

Axial Piston Variable Pump A7VO

RE 92202/05.12
Replaces: 12.07

1/36

Data sheet

Series 63
Size 28 to 160
Nominal pressure 350 bar
Maximum pressure 400 bar
Open circuit



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Features

- 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
- The flow is proportional to the drive speed and displacement.
- The flow can be infinitely varied by adjusting the bent axis.
- Wide selection of control devices
- Compact, robust pump with long service life

Ordering code for standard program

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

Axial piston unit

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

02	Pump, open circuit	O
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Sizes (NG)

03	Geometric displacement, see table of values on page 7	28	55	80	107	160
	Sizes 250, 355 and 500 See RE 92203					

Control devices

		28	55	80	107	160	
04	Power controller	●	●	●	●	●	LR
	with pressure cut-off	●	●	●	●	●	LRD
	with stroke limiter						
	negative control $\Delta p = 25$ bar	-	●	●	●	●	LRH1
	with pressure cut-off and stroke limiter						
	negative control $\Delta p = 25$ bar	-	●	●	●	●	LRDH1
	Pressure controller	●	●	●	●	●	DR
	remote controlled	●	●	●	●	●	DRG
	with load sensing	-	●	●	●	●	DRS
	Proportional control hydraulic						
positive control $\Delta p = 10$ bar	●	●	●	●	●	HD1	
positive control $\Delta p = 25$ bar	●	●	●	●	●	HD2	
with pressure cut-off, remote controlled							
positive control $\Delta p = 10$ bar	●	●	●	●	●	HD1G	
positive control $\Delta p = 25$ bar	●	●	●	●	●	HD2G	
Proportional control electric , without manual override							
positive control $U = 24$ V DC	●	●	●	●	●	EP2	
with pressure cut-off, remote controlled							
positive control $U = 24$ V DC	●	●	●	●	●	EP2G	

Series

05	Series 6, index 3	63
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Directions of rotation

		28 to 160	
06	Viewed on drive shaft	clockwise	● R
		counter-clockwise	● L

Seals

07	FKM (fluor-caoutchouc)	V
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Drive shafts

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

Mounting flange

09	ISO 3019-2 – 4 hole	B
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Port plate for service lines

10	SAE flange port A and S at rear (fastening thread metric)	01
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● = Available - = Not available = Preferred program

Ordering code for standard program

A7V	O			/	63		-			B	01		
01	02	03	04		05	06		07	08	09	10	11	12

Connector for solenoids (see page 33)

11	Without connector (without solenoid, only with hydraulic controls; without code)	
	DEUTSCH - molded connector, 2 pin – without suppressor diode ¹⁾	P

Standard / special version

12	Standard version (without code)	
	Special version	-S

● = Available – = Not available = Preferred program

1) Other connectors on request

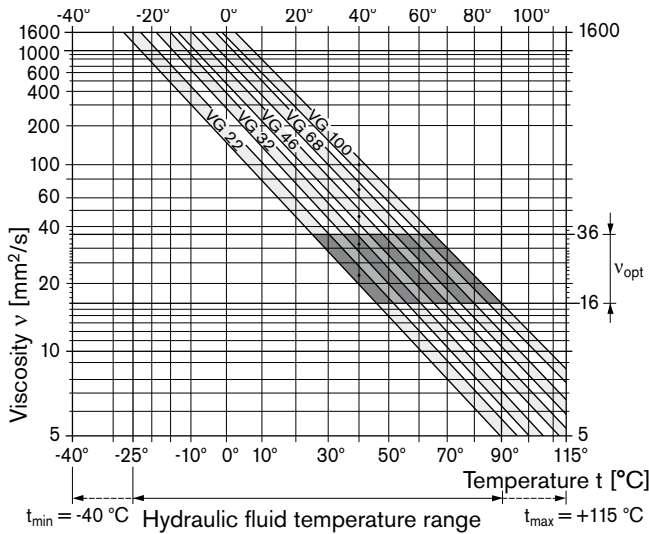
Technical data

Hydraulic fluid

Before starting project planning, please refer to our data sheets RE 90220 (mineral oil), RE 90221 (environmentally acceptable hydraulic fluids), RE 90222 (HFD hydraulic fluids) and RE 90223 (HFA, HFB, HFC hydraulic fluids) for detailed information regarding the choice of hydraulic fluid and application conditions.

The variable pump A7VO is not suitable for operation with HFA hydraulic fluid. If HFB, HFC and HFD or environmentally acceptable hydraulic fluids are used, the limitations regarding technical data or other seals must be observed.

Selection diagram



Details regarding the choice of hydraulic fluid

The correct choice of hydraulic fluid requires knowledge of the operating temperature in relation to the ambient temperature: in an open circuit the reservoir temperature.

The hydraulic fluid should be chosen so that the operating viscosity in the operating temperature range is within the optimum range (v_{opt} see the shaded area of the selection diagram). We recommended that the higher viscosity class be selected in each case.

Example: At an ambient temperature of X °C, an operating temperature of 60 °C is set in the circuit. In the optimum operating viscosity range (v_{opt} , shaded area), this corresponds to the viscosity classes VG 46 or VG 68; to be selected: VG 68.

Note

The case drain temperature, which is affected by pressure and speed, can be higher than the reservoir temperature. At no point of the component may the temperature be higher than 115 °C. The temperature difference specified below 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, we recommend flushing the case at port U.

Viscosity and temperature of hydraulic fluid

	Viscosity [mm ² /s]	Temperature	Comment
Transport and storage at ambient temperature		$T_{min} \geq -50 \text{ °C}$ $T_{opt} = +5 \text{ °C to } +20 \text{ °C}$	factory preservation: up to 12 months with standard, up to 24 months with long-term
(Cold) start-up ¹⁾	$v_{max} = 1600$	$T_{St} \geq -40 \text{ °C}$	$t \leq 3 \text{ min}$, without load ($p \leq 50 \text{ bar}$), $n \leq 1000 \text{ rpm}$
Permissible temperature difference		$\Delta T \leq 25 \text{ K}$	between axial piston unit and hydraulic fluid
Warm-up phase	$v < 1600 \text{ to } 400$	$T = -40 \text{ °C to } -25 \text{ °C}$	at $p \leq 0.7 \cdot p_{nom}$, $n \leq 0.5 \cdot n_{nom}$ and $t \leq 15 \text{ min}$
Operating phase			
Temperature difference		$\Delta T = \text{approx. } 12 \text{ K}$	between hydraulic fluid in the bearing and at port R ₁ /R ₂ . The bearing temperature can be reduced by flushing via port U.
Maximum temperature		115 °C 103 °C	in the bearing measured at port R ₁ /R ₂
Continuous operation	$v = 400 \text{ to } 10$ $v_{opt} = 36 \text{ to } 16$	$T = -25 \text{ °C to } +90 \text{ °C}$	measured at port R ₁ /R ₂ , no restrictions within the permissible data
Short-term operation	$v_{min} \geq 7$	$T_{max} = +103 \text{ °C}$	measured at port R ₁ /R ₂ , $t < 3 \text{ min}$, $p < 0.3 \cdot p_{nom}$
FKM shaft seal ¹⁾		$T \leq +115 \text{ °C}$	see page 5

1) At temperatures below -25°C, an NBR shaft seal is required (permissible temperature range: -40 °C to +90 °C).

Technical data

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.

To ensure the functional reliability of the axial piston unit, a gravimetric analysis of the hydraulic fluid is necessary to determine the amount of solid contaminant and to determine the cleanliness level according to ISO 4406. A cleanliness level of at least 20/18/15 is to be maintained.

At very high hydraulic fluid temperatures (90 °C to maximum 115 °C), a cleanliness level of at least 19/17/14 according to ISO 4406 is necessary.

If the above classes cannot be achieved, please contact us.

Case drain fluid

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

For versions with pressure controller or pressure cut-off, a case drain line for discharge from port T₁ to the reservoir is absolutely essential.

Direction of flow

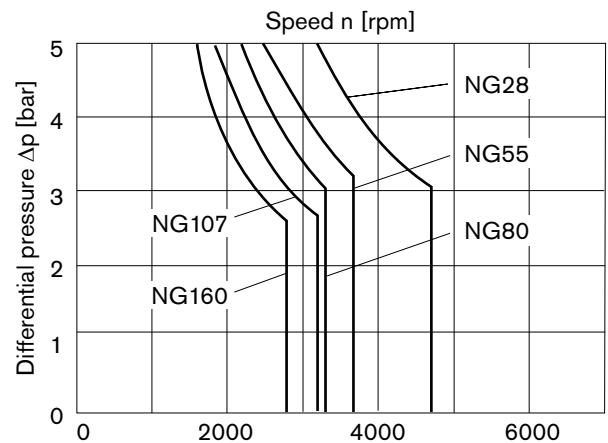
Direction of rotation, view on drive shaft	
clockwise	counter clockwise
S to B	S to A

Shaft seal

Permissible pressure loading

The service life of the shaft seal is influenced by the speed of the axial piston unit and the case drain pressure (case pressure). The mean differential pressure of 2 bar between the case and the ambient pressure may not be enduringly exceeded at normal operating temperature. For a higher differential pressure at reduced speed, see diagram. Momentary pressure spikes ($t < 0.1$ s) of up to 10 bar are permitted. The service life of the shaft seal decreases with an increase in the frequency of pressure spikes.

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



These values are valid for an ambient pressure $p_{abs} = 1$ bar.

Temperature range

The FKM shaft seal may be used for case drain temperatures from -25 °C to +115 °C.

Note

For application cases below -25 °C, an NBR shaft seal is required (permissible temperature range: -40 °C to +90 °C). State NBR shaft seal in plain text when ordering. Please contact us.

Technical data

Operating pressure range

(Operating with mineral oil)

Pressure at service line port A

Nominal pressure p_{nom} _____ 350 bar absolute

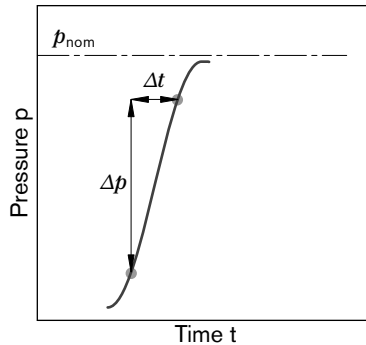
Maximum pressure p_{max} _____ 400 bar absolute

Single operating period _____ 10 s

Total operating period at n_{nom} _____ 300 h

Minimum pressure (high-pressure side) _____ 10 bar absolute

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



Pressure at suction port S (Inlet)

Minimum pressure $p_{S min}$ _____ 0.8 bar absolute

Maximum pressure $p_{S max}$ _____ 2 bar absolute

Note

Values for other hydraulic fluids, please contact us.

Definition

Nominal pressure p_{nom}

The nominal pressure corresponds to the maximum design pressure.

Maximum pressure p_{max}

The maximum pressure corresponds to the maximum operating pressure within the single operating period. The sum of the single operating periods must not exceed the total operating period.

Minimum pressure (high-pressure side)

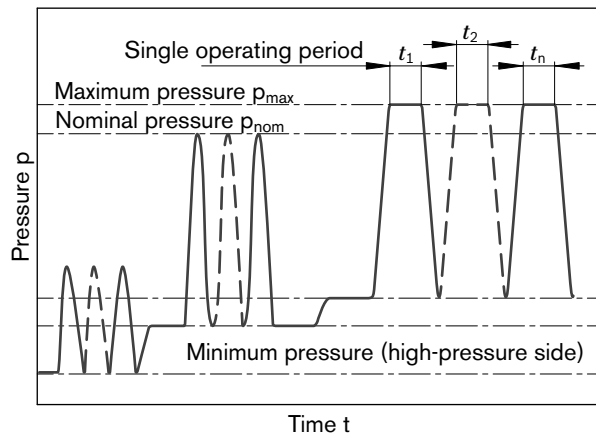
Minimum pressure at the high-pressure side (A or B) which is required in order to prevent damage to the axial piston unit.

Minimum pressure (Inlet)

Minimum pressure at suction port S (inlet) which is required in order to prevent damage to the axial piston unit. The minimum pressure is dependent on the speed and displacement of the axial piston unit (see diagram on page 7).

Rate of pressure change R_A

Maximum permissible rate of pressure rise and reduction during a pressure change over the entire pressure range.



Total operating period = $t_1 + t_2 + \dots + t_n$

Please contact us if these conditions cannot be satisfied.

Technical data

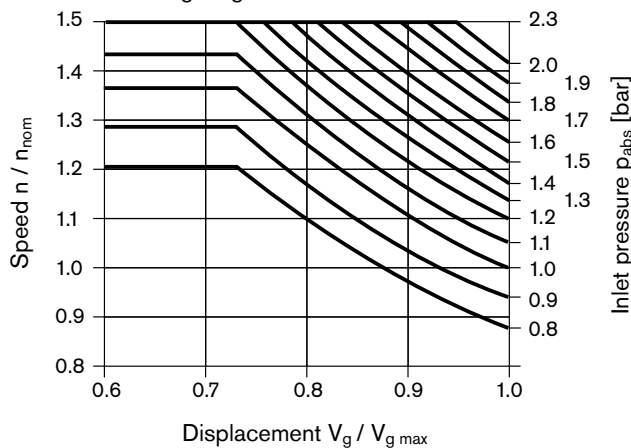
Table of values (theoretical values, without efficiency and tolerances; values rounded)

Size		NG	28	55	80	107	160	
Displacement geometric, per revolution		$V_{g \max}$	cm ³	28.1	54.8	80	107	160
Speed maximum ¹⁾	at $V_{g \max}$	n_{nom}	rpm	3150	2500	2240	2150	1900
	at $V_g < 0.74 \cdot V_{g \max}$ ²⁾	n_{max1}	rpm	4250	3400	3000	2900	2560
Speed maximum ²⁾		n_{max2}	rpm	4750	3750	3350	3200	2850
Flow	at n_{nom} and $V_{g \max}$	q_V	L/min	89	137	179	230	304
Power	at n_{nom} , $V_{g \max}$ and $\Delta p = 350$ bar	P	kW	52	80	105	134	177
Torque	at $V_{g \max}$ and $\Delta p = 350$ bar	T	Nm	156	305	446	596	891
Rotary stiffness	$V_{g \max}$ to $V_g/2$	c_{min}	Nm/rad	5546	10594	15911	21469	36073
	$V_g/2$ to 0 (interpolated)	c_{max}	Nm/rad	16541	32103	48971	67666	104622
Moment of inertia for rotary group		J_{GR}	kgm ²	0.0042	0.0042	0.0080	0.0127	0.0253
Maximum angular acceleration		α	rad/s ²	35900	31600	24200	19200	15300
Case volume		V	L	0.5	0.75	1.2	1.5	2.4
Mass approx.		m	kg	17	25	40	49	71

1) The values are valid:

- at an absolute pressure $p_{\text{abs}} = 1$ bar at suction port S
- for the optimum viscosity range from $\nu_{\text{opt}} = 36$ to 16 mm²/s
- with hydraulic fluid based on mineral oils

2) Maximum speed (limiting speed) with increased inlet pressure p_{abs} at the suction port S and $V_g < V_{g \max}$, see the following diagram.



Note

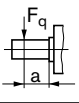
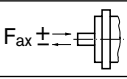
Operation above the maximum values or below the minimum values may result in a loss of function, a reduced service life or in the destruction of the axial piston unit. Other permissible limit values, with respect to speed variation, reduced angular acceleration as a function of the frequency and the permissible start up angular acceleration (lower than the maximum angular acceleration) can be found in data sheet RE 90261.

