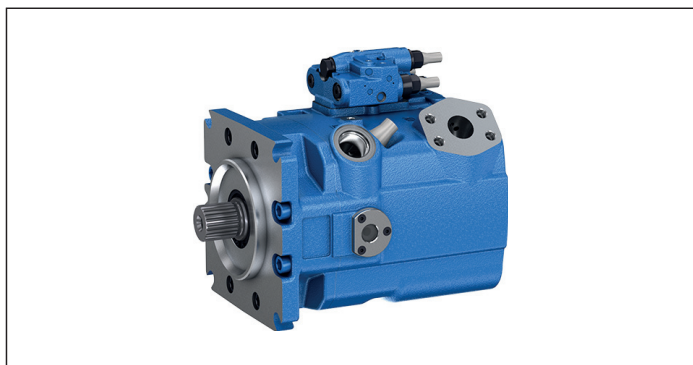


Axial piston variable pump A15VSO, A15VLO series 12

Americas



- ▶ Robust high-pressure pump for industrial applications
- ▶ Sizes 110 to 280
- ▶ Nominal pressure 5100 psi (350 bar)
- ▶ Maximum pressure 6100 psi (420 bar)
- ▶ Open circuit

Features

- ▶ Variable pump with axial piston rotary group in swashplate design for hydrostatic drives in open circuit.
- ▶ For use particularly in industrial application areas
- ▶ Flow is proportional to the drive speed and displacement.
- ▶ Flow can be infinitely varied by controlling the swashplate angle.
- ▶ The pump can work either self-priming or with a charge pump.
- ▶ Optionally with pre compression volume to reduce pressure pulsation
- ▶ Special control device program for industrial applications, with different control and regulation functions.
- ▶ The universal through drive is suitable for adding gear wheel pumps and axial piston pumps of up to the same size, i.e. 100% through drive.
- ▶ Compact design
- ▶ High efficiency
- ▶ High power density
- ▶ Low noise level
- ▶ U.S. Patent Numbers 8,261,654 and 8,418,599

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Type code

01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20
									/	12			V					0	-

Axial piston unit

01	Variable swashplate design, nominal pressure 5100 psi (350 bar), maximum pressure 6100 psi (420 bar)	Unpainted	A15V
		Painted	LA15V

Operating mode¹⁾

			110	145	175	210	280	
02	Pump, open circuit	Without charge pump	•	•	•	•	•	SO
		With charge pump	-	•	•	•	•	LO

Size (NG)

03	Geometric displacement, see table of values on page 9	110	145	175	210	280
----	---	-----	-----	-----	-----	-----

Swiveling range

			110	145	175	210	280	
04	One-sided swiveling	$V_{g \text{ max:}}$ + 50% to + 100% ³⁾ $V_{g \text{ min:}}$ - 5% to + 30%	•	•	•	•	•	P
	Two-sided swiveling ²⁾	$V_{g \text{ max:}}$ + 50% to + 100% ³⁾ $V_{g \text{ min:}}$ - 100% to - 50% ⁴⁾	•	•	•	•	•	M ⁶⁾

Position 05, 06, 07 with the relevant control axis combination option, controller group a) to e) is described below

Type code position	05	06	07
Combination options	a) Power controller Not for swiveling range "M"	No further controller, with code 00	
		b) Pressure controller	No further controller, with code 00
			c) Stroke control
			d) Load-sensing
			e) Override DG
		c) Stroke control	No further controller, with code 00
	b) Pressure controller	d) Load-sensing	No further controller, with code 00
		No further controller, with code 00	
		b) Pressure controller ⁵⁾	No further controller, with code 00
			e) Override DG
		d) Load-sensing	No further controller, with code 00
	c) Stroke control Not for swiveling range "M"	e) Override DG	No further controller, with code 00
		No further controller, with code 00	
		b) Pressure controller	No further controller, with code 00
			e) Override DG
		d) Load-sensing	No further controller, with code 00

• = Available ◦ = On request - = Not available

1) Note the selection option depending on the rotary group version.

2) Not possible with charge pump (VLO).

3) Values deviating at NG145: $V_{g \text{ max:}}$ + 75% to + 100%

4) Values deviating at NG145: $V_{g \text{ min:}}$ - 75% to - 100%

5) Cannot be combined with the same pressure controller

6) Function "two-sided swiveling" only possible for decompression operation (mooring) in operation as a pump. For operation as a motor please contact us.

01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20
									/	12			V					0	-

Control device: Controller group a)

											110	145	175	210	280	
a)	Power controller	Fixed setting									•	•	•	•	•	LR
		Override electric-proportional	Negative control	$U = 24\text{ V}$							•	•	•	•	•	L4
	Summation power controller	Override hydraulic-proportional, high pressure	Negative control	With stop							○	○	○	○	•	CR
				Without stop							○	○	○	○	•	PR

Controller group b)

											110	145	175	210	280	
b)	Without additional controller										•	•	•	•	•	00
	Pressure controller	Fixed setting									•	•	•	•	•	DR
	With one-side swiveling	Remote controlled hydraulically	Positive control								•	•	•	•	•	DG
		For parallel operation (cannot be combined with additional control: stroke control)	Positive control								•	•	•	•	•	DP

Controller group c)

											110	145	175	210	280	
c)	Without additional controller										•	•	•	•	•	00
	Stroke control	Electric-proportional	Positive control	$U = 24\text{ V}$							•	•	•	•	•	E2
		Electric, two-point	Positive control	$U = 24\text{ V}$							•	•	•	•	•	E6
				control pressure rise												
		Hydraulic-proportional, pilot pressure	Negative control	365 psi (25 bar)							•	•	•	•	•	H3
			Positive control	365 psi (25 bar)							•	•	•	•	•	H4
			Negative control	510 psi (35 bar)							•	•	•	•	•	H5
			Positive control	510 psi (35 bar)							○	•	•	•	•	H6
		Electro-hydraulic control	Positive control	$U = 12/24\text{ V}$ $I = 1500\text{ mA}$							•	•	•	•	•	U7

Controller group d)

											110	145	175	210	280	
d)	Without additional controller										•	•	•	•	•	00
	Load-sensing, pump pressure, internal	Fixed setting									•	•	•	•	•	S0 ¹⁾
	Pressure controller	Remote controlled hydraulically	Positive control								•	•	•	•	•	DG

Controller group e)

											110	145	175	210	280	
e)	Without additional controller										•	•	•	•	•	00
	Electric directional valve and pressure relief valve mounted	Only in combination with DG	De-energized standby	$U = 24\text{ V}$							•	•	•	•	•	V2
	Override DG	With integrated pilot control	Positive control	$U = 24\text{ V}$							•	•	•	•	•	T6
	electric-proportional	valve and only in combination with DG	Negative control	$U = 24\text{ V}$							•	•	•	•	•	T8

• = Available ○ = On request - = Not available

1) Cannot be used as individual controller, only in connection with other controllers

01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20				
										/	12			V				0	-				
Depressurized basic position and external control pressure supply ¹⁾											110	145	175	210	280								
08	Basic position maximum swivel angle ($V_{g \max}$)																						
	Without external control pressure supply (standard for power and pressure controllers)										•	•	•	•	•	A							
	With external control pressure supply (integrated shuttle valve, standard for negative stroke control)										•	•	•	•	•	B							
	Basic position minimum swivel angle ($V_{g \min}$)																						
With external control pressure supply (integrated shuttle valve, standard for positive stroke control)										•	•	•	•	•	C								
Connector for solenoids ²⁾											110	145	175	210	280								
09	Without connector (without solenoid, only for hydraulic control)										•	•	•	•	•	0							
	HIRSCHMANN connector										•	•	•	•	•	H							
	DEUTSCH – molded connector, 2-pin – without suppressor diode (only for electric controls U7)										•	•	•	•	•	P							
Swivel angle sensor											110	145	175	210	280								
10	Without swivel angle sensor (only for A15VLO)										•	•	•	•	•	0							
	Optical swivel angle indicator (only for A15VSO)										•	•	•	•	•	V							
	With electric swivel angle sensor ³⁾										Power supply 5 V DC					•	•	•	•	•	B		
	(as per data sheet 95150)										Power supply 8 V – 32V DC					•	•	•	•	•	K		
Series																							
11	Series 1, index 2																		12				
Version of port and fastening threads																							
12	Connection ports based on ISO 11926 with O-ring seal (ANSI), fastening threads according to ASME B1.1 at working ports and through drive																		A				
Direction of rotation											110	145	175	210	280								
13	Viewed on drive shaft										Clockwise					•	•	•	•	•	R		
											Counter-clockwise					•	•	•	•	•	L		
Sealing material											110	145	175	210	280								
14	FKM (fluorocarbon rubber)										○	•	•	•	•	○	V						
Mounting flange											110	145	175	210	280								
15	SAE J744					152-4					•	•	-	-	-	D4							
						165-4					-	-	•	•	•	E4							
Drive shaft (permissible input torque, see page 12)											110	145	175	210	280								
16	Splined shaft ANSI B92.1a					1 3/4 in 13T 8/16DP					•	•	•	•	-	T1							
						2 in 15T 8/16DP					-	•	•	•	-	T2							
						2 1/4 in 17T 8/16DP					-	-	-	-	•	T3							
	Parallel keyed shaft DIN 6885 (not for A15VLO)					ø45					•	-	-	-	-	B1							
						ø50					-	•	•	•	-	B2							
						ø60					-	-	-	-	•	B4							
	Parallel keyed shaft SAE J744					2 in					-	-	-	-	○	L2							

• = Available ○ = On request - = Not available

1) For description, see “Control device.”
Tables from page 12
2) Connectors for other electric components may deviate
3) Please contact us if the swivel angle sensor is used for control

01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20
									/	12			V					0	-

Rotary group version

		110	145	175	210	280
17	Standard version without charge pump	●	-	-	-	E
	Efficiency and speed optimized (version with and without charge pump)	-	●	●	●	P
	Pulsation damping (PCV) for NG 110 based on rotary group E, NG 145–280 based on rotary group P. For information, see page 71	○	○	○	○	V

Through drives (for mounting options, see page 68)

18	Flange SAE J744	Hub for splined shaft ¹⁾				110	145	175	210	280	
	Diameter	Attachment ¹⁾²⁾	Designation	Diameter	Designation						
	82-2 (A)	☼	A3	5/8 in	9T 16/32DP	S2	●	●	●	●	A3S2
	101-2 (B)	☼	B3	7/8 in	13T 16/32DP	S4	●	●	●	●	B3S4
				1 in	15T 16/32DP	S5	●	●	●	●	B3S5
		☼	B5	7/8 in	13T 16/32DP	S4	●	●	●	●	B5S4
				1 in	15T 16/32DP	S5	●	●	●	●	B5S5
	127-2 (C)	☼	C3	1 1/4 in	14T 12/24DP	S7	●	●	●	●	C3S7
				1 1/2 in	17T 12/24DP	S9	●	●	●	●	C3S9
		☼	C5	1 1/4 in	14T 12/24DP	S7	○	○	●	●	C5S7
	127-4 (C)	☼	C4	1 1/4 in	14T 12/24DP	S7	●	●	●	○	C4S7
	152-4 (D)	☼	D4	1 3/4 in	13T 8/16DP	T1	●	●	●	●	D4T1
				2 in	15T 8/16DP	T2	-	○	○	○	D4T2
	165-4 (E)	☼	E4	2 in	15T 8/16DP	T2	-	-	●	●	E4T2
				2 1/4 in	17T 8/16DP	T3	-	-	-	●	E4T3
	Prepared for through drive, with pressure-proof plugged cover (see also data sheet 95581)						●	●	●	●	U000

Pressure sensors and other sensors

19	Without sensor	0
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Standard/special version

20	Standard version	0
	Special version	S

● = Available ○ = On request - = Not available

Notice

- Note the project planning notes on page 76.
- The Rexroth material numbers of the A15 series 12 contain all form- and function-determining features incl. the settings.

For initial orders or changes, please request the new material number – to do so, use our

[Configurator in the internet:](#)



- For information on the mounting situation of combination pumps, see page 68.

¹⁾ In accordance with ANSI B92.1a

²⁾ The through drives A3, B3 and C3 are equipped with universal through drives with two mounting positions. For painting units, observe the mounting holes pattern when viewed on through drive with control at top (see page 68).

Hydraulic fluids

The A15VSO, A15VLO variable pump is designed for operation with HLP mineral oil according to DIN 51524. See the following data sheets for application instructions and requirements for hydraulic fluids before the start of project planning:

- ▶ 90220: Hydraulic fluids based on mineral oils and related hydrocarbons
- ▶ 90221: Environmentally acceptable hydraulic fluids
- ▶ 90222: Fire-resistant, water-free hydraulic fluids (HFDR/HFDU)

Selection of hydraulic fluid

Bosch Rexroth evaluates hydraulic fluids on the basis of the Fluid Rating according to the technical data sheet 90235.

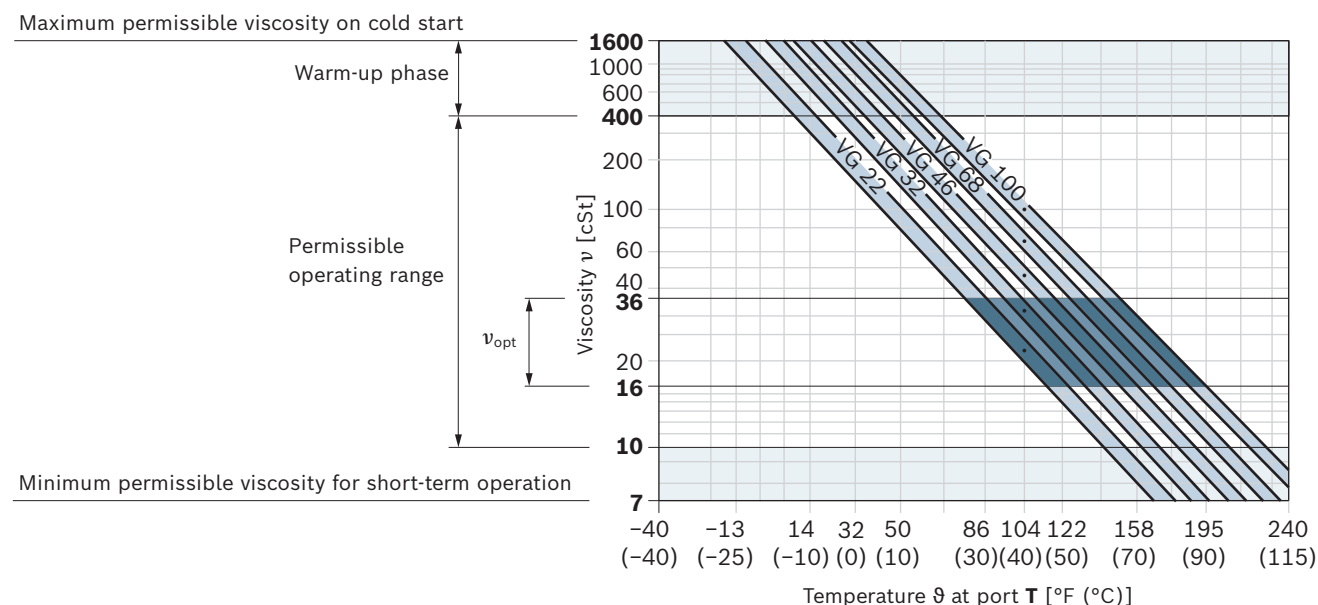
Hydraulic fluids with positive evaluation in the Fluid Rating are listed in the following data sheet: 90245: Bosch Rexroth Fluid Rating List for Rexroth hydraulic components (pumps and motors)

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

Viscosity and temperature of hydraulic fluids

	Viscosity	Shaft seal	Temperature ³⁾	Remarks
Cold start	$v_{max} \leq 1600 \text{ cSt}$	NBR ²⁾	$\vartheta_{St} \geq -40 \text{ °F } (-40 \text{ °C})$	$t \leq 3 \text{ min}$, without load ($p \leq 725 \text{ psi } (50 \text{ bar})$), $n \leq 1000 \text{ rpm}$ Permissible temperature difference between axial piston unit and hydraulic fluid in the system maximum 45 °F (25 K)
		FKM	$\vartheta_{St} \geq -13 \text{ °F } (-25 \text{ °C})$	
Warm-up phase	$v = 1600 \dots 400 \text{ cSt}$			$t \leq 15 \text{ min}$, $p \leq 0.7 \times p_{nom}$ and $n \leq 0.5 \times n_{nom}$
Permissible operating range	$v = 400 \dots 10 \text{ cSt}^{1)}$	NBR ²⁾	$\vartheta \leq +185 \text{ °F } (+85 \text{ °C})$	Measured at port T
		FKM	$\vartheta \leq +230 \text{ °F } (+110 \text{ °C})$	
	$v_{opt} = 36 \dots 16 \text{ cSt}$			Optimal operating viscosity and efficiency range
Short-term operation	$v_{min} = 10 \dots 7 \text{ cSt}$	NBR ²⁾	$\vartheta \leq +185 \text{ °F } (+85 \text{ °C})$	$t \leq 3 \text{ min}$, $p \leq 0.3 \times p_{nom}$, measured at port T
		FKM	$\vartheta \leq +230 \text{ °F } (+110 \text{ °C})$	

▼ Selection diagram



1) This corresponds, for example on the VG 46, to a temperature range of 39 °F to +185 °F (+4 °C to +85 °C) (see selection diagram)

2) Special version, please contact us

3) If the temperature cannot be adhered to due to extreme operating parameters, please contact us.

