RE 92 500/07.00

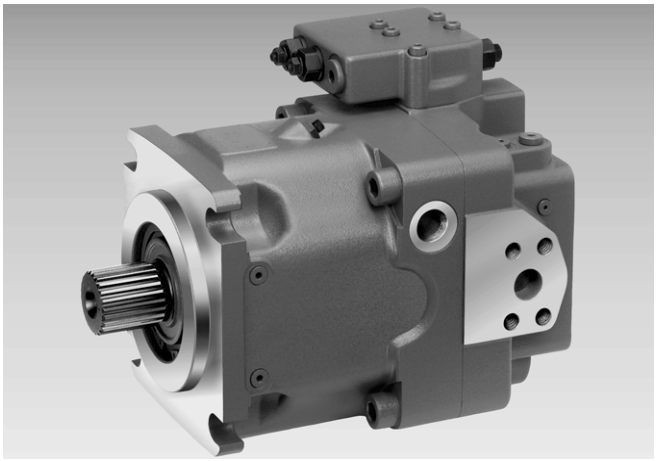
Replaces: 03.97

engineering mannesmann Rexroth

Variable Displacement Pump A11VO

for open circuits

Sizes 40…260
Series 1
Nominal pressure 350 bar
Peak pressure 400 bar



A11VO

Index

Features

- Variable displacement pump with axial piston drive swashplate design for hydrostatic drives in open circuits
- Designed primarily for use in mobile applications
- Pump operation either self-priming, with tank charging or charging pump
- A comprehensive range of variable units is available for different control functions
- Power can be adjusted from the outside, even when the machine is running
- The through drive is suitable for attachment of gear pumps and axial piston pumps up to the same size, i.e. 100% through drive
- The volume flow is adjustable in proportion to the drive speed and displacement and is infinitely variable from $q_{V\,max}$ to $q_{V\,min} = 0$

Ordering Code / Standard Program

Fluid

Mineral oil (no short code)

Axial piston unit

Variable displacement, swashplate design — **A11V**

Charging pump (impeller)

	40	60	75	95	130	190	260	
without charging pump (no short code)	●	●	●	●	●	●	●	
with charging pump	–	–	–	–	●	●	●	**L**

Operating mode

Pump, open circuits — **O**

Size

≙ Displacement $V_{g\,max}$ (cm^3)

40	60	75	95	130	190	260

Control devices

								40	60	75	95	130	190	260	
Power control			**LR**					●	●	●	●	●	●	●	**LR**
with override	cross-sensing		**LR**		**C**			●	●	●	●	●	●	●	**LR.C**
	high pressure dependent		**LR3**					●	●	●	●	●	●	●	**LR3**
	pilot pressure dependent, negative		**LG1**					●	●	●	●	●	●	●	**LG1**
	pilot pressure dependent, positive		**LG2**					●	●	●	●	●	●	●	**LG2**
	with 12V solenoid, negative		**LE1**					○	○	○	●	●	●	●	**LE1**
	with 24V solenoid, negative		**LE2**					○	○	○	●	●	●	●	**LE2**
with pressure cut-off				**D**				●	●	●	●	●	●	●	**L. D . .**
	2-stage			**E**				●	●	●	●	●	●	●	**L. E . .**
	remote controlled					**G**		●	●	●	●	●	●	●	**L. . G .**
with load sensing							**S**	●	●	●	●	●	●	●	**L. . . S**
	electric override						**S2**	○	○	○	○	○	○	○	**L. . . S2**
	hydraulic override						**S5**	○	○	○	●	●	●	●	**L. . . S5**
with stroke limiter	negative control	Δp = 25 bar					**H1**	●	●	●	●	●	●	●	**L. . . H1**
	negative control	Δp = 10 bar					**H5**	●	●	●	●	●	●	●	**L. . . H5**
	positive control	Δp = 25 bar					**H2**	●	●	●	●	●	●	●	**L. . . H2**
	positive control	Δp = 10 bar					**H6**	●	●	●	●	●	●	●	**L. . . H6**
	positive control	U = 12 V					**U1**	●	●	●	●	●	●	●	**L. . . U1**
	positive control	U = 24 V					**U2**	●	●	●	●	●	●	●	**L. . . U2**
Pressure control			**DR**					●	●	●	●	●	●	●	**DR**
with load sensing			**DRS**					●	●	●	●	●	●	●	**DRS**
remote controlled			**DRG**					●	●	●	●	●	●	●	**DRG**
for parallel operation			**DRL**					○	○	○	●	●	●	●	**DRL**
Hydraulic control,		Δp = 10 bar	**HD1**					●	●	●	●	●	●	●	**HD1**
pilot pressure dependent		Δp = 25 bar	**HD2**					●	●	●	●	●	●	●	**HD2**
with pressure cut-off				**D**				●	●	●	●	●	●	●	**HD.D**
with pressure cut-off, remote controlled				**G**				●	●	●	●	●	●	●	**HD.G**
Electric control,		U = 12 V	**EP1**					●	●	●	●	●	●	●	**EP1**
with proportional solenoid		U = 24 V	**EP2**					●	●	●	●	●	●	●	**EP2**
with pressure cut-off				**D**				●	●	●	●	●	●	●	**EP.D**
with pressure cut-off, remote controlled				**G**				●	●	●	●	●	●	●	**EP.G**

For controls with several additional functions, follow the **order** of the columns. Only **one** option possible in each column (e.g. LRDCH2).
Note that the following combinations are not possible with the power control:
…GS, …GS2, …GS5, …EC and the combination …DG in conjunction with stroke limiters H1, H2, H5, H6, U1 and U2.

● = available
○ = available on request
– = not available

= preferred program (preferred types see page 48)

A11V		O			/	1			–				12				

Axial piston unit

Charging pump

Operating mode

Size

Control devices

Series

	1

Index

Sizes	40...130	**0**
Sizes	190...260	**1**

Direction of rotation

Viewed on shaft end	clockwise	**R**
	anti-clockwise	**L**

Seals

NBR (nitrile rubber), shaft seal FKM (fluoride rubber)	**N**

Shaft end	**40**	**60**	**75**	**95**	**130**	**190**	**260**	
Splined shaft DIN 5480 for individual pumps and pump combinations	●	●	●	●	●	●	●	**Z**
Cylindrical shaft with key DIN 6885	●	●	●	●	●	●	●	**P**
Splined shaft ANSI B92.1a-1976 standard for single pump	●	●	●	●	●	●	●	**S**
standard for combination pump	●	●	●	–[1]	–[1]	●	●	**T**

Mounting flange

SAE J744 – 2 hole	●	●	–	–	–	–	–	**C**
SAE J744 – 4 hole	–	–	●	●	●	●	●	**D**

Connection for service lines

Pressure port and suction port SAE side ports (metric threads)	●	●	●	●	●	●	●	**12**

Through drive (for mounting options see page 30)

Flange SAE J744 [2]	Splined shaft hub		**40**	**60**	**75**	**95**	**130**	**190**	**260**	
–	–		●	●	●	●	●	●	●	**N00**
82-2 (A)	5/8in	9T 16/32DP [3]	●	●	●	●	●	●	●	**K01**
	3/4in	11T 16/32DP [3]	○	●	○	●	●	○	○	**K52**
101-2 (B)	7/8in	13T 16/32DP [3]	●	●	●	●	●	●	●	**K02**
	1in	15T 16/32DP [3]	●	●	●	●	●	●	●	**K04**
	W35	2x30x16x9g [4]	●	●	●	●	●	●	●	**K79**
127-2 (C)	1 1/4in	14T 12/24DP [3]	–	●	●	●	●	●	●	**K07**
	1 1/2in	17T 12/24DP [3]	–	–	–	●	●	●	●	**K24**
	W30	2x30x14x9g [4]	–	●	●	●	●	●	●	**K80**
	W35	2x30x16x9g [4]	–	●	●	●	●	●	●	**K61**
152-4 (D)	1 1/4in	14T 12/24DP [3]	–	–	●	●	●	●	●	**K86**
	1 3/4in	13T 8/16DP [3]	–	–	–	–	●	●	●	**K17**
	W40	2x30x18x9g [4]	–	–	●	●	●	●	●	**K81**
	W45	2x30x21x9g [4]	–	–	–	●	●	●	●	**K82**
	W50	2x30x24x9g [4]	–	–	–	–	●	●	●	**K83**
165-4 (E)	1 3/4in	13T 8/16DP [3]	–	–	–	–	–	●	●	**K72**
	W50	2x30x24x9g [4]	–	–	–	–	–	●	●	**K84**
	W60	2x30x28x9g [4]	–	–	–	–	–	–	●	**K67**

Swivel angle display

without swivel angle display (no short code)	●	●	●	●	●	●	●	
with optical swivel angle display	●	–	●	●	●	●	●	**V**
with electric swivel angle display	●	–	●	●	●	●	●	**R**

[1] **S** shaft suitable for combination pump [2] 2 ≙ 2 hole; 4 ≙ 4 hole [4] Splined shaft hub to DIN 5480

[3] Splined shaft hub to ANSI B92.1a-1976 (splined shaft allocation to SAE J744, see pages 42

Technical Data

Hydraulic Fluid

We request that before starting a project, detailed information about the choice of hydraulic fluids and application conditions are taken from our catalogue sheets RE 90220 (mineral oil), RE 90221 (environmentally acceptable hydraulic oils) and RE 90223 (HF hydraulic fluids).

The A11VO variable displacement pump is not suitable for operation with HFA, HFB and HFC. When operating with HFD or environmentally acceptable hydraulic fluids, restrictions in the technical data should be noted – please contact us (the hydraulic fluid used should be stated in clear text in the order).

Operating viscosity range

We recommend that the operating viscosity (at operating temperature), for both the efficiency and life of the unit, be chosen within the optimum range of:

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

referred to tank temperature (open circuit).

Viscosity limits

The limiting values for viscosity are as follows:

ν_{min} = 5 mm²/s

short term, at a max. permissible leakage oil temperature t_{max} = 115°C

ν_{max} = 1600 mm²/s short term, on cold start (t_{min} = -40°C)

Please note that the max. fluid temperature is also not exceeded in certain areas (for instance bearing area).

At temperatures of –25°C to –40°C special measures may be required. Please contact us for further information.

Notes on the selection of hydraulic fluid

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

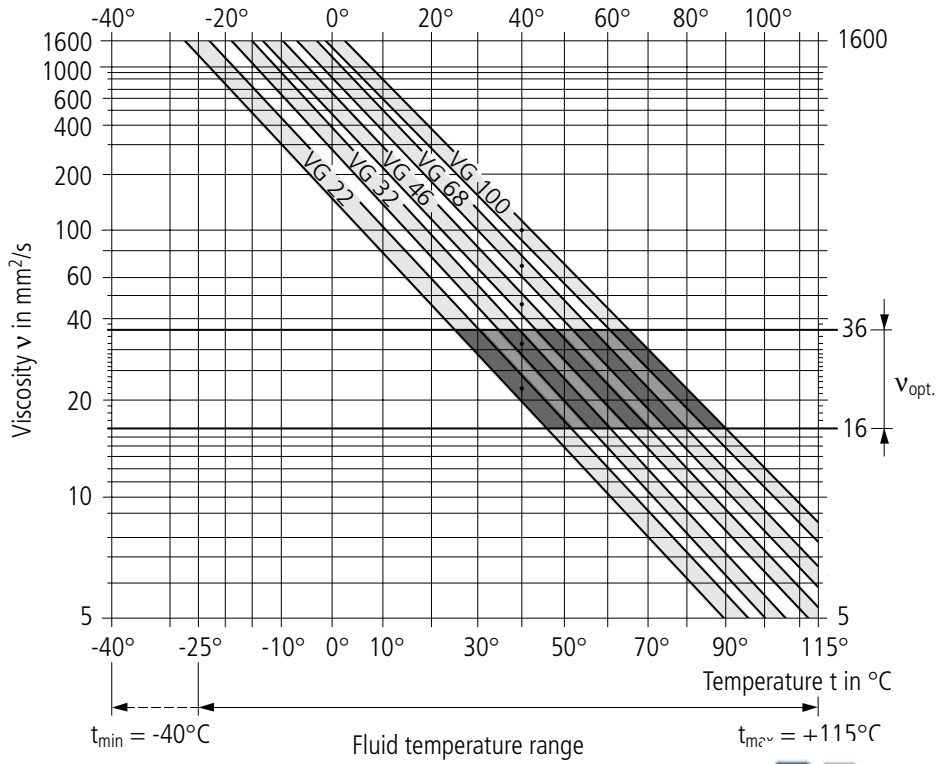
The hydraulic fluid should be selected so that within the operating temperature range, the operating viscosity lies within the optimum range (ν_{opt}) (see shaded section of the selection diagram). We recommend that the higher viscosity grade is selected in each case.

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

Important: The leakage oil temperature is influenced by pressure and speed and is typically higher than the tank temperature. However, maximum temperature at any point in the system must be less than 115°C.

Please consult Brueninghaus Hydromatik if the above conditions cannot be kept at extreme operating parameters or because of high ambient temperature.

Selection diagram



Technical Data

Filtration

The finer the filtration, the better the achieved purity grade of the hydraulic fluid and the longer the life of the axial piston unit.

To ensure the functioning of the axial piston unit, a minimum purity grade of

9 to NAS 1638

18/15 to ISO/DIS 4406 is necessary.

At very high hydraulic fluid temperatures, a minimum purity grade of

8 to NAS 1638

17/14 to ISO/DIS 4406 is necessary.

If the above mentioned grades cannot be maintained, please consult us.

Input operating pressure range

Absolute pressure at port S (suction port)

Version *without* charging pump

$p_{abs\ min}$ _____ 0,8 bar

$p_{abs\ max}$ _____ 30 bar

Please consult us if the pressure is > 5 bar.

Version *with* charging pump

$p_{abs\ min}$ _____ 0,6 bar

$p_{abs\ max}$ _____ 2 bar

Output operating pressure range

Pressure at port A or B

Nominal pressure p_N _____ 350 bar

Peak pressure p_{max} _____ 400 bar

Case drain pressure

Maximum permissible pressure of the leakage fluid at ports T_1 and T_2

p_L _____ 2 bar abs.

A drain oil line to the tank is necessary.

Flushing the housing

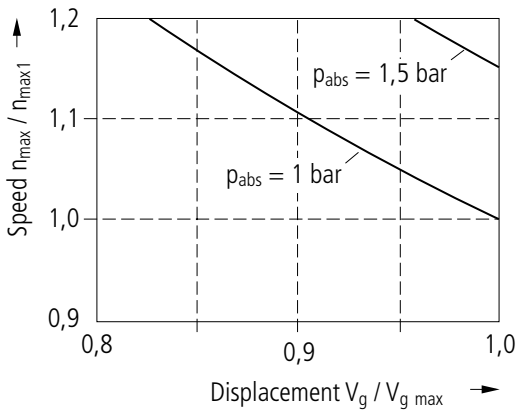
If a variable displacement pump with variable displacement units **EP, HD, DR** or with stroke limiter (**H., U.**) is operated for an extended period (t > 10 min) with zero volume flow or operating pressure < 15 bar, the housing should be flushed via one of the ports T1, T2 or R to avoid overheating.

NG	40	60	75	95	130	190	260
$q_{V\ flush}$ (L/min)	2	3	3	4	4	5	6

It is not necessary to flush the housing on the version with charging pump (A11VLO).

Maximum permissible speed (speed limit)

Permissible speed due to increasing the input pressure p_{abs} at suction port S or if $V_g \leq V_{g\ max}$



Shaft seal temperature range

The FPM shaft seal is suitable for housing temperatures of –25°C to +115°C.

Note:

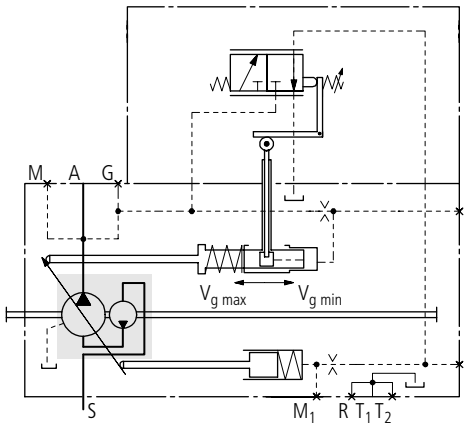
An NBR shaft seal is required for applications below –25°C (permissible temperature range: -40°C to +90°C).

Please state NBR shaft seal in clear text when ordering.

Charging pump

The charging pump is a centrifugal pump. Its role is to charge the A11VO, enabling it to run at higher speeds. It also makes cold starting easier at low temperatures and high hydraulic fluid viscosity.

Tank charging is never required.



Technical Data

Table of values, (theoretical values, regardless of η_{mh} and η_v; approximate values)

Size	**A11VO**		**40**	**60**	**75**	**95**	**130**	**190**	**260**			
	A11VLO (with charging pump)									**130**	**190**	**260**
Displacement	$V_{g\,max}$	cm^3	42	58,3	74	93,8	130	192,7	260	130	192,7	260
	$V_{g\,min}$	cm^3	0	0	0	0	0	0	0	0	0	0
Max. speed [1] at $V_{g\,max}$	n_{max}	min^{-1}	3000	2700	2550	2350	2100	2100	1800	2500 [2]	2500 [2]	2300 [2]
Max. speed [3] at $V_g \leq V_{g\,max}$	n_{max}	min^{-1}	3500	3250	3000	2780	2500	2500	2300	2500	2500	2300
Flow [4] at n_{max} und $V_{g\,max}$	$q_{V\,max}$	L/min	122	153	183	214	265	393	454	315	467	580
Power at $q_{V\,max}$ and $\Delta p = 350$ bar	P_{max}	kW	73	92	110	129	159	236	273	190	281	349
Torque at $V_{g\,max}$ and $\Delta p = 350$ bar	T_{max}	Nm	234	324	412	522	724	1073	1448	724	1073	1448
Moment of inertia about the drive axis	J	kgm^2	0,0048	0,0082	0,0115	0,0173	0,0318	0,055	0,0878	0,0337	0,0577	0,0895
Weight (approx.)	m	kg	28	36	45	53	66	95	125	69	100	130

[1]) The values are quoted for an absolute pressure (p_{abs}) of 1 bar at suction port S and mineral fluid.

[2]) The values are quoted for an absolute pressure (p_{abs}) of at least 0.8 bar at suction port S and mineral operating fluid.

[3]) The values are quoted for $V_g \leq V_{g\,max}$ or increase of the input pressure p_{abs} at suction port S (see graph on page 5).

[4]) Allows for 3% displacement loss.

Determination of size

Flow $q_V = \dfrac{V_g \bullet n \bullet \eta_v}{1000}$ in L/min

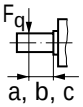
Drive torque $T = \dfrac{V_g \bullet \Delta p}{20 \bullet \pi \bullet \eta_{mh}} = \dfrac{1{,}59 \bullet V_g \bullet \Delta p}{100 \bullet \eta_{mh}}$ in Nm

Drive power $P = \dfrac{2\pi \bullet T \bullet n}{60000} = \dfrac{T \bullet n}{9549} = \dfrac{q_V \bullet \Delta p}{600 \bullet \eta_t}$ in kW

V_g = geometric displacement per revolution in cm^3
Δp = differential pressure in bar
n = speed in rpm
η_v = volumetric efficiency
η_{mh} = mechanical-hydraulic efficiency
η_t = total efficiency ($\eta_t = \eta_v \bullet \eta_{mh}$)

Drive

Permissible radial and axial loading of drive

Size					**40**	**60**	**75**	**95**	**130**	**190**	**260**
Distance of F_q (from shaft collar)		a		mm	17,5	17,5	20	20	22,5	26	29
		b		mm	30	30	35	35	40	46	50
	a, b, c	c		mm	42,5	42,5	50	50	57,5	66	71
Max. permissible radial force at		a	$F_{q\,max}$	N	3600	5000	6300	8000	11 000	16 925	22 000
		b	$F_{q\,max}$	N	2891	4046	4950	6334	8594	13 225	16 809
		c	$F_{q\,max}$	N	2416	3398	4077	5242	7051	10 850	13 600
Max. permissible axial force			$\pm F_{ax\,max}$	N	1500	2200	2750	3500	4800	6000	4150

LR Power Control

Power control regulates the pump displacement as a function of operating pressure so that a preset drive output is not exceeded at constant drive speed.

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

p_B = operating pressure
V_g = displacement

Precise adjustment according to the hyperbolic characteristic ensures optimum power utilisation.

The operating pressure acts, via a piston, on a fulcrum. This is countered by an externally adjustable spring force which determines the power setting.

If the operating pressure exceeds the set spring force, the pilot valve is actuated via the fulcrum and the pump swivels back (direction $V_{g\,min}$). This shortens the lever length at the fulcrum and the operating pressure can increase in the same proportion as the displacement decreases ($p_B \bullet V_g$ = constant).

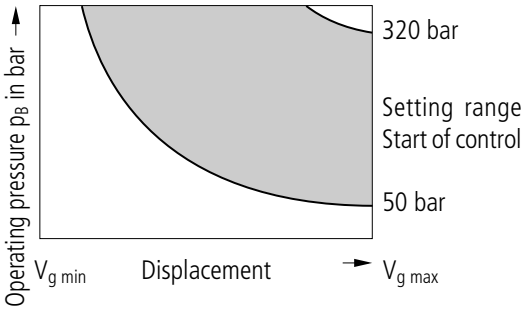
The output power (characteristic) is influenced by the efficiency of the pump.

When ordering, please state in clear text:

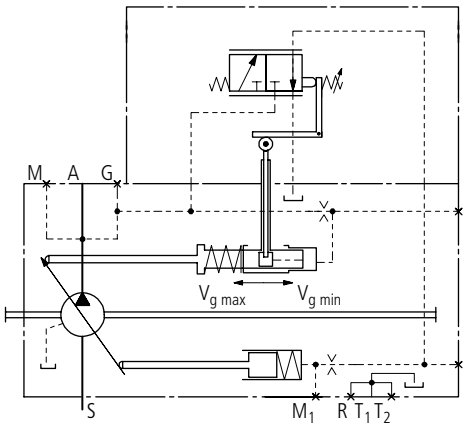
– Drive power P in kW
– Drive speed n in rpm
– Max. flow qv max in L/min

Once the details have been clarified, a power graph can be produced on our computers.

Characteristic: LR



Circuit diagram: LR



LRD Power Control with Pressure Cut-off

LRD Power control with pressure cut-off

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

This function overrides power control, i.e. below the pressure signal value, the power control function is performed.

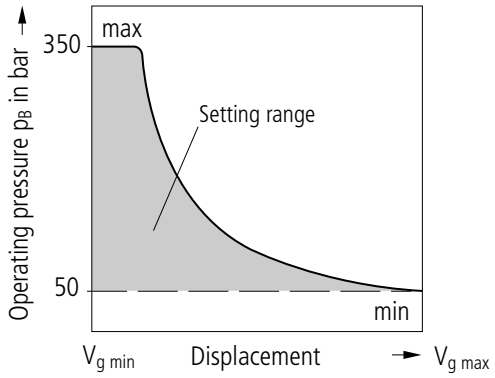
The valve is integrated into the control housing and is permanently set to a pressure signal value at the factory.

Setting range 50 to 350 bar.

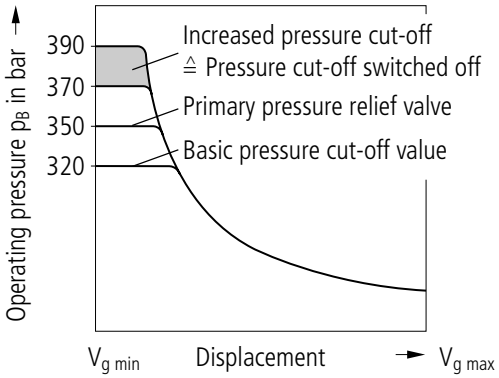
LRE Power control with 2-stage pressure cut-off

Sequencing an external pilot pressure at port Y allows the basic pressure cut-off value to be increased by 50^{+20} bar and a second pressure setting to be implemented. This value is higher than the setting value of the primary pressure relief valve and thus switches off pressure cut-off. The pressure signal at port Y must be between 20 and 50 bar.

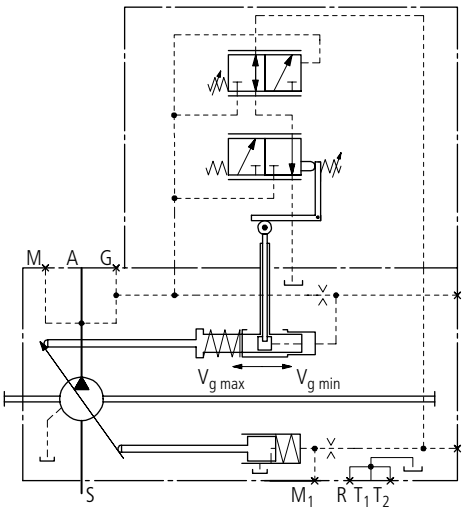
Characteristic: LRD



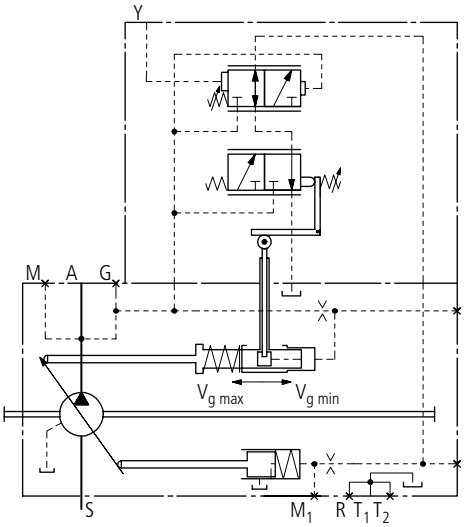
Characteristic: LRE



Circuit diagram: LRD



Circuit diagram: LRE



LRS Power Control with Load Sensing

LRDS Power control with pressure cut-off and load sensing

The load sensing control works as a flow controller controlled by load pressure and co-ordinates the pump displacement to the quantity required by the actuator.

