{R}_2$) a cleanliness level is necessary of at least 19/17/14 according to ISO 4406.

Leakage

The case interior is connected to the suction chamber. A separate case drain line from the case to the reservoir is therefore not required (both **R** ports are plugged).

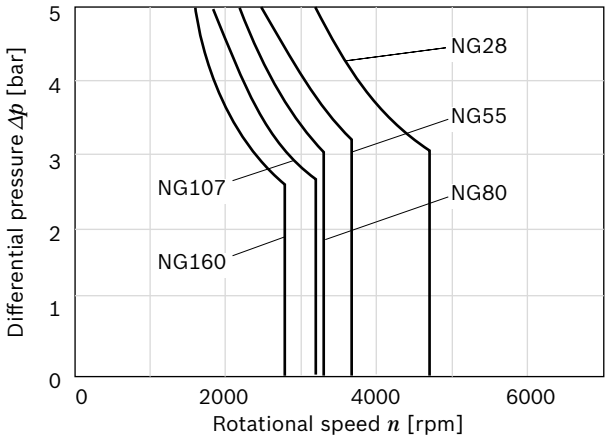
Exception: For versions with pressure controller or pressure cut-off, a drain line is needed to relieve port $\mathbf{T}_1$ to the reservoir.

Shaft seal ring

Permissible pressure loading

The service life of the shaft seal is influenced by the speed of the axial piston unit and the leakage pressure in the housing (case pressure). Momentary pressure spikes (t < 0.1 s) up to 10 bar are allowed. The service life of the shaft seal decreases with increasing frequency of pressure spikes and increasing mean differential pressure.

The case pressure must be equal to or higher than the ambient pressure.



The FKM shaft seal ring may be used for leakage temperatures from -25 °C to +115 °C. For application cases below -25 °C, an NBR shaft seal is required (permissible temperature range: -40 °C to +90 °C).

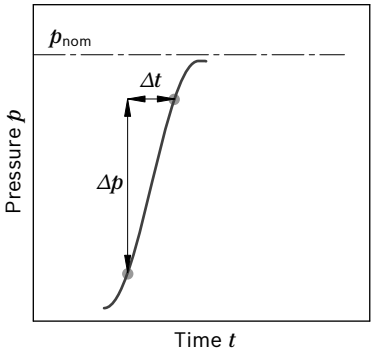
Flow direction

Direction of rotation, viewed on drive shaft	
clockwise	counter-clockwise
S to **B**	**S** to **A**

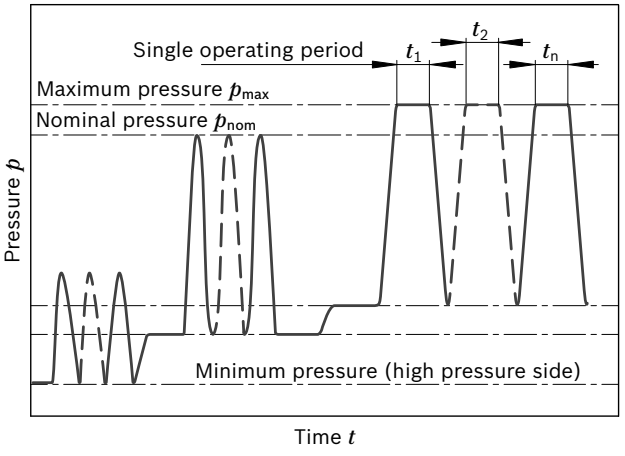
Operating pressure range

Pressure at working port A or B (high-pressure side)		Definition
Nominal pressure p_{nom}	350 bar absolute	The nominal pressure corresponds to the maximum design pressure.
Maximum pressure p_{max}	400 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	10 s	
Total operating period	300 h	
Minimum pressure (high-pressure side)	10 bar absolute	Minimum pressure on high-pressure side (**A** or **B**) required to prevent damage to the axial piston unit.
Rate of pressure change $R_{A\,max}$	16000 bar/s	Maximum permissible rate of pressure build-up and reduction during a pressure change over the entire pressure range.
Pressure at suction port S (Inlet)		
Minimum pressure $p_{S\,min}$	0.8 bar absolute	Minimum pressure at suction port **S** (inlet) that is required to avoid damage to the axial piston unit. The minimum required pressure is dependent on the speed and displacement of the axial piston unit (see diagram on page 7).
Maximum pressure $p_{S\,max}$	2 bar absolute	

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



▼ **Pressure definition**



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

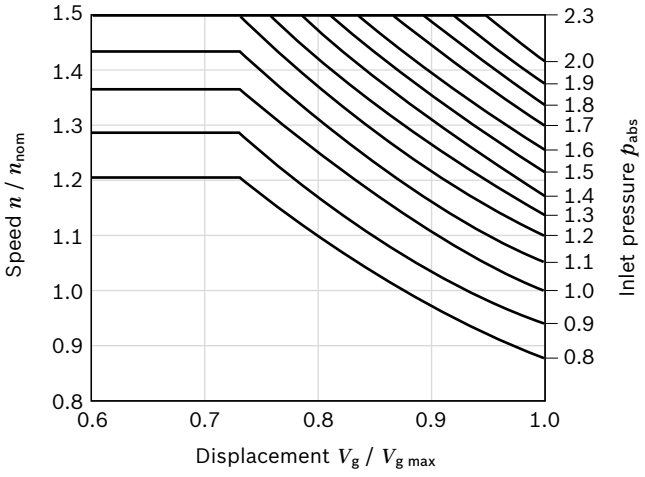
Note

Operating pressure range valid when using hydraulic fluids based on mineral oils. Values for other hydraulic fluids, please contact us.

Technical data

Size		NG		28	55	80	107	160
Displacement, geometric, per revolution		$V_{g\,max}$	cm³	28.1	54.8	80	107	160
Maximum rotational speed[1]	At $V_{g\,max}$	n_{nom}	rpm	3150	2500	2240	2150	1900
	At $V_g < 0.74 \times V_{g\,max}$	n_{max1}	rpm	4250	3400	3000	2900	2560
Maximum rotational speed[2]		n_{max2}	rpm	4750	3750	3350	3200	2850
Flow	At $V_{g\,max}$ and n_{nom}	q_v	l/min	89	137	179	230	304
Power	At $V_{g\,max}$, n_{nom} and Δp = 350 bar	P	kW	52	80	105	134	177
Torque	At $V_{g\,max}$ and Δp = 350 bar	T	Nm	156	305	446	596	891
Rotary stiffness	$V_{g\,max}$ to $V_g/2$	c_{min}	kNm/rad	5	10	16	21	36
	$V_g/2$ to 0 (interpolated)	c_{max}	kNm/rad	16	32	49	67	104
Moment of inertia rotary group		J_{GR}	kgm²	0.0042	0.0042	0.0080	0.0127	0.0253
Maximum angular acceleration		α	rad/s²	35900	31600	24200	19200	15300
Case volume		V	l	0.5	0.75	1.2	1.5	2.4
Weight (approx.)		m	kg	17	25	40	49	71

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



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

Key

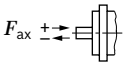
V_g	=	Displacement per revolution [cm³]
Δp	=	Differential pressure [bar]
n	=	Rotational speed [rpm]
η_v	=	Volumetric efficiency
η_{mh}	=	Mechanical-hydraulic efficiency
η_t	=	Total efficiency ($\eta_t = \eta_v \times \eta_{mh}$)

Notes

- 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. Other permissible limit values, such as speed variation, reduced angular acceleration as a function of the frequency and the permissible angular acceleration at start (lower than the maximum angular acceleration) can be found in data sheet 90261.

1) The values are valid:
   – At absolute pressure p_{abs} = 1 bar at suction port **S**
   – For the optimal viscosity range of v_{opt} = 36 to 16 mm²/s
   – For hydraulic fluid based on mineral oils.
2) Maximum rotational speed (speed limit) for increased inlet pressure p_{abs} at suction port **S** and $V_g < V_{g\,max}$, see diagram.

Permissible radial and axial forces of the drive shaft

Size		NG		28	55	80	107	160
Drive shaft		Ø	mm	25	30	35	40	45
Maximum radial force[1] at distance a (from shaft collar)		$F_{q\,max}$	N	6436	7581	10266	13758	18278
		a	mm	14.0	17.5	20.0	22.5	25.0
Maximum torque at $F_{q\,max}$		$T_{q\,max}$	Nm	179	281	444	681	1019
Maximum differential pressure at $V_{g\,max}$ and $F_{q\,max}$		$\Delta p_{q\,max}$	bar	400	322	349	400	400
Maximum axial force at standstill or pressure-free operation		+ $F_{ax\,max}$	N	0	0	0	0	0
		− $F_{ax\,max}$	N	315	500	710	900	11250
Permissible axial force per bar operating pressure		+ $F_{ax\,perm}$/bar	N/bar	4.6	7.5	9.6	11.3	15.1

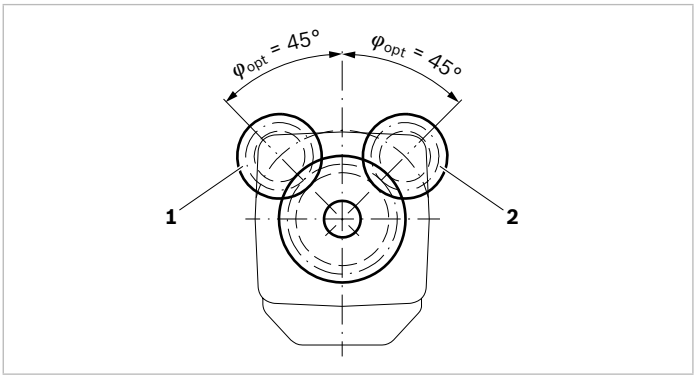
Effect of radialforce F_q on the service life of bearings

By selecting a suitable direction of radial force F_q, the load on the bearings, caused by the internal rotary group forces can be reduced, thus optimizing the service life of the bearings. Recommended position of mating gear is dependent on direction of rotation. Example:

Note

- The permissible axial force in direction $-F_{ax}$ is to be avoided, because thereby the bearing life is reduced.
- Special requirements apply in the case of belt drives. Please contact us.

▼ **Gear drive**



1 “Clockwise” rotation, pressure at port **B**
2 “Counter-clockwise” rotation, pressure at port **A**

1) With intermittent operation

LR – Power controller without power override

The power controller regulates the displacement of the pump depending on the operating pressure so that a given drive power is not exceeded at constant drive speed.
The precise control with a hyperbolic control characteristic, provides an optimum utilization of available power.
The operating pressure acts on a rocker via a measuring spool which moves with the control. An externally adjustable spring force counteracts this, it determines the power setting.
If the operating pressure exceeds the set spring force, the control valve is actuated by the rocker and the pump swivels back from the initial position $V_{g\,max}$ toward $V_{g\,min}$. When doing this, the lever length at the rocker shortens and the operating pressure may rise in the same proportion as the displacement reduces without the drive power being exceeded ($p_B \times V_g$ = constant; p_B = operating pressure; V_g = displacement).
When depressurized, the pump is swiveled to its initial position to $V_{g\,max}$ by a return spring.
The hydraulic output power (characteristic **LR**) is influenced by the efficiency of the pump.

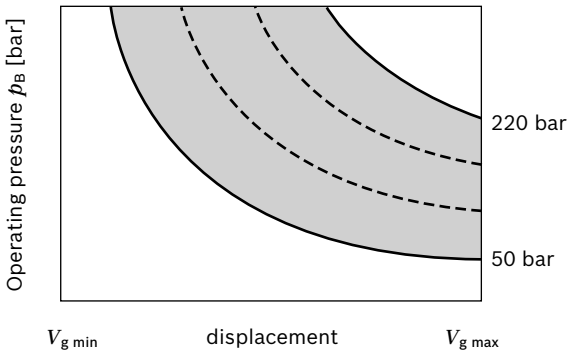
- Beginning of control, setting range 50 to 220 bar

When ordering, state in plain text:

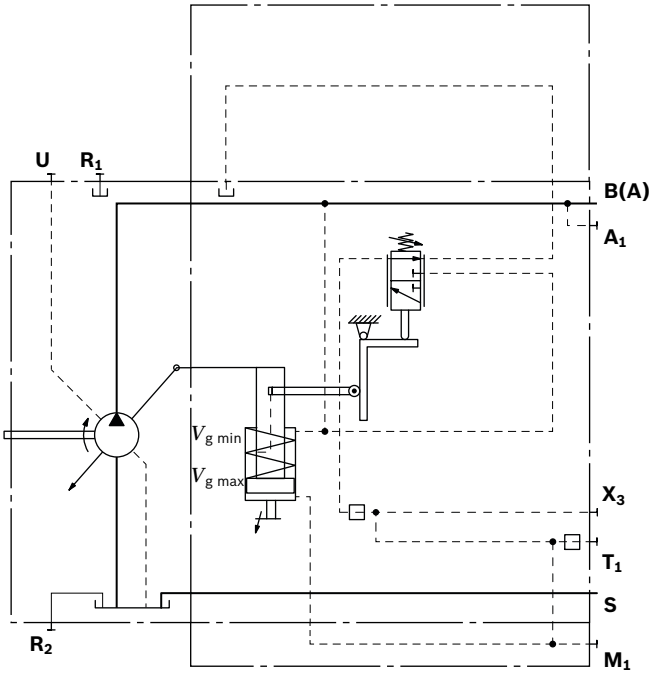
- Drive power P [kW]
- Drive speed n [rpm]
- Maximum flow $q_{v\,max}$ [l/min]

Please contact us if you need a power diagram.

▼ **Characteristic curve LR**



▼ **Schematic LR**



LRD – Power controller with pressure cut-off

The pressure cut-off is a pressure control which adjusts the displacement of the pump back to $V_{g\,min}$ after reaching the set pressure command value.

This function overrides the power controller, i.e. the power control function is executed below the pressure command value.

Pressure cut-off is preset to a pressure command value at the factory.

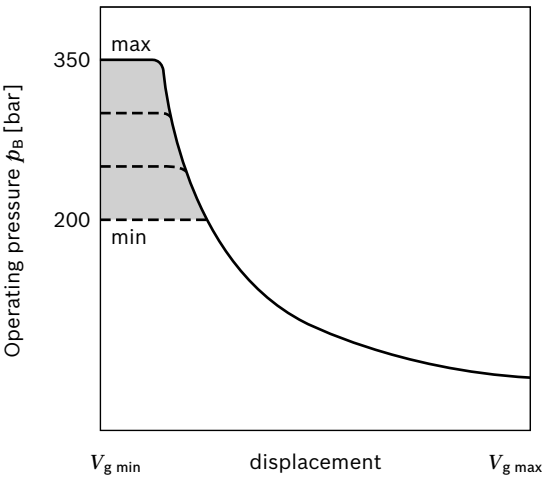
- Setting range 200 to 350 bar
  When ordering, state the setting in plain text.

Notes

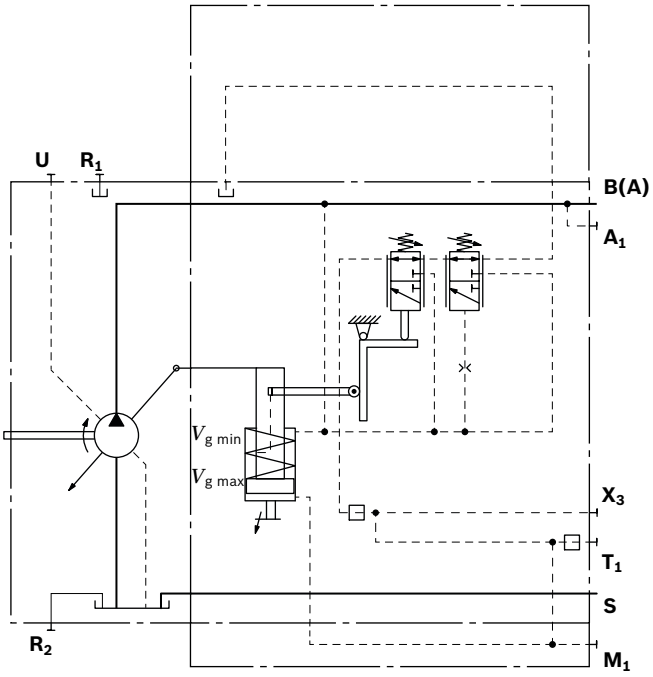
- The pressure setting of the pressure cut-off must be at least a factor of 5 higher than the beginning of control of power control.
  Example:
  - Beginning of control of the power controller: 50 bar
  - Minimum setting of pressure cut-off:
    5 × 50 = 250 bar

  Higher settings of the pressure cut-off are always possible.
- For versions with pressure cut-off, a drain line is needed from port **T_1** to the reservoir.
  When port **T_1** is plugged and $t_{tank} \leq 50$ °C, this results in a permissible pressure cut-off of ≤ 2 min.
- Any pressure-relief valve included in the system to limit the maximum pressure must have its start of opening at least 20 bar above the pressure cut-off setting.