Filtration of the hydraulic fluid

Finer filtration improves the cleanliness level of the hydraulic fluid, which increases the service life of the axial piston unit.

A cleanliness level of at least 20/18/15 under ISO 4406 should be maintained.

At a hydraulic fluid viscosity of less than 10 cSt (e.g. due to high temperatures during short-term operation) at the drain port, a cleanliness level of at least 19/17/14 under ISO 4406 is required.

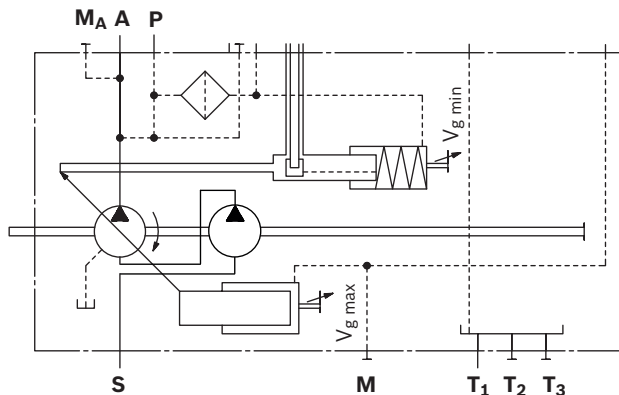
Examples of temperatures of hydraulic fluids at a viscosity of 10 cSt:

- 163 °F (73 °C) 73 °C at HLP 32
- 185 °F (85 °C) 85 °C at HLP 46

Charge pump (impeller)

The charge pump is a centrifugal pump with which the A15VLO is filled and therefore can be operated at higher rotational speeds. This also facilitates cold starting at low temperatures and high viscosity of the hydraulic fluid.

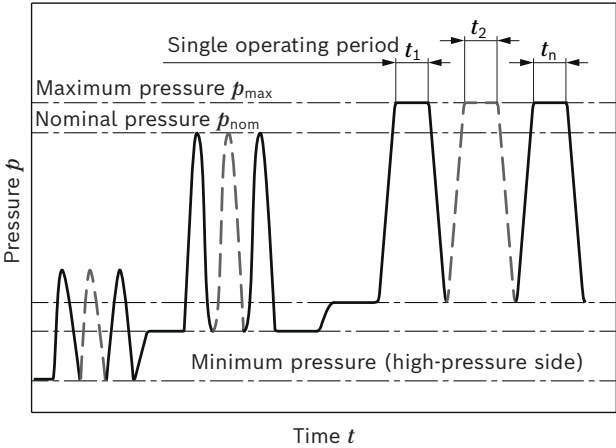
Externally increasing the inlet pressure is therefore unnecessary in most cases. Charging the reservoir with compressed air is not permissible.



Working pressure range

Pressure at working port A		Definition
Nominal pressure p_{nom}	5100 psi (350 bar)	The nominal pressure corresponds to the maximum design pressure. The maximum pressure corresponds to the maximum working pressure within a single operating period. The sum of single operating periods must not exceed the total operating period of 300 h.
Maximum pressure p_{max}	6100 psi (420 bar)	
Single operating period	< 1 s	
Load cycles	< 1 million	
Minimum pressure $p_{A abs}$ (high-pressure side)	220 psi (15 bar) ¹⁾²⁾	Minimum pressure at the high-pressure side (A) which is required in order to prevent damage to the axial piston unit. The minimum pressure depends on the rotational speed and the swivel angle.
Rate of pressure change $R_{A max}$	232000 psi/s (16000 bar/s)	Maximum permissible speed of pressure build-up and reduction during a pressure change across the entire pressure range.
Pressure at suction port S (inlet)		
Version without charge pump (A15VSO)		Minimum pressure at suction port S (inlet) which is required to prevent damage to the axial piston unit. The minimum pressure depends on the rotational speed and displacement volume of the axial piston unit (see diagram on page 11 and footnote ⁴⁾ Technical data on page 9 and 10).
Minimum pressure $p_{S min}$	≥ 12 psi (0.8 bar) absolute	
Maximum pressure $p_{S max}$	≤ 435 psi (30 bar)	
Version with charge pump (A15VLO)		
Minimum pressure $p_{S min}$	≥ 10.5 psi (0.7 bar) absolute	
Maximum pressure $p_{S max}$	≤ 30 psi (2 bar) absolute	
Case pressure at port T ₁ , T ₂ , T ₃		
Max. static pressure $p_{L max}$	45 psi (3 bar)	Maximum 18 psi (1.2 bar) higher than inlet pressure at port S , but not higher than $p_{L max}$. A drain line to the reservoir is required.
Pressure peaks $p_{L peak}$	75 psi (5 bar)	t < 0.1 s
External control pressure P (type code position 08 version B and C)		
Minimum pressure $p_{P nom}$	435 psi (30 bar)	Control systems with external control pressure supply need a control pressure appropriate to the adjustment time and size.
Maximum pressure $p_{P max}$	725 psi (50 bar)	

▼ Pressure definition



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

1) Lower values on request
2) See also footnote 4 on page 9 and 10

Notice

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

Technical data

Without charge pump (A15VSO) rotary group version E and P

Size		NG		110	145	175	210	280
Displacement, geometric, per revolution	$V_{g \max}$	in ³		6.71	8.85	10.68	12.81	17.09
			cm ³	110.0	145.0	175.0	210.0	280.0
	$V_{g \min}$	in ³ (cm ³)		0	0	0	0	0
Rotational speed maximum ¹⁾	at $V_{g \max}^{2)}$ version E	n_{nom}	rpm	2400	–	–	–	–
	at $V_{g \max}^{2)}$ version P			–	2300	2150	2100	1800
	at $V_g \leq V_{g \max}^{3)}$ version E	n_{max}	rpm	2400	–	–	–	–
	at $V_g \leq V_{g \max}^{3)}$ version P			–	2600	2500	2350 ⁴⁾	2150 ⁴⁾
Flow	at n_{nom} and $V_{g \max}$	q_v	gpm (l/min)	70 (264)	88 (334)	99 (376)	117 (441)	133 (504)
Power	at n_{nom} , $V_{g \max}$ and $\Delta p = 5100$ psi (350 bar)	P	hp	207	261	294	349	394
			kW	154	195	219	257	294
Torque	at $V_{g \max}$ and $\Delta p = 5100$ psi (350 bar) ²⁾	M	lb-ft	452	596	719	863	1151
			Nm	613	808	975	1170	1560
Rotary stiffness of drive shaft	1 3/4 in 13T 8/16DP	T1	c	lb-ft/rad	–	173327	179227	187340
				kNm/rad	–	235	243	254
	2 in 15T 8/16DP	T2	c	lb-ft/rad	–	210942	219794	231595
				kNm/rad	–	286	298	314
	2 1/4 in 17T 8/16DP	T3	c	lb-ft/rad	–	–	–	382795
				kNm/rad	–	–	–	519
	W45	B1	c	lb-ft/rad	178489	–	–	–
				kNm/rad	242	–	–	–
	W50	B2	c	lb-ft/rad	–	246345	263309	281011
				kNm/rad	–	334	357	381
	W60	B4	c	lb-ft/rad	–	–	–	475727
				kNm/rad	–	–	–	645
	2 in	L2	c	lb-ft/rad	–	–	–	358455
				kNm/rad	–	–	–	486
Moment of inertia rotary group	version E	J_{TW}	lb-ft ²	0.5221	–	–	–	–
			kgm ²	0.022	–	–	–	–
	version P	J_{TW}	lb-ft ²	–	0.8306	1.0679	1.4238	2.3019
Maximum angular acceleration ⁵⁾	version E	α	rad/s ²	7465	–	–	–	–
	version P	α	rad/s ²	–	6298	5609	5014	4200
Case volume	V		gal (l)	0.58 (2.2)	0.71 (2.7)	0.95 (3.6)	1.06 (4)	1.72 (6.5)
Weight (without through drive) approx.	m		lbs (kg)	141 (64)	174 (79)	214 (97)	245 (111)	315 (143)

- 1) The values are applicable:
- for the optimum viscosity range from $\nu_{\text{opt}} = 36$ to 16 cSt
 - with hydraulic fluid based on mineral oils
- 2) The values apply at absolute pressure $p_{\text{abs}} = 15$ psi (1 bar) at suction port **S**.
- 3) Maximum rotational speed (speed limit) for increased inlet pressure p_{abs} at suction port **S** and $V_g < V_{g \max}$, see diagram page 11.
- 4) If both conditions listed in the following table are met, the rotational speed can be increased:

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

Determination of characteristics see page 11

NG	Speed [rpm]	Pressure at port A $p_{A \text{ abs}}$ [psi (bar)]	Swivel angle [%]
280	2300	minimum 510 (35)	minimum 10
210	2500	minimum 510 (35)	minimum 10

Technical data

With charge pump (A15VLO) rotary group version P

Size		NG		145	175	210	280
Displacement, geometric, per revolution	$V_{g \max}$	in ³		8.85	10.68	12.81	17.09
			cm ³	145.0	175.0	210.0	280.0
	$V_{g \min}$	in ³		0	0	0	0
			cm ³	0	0	0	0
Rotational speed maximum ¹⁾	at $V_{g \max}$ ²⁾	n_{nom}	rpm	2600 ³⁾	2500 ³⁾	2350 ⁴⁾	2150 ⁴⁾
	at $V_g \leq V_{g \max}$	n_{max}	rpm	2600 ³⁾	2500 ³⁾	2350 ⁴⁾	2150 ⁴⁾
Flow	at n_{nom} and $V_{g \max}$	q_v	gpm	100	116	130	159
			l/min	377	438	493	602
Power	at n_{nom} , $V_{g \max}$ and $\Delta p = 5100 \text{ psi (350 bar)}$	P	hp	295	342	386	470
			kW	220	255	288	351
Torque	at $V_{g \max}$ and $\Delta p = 5100 \text{ psi (350 bar)}^{2)}$	M	lb-ft	596	719	863	1151
			Nm	808	975	1170	1560
Rotary stiffness of drive shaft	1 3/4 in 13T 8/16DP T1	c	lb-ft/rad	173327	179227	187340	–
			kNm/rad	235	243	254	–
	2 in 15T 8/16DP T2	c	lb-ft/rad	210942	219794	231595	–
			kNm/rad	286	298	314	–
	2 1/4 in 17T 8/16DP T3	c	lb-ft/rad	–	–	–	382795
			kNm/rad	–	–	–	519
Moment of inertia		J_{TW}	lb-ft ²	0.8306	1.0679	1.4238	2.3019
			kgm ²	0.035	0.047	0.063	0.1
Maximum angular acceleration ⁵⁾		α	rad/s ²	6298	5609	5014	4100
Case volume		V	gpm	0.77	0.95	0.98	1.48
			(l)	2.9	3.6	3.7	5.6
Weight (without through drive) approx.		m	lbs	203	243	276	326
			(kg)	92	110	125	148

Determining the operating characteristics see on page 11

Notes

- Theoretical values, without efficiency and tolerances; values rounded
- Operation above the maximum values or below the minimum values may result in a loss of function, a reduced service life or in the destruction of the axial piston unit. We recommend checking loads through tests or calculation/simulation and comparing them with the permissible values.

- The values are applicable:
 - for the optimum viscosity range from $\nu_{\text{opt}} = 36$ to 16 cSt
 - with hydraulic fluid based on mineral oils
- The values apply at absolute pressure $p_{\text{abs}} = 15 \text{ psi (1 bar)}$ at suction port **S**.
- Maximum rotational speed (speed limit) for increased inlet pressure p_{abs} at suction port **S** and $V_g < V_{g \max}$, see diagram page 11.
- If both conditions listed in the following table are met, the rotational speed can be increased:

NG	Speed [rpm]	Pressure at port A $p_{\text{A abs}}$ [psi (bar)]	Swivel angle [%]
280	2300	minimum 510 (35)	minimum 10
210	2500	minimum 510 (35)	minimum 10

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

Determining the characteristics

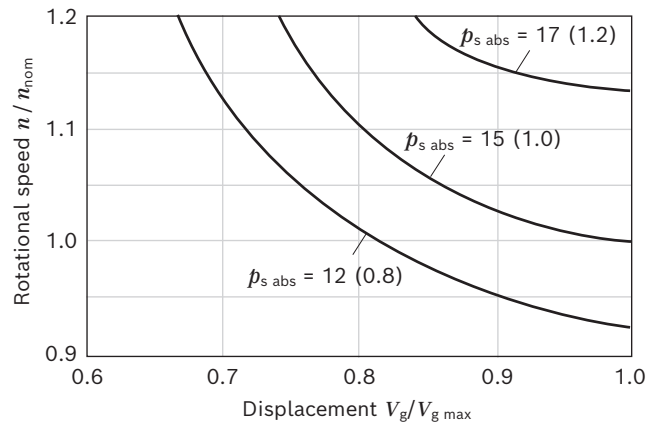
Flow	$q_v = \frac{V_g \times n \times \eta_v}{231}$	[gpm]
	$q_v = \frac{V_g \times n \times \eta_v}{1000}$	[l/min]
Torque	$M = \frac{V_g \times \Delta p}{24 \times \pi \times \eta_{hm}}$	[lb-ft]
	$M = \frac{V_g \times \Delta p}{20 \times \pi \times \eta_{hm}}$	[Nm]
Power	$P = \frac{2 \pi \times M \times n}{33000} = \frac{q_v \times \Delta p}{1714 \times \eta_t}$	[hp]
	$P = \frac{2 \pi \times M \times n}{60000} = \frac{q_v \times \Delta p}{600 \times \eta_t}$	[kW]

Key

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

Maximum permissible rotational speed (speed limit)

($p_{s\ abs}$ = Inlet pressure [psi (bar)])



Notes

- The maximum permissible rotational speed n_{max} must not be exceeded (see table of values on page 9).

Permissible radial and axial forces of the drive shafts

Size	NG		110	110	145	145	145	175	175	175	210	210	210	280	280
Drive shaft			1 3/4 in	W45	1 3/4 in	2 in	W50	1 3/4 in	2 in	W50	1 3/4 in	2 in	W50	2 1/4 in	W60
Maximum radial force at distance a (from shaft collar)	$F_q \text{ max}$	lb	1798	1798	2473	2473	2473	2765	2765	3147	3805	3805	3822	4046	5305
		N	8000	8000	11000	11000	11000	12300	12300	14000	16925	16925	17000	18000	23600
	a	in	1.32	0.98	1.32	1.57	1.08	1.32	1.57	1.06	1.32	1.57	1.06	1.57	1.14
		mm	33.5	25	33.5	40	27.5	33.5	40	27	33.5	40	27	40	29
															
Maximum axial force	$+ F_{ax} \text{ max}$	lb	270	270	304	304	304	315	315	315	326	326	326	405	405
		N	1200	1200	1350	1350	1350	1400	1400	1400	1450	1450	1450	1800	1800
	$- F_{ax} \text{ max}$	lb	112	112	135	135	135	146	146	146	157	157	157	191	191
		N	500	500	600	600	600	650	650	650	700	700	700	850	850
															

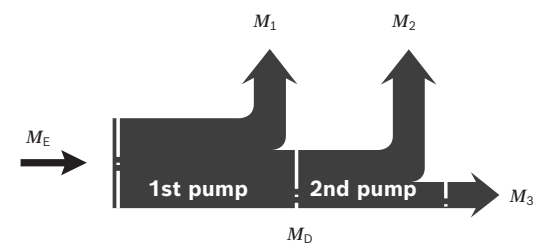
Notes

- The values given are maximum values and do not apply to continuous operation. All loads of the drive shaft reduce the bearing service life!