Determining the operating characteristics

Flow	$q_v = \frac{V_g \cdot n \cdot \eta_v}{1000}$	[L/min]	$V_g =$ Displacement per revolution in cm ³
			$\Delta p =$ Differential pressure in bar
Torque	$T = \frac{V_g \cdot \Delta p}{20 \cdot \pi \cdot \eta_{mh}}$	[Nm]	$n =$ Speed in rpm
			$\eta_v =$ Volumetric efficiency
Power	$P = \frac{2 \pi \cdot T \cdot n}{60000} = \frac{q_v \cdot \Delta p}{600 \cdot \eta_t}$	[kW]	$\eta_{mh} =$ Mechanical-hydraulic efficiency
			$\eta_t =$ Total efficiency ($\eta_t = \eta_v \cdot \eta_{mh}$)

Technical data

Permissible radial and axial forces of the drive shafts

Size	NG		28	55	80	107	160	
Drive shaft	Ø	mm	25	30	35	40	45	
Maximum radial force at distance a (from shaft collar)		$F_{q \max}$	N	5696	9280	11657	13580	18062
		a	mm	12.5	15	17.5	20	22.5
Maximum axial force ¹⁾		$+ F_{ax \max}$	N	315	500	710	900	1120
		$- F_{ax \max}$	N	0	0	0	0	0
Permissible axial force per bar of operating pressure	$\pm F_{ax \text{ per}} / \text{bar}$	N/bar	4.6	7.5	9.6	11.3	15.1	

1) Maximum permissible axial force during standstill or when the axial piston unit is operating in non-pressurized condition.

Note

Influence of the direction of the permissible axial force:

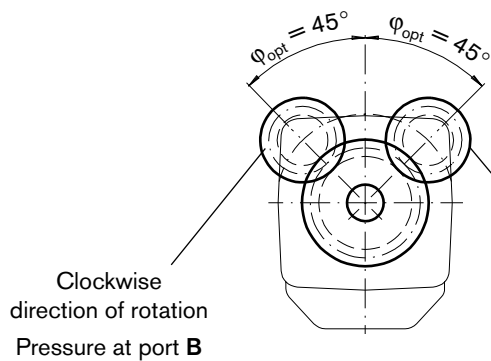
$+ F_{ax \max}$ = Increase in service life of bearings

$- F_{ax \max}$ = Reduction in service life of bearings (avoid)

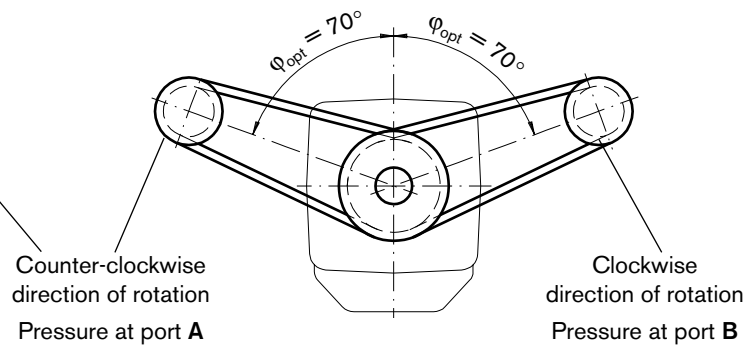
Effect of radial force F_q on the service life of bearings

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:

Toothed gear drive



V-belt drive



LR – Power controller

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.

$$p_B \cdot V_g = \text{constant}$$

p_B = operating pressure; V_g = displacement

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 piston. 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, the pump swivels back (direction $V_{g \min}$). The lever length at the rocker is shortened and the operating pressure can increase at the same rate as the displacement decreases without the drive powers being exceeded ($p_B \cdot V_g = \text{constant}$).

When depressurized, the pump is swiveled to its initial position $V_{g \max}$ by a return spring.

Setting range for beginning of control _____ 50 to 220 bar

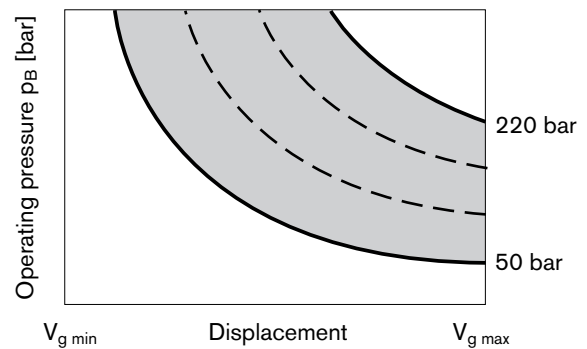
The hydraulic output power (characteristic LR) is influenced by the efficiency of the pump.

When ordering, state in plain text:

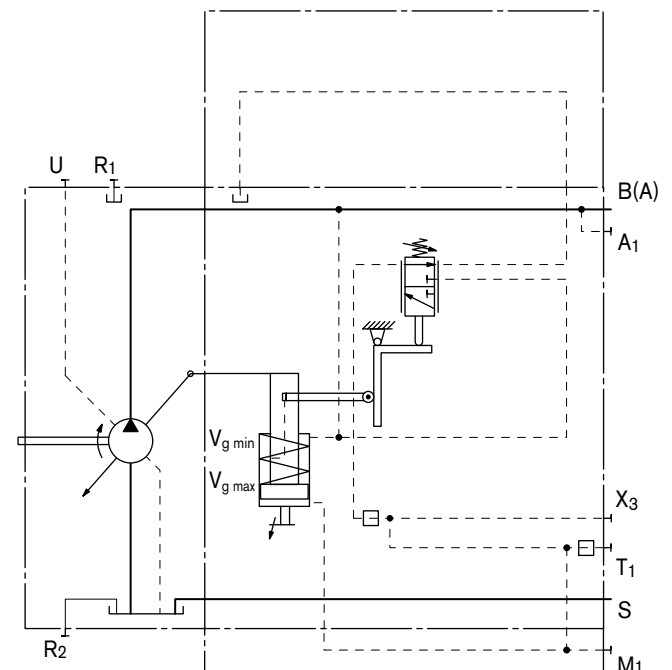
- Drive power P in kW
- Drive speed n in rpm
- Maximum flow $q_{v \max}$ in L/min

After clarifying the details a power diagram can be created by our computer.

Characteristic LR



Schematic LR



LR – Power controller

LRD – Power controller with pressure cut-off

The pressure cut-off corresponds to a pressure control which adjusts the pump displacement back to $V_{g \min}$, when the pressure setting is reached.

This function overrides the power control, i. e. below the preset pressure value, the power function is effective.

The pressure cut-off is preset to a specified value at the factory.

Setting range for pressure cut-off _____ 200 to 350 bar

Please state the pressure cut-off setting in plain text when ordering.

Note

- The pressure setting for the pressure cut-off must be at least a factor of 5 higher than the beginning of control of the power control.

Example: Beginning of control of the power controller:

50 bar

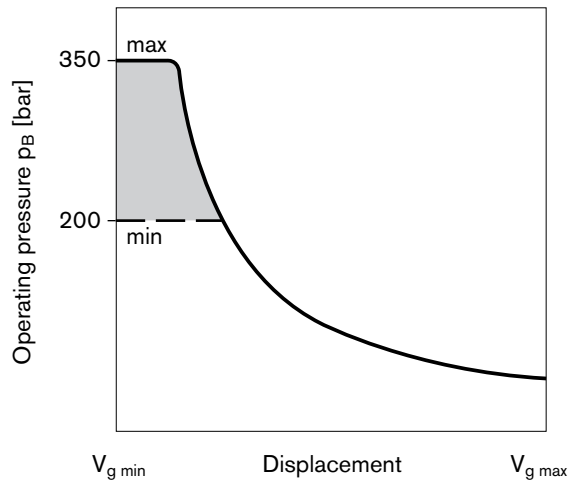
Minimum setting for pressure cut-off:

$5 \cdot 50 = 250$ bar

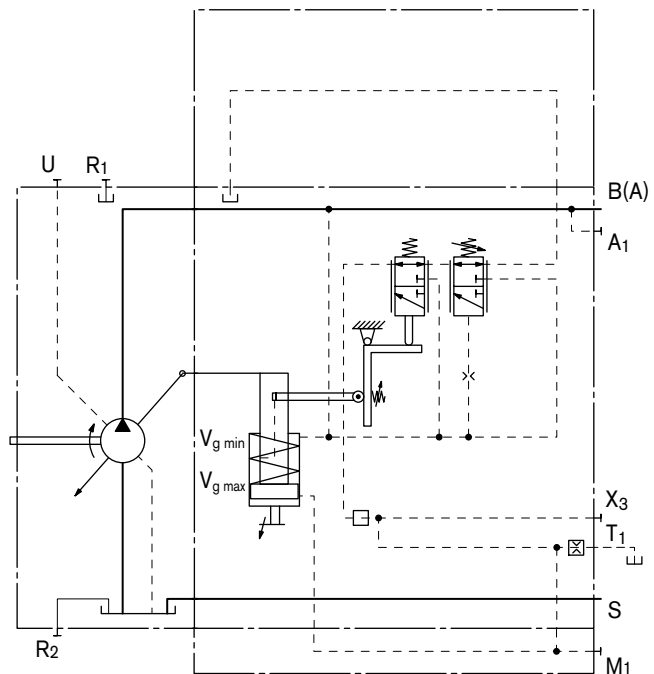
Higher settings for pressure cut-off are always possible.

- On versions with pressure cut-off, a case drain line from port T_1 to the reservoir is required. For a plugged case drain port the allowable actuated time for pressure cut-off is ≤ 2 min for $t_{\text{reservoir}} \leq 50$ °C.
- 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 pressure cut-off setting.

Characteristic LRD



Schematic LRD



LR – Power controller

LR... – Power controller with stroke limiter

The hydraulic stroke limiter, the displacement of the pump can be continuously varied or limited over the entire allowable range. The displacement is set proportionally by the pilot pressure p_{St} (maximum 40 bar) applied at port X_1 .

The power controller overrides the hydraulic stroke limiter, i. e. below the hyperbolic power characteristic, the displacement is controlled by the pilot pressure. When exceeding the power characteristic with a set flow or operating pressure, the power control overrides and reduces the displacement following the hyperbolic characteristic.

A control pressure of 40 bar is required 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 functioning of the stroke limiter even at low operating pressure < 40 bar, port Y_3 must be supplied with external control pressure of approx. 40 bar.

LRH1 – Hydraulic stroke limiter (negative control)

Control from $V_{g\ max}$ to $V_{g\ min}$

With increasing pilot pressure the pump swivels to a smaller displacement.

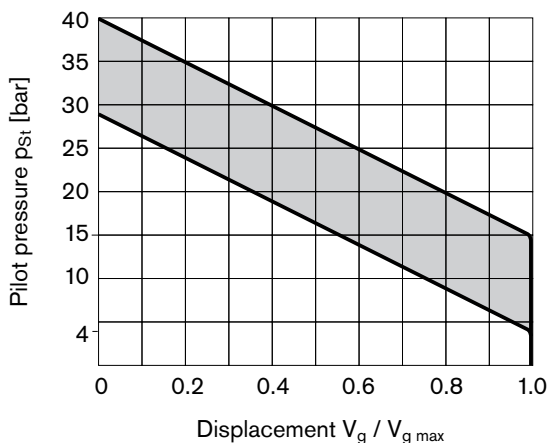
Beginning of control (at $V_{g\ max}$), adjustable _____ 4 to 15 bar

Please state the beginning of control in plain text when ordering.

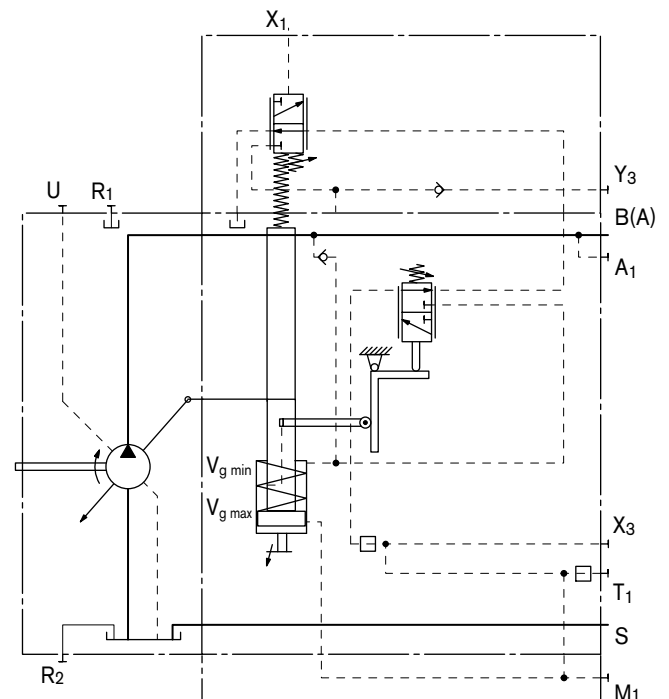
Initial position without control signal (pilot pressure): $V_{g\ max}$

Characteristic LRH1

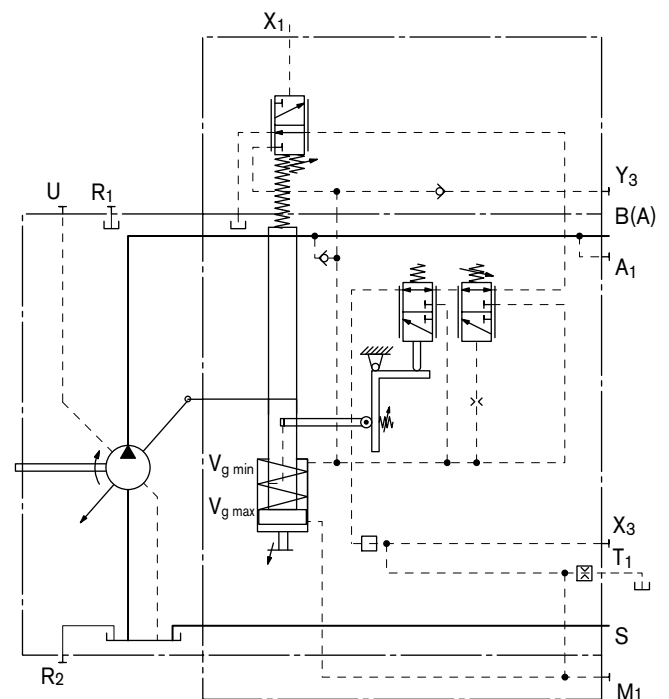
Pilot pressure increase ($V_{g\ max} - V_{g\ min}$) _____ $\Delta p = 25$ bar



Schematic LRH1



Schematic LRDH1



DR – Pressure controller

The pressure controller limits the maximum pressure at the pump outlet within the control range of the pump. The variable pump only delivers as much hydraulic fluid as the consumers actually need. If the operating pressure exceeds the pressure setpoint set at the integrated pressure valve, the pump will regulate to a smaller displacement to reduce the control deviation.

In a non-pressurized state, the pump is swiveled to its initial position to $V_g \text{ max}$ by a return spring.

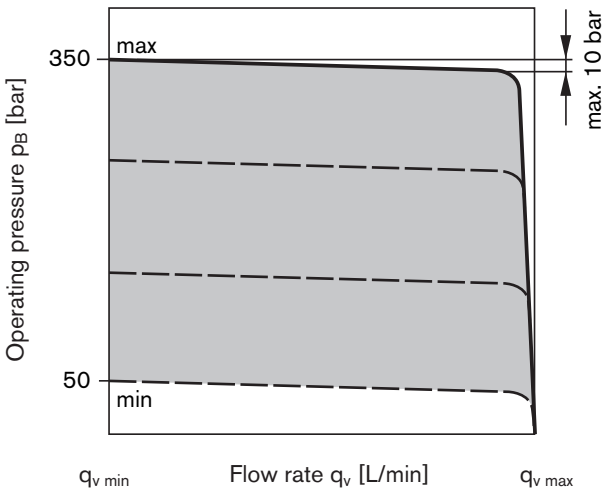
Setting range for pressure control _____ 50 to 350 bar

Please state the pressure control setting in plain text when ordering.