The pump flow depends on the external orifice (control block, throttle valve) switched between the pump and the actuator, but is not affected by the load pressure over the whole range below the pressure signal value.

The valve compares the pressure upstream of the orifice with the downstream pressure and keeps the pressure drop (differential pressure Δp) occurring here, and hence the flow, constant.

If the differential pressure rises, the pump is swivelled back (direction $V_{g\,min}$). If the differential pressure Δp drops, the pump is swivelled out (direction $V_{g\,max}$) until balance is restored in the valve.

$$\Delta p_{orifice} = p_{pump} - p_{actuator}$$

The setting range for Δp is between 14 bar and 25 bar.

The standard setting is 18 bar (please state in clear text).

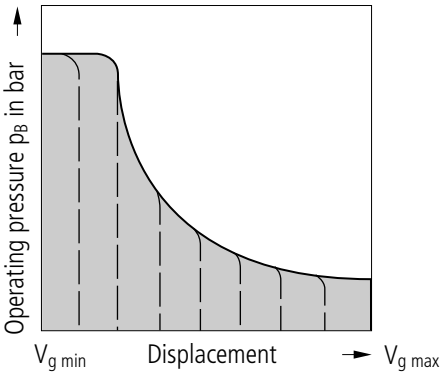
The stand-by pressure in zero stroke mode (orifice closed) is slightly higher than the Δp-setting.

Power control and pressure cut-off override the load sensing control, i.e. the load sensing function is performed below the set hyperbolic characteristic and below the set pressure signal value.

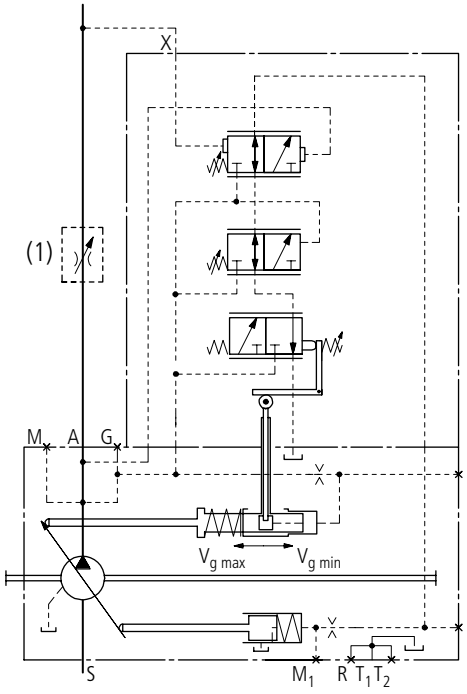
In a standard LS system, pressure cut-off is integrated into the pump control. In an LUDV system, pressure cut-off is integrated into the LUDV valve block.

(1) The orifice (throttle valve) is not included in the supply.

Characteristic: LRS



Circuit diagram: LRDS

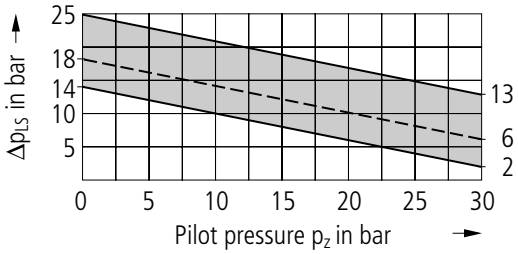


LRS5 Power control with load sensing, with hydraulic override

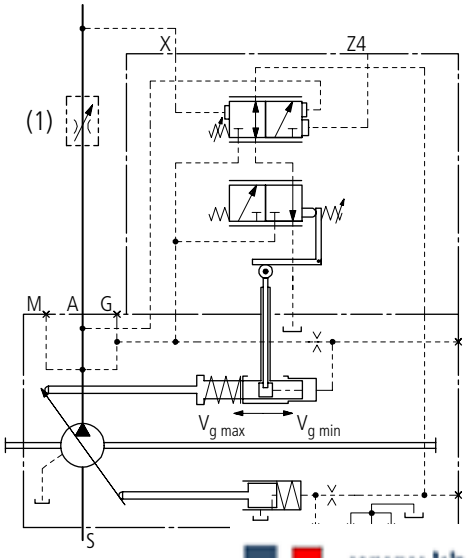
By sequencing an external pilot pressure at port Z, the differential pressure Δp of the load sensing control can be proportionally overridden.

An example of this is shown in the characteristic below. Please consult us when planning your system.

Characteristic: LRS5



Circuit diagram: LRS5



LR... Power Control with Stroke Limiter

LR... Power control with stroke limiter

The stroke limiter enables the pump displacement to be infinitely varied or limited across the whole setting range. The displacement is set once proportionally by the pilot current applied at the proportional solenoid or the pilot pressure … applied at port Y (max. 40 bar). Direct current at 12V (U1) or 24V (U2) respectively is required to trigger the proportional solenoid (insulation IP 54).

The stroke limiter is overridden by the power control, i.e. below the power control characteristic (hyperbolic characteristic) the displacement is set according to the pilot current or pilot pressure. If the power control characteristic is exceeded by the flow set or the operating pressure, the power control overrides and readjusts the displacement according to the hyperbolic characteristic.

To swivel the pump out of its initial position $V_{g\,max}$ towards $V_{g\,min}$, a positioning pressure of 30 bar is needed with the electric stroke limiter LRU1/2 and the hydraulic stroke limiter LRH2/6.

The necessary positioning oil is taken from the high pressure or from the external positioning pressure available at port G ($\geq$ 30 bar).

If the operating pressure is $\geq$ 30 bar and $V_{g\,min} > 0$, no external positioning pressure is required. In this case the change-over valve should be removed from the pump before commissioning (see note in repair instructions RDE 92500-R) and port G should be closed.

LRU1/2 Power control with electric stroke limiter (positive control)

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

As the pilot current increases, the pump swivels to a *higher* displacement.

Start of control at approx.:	400 mA (12 V)	200 mA (24 V)
End of control at approx.:	1200 mA (12 V)	600 mA (24 V)

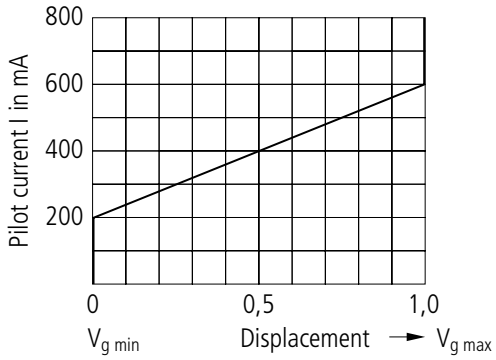
Starting position in unpressurised state: $V_{g\,max}$

At operating pressure > 30 bar the pump swivels from $V_{g\,max}$ towards $V_{g\,min}$ (pilot current < start of control)

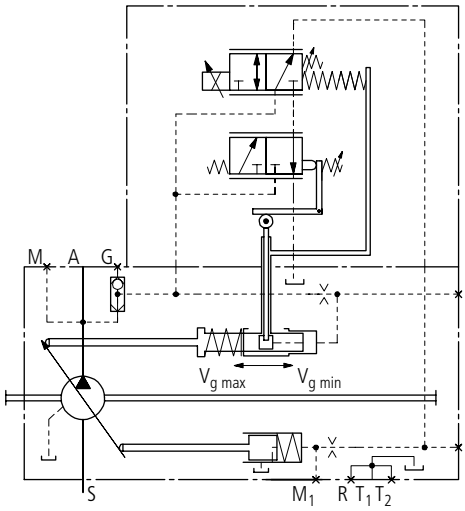
The following are available to trigger the proportional solenoid:

- Proportional amplifier **PV** _____ (see RE 95023)
- Proportional amplifier **VT 2000** _____ (see RE 29904)
- Chopper amplifier **CV** _____ (see RE 95029)
- Microcontroller **MC** _____ (see RE 95050)

Characteristic: LRU2



Circuit diagram: LRU1/2



LR... Power Control with Stroke Limiter

LRH1/5 Hydraulic stroke limiter (negative control)

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

As the pilot pressure rises, the pump swivels to a *smaller* displacement.

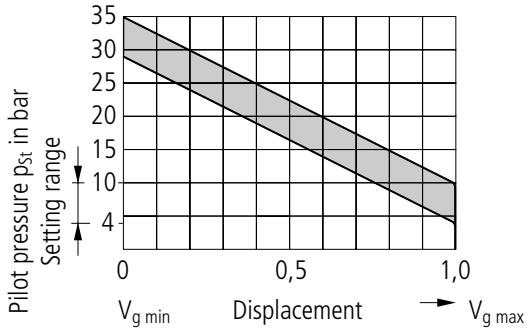
Start of control (at $V_{g\,max}$) adjustable _____ from 4 – 10 bar

Please state start of control in clear text when ordering.

Starting position in unpressurised state: $V_{g\,max}$

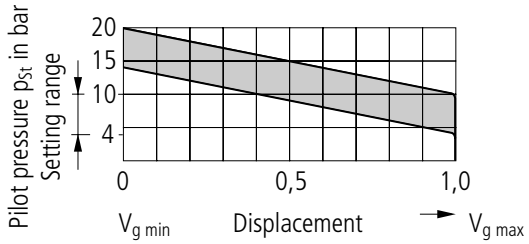
Characteristic: H1

Pilot pressure rise ($V_{g\,max} - V_{g\,min}$) _____ Δp = 25 bar

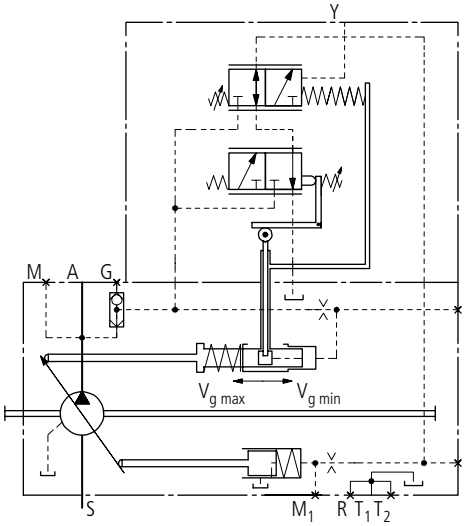


Characteristic: H5

Pilot pressure rise ($V_{g\,max} - V_{g\,min}$) _____ Δp = 10 bar



Circuit diagram: LRH1, LRH5



LRH2/6 Hydraulic stroke limiter (positive control)

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

As the pilot pressure rises, the pump swivels to a *higher* displacement.

Start of control (at $V_{g\,min}$) adjustable _____ from 4 – 10 bar

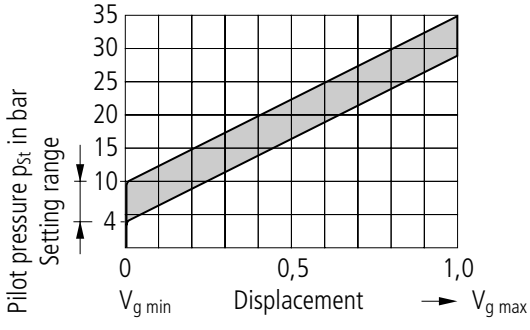
Please state start of control in clear text when ordering.

Starting position in unpressurised state: $V_{g\,max}$

At operating pressure > 30 bar the pump swivels from $V_{g\,max}$ towards $V_{g\,min}$ (pilot pressure < start of control)

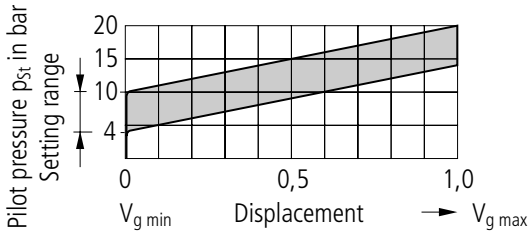
Characteristic: H2

Pilot pressure rise ($V_{g\,min} - V_{g\,max}$) _____ Δp= 25 bar

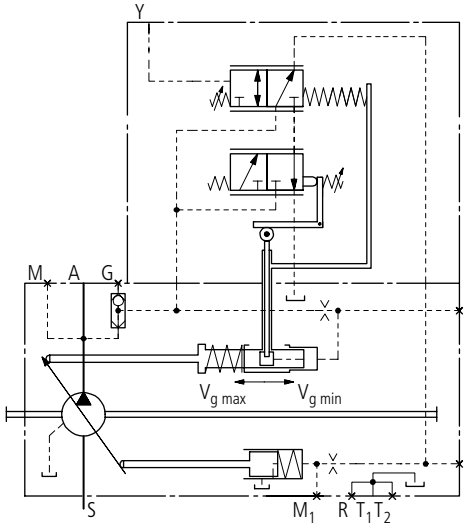


Characteristic: H6

Pilot pressure rise ($V_{g\,min} - V_{g\,max}$) _____ Δp = 10 bar



Circuit diagram: LRH2, LRH6



LR... Power Control with Override

LRC Override with cross-sensing

Cross-sensing is a total power control (high pressure dependent) which links two A11VO pumps of equal size with LRC control in power control.

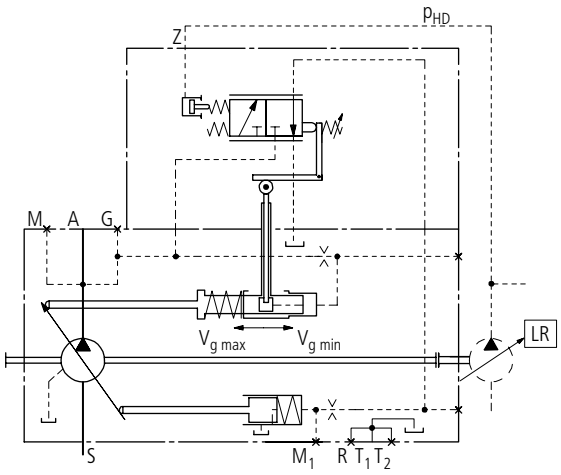
If one pump is running at operating pressures below the set start of control, the drive power not drawn, in a limit case up to 100%, is available to the other pump. Total drive power is thus distributed between two actuators as required.

Power released by pressure cut-off or other overrides is disregarded.

Semi cross-sensing function

If LRC control is used on the first pump (A11VO) and another pump mounted on the through drive also with power control without cross-sensing, the power required for the second pump is subtracted from the first pump in its setting. The second pump has priority in the total power setting.

Circuit diagram: LRC



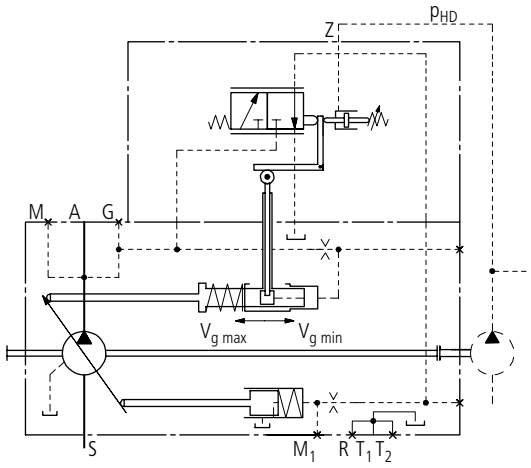
LR3 High pressure dependent override

High pressure dependent power override is a total power control where the power setting is loaded by the operating pressure of an attached fixed displacement pump (port Z).

The A11VO can thus be set to 100% of the total drive power. The power setting of the A11VO is reduced in proportion to the load-dependent rise in the operating pressure of the fixed displacement pump. The fixed displacement pump has priority in the total power setting.

The measuring area for the power reduction is adapted to the displacement of the fixed displacement pump.

Circuit diagram: LR3



LE1/2 Electric override (negative)

In this case, in contrast to hydraulic power override, the power setting is loaded by a pilot current. This pilot current acts, via a proportional solenoid, against the power control setting spring.

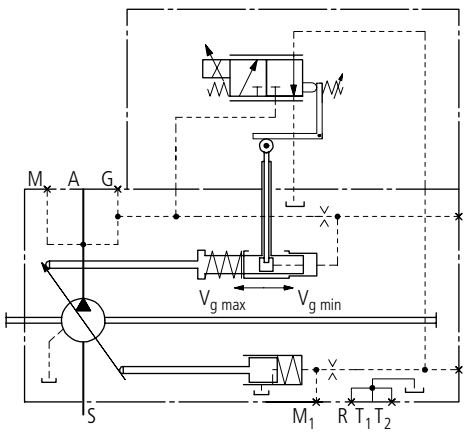
Higher pilot current ≙ power decrease.

Direct current at 12V (E1) or 24V (E2) respectively is required to trigger the proportional solenoid.

The mechanically set basic power setting can be varied by means of different pilot currents.

If the pilot current signal is variably readjusted via a load limit sensing control, the power decrease of all the actuators is adapted to the possible power output of the diesel engine.

Circuit diagram: LE1, LE2



LR... Power Control with Override

LG1/2 Pilot pressure dependent override

An external pilot pressure acts via port Z on the power control setting spring.

The mechanically set basic power setting can be varied by means of different pilot pressure settings.

If the pilot pressure signal is variably readjusted via a load limit sensing control, the power decrease of all the actuators is adapted to the possible power output of the diesel engine.

The pilot pressure used for power control is generated by an external controller which is not part of the A11VO (see also sheet RE 95072, Electronic load limit sensing control for excavators, GLB).

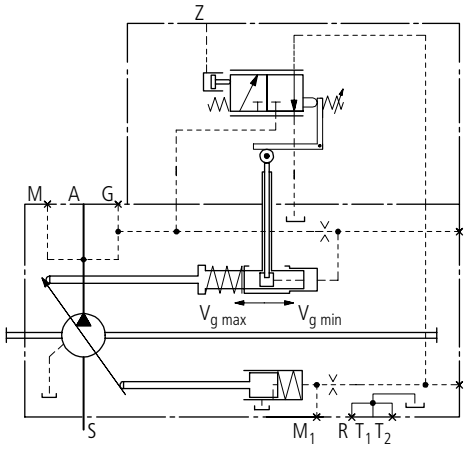
LG1 Negative power override

With negative power override LG1, the force resulting from the pilot pressure acts against the power control setting spring, i.e. higher pilot pressure ≙ power decrease.

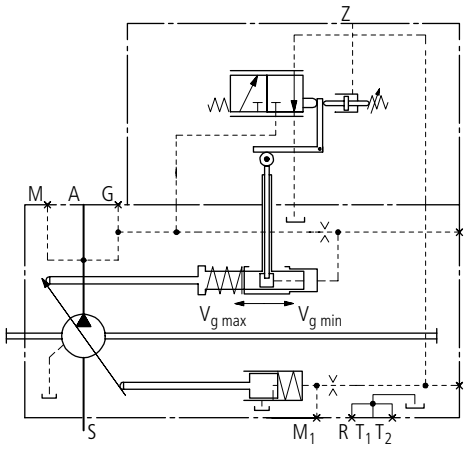
LG2 Positive power override

With positive power override LG2, the force resulting from the pilot pressure supports the power control setting spring, i.e. higher pilot pressure ≙ power increase.

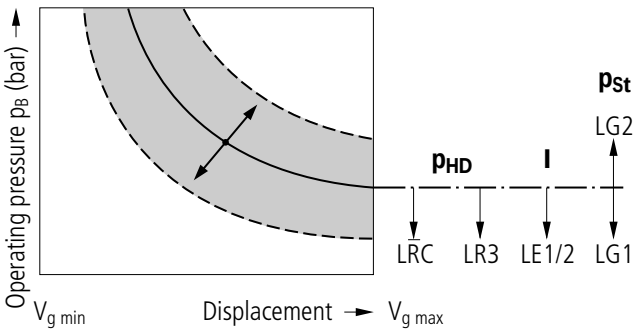
Circuit diagram: LG1



Circuit diagram: LG2



Controlling the power setting



DR Pressure Control

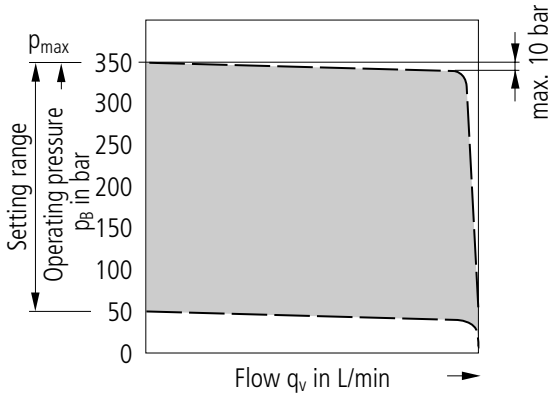
DR Pressure control

The pressure control maintains constant pressure in a hydraulic system within its control range despite fluctuations in the flow required. The variable displacement pump delivers only the amount of hydraulic fluid needed by the actuators. If the operating pressure exceeds the pressure signal value set at the integral valve, the pump is automatically swivelled back and the closed loop error reduced.

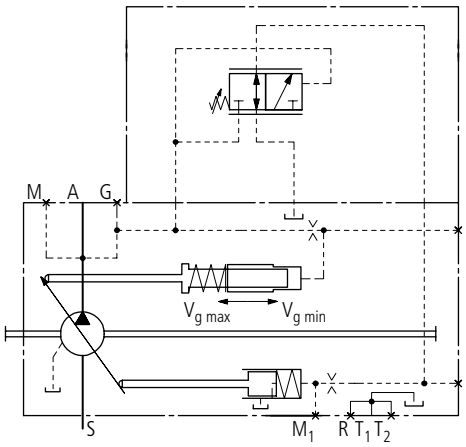
Starting position in unpressurised state: $V_{g\ max}$

Setting range 50 to 350 bar.

Characteristic: DR



Circuit diagram: DR



DRS Pressure control with load sensing

The load sensing control works as a flow controller controlled by load pressure and co-ordinates the pump displacement to the quantity required by the actuator.

The pump flow depends on the external orifice (control block, throttle valve) switched between the pump and the actuator, but is not affected by the load pressure over the whole range below the pressure signal value.

The valve compares the pressure upstream of the orifice with the downstream pressure and keeps the pressure drop (differential pressure Δp) occurring here, and hence the flow, constant.

If the differential pressure rises, the pump is swivelled back (direction $V_{g\ min}$). If the differential pressure Δp drops, the pump is swivelled out (direction $V_{g\ max}$) until balance is restored in the valve.

$\Delta p_{orifice} = p_{pump} - p_{actuator}$

The setting range for Δp is between 14 bar and 25 bar.

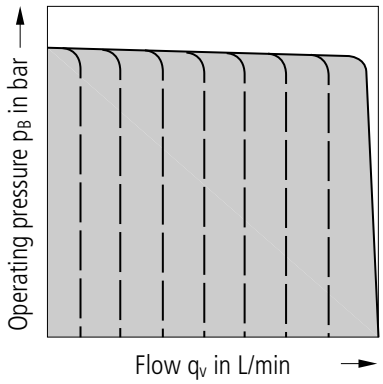
The standard setting is 18 bar (please state in clear text).

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

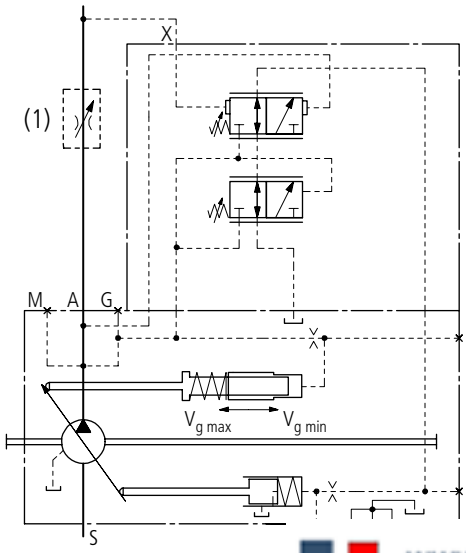
Pressure control overrides the load sensing control, i.e. the load sensing function is performed below the set pressure signal value.

(1) The orifice (throttle valve) is not included in the supply.

Characteristic: DRS



Circuit diagram: DRS



DR Pressure Control

DRG Pressure remote control

The pressure remote control enables the pressure control setting to be overridden by means of a separate pressure relief valve (1) and a lower pressure signal value can thus be set.

Setting range 50 to 350 bar.

Alternatively, the system can be started at low operating pressures (stand-by pressure) by actuating a 2-2 way valve (2), also separately mounted.

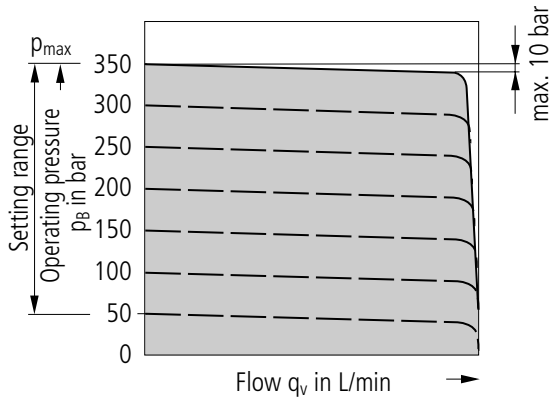
Both functions can be carried out separately or in conjunction (see circuit diagram).

The external valves are *not* included in the supply.