Permissible input and through-drive torques

Size			NG	110	145	175	210	280	
Torque at $V_{g\ max}$ and $\Delta p = 5100\ \text{psi}\ (350\ \text{bar})^{1)}$			$M_{\max}$	lb-ft	452	596	719	863	1151
				Nm	610	808	975	1170	1560
Maximum input torque at drive shaft ²⁾									
T1	1 3/4 in		$M_{E\ \max}$	lb-ft	1210	1210	1210	1210	–
				Nm	1640	1640	1640	1640	–
T2	2 in		$M_{E\ \max}$	lb-ft	–	1969	1969	1969	–
				Nm	–	2670	2670	2670	–
T3	2 1/4 in		$M_{E\ \max}$	lb-ft	–	–	–	–	3231
				Nm	–	–	–	–	4380
B1	Ø 45		$M_{E\ \max}$	lb-ft	774	–	–	–	–
				Nm	1050	–	–	–	–
B2	Ø 50		$M_{E\ \max}$	lb-ft	–	1106	1106	1106	–
				Nm	–	1500	1500	1500	–
B4	Ø 60		$M_{E\ \max}$	lb-ft	–	–	–	–	2065
				Nm	–	–	–	–	2800
L2	2 in		$M_{E\ \max}$	lb-ft	–	–	–	–	2065
				Nm	–	–	–	–	2800
Maximum through-drive torque									
			$M_{D\ \max}$	lb-ft	708	819	988	1412	1641
				Nm	960	1110	1340	1915	2225

▼ Distribution of torques



Torque at 1st pump	M_1
Torque at 2nd pump	M_2
Torque at 3rd pump	M_3
Input torque	$M_E = M_1 + M_2 + M_3$
	$M_E < M_{E\ \max}$
Through-drive torque	$M_D = M_2 + M_3$
	$M_D < M_{D\ \max}$

External control pressure supply
(type code position 08 B and C)

Control systems with external control pressure supply need a flow appropriate to the adjustment time and size. See also page 18

Size	Flow [gpm (l/min)] with 100 ms swivel time
110	2.64 (10)
145	3.43 (13)
175	3.70 (14)
210	4.49 (17)
280	5.81 (22)

1) Efficiency not considered
2) For drive shafts free of radial force

Power controller

LR – Power controller, fixed setting

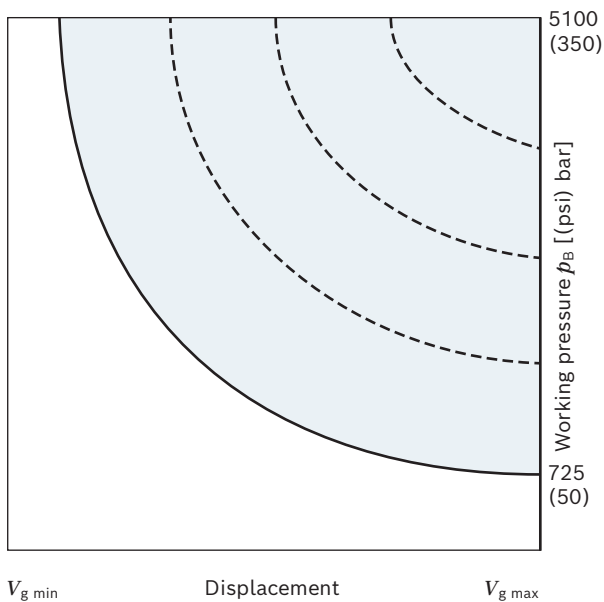
The power controller regulates the displacement of the pump depending on the working pressure so that a given drive power is not exceeded at constant drive speed. The precise control with a hyperbolic characteristic curve, provides an optimum utilization of available power. The working pressure acts on a rocker via a measuring spool moved together with the control. An externally adjustable spring force counteracts this, it determines the power setting. The depressurized basic position is $V_{g \max}$. If the working pressure exceeds the set spring force, the control valve will be actuated by the rocker and the pump will swivel back from the basic setting $V_{g \max}$ toward $V_{g \min}$. Here, the lever length at the rocker is shortened and the working pressure can increase at the same rate as the displacement is reduced ($p_B \times V_g = \text{constant}$; p_B = working pressure; V_g = displacement). The hydraulic output power (characteristic curve LR) is influenced by the efficiency of the pump. Setting range for beginning of control is 725 psi (50 bar) to 5100 psi (350 bar) (see table on the right).

When ordering, state in plain text:

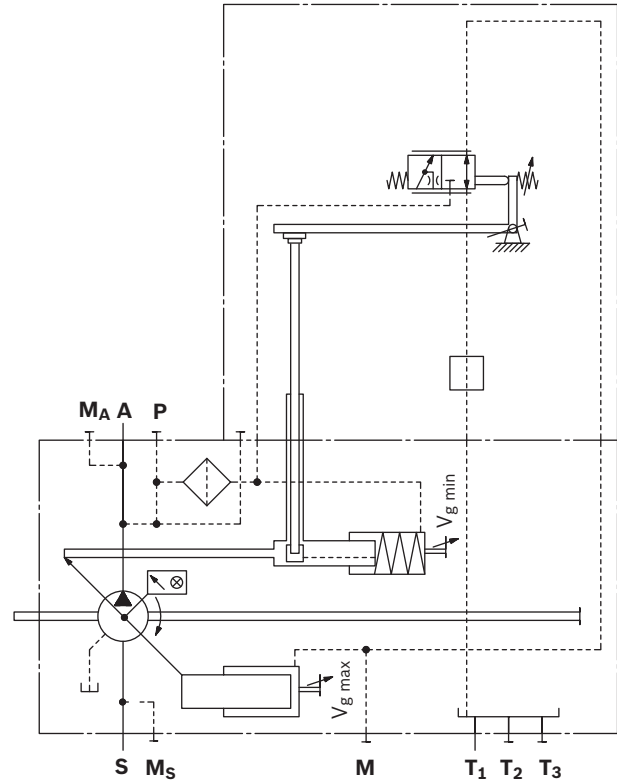
- ▶ Drive power P [hp (kW)]
- ▶ Drive speed n [rpm]
- ▶ Maximum flow $q_{V \max}$ [gpm (l/min)]

Please contact us if you need a performance chart.

▼ Characteristic curve LR



▼ Circuit diagram LR



Size	Rotational speed [rpm]		
	1000	1500	1800
	Minimum adjustable drive power [hp (kW)] (at 725 psi (50 bar) beginning of control)		
110	15 (11)	23 (17)	27 (20)
145	19 (14)	29 (21)	34 (25)
175	23 (17)	34 (25)	41 (30)
210	27 (20)	41 (30)	49 (36)
280	35 (26)	53 (39)	64 (47)

L4 – Power controller, electric-proportional override (negative control)

A control current acts against the adjustment spring of the power controller via a proportional solenoid. The mechanically adjusted basic power setting can be reduced by means of different control current settings. Increasing control current = reduced power. The following amplifiers are recommended for industrial applications and are available for controlling the proportional solenoids:

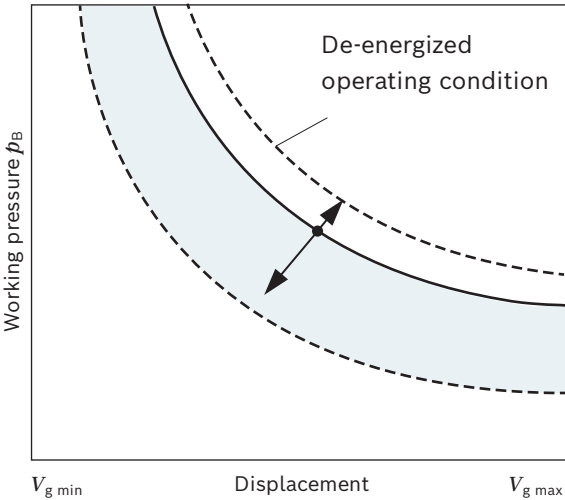
- ▶ Amplifier module VT-MSPA1-2X data sheet 30232
Further information can also be found on the Internet at www.boschrexroth.com/industrial-hydraulics-catalog/

Technical data, solenoid	L4
Voltage	24 V (±20%)
Control current	
Start of control	200 mA
End of control	600 mA
Current limit	0.77 A
Nominal resistance (at 68 °F (20 °C))	22.7 Ω
Dither frequency	100 Hz
Duty cycle	100%
Type of protection: see connector version on page 72	

When ordering, state in plain text:

- ▶ Drive power P [hp (kW)] at beginning of control
▶ Drive speed n [rpm]
▶ Maximum flow $q_{V\ max}$ [gpm (l/min)]

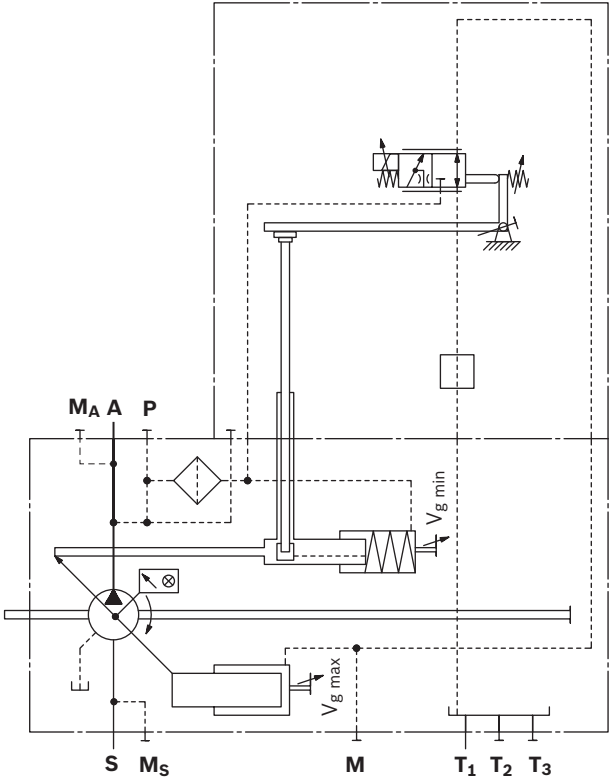
▼ Effect of power override through current increase or de-energized operating condition



Notice

In operating condition **L4** de-energized (jump 200 to 0 mA):
Power increase by a factor of 1 of the table values.

▼ Circuit diagram L4



Reduction of power by control current to the proportional solenoids with **L4**¹⁾

Power reduction/control current [hp (kW)/100 mA]

Size	Rotational speed [rpm]		
	1000	1500	1800
110	16.5 (12.3)	24.8 (18.5)	29.6 (22.1)
145	19.8 (14.8)	29.8 (22.2)	35.7 (26.6)
175	22.5 (16.8)	33.8 (25.2)	40.5 (30.2)
210	25.3 (18.9)	38.1 (28.4)	45.6 (34.0)
280	30.7 (22.9)	46.1 (34.4)	55.3 (41.2)

¹⁾ Values in the tables are reference points. Determination of the exact power override on request.

CR – Summation power control of two power-controlled pumps, high-pressure-dependent override (with stop)

With two pumps of the same size working in different operating circuits, the CR controller limits the overall power.

The CR works like the normal LR with a fixed maximum power setting along the power hyperbola. The high-pressure-related override reduces the power setpoint in dependence on the working pressure of the other pump. That happens proportionally below the beginning of control and is blocked by a stop when the minimum power is reached. Here, the **CR** port of the one pump has to be connected to the **M_A** port of the other pump.

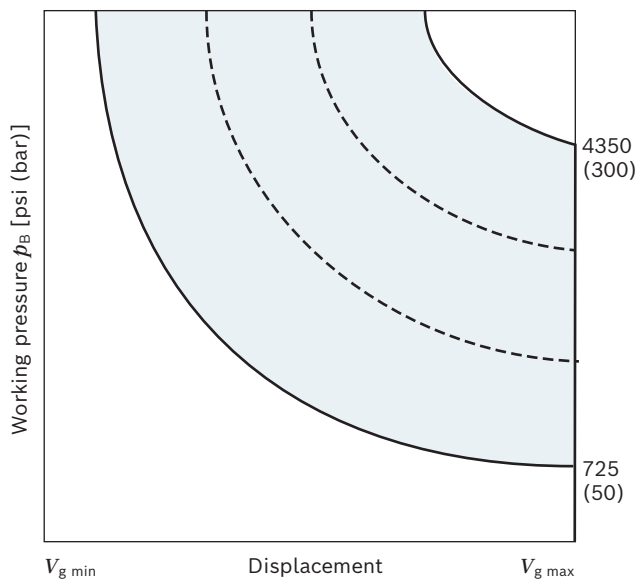
The maximum power of the first pump is reached when the second pump is working at idle when depressurized. When defining the maximum power, the idle power of the second pump has to be taken into account. The minimum power of each pump is reached when both pumps are working at high pressure. The minimum power usually equates to 50% of the total power. Power that is released by the pressure controller or other overrides remains unconsidered.

Setting range for beginning of control is 725 psi (50 bar) to 4350 psi (300 bar).

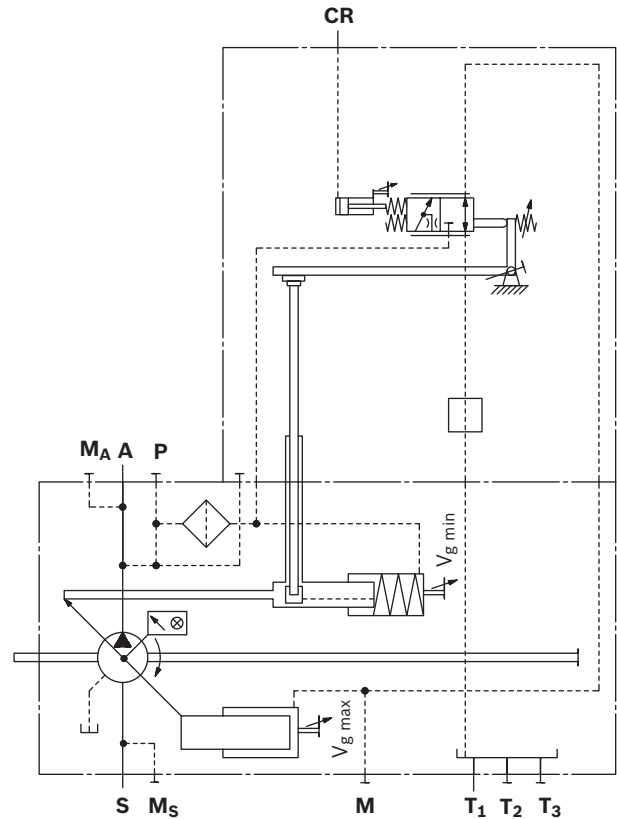
When ordering, please specify separately for each pump:

- ▶ Maximum drive power $P_{\max}$ [hp (kW)]
- ▶ Minimum drive power $P_{\min}$ [hp (kW)]
- ▶ Drive speed n [rpm]
- ▶ Maximum flow $q_{V \max}$ [gpm (l/min)]

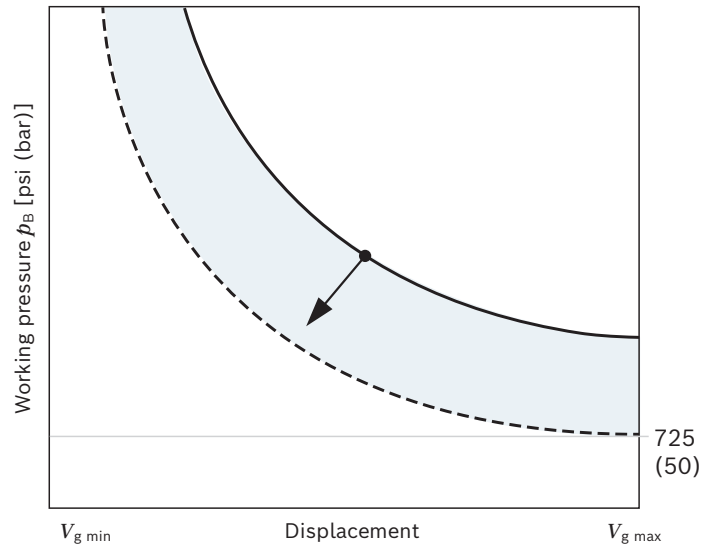
▼ Characteristic curve CR



▼ Circuit diagram CR



▼ Effect of power override of a pump with increasing pressure in the 2nd pump



PR – Summation power control of a power-controlled pump and a constant pump

Together with the mounted fixed pump, the PR controller on an A15V(L)O effects a limitation of the overall power. The PR works like the normal LR with a fixed maximum power setting along the power hyperbola. The high-pressure-dependent override reduces the power specification in proportion to the working pressure of the fixed pump. Here, port **PR** of the A15V(L)O must be connected to the working pressure of the fixed pump. The power of the controlled pump can then be reduced to zero in a borderline case.

The maximum power of the controlled pump is reached when the fixed pump works at idle when depressurized. When defining the maximum power, the idle power of the fixed pump has to be taken into account.

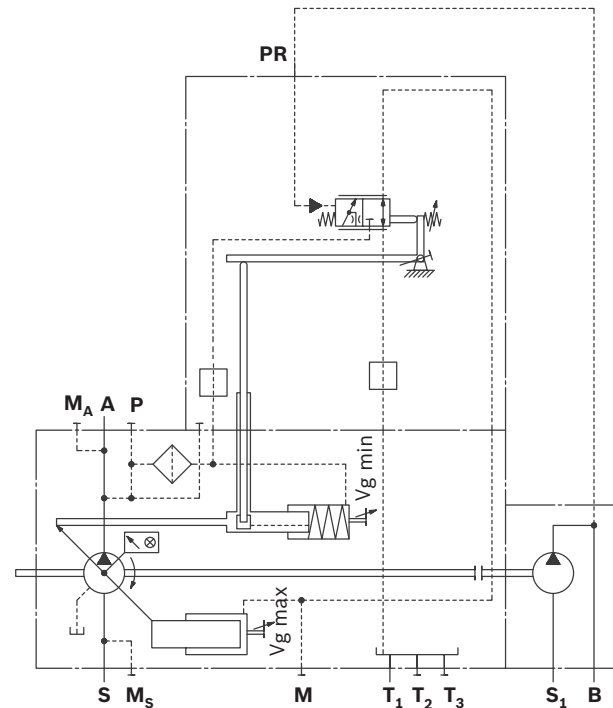
Power that is released by the pressure controller or other overrides remains unconsidered.

Setting range for beginning of control is 725 psi (50 bar) to 5100 psi (350 bar).