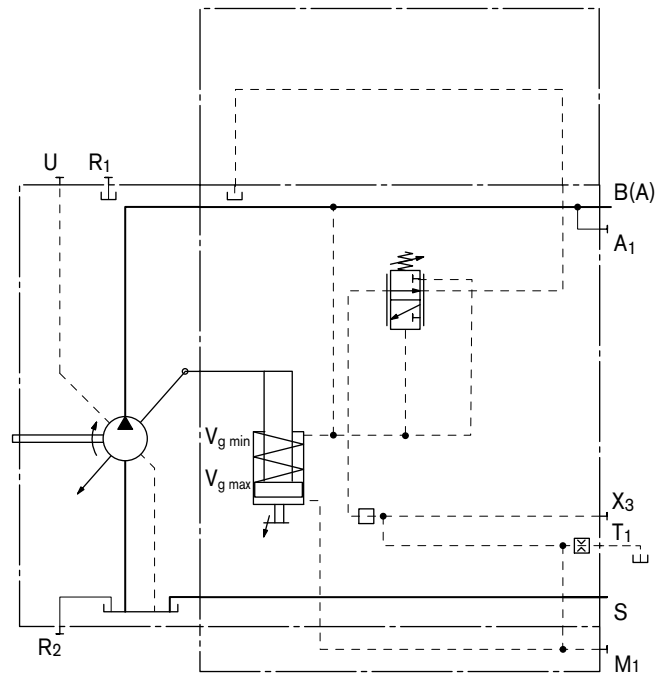
Note

- On versions with DR controller, a case drain line from port T_1 to the reservoir is essential.
- 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 DR



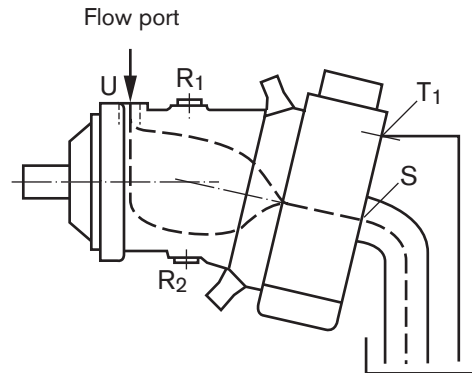
Schematic DR



Zero stroke operation

The standard version is designed for intermittent, constant-pressure operation. Short-term (< 1 min), zero-stroke operation is permissible up to an operating pressure $p_{max} = 315 \text{ bar}$ with reservoir temperature $\leq 50 \text{ }^\circ\text{C}$.

In the case of longer zero-stroke operation, the bearings should be flushed by way of the flushing port U.



Flushing flow (Recommended)

NG	28	55	80	107	160
$q_{v \text{ flush}}$ L/min	3	4	6	8	12

Temperature of the flushing fluid \leq reservoir temperature

DR – Pressure controller

DRG – Pressure controller remotely controlled

A separate sequence valve with port plate provides the pressure control functionality. The valve is mounted away from the pump, whereby the length of the line should not exceed 5 m. The valve is supplied with high pressure from port A_1 of the pump. The control power of the valve is returned to the pump via port X_3 which retards the pump down to $V_{g \min}$. Care should be taken that the ports T on the sequence valve and T_1 on the pump are connected to the reservoir (cooler).

Setting range for pressure control _____ 50 to 315 bar

Please state the pressure control setting in plain text when ordering.

Note

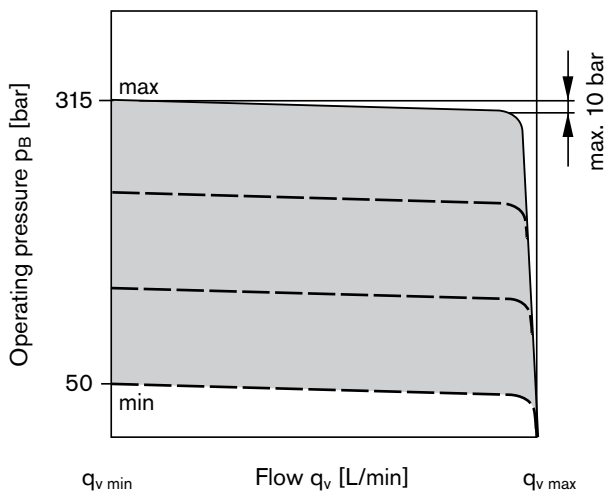
- On versions with DRG controller, a case drain line from port T_1 to the reservoir is essential.
- Any pressure-relief valve included in the system to limit the maximum pressure must be set to a cracking pressure at least 20 bar above the controller setting.

Sequence valve and port plate must be ordered separately.

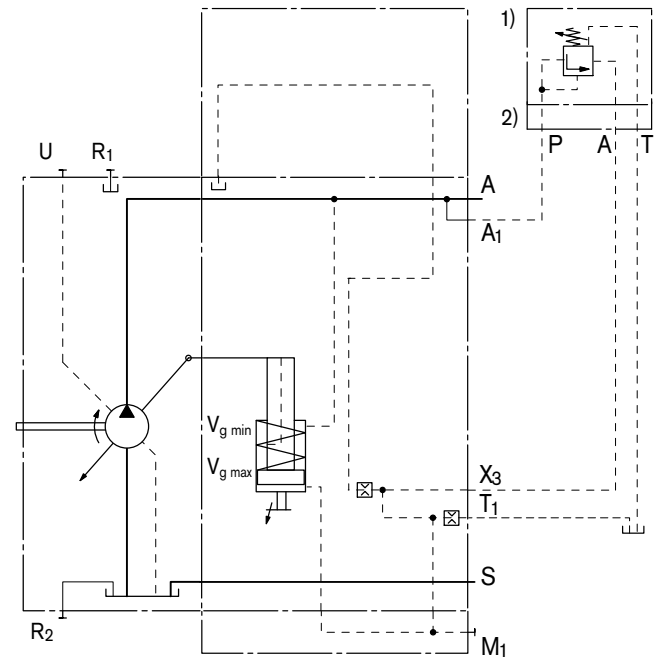
Sequence valve (1): DZ5DP2-1X/315YMSO21
(Mat.No. R900495604)

Port plate (2): G 115/1 (Mat.No. R900424379)

Characteristic DRG



Schematic DRG



Positions (1) and (2) are not included in the delivery contents for the pump.

DR – Pressure controller

DRS – Pressure controller with load sensing

The load sensing controller is a flow control option that operates as a function of the load pressure to regulate the pump displacement to match the consumer flow requirement.

The flow of the pump depends here on the cross section of the external sensing orifice (1) fitted between the pump and the consumer. Below the setting for the pressure control and within the control range of the pump, the flow is independent of load pressure.

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

The load sensing controller compares pressure before and after the sensing orifice and keeps the pressure drop (differential pressure Δp) and with it the pump flow constant.

If the differential pressure Δp at the sensing orifice increases, the pump is swivelled back (towards $V_{g \text{ min}}$) and if the differential pressure Δp decreases, the pump is swivelled out (towards $V_{g \text{ max}}$) until equilibrium is at the sensing orifice is restored.

$$\Delta p_{\text{sensing orifice}} = p_{\text{pump}} - p_{\text{consumer}}$$

Setting range for Δp _____ 14 to 25 bar

Standard setting _____ 18 bar

Please state the Δp setting in plain text when ordering.

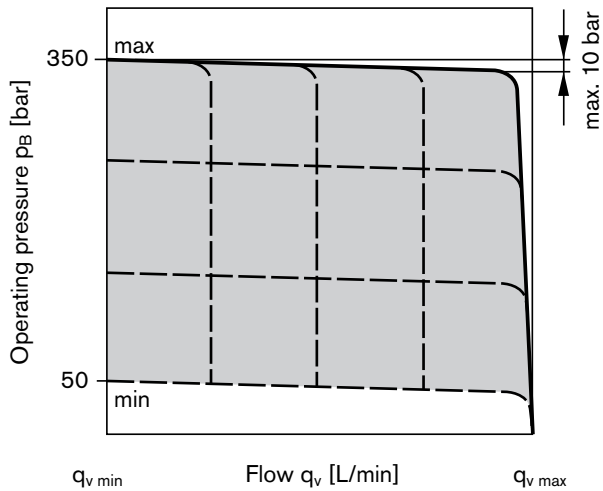
The stand-by pressure during zero-stroke operation (sensing orifice closed) is slightly above the Δp setting.

Note

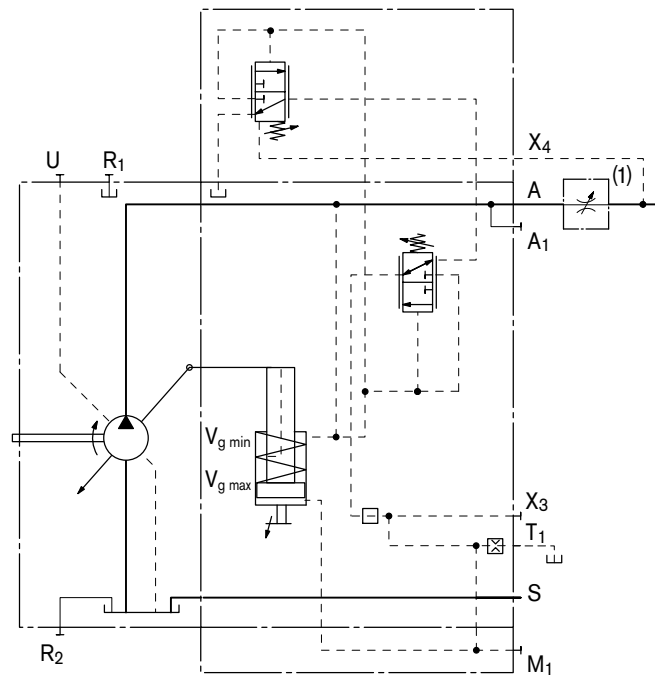
On versions with DRS controller, a case drain line from port T_1 to the reservoir is essential.

The pressure controller overrides the load sensing controller, i. e. the load sensing function operates below the set pressure.

Characteristic DRS



Schematic DRS



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

HD – Proportional control hydraulic

The proportional hydraulic control provides infinite setting of the displacement, proportional to the pilot pressure applied to port X₁.

Maximum permissible pilot pressure $p_{St} = 40$ bar

Adjustment from $V_{g\ min}$ to $V_{g\ max}$ (positive control)

With increasing pilot pressure the pump swivels to a higher displacement.

Beginning of control (at $V_{g\ min}$), adjustable _____ 4 to 15 bar

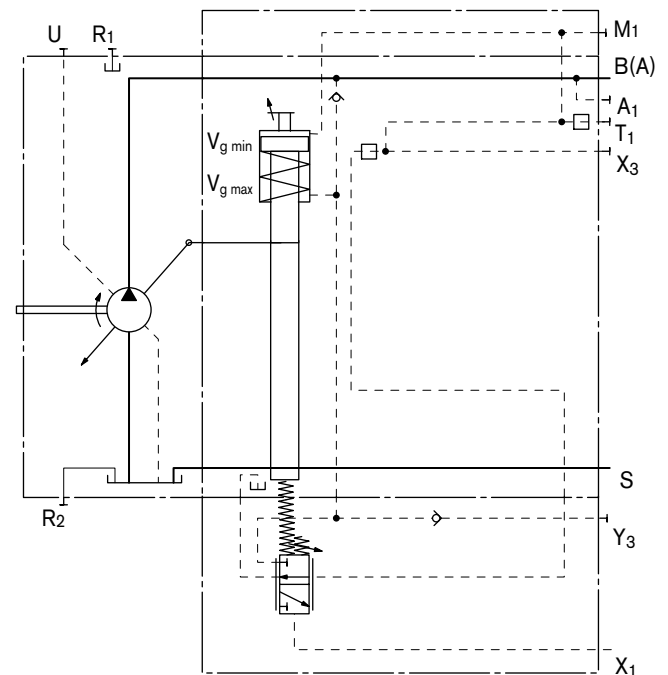
Please state the beginning of control in plain text when ordering.

A control pressure of 40 bar is required 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 Y₃.

In order to ensure control function even at low operating pressures < 40 bar, port Y₃ must be supplied with an external control pressure of approx. 40 bar.

Schematic HD



Note

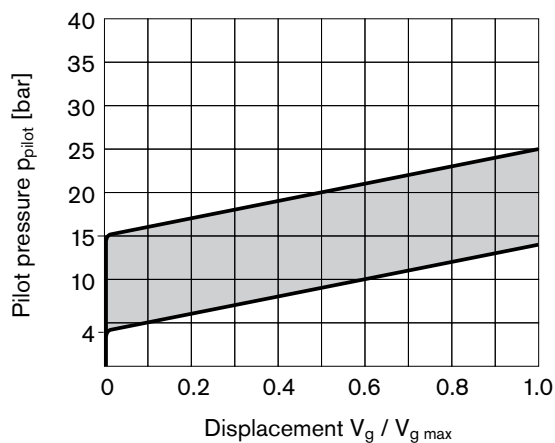
The spring return feature in the controller is not a safety device.

The controller can stick in an undefined position by internal contamination (contaminated hydraulic fluid, abrasion or residual contamination from system components). As a result, the control will no longer respond correctly to the operator's commands.

Check whether the application on your machine requires additional safety measures, in order to bring the driven actuator into a controlled and safe position (e. g. - immediate stop).

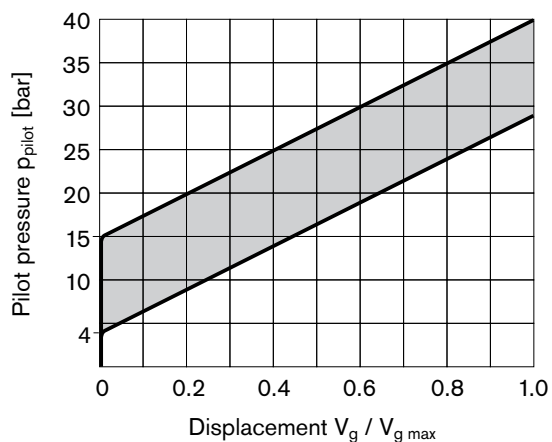
Characteristic HD1 positive control

Control pressure increase $V_{g\ min}$ to $V_{g\ max}$ _____ $\Delta p = 10$ bar



Characteristic HD2 positive control

Control pressure increase $V_{g\ min}$ to $V_{g\ max}$ _____ $\Delta p = 25$ bar



HD – Proportional control hydraulic

HD.G – Hydraulic control with pressure cut-off, remotely controlled

A separate sequence valve with port plate provides the pressure cut-off functionality. The valve is mounted away from the pump, whereby the length of the line should not exceed 5 m. The valve is supplied with high pressure from port A₁ of the pump. By way of port X₃ the control power of the pump is transmitted to the valve and into the reservoir at port A of the port plate of the sequence valve whereby the pump is retarded to V_{g min}, if the target pressure value is exceeded.

Setting range for pressure cut-off _____ 50 to 315 bar

Please state the pressure cut-off setting in plain text when ordering.

Note

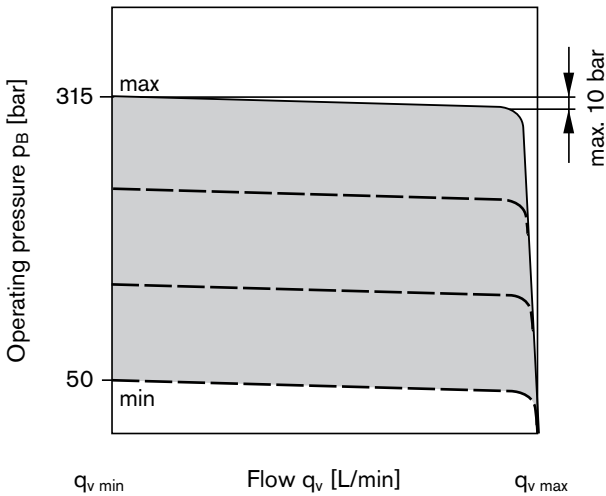
- Port A of the sequence valve must be connected to the reservoir (cooler).
- Any pressure-relief valve included in the system to limit the maximum pressure must be set to a cracking pressure at least 20 bar above the controller setting.

Sequence valve and port plate must be ordered separately.

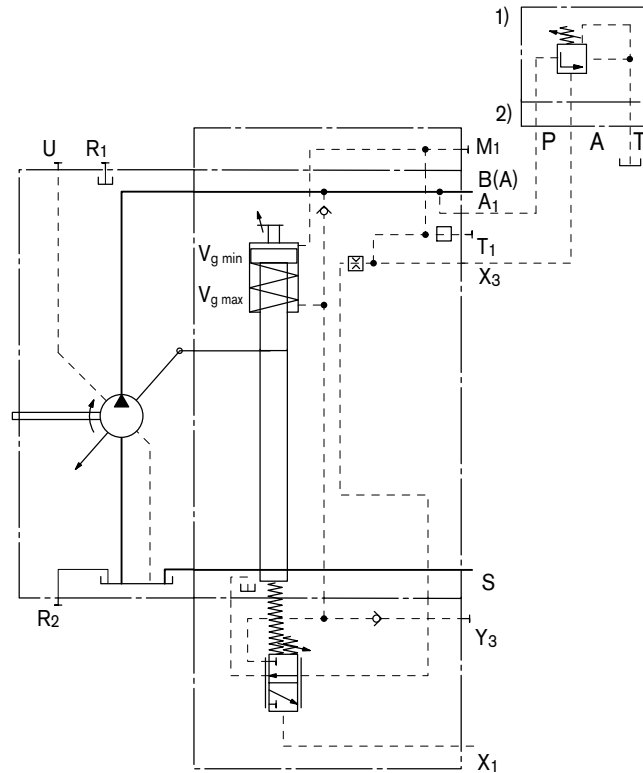
Sequence valve (1): DZ5DP2-1X/315XYMSO20
(Mat.No. R900490554)

Port plate (2): G 115/1 (Mat.No. R900424379)

Characteristic HD.G positive control



Schematic HD.G



Positions (1) and (2) are not included in the delivery contents for the pump.