▼ **Characteristic curve LRD**



▼ **Schematic LRD**



LR... – Power controller with stroke limiter

Due to the hydraulic stroke limiter, it is possible to change or limit the displacement of the pump continuously across the entire control range. The displacement is set proportionally using the pilot pressure p_{St} applied to port **X**$_1$ (maximum of 40 bar).

The power control overrides the hydraulic stroke limiter, i.e. below the power characteristic (hyperbolic characteristic), the displacement is controlled in dependence on the pilot pressure. If the set flow or operating pressure exceeds the power control characteristic, the power control overrides and reduces the displacement along the hyperbolic characteristic.

A control pressure of 40 bar is needed to swivel the pump from its initial position $V_{g\,max}$ to $V_{g\,min}$.

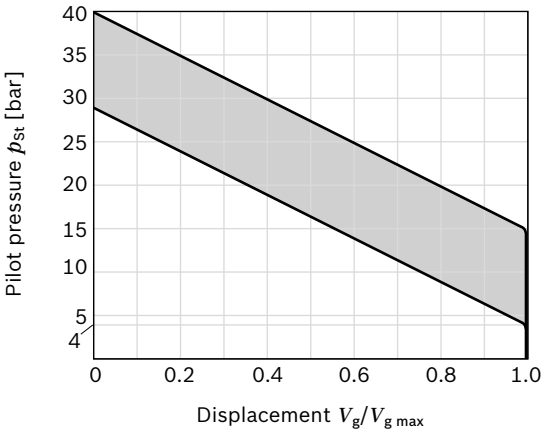
The necessary control power is taken from the operating pressure or the external control pressure applied to port **Y**$_3$. To ensure that the stroke limiter functions at a low operating pressure of < 40 bar, port **Y**$_3$ must be supplied with an external control pressure of about 40 bar.

LRH1 – Hydraulic stroke limiter (negative control)

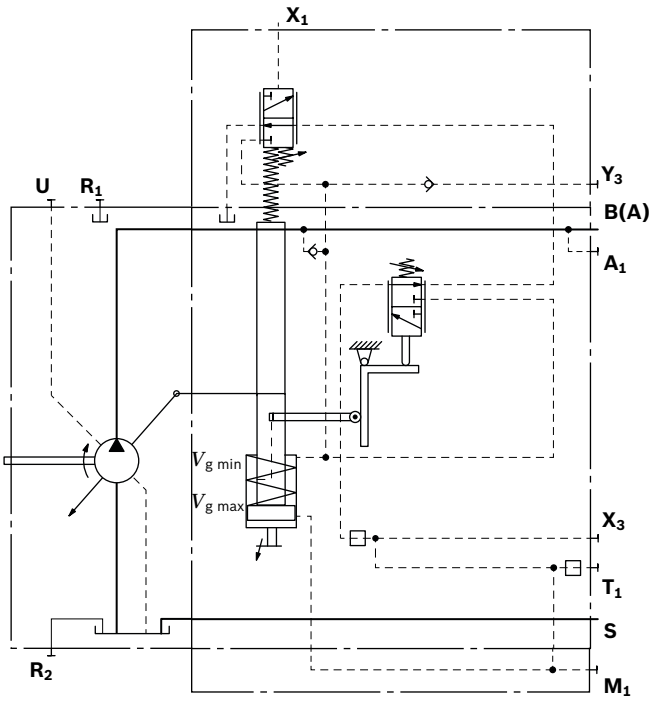
- Control from $V_{g\,max}$ to $V_{g\,min}$
  As the pilot pressure increases, the pump swivels to a smaller displacement.
- Start of control (at $V_{g\,max}$) can be set to 4 to 15 bar
  When ordering, state the start of control in plain text.
- Initial position without pilot signal (pilot pressure): $V_{g\,max}$

▼ **Characteristic curve LRH1**

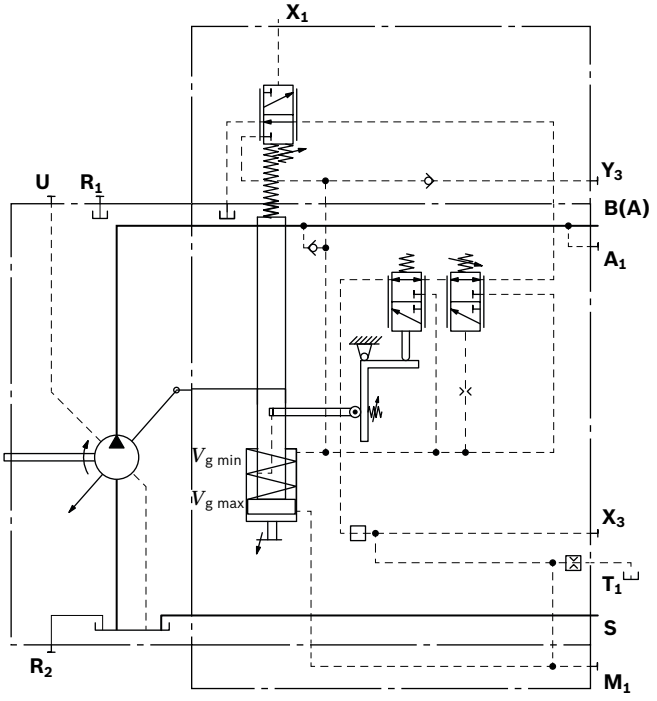
control pressure increase ($V_{g\,max}$ – $V_{g\,min}$) Δp = 25 bar



▼ **Schematic LRH1**



▼ **Schematic LRDH1**



LRDS – Power control with pressure cut-off and load sensing

The load sensing controller works as a load-pressure controlled flow controller and adjusts the displacement of the pump to the volume required by the consumer. The flow of the pump is then dependent on the cross section of the external measuring orifice (**1**), which is located between the pump and the consumer. Below the power curve and the setting of the pressure cut-off and within the control range of the pump, the flow is independent of the load pressure.

The measuring orifice is usually a separately located load sensing directional valve (control block). The position of the directional valve spool determines the opening cross-section of the measuring orifice and thus the flow of the pump.

The load sensing controller compares pressure before and after the orifice and keeps the pressure drop (differential pressure Δp) across the orifice – and therefore the flow – constant.

If the differential pressure Δp at the measuring orifice rises, the pump is swiveled back (toward $V_{g\,min}$). If the differential pressure Δp drops, the pump is swiveled out (toward $V_{g\,max}$) until equilibrium at the measuring orifice is restored.

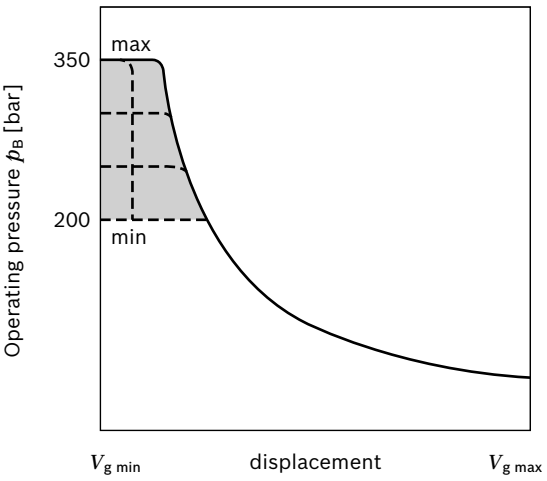
$\Delta p_{measuring\ orifice} = p_{pump} - p_{consumer}$

- Setting range for Δp 14 to 25 bar
- Default setting 18 bar
  When ordering, state the setting in plain text.

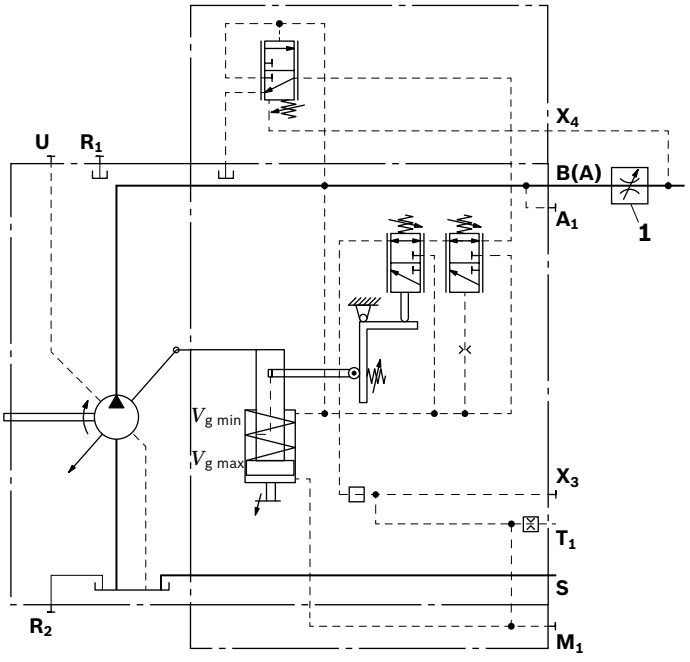
The stand-by pressure in zero-stroke mode (metering orifice closed) is slightly higher than the Δp setting.

In an LUDV system, the pressure cut-off is integrated in the flow sharing control block (LUDV).

▼ **Characteristic curve LRDS**



▼ **Schematic LRDS**

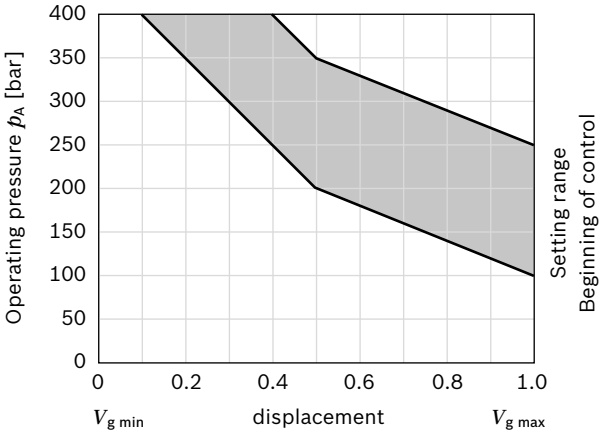


The measuring orifice (control block) (**1**) is not included in the scope of delivery.

LA1 – Power controller with hydraulically proportional power override

The power controller regulates the displacement of the pump depending on the operating pressure so that a given drive power is not exceeded at constant drive speed.
The hyperbolic power curve is approximated with two measuring springs. The operating pressure acts on the measurement area of a differential piston against the measuring springs and an externally adjustable spring force which determines the power setting.
If the sum of the hydraulic forces exceeds the forces of the springs, the control oil is fed to the stroking piston, which swivels the pump back to reduce the flow.
In a depressurized state, the pump is swiveled to its initial position to $V_{g\,max}$ by a return spring.
By connecting an external pilot pressure at port **X**$_3$, it is possible to override the power control proportionally.
Increasing pilot pressure = reduced power.

▼ **Characteristic curve LA1**



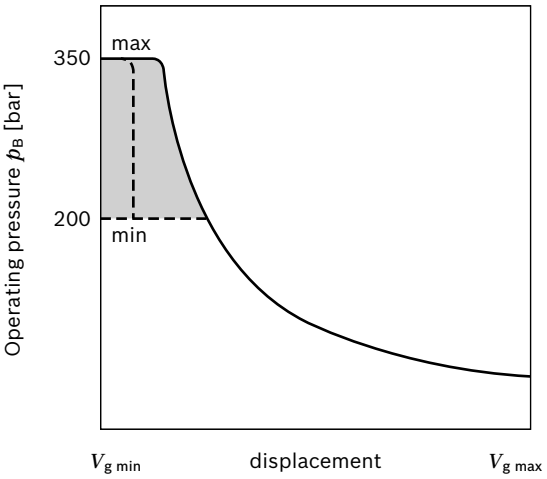
The hydraulic output power (characteristic curve) is affected by the efficiency.
When ordering, state in plain text:

- Drive power P [kW]
- Drive speed n [rpm]
- Maximum volume flow $q_{V\,max}$ [l/min]

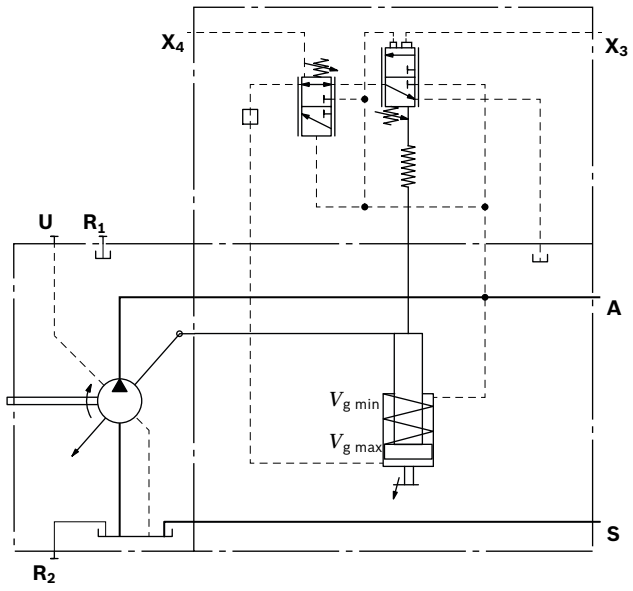
Please contact us if you need a power diagram.

LA1S – Power controller with load sensing
For description of load sensing, see page 12.

▼ **Characteristic curve LA1S**



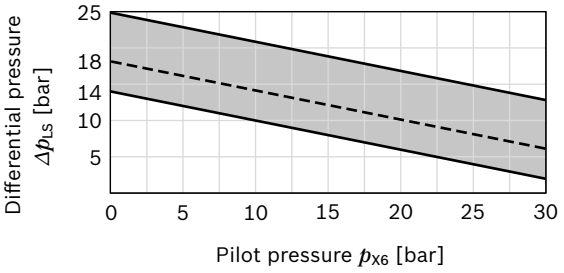
▼ **Schematic LA1S**



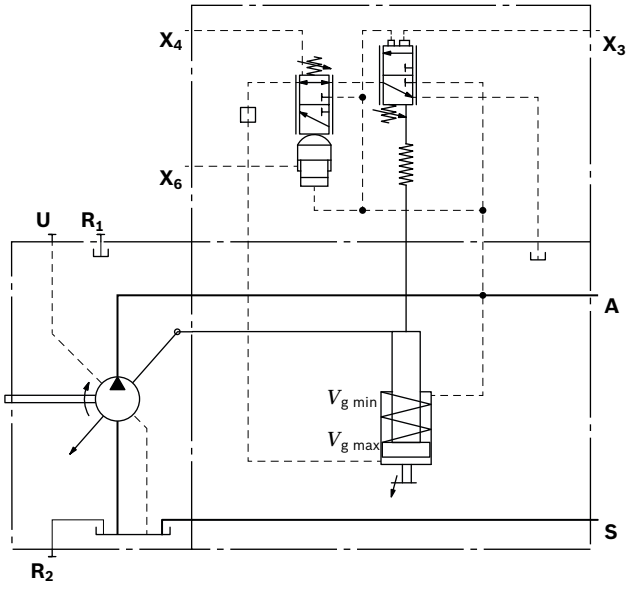
LA1S5 – Power controller with load sensing and hydraulically proportional LS-override

By connecting an external pilot pressure at port $\mathbf{X}_6$, it is possible to override proportionally the differential pressure Δp of the load sensing control.
Increasing pilot pressure = lower Δp setting.
An example of this is shown in the characteristic curve below.
Please consult us before carrying out project planning.

▼ **Characteristic curve LA1S5**



▼ **Schematic LA1S5**



DR – Pressure controller

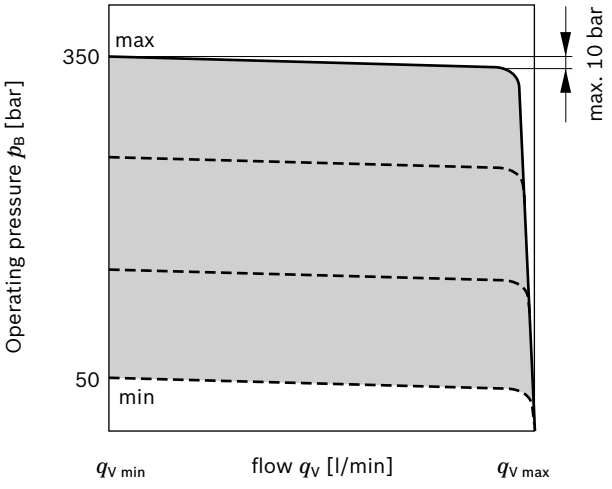
The pressure control limits the maximum pressure at the pump outlet within the control range of the variable pump. The variable pump only delivers as much hydraulic fluid as is required by the consumers. If the operating pressure exceeds the setpoint value set at the integrated pressure valve, the pump control will shift toward a smaller displacement and the control deviation will decrease. When depressurized, the pump is swiveled to its initial position $V_{g\,max}$ by an adjustment spring.

- Setting range of pressure control 50 to 350 bar
  When ordering, state the setting in plain text.