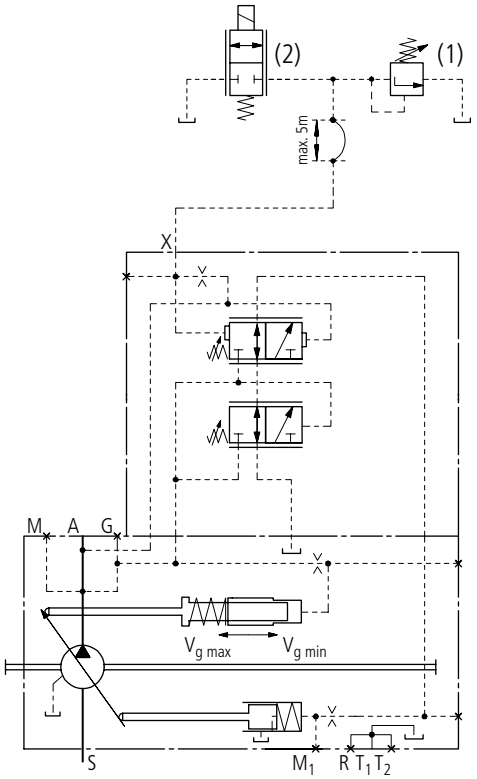
We recommend that the following is used as the separate pressure relief valve (1):

DBDH 6 (manual), see RE 25402.

Characteristic: DRG



Circuit diagram: DRG



DRL Pressure control for parallel operation

Pressure control DRL is designed for pressure control of several A11VO axial piston pumps arranged in parallel.

The pressure signal valve for all the pumps connected to the system can be preset by means of an external pressure relief valve (1).

Setting range 50 to 350 bar.

Each pump can be disconnected from the system via a 3-2 way valve (2), also separately mounted.

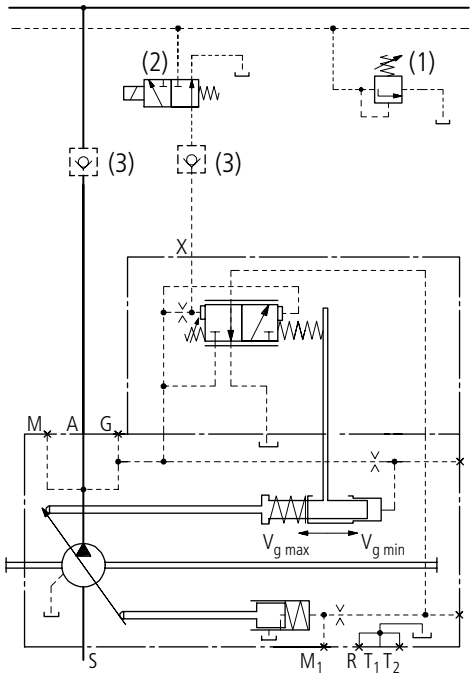
Check valves (3) should as a rule be provided in the main conduit (port A) or control line (port X).

The external valves are *not* included in the supply.

We recommend that the following is used as the separate pressure relief valve (1):

DBDH 6 (manual), see RE 25402.

Circuit diagram : DRL



HD Hydraulic Control, Pilot Pressure Dependent

Pilot pressure dependent control allows the pump displacement to be infinitely adjusted in proportion to the pilot pressure applied to port Y (max. 40 bar).

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

As the pilot pressure rises, the pump swivels to a *higher* displacement.

Start of control (at $V_{g\,min}$), adjustable _____ from 4 – 10 bar.

Start of control should be stated in clear text when ordering.

Pump starting position in unpressurised state: $V_{g\,max}$

To swivel the pump from its starting position $V_{g\,max}$ towards $V_{g\,min}$, a positioning pressure of 30 bar is needed (pilot pressure < start of control).

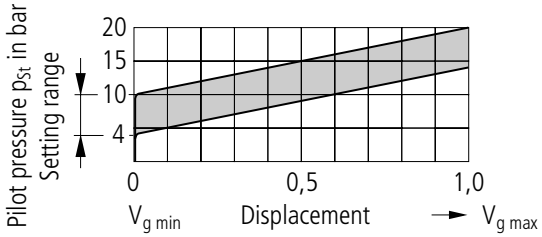
The necessary positioning oil is taken from the operating pressure if this is ≥ 30 bar. If the operating pressure is < 30 bar, the positioning oil has to be taken from the external positioning pressure available at port G (≥ 30 bar).

If the operating pressure is ≥ 30 bar and $V_{g\,min} > 0$, no external positioning pressure is required. In this case the change-over valve should be removed from the pump before commissioning (see note in repair instructions RDE 92500-R) and port G should be closed.

HD Hydraulic control, pilot pressure dependent

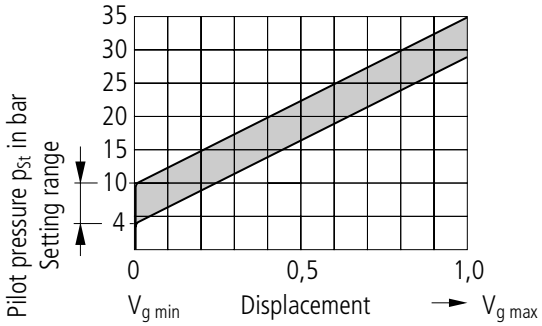
Characteristic: HD1

Pilot pressure rise $V_{g\,min}$ to $V_{g\,max}$ _____ Δp = 10 bar

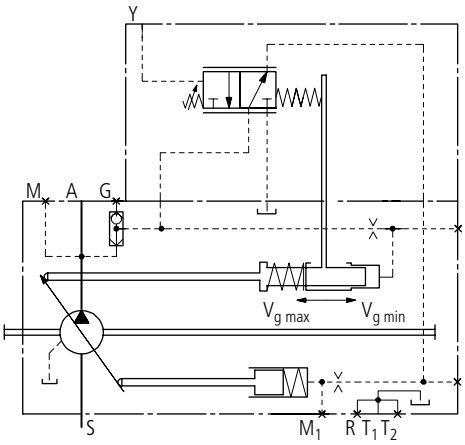


Characteristic: HD2

Pilot pressure rise $V_{g\,min}$ to $V_{g\,max}$ _____ Δp = 25 bar



Circuit diagram: HD1, HD2



HD.D Hydraulic control with pressure cut-off

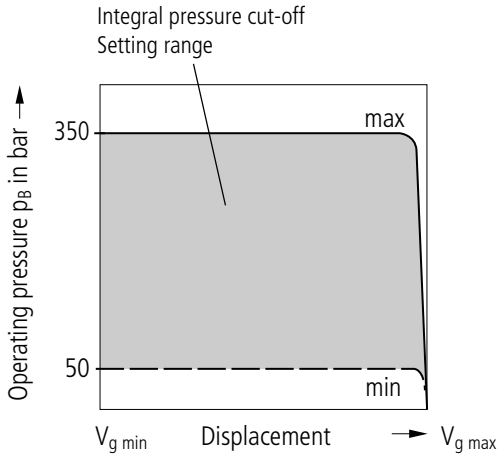
Pressure cut-off corresponds to a pressure control which adjusts the pump displacement back to $V_{g\,min}$ when the set pressure signal value is reached.

This function overrides HD control, i.e. below the pressure signal value, the pilot pressure dependent function is performed.

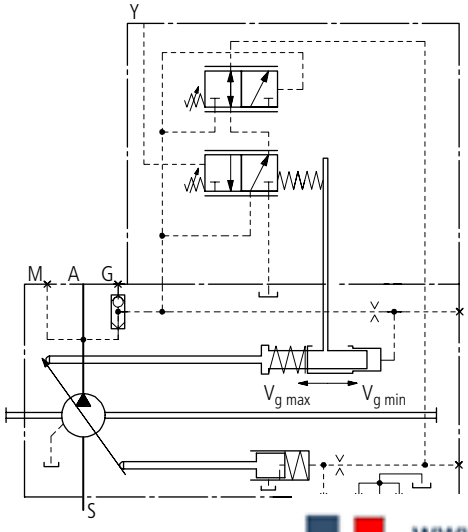
The valve is integrated into the control housing and is permanently set to a pressure signal value at the factory.

Setting range 50 to 350 bar.

Characteristic: HD1D, HD2D



Circuit diagram: HD1D, HD2D



EP Electric Control with Proportional Solenoid

Electric control with proportional solenoid allows the pump displacement to be infinitely set and programmed in proportion to the solenoid force or current strength. The control force at the control spool is applied by a proportional solenoid.

Direct current at 12V (EP1) or 24V (EP2) respectively is required to trigger the proportional solenoid (insulation IP 54).

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

As the pilot current increases, the pump swivels to a *higher* displacement.

Start of control at approx.:	400 mA (12 V)	200 mA (24 V)
End of control at approx.:	1200 mA (12 V)	600 mA (24 V)

Starting position in unpressurised state: $V_{g\,max}$

To swivel the pump from its starting position $V_{g\,max}$ towards $V_{g\,min}$, a positioning pressure of 30 bar is needed (pilot current < start of control).

The necessary positioning oil is taken from the operating pressure if this is ≥ 30 bar. If the operating pressure is < 30 bar, the positioning oil has to be taken from the external positioning pressure available at port G (≥ 30 bar).

If the operating pressure is ≥ 30 bar and $V_{g\,min} > 0$, no external positioning pressure is required. In this case the change-over valve should be removed from the pump before commissioning (see note in repair instructions RDE 92500-R) and port G should be closed.

Important:

Pump with EP control should be fitted in the tank only if mineral hydraulic fluid is used and the oil temperature in the tank does not exceed 80°C.

The following are available to trigger the proportional solenoid:

- Proportional amplifier **PV** _____ (see RE 95023)
- Proportional amplifier **VT 2000** _____ (see RE 29904)
- Chopper amplifier **CV** _____ (see RE 95029)
- Microcontroller **MC** _____ (see RE 95050)

EP.D Electric control with pressure cut-off

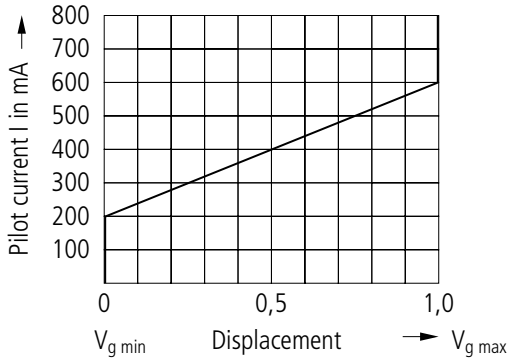
Pressure cut-off corresponds to a pressure control which adjusts the pump displacement back to $V_{g\,min}$ when the set pressure signal value is reached.

This function overrides EP control, i.e. below the pressure signal value, the pilot current dependent function is performed.

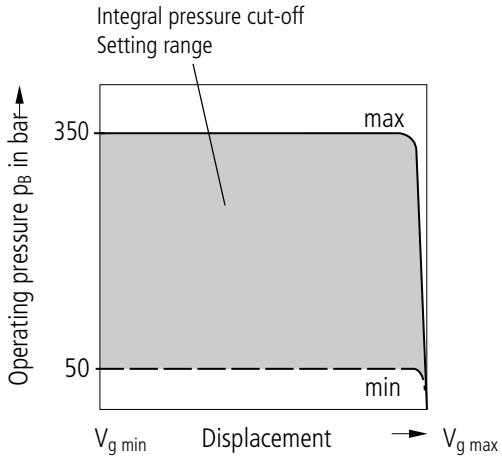
The valve is integrated into the control housing and is permanently set to a pressure signal value at the factory.

Setting range 50 to 350 bar.

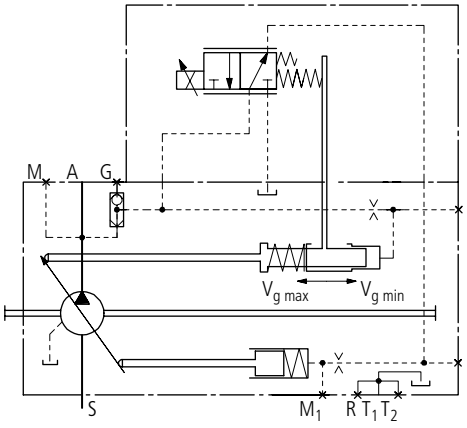
Characteristic: EP2



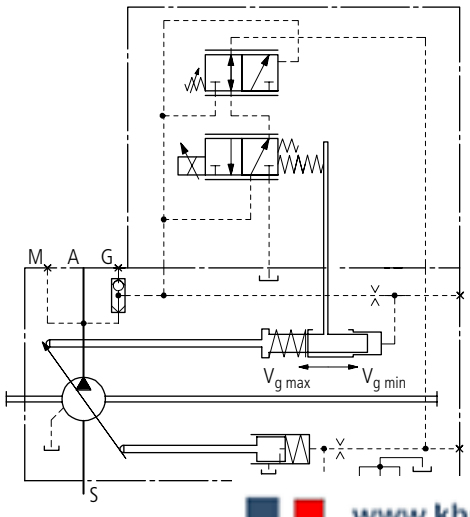
Characteristic: EP2D



Circuit diagram: EP



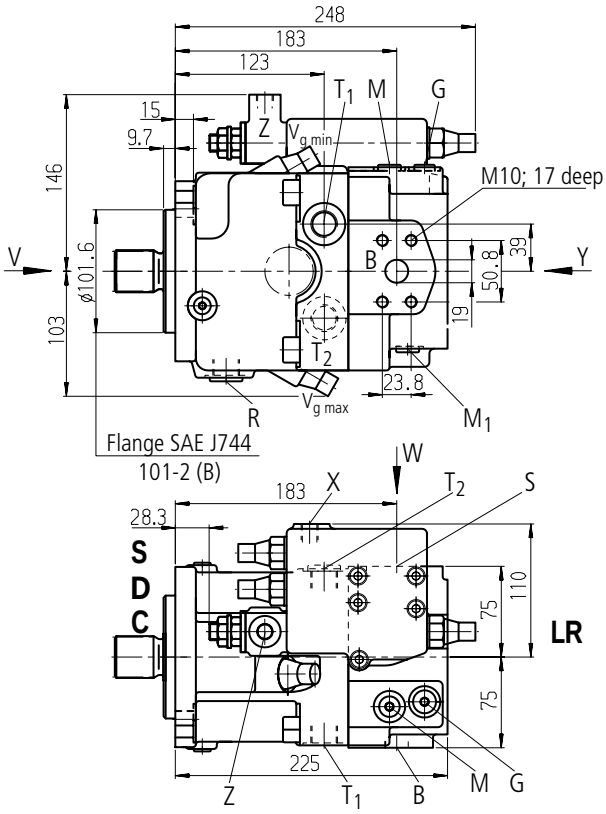
Circuit diagram: EP2D

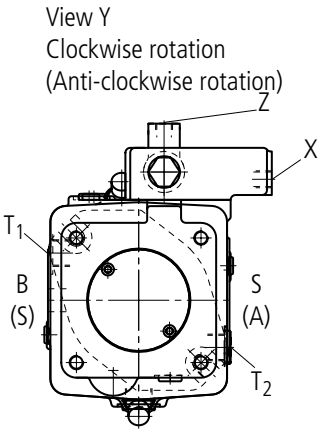


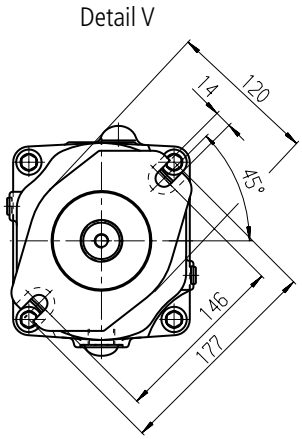
Unit Dimensions Size 40

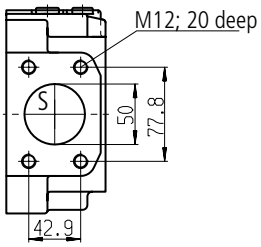
Prior to finalising your design, please request certified installation drawing.

LRDCS:
Power control LR with pressure cut-off D, cross-sensing control C and load sensing control S



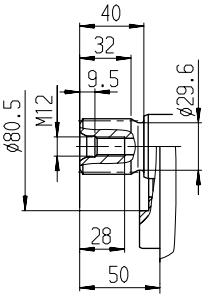




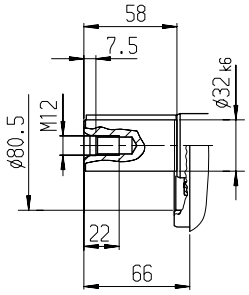


Shaft ends

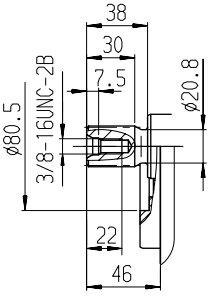
Z
Splined shaft DIN 5480
W35x2x30x16x9g



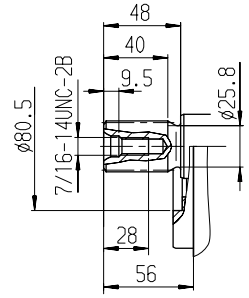
P
Cyl. shaft with key
DIN 6885 – AS10x8x56



S
Splined shaft ANSI B92.1a-1976
1in 15T 16/32DP [1])
(SAE J744 – 25-4 (B-B))



T
Splined shaft ANSI B92.1a-1976
1 1/4in 14T 12/24DP [1])
(SAE J744 – 32-4 (C))



Ports

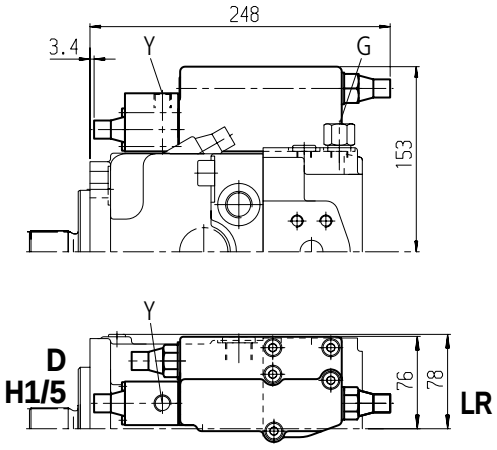
A, B	Service port	SAE 3/4; 420 bar (6000 psi) High pressure series
S	Suction port	SAE 2; 210 bar (3000 psi) Standard series
T_1, T_2	Air bleed, tank	M22x1,5; 14 deep
R	Air bleed, oil drain	M22x1,5; 14 deep
M_1	Measuring point, regulating chamber	M12x1,5; 12 deep
M	Measuring point, service port	M12x1,5; 12 deep
X	Pilot port for version with load sensing (S) and remote pressure ct-off control (G)	M14x1,5; 12 deep
Y	Pilot port for version with stroke limiter (H...), 2-stage pressure cut-off (E) and HD	M14x1,5; 12 deep
Z	Pilot port for version with cross-sensing (C) and power override (LR3, LG1)	M14x1,5; 12 deep
G	Port for positioning pressure (controller) for version with stroke limiter (H.., U2), HD and EP with screwed fitting GE10 - PLM (otherwise port G closed)	M14x1,5; 12 deep

[1]) 30° pressure angle, flat root, side fit, tolerance class 5

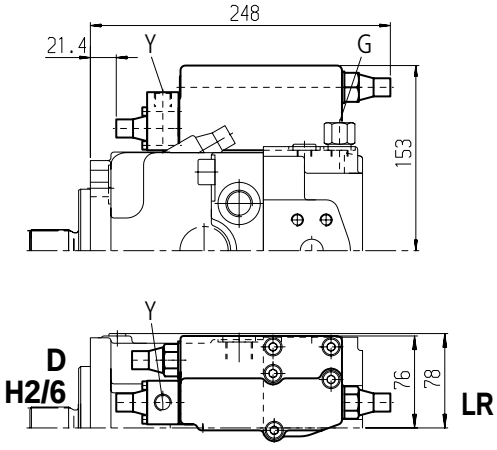
Unit Dimensions Size 40

Prior to finalising your design, please request certified installation drawing.

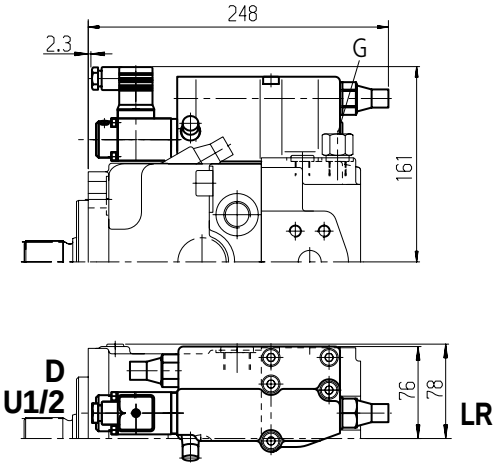
LRDH1/LRDH5:
Power control with pressure cut-off and hydraulic stroke limiter (function: $V_{g\,max}$ to $V_{g\,min}$)



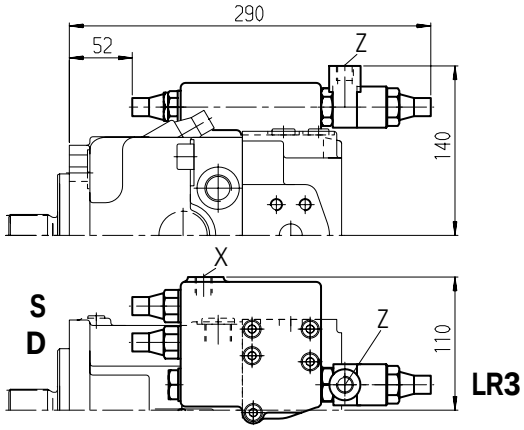
LRDH2/LRDH6:
Power control with pressure cut-off and hydraulic stroke limiter (function: $V_{g\,min}$ to $V_{g\,max}$)



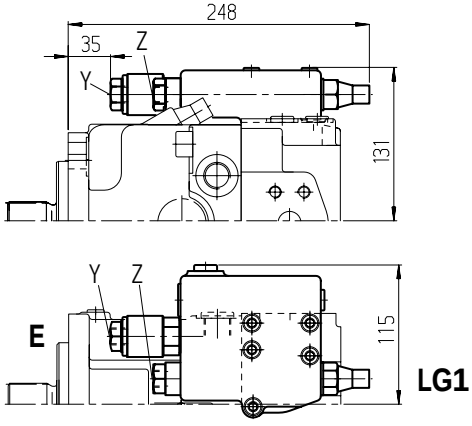
LRDU1/LRDU2:
Power control with pressure cut-off and electric stroke limiter (function: $V_{g\,min}$ to $V_{g\,max}$)



LR3DS:
Power control with high pressure dependent override, pressure cut-off and load sensing control



LG1E:
Power control with pilot pressure dependent override (negative) and 2-stage pressure cut-off

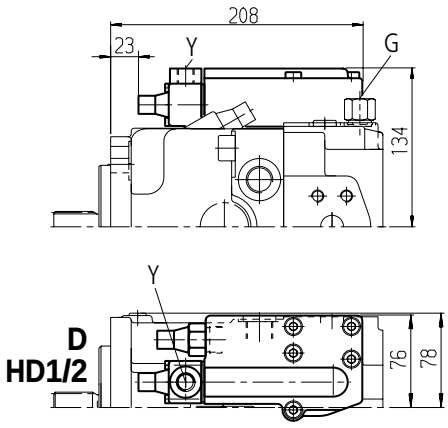


LG2E:
Power control with pilot pressure dependent override (positive) and 2-stage pressure cut-off

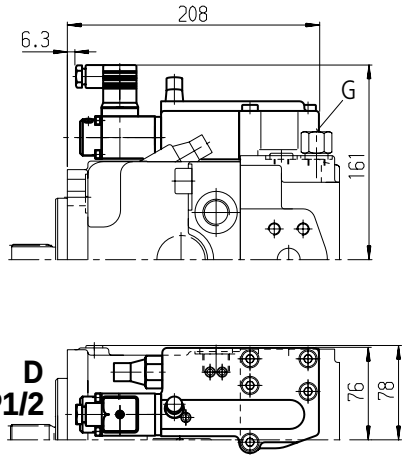
Unit Dimensions Size 40

Prior to finalising your design, please request certified installation drawing.