EP – Proportional control electric

The proportional electric control provides infinite adjustment of the displacement, proportional to the control current applied to the solenoid.

Adjustment from $V_{g \min}$ to $V_{g \max}$ (positive control)

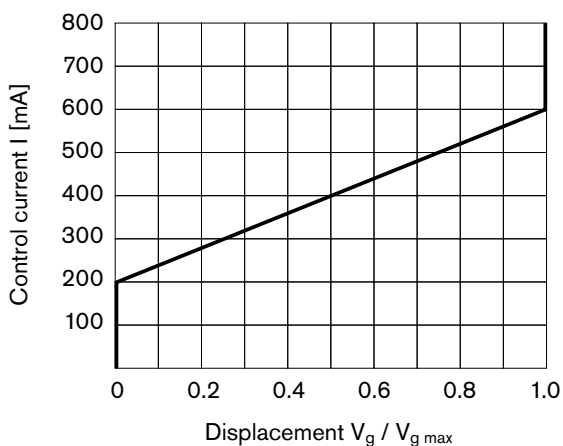
With increasing control current the pump swivels to a higher displacement.

A control pressure of 40 bar is required 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 .

In order to ensure control function even at low operating pressures < 40 bar, port Y_3 must be supplied with an external control pressure of approx. 40 bar.

Characteristic EP2 positive control



Technical data, solenoid

EP2	
Voltage	24 V ($\pm 20\%$)
Control current	
Beginning of control	200 mA
End of control	600 mA
Limiting current	0.77 A
Nominal resistance (at 20 °C)	22.7 Ω
Dither frequency	100 Hz
Duty cycle	100 %
Type of protection see connector design page 33	

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

– BODAS controller RC

 Series 20 _____ RE 95200

 Series 21 _____ RE 95201

 Series 22 _____ RE 95202

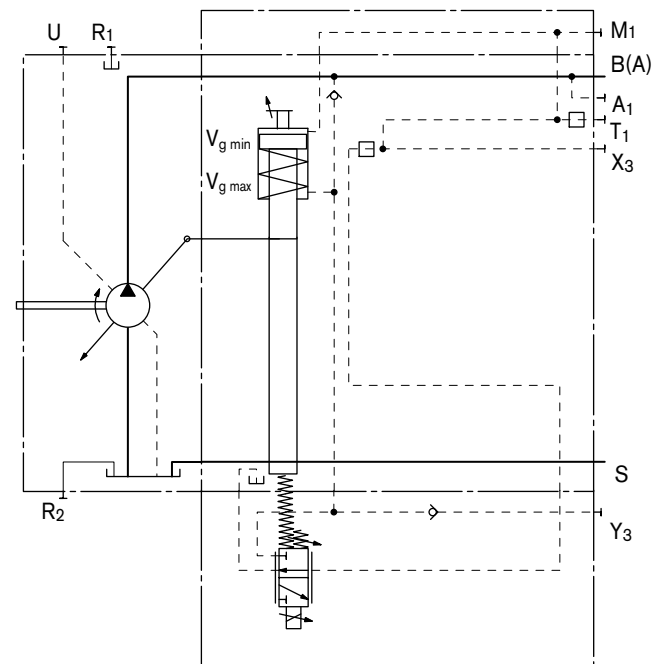
 Series 30 _____ RE 95203, RE 95204

and application software

– Analog amplifier RA _____ RE 95230

Further information can also be found on the Internet at www.boschrexroth.com/mobile-electronics

Schematic EP2



EP2G – Electric control with pressure cut-off, remotely controlled

See HD.G

Note

The spring return feature in the controller is not a safety device.

The controller can stick in an undefined position by internal contamination (contaminated hydraulic fluid, abrasion or residual contamination from system components). As a result, the control will no longer respond correctly to the operator's commands.

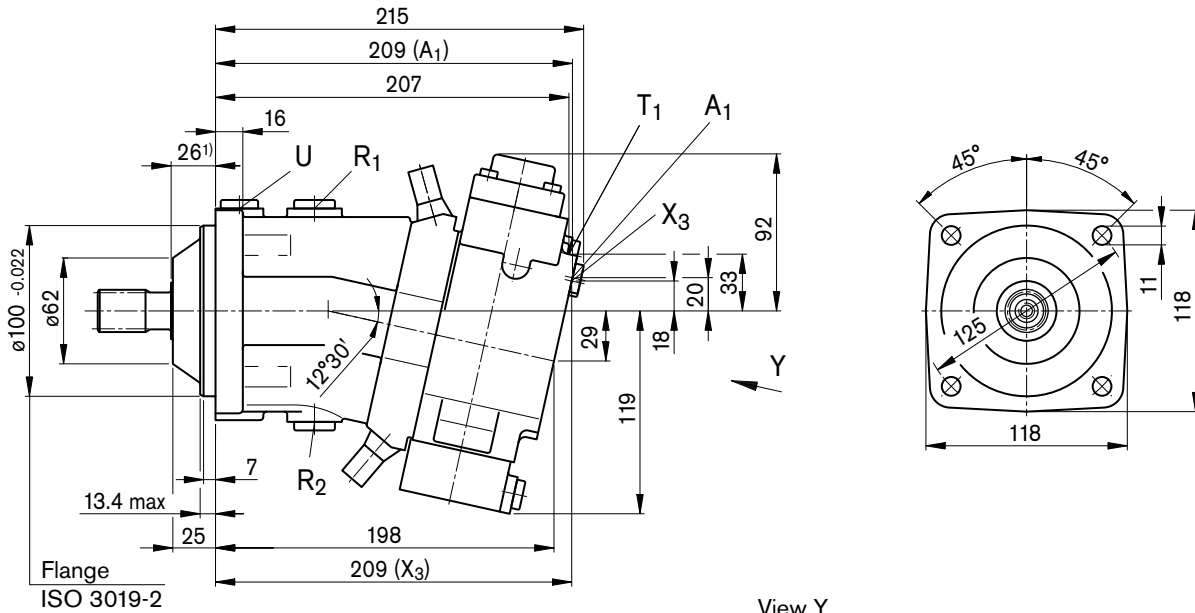
Check whether the application on your machine requires additional safety measures, in order to bring the driven actuator into a controlled and safe position (e. g. - immediate stop).

Dimensions size 28

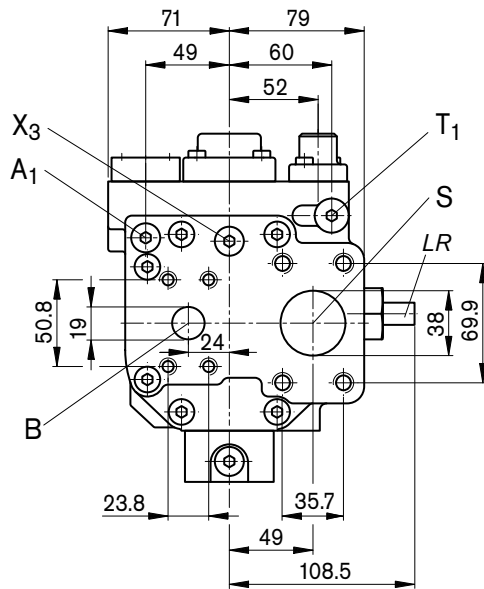
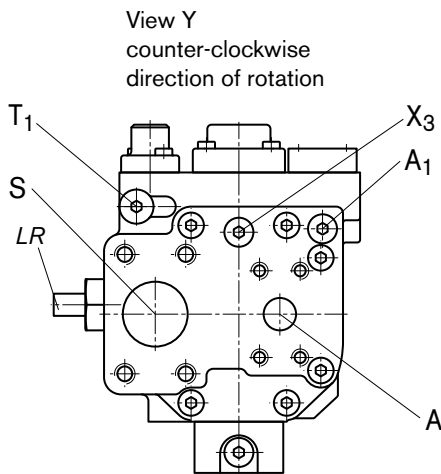
Before finalizing your design, request a binding installation drawing. Dimensions in mm.

LR – Power controller

Note: All versions of the controller are illustrated for clockwise direction of rotation (View Y).



View Y
clockwise
direction of rotation

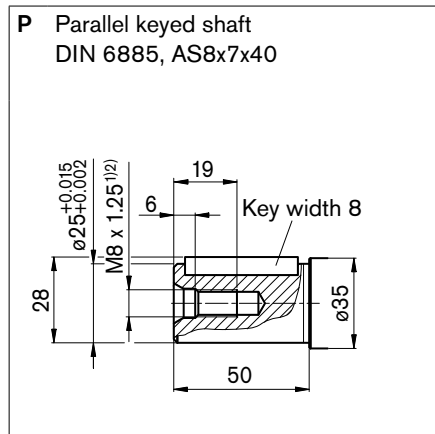
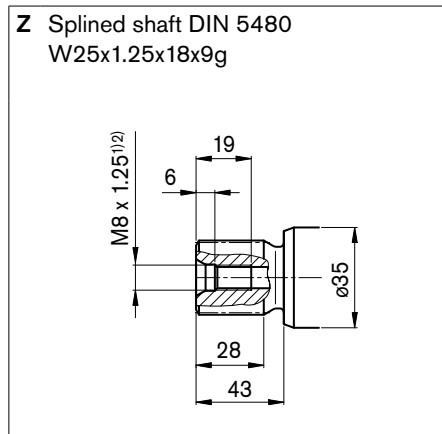


1) To shaft collar

Dimensions size 28

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

Drive shafts



Ports

Designation	Port for	Standard	Size ²⁾	Maximum pressure [bar] ³⁾	State ⁶⁾
A	Service line (high pressure series) Fastening thread	SAE J518 ⁴⁾ DIN 13	3/4 in M10 x 1.5; 17 deep	400	O
S	Suction line (standard series) Fastening thread	SAE J518 ⁴⁾ DIN 13	1 1/2 in M12 x 1.75; 20 deep	2	O
U	Bearing flushing	DIN 3852 ⁵⁾	M16 x 1.5; 12 deep	2	X
R ₁ , R ₂	Air bleed	DIN 3852 ⁵⁾	M18 x 1.5; 12 deep	2	X
A ₁	Measuring high pressure	DIN 3852 ⁵⁾	M12 x 1.5; 12 deep	400	X
T ₁	Pilot fluid drain	DIN 3852 ⁵⁾	M12 x 1.5; 12 deep	400	X
T ₁	Pilot fluid drain (only DR, ..D..)	DIN 3852 ⁵⁾	M12 x 1.5; 12 deep	400	O
X ₃	Override	DIN 3852 ⁵⁾	M12 x 1.5; 12 deep	400	X
Y ₃	External pilot pressure	DIN 3852 ⁵⁾	M14 x 1.5; 12 deep	40	X
X ₁	Pilot pressure	DIN 3852 ⁵⁾	M14 x 1.5; 12 deep	40	O
M ₁	Measuring control pressure	DIN 3852 ⁵⁾	M12 x 1.5; 12 deep	400	X

1) Center bore according to DIN 332 (thread according to DIN 13)

2) Observe the general instructions on page 36 for the maximum tightening torques.

3) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.

4) Only dimensions according to SAE J518, metric fastening thread is a deviation from standard.

5) The spot face can be deeper than specified in the appropriate standard.

6) O = Must be connected (plugged on delivery)

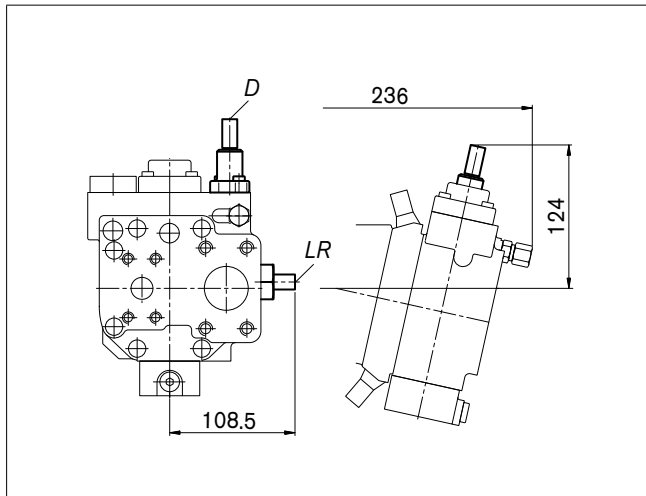
X = Plugged (in normal operation)

Dimensions size 28

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

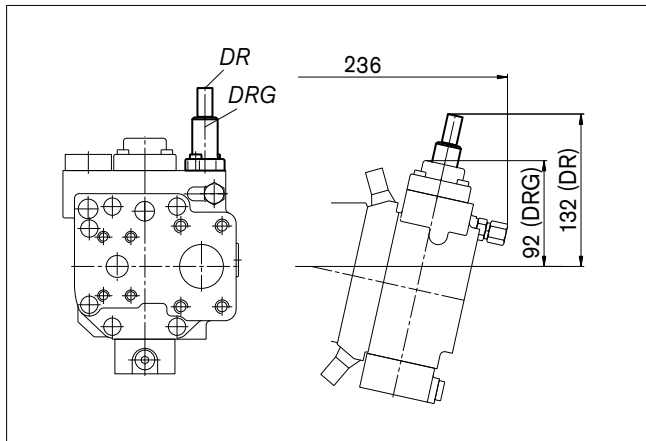
LRD

Power controller with pressure cut-off



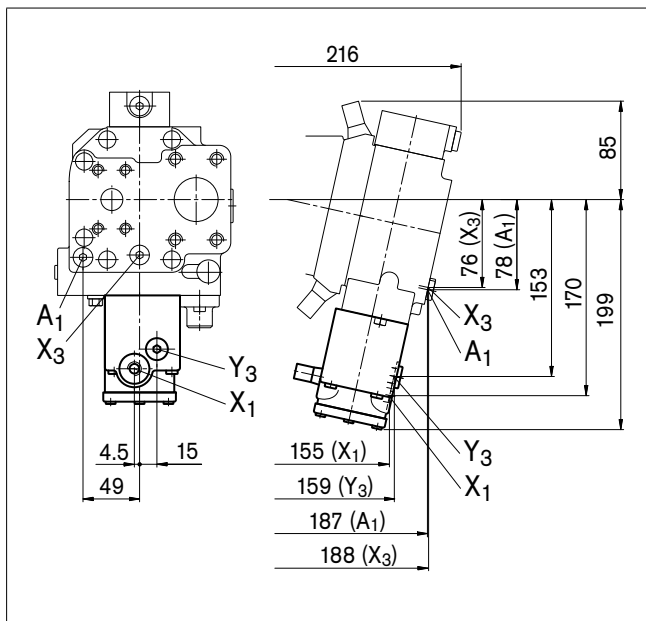
DR/DRG

Pressure controller / pressure controller remotely controlled



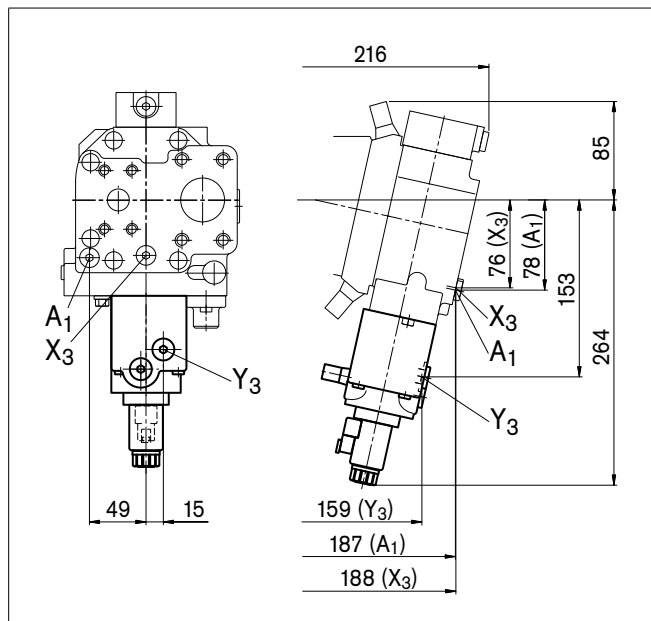
HD1, HD2/HD1G, HD2G

Proportional control hydraulic, positive control and variants with pressure cut-off, remotely controlled