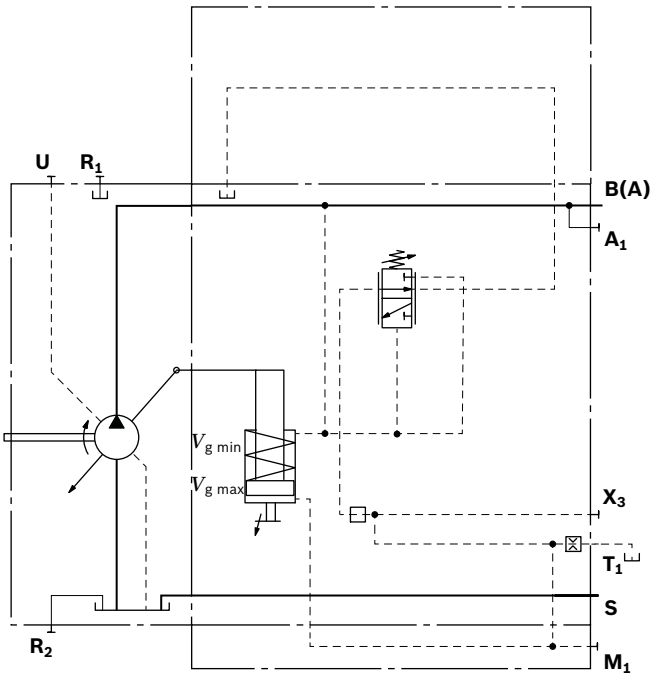
Notes

- For versions with controller **DR,** a drain line is needed from port **T**$_1$ to the reservoir.
- Any pressure-relief valve included in the system to limit the maximum pressure must be set to a cracking pressure at least 20 bar above the controller setting.

▼ **Characteristic curve DR**

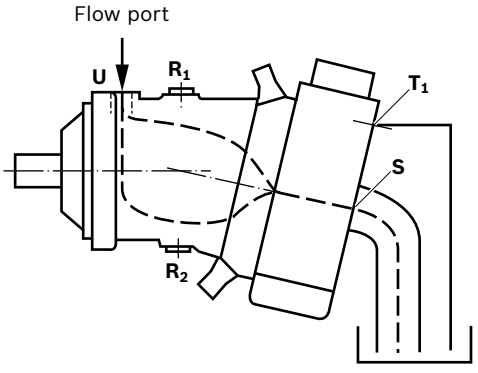


▼ **Schematic DR**



Zero-stroke operation

The standard pump unit is designed for intermittent constant pressure operation. Short-term zero-stroke operation (< 1 min.) is permissible up to an operating pressure p_{max} = 315 bar at a reservoir temperature of ≤ 50 °C.
In the case of longer zero-stroke operation (> 1 min), bearing flushing should be carried out via flushing port **U**.



Flushing flow (recommended)

NG		28	55	80	107	160
$q_{V\,flush}$	l/min	3	4	6	8	12

Temperature of flushing fluid ≤ reservoir temperature

DRG – Pressure controller, remotely controlled

A separate sequence valve with port plate provides the pressure control function. The valve is arranged separate from the pump; in this connection, you should not exceed the single line length of 5 m. The valve is supplied with high pressure from port $\mathbf{A}_1$ of the pump. The system feeds back via port $\mathbf{X}_3$ the control power of the valve into the pump; the valve adjusts the pump back to $V_{g\,min}$. Note that ports **T** of the sequence valve and $\mathbf{T}_1$ of the pump are returned to the reservoir (cooler).

- Setting range of pressure control 50 to 315 bar
  When ordering, state the setting in plain text.

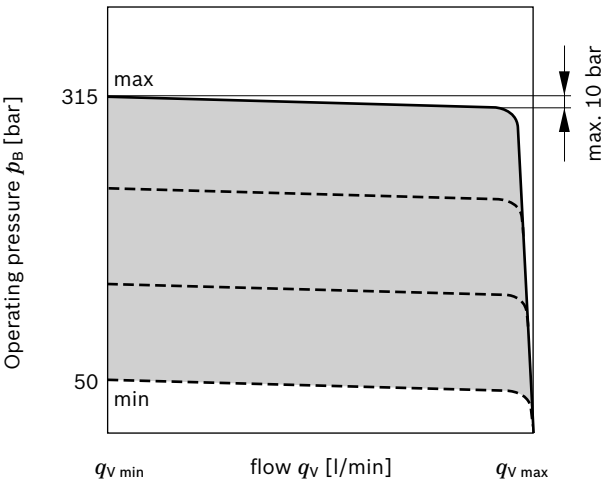
Notes

- For versions with controller **DRG,** a drain line is needed from port $\mathbf{T}_1$ to the reservoir.
- Any pressure-relief valve included in the system to limit the max. pressure must be set to a cracking pressure at least 20 bar above the controller setting.

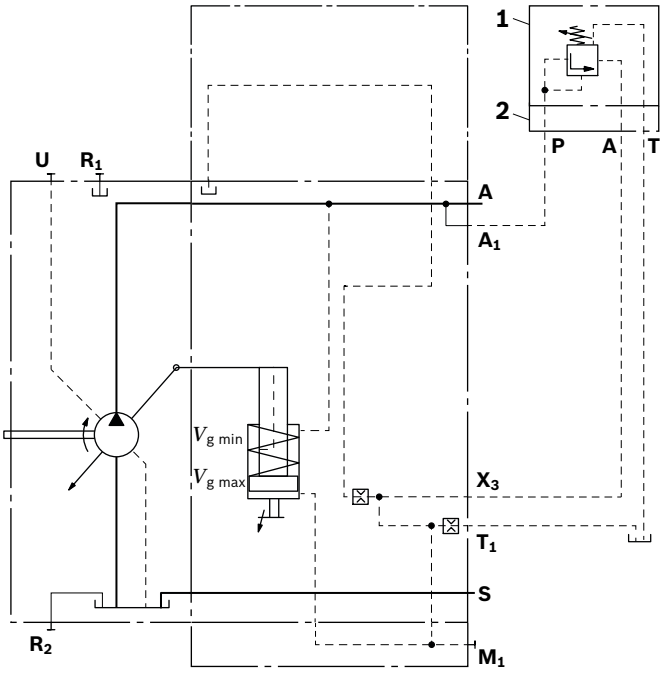
You must order the sequence valve and the port plate separately.

- Sequence valve (**1**): DZ5DP2-1X/315YMSO21
  (Material number R900495604)
- Port plate (**2**): G 115/1
  (Material number R900424379)

▼ **Characteristic curve DRG**



▼ **Schematic DRG**



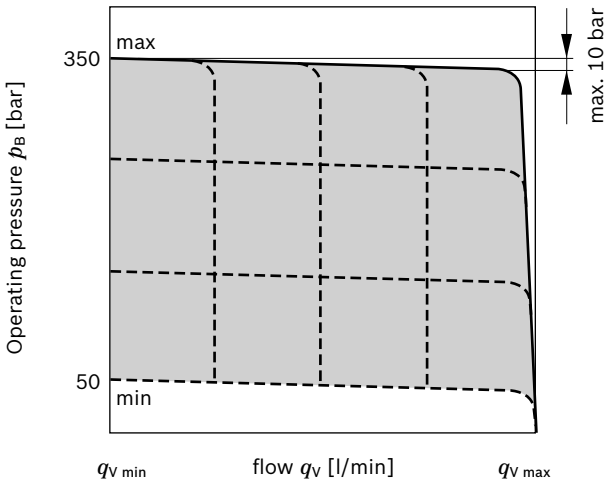
DRS – Pressure controller with load sensing

For description of load sensing, see page 12.

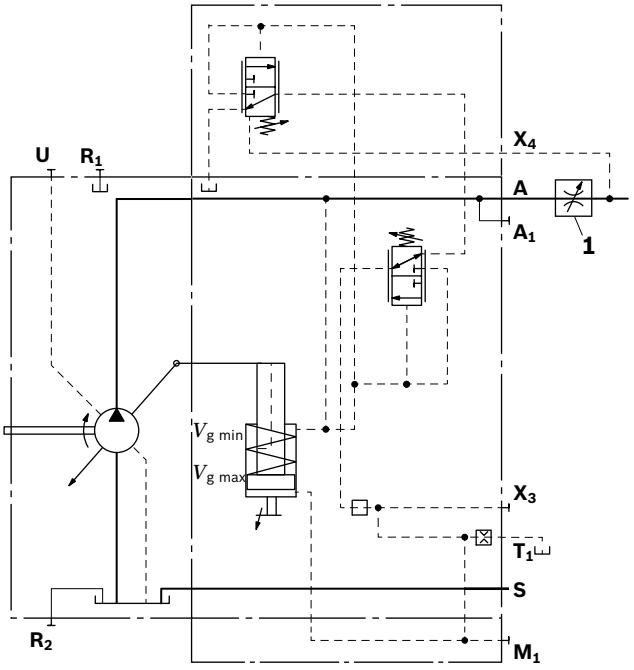
Notes

- For versions with controller **DRS,** a drain line is needed from port $\mathbf{T_1}$ to the reservoir.
- The pressure controller overrides the load-sensing controller, i.e. the load-sensing function operates below the set pressure.

▼ **Characteristic curve DRS**



▼ **Schematic DRS**



The measuring orifice (control block) (**1**) is not included in the scope of delivery.

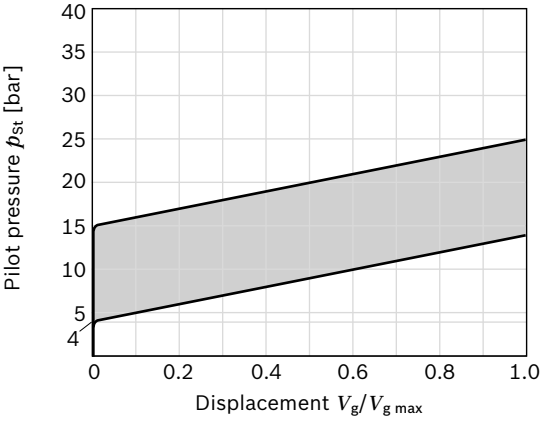
HD – Proportional hydraulic control

The proportional hydraulic control provides continuous control of the displacement. Control is carried out proportional to the pilot pressure applied at port **X**$_1$.

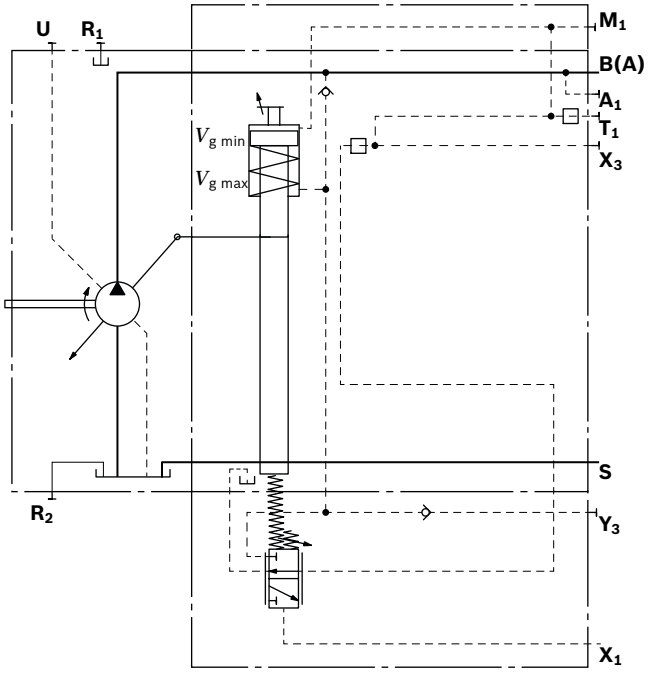
- Maximum permissible pilot pressure p_{St} = 40 bar
- Control from $V_{g\,min}$ to $V_{g\,max}$ (positive control)
  As the pilot pressure increases, the pump swivels to a larger displacement.
- Start of control (at $V_{g\,min}$) can be set to 4 to 15 bar
  When ordering, state the start of control in plain text.

A control pressure of 40 bar is needed to swivel the pump from its initial position $V_{g\,min}$ to $V_{g\,max}$.
The necessary control power is taken from the operating pressure or the external control pressure applied to port **Y**$_3$.
To ensure that control is guaranteed at a low operating pressure of < 40 bar too, port **Y**$_3$ must be supplied with an external control pressure of about 40 bar.

▼ **Characteristic curve HD1 positive control**
increase in control pressure ($V_{g\,min} - V_{g\,max}$) Δp = 10 bar



▼ **Schematic HD**



HD1G – Proportional hydraulic control with pressure cut-off, remotely controlled

A separate sequence valve with port plate provides the pressure cut-off function. The valve is arranged separate from the pump; in this connection, you should not exceed the single line length of 5 m. The valve is supplied with high pressure from port **A_1** of the pump. The system feeds back via port **X_3** the control power of the pump into the valve and at port **A** of the sequence valve's port plate diverts it into the reservoir; if the set pressure command value is exceeded, this adjusts the pump back to $V_{g\,min}$.

- Pressure cut-off setting range 50 to 315 bar
  When ordering, state the pressure cut-off setting in plain text.

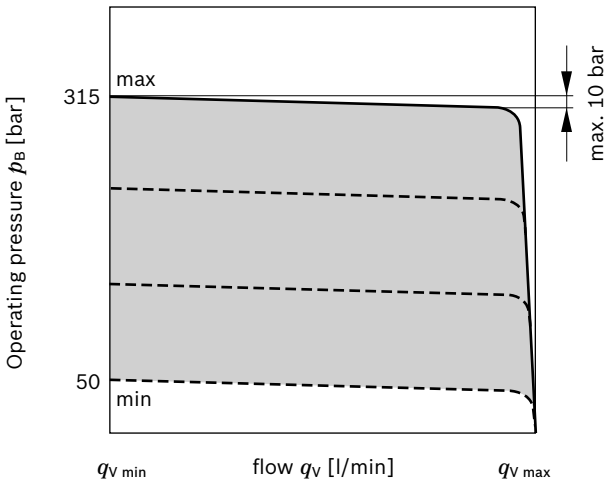
Notes

- Port **A** from the sequence valve must be returned to the reservoir (cooler).
- Any pressure-relief valve included in the system to limit the max. pressure must be set to a cracking pressure at least 20 bar above the controller setting.

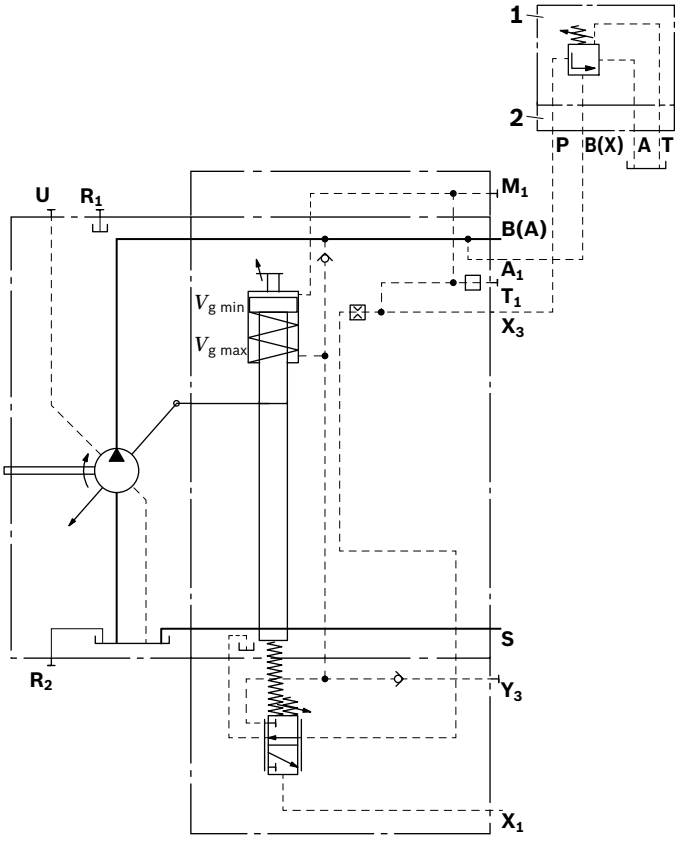
You must order the sequence valve and the port plate separately.

- Sequence valve (**1**): DZ5DP2-1X/315XYMSO20
  (Material number R900490554)
- Port plate (**2**): G 115/1
  (Material number R900424379)

▼ **Characteristic curve HD1G positive control**



▼ **Schematic HD1G**



EP – Proportional electric control

The proportional electric control, type EP, provides continuous control of the displacement. Control is proportional to the electric control current applied to the solenoid.

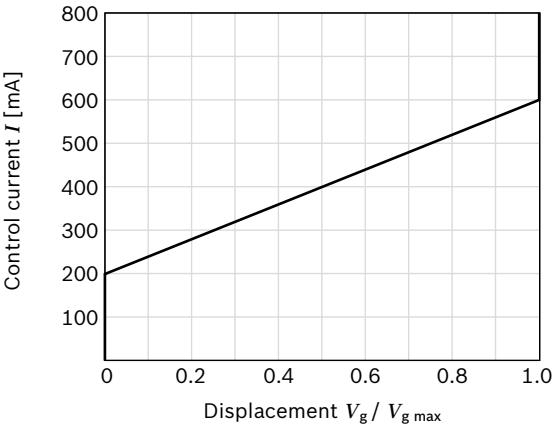
- Control from $V_{g\,min}$ to $V_{g\,max}$ (positive control)
  As the pilot pressure increases, the pump swivels to a larger displacement.