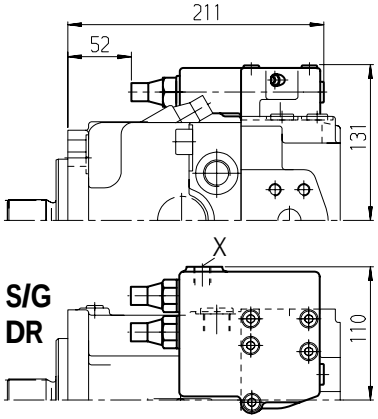
HD1D/HD2D:
Hydraulic, pilot pressure dependent control with pressure cut-off



EP1D/EP2D:
Electric control (proportional solenoid) with pressure cut-off



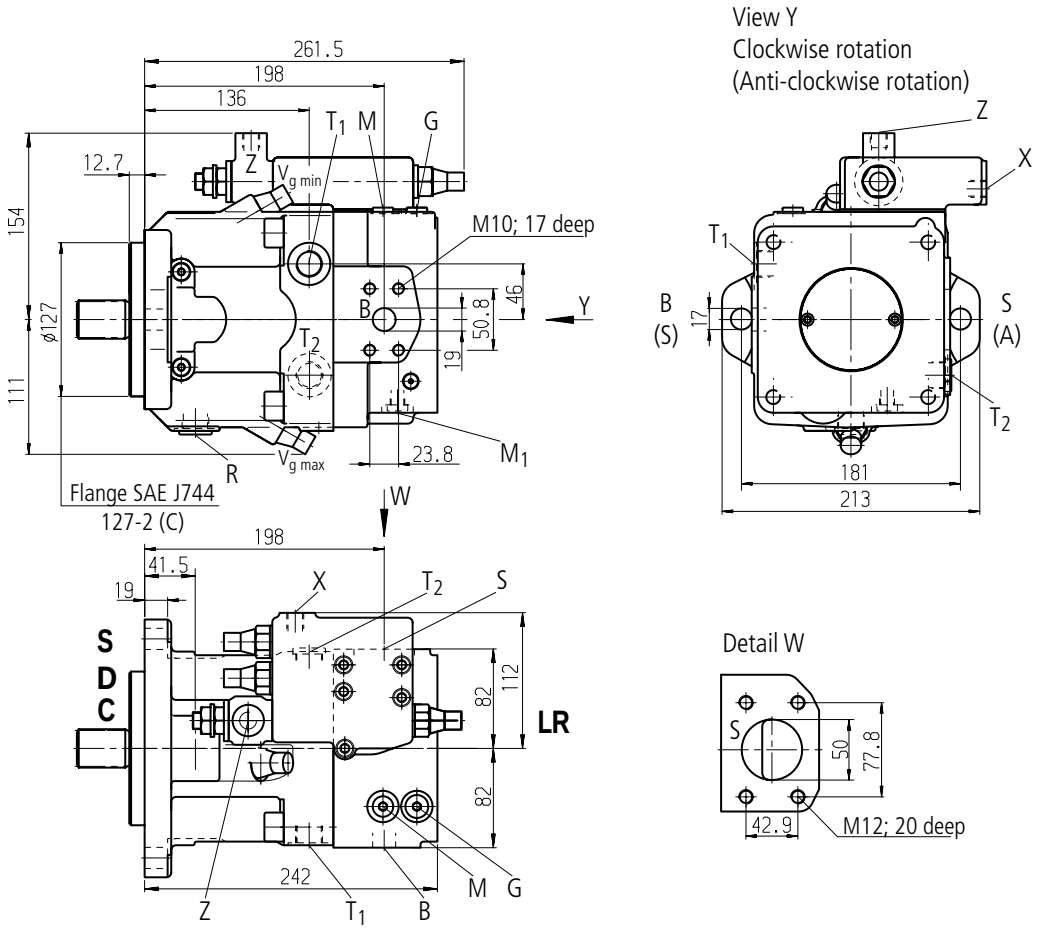
DRS/DRG:
Pressure control with load sensing
Pressure remote control



Unit Dimensions Size 60

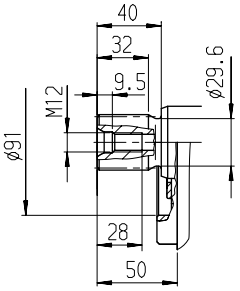
Prior to finalising your design, please request certified installation drawing.

LRDCS:
Power control LR with pressure cut-off D, cross-sensing control C and load sensing control S

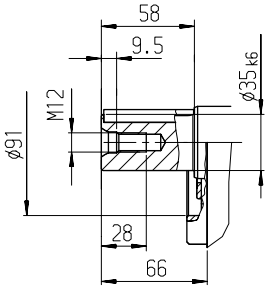


Shaft ends

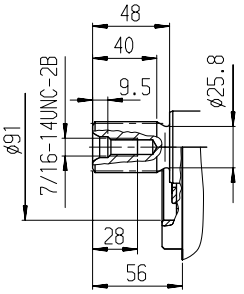
Z
Splined shaft DIN 5480
W35x2x30x16x9g



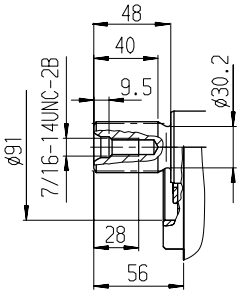
P
Cyl. shaft with key
DIN 6885 – AS10x8x56



S
Splined shaft ANSI B92.1a-1976
1 1/4in 14T 12/24DP [1])
(SAE J744 – 32-4 (C))



T
Splined shaft ANSI B92.1a-1976
1 3/8in 21T 16/32DP [1])



Ports

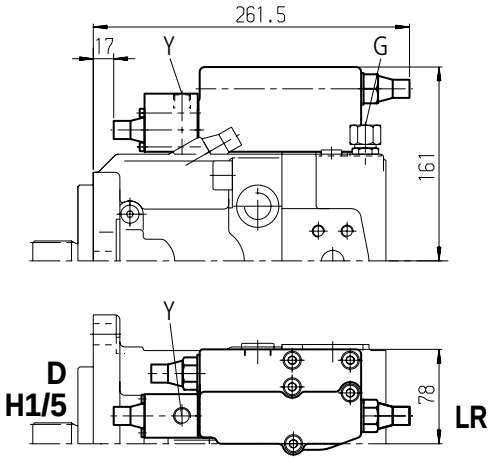
A, B	Service port	SAE 3/4; 420 bar (6000 psi) High pressure series
S	Suction port	SAE 2; 210 bar (3000 psi) Standard series
T_1, T_2	Air bleed, tank	M22x1,5; 14 deep
R	Air bleed, oil drain	M22x1,5; 14 deep
M_1	Measuring point, regulating chamber	M12x1,5; 12 deep
M	Measuring point, service port	M12x1,5; 12 deep
X	Pilot port for version with load sensing (S) and remote presure cut-off control (G)	M14x1,5; 12 deep
Y	Pilot port for version with stroke limiter (H...), 2-stage pressure cut-off (E) and HD	M14x1,5; 12 deep
Z	Pilot port for version with cross-sensing (C) and power override (LR3, LG1)	M14x1,5; 12 deep
G	Port for positioning pressure (controller) for version with stroke limiter (H.., U2), HD and EP with screwed fitting GE10 - PLM (otherwise port G closed)	M14x1,5; 12 deep

[1]) 30° pressure angle, flat root, side fit, tolerance class 5

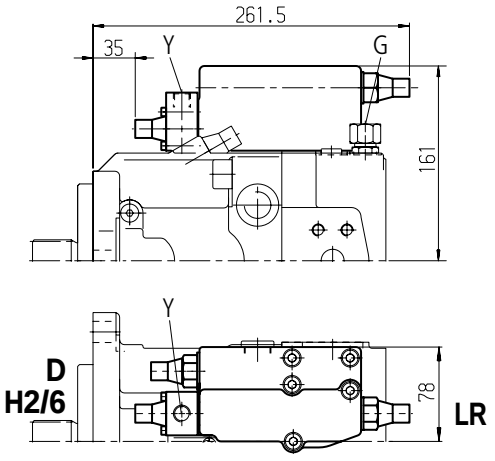
Unit Dimensions Size 60

Prior to finalising your design, please request certified installation drawing.

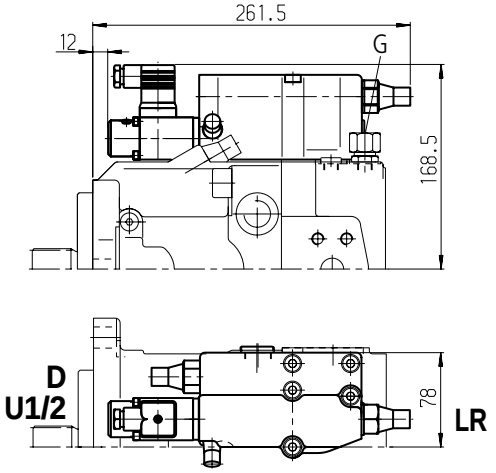
LRDH1/LRDH5:
Power control with pressure cut-off and hydraulic stroke limiter (function: $V_{g\ max}$ to $V_{g\ min}$)



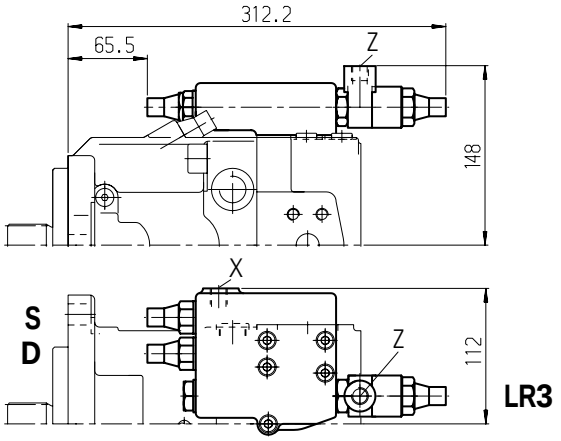
LRDH2/LRDH6:
Power control with pressure cut-off and hydraulic stroke limiter (function: $V_{g\ min}$ to $V_{g\ max}$)



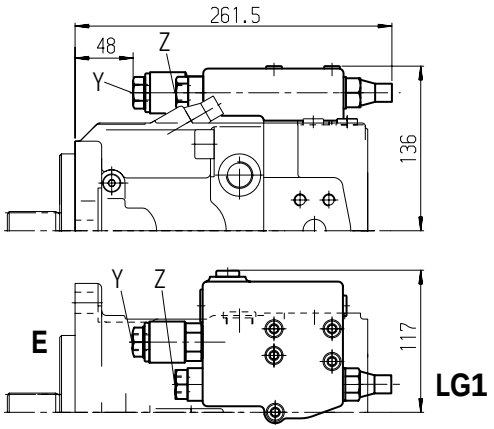
LRDU1/LRDU2:
Power control with pressure cut-off and electric stroke limiter (function: $V_{g\ min}$ to $V_{g\ max}$)



LR3DS:
Power control with high pressure dependent override, pressure cut-off and load sensing control



LG1E:
Power control with pilot pressure dependent override (negative) and 2-stage pressure cut-off

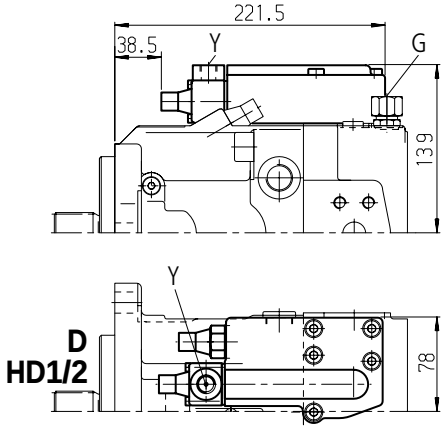


LG2E:
Power control with pilot pressure dependent override (positive) and 2-stage pressure cut-off

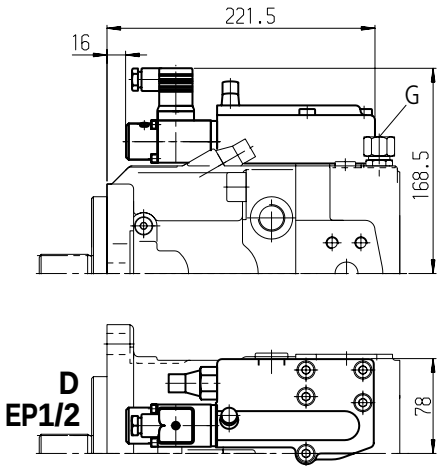
Unit Dimensions Size 60

Prior to finalising your design, please request certified installation drawing.

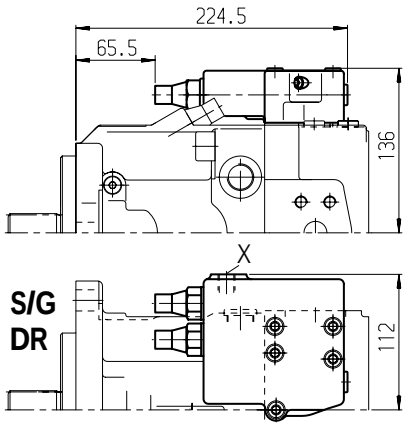
HD1D/HD2D:
Hydraulic, pilot pressure dependent control with pressure cut-off



EP1D/EP2D:
Electric control (proportional solenoid) with pressure cut-off



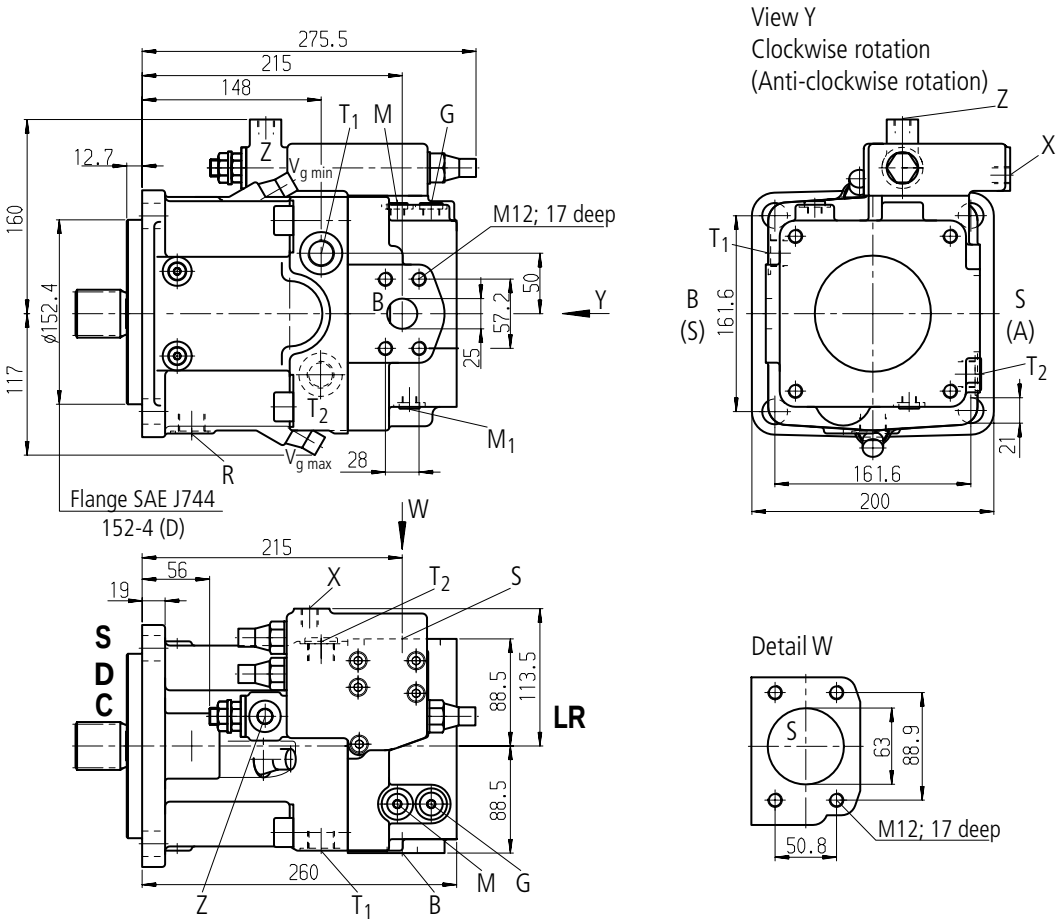
DRS/DRG:
Pressure control with load sensing
Pressure remote control



Unit Dimensions Size 75

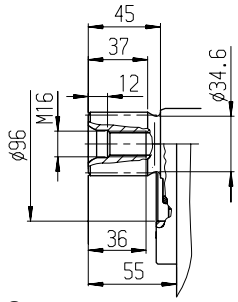
Prior to finalising your design, please request certified installation drawing.

LRDCS:
Power control LR with pressure cut-off D, cross-sensing control C and load sensing control S

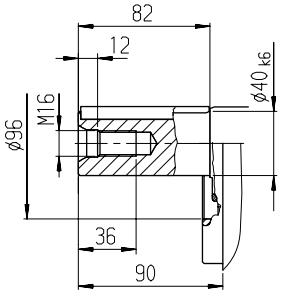


Shaft ends

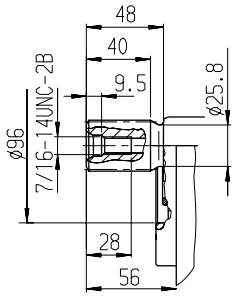
Z
Splined shaft DIN 5480
W40x2x30x18x9g



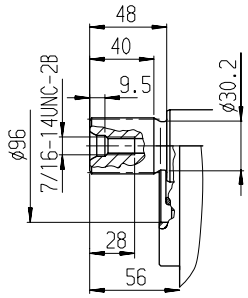
P
Cyl. shaft with key
DIN 6885 – AS12x8x80



S
Splined shaft ANSI B92.1a-1976
1 1/4in 14T 12/24DP [1])
(SAE J744 – 32-4 (C))



T
Splined shaft ANSI B92.1a-1976
1 3/8in 21T 16/32DP [1])



Ports

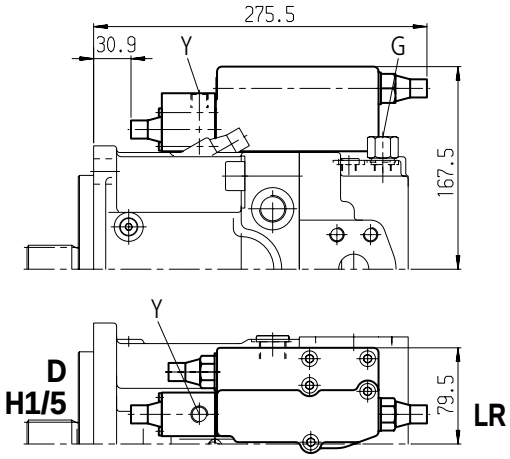
A, B	Service port	SAE 1; 420 bar (6000 psi) High pressure series
S	Suction port	SAE 2 1/2; 210 bar (3000 psi) Standard series
T_1, T_2	Air bleed, tank	M22x1,5; 14 deep
R	Air bleed, oil drain	M22x1,5; 14 deep
M_1	Measuring point, regulating chamber	M12x1,5; 12 deep
M	Measuring point, service port	M12x1,5; 12 deep
X	Pilot port for version with load sensing (S) and remote presure cut-off control (G)	M14x1,5; 12 deep
Y	Pilot port for version with stroke limiter (H...), 2-stage pressure cut-off (E) and HD	M14x1,5; 12 deep
Z	Pilot port for version with cross-sensing (C) and power override (LR3, LG1)	M14x1,5; 12 deep
G	Port for positioning pressure (controller) for version with stroke limiter (H.., U2), HD and EP with screwed fitting GE10 - PLM (otherwise port G closed)	M14x1,5; 12 deep

[1]) 30° pressure angle, flat root, side fit, tolerance class 5

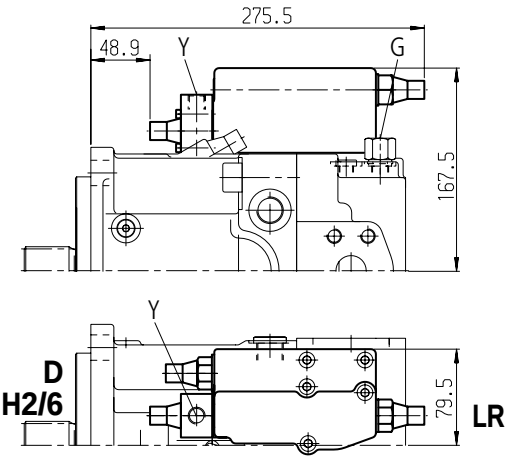
Unit Dimensions Size 75

Prior to finalising your design, please request certified installation drawing.

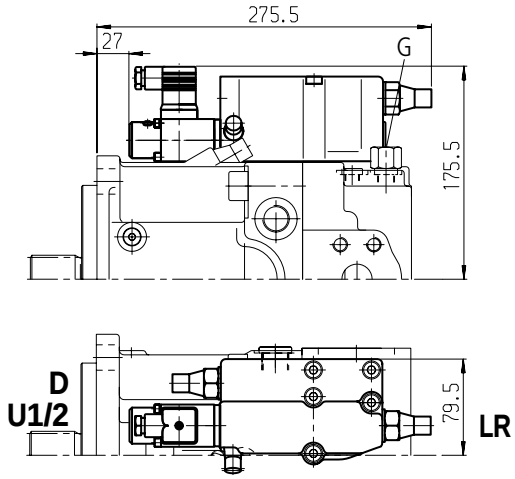
LRDH1/LRDH5:
Power control with pressure cut-off and hydraulic stroke limiter (function: $V_{g\,max}$ to $V_{g\,min}$)



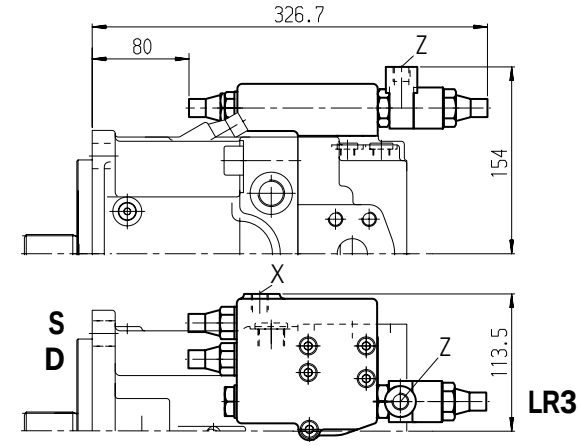
LRDH2/LRDH6:
Power control with pressure cut-off and hydraulic stroke limiter (function: $V_{g\,min}$ to $V_{g\,max}$)



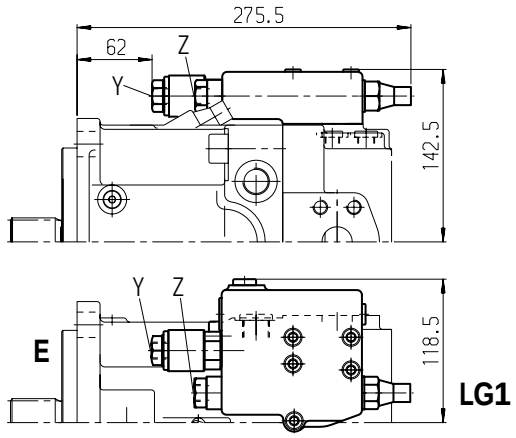
LRDU1/LRDU2:
Power control with pressure cut-off and electric stroke limiter (function: $V_{g\,min}$ to $V_{g\,max}$)



LR3DS:
Power control with high pressure dependent override, pressure cut-off and load sensing control



LG1E:
Power control with pilot pressure dependent override (negative) and 2-stage pressure cut-off

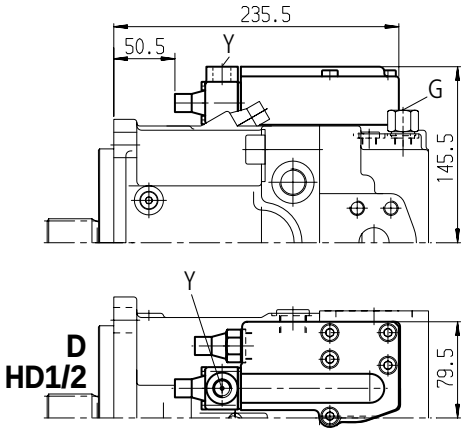


LG2E:
Power control with pilot pressure dependent override (positive) and 2-stage pressure cut-off

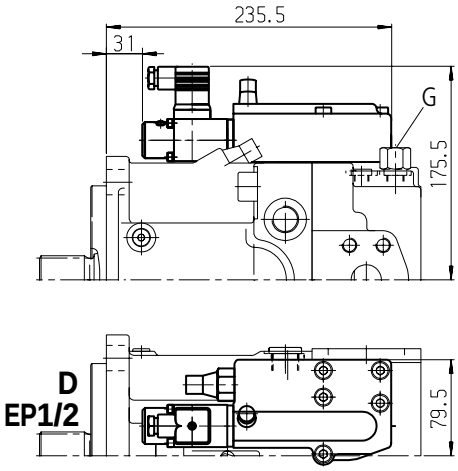
Unit Dimensions Size 75

Prior to finalising your design, please request certified installation drawing.