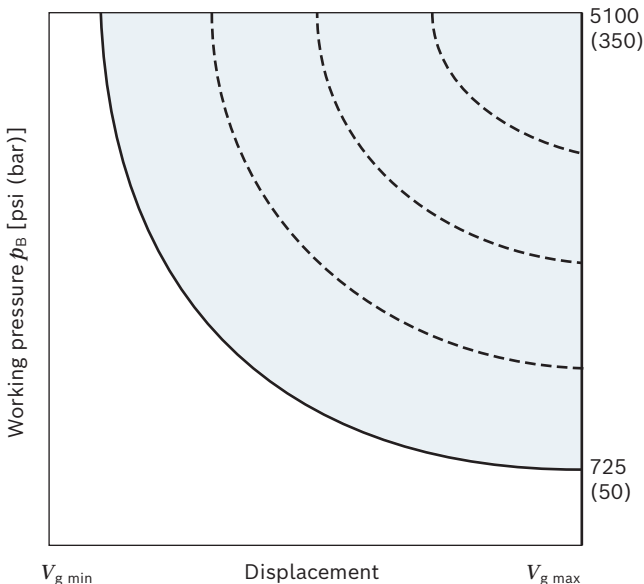
When ordering, state in plain text:

- ▶ Maximum drive power $P_{\max}$ [hp (kW)]
- ▶ Drive speed n [rpm]
- ▶ Maximum flow $q_{V \max}$ [gpm (l/min)]
- ▶ Size of the fixed pump

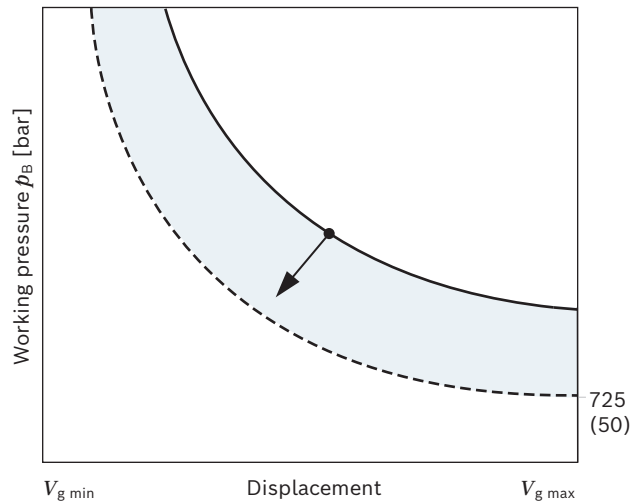
▼ Circuit diagram PR



▼ Characteristic curve PR



▼ Effect of power override of a pump with increasing pressure in the 2nd pump



Stroke control

E2 – Stroke control, electric, proportional (positive control)

With the electrical stroke control with proportional solenoid, the pump displacement is steplessly adjusted in proportion to the current via the magnetic force.

Basic position without pilot signal is $V_{g \min}$.

The mechanical depressurized basic position is $V_{g \min}$ (see type code 08, letter C).

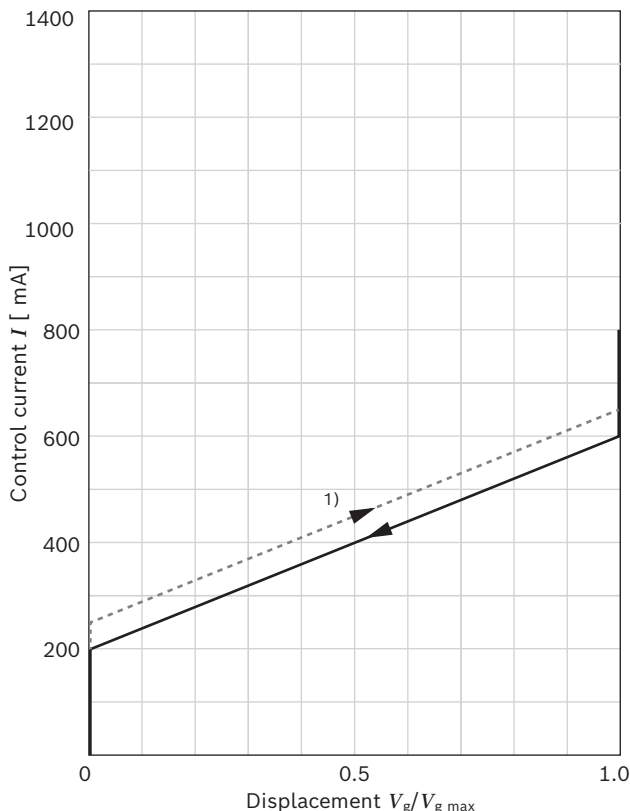
With increasing control current and flow, the pump swivels to a higher displacement (from $V_{g \min}$ to $V_{g \max}$).

The required control fluid is taken from the working pressure or the external control pressure applied to port **P**. If the pump is to be adjusted from the basic position $V_{g \min}$ or from a low working pressure, port **P** must be supplied with an external control pressure of at least 435 psi (30 bar), maximum 725 psi (50 bar).

Notice

If there is no external control pressure applied to **P**, the version "Maximum swivel angle ($V_{g \max}$), without external control pressure supply" must be ordered (see type code position 08, A).

▼ Characteristic curve E2



The following amplifiers are recommended for industrial applications and are available for controlling the proportional solenoids:

► Amplifier module VT-MSPA1-2X data sheet 30232

Further information can also be found on the Internet at www.boschrexroth.com/industrial-hydraulics-catalog/

Technical data, solenoid	E2
Voltage	24 V ($\pm 20\%$)
Control current	
Beginning of control at $V_{g \min}$	200 mA
End of control at $V_{g \max}$	600 mA ¹⁾
Current limit	0.77 A
Nominal resistance (at 68 °F (20 °C))	22.7 Ω
Dither frequency	100 Hz
Duty cycle	100%
Type of protection: see connector version on page 72	

When ordering, state in plain text:

- Drive speed n [rpm]
- Maximum flow $q_{V \max}$ [gpm (l/min)]
- Minimum flow $q_{V \min}$ [gpm (l/min)]

See circuit diagram on page 18

Notice!

The spring feedback in the controller is not a safety device.

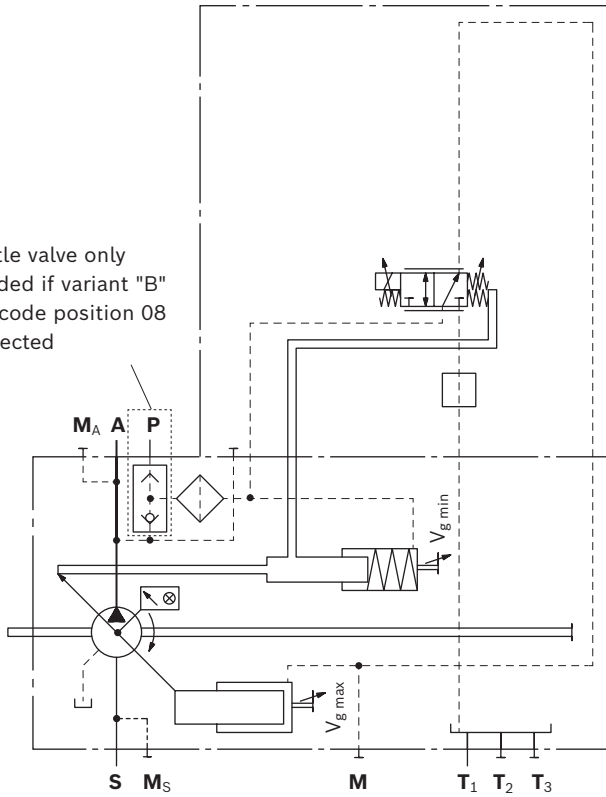
The controller can stick in an undefined position due to internal contamination (contaminated hydraulic fluid, abrasion or residual contamination from system components). As a result, the flow in the axial piston unit will no longer respond correctly to the operator's specifications.

Check whether the application on your machine requires additional safety measures to bring the driven consumer to a safe position (immediate stop). If necessary, make sure these are appropriately implemented.

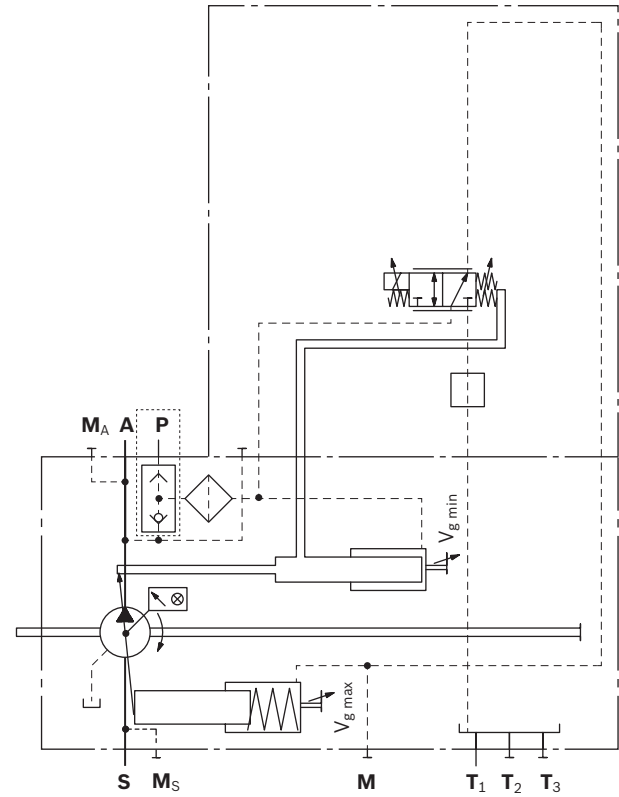
¹⁾ Because of the control hysteresis, a control current of up to 650 mA may be required for the $V_{g \max}$ position.

▼ **Circuit diagram E2**
Basic position A/B,
depressurized at maximum
swivel angle ($V_{g \max}$)

Shuttle valve only
included if variant "B"
type code position 08
is selected



▼ **Circuit diagram E2**
Basic setting C,
depressurized at minimum
swivel angle ($V_{g \min}$)



E6 – Stroke control, electric, proportional (positive control)

With the electric two-point stroke control with switching solenoid, the displacement of the pump is adjusted between $V_{g \min}$ and $V_{g \max}$.

Basic setting without current is $V_{g \min}$. This includes the mechanically depressurized basic setting $V_{g \min}$ (see type code digit 08).

When the solenoid is energized, the pump swivels from $V_{g \min}$ to $V_{g \max}$.

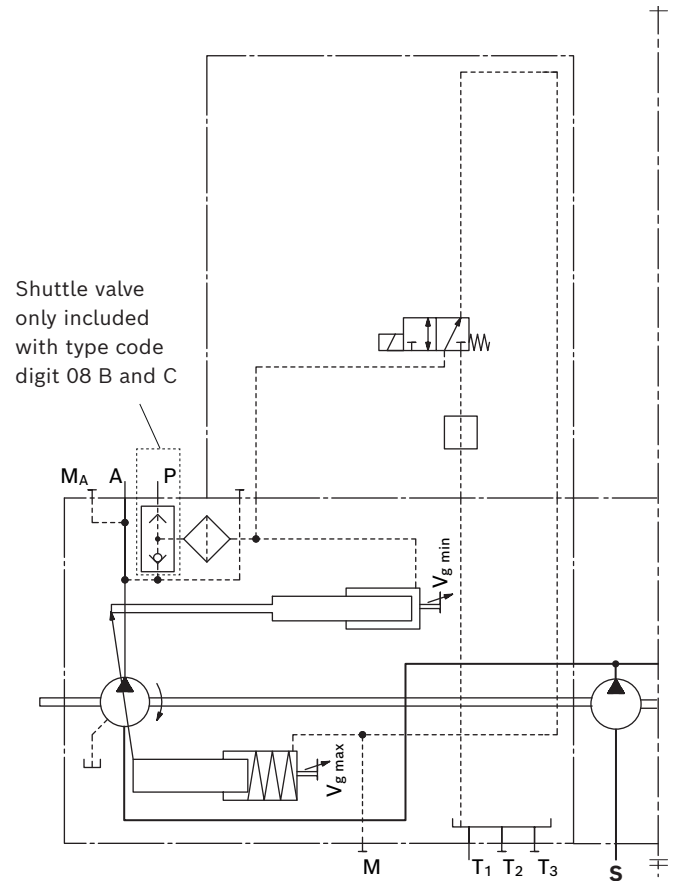
The required control power is taken from the working pressure or the external control pressure applied to port **P**. To enable the pump to be adjusted from the basic setting $V_{g \min}$ or from a low working pressure, port **P** must be supplied with an external control pressure of at least 435 psi (30 bar), maximum 725 psi (50 bar).

Notice

If no external control pressure is connected to **P**, the version "Maximum swivel angle ($V_{g \max}$), without external control pressure supply" must be ordered (see type code digit 08, A).

Technical data, solenoid	E6
Voltage	24 V
Nominal resistance (at 68 °F (20 °C))	21.7 Ω
Nominal power	26.5 W
Test current	0.67 A
Duty cycle	100%
Type of protection: see connector version on page 72	

▼ Circuit diagram E6



Notice

The spring feedback in the controller is not a safety device.

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

Check whether your application requires that remedial measures be taken on your machine in order to bring the driven consumer into a safe position (e.g. immediate stop). If necessary, make sure these are appropriately implemented.

H3 – Stroke control, hydraulic-proportional, pilot pressure (negative control)

With pilot-pressure related control, the pump displacement is adjusted in proportion to the pilot pressure applied at port **H3**.

Basic position without pilot signal is $V_{g \max}$.

The mechanical depressurized basic position is $V_{g \max}$ (see type code 08, letter B).

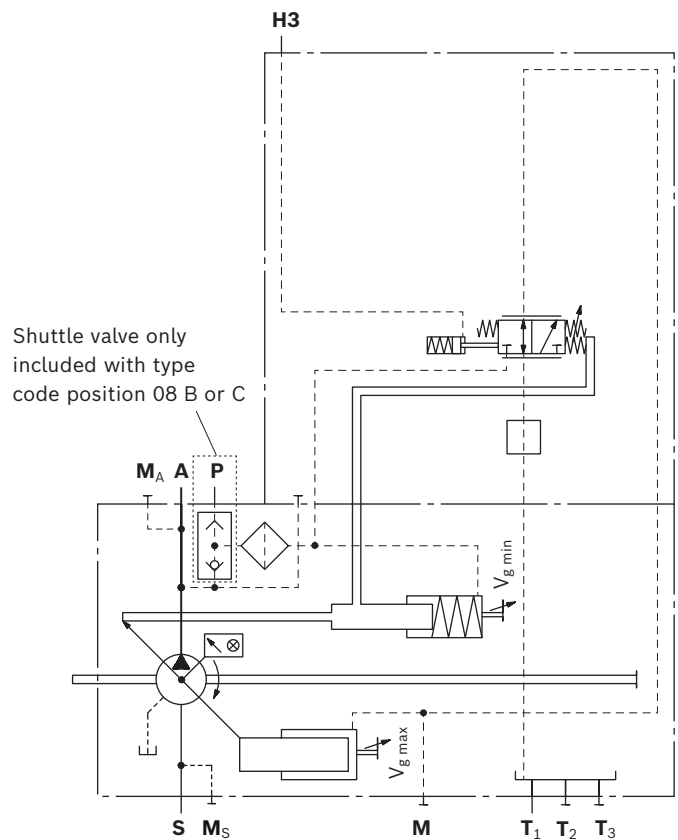
- ▶ Control from $V_{g \max}$ to $V_{g \min}$
With increasing pilot pressure the pump swivels to a smaller displacement.
- ▶ Setting range for start of control (at $V_{g \max}$) is 100 psi (7 bar) to 145 psi (10 bar), standard is 145 psi (10 bar).
Setting range 75 psi (5 bar) to 100 psi (7 bar) upon request.
State the beginning of control in plain text in the order.
- ▶ Maximum permissible pilot pressure $p_{St \max} = 1450$ psi (100 bar)

The required control fluid is taken from the working pressure or the external control pressure applied to port **P**. If the pump is to be adjusted from the basic position $V_{g \min}$ or from a low working pressure, port **P** must be supplied with an external control pressure of at least 435 psi (30 bar), maximum 725 psi (50 bar).

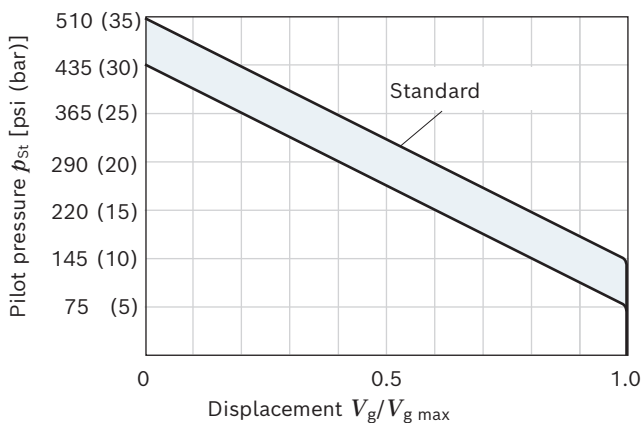
Notice

If there is no external control pressure applied to **P**, the version "Maximum swivel angle ($V_{g \max}$), without external control pressure supply" must be ordered (see type code position 08, letter A).