A control pressure of 40 bar is needed to swivel the pump from its initial position $V_{g\,min}$ to $V_{g\,max}$.
The necessary control power is taken from the operating pressure or the external control pressure applied to port **Y_3**.
To ensure that control is guaranteed at a low operating pressure of < 40 bar too, port **Y_3** must be supplied with an external control pressure of about 40 bar.

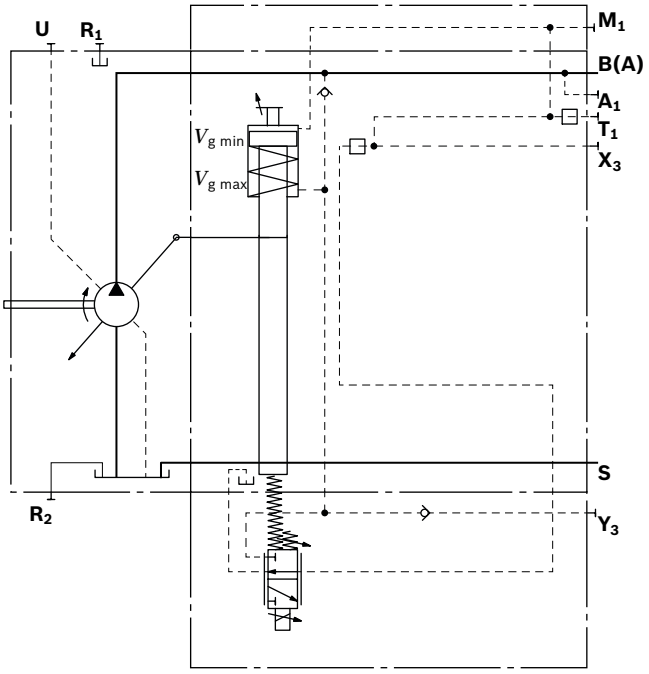
Various BODAS controllers with application software and amplifiers are available for controlling the proportional solenoids.
Further information can also be found on the Internet at www.boschrexroth.com/mobile-electronics.

Technical data, solenoid	EP2
Voltage	24 V (±20%)
Control current	
Start of control	200 mA
End of control	600 mA
Current limit	0.77 A
Nominal resistance (at 20 °C)	22.7 Ω
Dither frequency	100 Hz
Duty cycle	100%
Type of protection: see connector version page 40	

▼ **Characteristic curve EP2 positive control**



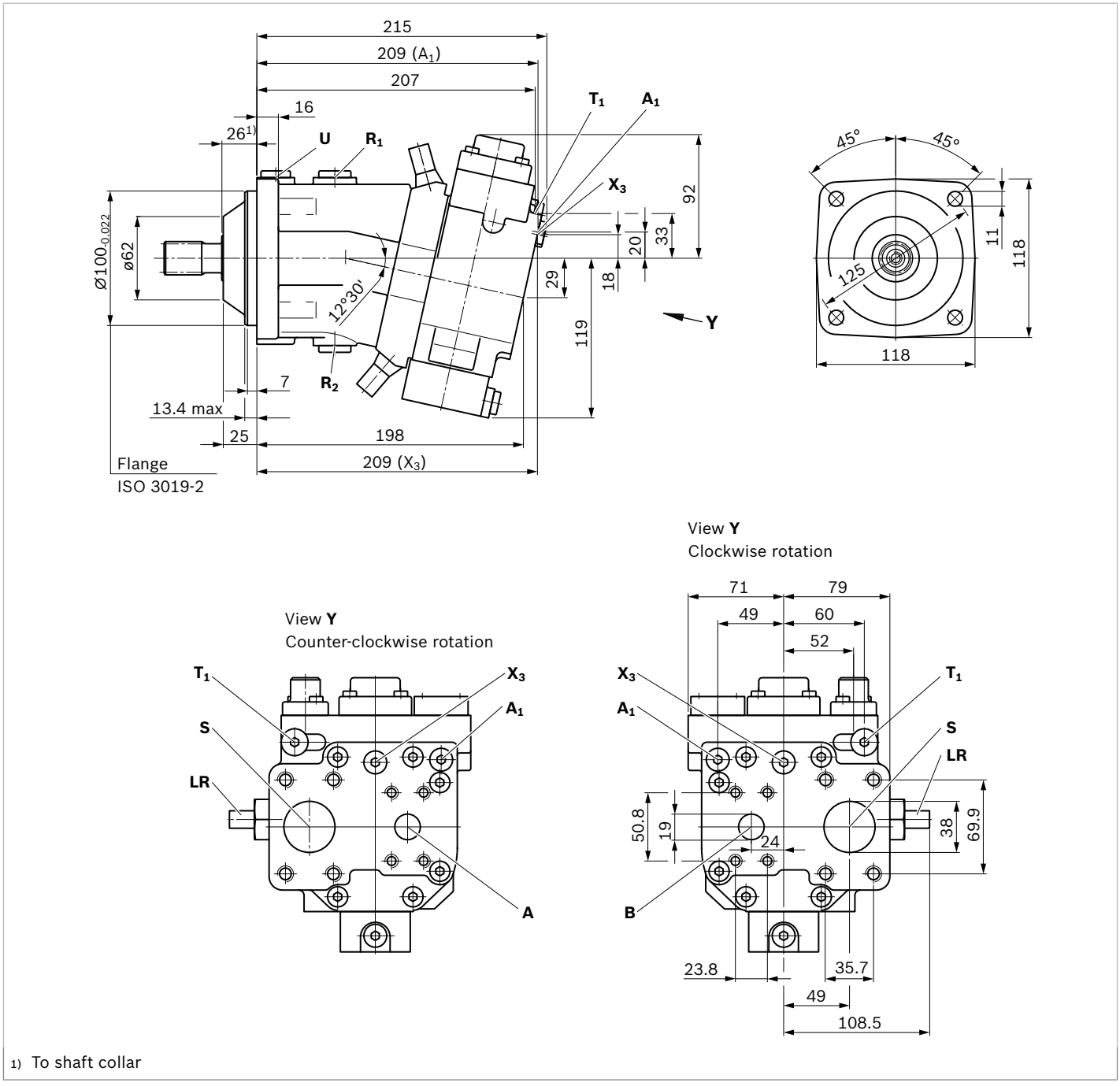
▼ **Schematic EP2**



Dimensions, size 28

LR – Power controller without power override

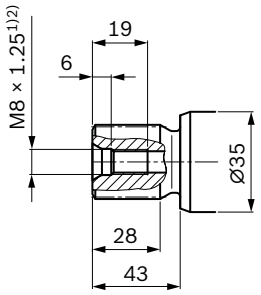
All of the variants of the controllers on page 23 are shown for the clockwise direction of input rotation (view **Y**)



1) To shaft collar

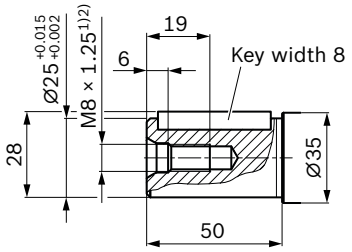
▼ **Splined shaft DIN 5480**

Z – W25×1.25×18×9g



▼ **Parallel keyed shaft DIN 6885**

P – AS8×7×40

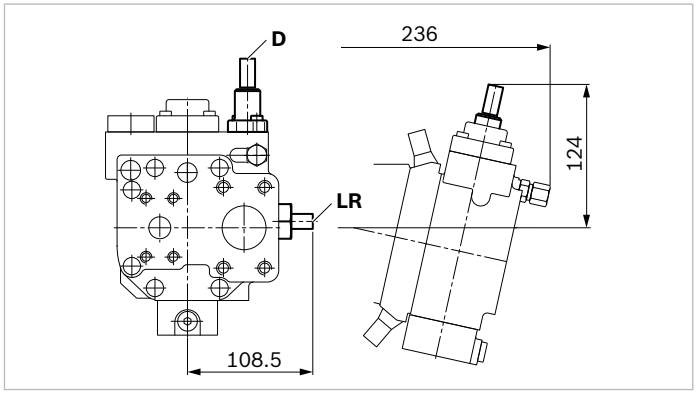


Ports		Standard	Size[2)]	$p_{max\ abs}$ [bar][3)]	Status
A (B)	Working port (high-pressure series) fastening thread	SAE J518[4)] DIN 13	3/4 in M10 × 1.5; 17 deep	400	O
S	Suction port (standard series) fastening thread	SAE J518[4)] DIN 13	1 1/2 in M12 × 1.75; 20 deep	2	O
U	Bearing flushing	DIN 3852[5)]	M16 × 1.5; 12 deep	2	X
R_1, R_2	Air bleed	DIN 3852[5)]	M18 × 1.5; 12 deep	2	X
A_1	Measuring high pressure	DIN 3852[5)]	M12 × 1.5; 12 deep	400	X
T_1	Control fluid drain	DIN 3852[5)]	M12 × 1.5; 12 deep	400	X[6)]
X_3	Override	DIN 3852[5)]	M12 × 1.5; 12 deep	400	X
Y_3	External control pressure	DIN 3852[5)]	M14 × 1.5; 12 deep	40	X
X_1	Pilot pressure	DIN 3852[5)]	M14 × 1.5; 12 deep	40	O
M_1	Control pressure measurement	DIN 3852[5)]	M12 × 1.5; 12 deep	400	X

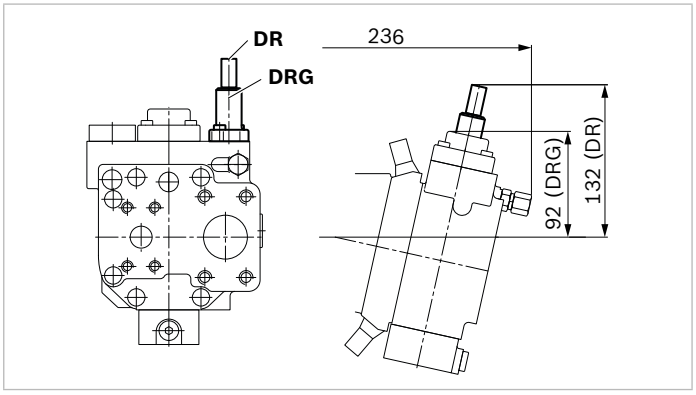
1) Center bore according to DIN 332 (thread according to DIN 13)
2) For notes on tightening torques, see instruction manual.
3) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
4) Only dimensions according to SAE J518, metric fastening thread is a deviation from the standard.
5) The spot face can be deeper than specified in the appropriate standard.
6) For versions with a pressure controller or pressure cut-off, a drain line is needed to relieve port **T_1** to the reservoir.

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

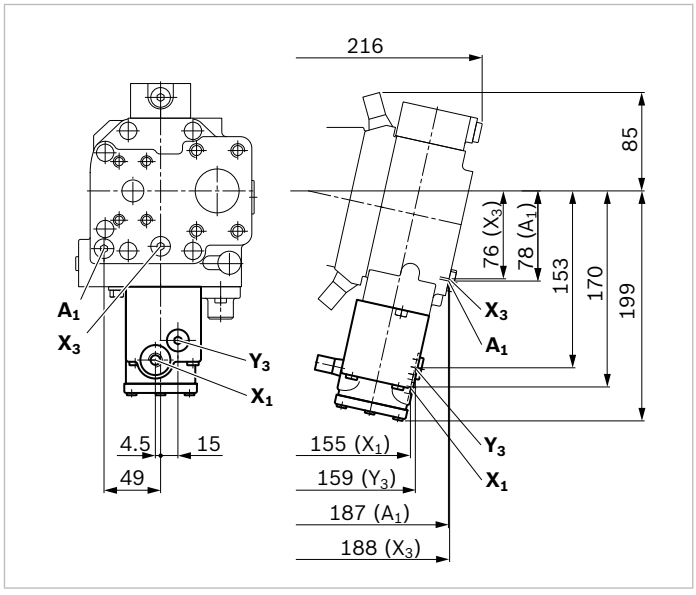
▼ **LRD** – Power controller with pressure cut-off



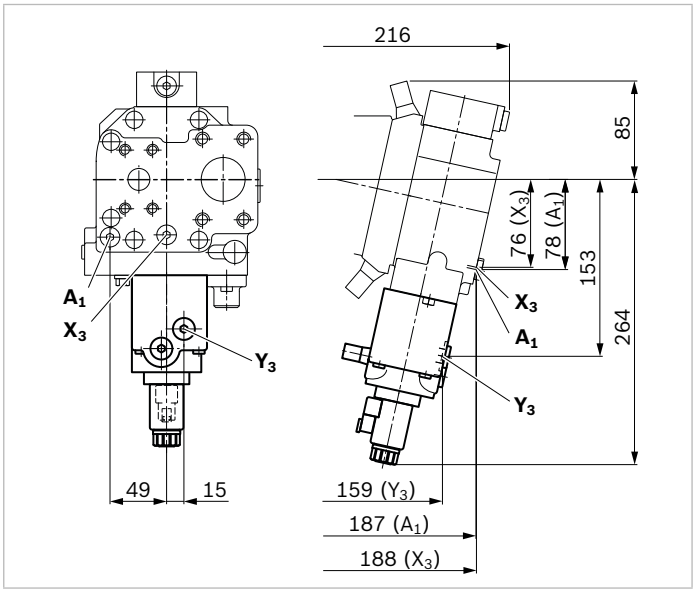
▼ **DR/DRG** – Pressure controller/pressure controller remotely controlled



▼ **HD1, HD1G** – Proportional hydraulic control , positive control, and variant with pressure cut-off, remotely controlled



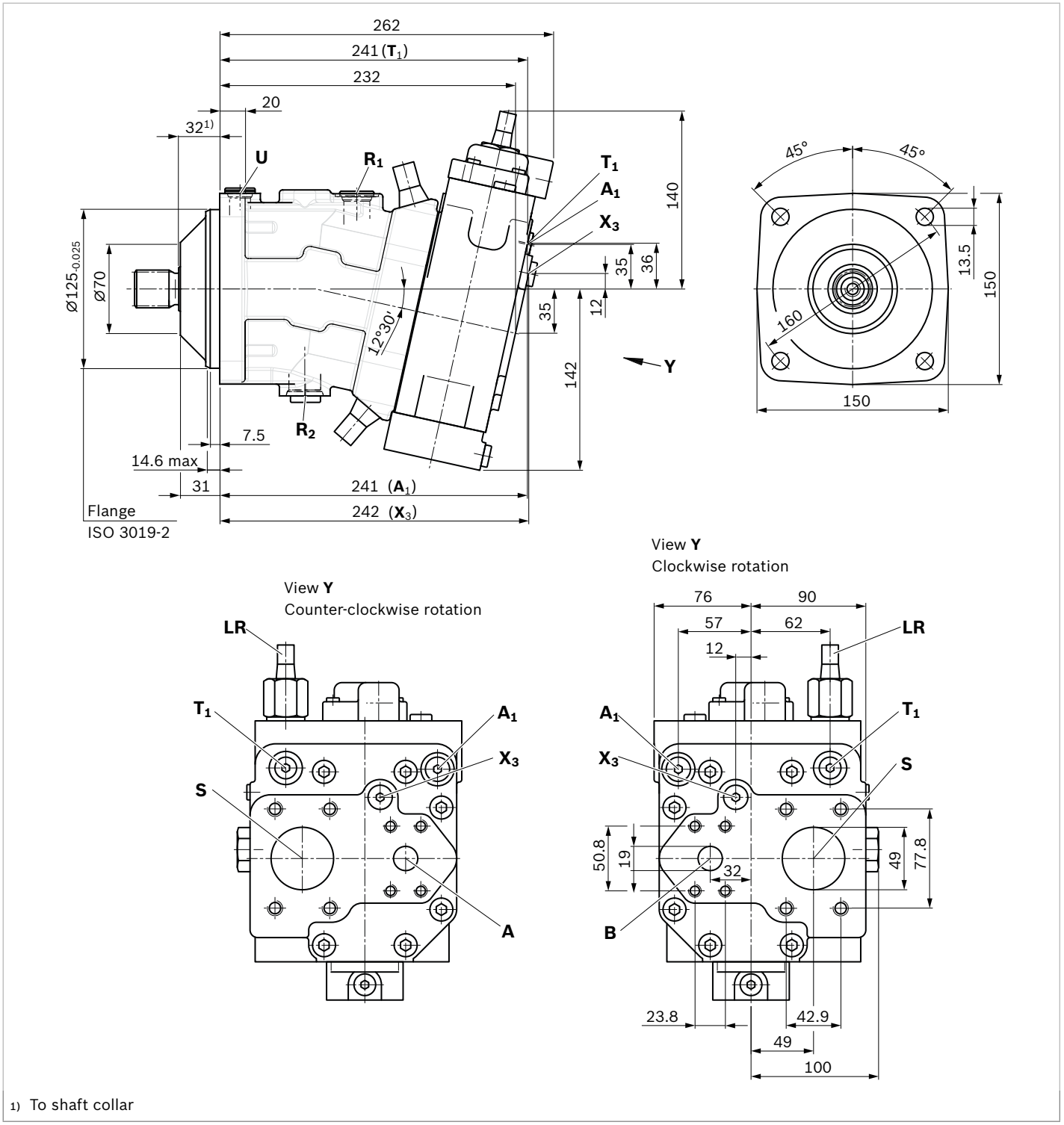
▼ **EP2** – Proportional control electric, positive control