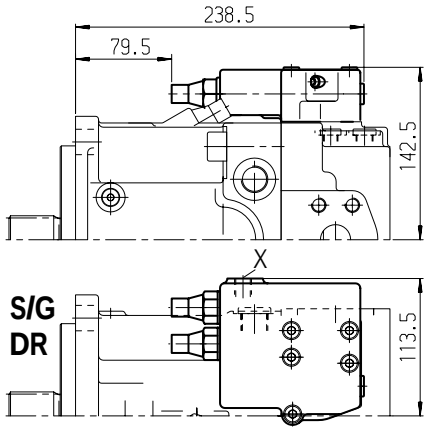
HD1D/HD2D:
Hydraulic, pilot pressure dependent control with pressure cut-off



EP1D/EP2D:
Electric control (proportional solenoid) with pressure cut-off



DRS/DRG:
Pressure control with load sensing
Pressure remote control

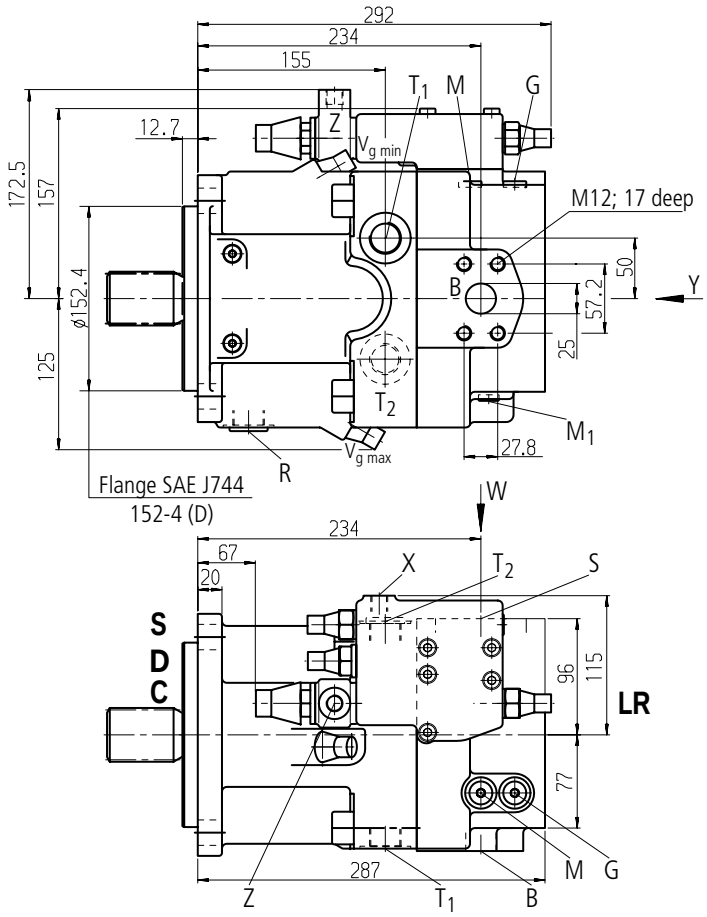


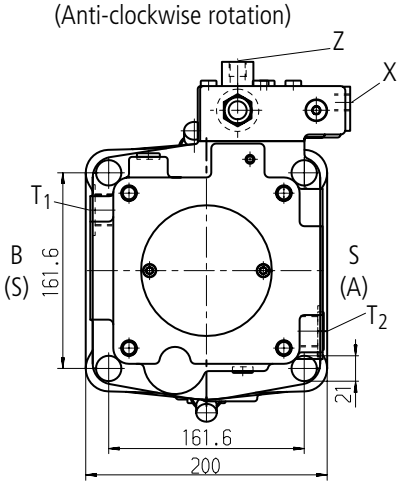
Unit Dimensions Size 95

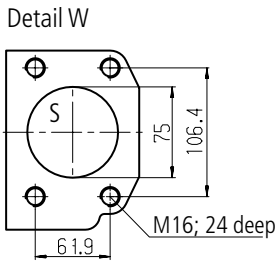
Prior to finalising your design, please request certified installation drawing.

LRDCS:

Power control LR with pressure cut-off D, cross-sensing control C and load sensing control S



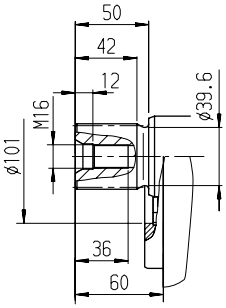




Shaft ends

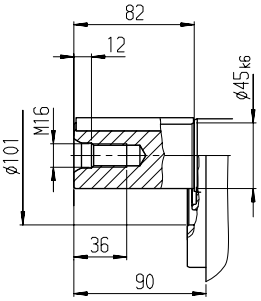
Z

Splined shaft DIN 5480
W45x2x30x21x9g



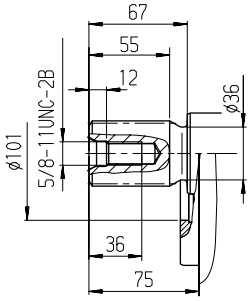
P

Cyl. shaft with key
DIN 6885 – AS14x9x80



S

Splined shaft ANSI B92.1a-1976
1 3/4in 13T 8/16DP [1])
(SAE J744 – 44-4 (D))



[1]) 30° pressure angle, flat root, side fit, tolerance class 5

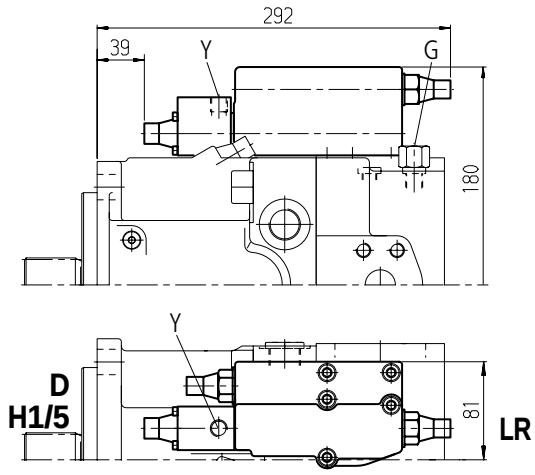
Ports

A, B	Service ports	SAE 1; 420 bar (6000 psi) High pressure series
S	Suction port	SAE 3; 140 bar (2000 psi) Standard series
T_1, T_2	Air bleed, tank	M26x1,5; 16 deep
R	Air bleed, oil drain	M26x1,5; 16 deep
M_1	Measuring point, regulating chamber	M12x1,5; 12 deep
M	Measuring point, service port	M12x1,5; 12 deep
X	Pilot port for version with load sensing (S), DRL and remote pressure cut-off control (G)	M14x1,5; 12 deep
Y	Pilot port for version with stroke limiter (H...), 2-stage pressure cut-off (E) and HD	M14x1,5; 12 deep
Z	Pilot port for version with cross-sensing (C) and power override (LR3, LG1)	M14x1,5; 12 deep
G	Port for positioning pressure (controller) for version with stroke limiter (H.., U2), HD and EP with screwed fitting GE10 - PLM (otherwise port G closed)	M14x1,5; 12 deep

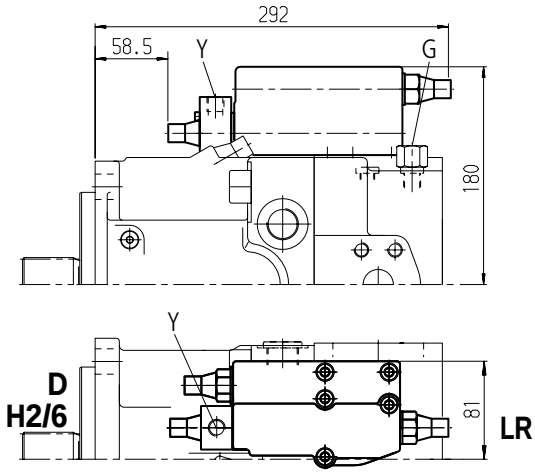
Unit Dimensions Size 95

Prior to finalising your design, please request certified installation drawing.

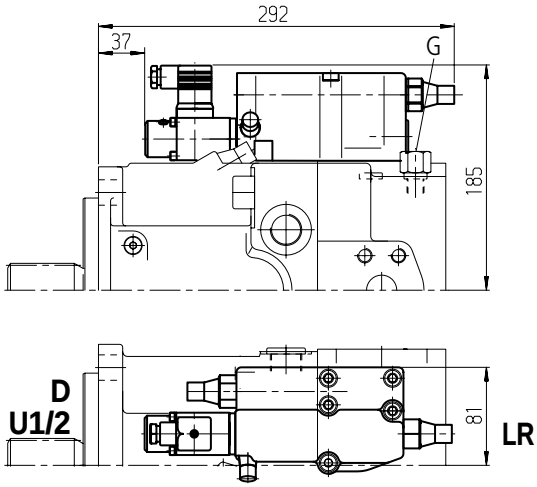
LRDH1/LRDH5:
Power control with pressure cut-off and hydraulic stroke limiter (function: $V_{g\ max}$ to $V_{g\ min}$)



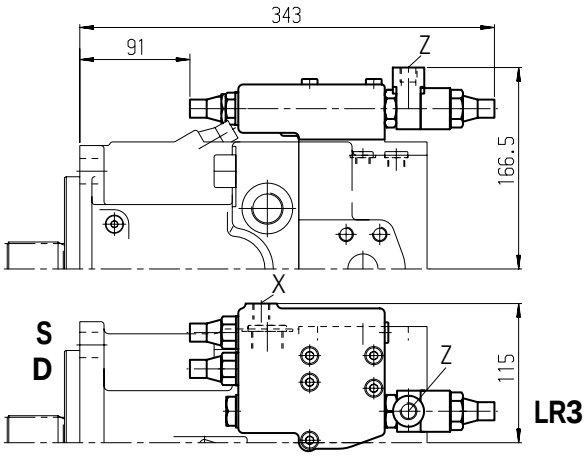
LRDH2/LRDH6:
Power control with pressure cut-off and hydraulic stroke limiter (function: $V_{g\ min}$ to $V_{g\ max}$)



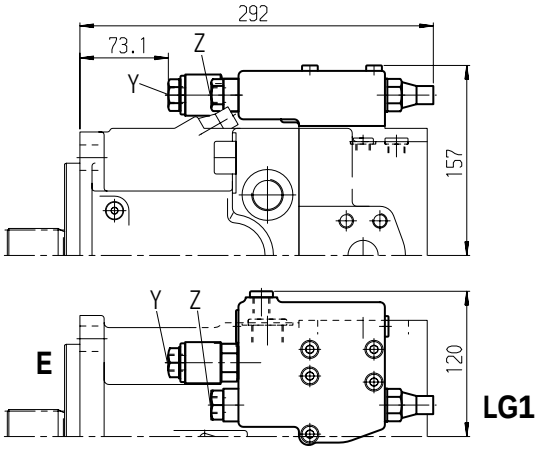
LRDU1/LRDU2:
Power control with pressure cut-off and electric stroke limiter (function: $V_{g\ min}$ to $V_{g\ max}$)



LR3DS:
Power control with high pressure dependent override, pressure cut-off and load sensing control



LG1E:
Power control with pilot pressure dependent override (negative) and 2-stage pressure cut-off

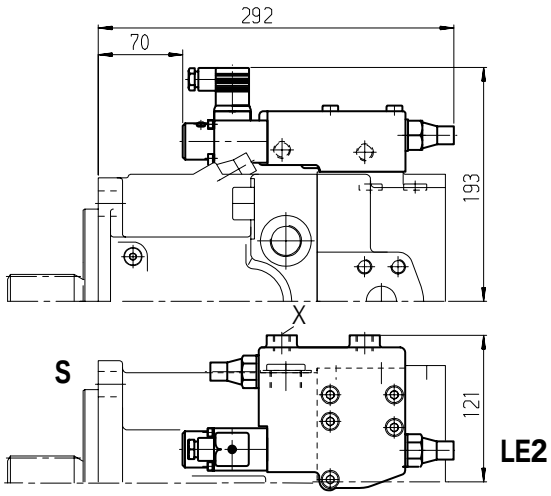


LG2E:
Power control with pilot pressure dependent override (positive) and 2-stage pressure cut-off

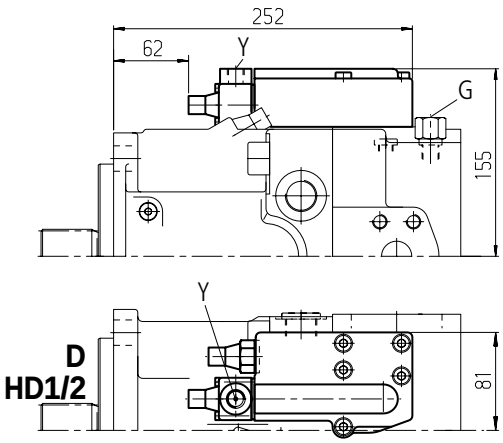
Unit Dimensions Size 95

Prior to finalising your design, please request certified installation drawing.

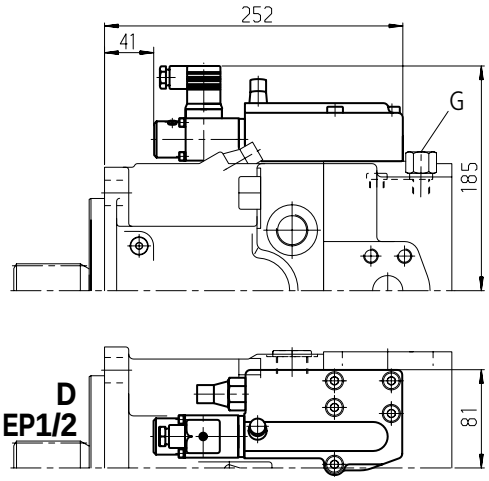
LE1S/LE2S:
Power control with electric override (negative) and load sensing control



HD1D/HD2D:
Hydraulic, pilot pressure dependent control with pressure cut-off

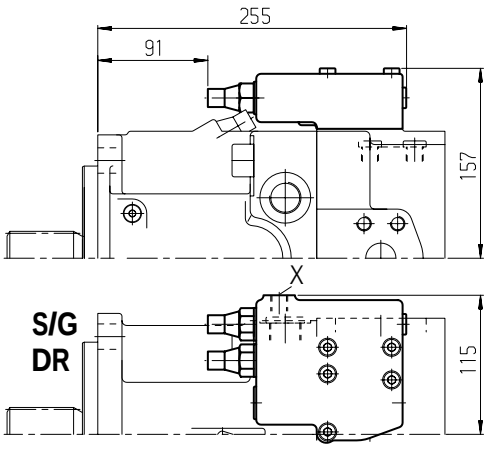


EP1D/EP2D:
Electric control (proportional solenoid) with pressure cut-off

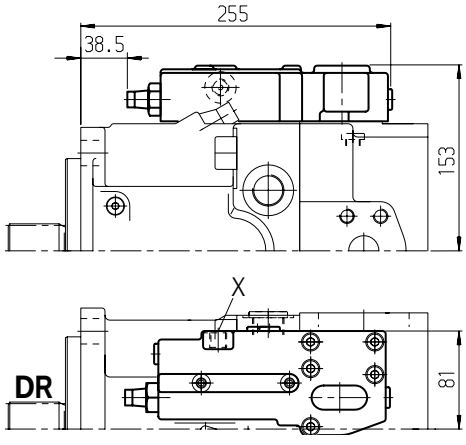


DRS/DRG:
Pressure control with load sensing

Pressure remote control



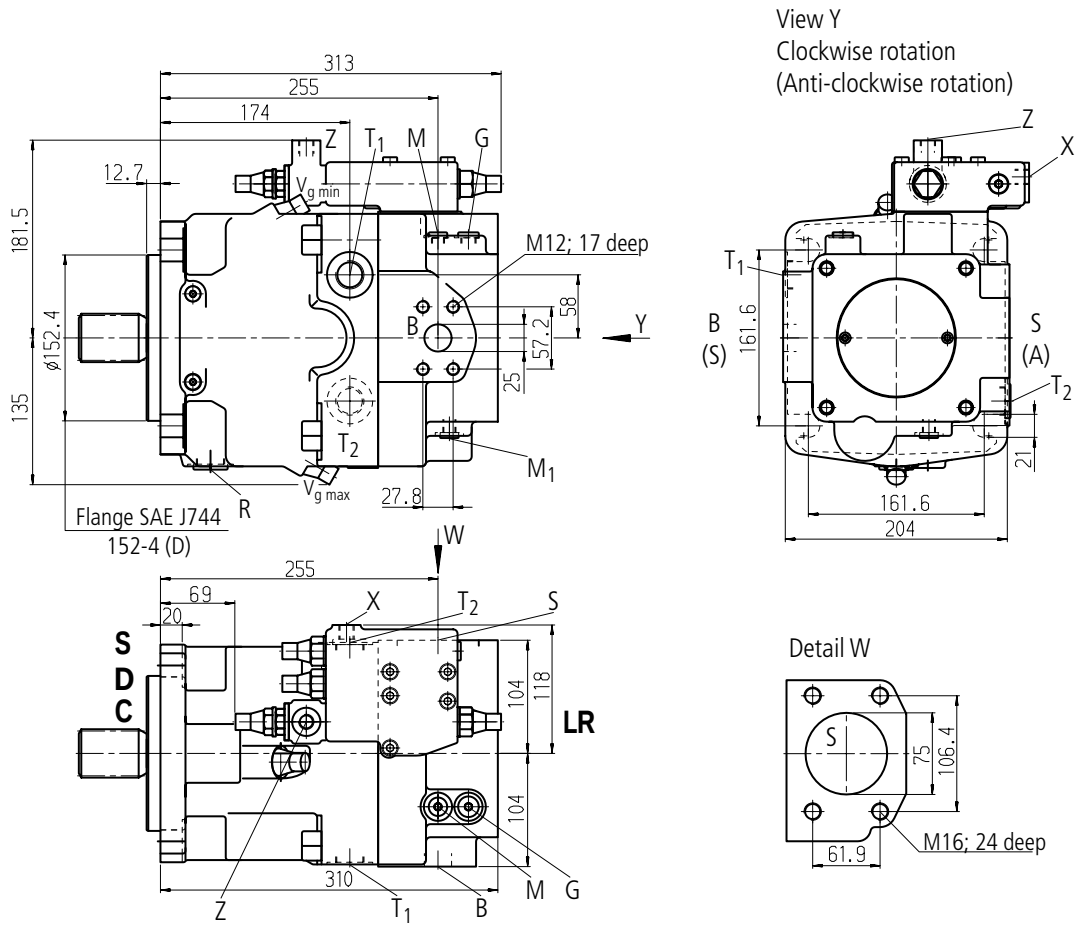
DRL:
Pressure control for parallel operation



Unit Dimensions Size 130

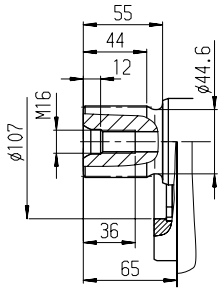
Prior to finalising your design, please request certified installation drawing.

LRDCS:
Power control LR with pressure cut-off D, cross-sensing control C and load sensing control S

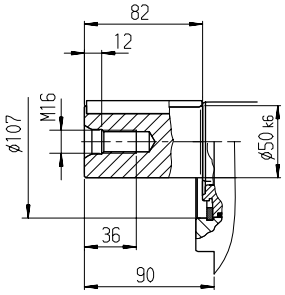


Shaft ends

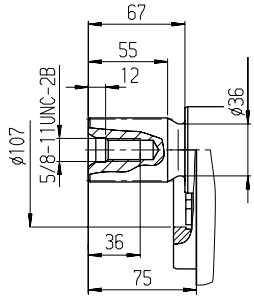
Z
Splined shaft DIN 5480
W50x2x30x24x9g



P
Cyl. shaft with key
DIN 6885 – AS14x9x80



S
Splined shaft ANSI B92.1a-1976
1 3/4in 13T 8/16DP [1])
(SAE J744 – 44-4 (D))



Ports

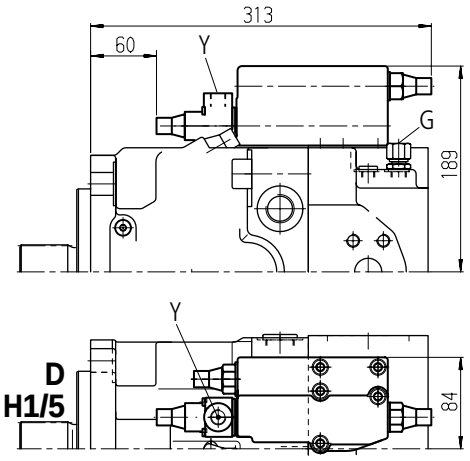
A, B	Service port (without charging pump)	SAE 1; 420 bar (6000 psi) High pressure series
S	Suction port (without charging pump)	SAE 3; 140 bar (2000 psi) Standard series
T_1, T_2	Air bleed, tank	M26x1,5; 16 deep
R	Air bleed, oil drain	M26x1,5; 16 deep
M_1	Measuring point, regulating chamber	M12x1,5; 12 deep
M	Measuring point, service port	M12x1,5; 12 deep
X	Pilot port for version with load sensing (S), DRL and remote pressure cut-off control (G)	M14x1,5; 12 deep
Y	Pilot port for version with stroke limiter (H...), 2-stage pressure cut-off (E) and HD	M14x1,5; 12 deep
Z	Pilot port or version with cross-sensing (C) and power override (LR3, LG1)	M14x1,5; 12 deep
G	Port for positioning pressure (controller) for version with stroke limiter (H.., U2), HD and EP with screwed fitting GE10 - PLM (otherwise port G closed)	M14x1,5; 12 deep

[1]) 30° pressure angle, flat root, side fit, tolerance class 5

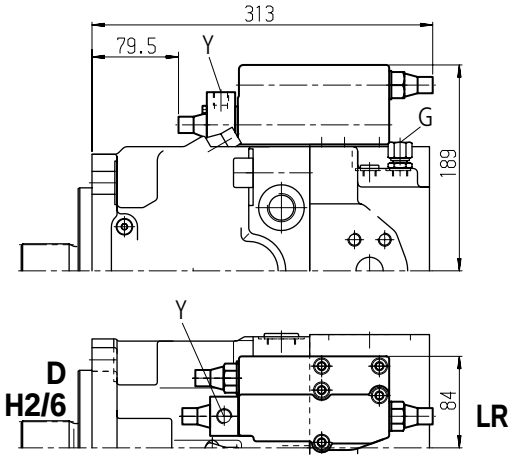
Unit Dimensions Size 130

Prior to finalising your design, please request certified installation drawing.

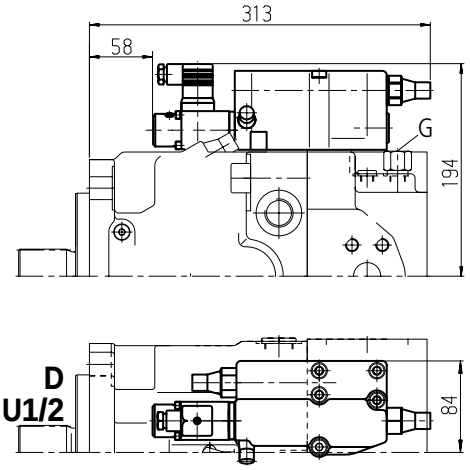
LRDH1/LRDH5:
Power control with pressure cut-off and hydraulic stroke limiter (function: $V_{g\,max}$ to $V_{g\,min}$)



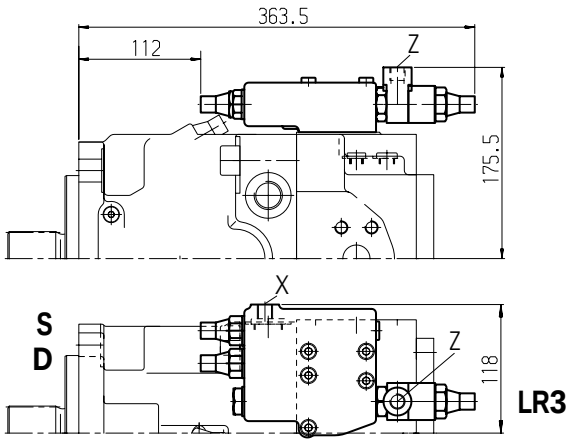
LRDH2/LRDH6:
Power control with pressure cut-off and hydraulic stroke limiter (function: $V_{g\,min}$ to $V_{g\,max}$)



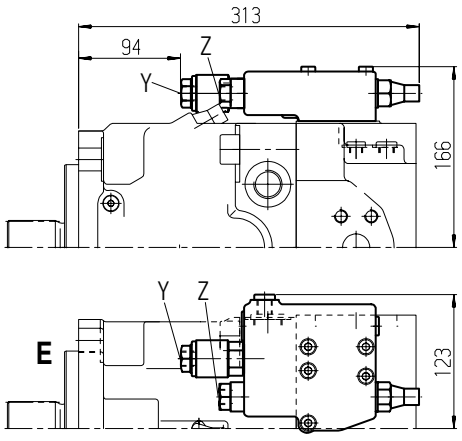
LRDU1/LRDU2:
Power control with pressure cut-off and electric stroke limiter (function: $V_{g\,min}$ to $V_{g\,max}$)



LR3DS:
Power control with high pressure dependent override, pressure cut-off and load sensing control



LG1E:
Power control with pilot pressure dependent override (negative) and 2-stage pressure cut-off

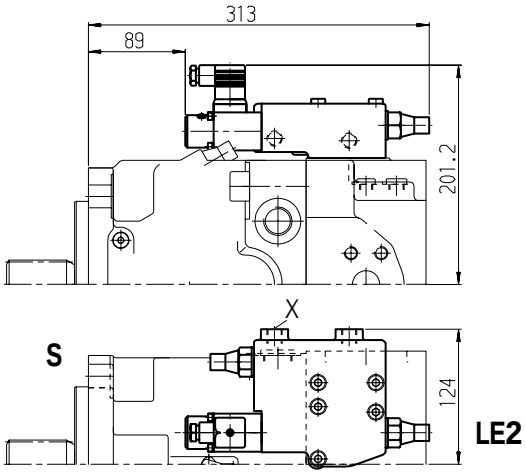


LG2E:
Power control with pilot pressure dependent override (positive) and 2-stage pressure cut-off

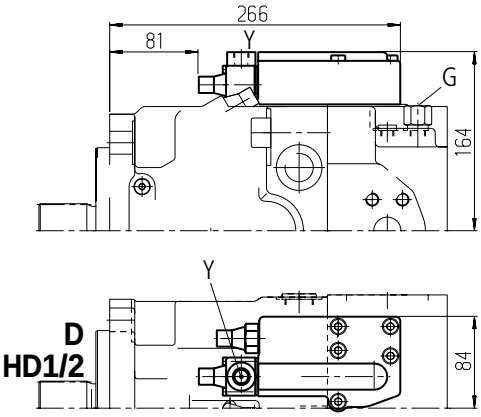
Unit Dimensions Size 130

Prior to finalising your design, please request certified installation drawing.