EP2/EP2G

Proportional control electric, positive control and variants with pressure cut-off, remotely controlled

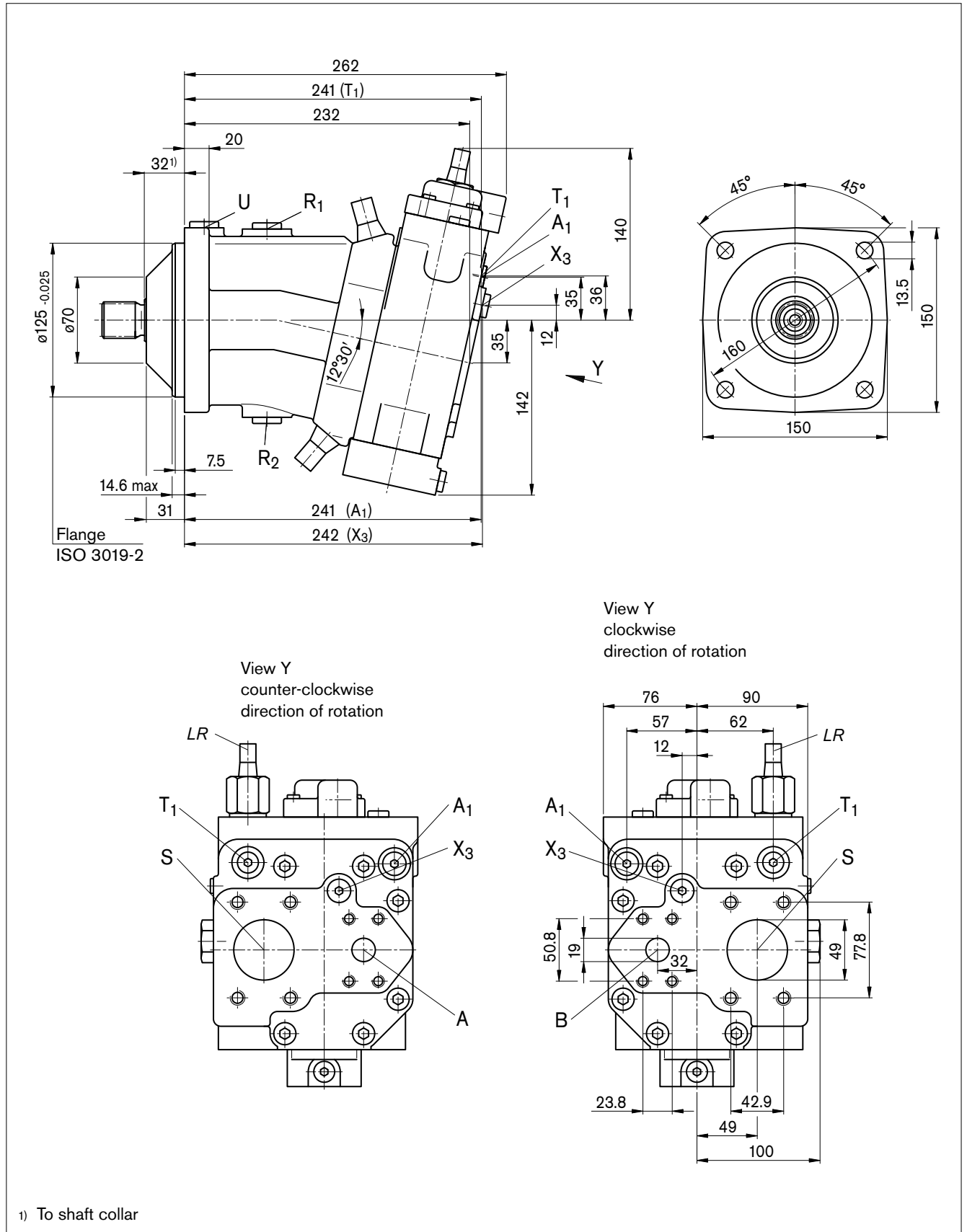


Dimensions size 55

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

LR – Power controller

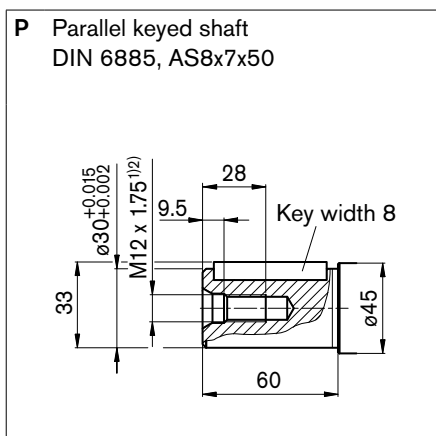
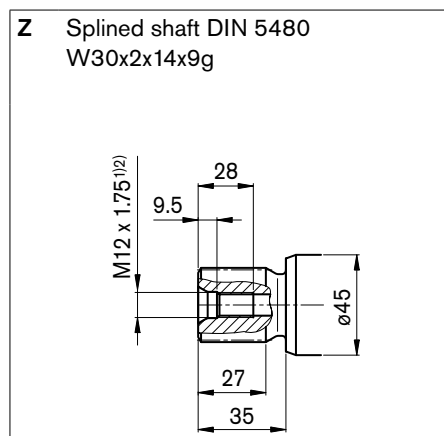
Note: All versions of the controller are illustrated for clockwise direction of rotation (View Y).



Dimensions size 55

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

Drive shafts



Ports

Designation	Port for	Standard	Size ²⁾	Maximum pressure [bar] ³⁾	State ⁶⁾
A	Service line (high pressure series) Fastening thread	SAE J518 ⁴⁾ DIN 13	3/4 in M10 x 1.5; 17 deep	400	O
S	Suction line (standard series) Fastening thread	SAE J518 ⁴⁾ DIN 13	2 in M12 x 1.75; 20 deep ²⁾	2	O
U	Bearing flushing	DIN 3852 ⁵⁾	M18 x 1.5; 12 deep	2	X
R ₁ , R ₂	Air bleed	DIN 3852 ⁵⁾	M18 x 1.5; 12 deep	2	X
A ₁	Measuring high pressure	DIN 3852 ⁵⁾	M14 x 1.5; 12 deep	400	X
T ₁	Pilot fluid drain	DIN 3852 ⁵⁾	M12 x 1.5; 12 deep	400	X
T ₁	Pilot fluid drain (only DR, ..D..)	DIN 3852 ⁵⁾	M12 x 1.5; 12 deep	400	O
X ₃	Override	DIN 3852 ⁵⁾	M14 x 1.5; 12 deep	400	X
Y ₃	External pilot pressure	DIN 3852 ⁵⁾	M14 x 1.5; 12 deep	40	X
X ₁	Pilot pressure	DIN 3852 ⁵⁾	M14 x 1.5; 12 deep	40	O
X ₄	Load pressure	DIN 3852 ⁵⁾	M14 x 1.5; 12 deep	400	O
M ₁	Measuring control pressure	DIN 3852 ⁵⁾	M12 x 1.5; 12 deep	400	X

1) Center bore according to DIN 332 (thread according to DIN 13)

2) Observe the general instructions on page 36 for the maximum tightening torques.

3) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.

4) Only dimensions according to SAE J518, metric fastening thread is a deviation from standard.

5) The spot face can be deeper than specified in the appropriate standard.

6) O = Must be connected (plugged on delivery)

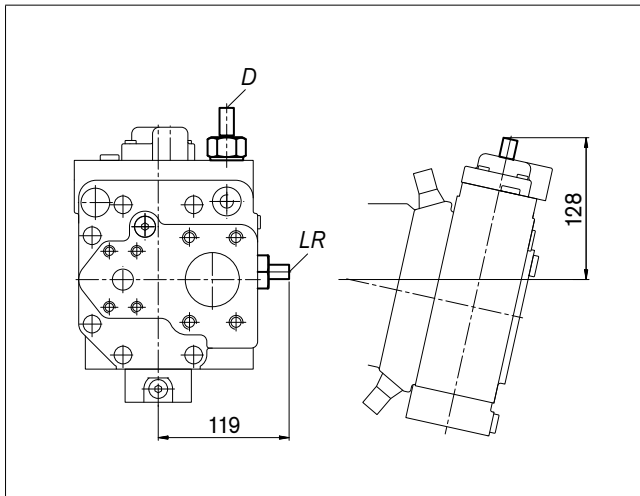
X = Plugged (in normal operation)

Dimensions size 55

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

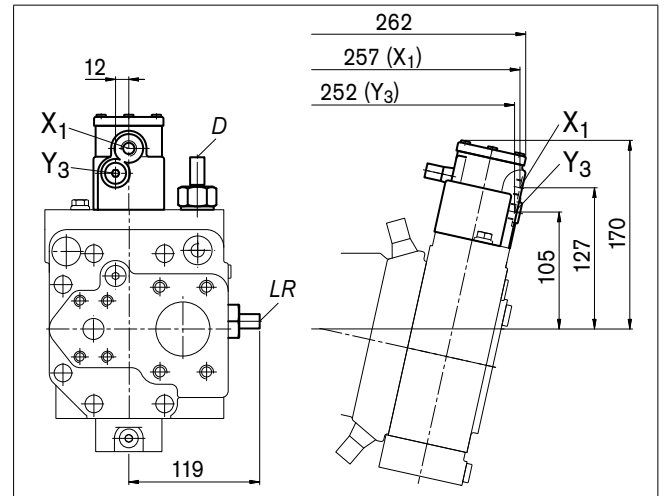
LRD

Power controller with pressure cut-off



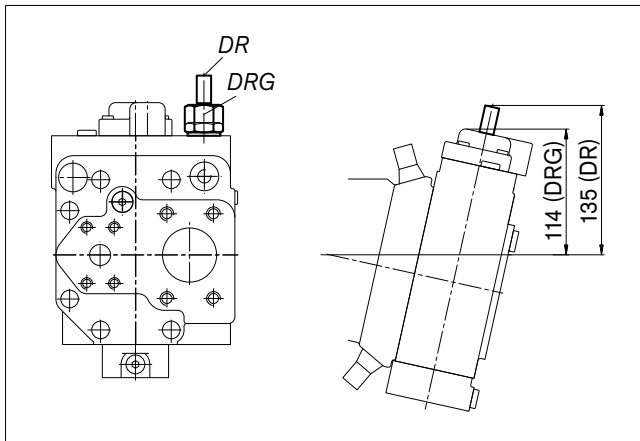
LRDH1

Power controller with pressure cut-off and stroke limiter



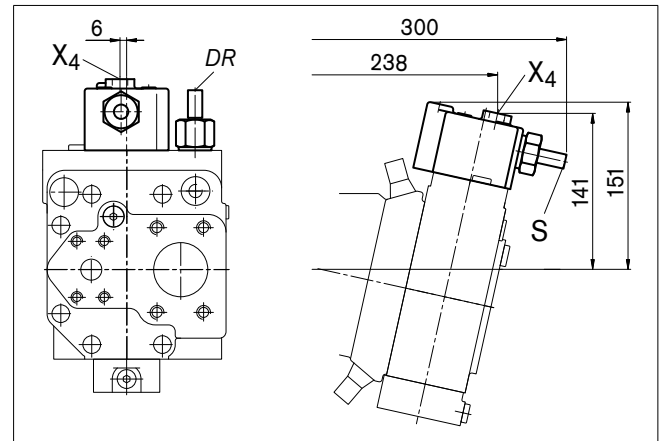
DR/DRG

Pressure controller / pressure controller remotely controlled



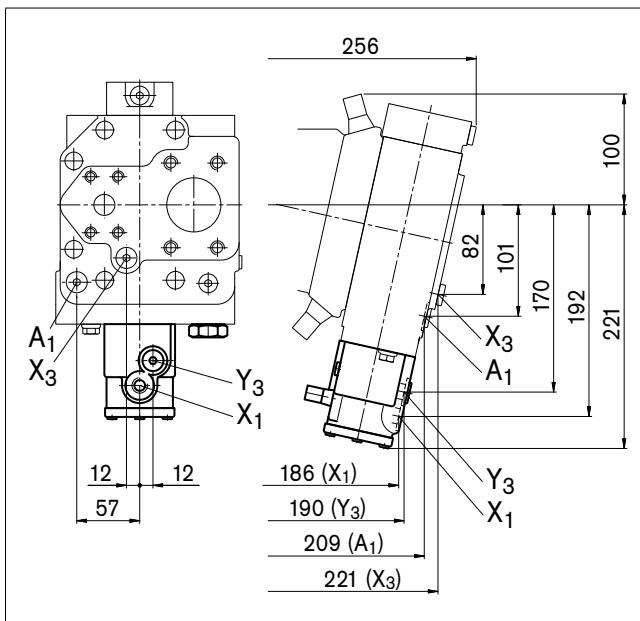
DRS

Pressure controller with load sensing



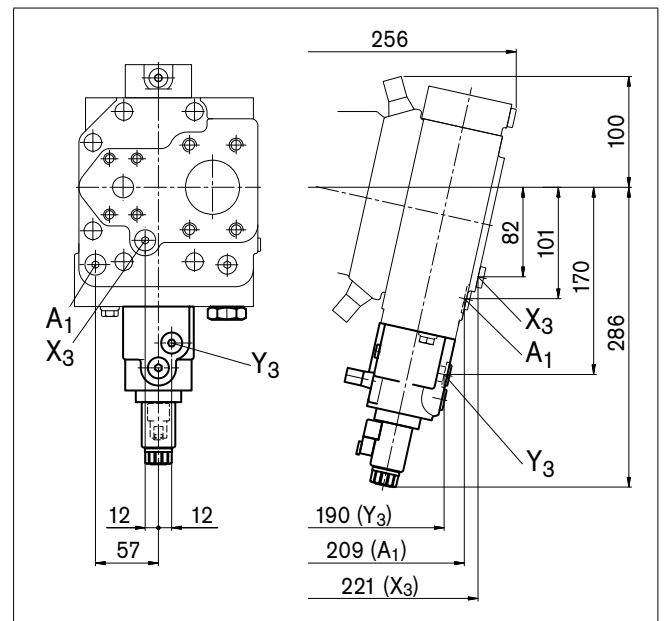
HD1, HD2/HD1G, HD2G

Proportional control hydraulic, positive control and variants with pressure cut-off, remotely controlled



EP2/EP2G

Proportional control electric, positive control and variants with pressure cut-off, remotely controlled