Dimensions, size 55

LR – Power controller without power override

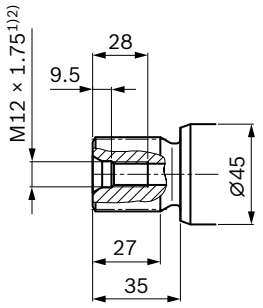
All of the variants of the controllers on pages 26 and 27 are shown for the clockwise direction of input rotation (view **Y**)



1) To shaft collar

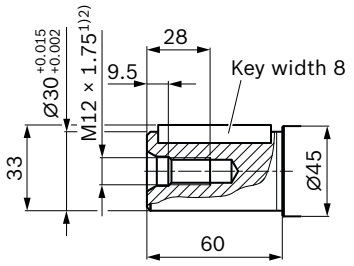
▼ **Splined shaft DIN 5480**

Z – W30×2×14×9g



▼ **Parallel keyed shaft DIN 6885**

P – AS8×7×50

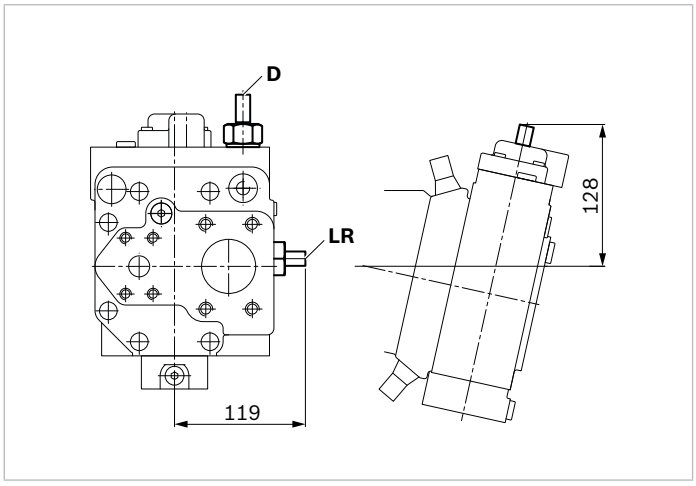


Ports		Standard	Size[2)]	$p_{max\ abs}$ [bar][3)]	Status
A (B)	Working port (high-pressure series) fastening thread	SAE J518[4)] DIN 13	3/4 in M10 x 1.5; 17 deep	400	O
S	Suction port (standard series) fastening thread	SAE J518[4)] DIN 13	2 in M12 × 1.75; 20 deep[2)]	2	O
U	Bearing flushing	DIN 3852[5)]	M18 × 1.5; 12 deep	2	X
R_1, R_2	Air bleed	DIN 3852[5)]	M18 × 1.5; 12 deep	2	X
R_1	Air bleed (LA1S only.)	DIN 3852[5)]	M22 × 1.5; 15.5 deep	2	X
R_2	Air bleed (LA1S only.)	DIN 3852[5)]	M27 × 2; 19 deep	2	X
A_1	Measuring high pressure	DIN 3852[5)]	M14 × 1.5; 12 deep	400	X
T_1	Control fluid drain	DIN 3852[5)]	M12 × 1.5; 12 deep	400	X[6)]
X_3	Override	DIN 3852[5)]	M14 × 1.5; 12 deep	400	X
Y_3	External control pressure	DIN 3852[5)]	M14 × 1.5; 12 deep	40	X
X_1	Pilot pressure	DIN 3852[5)]	M14 × 1.5; 12 deep	40	O
X_4	Load pressure	DIN 3852[5)]	M14 × 1.5; 12 deep	400	O
M_1	Control pressure measurement	DIN 3852[5)]	M12 × 1.5; 12 deep	400	X

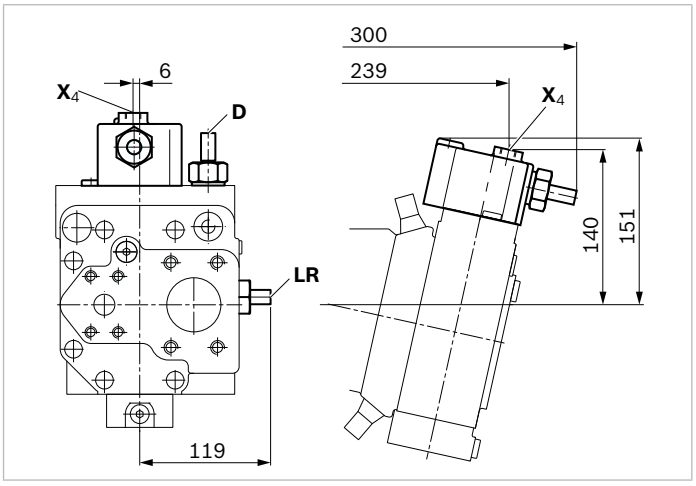
1) Center bore according to DIN 332 (thread according to DIN 13)
2) For notes on tightening torques, see instruction manual.
3) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
4) Only dimensions according to SAE J518, metric fastening thread is a deviation from the standard.
5) The spot face can be deeper than specified in the appropriate standard.
6) For versions with a pressure controller or pressure cut-off, a drain line is needed to relieve port **T_1** to the reservoir.

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

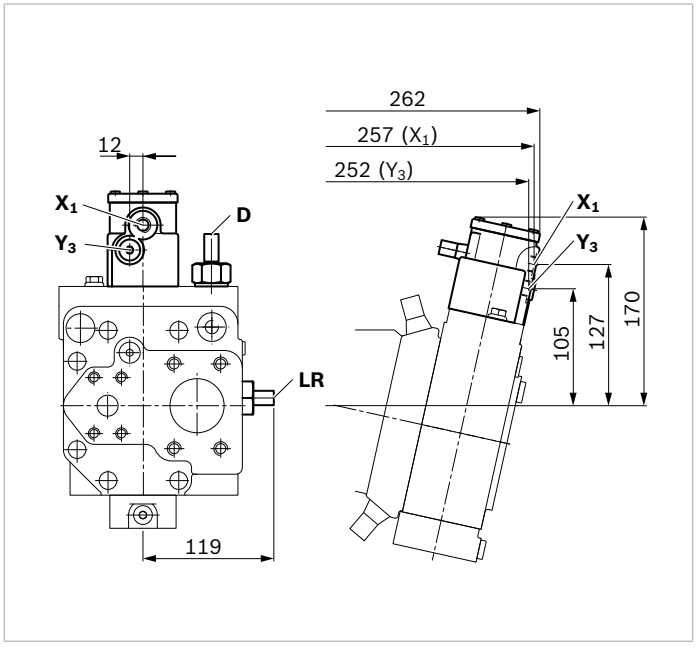
▼ **LRD** – Power controller with pressure cut-off



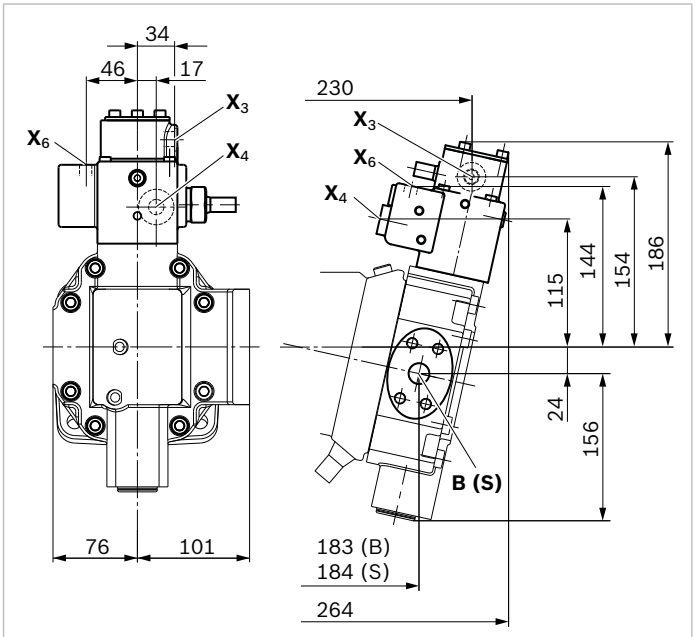
▼ **LRDS** – Power control with pressure cut-off and load sensing



▼ **LRDH1** – Power control with pressure cut-off and stroke limiter

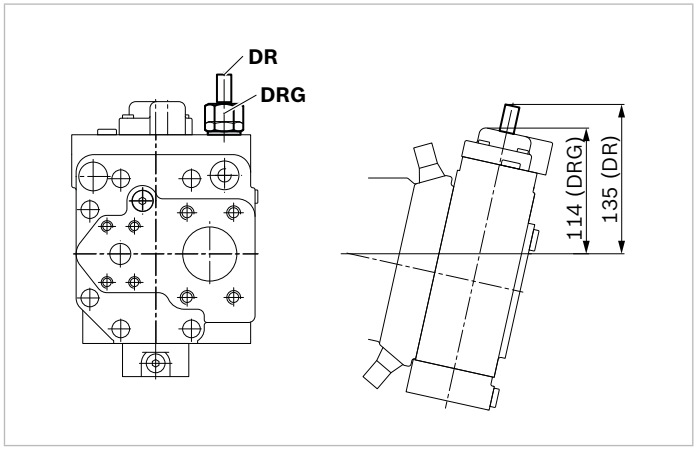


▼ **LA1S** – Power control with load sensing,
LA1S5 – Power control with load sensing and hydraulically proportional LS-override

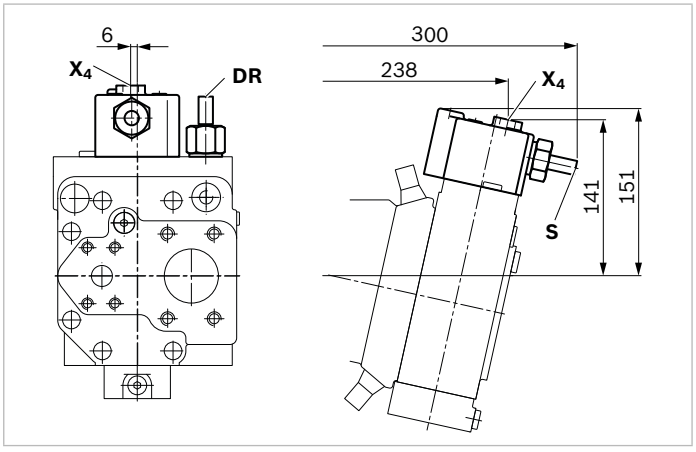


Port **X6** with version LA1S5 only

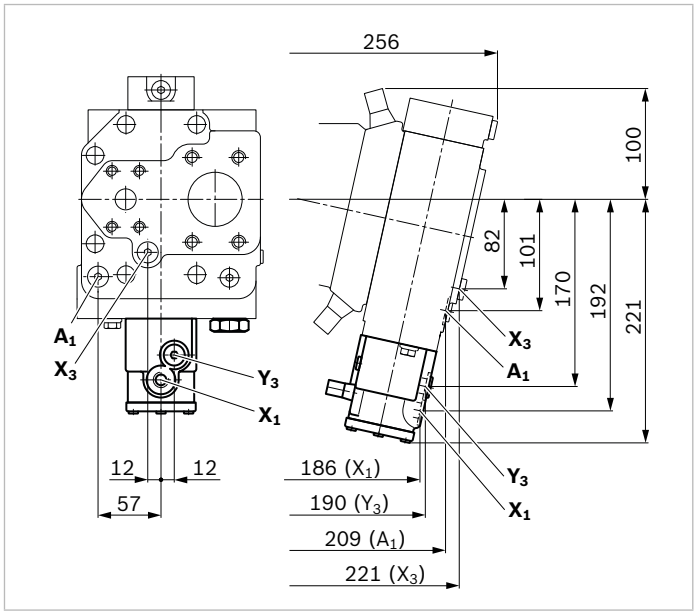
▼ **DR/DRG** – Pressure controller/pressure controller remotely controlled



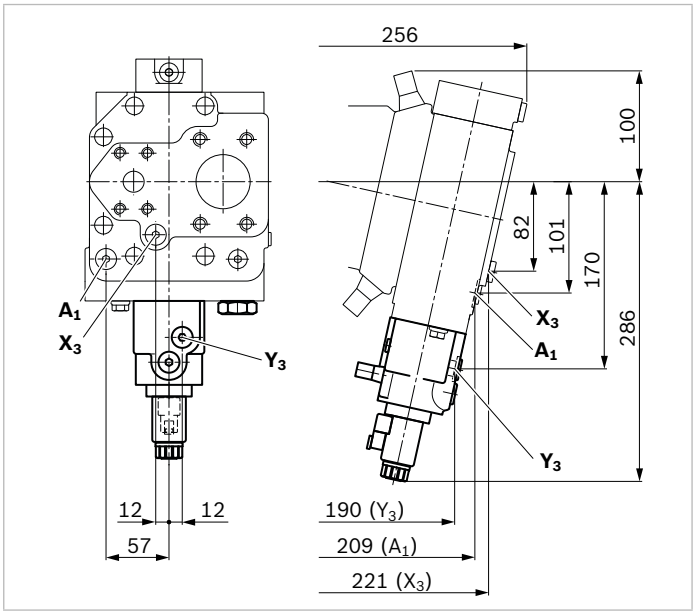
▼ **DRS** – Pressure controller with load sensing



▼ **HD1, HD1G** – Proportional hydraulic control , positive control, and variant with pressure cut-off, remotely controlled



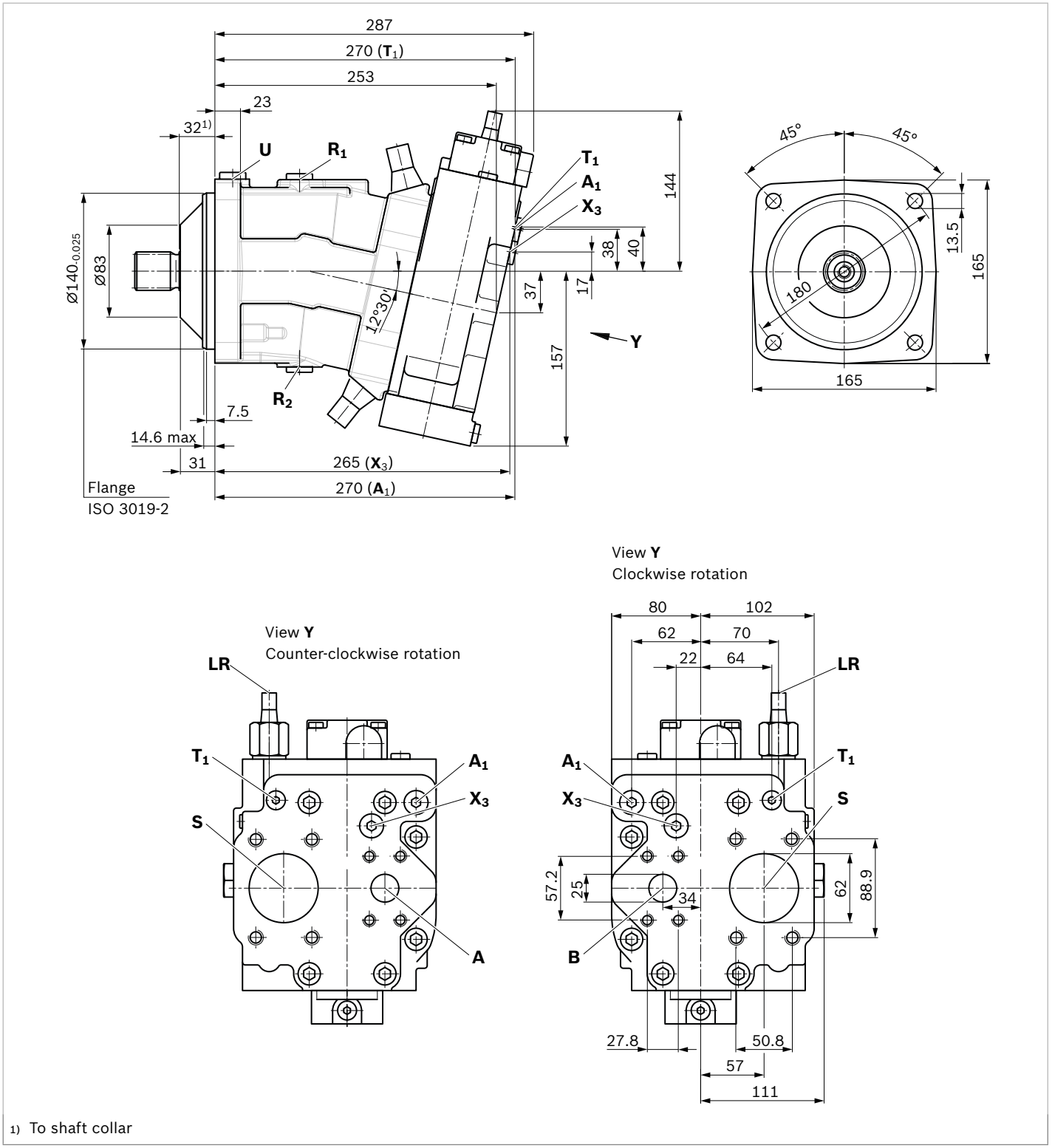
▼ **EP2** – Proportional control electric, positive control