▼ Circuit diagram H3



▼ Characteristic curve H3 (negative)



Pilot pressure increase $V_{g \max}$ to $V_{g \min}$:

$$\Delta p = 365 \text{ psi (25 bar)}$$

When ordering, state in plain text:

- ▶ Beginning of control [bar] at $V_{g \max}$

H4 – Stroke control, hydraulic-proportional, pilot pressure (positive control)

With pilot-pressure related control, the pump displacement is adjusted proportionally and continuously with a pilot pressure applied at port **H4**.

Basic position without pilot signal is $V_{g \min}$.

The mechanical depressurized basic position is $V_{g \min}$ (see type code position 08, letter C).

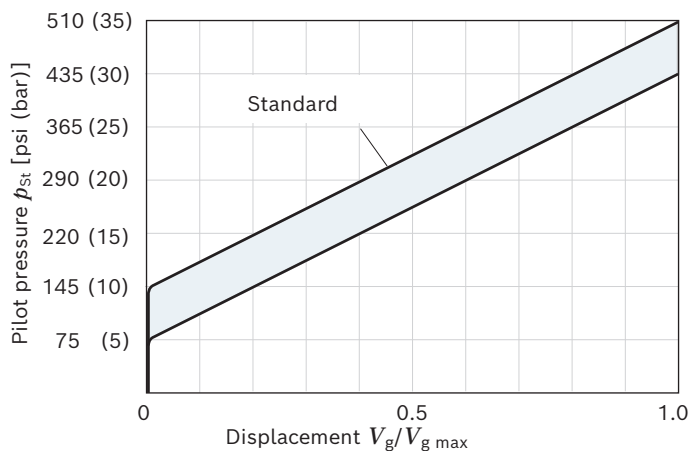
- Control from $V_{g \min}$ to $V_{g \max}$
With increasing pilot pressure the pump swivels to a higher displacement.
- Setting range for start of control (at $V_{g \min}$) is 75 psi (5 bar) to 145 psi (10 bar), standard is 145 psi (10 bar). State the beginning of control in plain text in the order.
- Maximum permissible pilot pressure $p_{St \max} = 1450$ psi (100 bar)

The required control fluid is taken from the working pressure or the external control pressure applied to port **P**. If the pump is to be adjusted from the basic position $V_{g \min}$ or from a low working pressure, port **P** must be supplied with an external control pressure of at least 435 psi (30 bar), maximum 725 psi (50 bar).

Notice

If there is no external control pressure applied to **P**, the version "Maximum swivel angle ($V_{g \max}$), without external control pressure supply" must be ordered (see type code position 08, letter A).

▼ Characteristic curve H4 (positive)



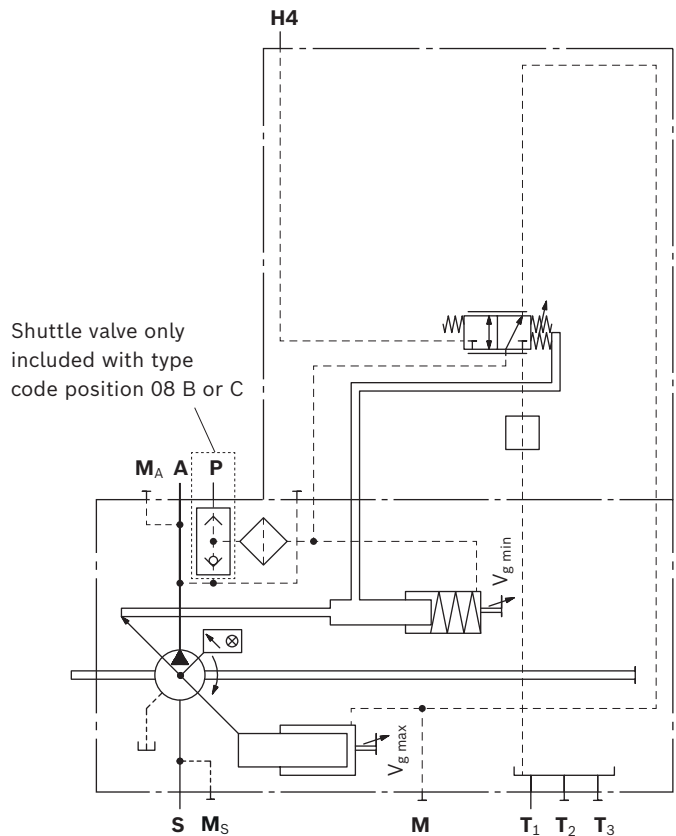
Pilot pressure increase $V_{g \min}$ to $V_{g \max}$:

$$\Delta p = 365 \text{ psi (25 bar)}$$

When ordering, state in plain text:

- Beginning of control [bar] at $V_{g \min}$

▼ Circuit diagram H4



Notice!

The spring feedback in the controller is not a safety device.

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

Check whether the application on your machine requires additional safety measures to bring the driven consumer to a safe position (immediate stop). If necessary, make sure these are appropriately implemented.

H5 – Stroke control, hydraulic-proportional, pilot pressure (negative control)

With pilot-pressure related control, the pump displacement is adjusted in proportion to the pilot pressure applied at port **H5**.

Basic position without pilot signal is $V_{g \max}$, which includes the mechanically depressurized basic position $V_{g \max}$ (see type code digit 08).

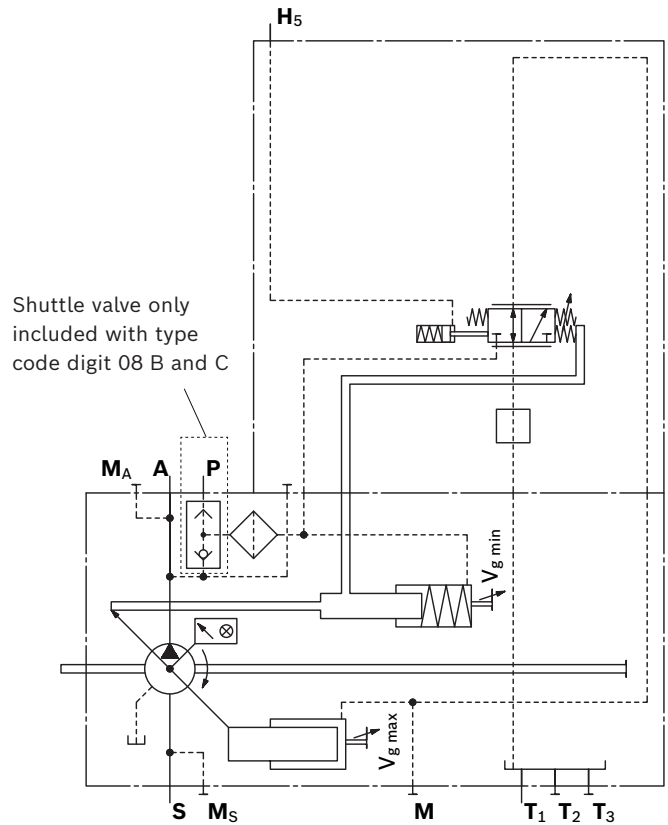
- ▶ Maximum permissible pilot pressure $p_{St \max} = 1450$ psi (100 bar)
- ▶ Control from $V_{g \max}$ to $V_{g \min}$
With increasing pilot pressure the pump swivels to a smaller displacement.
- ▶ Beginning of control (at $V_{g \max}$) 145 psi (10 bar)

The required control power is taken from the working pressure or the external control pressure applied to port **P**. If the pump is to be adjusted at low working pressure, port **P** must have an external control pressure supply of at least 435 psi (30 bar), maximum 725 psi (50 bar).

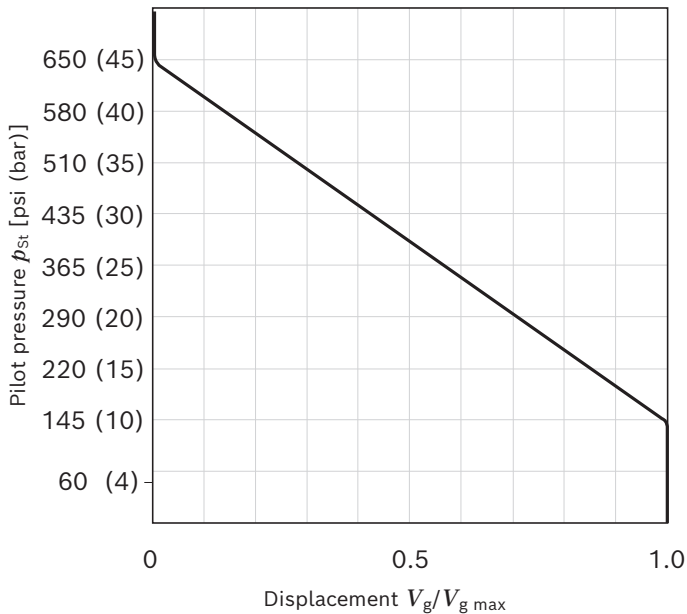
Notice

If no external control pressure is connected to **P**, the version "Maximum swivel angle ($V_{g \max}$), without external control pressure supply" must be ordered (see type code digit 08, A).

▼ Circuit diagram H5



▼ Characteristic curve H5 (negative)



Pilot pressure increase $V_{g \max}$ to $V_{g \min}$: $\Delta p = 35$ bar

Notice!

The spring feedback in the controller is not a safety device.

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

Check whether the application on your machine requires additional safety measures to bring the driven consumer to a safe position (immediate stop). If necessary, make sure these are appropriately implemented.

H6 – Stroke control, hydraulic-proportional, pilot pressure (positive control)

With pilot-pressure related control, the pump displacement is adjusted in proportion to the pilot pressure applied at port **H6**.

Basic position without pilot signal is $V_{g \min}$, which includes the mechanically depressurized basic position $V_{g \min}$ (see type code digit 08).

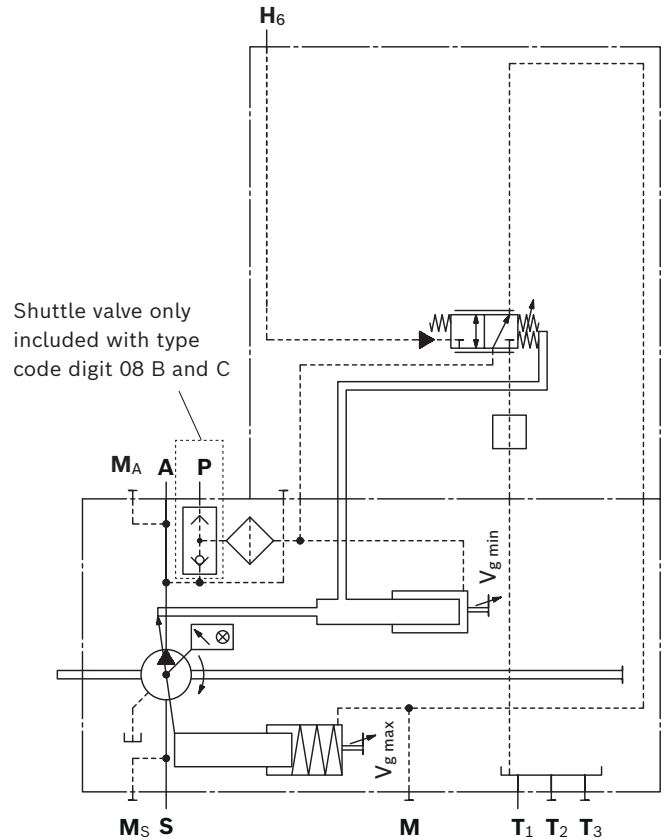
- ▶ Maximum permissible pilot pressure $p_{St \max} = 1450$ psi (100 bar)
- ▶ Control from $V_{g \min}$ to $V_{g \max}$
With increasing pilot pressure the pump swivels to a bigger displacement.
- ▶ Beginning of control (at $V_{g \min}$) 145 psi (10 bar).

The required control power is taken from the working pressure or the external control pressure applied to port **P**. If the pump is to be adjusted from the zero basic setting or from a low working pressure, port **P** must be supplied with an external control pressure of at least 435 psi (30 bar), maximum 725 psi (50 bar).

Notice

If no external control pressure is connected to **P**, the version "Maximum swivel angle ($V_{g \max}$), without external control pressure supply" must be ordered (see type code digit 08, A).

▼ Circuit diagram H6



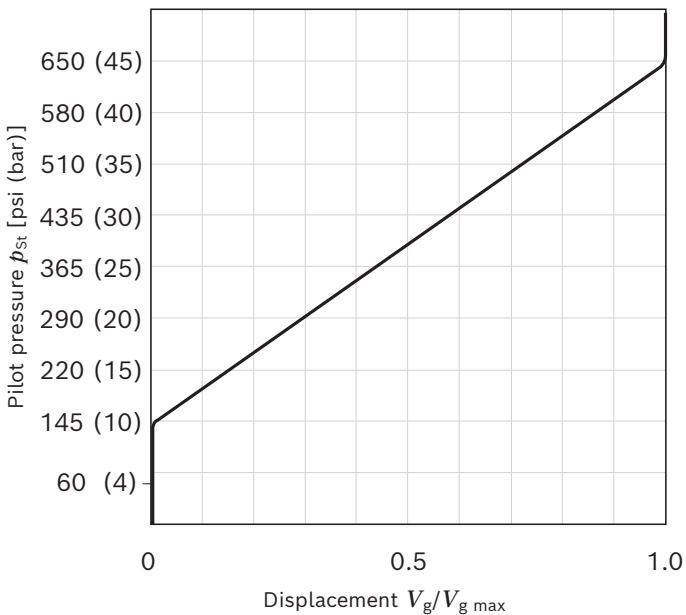
Notice!

The spring feedback in the controller is not a safety device.

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

Check whether the application on your machine requires additional safety measures to bring the driven consumer to a safe position (immediate stop). If necessary, make sure these are appropriately implemented.

▼ Characteristic curve H6 (positive)



Pilot pressure increase $V_{g \min}$ to $V_{g \max}$: $\Delta p = 35$ bar

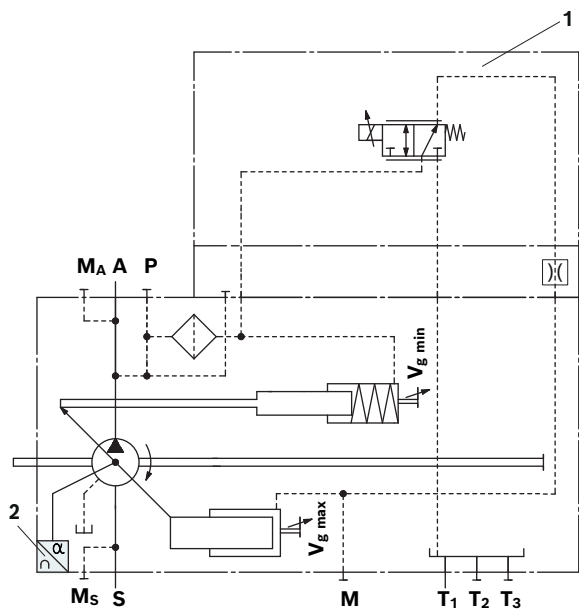
U7 – Electrohydraulic control valve (positive control)

The U7 version with built-up proportional directional control valve is used as a basis for the layout of a customer-owned pump control system for electronic swivel angle and pressure control as well as torque limitation. In addition, swivel angle sensor (see type code item 10, code B or K) and, if required, pressure sensor HM20-2X/630-C-K35 (see data sheet 30272) as well as a suitable valve amplifier are required; we recommend the amplifier module VT-MSPA1-2X data sheet 30232.

Notice

- ▶ For development of a customer-specific solution in connection with the H4U.app pQ software, please contact us.

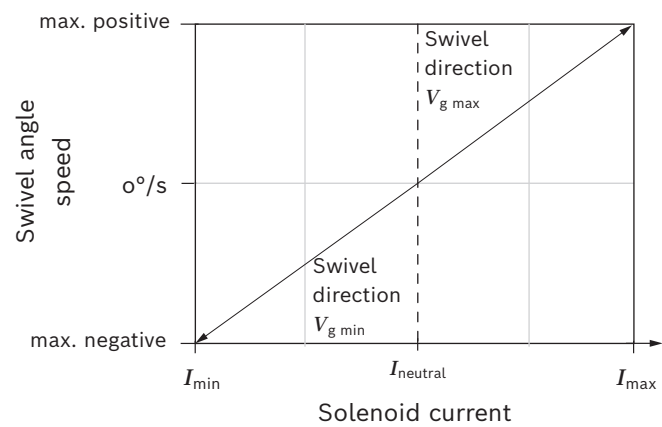
▼ Circuit diagram U7



- 1 Proportional directional valve U7
- 2 Swivel angle sensor type code position 10

The valve spool is clamped between a proportional solenoid and a spring and releases an opening cross-section depending on the stroke. This results in a proportionality of the solenoid current with respect to the opening cross-section and thus the swiveling speed of the pump. The neutral position, which does not lead to a swivel motion, is assigned to a corresponding neutral current. If the solenoid current is above the neutral current ($I_{neutral}$), the pump swivels in the direction of $V_{g\ max}/100\%$; if it is below, the pump swivels in the direction of $V_{g\ min}/0\%$.

▼ Operating principle U7



For further technical data on the solenoid with respective information, see page 72.