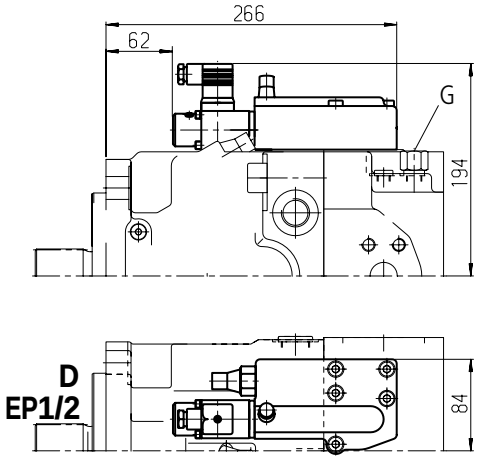
LE1S/LE2S:
Power control with electric override (negative) and load sensing control



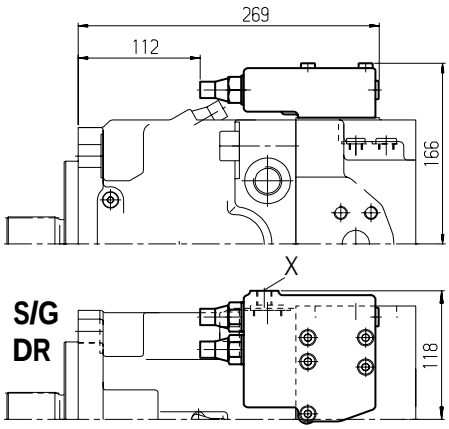
HD1D/HD2D:
Hydraulic, pilot pressure dependent control with pressure cut-off



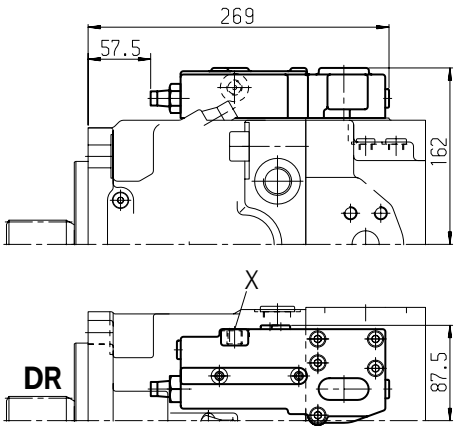
EP1D/EP2D:
Electric control (proportional solenoid) with pressure cut-off



DRS/DRG:
Pressure control with load sensing
Pressure remote control



DRL:
Pressure control for parallel operation

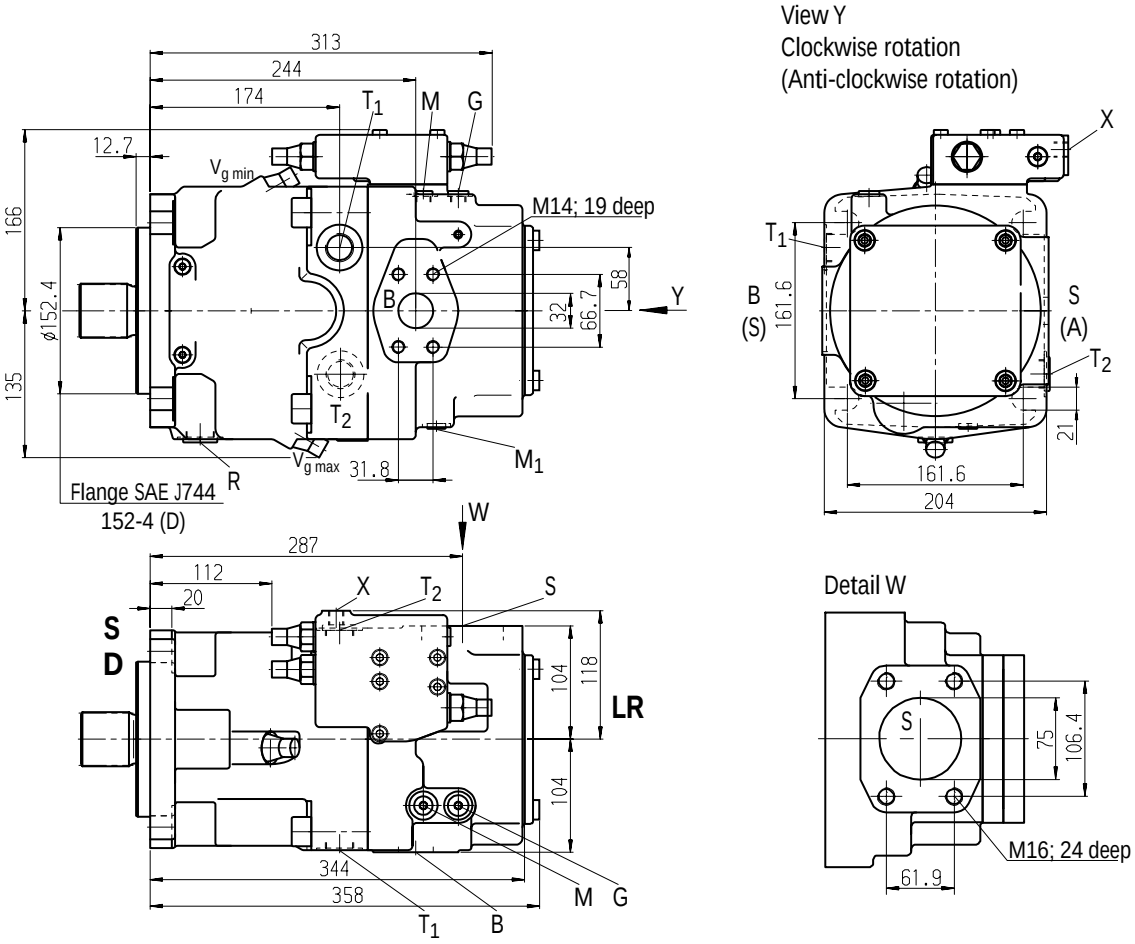


Unit Dimensions Size 130

Prior to finalising your design, please request certified installation drawing.

Version with charging pump A11VLO130LRDS:

Power control LR with pressure cut-off D and load sensing control S



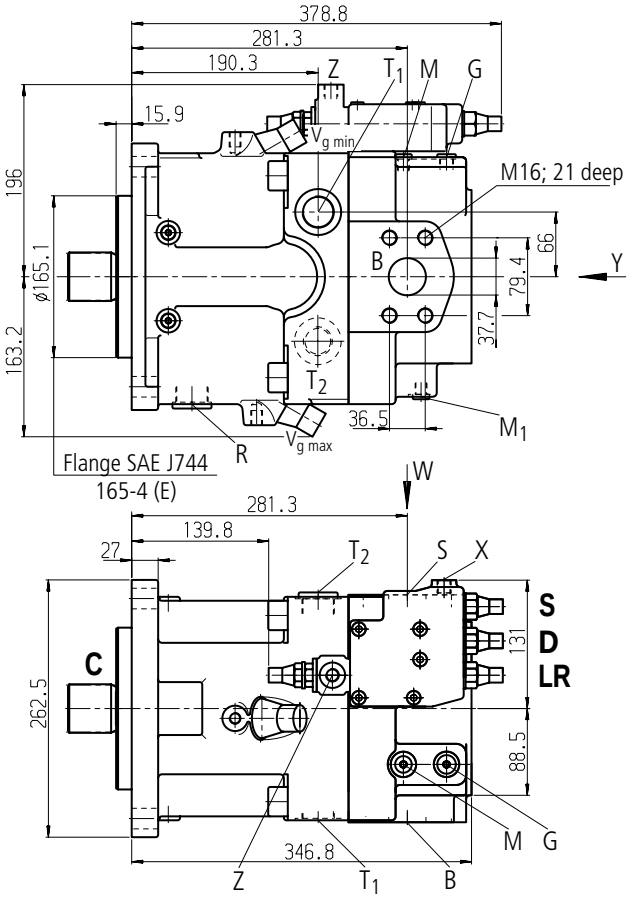
Ports

A, B	Service port (with charging pump)	SAE 1 1/4; 420 bar (6000 psi) High pressure series
S	Suction port (with charging pump)	SAE 3; 140 bar (2000 psi) Standard series
T_1, T_2	Air bleed, tank	M26x1,5; 16 deep
R	Air bleed, oil drain	M26x1,5; 16 deep
M_1	Measuring point, regulating chamber	M12x1,5; 12 deep
M	Measuring point, service port	M12x1,5; 12 deep
X	Pilot port for version with load sensing (S), DRL and remote pressure cut-off control (G)	M14x1,5; 12 deep
Y	Pilot port for version with stroke limiter (H...), 2-stage pressure cut-off (E) and HD	M14x1,5; 12 deep
Z	Pilot port or version with cross-sensing (C) and power override (LR3, LG1)	M14x1,5; 12 deep
G	Port for positioning pressure (controller) for version with stroke limiter (H.., U2), HD and EP with screwed fitting GE10 - PLM (otherwise port G closed)	M14x1,5; 12 deep

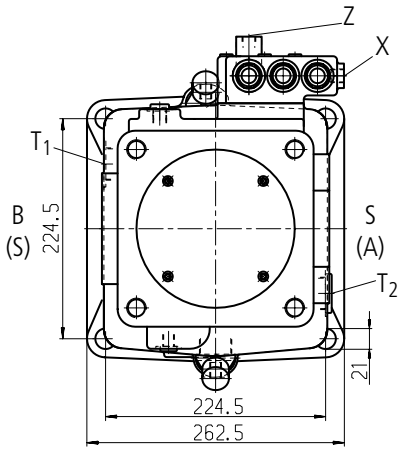
Unit Dimensions Size 190

Prior to finalising your design, please request certified installation drawing.

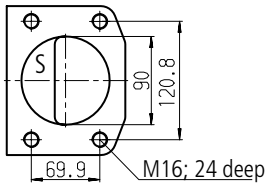
LRDCS:
Power control LR with pressure cut-off D, cross-sensing control C and load sensing control S



View Y
Clockwise rotation
(Anti-clockwise rotation)

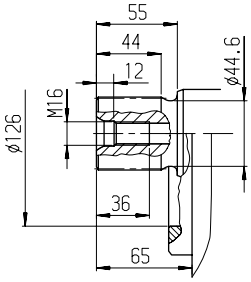


Detail W

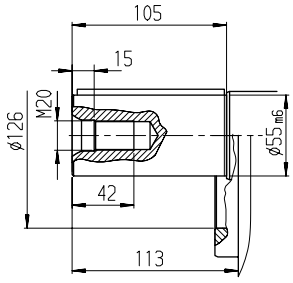


Shaft ends

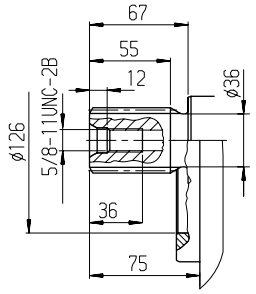
Z
Splined shaft DIN 5480
W50x2x30x24x9g



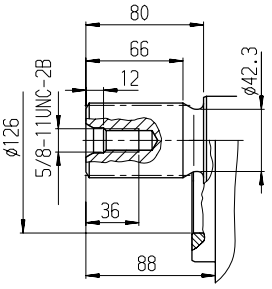
P
Cyl. shaft with key
DIN 6885 – AS16x10x100



S
Splined shaft ANSI B92.1a-1976
1 3/4in 13T 8/16DP [1])
(SAE J744 – 44-4 (D))



T
Splined shaft ANSI B92.1a-1976
2in 15T 8/16DP [1])
(SAE J744 – 50-4 (F))



Ports

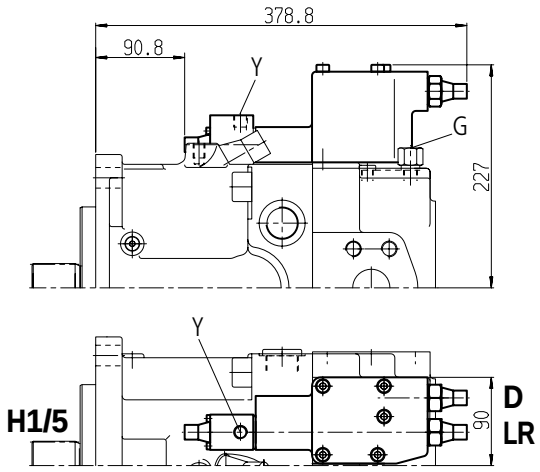
A, B	Service port (without charging pump)	SAE 1 1/2; 420 bar (6000 psi) High pressure series
S	Suction port (without charging pump)	SAE 3 1/2; 35 bar (500 psi) Standard series
T_1, T_2	Air bleed, tank	M33x2; 16 deep
R	Air bleed, oil drain	M33x2; 16 deep
M_1	Measuring point, regulating chamber	M12x1,5; 12 deep
M	Measuring point, service port	M12x1,5; 12 deep
X	Pilot port for version with load sensing (S), DRL and remote pressure cut-off control (G)	M14x1,5; 12 deep
Y	Pilot port for version with stroke limiter (H...), 2-stage pressure cut-off (E) and HD	M14x1,5; 12 deep
Z	Pilot port or version with cross-sensing (C) and power override (LR3, LG1)	M14x1,5; 12 deep
G	Port for positioning pressure (controller) for version with stroke limiter (H.., U2), HD and EP with screwed fitting GE10 - PLM (otherwise port G closed)	M14x1,5; 12 deep

[1]) 30° pressure angle, flat root, side fit, tolerance class 5

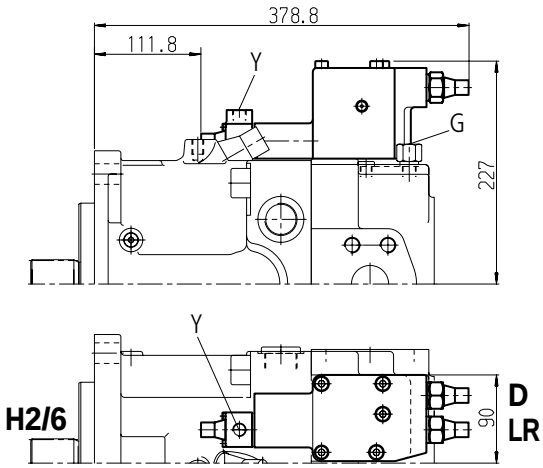
Unit Dimensions Size 190

Prior to finalising your design, please request certified installation drawing.

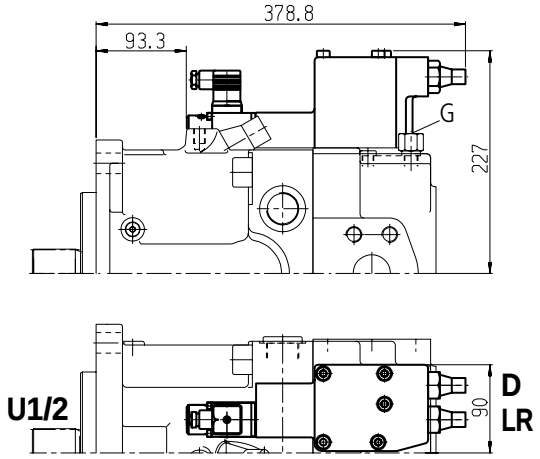
LRDH1/LRDH5:
Power control with pressure cut-off and hydraulic stroke limiter (function: $V_{g\ max}$ to $V_{g\ min}$)



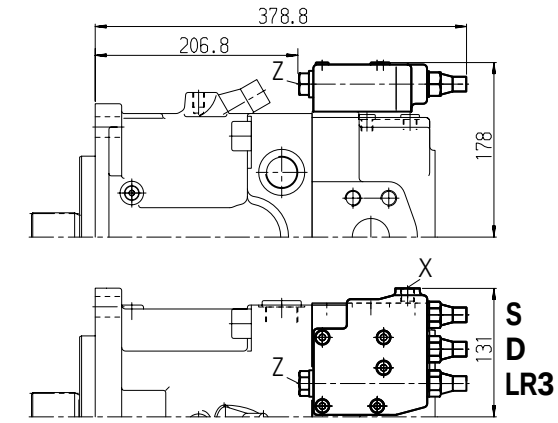
LRDH2/LRDH6:
Power control with pressure cut-off and hydraulic stroke limiter (function: $V_{g\ min}$ to $V_{g\ max}$)



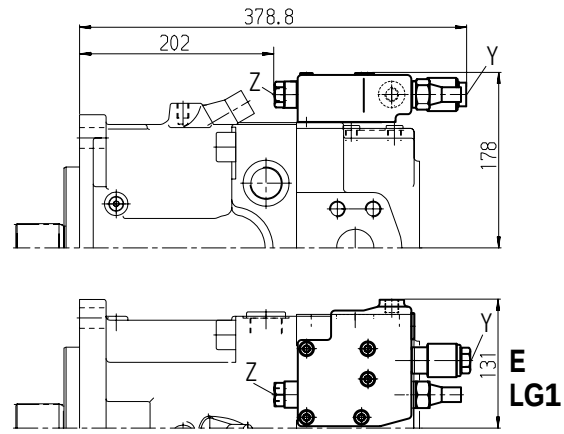
LRDU1/LRDU2:
Power control with pressure cut-off and electric stroke limiter (function: $V_{g\ min}$ to $V_{g\ max}$)



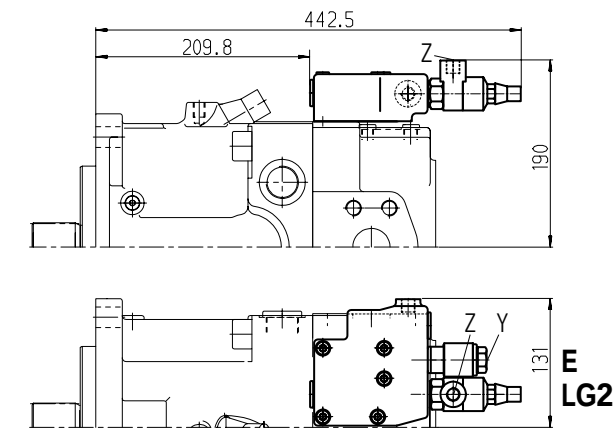
LR3DS:
Power control with high pressure dependent override, pressure cut-off and load sensing control



LG1E:
Power control with pilot pressure dependent override (negative) and 2-stage pressure cut-off



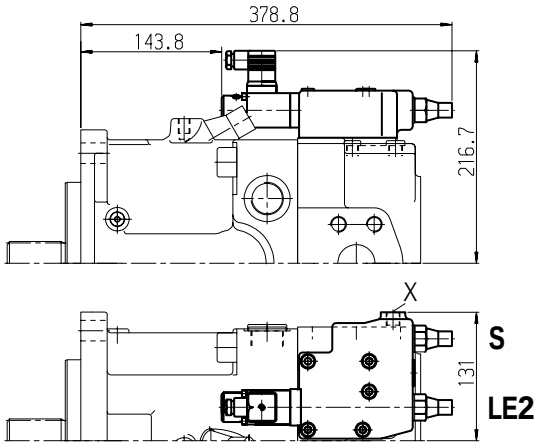
LG2E:
Power control with pilot pressure dependent override (positive) and 2-stage pressure cut-off



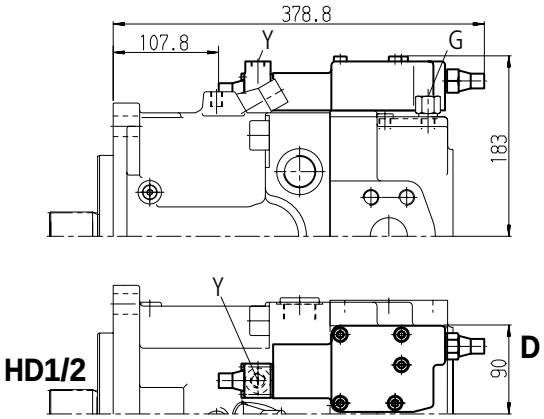
Unit Dimensions Size 190

Prior to finalising your design, please request certified installation drawing.

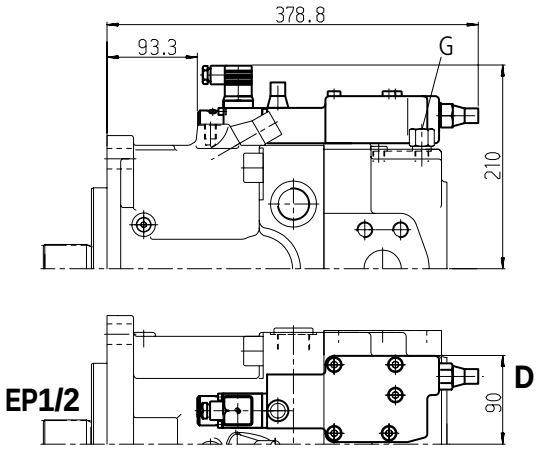
LE1S/LE2S:
Power control with electric override (negative) and load sensing control



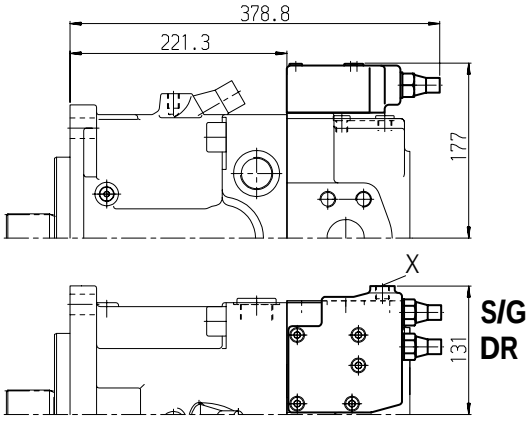
HD1D/HD2D:
Hydraulic, pilot pressure dependent control with pressure cut-off



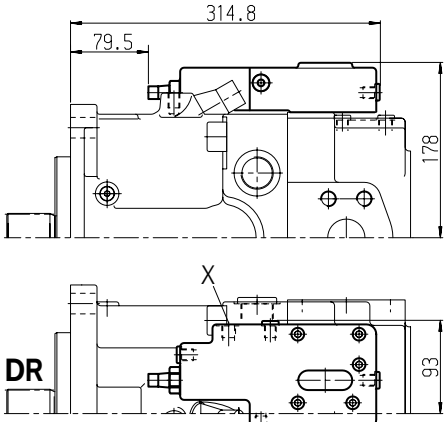
EP1D/EP2D:
Electric control (proportional solenoid) with pressure cut-off



DRS/DRG:
Pressure control with load sensing
Pressure remote control



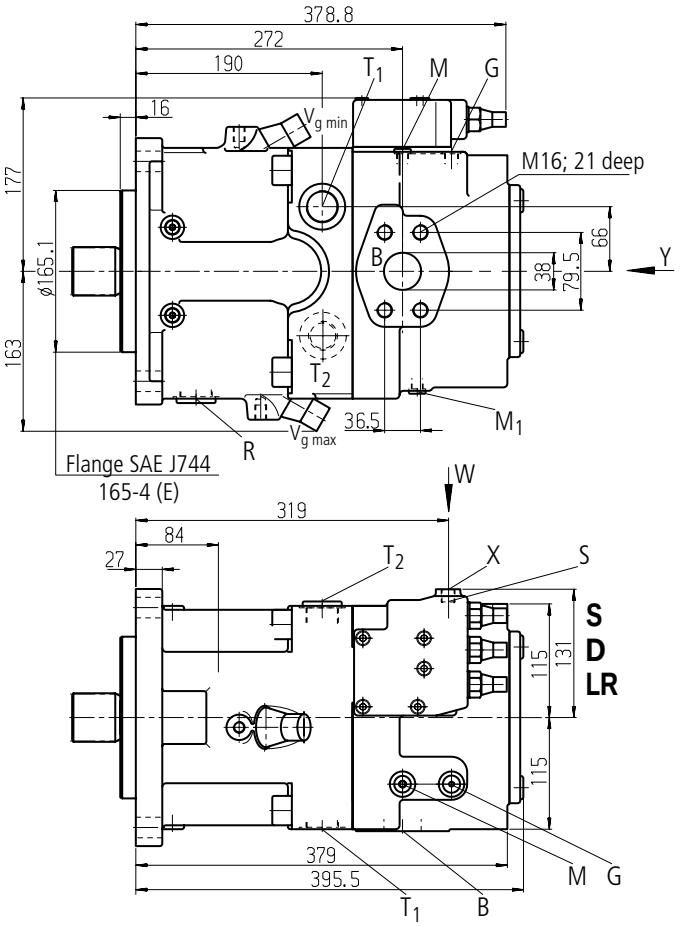
DRL:
Pressure control for parallel operation

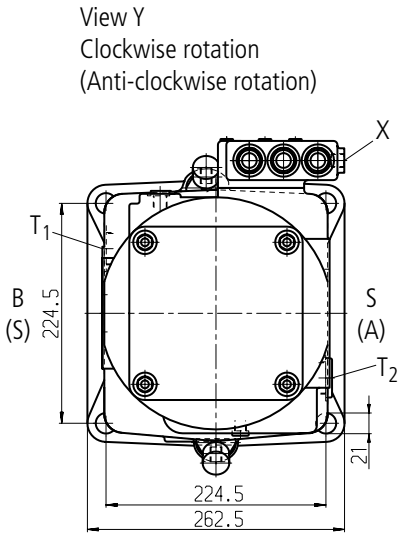


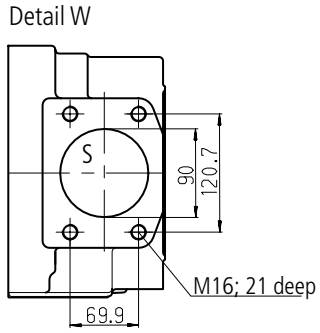
Unit Dimensions Size 190

Prior to finalising your design, please request certified installation drawing.