Dimensions, size 80

LR – Power controller without power override

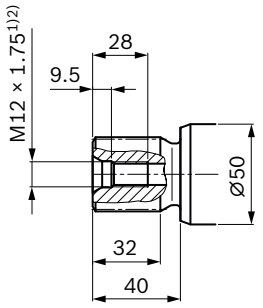
All of the variants of the controllers on pages 30 and 31 are shown for the clockwise direction of input rotation (view **Y**)



1) To shaft collar

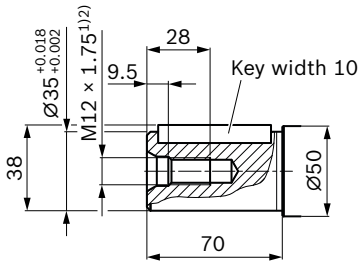
▼ **Splined shaft DIN 5480**

Z – W35×2×16×9g



▼ **Parallel keyed shaft DIN 6885**

P – AS10×8×56

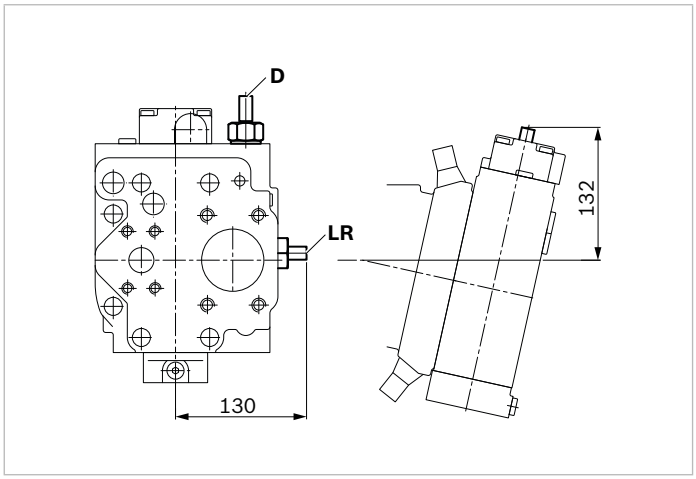


Ports		Standard	Size[2)]	$p_{max\ abs}$ [bar][3)]	Status
A (B)	Working port (high-pressure series) fastening thread	SAE J518[4)] DIN 13	1 in M12 × 1.75; 17 deep	400	O
S	Suction port (standard series) fastening thread	SAE J518[4)] DIN 13	2 1/2 in M12 × 1.75; 17 deep	2	O
U	Bearing flushing	DIN 3852[5)]	M18 × 1.5; 12 deep	2	X
R_1, R_2	Air bleed	DIN 3852[5)]	M18 × 1.5; 12 deep	2	X
R_1	Air bleed (LA1S only.)	DIN 3852[5)]	M22 × 1.5; 15.5 deep	2	X
R_2	Air bleed (LA1S only.)	DIN 3852[5)]	M27 × 2; 19 deep	2	X
A_1	Measuring high pressure	DIN 3852[5)]	M16 × 1.5; 12 deep	400	X
T_1	Control fluid drain	DIN 3852[5)]	M12 × 1.5; 12 deep	400	X[6)]
X_3	Override	DIN 3852[5)]	M16 × 1.5; 12 deep	400	X
Y_3	External control pressure	DIN 3852[5)]	M14 × 1.5; 12 deep	40	X
X_1	Pilot pressure	DIN 3852[5)]	M14 × 1.5; 12 deep	40	O
X_4	Load pressure	DIN 3852[5)]	M14 × 1.5; 12 deep	400	O
M_1	Control pressure measurement	DIN 3852[5)]	M12 × 1.5; 12 deep	400	X

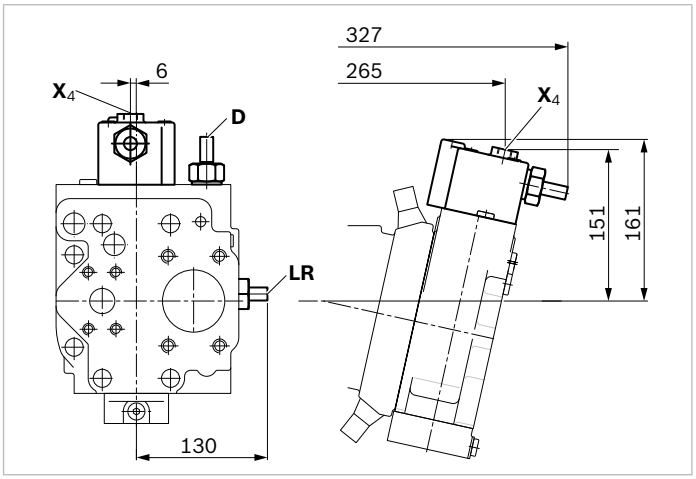
1) Center bore according to DIN 332 (thread according to DIN 13)
2) For notes on tightening torques, see instruction manual.
3) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
4) Only dimensions according to SAE J518, metric fastening thread is a deviation from the standard.
5) The spot face can be deeper than specified in the appropriate standard.
6) For versions with a pressure controller or pressure cut-off, a drain line is needed to relieve port **T_1** to the reservoir.

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

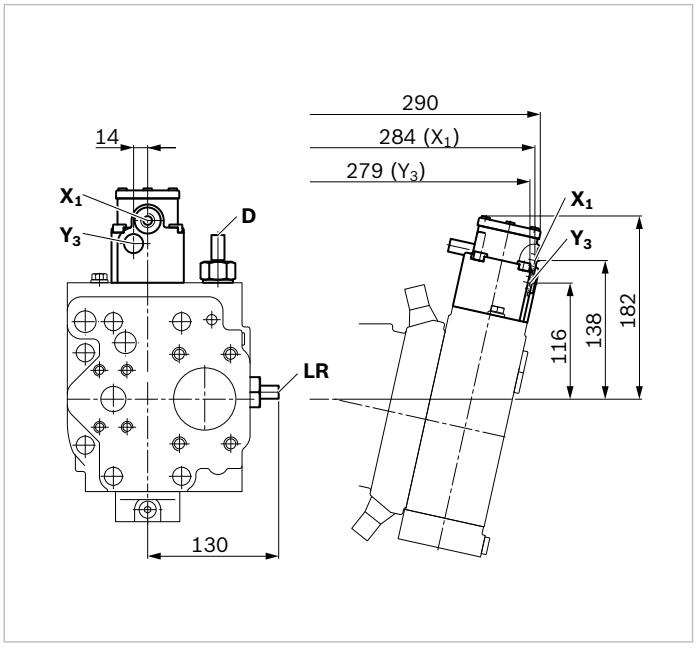
▼ **LRD** – Power controller with pressure cut-off



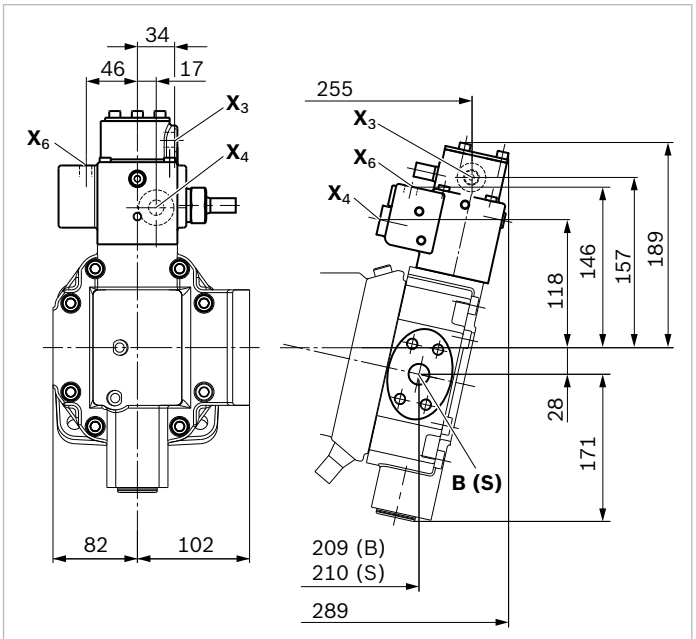
▼ **LRDS** – Power control with pressure cut-off and load sensing



▼ **LRDH1** – Power control with pressure cut-off and stroke limiter

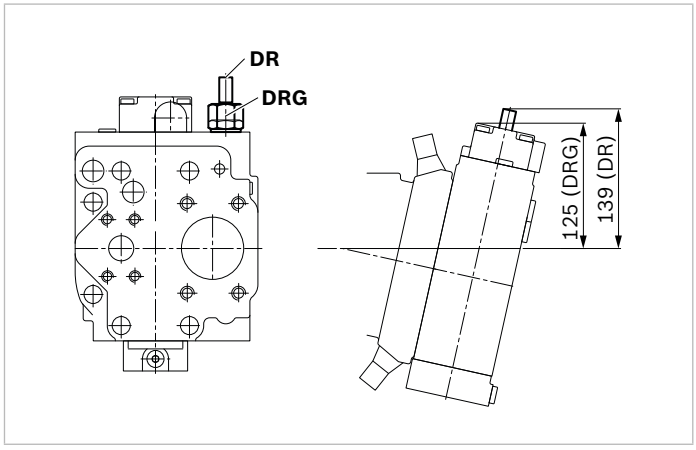


▼ **LA1S** – Power control with load sensing,
LA1S5 – Power control with load sensing, can be overridden on a hydraulically proportional basis

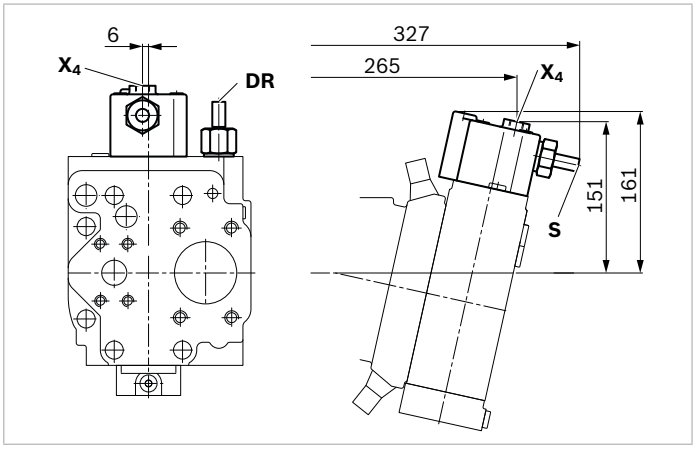


Port **X6** with version LA1S5 only

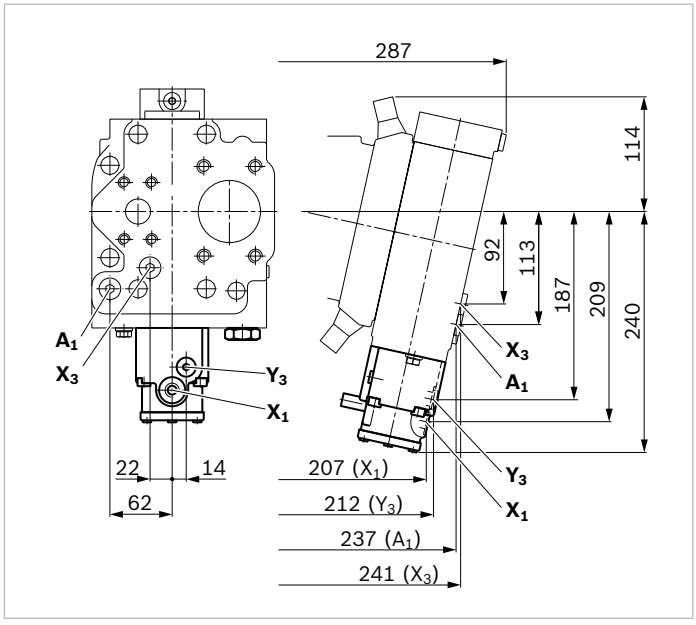
▼ **DR/DRG** – Pressure controller/pressure controller remotely controlled



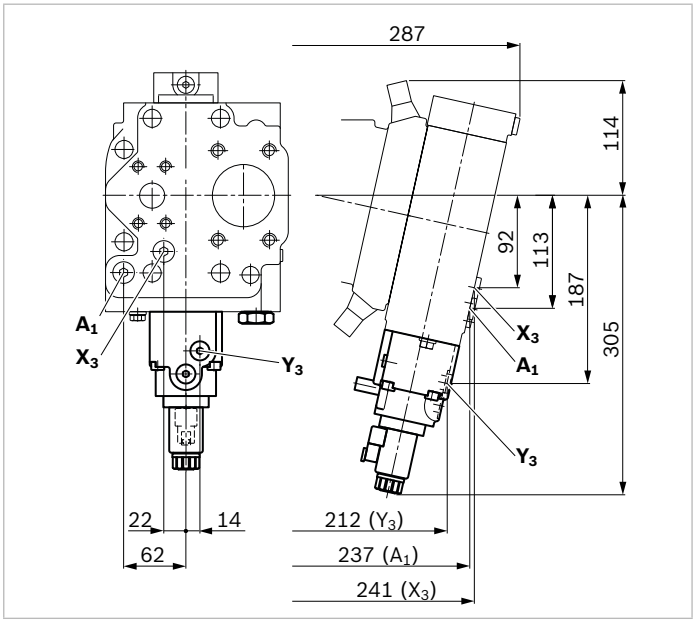
▼ **DRS** – Pressure controller with load sensing



▼ **HD1, HD1G** – Proportional hydraulic control , positive control, and variant with pressure cut-off, remotely controlled



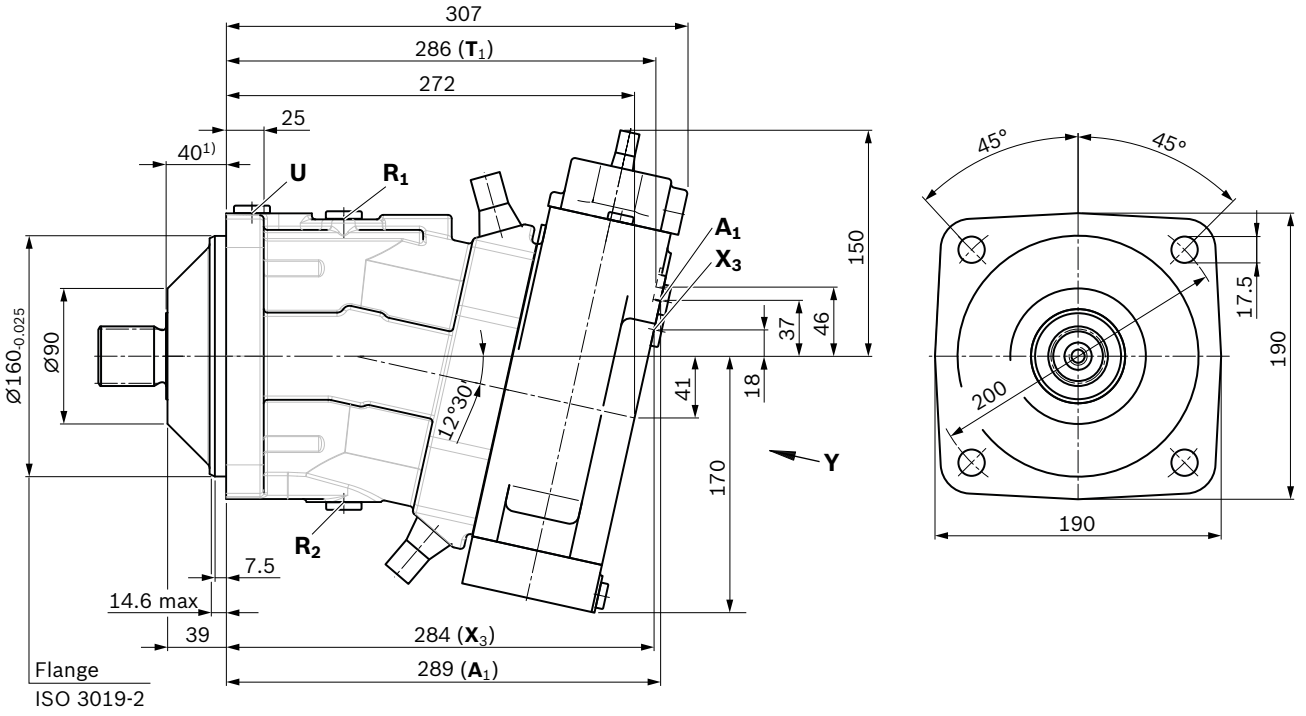
▼ **EP2** – Proportional control electric, positive control