Solenoid technical data

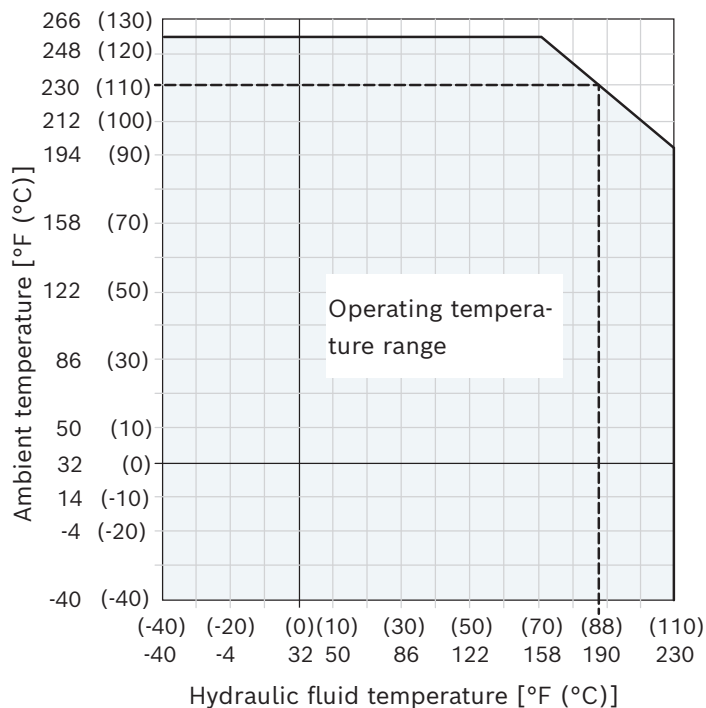
U7	
Minimum permissible current, produces maximum swivel-in dynamic.	I_{min} 0 mA
Neutral current (nominal value) The neutral current, i.e. the neutral position, must be calibrated during commissioning.	$I_{neutral}$ 1170 mA
Permissible maximum solenoid current. The current supply time with I_{max} depends on the mean current value ($I_{permissible\ average}$ 1355 mA)	I_{max} < 1900 mA
Permissible average solenoid current over a maximum interval width of 5 s	$I_{permissible\ average}$ < 1355 mA
Dither frequency (recommended)	100 Hz
Dither amplitude (recommended)	120 mA
Nominal resistance at 20 °C winding temperature	4.26 Ω
Hot resistance 180 °C winding temperature	6.92 Ω
Limit temperature for winding	Insulating material class H (356 °F (180 °C))
Hydraulic fluid or operating temperature	see diagram on page 25
Type of protection: see connector version on page 72	

Notice

- ▶ The limit voltage of the coil is 36 VDC. In general, the maximum current must not be exceeded by the actual current.
- ▶ For calculation of the hot resistance, a temperature coefficient of $0.0039k^{-1}$ is to be applied.
- ▶ The dither frequency/amplitude may have to be adapted to the complete system.

▼ **Characteristic curve operating temperature range at $I_{\text{permissible average}}$**

Example: An ambient temperature of 230 °F (110 °C) is permitted at 190 °F (88 °C) hydraulic fluid temperature.



Notice

- Notice regarding U7 overheating – overheating by overcurrent ($I_{\text{average}} > I_{\text{permissible average}}$) can lead to damage or destruction of the U7 valve. This can occur when the drive is switched off and the hydraulic closed loop control is still activated. The hydraulic closed loop control must therefore be deactivated when the drive is switched off.

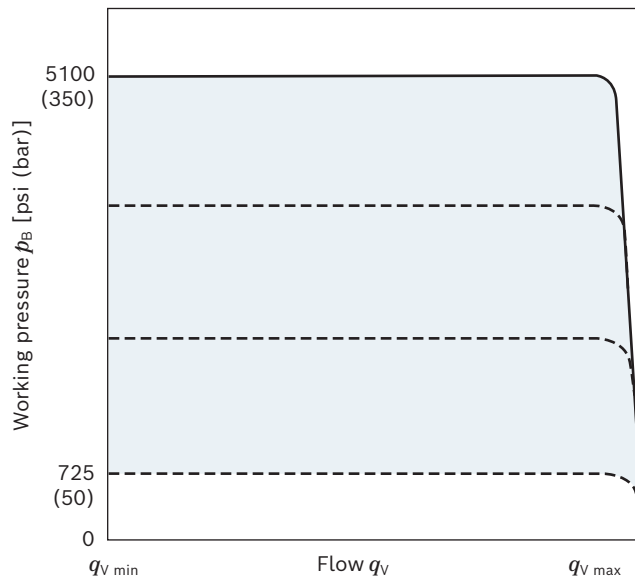
Pressure controller

DR – Pressure controller with one-sided swiveling, fixed setting

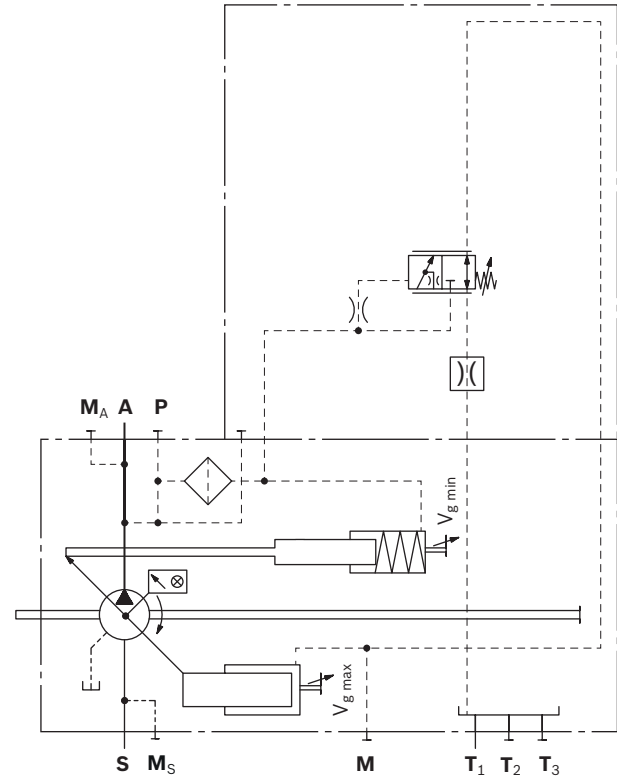
The pressure controller limits the maximum pressure at the pump outlet within the control range of the variable pump. The variable pump only supplies as much hydraulic fluid as is required by the consumers. If the working pressure exceeds the pressure command value at the pressure valve, the pump will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

- ▶ Basic position in depressurized state: $V_{g \max}$
- ▶ Setting range for pressure control 725 psi to 5100 psi (50 bar to 350 bar), standard is 5100 psi (350 bar).

▼ Characteristic curve DR



▼ **Circuit diagram DR**



DRS0 – Pressure controller with load-sensing

The load-sensing controller works as a load-pressure controlled flow controller and adjusts the displacement of the pump to the volume required by the consumer.

The flow of the pump is then dependent on the cross section of the external metering orifice (1), which is located between the pump and the consumer.

Below the setting of the pressure controller and within the control range of the pump, the flow is not dependent on the load pressure.

The metering orifice is usually a separately located load-sensing directional valve (control block).

The position of the directional valve spool determines the opening cross-section of the metering orifice and thus the flow of the pump.

The load-sensing controller compares the pressure upstream of the metering orifice to the one downstream of the orifice and keeps the pressure drop (differential pressure Δp) occurring here and thus the flow constant.

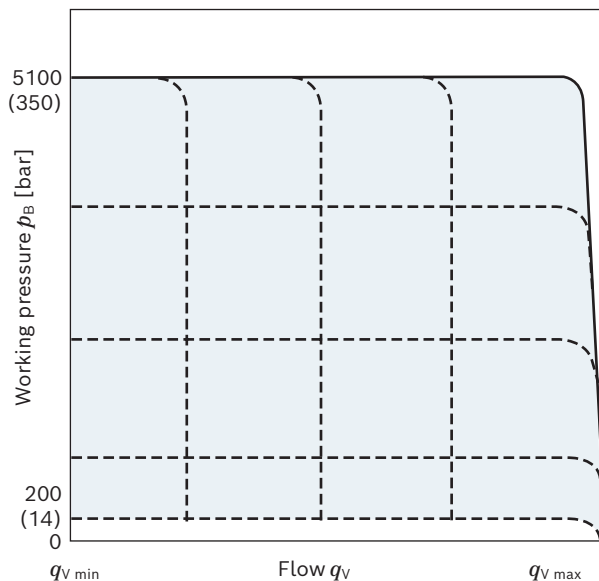
If the differential pressure Δp at the metering orifice rises, the pump is swiveled back (toward $V_{g \min}$). If the differential pressure Δp drops, the pump is swiveled out (toward $V_{g \max}$) until equilibrium at the metering orifice is restored.

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

- ▶ Setting range for Δp 200 psi to 435 psi (14 bar to 30 bar) (please state in plain text)
- ▶ Standard setting 200 psi (14 bar)

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

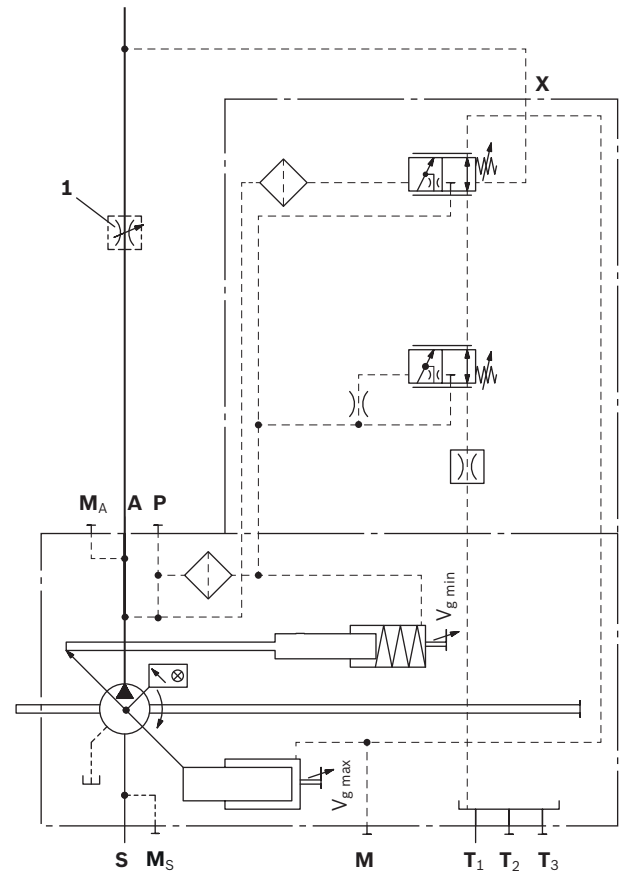
▼ Characteristic curve DRS0



When ordering, state in plain text:

- ▶ Pressure setting p [psi (bar)] at pressure controller DR
- ▶ Differential pressure Δp [psi (bar)] at load-sensing controller S0

▼ Circuit diagram DRS0



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

DG – Pressure controller with one-sided swiveling, hydraulically remote controlled (positive control)

The remote controlled pressure controller has a fixed setting Δp value. A separately connected pressure relief valve at port **X (1)** enables the pressure controller to be remotely controlled.

- ▶ Setting range Δp 200 to 580 psi (14 to 40 bar)
- ▶ Recommended value 290 psi (20 bar) (standard)
- ▶ Control volume at **X**: approx. 0.42 gpm (1.6 l/min)
(static) at Δp 290 psi (20 bar)

In addition, a separately configured 2/2 directional valve **(2)** can be actuated to start the pump with low working pressure (standby pressure).

Both functions can be used individually or in combination (see circuit diagram).

The external valves are not included in the scope of delivery.

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

- ▶ DBD.6, see data sheet 25402
- ▶ DBET i.e. DBETA 7 (see data sheet 29262)

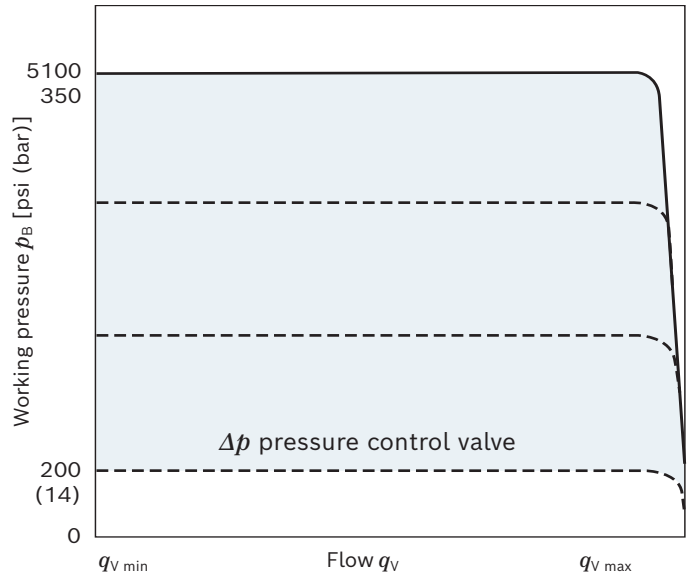
Note for setting remote-controlled pressure control

The setting value for the external pressure relief valve plus the differential pressure value at the pressure control valve determines the level of pressure control.

Example:

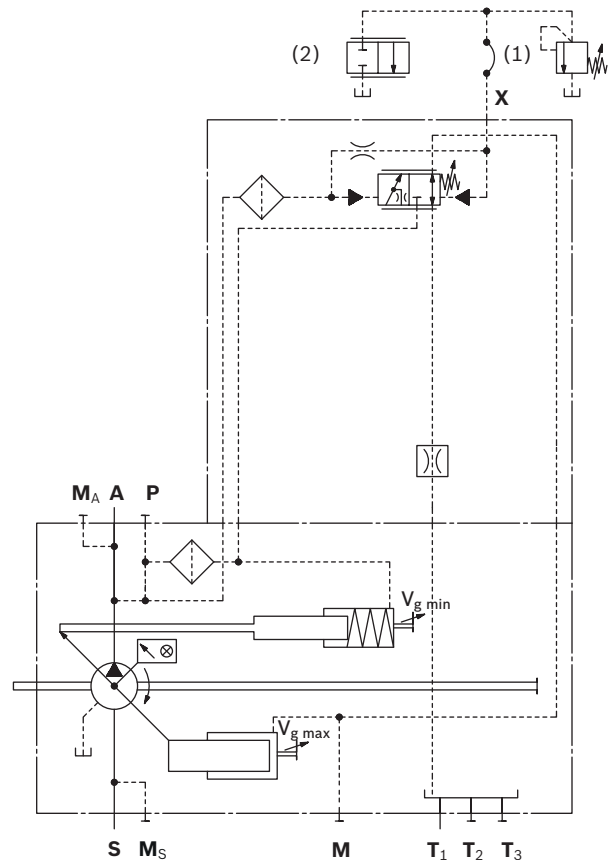
- ▶ External pressure relief valve 4800 psi (330 bar)
- ▶ Differential pressure on pressure control valve 290 psi (20 bar)
- ▶ Resulting pressure control of 4810 + 290 = 5100 psi (330 + 20 = 350 bar)

▼ Characteristic curve DG



For function and description of pressure control DR, see page 26

▼ **Circuit diagram DG**



- 1 Pressure relief valve (not included in the scope of delivery)
- 2 2/2 directional valve (not included in the scope of delivery)

DGV2 – With integrated pressure relief valve and electric 2/2 directional seat valve (de-energized standby)

The remote controlled pressure controller has a fixed setting Δp value. A pressure relief valve (pilot valve) integrated in the control valve allows for a fixed pressure control with switch-off through to standby = Δp value due to the integrated electric 2/2 directional seat valve.