Version with charging pump A11VLO190LRDS:
Power control LR with pressure cut-off D and Load sensing control S







Ports

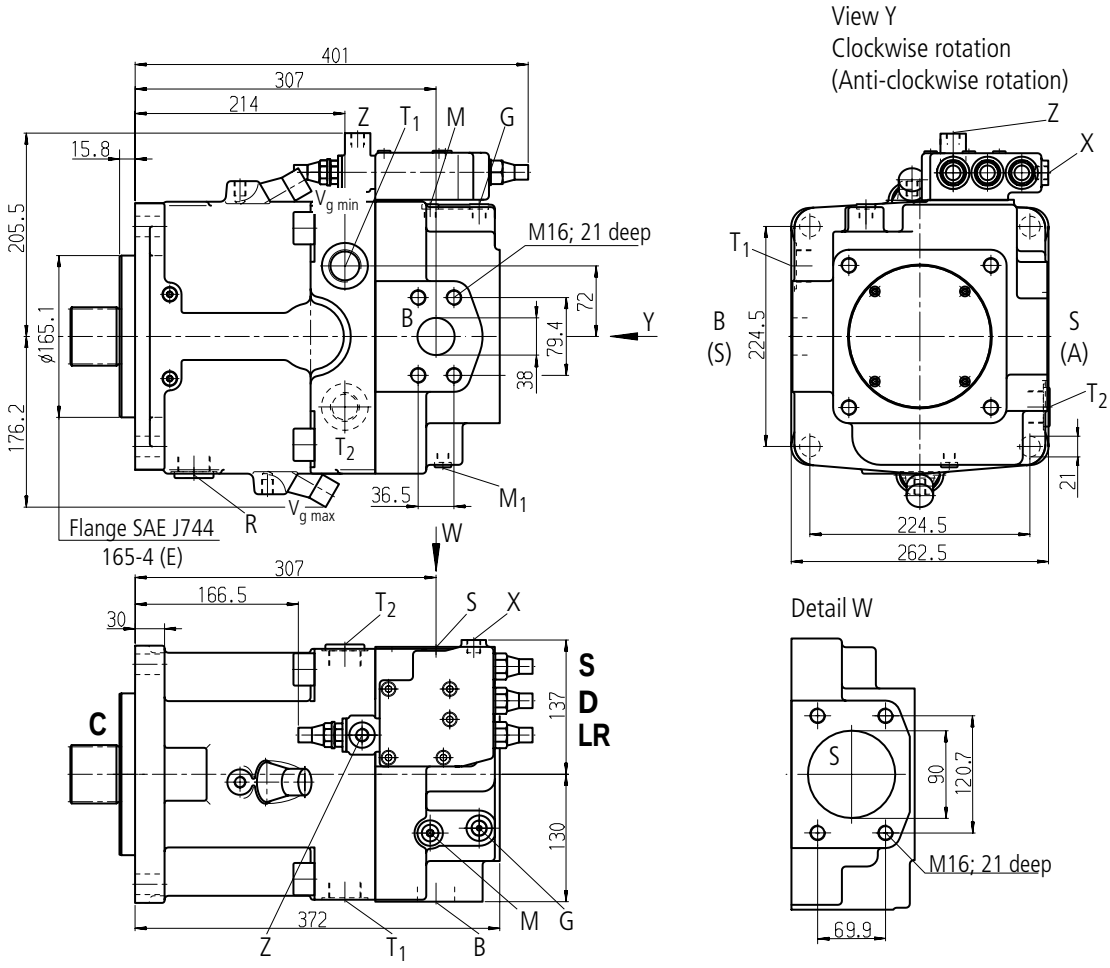
A, B	Service port (with charging pump)	SAE 1 1/2; 420 bar (6000 psi) High pressure series
S	Suction port (with charging pump)	SAE 3 1/2; 35 bar (500 psi) Standard series
T_1, T_2	Air bleed, tank	M33x2; 16 deep
R	Air bleed, oil drain	M33x2; 16 deep
M_1	Measuring point, regulating chamber	M12x1,5; 12 deep
M	Measuring point, service port	M12x1,5; 12 deep
X	Pilot port for version with load sensing (S), DRL and remote pressure cut-off control (G)	M14x1,5; 12 deep
Y	Pilot port for version with stroke limiter (H...), 2-stage pressure cut-off (E) and HD	M14x1,5; 12 deep
Z	Pilot port or version with cross-sensing (C) and power override (LR3, LG1)	M14x1,5; 12 deep
G	Port for positioning pressure (controller) for version with stroke limiter (H.., U2), HD and EP with screwed fitting GE10 - PLM (otherwise port G closed)	M14x1,5; 12 deep

Unit Dimensions Size 260

Prior to finalising your design, please request certified installation drawing.

LRDCS:

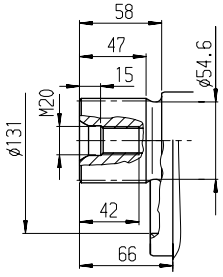
Power control LR with pressure cut-off D, cross-sensing control C and load sensing control S



Shaft ends

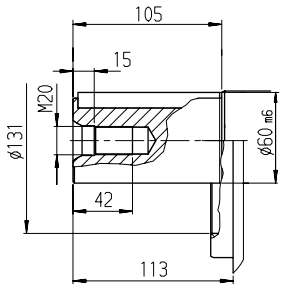
Z

Splined shaft DIN 5480
W60x2x30x28x9g



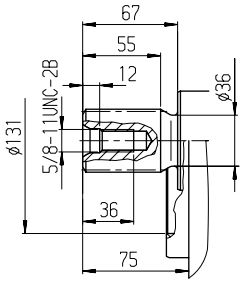
P

Cyl. shaft with key
DIN 6885 – AS18x11x100



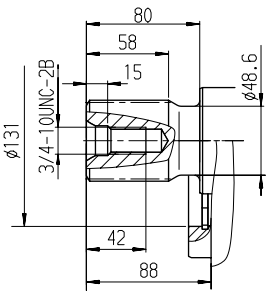
S

Splined shaft ANSI B92.1a-1976
1 3/4in 13T 8/16DP [1])
(SAE J744 – 44-4 (D))



T

Splined shaft ANSI B92.1a-1976
2 1/4in 17T 8/16DP [1])



Ports

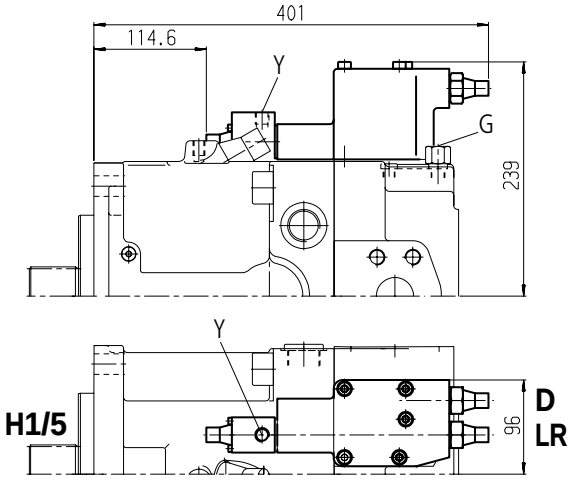
A, B	Service port (without charging pump)	SAE 1 1/2; 420 bar (6000 psi) High pressure series
S	Suction port (without charging pump)	SAE 3 1/2; 35 bar (500 psi) Standard series
T_1, T_2	Air bleed, tank	M33x2; 16 deep
R	Air bleed, oil drain	M33x2; 16 deep
M_1	Measuring point, regulating chamber	M12x1,5; 12 deep
M	Measuring point, service port	M12x1,5; 12 deep
X	Pilot port for version with load sensing (S), DRL and remote pressure cut-off control (G)	M14x1,5; 12 deep
Y	Pilot port for version with stroke limiter (H...), 2-stage pressure cut-off (E) and HD	M14x1,5; 12 deep
Z	Pilot port or version with cross-sensing (C) and power override (LR3, LG1)	M14x1,5; 12 deep
G	Port for positioning pressure (controller) for version with stroke limiter (H.., U2), HD and EP with screwed fitting GE10 - PLM (otherwise port G closed)	M14x1,5; 12 deep

[1]) 30° pressure angle, flat root, side fit, tolerance class 5

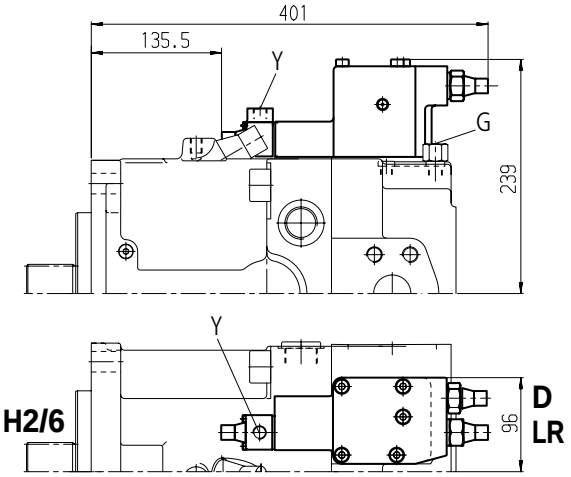
Unit Dimensions Size 260

Prior to finalising your design, please request certified installation drawing.

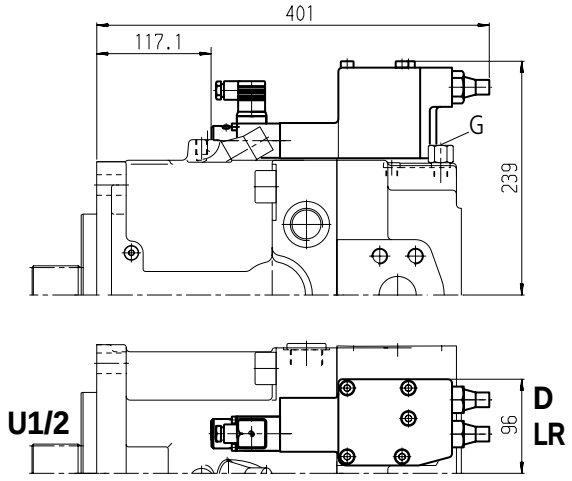
LRDH1/LRDH5:
Power control with pressure cut-off and hydraulic stroke limiter (function: $V_{g\ max}$ to $V_{g\ min}$)



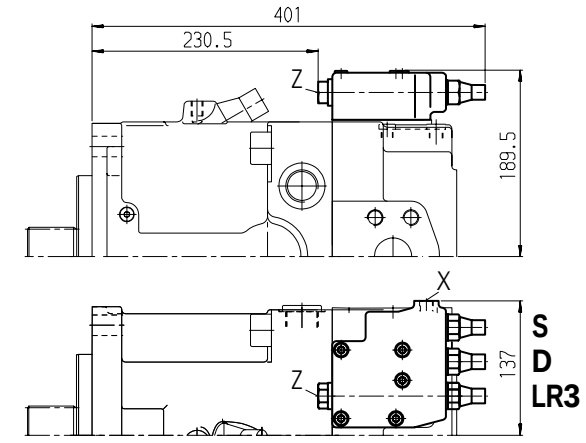
LRDH2/LRDH6:
Power control with pressure cut-off and hydraulic stroke limiter (function: $V_{g\ min}$ to $V_{g\ max}$)



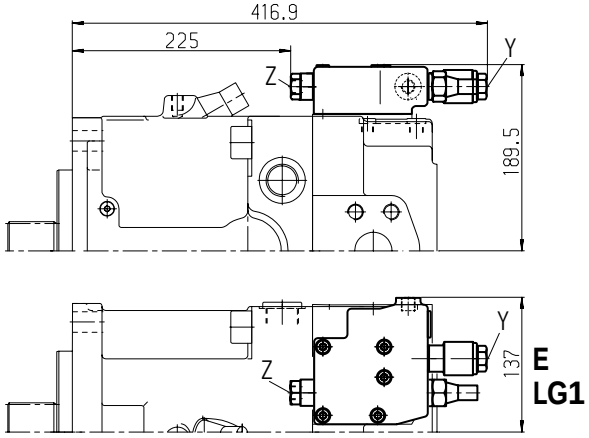
LRDU1/LRDU2:
Power control with pressure cut-off and electric stroke limiter (function: $V_{g\ min}$ to $V_{g\ max}$)



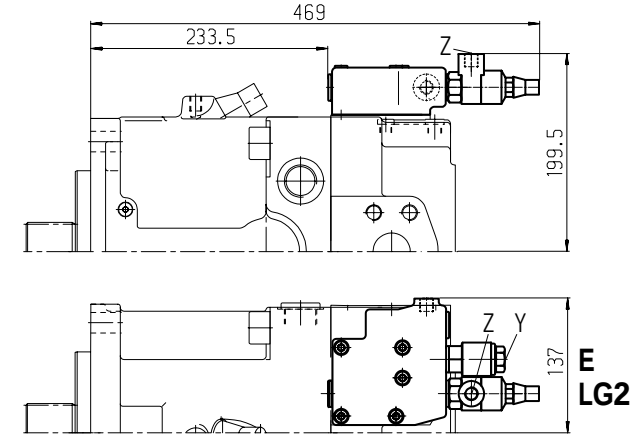
LR3DS:
Power control with high pressure dependent override, pressure cut-off and load sensing control



LG1E:
Power control with pilot pressure dependent override (negative) and 2-stage pressure cut-off



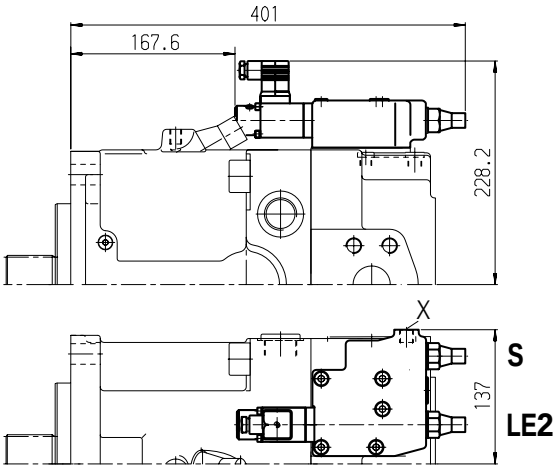
LG2E:
Power control with pilot pressure dependent override (positive) and 2-stage pressure cut-off



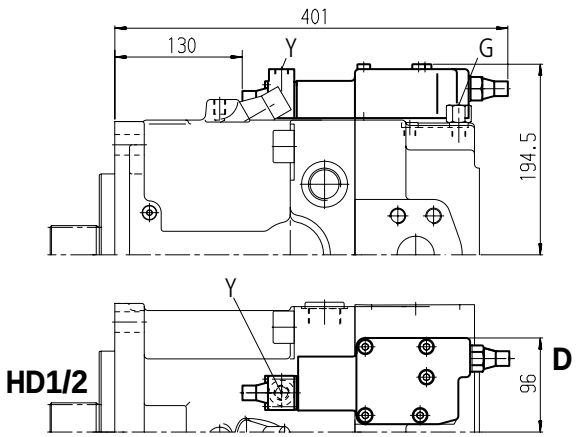
Unit Dimensions Size 260

Prior to finalising your design, please request certified installation drawing.

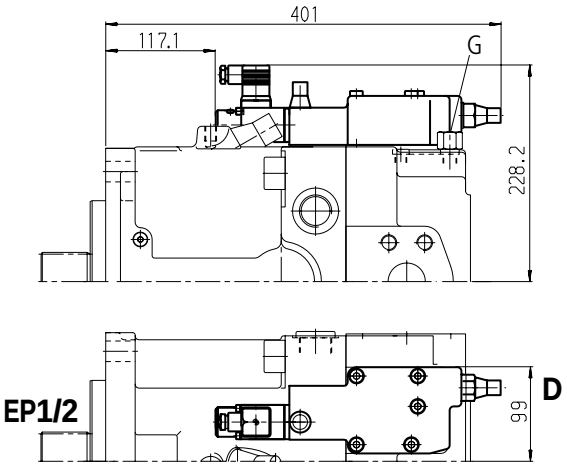
LE1S/LE2S:
Power control with electric override (negative) and load sensing control



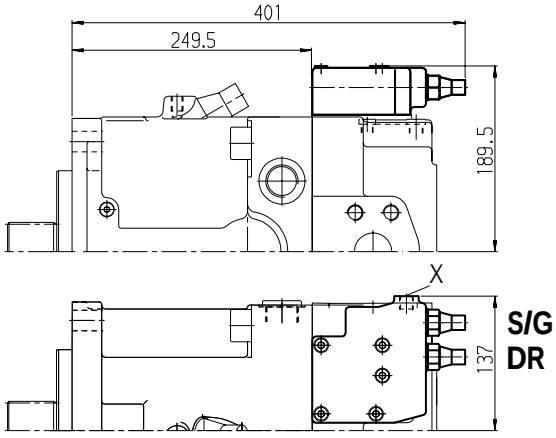
HD1D/HD2D:
Hydraulic, pilot pressure dependent control with pressure cut-off



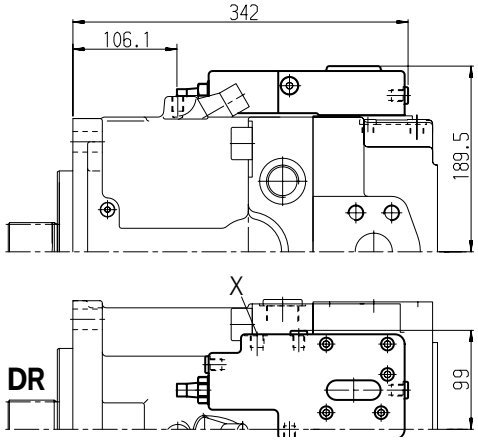
EP1D/EP2D:
Electric control (proportional solenoid) with pressure cut-off



DRS/DRG:
Pressure control with load sensing
Pressure remote control



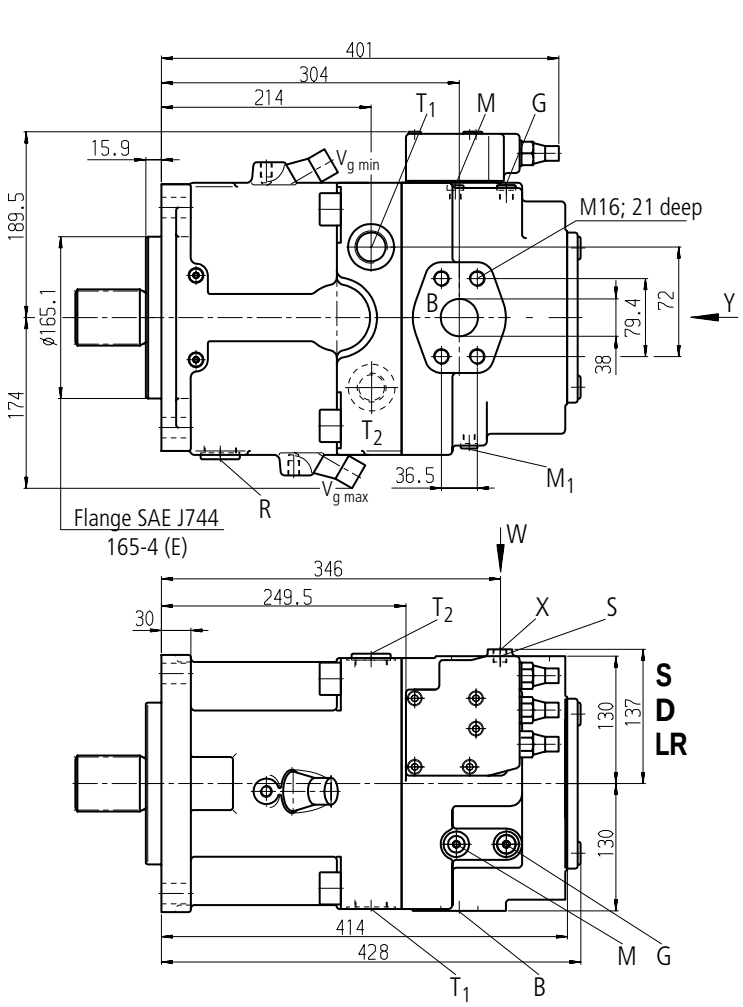
DRL:
Pressure control for parallel operation



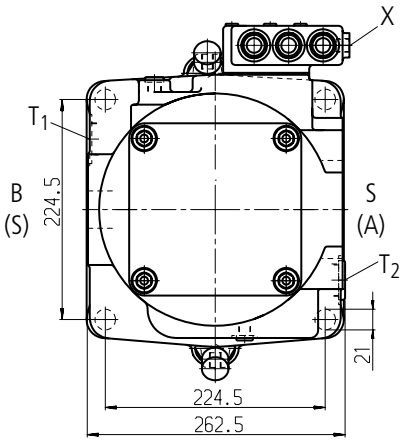
Unit Dimensions Size 260

Prior to finalising your design, please request certified installation drawing.

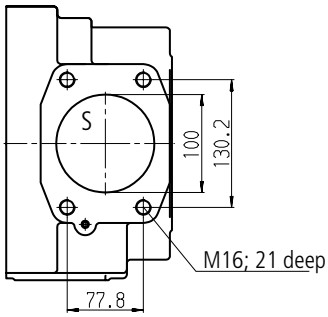
Version with charging pump A11VLO260LRDS:
Power control LR with pressure cut-off D and Load sensing control S



View Y
Clockwise rotation
(Anti-clockwise rotation)



Detail W



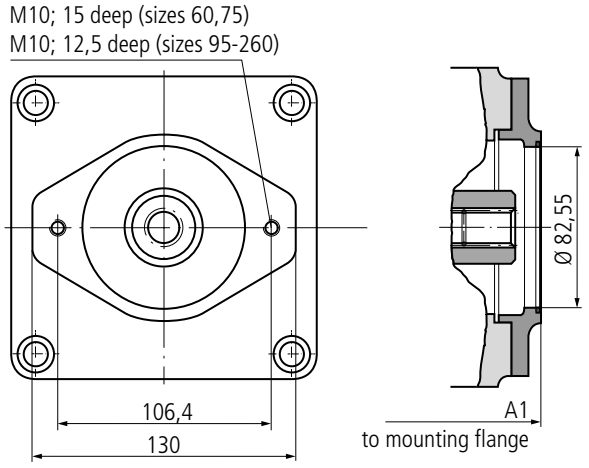
Ports

A, B	Service port (with charging pump)	SAE 1 1/2; 420 bar (6000 psi) High pressure series
S	Suction port (with charging pump)	SAE 4; 35 bar (500 psi) Standard series
T_1, T_2	Air bleed, tank	M33x2; 16 deep
R	Air bleed, oil drain	M33x2; 16 deep
M_1	Measuring point, regulating chamber	M12x1,5; 12 deep
M	Measuring point, service port	M12x1,5; 12 deep
X	Pilot port for version with load sensing (S), DRL and remote pressure cut-off control (G)	M14x1,5; 12 deep
Y	Pilot port for version with stroke limiter (H...), 2-stage pressure cut-off (E) and HD	M14x1,5; 12 deep
Z	Pilot port or version with cross-sensing (C) and power override (LR3, LG1)	M14x1,5; 12 deep
G	Port for positioning pressure (controller) for version with stroke limiter (H.., U2), HD and EP with screwed fitting GE10 - PLM (otherwise port G closed)	M14x1,5; 12 deep

Through Drive Dimensions

Prior to finalising your design, please request certified installation drawing.

Flange SAE J744 – 82-2 **(A)** **Hub** for splined shaft to ANSI B92.1a-1976 5/8in 9T 16/32DP [1] (SAE J744 – 16-4 (A)) **K01**
3/4in 11T 16/32DP [1] (SAE J744 – 19-4 (A-B)) **K52**



Overall length A1

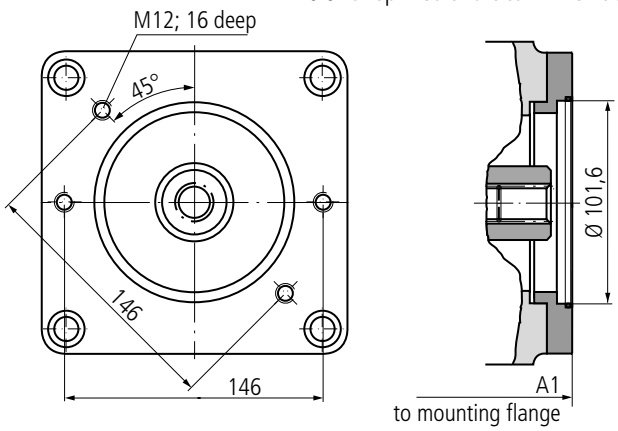
Size	K01	K52
40	240	240
60	257	257
75	275	275
95	306	306
130	339	339
130*	373	373
190	359,8	359,8
190*	394	394
260	385	385
260*	427,3	427,3

*) Version with charging pump

Note: The mounting flange can also be turned 90°. If required, please state in clear text.

Flange SAE J744 – 101-2 **(B)** **Hub** for splined shaft to ANSI B92.1a-1976 7/8in 13T 16/32DP [1] (SAE J744 – 22-4 (B)) **K02**
1in 15T 16/32DP [1] (SAE J744 – 25-4 (B-B)) **K04**

Hub for splined shaft to DIN 5480 W35x2x30x16x9g **K79**



Overall length A1

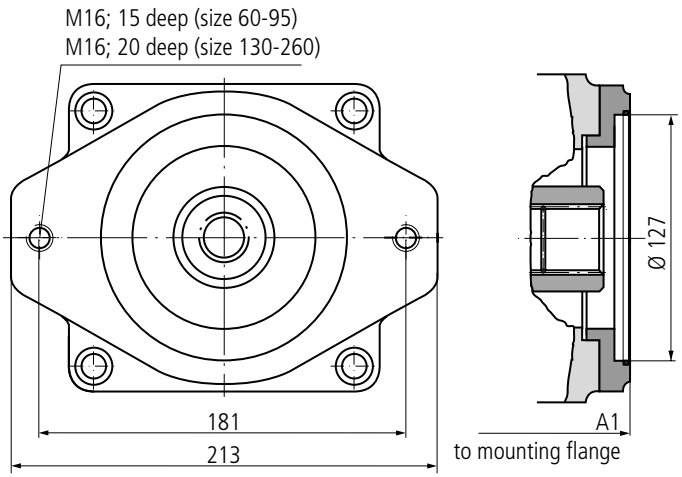
Size	K02	K04	K79
40	244	244	
60	261	261	265
75	279	279	
95	303	303	303
130	326	326	326
130*	360	360	360
190	371,8	371,8	361,8
190*	404	404	394
260	395	395	395
260*	437,5	437,5	437,5

*) Version with charging pump

Note: The mounting flange can also be turned 90°. If required, please state in clear text.