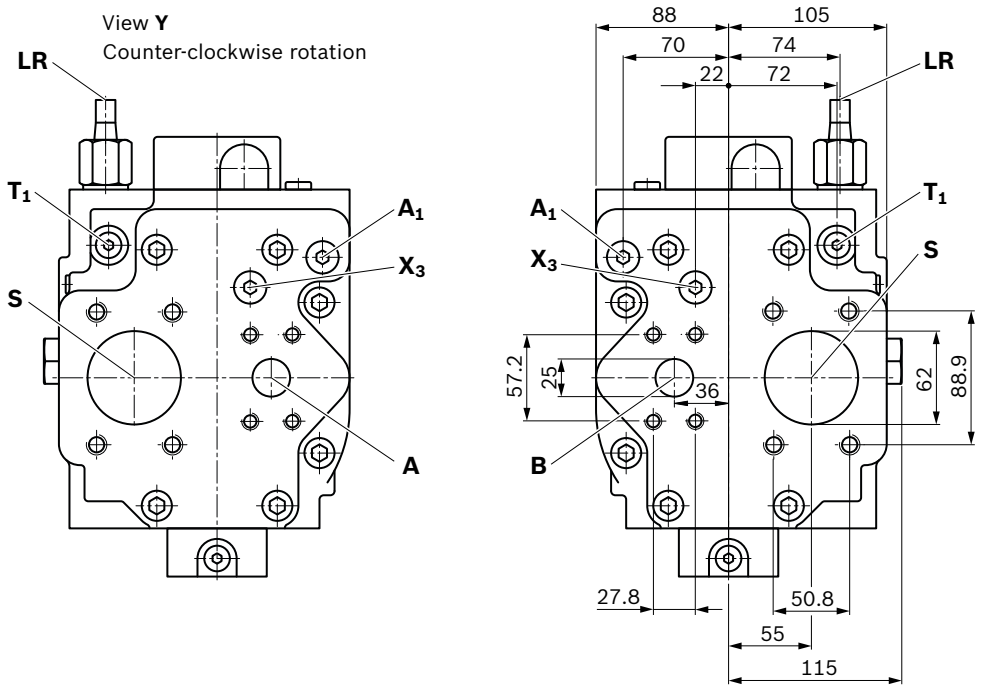
Dimensions, size 107

LR – Power controller without power override

All of the variants of the controllers on pages 34 and 35 are shown for the clockwise direction of input rotation (view **Y**)



View **Y**
Clockwise rotation

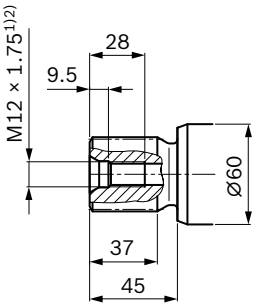


View **Y**
Counter-clockwise rotation

1) To shaft collar

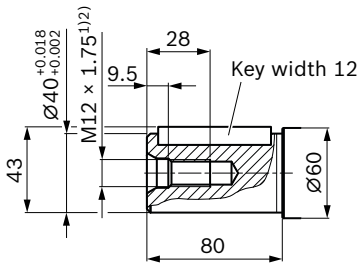
▼ **Splined shaft DIN 5480**

Z - W40×2×18×9g



▼ **Parallel keyed shaft DIN 6885**

P - AS12×8×63

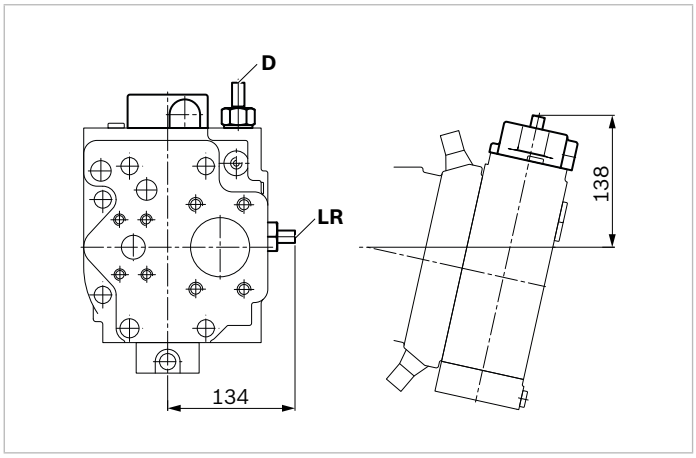


Ports		Standard	Size[2)]	$p_{max\ abs}$ [bar][3)]	Status
A (B)	Working port (high-pressure series) fastening thread	SAE J518[4)] DIN 13	1 in M12 × 1.75; 17 deep	400	O
S	Suction port (standard series) fastening thread	SAE J518[4)] DIN 13	2 1/2 in M12 × 1.75; 17 deep	2	O
U	Bearing flushing	DIN 3852[5)]	M18 × 1.5; 12 deep	2	X
R_1, R_2	Air bleed	DIN 3852[5)]	M18 × 1.5; 12 deep	2	X
A_1	Measuring high pressure	DIN 3852[5)]	M16 × 1.5; 12 deep	400	X
T_1	Control fluid drain	DIN 3852[5)]	M12 × 1.5; 12 deep	400	X[6)]
X_3	Override	DIN 3852[5)]	M16 × 1.5; 12 deep	400	X
Y_3	External control pressure	DIN 3852[5)]	M14 × 1.5; 12 deep	40	X
X_1	Pilot pressure	DIN 3852[5)]	M14 × 1.5; 12 deep	40	O
X_4	Load pressure	DIN 3852[5)]	M14 × 1.5; 12 deep	400	O
M_1	Control pressure measurement	DIN 3852[5)]	M12 × 1.5; 12 deep	400	X

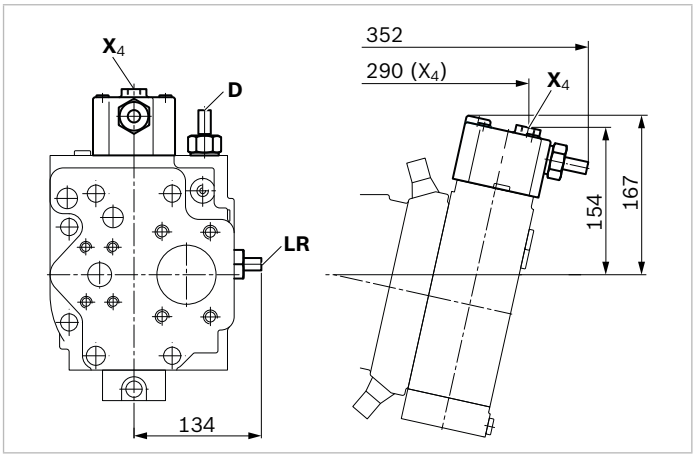
1) Center bore according to DIN 332 (thread according to DIN 13)
2) For notes on tightening torques, see instruction manual.
3) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
4) Only dimensions according to SAE J518, metric fastening thread is a deviation from the standard.
5) The spot face can be deeper than specified in the appropriate standard.
6) For versions with a pressure controller or pressure cut-off, a drain line is needed to relieve port **T_1** to the reservoir.

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

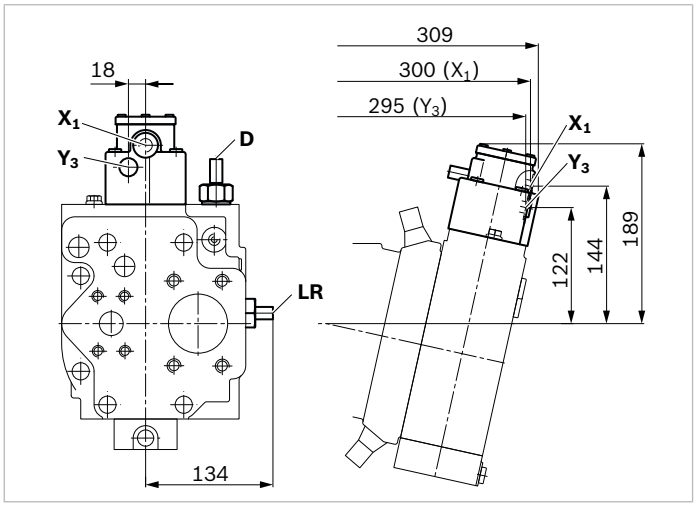
▼ **LRD** – Power controller with pressure cut-off



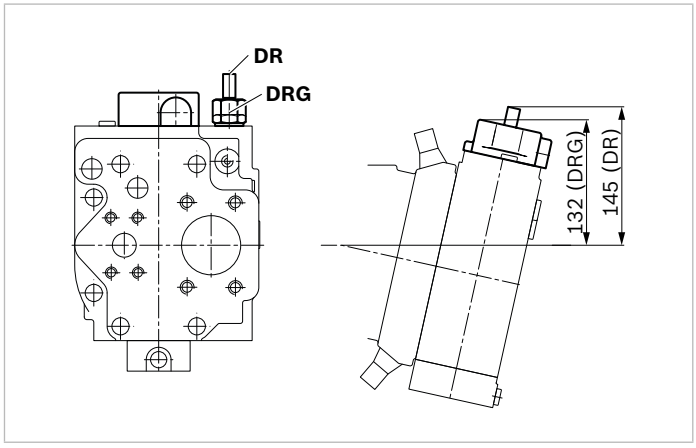
▼ **LRDS** – Power control with pressure cut-off and load sensing



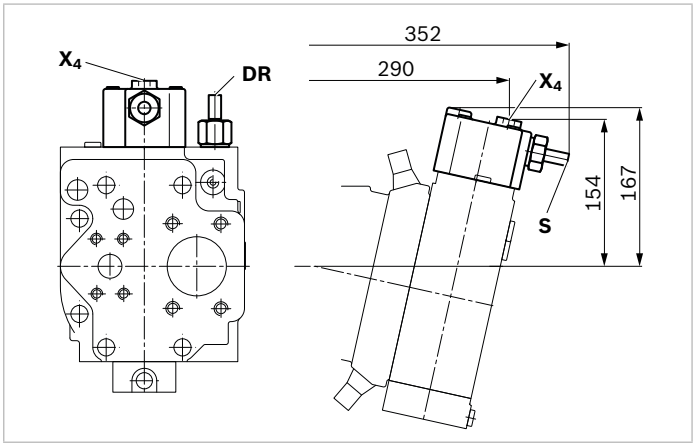
▼ **LRDH1** – Power control with pressure cut-off and stroke limiter



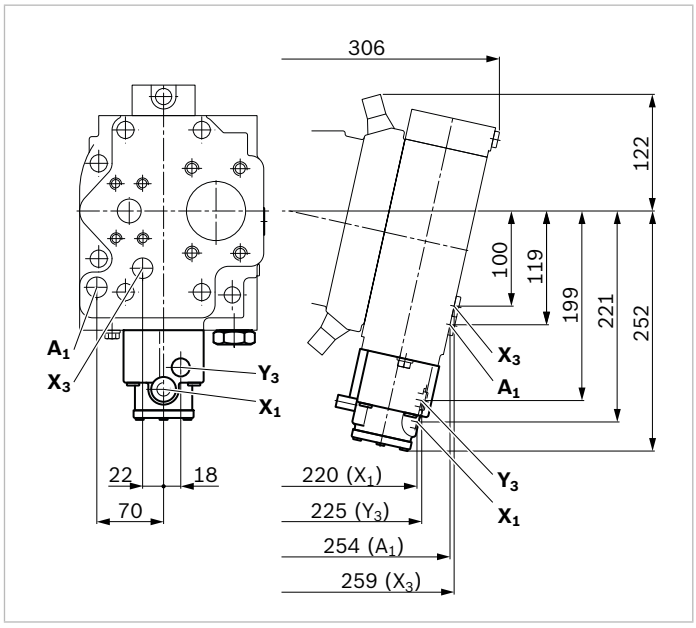
▼ **DR/DRG** – Pressure controller/pressure controller remotely controlled



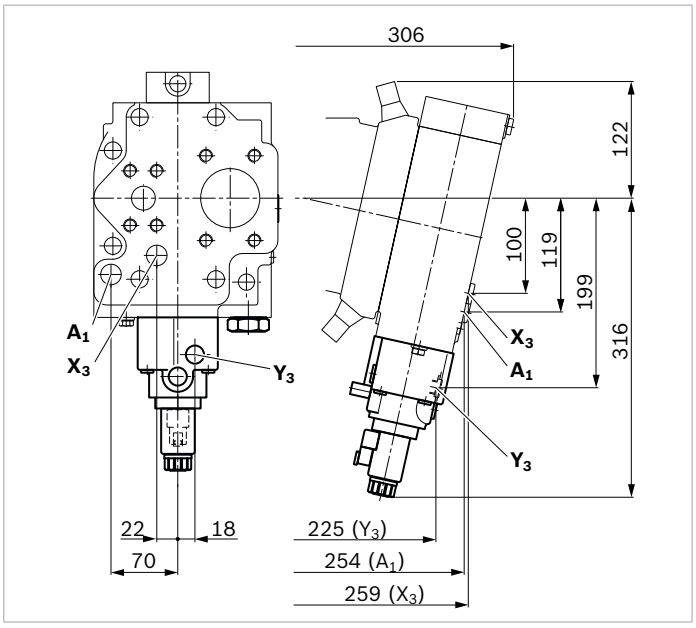
▼ **DRS** – Pressure controller with load sensing



▼ **HD1, HD1G** – Proportional hydraulic control , positive control, and variant with pressure cut-off, remotely controlled



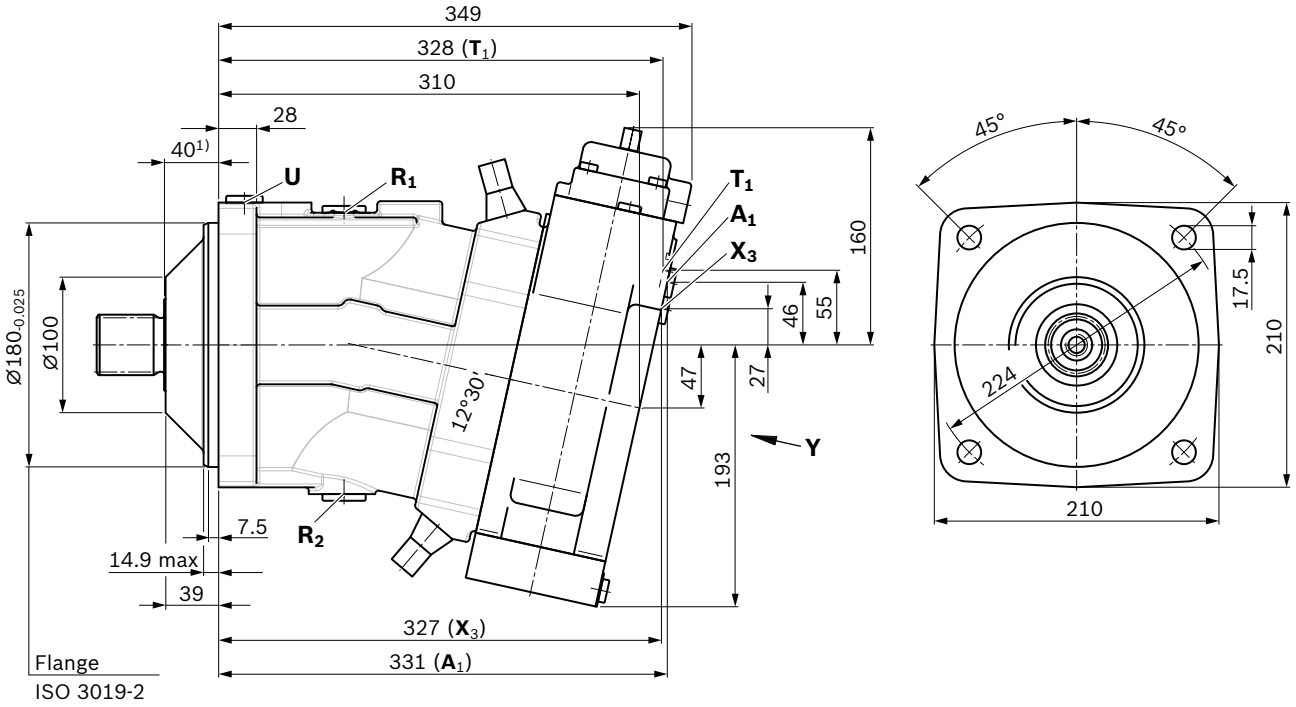
▼ **EP2** – Proportional control electric, positive control