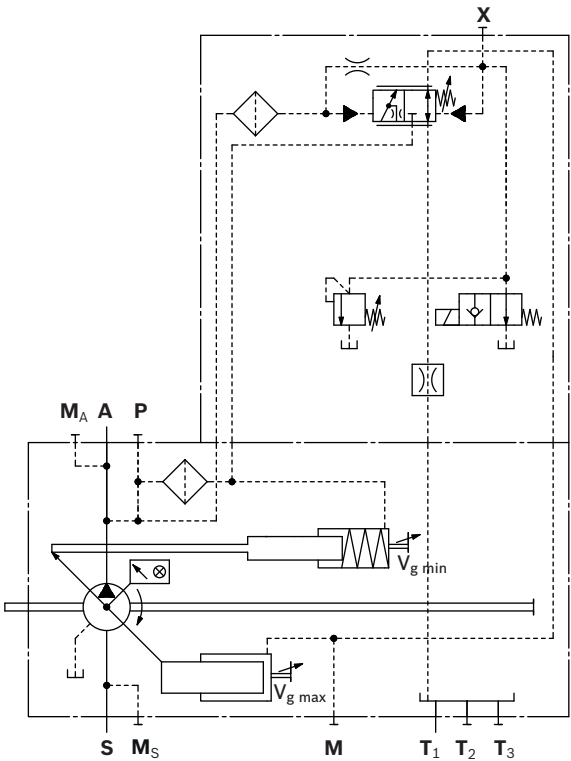
- ▶ Setting range Δp 200 to 365 psi (14 bar to 25 bar)
- ▶ Recommended value 290 psi (20 bar) (standard)
- ▶ Setting range for pressure control is 870 to 5100 psi (60 bar to 350 bar)
- ▶ Standard is 5100 psi (350 bar)

When ordering, state in plain text:

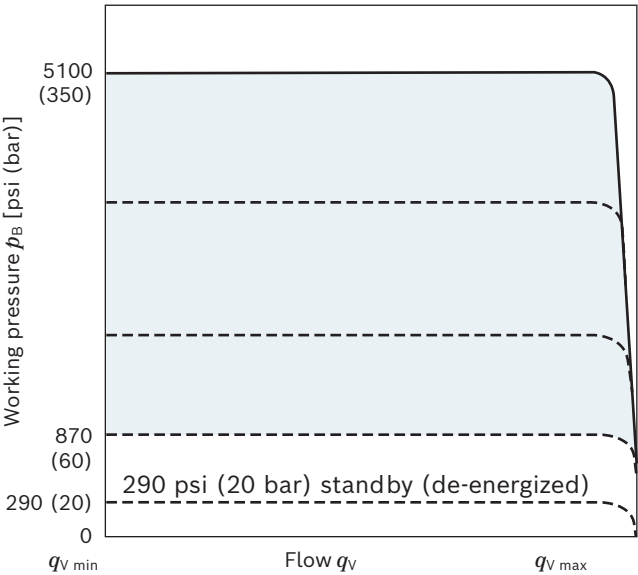
- ▶ Differential pressure Δp in psi (bar)
- ▶ Pressure setting p in psi (bar)
(working pressure at port **A**)

Technical data, solenoid	DGV2
Voltage	24V ±10%
Current	900 mA
Nominal resistance (at 68–77 °F (20–25°C))	28.2 Ω
Power consumption	20 W
Type of protection: see connector version on page 72	

Circuit diagram DGV2



Characteristic curve DGV2



DGT6 – With integrated pilot control valve, electric-proportional override (positive control)

The remote controlled pressure controller has a fixed-setting Δp value. An electric pressure relief valve (pilot valve) integrated in the control valve enables remote pressure control.

- Fixed value at Δp 200 psi (14 bar)
- Pilot valve pressure, fixed setting: 4870 psi (336 bar)
- Maximum pressure $p_{\max}$ [bar] (pressure on port **A**) with 1200 mA current: 5100 psi (350 bar)

Pilot valve T6

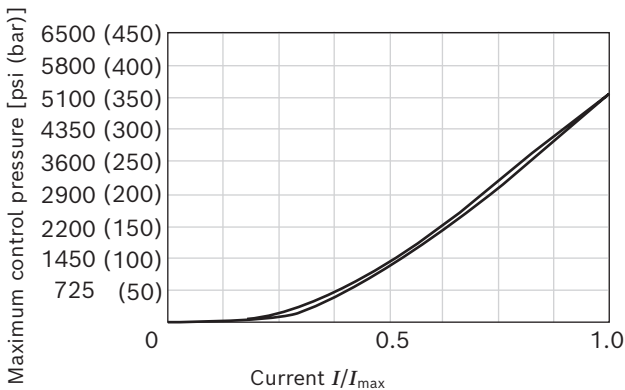
The electro proportional pressure relief valve is directly controlled with a positive control as cartridge version (see data sheet 18139-04).

Electric proportional valve:

350 bar: KBPSR8AA/HCG24K40V

Notes and explanations for the DG controller can be found on page 28.

▼ Characteristic curve T6

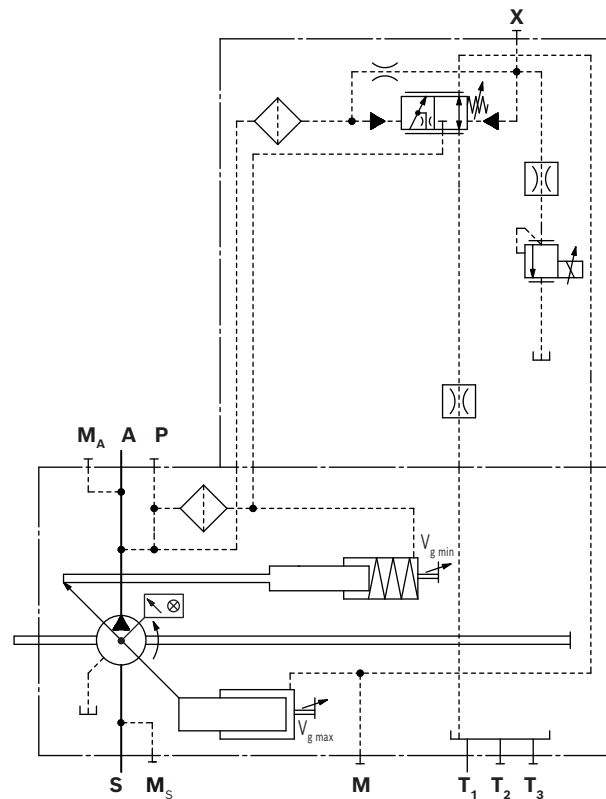


Technical data, solenoid	T6
Voltage	24 V
Control current	
Minimum pressure $p_{\min}$	0 mA
Maximum pressure $p_{\max}$	1200 mA
Maximum rated current	1200 mA
Nominal resistance (at 68 °F (20 °C))	4.8 Ω
Dither frequency	200 Hz
Duty cycle	100%
Type of protection: see connector version on page 72	

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

Amplifier card	Data sheet
VT-MSPA1-2X	30232

▼ Circuit diagram DGT6



DGT8 – With integrated pilot control valve, electric-proportional override (negative control)

The remote controlled pressure controller has a fixed-setting Δp value. An electric pressure relief valve (pilot valve) integrated in the control valve enables remote pressure control.

- Fixed value at Δp 200 psi (14 bar).

When ordering, state pressure setting in plain text:

- Maximum pressure $p_{\max}$ [bar] (pressure on port **A**) with 0 mA current.
Standard is 5100 psi (350 bar)

Pilot valve T8

The electro proportional pressure relief valve is directly controlled with a negative control as cartridge version (see data sheet 18139-05).

Due to the pressure settings stated in plain text, the following electro proportional pressure relief valves are used:

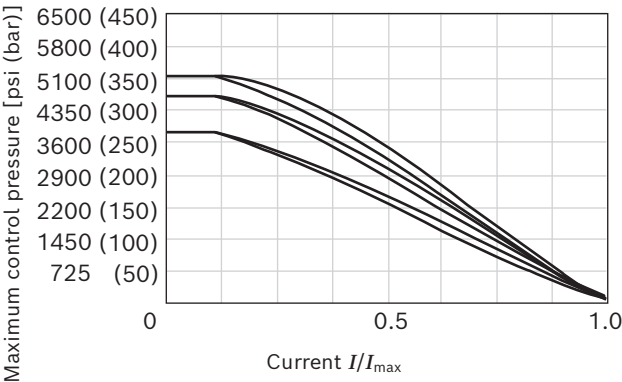
2900...3600 psi (200...250 bar): KBPS**N**8BA/HCG24K40V

3640...4550 psi (251...315 bar): KBPS**P**8BA/HCG24K40V

4580...5100 psi (316...350 bar): KBPS**R**8BA/HCG24K40V

Notes and explanations for the DG controller can be found on page 28.

▼ **Characteristic curve T8**

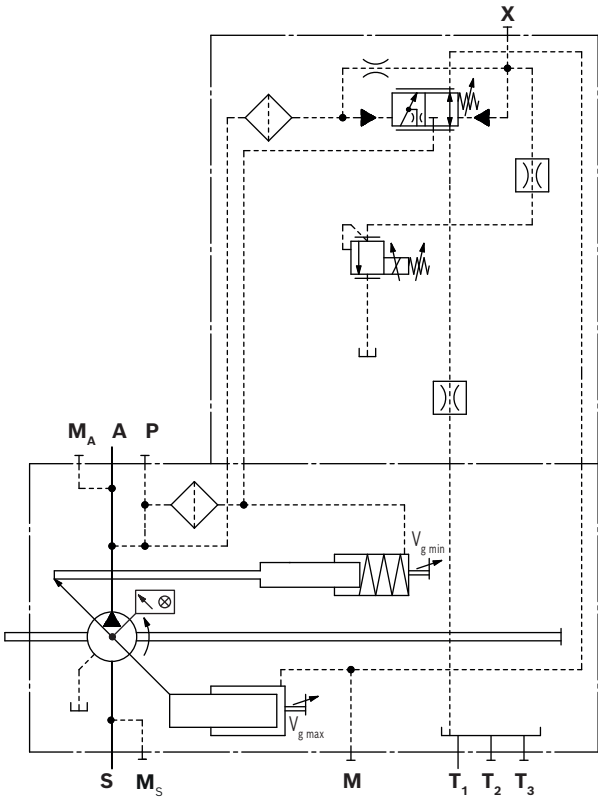


Technical data, solenoid	T8
Voltage	24 V
Control current	
Maximum pressure $p_{\max}$	0 mA
Minimum pressure $p_{\min}$	1200 mA
Maximum rated current	1200 mA
Nominal resistance (at 68 °F (20 °C))	4.8 Ω
Dither frequency	200 Hz
Duty cycle	100%
Type of protection: see connector version on page 72	

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

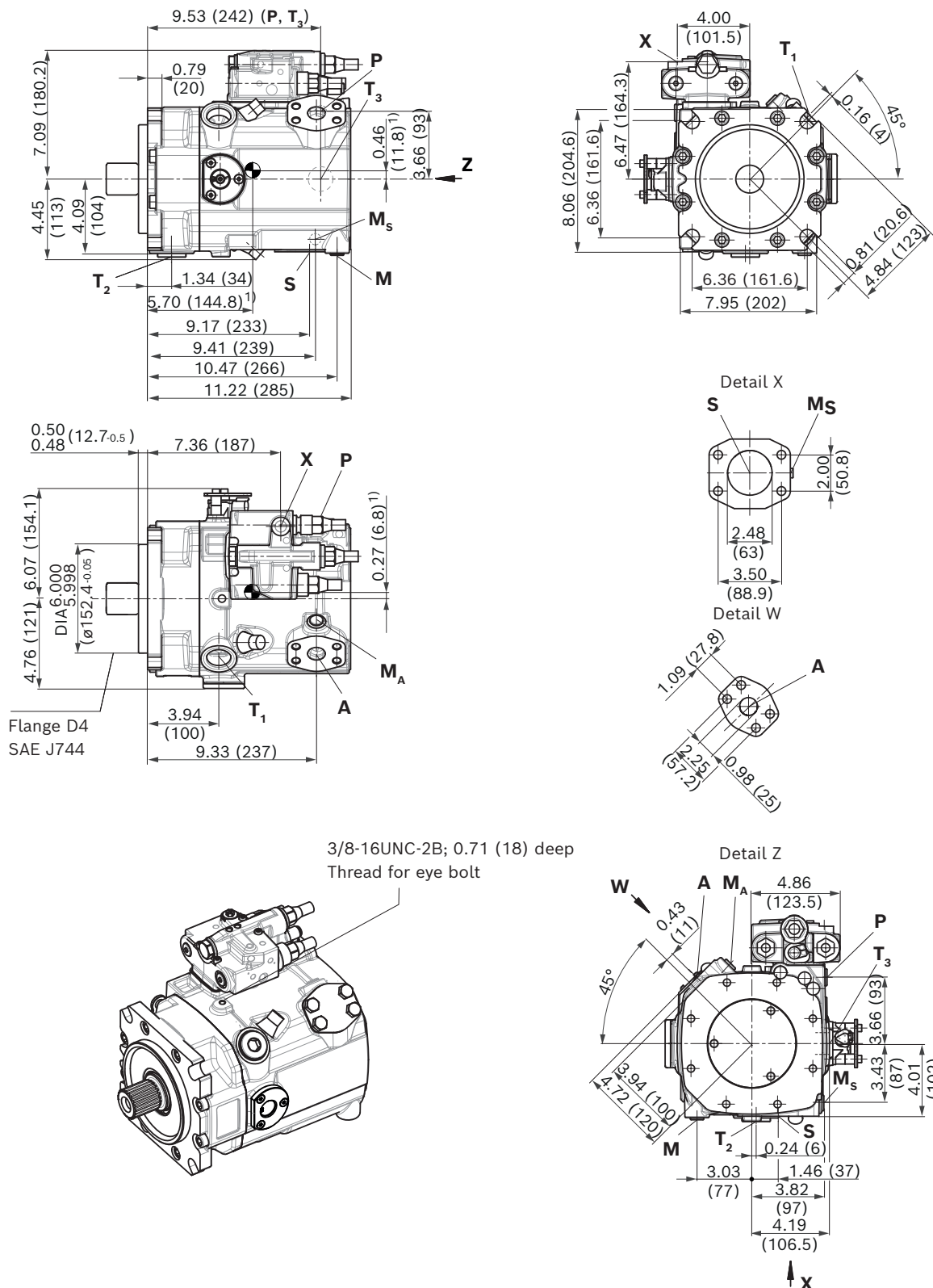
Amplifier card	Data sheet
VT-MSPA1-2X	30232

▼ **Circuit diagram DGT8**



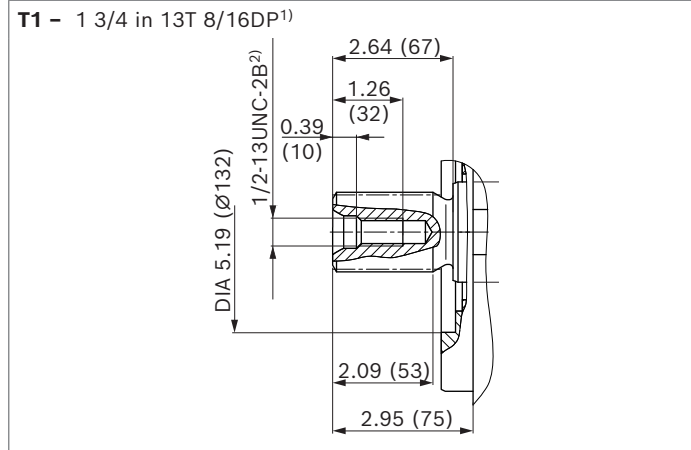
Dimensions, size 110**LRDRS0 – Power controller with pressure controller, load-sensing and with electric swivel angle sensor**