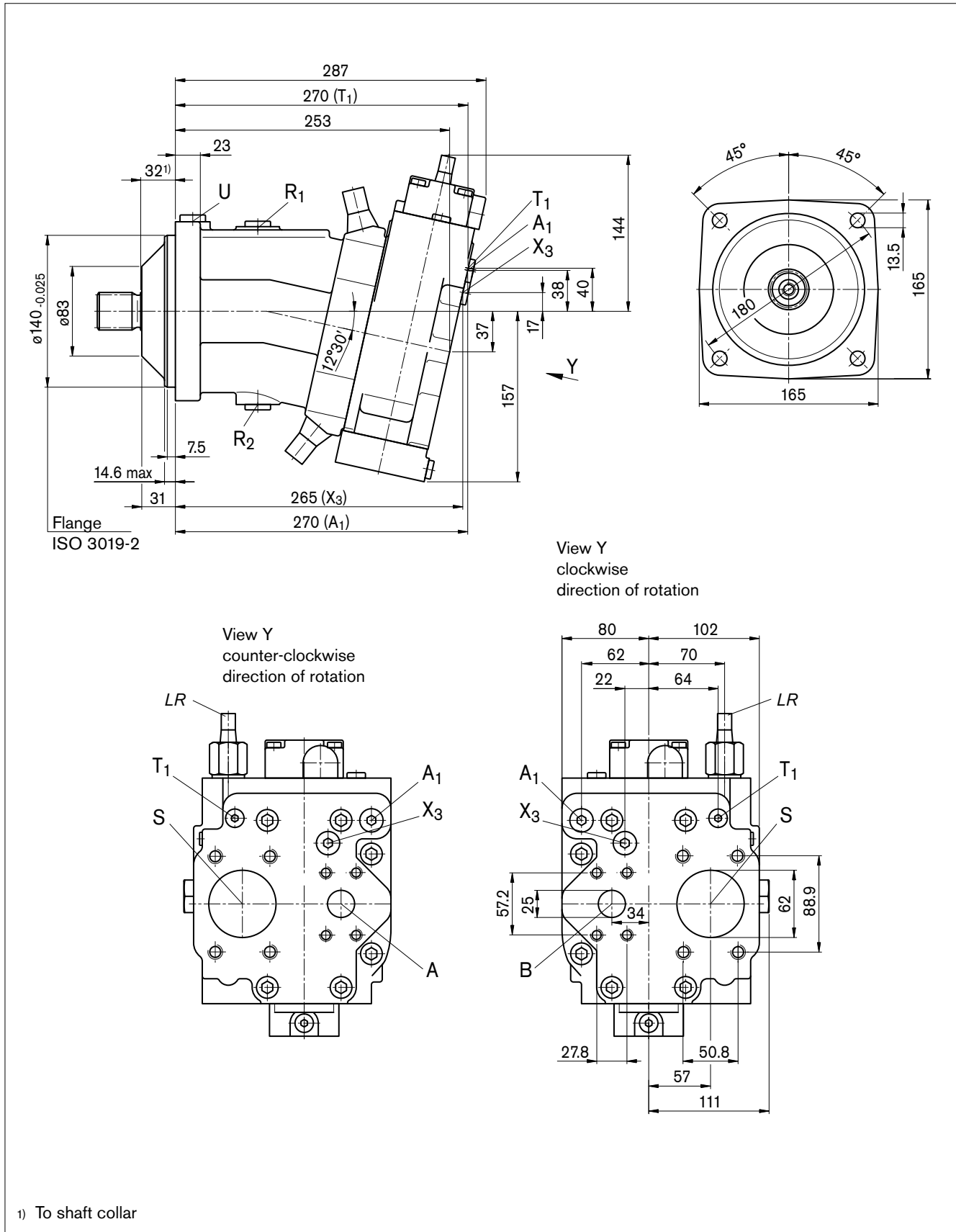


Dimensions size 80

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

LR – Power controller

Note: All versions of the controller are illustrated for clockwise direction of rotation (View Y).

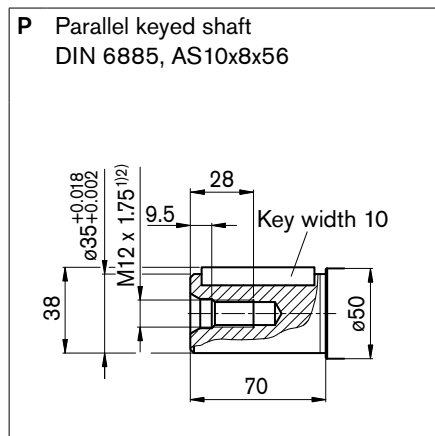
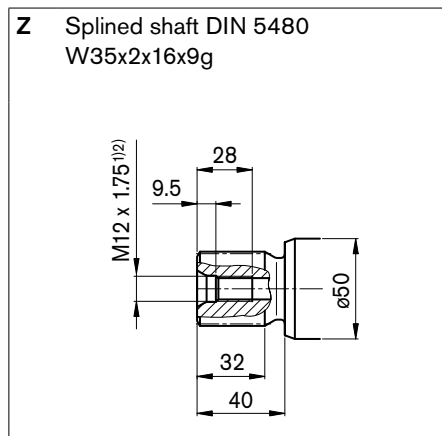


1) To shaft collar

Dimensions size 80

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

Drive shafts



Ports

Designation	Port for	Standard	Size ²⁾	Maximum pressure [bar] ³⁾	State ⁶⁾
A	Service line (high pressure series) Fastening thread	SAE J518 ⁴⁾ DIN 13	1 in M12 x 1.75; 17 deep	400	O
S	Suction line (standard series) Fastening thread	SAE J518 ⁴⁾ DIN 13	2 1/2 in M12 x 1.75; 17 deep	2	O
U	Bearing flushing	DIN 3852 ⁵⁾	M18 x 1.5; 12 deep	2	X
R ₁ , R ₂	Air bleed	DIN 3852 ⁵⁾	M18 x 1.5; 12 deep	2	X
A ₁	Measuring high pressure	DIN 3852 ⁵⁾	M16 x 1.5; 12 deep	400	X
T ₁	Pilot fluid drain	DIN 3852 ⁵⁾	M12 x 1.5; 12 deep	400	X
T ₁	Pilot fluid drain (only DR, ..D..)	DIN 3852 ⁵⁾	M12 x 1.5; 12 deep	400	O
X ₃	Override	DIN 3852 ⁵⁾	M16 x 1.5; 12 deep	400	X
Y ₃	External pilot pressure	DIN 3852 ⁵⁾	M14 x 1.5; 12 deep	40	X
X ₁	Pilot pressure	DIN 3852 ⁵⁾	M14 x 1.5; 12 deep	40	O
X ₄	Load pressure	DIN 3852 ⁵⁾	M14 x 1.5; 12 deep	400	O
M ₁	Measuring control pressure	DIN 3852 ⁵⁾	M12 x 1.5; 12 deep	400	X

1) Center bore according to DIN 332 (thread according to DIN 13)

2) Observe the general instructions on page 36 for the maximum tightening torques.

3) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.

4) Only dimensions according to SAE J518, metric fastening thread is a deviation from standard.

5) The spot face can be deeper than specified in the appropriate standard.

6) O = Must be connected (plugged on delivery)

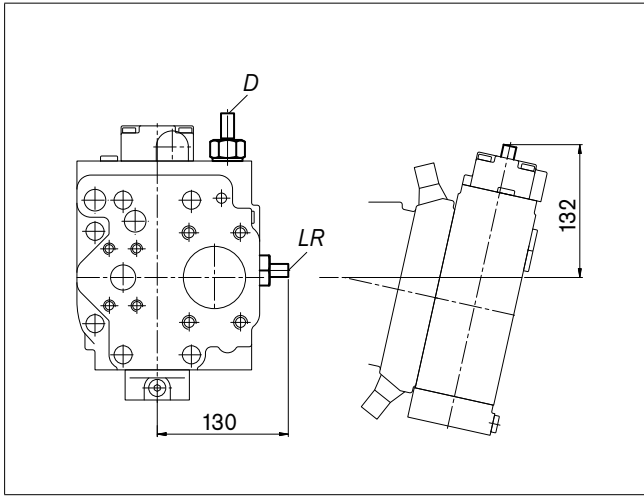
X = Plugged (in normal operation)

Dimensions size 80

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

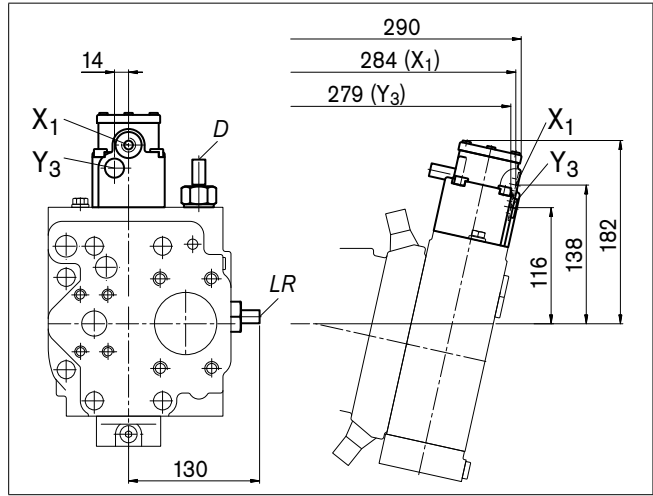
LRD

Power controller with pressure cut-off



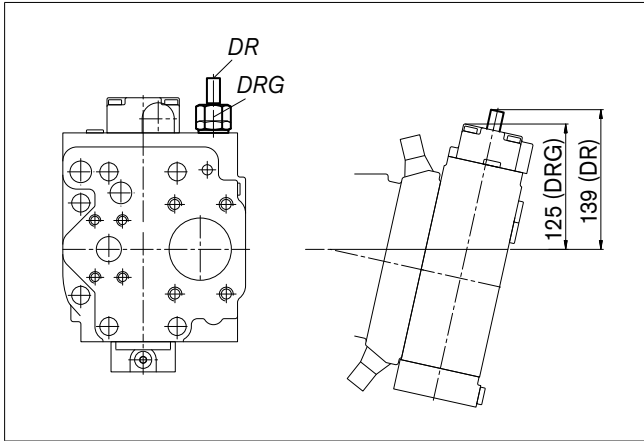
LRDH1

Power controller with pressure cut-off and stroke limiter



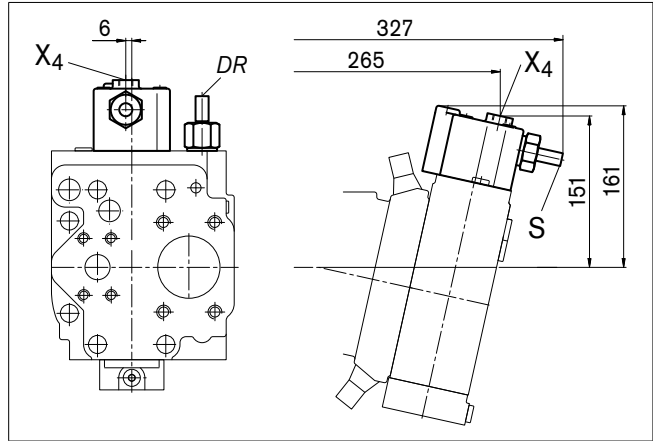
DR/DRG

Pressure controller / pressure controller remotely controlled



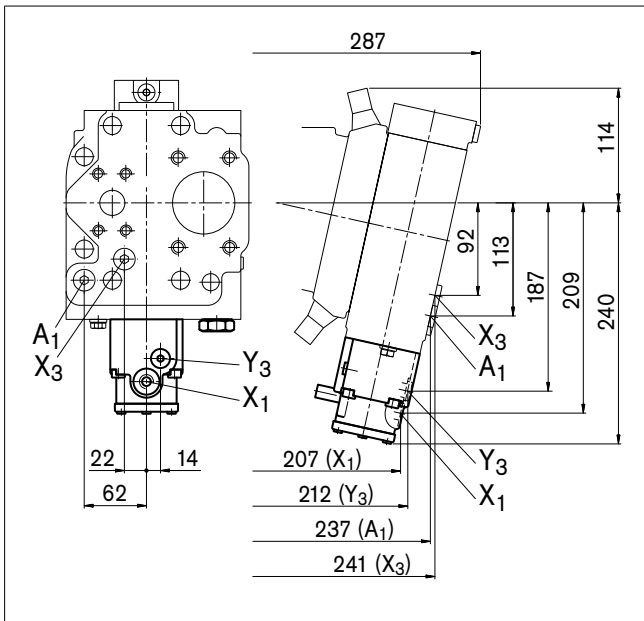
DRS

Pressure controller with load sensing



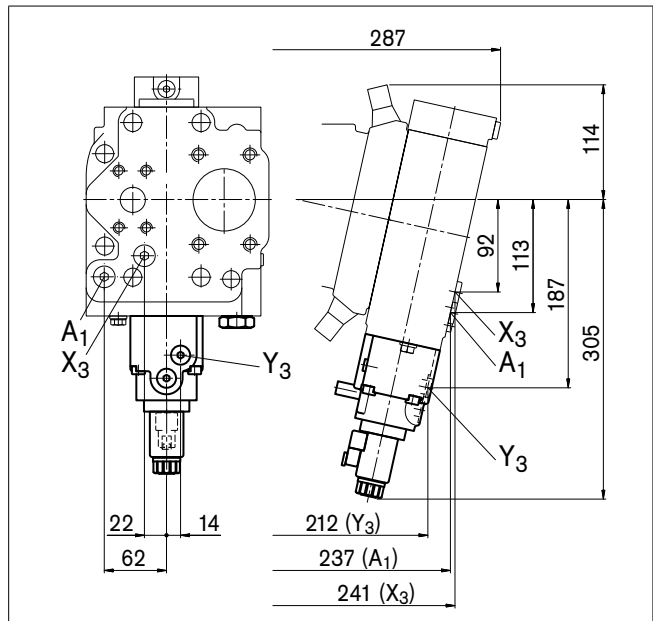
HD1, HD2/HD1G, HD2G

Proportional control hydraulic, positive control and variants with pressure cut-off, remotely controlled



EP2/EP2G

Proportional control electric, positive control and variants with pressure cut-off, remotely controlled

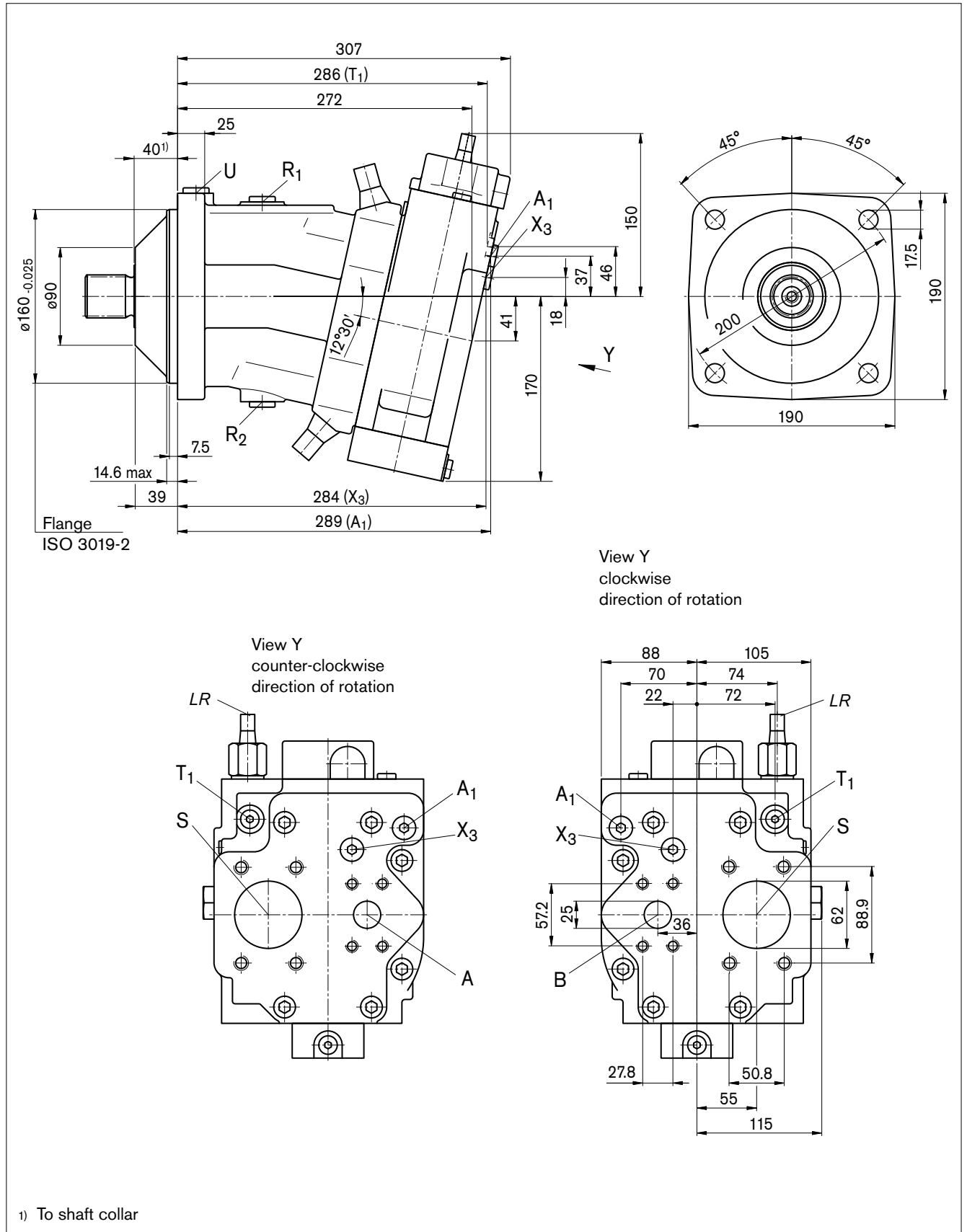


Dimensions size 107

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

LR – Power controller

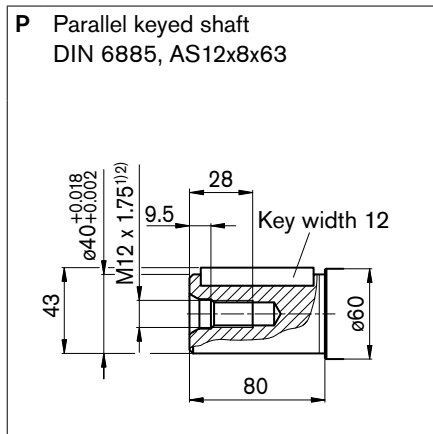
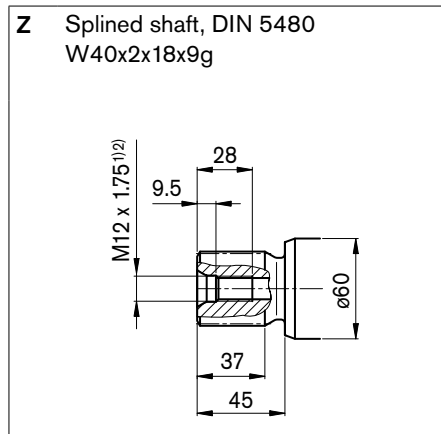
Note: All versions of the controller are illustrated for clockwise direction of rotation (View Y).