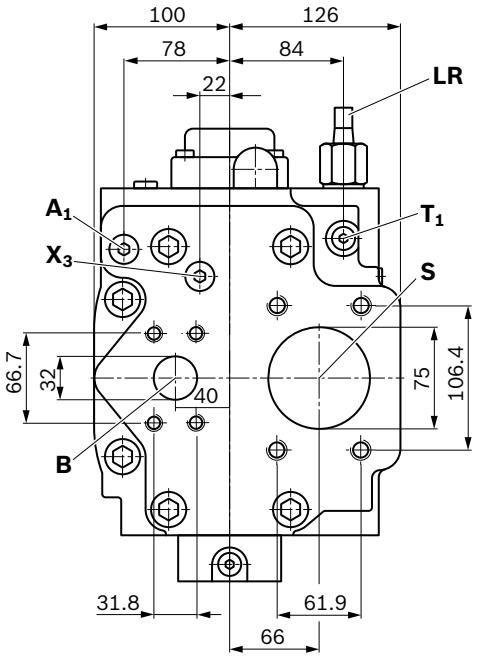
Dimensions, size 160

LR – Power controller without power override

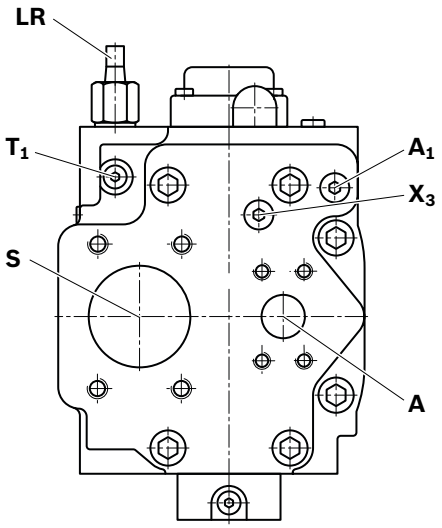
All of the variants of the controllers on pages 38 and 39 are shown for the clockwise direction of input rotation (view **Y**)



View **Y**
Clockwise rotation



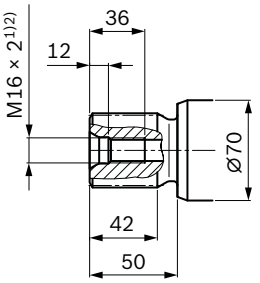
View **Y**
Counter-clockwise rotation



1) To shaft collar

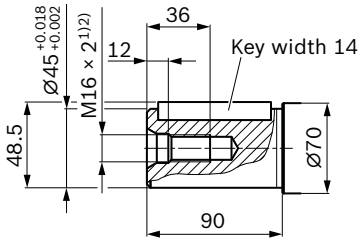
▼ **Splined shaft DIN 5480**

Z – W45×2×21×9g



▼ **Parallel keyed shaft DIN 6885**

P – AS14×9×70

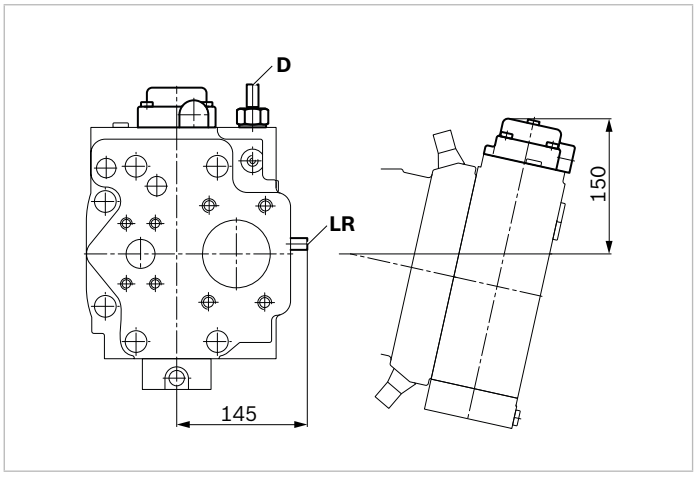


Ports		Standard	Size[2)]	$p_{max\ abs}$ [bar][3)]	Status
A (B)	Working port (high-pressure series) fastening thread	SAE J518[4)] DIN 13	1 1/4 in M14 × 2; 19 deep	400	O
S	Suction port (standard series) fastening thread	SAE J518[4)] DIN 13	3 in M16 × 2; 24 deep	2	O
U	Bearing flushing	DIN 3852[5)]	M22 × 1.5; 14 deep	2	X
R_1, R_2	Air bleed	DIN 3852[5)]	M26 × 1.5; 16 deep	2	X
A_1	Measuring high pressure	DIN 3852[5)]	M16 × 1.5; 12 deep	400	X
T_1	Control fluid drain	DIN 3852[5)]	M12 × 1.5; 12 deep	400	X[6)]
X_3	Override	DIN 3852[5)]	M16 × 1.5; 12 deep	400	X
Y_3	External control pressure	DIN 3852[5)]	M14 × 1.5; 12 deep	40	X
X_1	Pilot pressure	DIN 3852[5)]	M14 × 1.5; 12 deep	40	O
X_4	Load pressure	DIN 3852[5)]	M14 × 1.5; 12 deep	400	O
M_1	Control pressure measurement	DIN 3852[5)]	M12 × 1.5; 12 deep	400	X

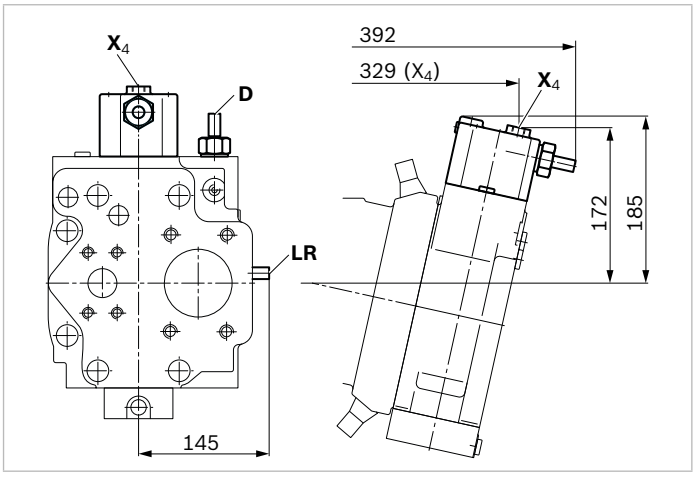
1) Center bore according to DIN 332 (thread according to DIN 13)
2) For notes on tightening torques, see instruction manual.
3) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
4) Only dimensions according to SAE J518, metric fastening thread is a deviation from the standard.
5) The spot face can be deeper than specified in the appropriate standard.
6) For versions with a pressure controller or pressure cut-off, a drain line is needed to relieve port **T_1** to the reservoir.

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

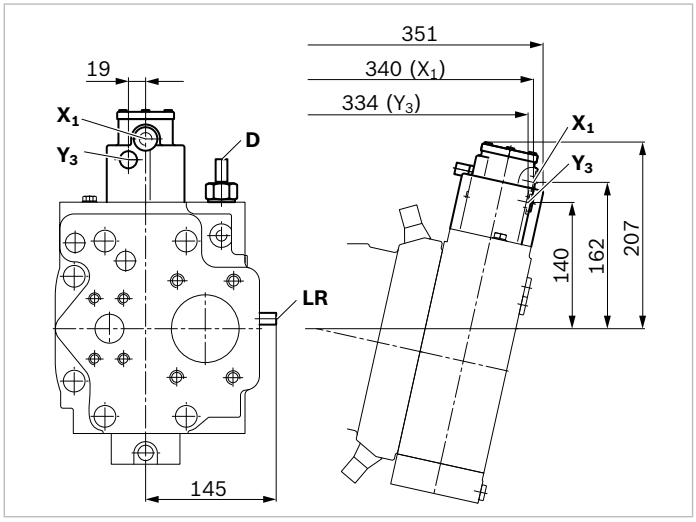
▼ **LRD** – Power controller with pressure cut-off



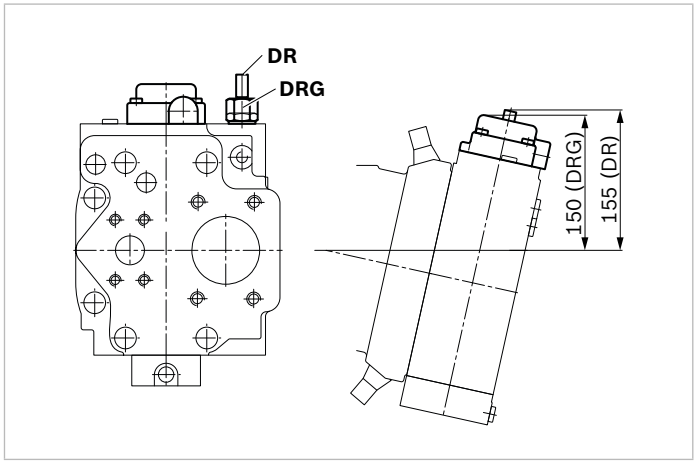
▼ **LRDS** – Power control with pressure cut-off and load sensing



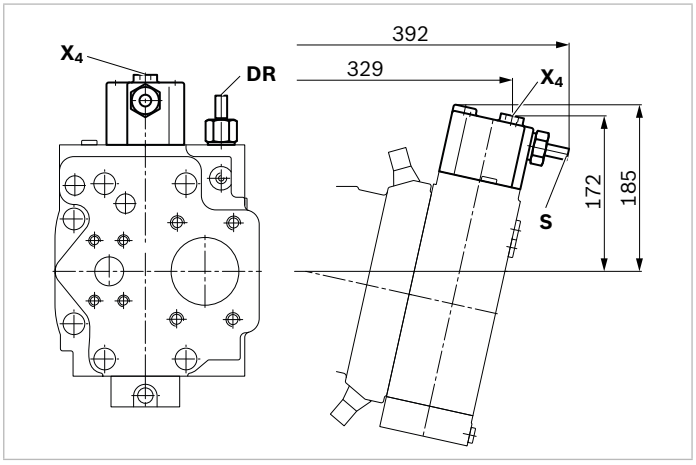
▼ **LRDH1** – Power control with pressure cut-off and stroke limiter



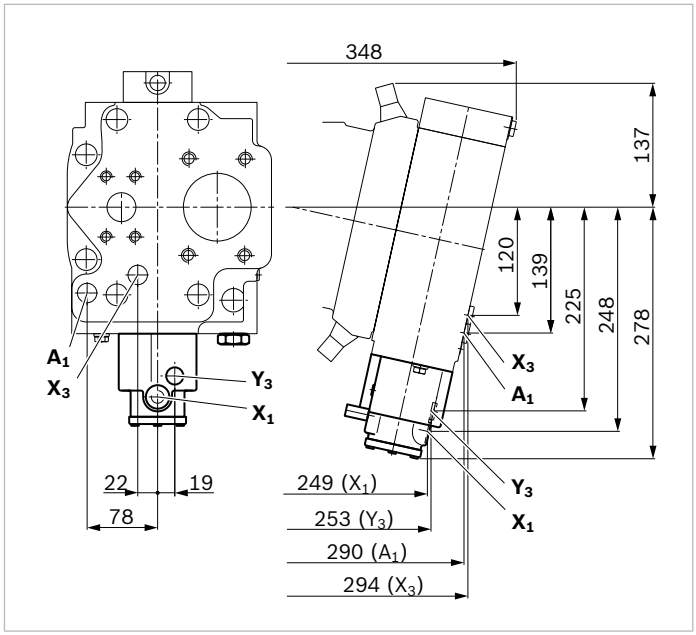
▼ **DR/DRG** – Pressure controller/pressure controller remotely controlled



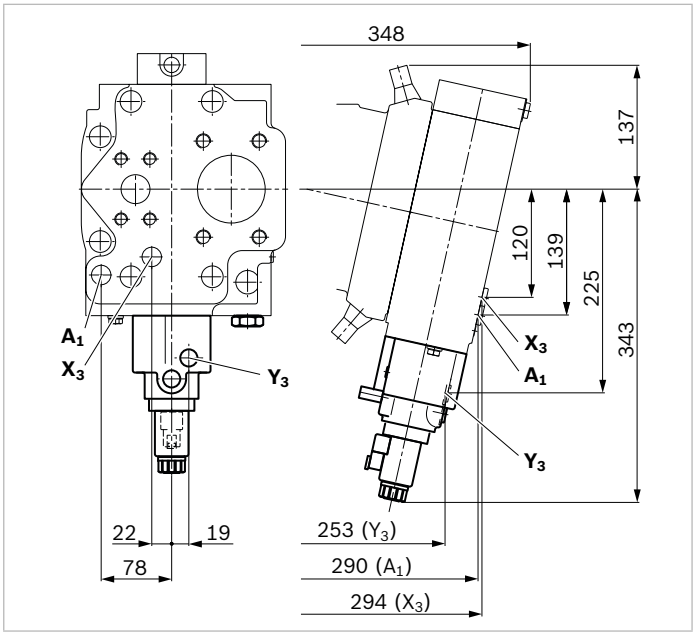
▼ **DRS** – Pressure controller with load sensing



▼ **HD1, HD1G** – Proportional hydraulic control , positive control, and variant with pressure cut-off, remotely controlled



▼ **EP2** – Proportional control electric, positive control



Connector for solenoids

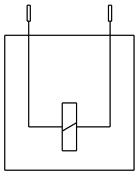
DEUTSCH DT04-2P-EP04

Molded connector, 2-pin, without bidirectional suppressor diode

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

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

▼ **Circuit 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).

Note

If necessary, you can change the connector orientation by turning the solenoid housing.

The procedure can be taken from the instruction manual.

Installation instructions

General

At commissioning and during operation, the axial piston unit must be filled with hydraulic fluid and air bled. This must also be observed following a long standstill as the axial piston unit can empty via the hydraulic lines.
Particularly in the installation position "drive shaft upwards", filling and air bleeding must be carried out completely as there is, for example, a danger of dry running.
The pump housing is internally connected to the suction chamber. A separate drain line from the case to the reservoir is not needed. Exception: For versions with pressure controller or pressure cut-off, a drain line is needed to relieve port $\mathbf{T_1}$ to the reservoir.
To achieve favorable noise values, decouple all connecting lines using elastic elements.
In all operating conditions, the suction line and the drain line must flow into the reservoir below the minimum fluid level. The minimum suction pressure at port **S** must not fall below 0.8 bar absolute during operation either.
When designing the reservoir, ensure that there is adequate spacing between the suction line and the drain line. This minimizes oil turbulence and carries out degassing, which prevents the heated hydraulic fluid from being sucked directly back in again.

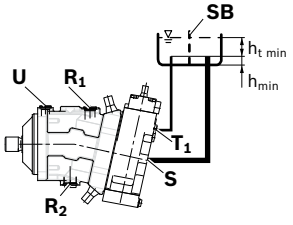
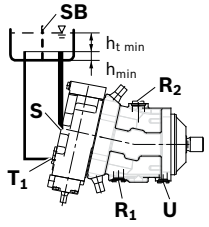
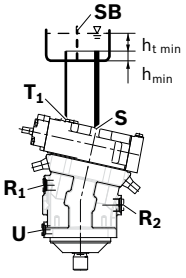
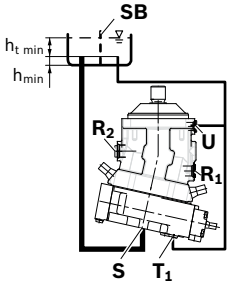
Notes

- Axial piston units with electric components (e.g. electric controls, sensors) must not be installed in a reservoir below the fluid level.
- In certain installation conditions, an influence on the control characteristic curves can be expected. Gravity, dead weight and case pressure can cause minor shifts in characteristics and changes in response time.

Key	
$\mathbf{R_1/R_2}$	Air bleed port
U	Bearing flushing
S	Suction port
$\mathbf{T_1}$	Control fluid drain
$\mathbf{h_{t\ min}}$	Minimum required immersion depth (200 mm)
$\mathbf{h_{min}}$	Minimum required spacing to reservoir base (100 mm)
SB	Baffle (baffle plate)

Installation position

See the following examples **1** to **4**.
Additional installation positions are available upon request.
Recommended installation position: **1** and **2**.

Installation position	Air bleeding	Filling
1	$\mathbf{R_1}$	**S**
		
2	$\mathbf{R_2}$	**S**
		
3	$\mathbf{T_1}$	**S**
		
4	**U**	**S**
		

Project planning notes

- The A7VO pump is designed to be used in open circuits.
- Project planning, installation and commissioning of the axial piston units requires the involvement of skilled personnel.
- Before using the axial piston unit, please read the corresponding instruction manual thoroughly and completely. If necessary, request them from Bosch Rexroth.
- Before finalizing your design, request a binding installation drawing.
- The specified data and notes must be observed.
- Pressure controllers are no protection from pressure overload. A separate pressure relief valve is to be provided in the hydraulic system.
- Depending on the operating condition of the axial piston unit (operating pressure, fluid temperature), the characteristic may shift.
- Not all versions of the product are approved for use in a safety function pursuant to ISO 13849. Please consult the responsible contact person at Bosch Rexroth if you require reliability parameters (e.g. $MTTF_d$) for functional safety.
- Working ports:
  - The ports and fastening threads are designed for the specified maximum pressure. The machine or system manufacturer must ensure that the connecting elements and lines correspond to the specified operating conditions (pressure, flow, hydraulic fluid, temperature) with the necessary safety factors.
  - 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 and regulation systems (e.g. valve spools) may in certain circumstances become stuck in an undefined position due to contamination (e.g. contaminated hydraulic fluid, abrasion or residual dirt from components). As a result, the hydraulic fluid flow or build-up of torque of the axial piston unit will no longer respond correctly to the operator's commands. Even the use of different filter cartridges (external or internal inlet filter) will not rule out a fault but merely minimize 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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