Flange SAE J744 – 127-2 **(C)** **Hub** for splined shaft to ANSI B92.1a-1976 1 1/4in 14T 12/24DP [1] (SAE J744 – 32-4 (C)) **K07**
1 1/2in 17T 12/24 DP [1] (SAE J744 – 38-4 (C-C)) **K24**

Hub for splined shaft to DIN 5480 W30x2x30x14x9g **K80**
W35x2x30x16x9g **K61**



Overall length A1

Size	K07	K24	K80	K61
60	272	–	265	265
75	290	–	283	283
95	318	318	318	318
130	330	330	330	330
130*	364	364	364	364
190	367,8	367,8	367,8	367,8
190*	400	400	400	400
260	391,5	391,5	391,5	391,5
260*	433,5	433,5	433,5	433,5

*) Version with charging pump

Note: The mounting flange can also be turned 90°. If required, please state in clear text.

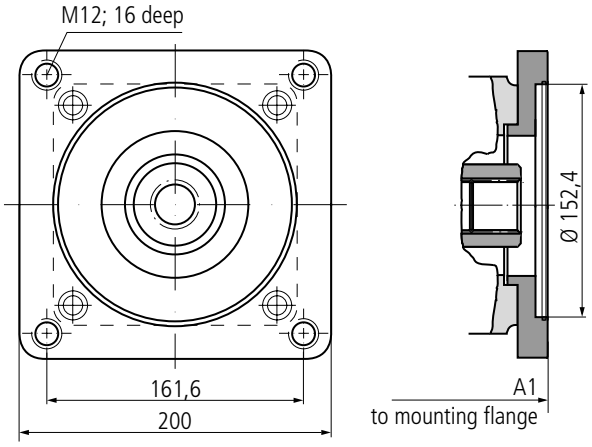
[1]) 30° pressure angle, flat root, side fit, tolerance class 5

Through Drive Dimensions

Prior to finalising your design, please request certified installation drawing.

Flange SAE J744 – 152-4 **(D)**

Hub for splined shaft to ANSI B92.1a-1976	1 1/4in 14T 12/24DP [1] (SAE J744 – 32-4 (C))	**K86**
	1 3/4in 13T 8/16DP [1] (SAE J744 – 44-4 (D))	**K17**
Hub for splined shaft to DIN 5480	W40x2x30x18x9g	**K81**
	W45x2x30x21x9g	**K82**
	W50x2x30x24x9g	**K83**



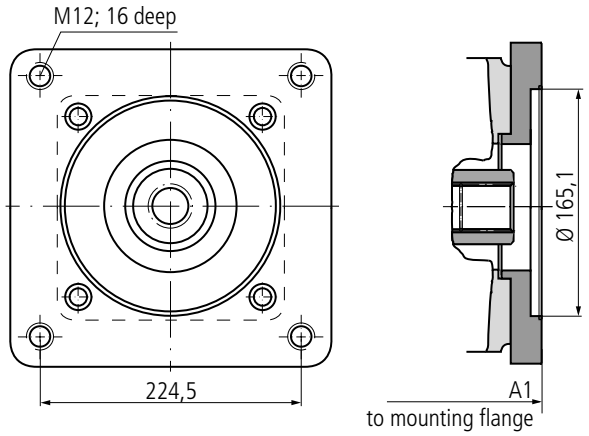
Overall length A1

Size	K86	K17	K81	K82	K83
75	290	–	290	–	–
95	317	–	317	317	–
130	340	350	340	340	340
130*	374	384	374	374	374
190	392	392	392	392	392
190*	424	424	424	424	424
260	417	417	417	417	417
260*	459	459	459	459	459

*) Version with charging pump

Flange SAE J744 – 165-4 **(E)**

Hub for splined shaft to ANSI B92.1a-1976	1 3/4in 13T 8/16DP [1] (SAE J744 – 32-4 (C))	**K72**
Hub for splined shaft to DIN 5480	W50x2x30x24x9g	**K84**
	W60x2x30x28x9g	**K67**



Overall length A1

Size	K72	K84	K67
190	376,8	376,8	–
190*	409	409	–
260	417	400	400
260*	459	442,5	442,5

*)Version with charging pump

[1]) 30° pressure angle, flat root, side fit, tolerance class 5

Overview of A11VO Attachments

Through drive – A11VO			Attachment for 2nd pump							Through drive
flange	hub for splined shaft	Short code	A11VO size (shaft)	A10V(S)O/31 size (shaft)	A10V(S)O/52 size (shaft)	A4FO size (shaft)	A4VG size (shaft)	A10VG size (shaft)	external gear pump	available for size
82-2 (A)	5/8in	**K01**	—	18 (U)	10 (U)	—	—	—	G2 / 4-22 (R)	40...260
	3/4in	**K52**	—	18 (S)	10 (S)	—	—	—	—	40...260
101-2 (B)	7/8in	**K02**	—	28 (S,R) 45 (U)	28 (S,R) 45 (U,W)	16 (S), 22 (S) 28 (S)	—	18 (S)	G3 / 20-45 (D) G4 / 40-100 (D)	40...260
	1in	**K04**	40 (S)	45 (S,R)	45 (S,R) 60 (U,W)	—	28 (S)	28 (S), 45 (S)	—	40...260
	W35	**K79**	40 (Z)	—	—	—	—	—	—	40...260
127-2 (C)	1 1/4in	**K07**	60 (S)	71 (S,R) 100 (U)	60 (S) 85 (U)	—	40 (S), 56 (S) 71 (S)	63 (S)	—	60...260
	1 1/2in	**K24**	—	100 (S)	85 (S)	—	—	—	—	95...260
	W30	**K80**	—	—	—	—	40 (Z), 56 (Z)	—	—	60...260
	W35	**K61**	60 (Z)	—	—	—	40 (A), 56 (A) 71 (Z)	—	—	60...260
152-4 (D)	1 1/4in	**K86**	75 (S)	—	—	—	—	—	—	75...260
	1 3/4in	**K17**	95 (S), 130 (S)	140 (S)	—	—	90 (S), 125 (S)	—	—	130...260
	W40	**K81**	75 (Z)	—	—	—	125 (Z)	—	—	75...260
	W45	**K82**	95 (Z)	—	—	—	90 (A), 125 (A)	—	—	95...260
	W50	**K83**	130 (Z)	—	—	—	—	—	—	130...260
165-4 (E)	1 3/4in	**K72**	190 (S), 260 (S)	—	—	—	180 (S), 250 (S)	—	—	190...260
	W50	**K84**	190 (Z)	—	—	—	180 (Z)	—	—	190...260
	W60	**K67**	260 (Z)	—	—	—	—	—	—	260

Pump Combinations A11VO + A11VO

Overall length A1 [1])

A11VO (1st pump)	A11VO (2nd pump)									
	size 40	size 60	size 75	size 95	size 130	size 130 [2])	size 190	size 190 [2])	size 260	size 260 [2])
size 40		—	—	—	—	—	—	—	—	—
size 60	490	507	—	—	—	—	—	—	—	—
size 75		525	550	—	—	—	—	—	—	—
size 95	528	560	577	604	—	—	—	—	—	—
size130	551	572	600	627	650	698	—	—	—	—
size130[2])	585	606	634	661	684	732	—	—	—	—
size190	586,8	609,8	652	679	702	750	723,6	772,3	—	—
size190[2])	619	642	684	711	734	782	755,8	804,5	—	—
size260	620	633,5	677	704	727	775	746,8	795,5	772	828
size260[2])	662,5	675,5	719	746	769	817	789,3	838	814,5	870,5

[1]) When using the Z shaft (splined shaft DIN 5480) for the mounted pump (2nd pump)

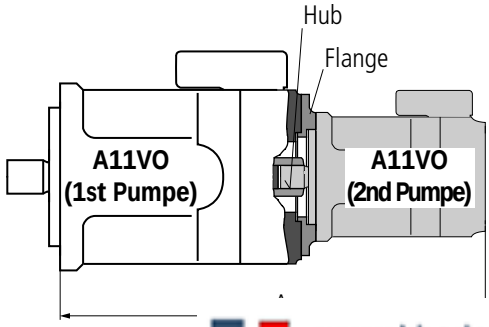
[2]) Version with charging pump

When ordering pump combinations the type designatins for the 1st and 2nd pumps should be joined by „**+**“

ordering code for 1st pump **+** ordering code for 2nd pump

Example order:

A11VO130LRDS/10R-NZD12**K61** + A11VO60LRDS/10R-NZC12N00



Permissible Input or Through Drive Torque

Size			40	60	75	95	130	190	260
Torque at $V_{g\,max}$ and Δp = 350 bar [1]	T_{max}	Nm	234	324	412	522	723	1073	1447
Max permissible input torque [2]									
at shaft end P	$T_{E\,zul.}$	Nm	468	648	824	1044	1448	2226	2787
(key DIN 6885)			(Ø32)	(Ø35)	(Ø40)	(Ø45)	(Ø50)	(Ø55)	(Ø60)
at shaft end Z	$T_{E\,zul.}$	Nm	912	912	1460	2190	3140	3140	5780
(DIN 5480)			(W35)	(W35)	(W40)	(W45)	(W50)	(W50)	(W60)
at shaft end S	$T_{E\,zul.}$	Nm	314	602	602	1640	1640	1640	1640
(ANSI B92.1a-1976)			(1in)	(1 1/4in)	(1 1/4in)	(1 3/4in)	(1 3/4in)	(1 3/4in)	(1 3/4in)
at shaft end T	$T_{E\,zul.}$	Nm	602	970	970	—	—	2670	4070
(ANSI B92.1a-1976)			(1 1/4in)	(1 3/8in)	(1 3/8in)	—	—	(2in)	(2 1/4in)
Max perm. through drive torque [3]	$T_{D\,zul.}$	Nm	314	521	660	822	1110	1760	2065

[1]) disregading efficiency

[2]) for drive shafts not subject to radial stress

[3]) Note max. perm. input torque for shaft **S**!

Key to symbols

$T_{D\,zul.}$ = Max. perm. through drive torque — in Nm

$T_{E\,zul.}$ = Max. perm. input torquw at drive shaft — in Nm

T_1 = Torque decrease at 1st pump $= \dfrac{1{,}59 \bullet V_{g1} \bullet \Delta p_1}{100 \bullet \eta_{mh}}$ in Nm

T_2 = Torque decrease at 2nd pump $= \dfrac{1{,}59 \bullet V_{g2} \bullet \Delta p_2}{100 \bullet \eta_{mh}}$ in Nm

V_{g1} = Displacement per revolution, 1st pump — in cm^3

V_{g2} = Displacement per revolution, 2nd pump — in cm^3

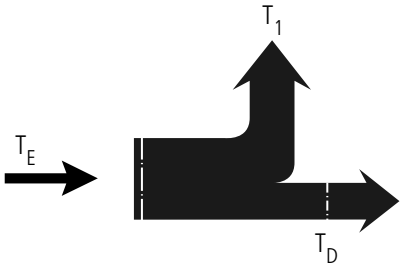
Δp_1 = Differential pressure, 1st pump — in bar

Δp_2 = Differential pressure, 2nd pump — in bar

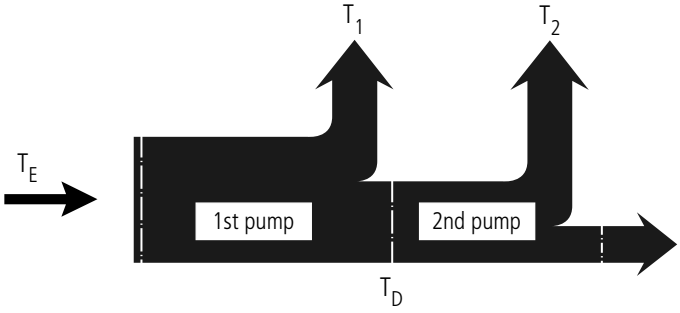
η_{mh} = Mechanical-hydraulic efficiency

Torque distribution

Single pump



Pump combination



Swivel Angle Display

Optical swivel angle display (V)

With the optical swivel angle display, the pump swivel position is shown by a mechanical indicator at the side of the housing.

Electric swivel angle display (R)

With the electric swivel angle display, the pump swivel position is reported by a position sensor. This sensor converts the swivel position into an electrical signal.

Supply voltage: 5V

Output signal U_α: 2,5V _____ $V_{g\,min}$

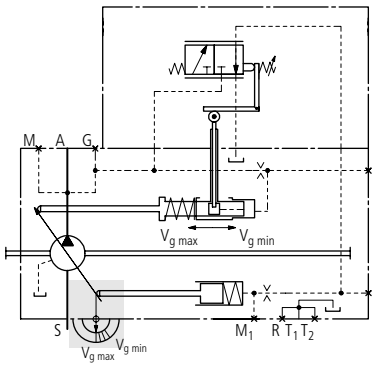
4,5V _____ $V_{g\,max}$

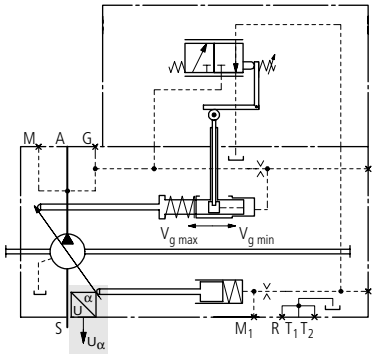
The 6-pin *AMP-MQS connector* comprising:

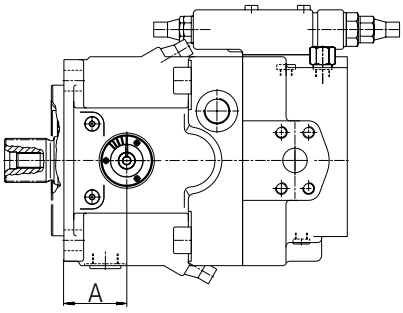
- 6-pin MQS connector, code A _____ 1-0967616-1
- 6 connector contacts _____ 0-0963727-2
- 6 single-conductor seals _____ 0-0967067-1
- 3 blind plugs _____ 0-0967056-1

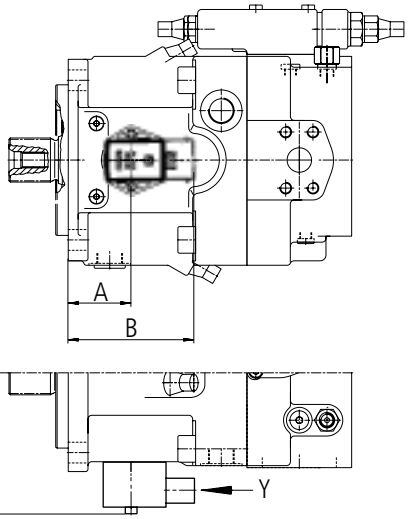
is not included in the supply.

Available from Brueninghaus Hydromatik on request.



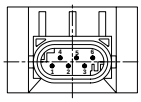






Detail Y

M 2:1



Allocation:
1: + (supply)
2: – (earth)
4: U_α

Size	A	C
40	50,5	84,0
60	not available	
75	60,7	97,0
95	63,5	104,0
130	70,9	112,0
190	87,6	123,5
260	87,6	137,0

Size	A	B	C
40	50,5	88,5	118,3
60	not available		
75	60,7	98,7	131,3
95	63,5	101,5	138,3
130	70,9	108,9	146,3
190	87,6	125,6	157,8
260	87,6	125,6	

Installation and Commissioning Notes

General

The pump housing must be filled with fluid during commissioning and remain full when operating (housing space filled).

Commissioning should be carried out at low speed and with no load until all air has been bled from the system.

If the pump is idle for extended periods, the housing may drain via the service lines. it is important to refill the housing sufficiently before putting it back into operation.

Leakage fluid in the housing space should be sent to the tank via the highest leakage oil port. The minimum suction pressure at port S of 0,8 bar abs. (without charging pump) or 0,6 bar (with charging pump) must be observed.

Mounting below the tank

Pumping below minimum oil level in tank (standard).

- Installation position is optional.
- Installation position "shaft end upwards":

  It is important to ensure that the pump housing is completely full when commissioning. An air bubble in the bearing area will cause damage to the axial piston unit.

Steps:

- Before commissioning, fill axial piston pump via the highest leakage oil port T1, T2, R.
- Recommendation: fill the suction lines.
- Run pump at low speed (starter speed) until pump system is completely filled.
- Minimum immersion depth of suction or leakage oil line in tank: 200 mm (in relation to min. oil level in tank).

Mounting above the tank

Pumping above minimum oil level in tank.

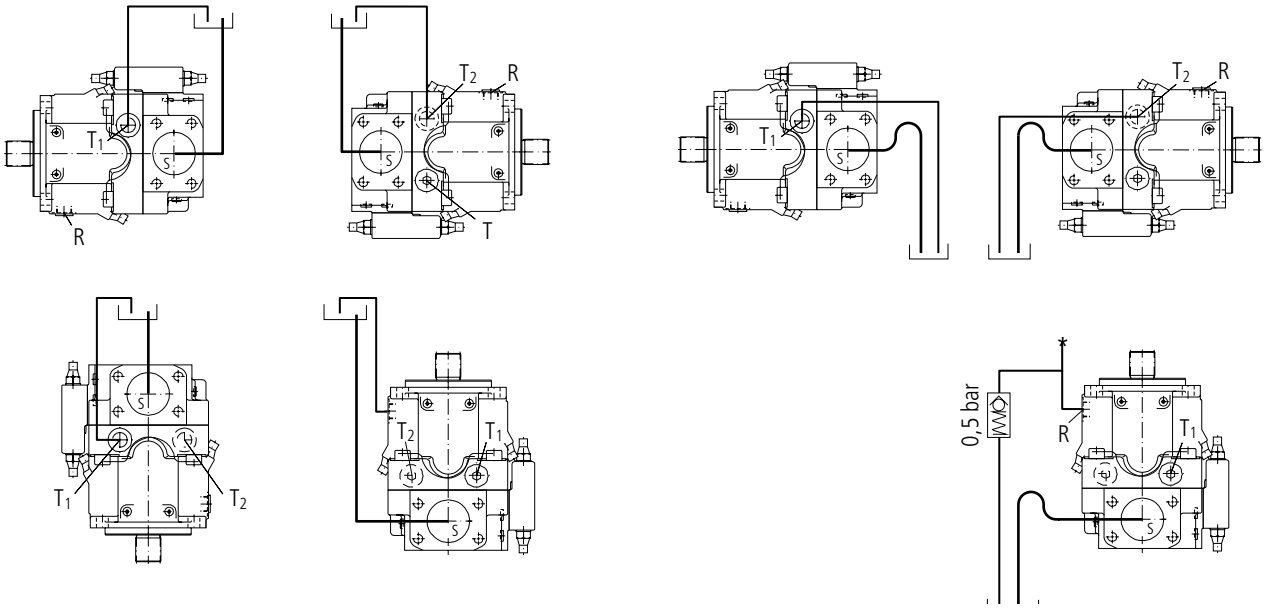
- Installation position "shaft horizontal" and "shaft end upwards".
- Installation position "shaft end upwards":

  If the pump is idle for extended periods, the housing space may drain via the service lines (air enters via the shaft seal). The bearings are thus insufficiently lubricated when the pump is started up again. It is important to refill the axial piston pump via the highest leakage oil port before putting it back into operation (air bleed via port R). A check valve in the leakage oil line (opening pressure 0,5 bar) can prevent draining via the leakage oil line. Draining via the service ports can be reduced via a special control plate design.
- Version A11VLO (with charging pump) is not designed for mounting above the tank.

For steps, refer to mounting below the tank.

In addition please note the following:

- max. perm. suction height h_{max} = 800 mm
- min. perm. pressure at port S (min. suction pressure)
- when adjusting with pressure control, stroke limiter, HD and EP adjustment, set residual flow $V_g \geq 5\%\ V_{g\,max}$.
- Recommendation: use "swan neck" suction line.



Preferred Types

Type	ID number
A11VO40LRS/10R-NSC12N00	9609790
A11VO40LRS/10R-NPC12N00	9609791
A11VO40LRH2/10R-NSC12N00	9609792
A11VO40LRH2/10R-NPC12N00	9609793
A11VO40DRS/10R-NSC12N00	9609656
A11VO40DRS/10R-NPC12N00	9609794
A11VO60LRS/10R-NSC12N00	9609798
A11VO60LRS/10R-NPC12N00	9609799
A11VO60LRS/10R-NSC12K01	9609800
A11VO60LRS/10R-NPC12K01	9609801
A11VO60LRH2/10R-NSC12N00	9609802
A11VO60LRH2/10R-NPC12N00	9609803
A11VO60LRH2/10R-NSC12K01	9609804
A11VO60LRH2/10R-NPC12K01	9609805
A11VO60DRS/10R-NSC12N00	9606644
A11VO60DRS/10R-NPC12N00	9609807
A11VO60DRS/10R-NSC12K01	9601648
A11VO60DRS/10R-NPC12K01	9609809
A11VO75LRS/10R-NSD12N00	9609815
A11VO75LRS/10R-NPD12N00	9609816
A11VO75LRS/10R-NSD12K01	9609817
A11VO75LRS/10R-NPD12K01	9609818
A11VO75LRH2/10R-NSD12N00	9609819
A11VO75LRH2/10R-NPD12N00	9608474
A11VO75LRH2/10R-NSD12K01	9609821
A11VO75LRH2/10R-NPD12K01	9609822
A11VO75DRS/10R-NSD12N00	9448021
A11VO75DRS/10R-NPD12N00	9609824
A11VO75DRS/10R-NSD12K01	9609825
A11VO75DRS/10R-NPD12K01	9609826
A11VO95LRS/10R-NSD12N00	9609834
A11VO95LRS/10R-NPD12N00	9609835
A11VO95LRS/10R-NSD12K01	9609836
A11VO95LRS/10R-NPD12K01	9609837
A11VO95LRH2/10R-NSD12N00	9609838
A11VO95LRH2/10R-NPD12N00	9609839
A11VO95LRH2/10R-NSD12K01	9609840
A11VO95LRH2/10R-NPD12K01	9609841
A11VO95DRS/10R-NSD12N00	9609842
A11VO95DRS/10R-NPD12N00	9608484
A11VO95DRS/10R-NSD12K01	9609844
A11VO95DRS/10R-NPD12K01	9609845

Type	ID number
A11VO130LRS/10R-NSD12N00	9609848
A11VO130LRS/10R-NPD12N00	9609646
A11VO130LRS/10R-NSD12K02	9609850
A11VO130LRS/10R-NPD12K02	9609851
A11VO130LRH2/10R-NSD12N00	9609852
A11VO130LRH2/10R-NPD12N00	9609853
A11VO130LRH2/10R-NSD12K02	9609854
A11VO130LRH2/10R-NPD12K02	9609855
A11VO130DRS/10R-NSD12N00	2005582
A11VO130DRS/10R-NPD12N00	9609857
A11VO130DRS/10R-NSD12K02	9609858
A11VO130DRS/10R-NPD12K02	9609859
A11VLO190LRS/11R-NSD12N00	2015194
A11VLO190LRS/11R-NPD12N00	2015195
A11VLO190LRS/11R-NSD12K02	2015196
A11VLO190LRS/11R-NPD12K02	2015197
A11VLO190HD1/11R-NSD12N00	2048497
A11VLO190HD1/11R-NPD12N00	2048499
A11VLO190HD1/11R-NSD12K02	2048501
A11VLO190HD1/11R-NPD12K02	2048503
A11VLO190HD2/11R-NSD12N00	2048498
A11VLO190HD2/11R-NPD12N00	2048500
A11VLO190HD2/11R-NSD12K02	2048502
A11VLO190HD2/11R-NPD12K02	2048504
A11VLO190EP2/11R-NSD12N00	2048505
A11VLO190EP2/11R-NPD12N00	2048506
A11VLO190EP2/11R-NSD12K02	2048507
A11VLO190EP2/11R-NPD12K02	2048508
A11VLO260LRS/11R-NSD12N00	2015256
A11VLO260LRS/11R-NPD12N00	2015257
A11VLO260LRS/11R-NSD12K02	2015258
A11VLO260LRS/11R-NPD12K02	2015259
A11VLO260HD1/11R-NSD12N00	2048509
A11VLO260HD1/11R-NPD12N00	2048511
A11VLO260HD1/11R-NSD12K02	2048513
A11VLO260HD1/11R-NPD12K02	2048515
A11VLO260HD2/11R-NSD12N00	2048510
A11VLO260HD2/11R-NPD12N00	2048512
A11VLO260HD2/11R-NSD12K02	2048514
A11VLO260HD2/11R-NPD12K02	2048516
A11VLO260EP2/11R-NSD12N00	2048517
A11VLO260EP2/11R-NPD12N00	2048518
A11VLO260EP2/11R-NSD12K02	2048519
A11VLO260EP2/11R-NPD12K02	2048520

When ordering, please quote type and ID number

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