Dimensions size 107

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

Drive shafts



Ports

Designation	Port for	Standard	Size ²⁾	Maximum pressure [bar] ³⁾	State ⁶⁾
A	Service line (high pressure series) Fastening thread	SAE J518 ⁴⁾ DIN 13	1 in M12 x 1.75; 17 deep	400	O
S	Suction line (standard series) Fastening thread	SAE J518 ⁴⁾ DIN 13	2 1/2 in M12 x 1.75; 17 deep	2	O
U	Bearing flushing	DIN 3852 ⁵⁾	M18 x 1.5; 12 deep	2	X
R ₁ , R ₂	Air bleed	DIN 3852 ⁵⁾	M18 x 1.5; 12 deep	2	X
A ₁	Measuring high pressure	DIN 3852 ⁵⁾	M16 x 1.5; 12 deep	400	X
T ₁	Pilot fluid drain	DIN 3852 ⁵⁾	M12 x 1.5; 12 deep	400	X
T ₁	Pilot fluid drain (only DR, ..D..)	DIN 3852 ⁵⁾	M12 x 1.5; 12 deep	400	O
X ₃	Override	DIN 3852 ⁵⁾	M16 x 1.5; 12 deep	400	X
Y ₃	External pilot pressure	DIN 3852 ⁵⁾	M14 x 1.5; 12 deep	40	X
X ₁	Pilot pressure	DIN 3852 ⁵⁾	M14 x 1.5; 12 deep	40	O
X ₄	Load pressure	DIN 3852 ⁵⁾	M14 x 1.5; 12 deep	400	O
M ₁	Measuring control pressure	DIN 3852 ⁵⁾	M12 x 1.5; 12 deep	400	X

1) Center bore according to DIN 332 (thread according to DIN 13)

2) Observe the general instructions on page 36 for the maximum tightening torques.

3) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.

4) Only dimensions according to SAE J518, metric fastening thread is a deviation from standard.

5) The spot face can be deeper than specified in the appropriate standard.

6) O = Must be connected (plugged on delivery)

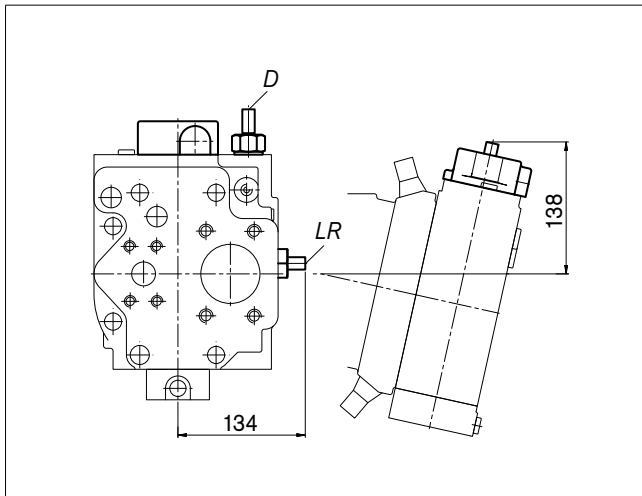
X = Plugged (in normal operation)

Dimensions size 107

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

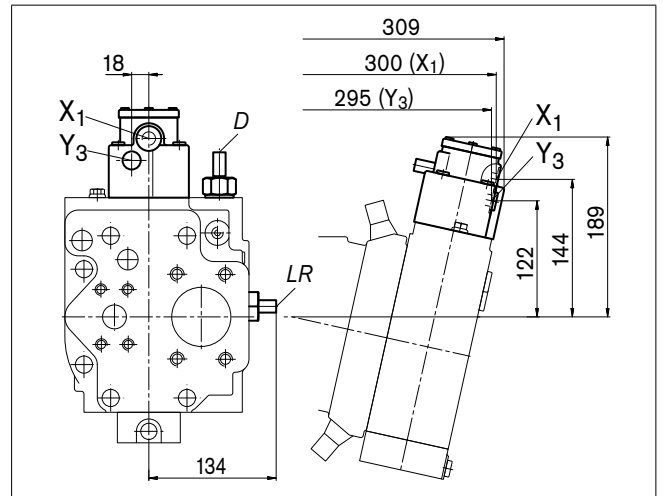
LRD

Power controller with pressure cut-off



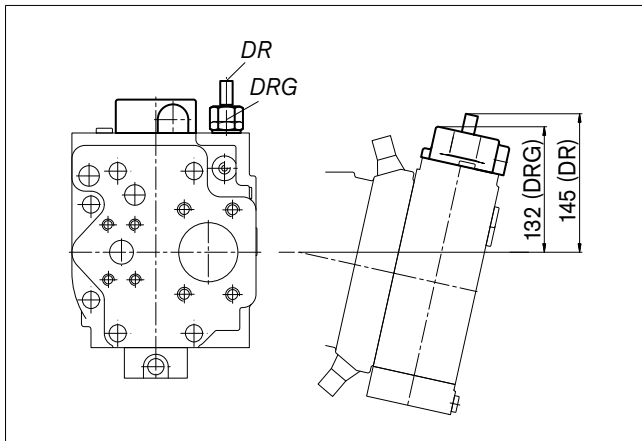
LRDH1

Power controller with pressure cut-off and stroke limiter



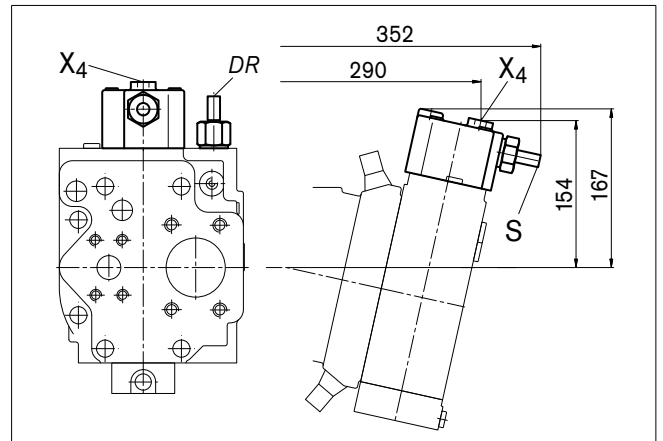
DR/DRG

Pressure controller / pressure controller remotely controlled



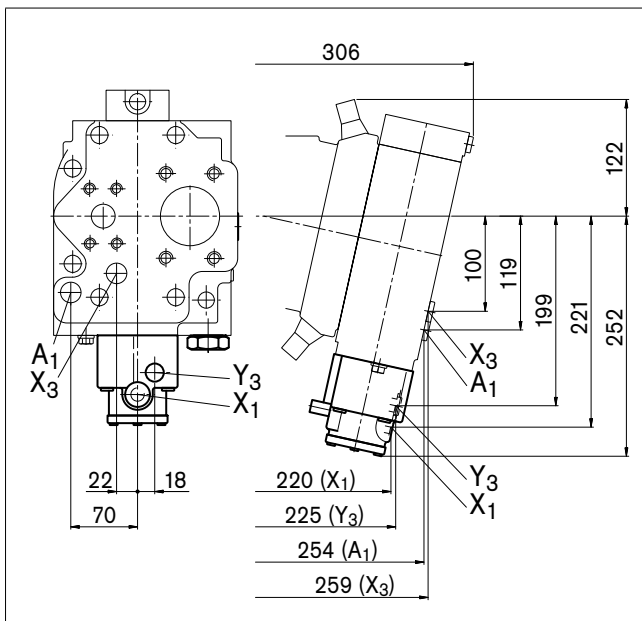
DRS

Pressure controller with load sensing



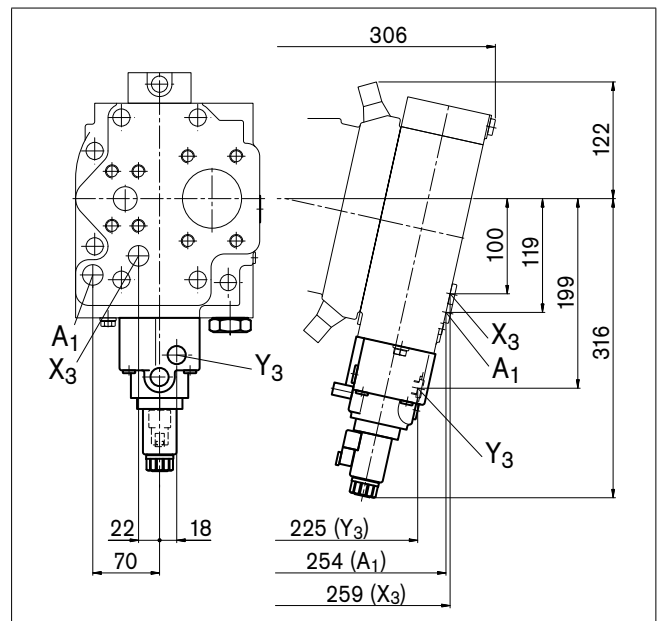
HD1, HD2/HD1G, HD2G

Proportional control hydraulic, positive control and variants with pressure cut-off, remotely controlled



EP2/EP2G

Proportional control electric, positive control and variants with pressure cut-off, remotely controlled

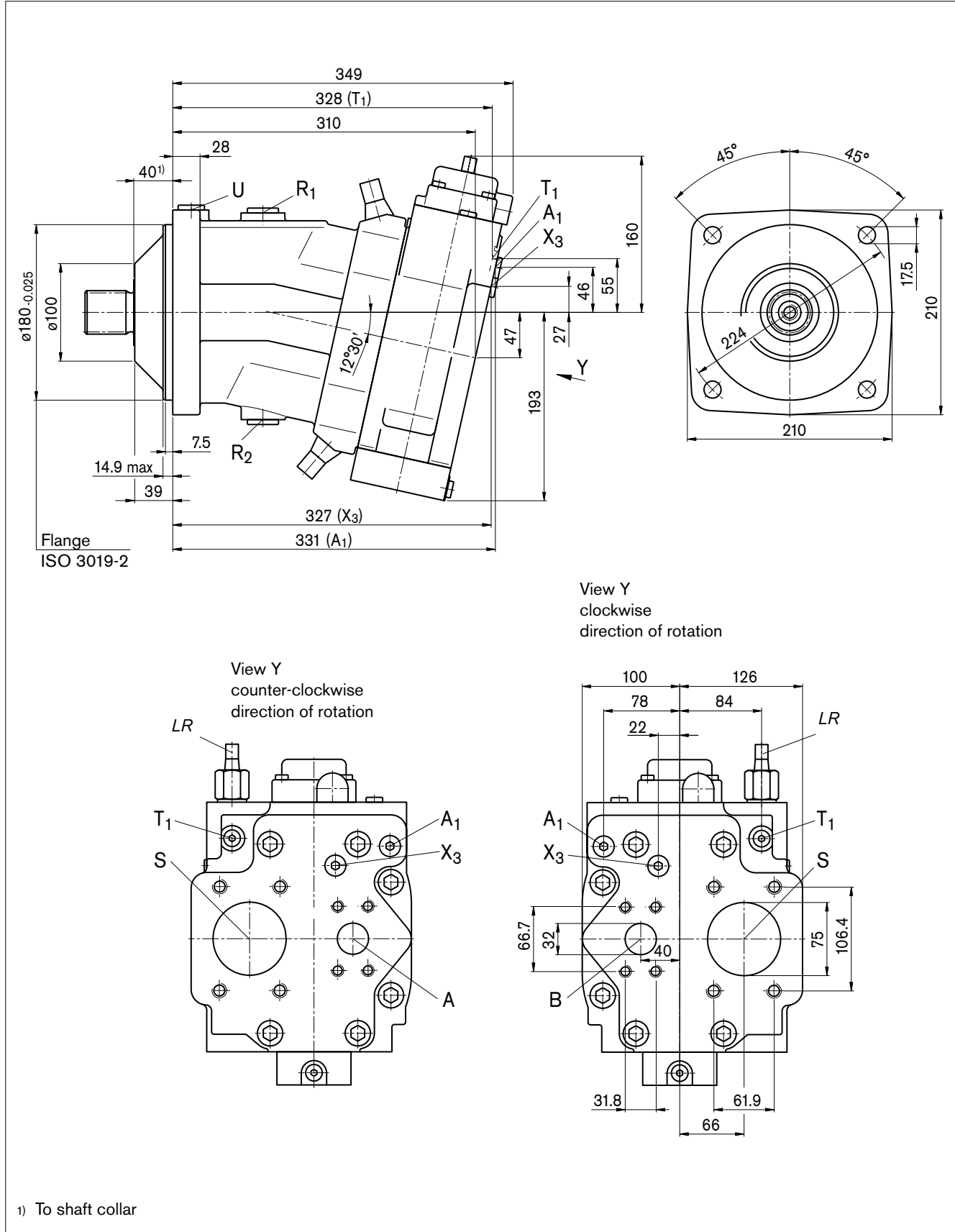


Dimensions size 160

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

LR – Power controller

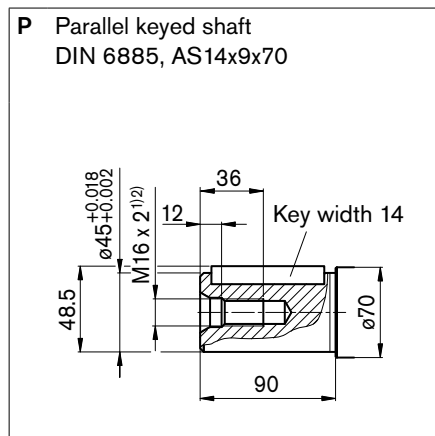
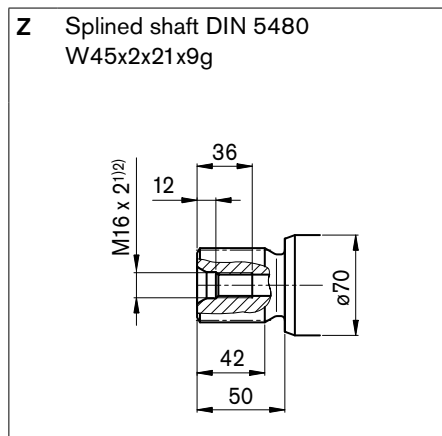
Note: All versions of the controller are illustrated for clockwise direction of rotation (View Y).



Dimensions size 160

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

Drive shafts



Ports

Designation	Port for	Standard	Size ²⁾	Maximum pressure [bar] ³⁾	State ⁶⁾
A	Service line (high pressure series) Fastening thread	SAE J518 ⁴⁾ DIN 13	1 1/4 in M14 x 1.5; 19 deep	400	O
S	Suction line (standard series) Fastening thread	SAE J518 ⁴⁾ DIN 13	3 in M16 x 1.5; 24 deep	2	O
U	Bearing flushing	DIN 3852 ⁵⁾	M22 x 1.5; 14 deep	2	X
R ₁ , R ₂	Air bleed	DIN 3852 ⁵⁾	M26 x 1.5; 16 deep	2	X
A ₁	Measuring high pressure	DIN 3852 ⁵⁾	M16 x 1.5; 12 deep	400	X
T ₁	Pilot fluid drain	DIN 3852 ⁵⁾	M12 x 1.5; 12 deep	400	X
T ₁	Pilot fluid drain (only DR, ..D..)	DIN 3852 ⁵⁾	M12 x 1.5; 12 deep	400	O
X ₃	Override	DIN 3852 ⁵⁾	M16 x 1.5; 12 deep	400	X
Y ₃	External pilot pressure	DIN 3852 ⁵⁾	M14 x 1.5; 12 deep	40	X
X ₁	Pilot pressure	DIN 3852 ⁵⁾	M14 x 1.5; 12 deep	40	O
X ₄	Load pressure	DIN 3852 ⁵⁾	M14 x 1.5; 12 deep	400	O
M ₁	Measuring control pressure	DIN 3852 ⁵⁾	M12 x 1.5; 12 deep	400	X

1) Center bore according to DIN 332 (thread according to DIN 13)

2) Observe the general instructions on page 36 for the maximum tightening torques.

3) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.

4) Only dimensions according to SAE J518, metric fastening thread is a deviation from standard.

5) The spot face can be deeper than specified in the appropriate standard.

6) O = Must be connected (plugged on delivery)

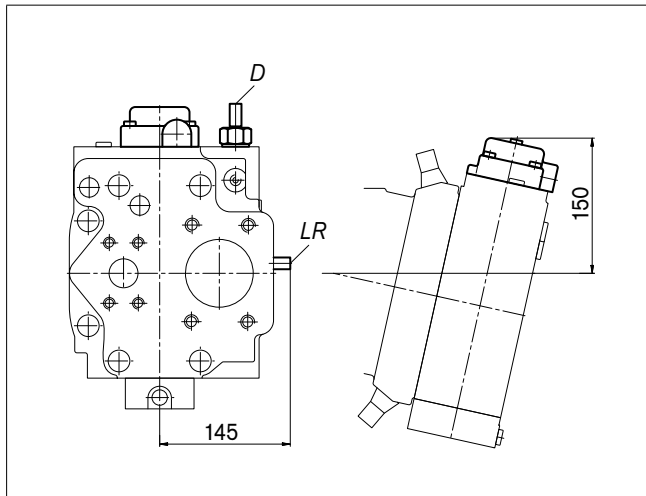
X = Plugged (in normal operation)

Dimensions size 160

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

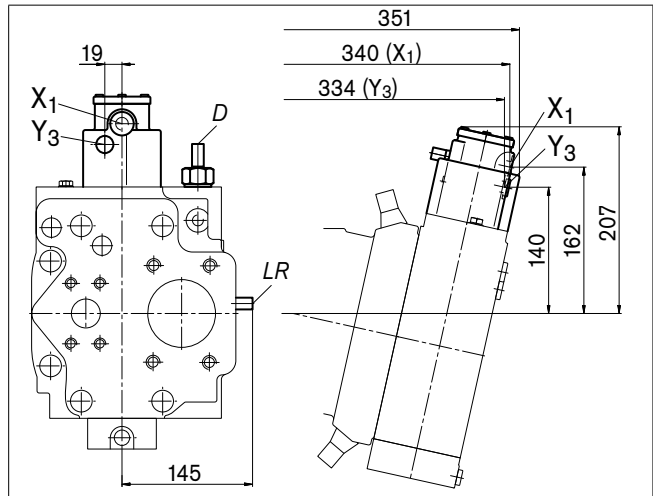
LRD

Power controller with pressure cut-off



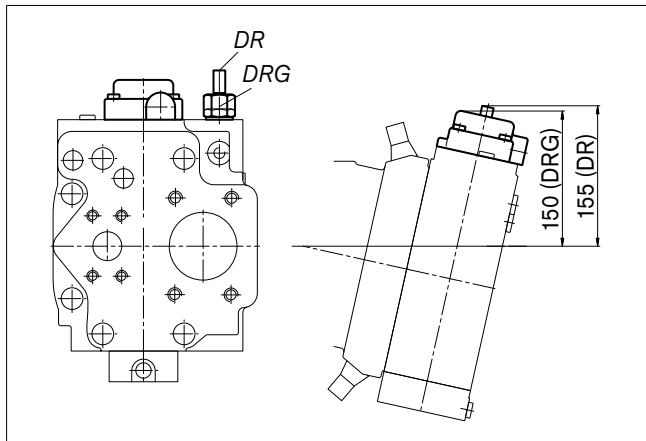
LRDH1

Power controller with pressure cut-off and stroke limiter



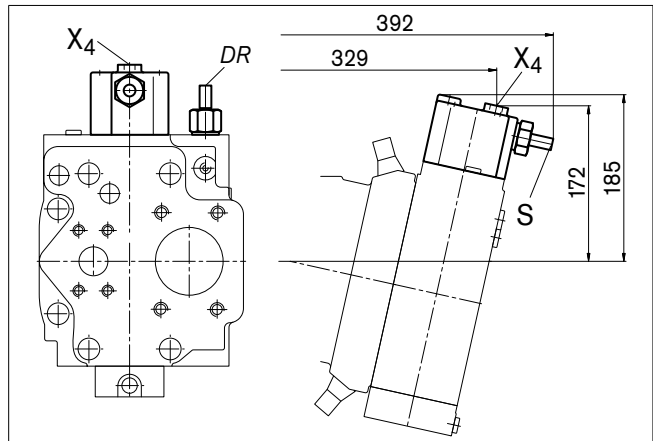
DR/DRG

Pressure controller / pressure controller remotely controlled



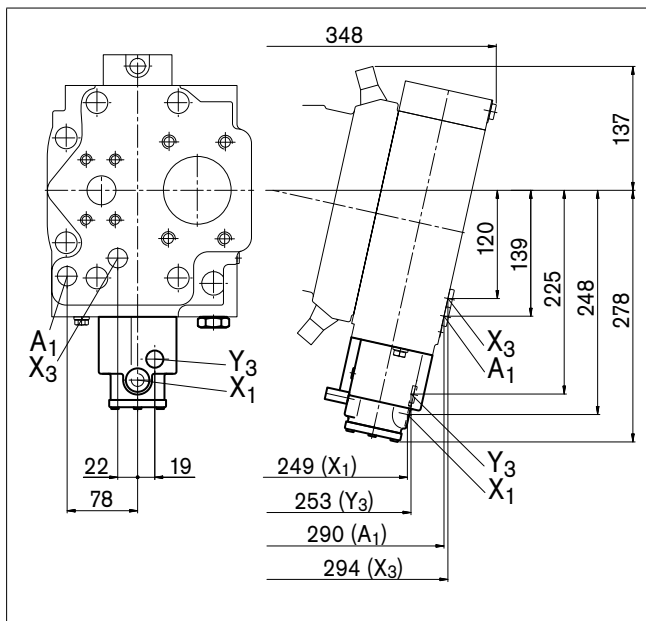
DRS

Pressure controller with load sensing



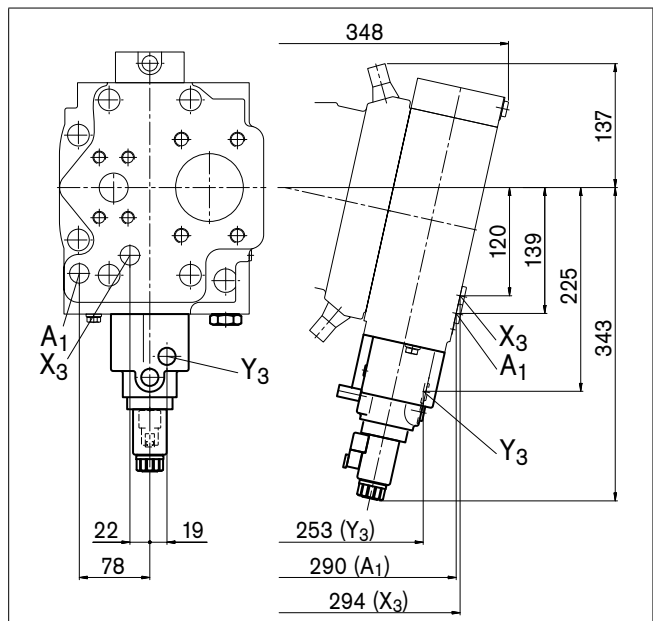
HD1, HD2/HD1G, HD2G

Proportional control hydraulic, positive control and variants with pressure cut-off, remotely controlled



EP2/EP2G

Proportional control electric, positive control and variants with pressure cut-off, remotely controlled



Connector for solenoids

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

DEUTSCH DT04-2S-EP04

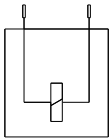
Molded, 2-pin, without bidirectional suppressor diode

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

Bosch Rexroth Mat. No. R902601804

Consisting of: _____ DT designation

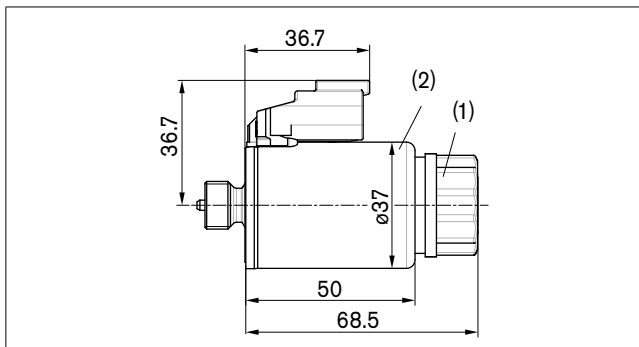
– 1 housing _____ DT06-2S-EP04

– 1 wedge _____ W2S

– 2 sockets _____ 0462-201-16141

The mating connector is not included in the delivery contents.

This can be supplied by Bosch Rexroth on request.



Changing connector orientation

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

To do this, proceed as follows:

1. Loosen the mounting nut (1) of the solenoid. To do this, turn the mounting nut (1) one turn counter-clockwise.
2. Turn the solenoid body (2) to the desired orientation.
3. Retighten the mounting nut. Tightening torque: 5+1 Nm. (WAF26, 12-sided DIN 3124)

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

Installation instructions

General

During commissioning and operation, the axial piston unit must be filled with hydraulic fluid and air bled. This must also be observed following a relatively long standstill as the axial piston unit may drain back to the reservoir 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 case drain chamber is internally connected to the suction chamber. A case drain line from the case to the reservoir is not required. Exception: for operation with pressure controller or pressure cut-off, a case drain line from port T_1 to the reservoir is required.

To achieve favorable noise values, decouple all connecting lines using elastic elements.

In all operating conditions, the suction and case drain lines must flow into the reservoir below the minimum fluid level. The minimum suction pressure at port S must also not fall below 0.8 bar absolute during operation.

Installation position

See the following examples 1 to 4.

Further installation positions are possible upon request.

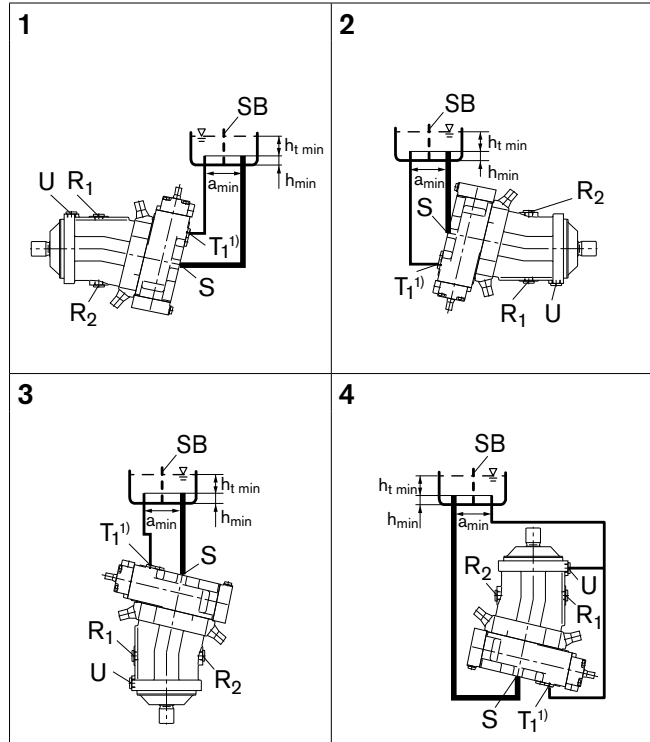
Recommended installation position: 1 and 2.

Note

Axial piston units with electric components (e.g. electric controls, sensors) must not be installed in a reservoir below the fluid level.

Below-reservoir installation (standard)

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



Installation position	Air bleed	Filling
1	R ₁	S
2	R ₂	S
3	T ₁	S
4	U	S

- R₁, R₂** Air bleed port
- U** Bearing flushing
- S** Suction port
- T₁** Drain port
- h_{t min}** Minimum required immersion depth (200 mm)
- h_{min}** Minimum required spacing to reservoir bottom (100 mm)
- SB** Baffle (baffle plate)
- a_{min}** When designing the reservoir, ensure adequate space between the suction line and the case drain line. This prevents the heated, return flow from being drawn directly back into the suction line.

1) Only for versions with pressure controller or pressure cut-off, a case drain line from port T_1 to the reservoir is essential.

Notice

General instructions

- The pump A7VO 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, these can be requested from Bosch Rexroth.
- During and shortly after operation, there is a risk of burns on the axial piston unit and especially on the solenoids. Take appropriate safety measures (e. g. by wearing protective clothing).
- Depending on the operating conditions of the axial piston unit (operating pressure, fluid temperature), the characteristic may shift.
- Service line ports:
 - The ports and fastening threads are designed for the specified maximum pressure. The machine or system manufacturer must ensure that the connecting elements and lines correspond to the specified application conditions (pressure, flow, hydraulic fluid, temperature) with the necessary safety factors.
 - The service line ports and function ports can only be used to accommodate hydraulic lines.
- Pressure cut-off and pressure controller do not provide security against pressure overload. A pressure-relief valve is to be provided in the hydraulic system.
- The data and notes contained herein must be adhered to.
- The product is not approved as a component for the safety concept of a general machine according to ISO 13849.
- The following tightening torques apply:
 - Fittings:
 - Observe the manufacturer's instructions regarding the tightening torques of the fittings used.
 - Mounting bolts:
 - For mounting bolts with metric ISO thread according to DIN 13 or thread according to ASME B1.1, we recommend checking the tightening torque in individual cases in accordance with VDI 2230.
 - Female threads in the axial piston unit:
 - The maximum permissible tightening torques $M_{G \max}$ are maximum values of the female threads and must not be exceeded. For values, see the following table.
 - Threaded plugs:
 - For the metallic threaded plugs supplied with the axial piston unit, the required tightening torques of threaded plugs M_V apply. For values, see the following table.

Ports		Maximum permissible tightening torque of the female threads $M_{G \max}$	Required tightening torque of the threaded plugs $M_V^{1)}$	WAF hexagon socket of the threaded plugs
Standard	Size of thread			
DIN 3852	M12 x 1.5	50 Nm	25 Nm ²⁾	6 mm
	M14 x 1.5	80 Nm	35 Nm	6 mm
	M16 x 1.5	100 Nm	50 Nm	8 mm
	M18 x 1.5	140 Nm	60 Nm	8 mm
	M22 x 1.5	210 Nm	80 Nm	10 mm
	M26 x 1.5	230 Nm	120 Nm	12 mm

- 1) The tightening torques apply for screws in the "dry" state as received on delivery and in the "lightly oiled" state for installation.
- 2) In the "lightly oiled" state, the M_V is reduced to 17 Nm for M12 x 1.5.