Clockwise rotation

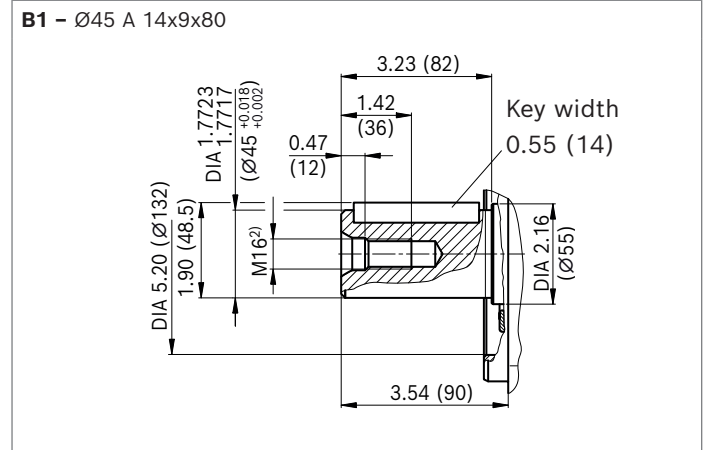


1) Center of gravity

▼ **Splined shaft SAE J744**



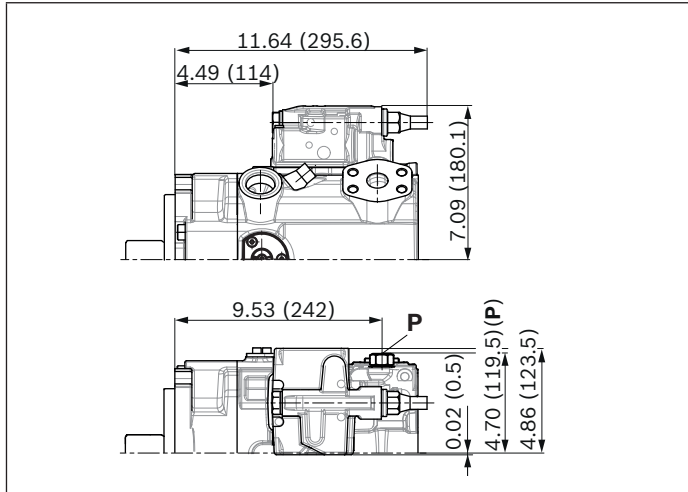
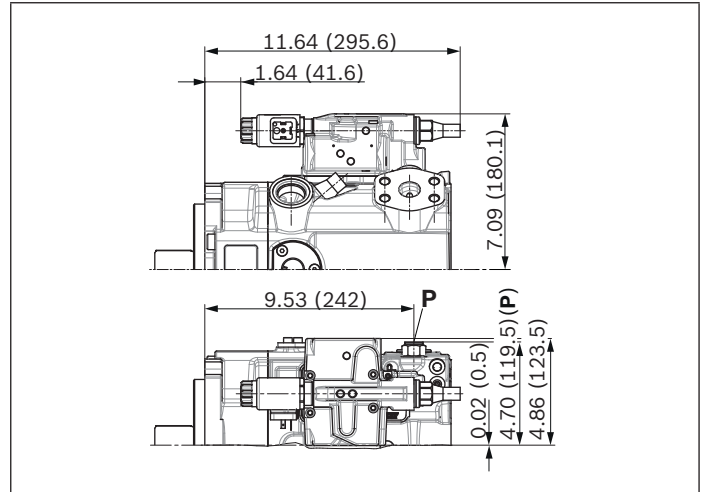
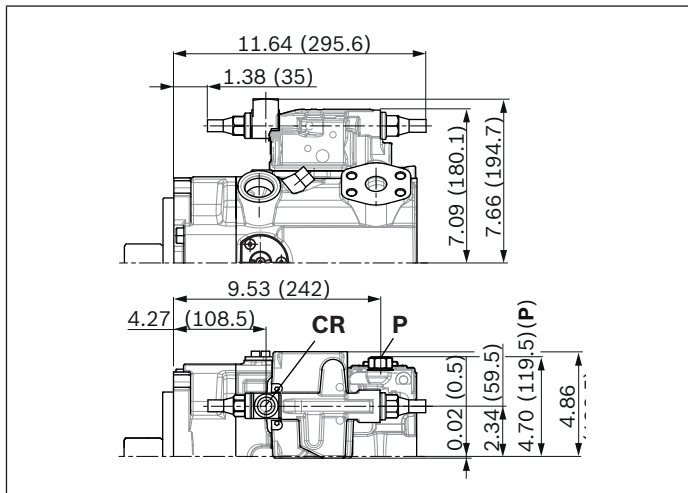
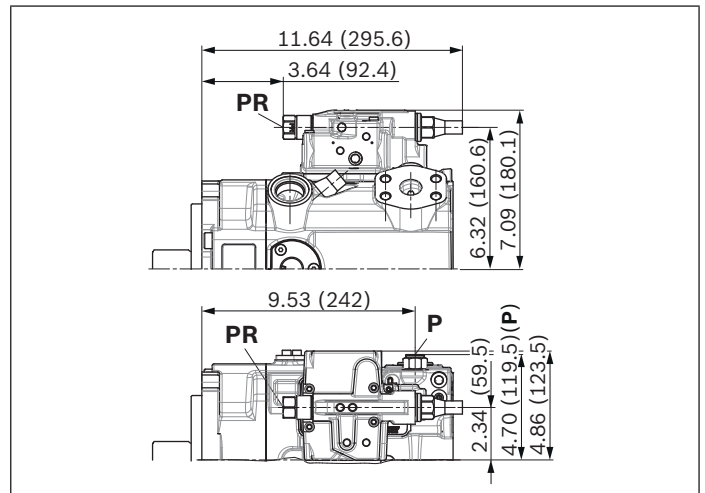
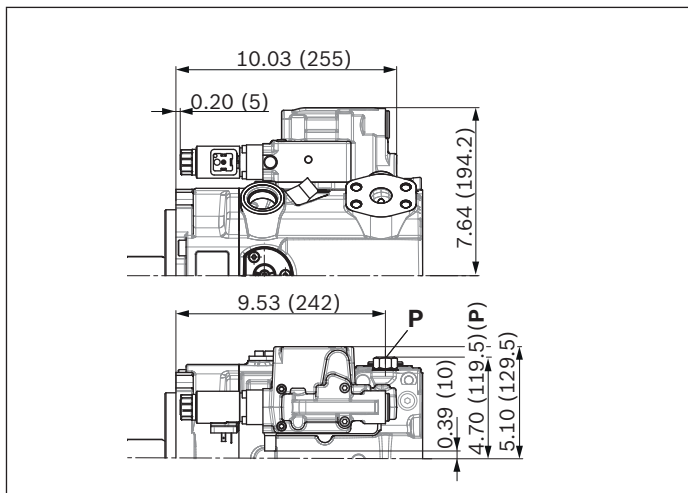
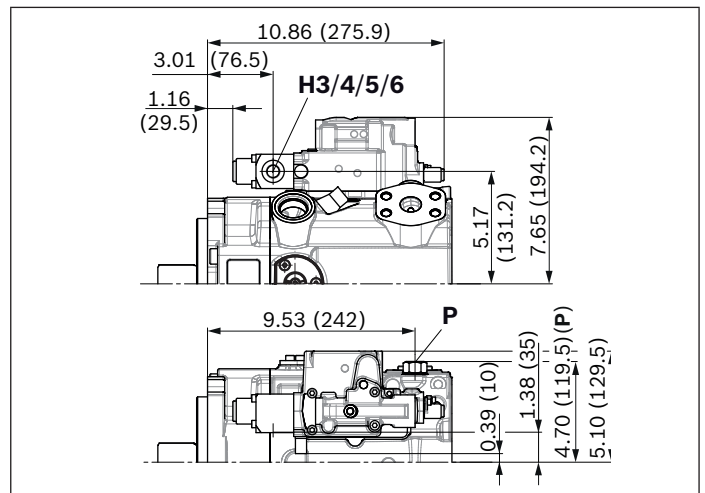
▼ **Parallel keyed shaft DIN 6885**



Ports		Standard	Size	$p_{\max}$ [psi (bar)] ⁴⁾	State ⁷⁾
A	Working port Fastening thread	SAE J518 ASME B1.1	1 in 7/16-14UNC-2B; 19 (0.75) deep	6100 (420)	O
S	Suction port (without charge pump) Fastening thread	SAE J518 ASME B1.1	2 1/2 in 1/2-13UNC-2B; 19 (0.75) deep	435 (30)	O
T₁	Drain port	ISO 11926 ⁵⁾	1 5/16UN-2B; 20 (0.79) deep	75 (5)	O ⁶⁾
T₂	Drain port	ISO 11926 ⁵⁾	1 5/16UN-2B; 20 (0.79) deep	75 (5)	X ⁶⁾
T₃	Drain port	ISO 11926 ⁵⁾	1 5/16UN-2B; 20 (0.79) deep	75 (5)	X ⁶⁾
CR	Pilot signal (CR only)	ISO 11926	9/16-18 UNF-2B; 13 (0.51) deep	6100 (420)	O
PR	Pilot signal (PR only)	ISO 11926	9/16-18 UNF-2B; 13 (0.51) deep	6100 (420)	O
H3 to H6	Pilot signal (only on H3, H4, H5 and H6)	ISO 11926	9/16-18 UNF-2B; 13 (0.51) deep	1450 (100)	O
DP	Pilot pressure (only on DP)	ISO 11926	9/16-18 UNF-2B; 0.51 (13) deep	6100 (420)	O
DP₁	Measuring port pilot signal (DP)	ISO 11926	9/16-18 UNF-2B; 13 (0.51) deep	6100 (420)	X
X	Pilot signal	ISO 11926 ⁵⁾	9/16-18 UNF-2B; 13 (0.51) deep	6100 (420)	O
M	Measurement of stroking chamber pressure	ISO 11926 ⁶⁾	9/16-18UNF-2B; 13 (0.51) deep	6100 (380)	X
M_A	Measuring pressure A	ISO 11926 ⁵⁾	9/16-18 UNF-2B; 13 (0.51) deep	6100 (420)	X
M_S	Measuring suction pressure	ISO 11926 ⁵⁾	9/16-18 UNF-2B; 13 (0.51) deep	435 (30)	X
P	External control pressure (type code position 8 version B or C = with external control pressure supply)	ISO 11926 ⁵⁾	9/16-18 UNF-2B; 13 (0.51) deep	725 (50)	O
	Port P is without function (Type code position 8 version A = without external control pressure supply)	ISO 11926 ⁵⁾	3/4-16 UNF-2B; 12.6 (0.50) deep	6100 (420)	X

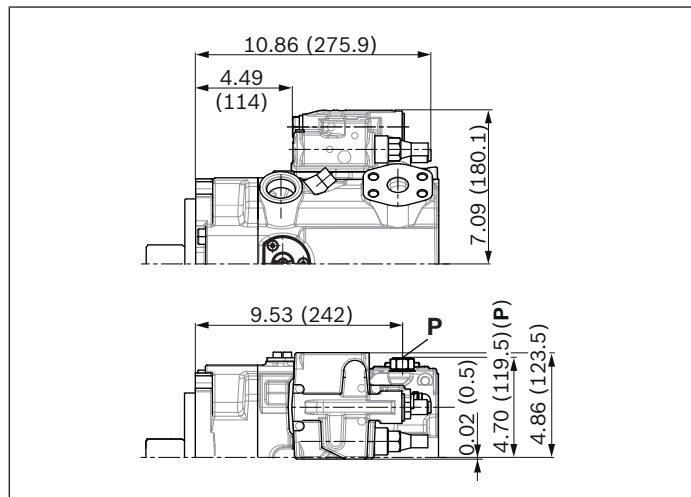
1) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5.
2) Center bore according to DIN 332 (thread according to DIN 13)
3) Thread according to DIN 13
4) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.

5) The countersink may be deeper than specified in the standard.
6) Depending on installation position, **T₁**, **T₂** or **T₃** must be connected (see also Installation instructions on pages 73 and 75).
7) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

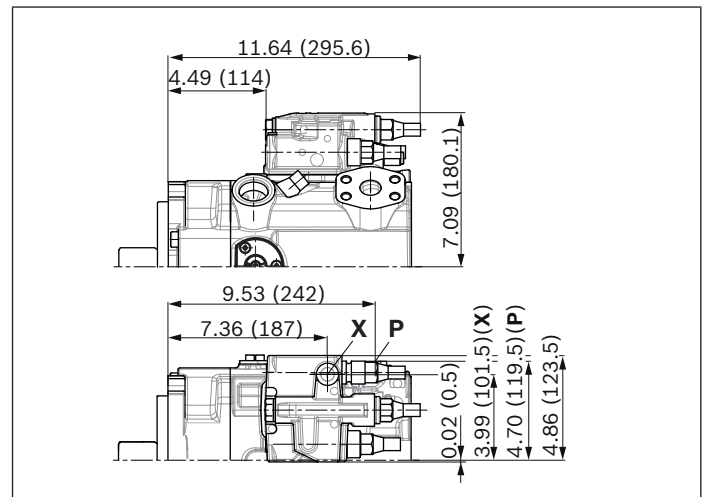
▼ **LR – Power controller, fixed setting**▼ **L4 – Power controller, electric-proportional override**▼ **CR – Power controller, hydraulic-proportional override, high pressure, with stop**▼ **PR – Power controller, hydraulic-proportional override, high pressure, without stop**▼ **E2/E6 – Stroke control electric-proportional**▼ **H3/4/5/6 – Stroke control, hydraulic-prop., pilot pressure****Notice**

All controllers described with shuttle valve in **P**
(some contrary to standard as per type code digit 08)

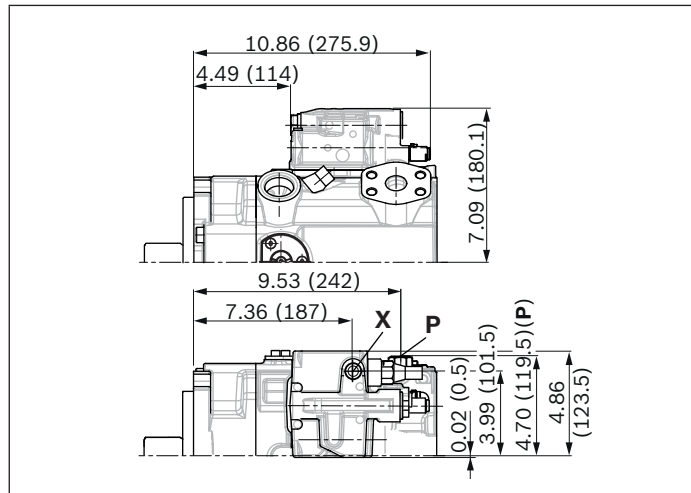
▼ **DR – Pressure controller, fixed setting**



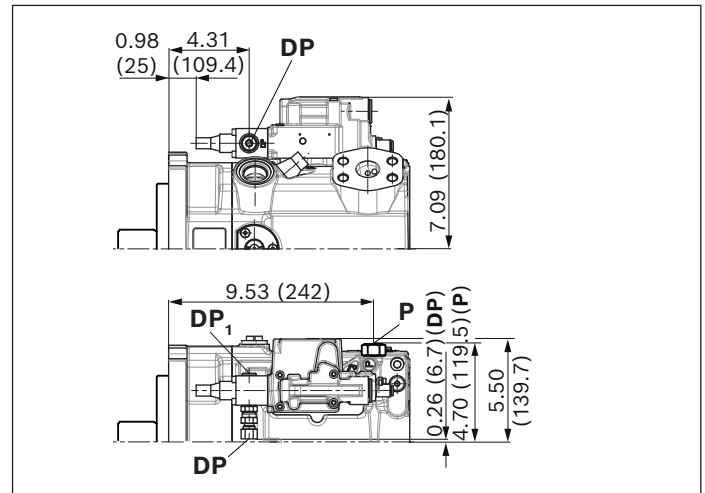
▼ **LRDRS0 – Power controller with pressure controller and load-sensing, fixed setting**



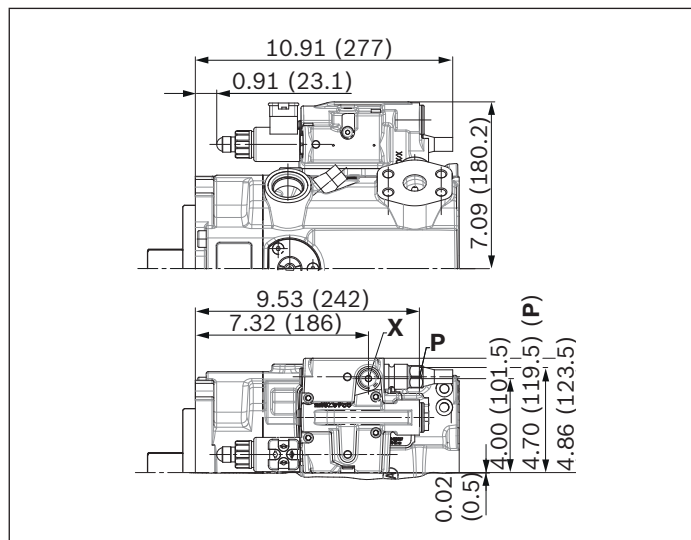
▼ **DG – Pressure controller, hydraulic, remote controlled**



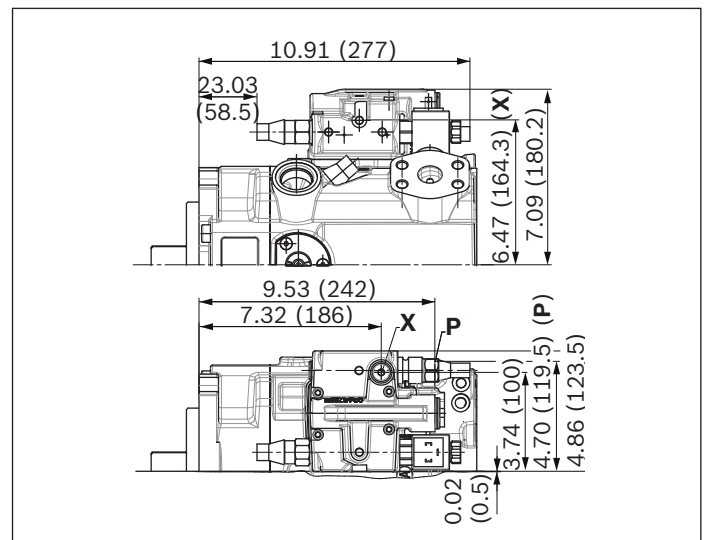
▼ **DP – Pressure controller, for parallel operation**



▼ **DGT6/DGT8 – With integrated pilot control valve, electric-proportional override**



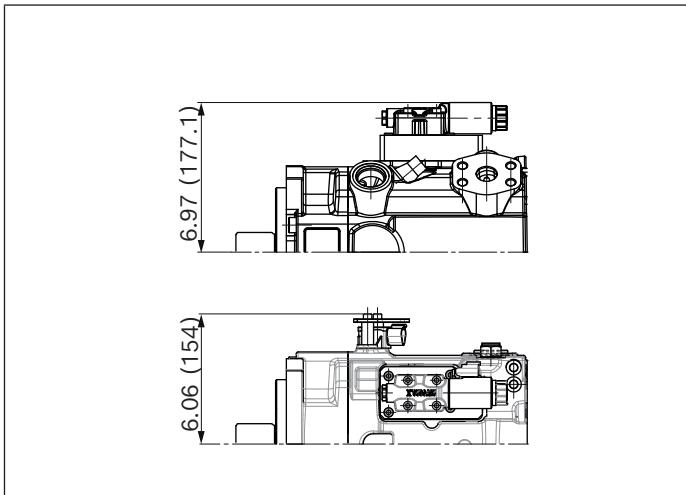
▼ **DGV2 – Mounted electric directional valve and pressure relief valve (only in combination with pressure controller)**



Notice

All controllers described with shuttle valve in **P**
(some contrary to standard as per type code digit 08)

▼ **U7 – Electrohydraulic control system
(positive control)**



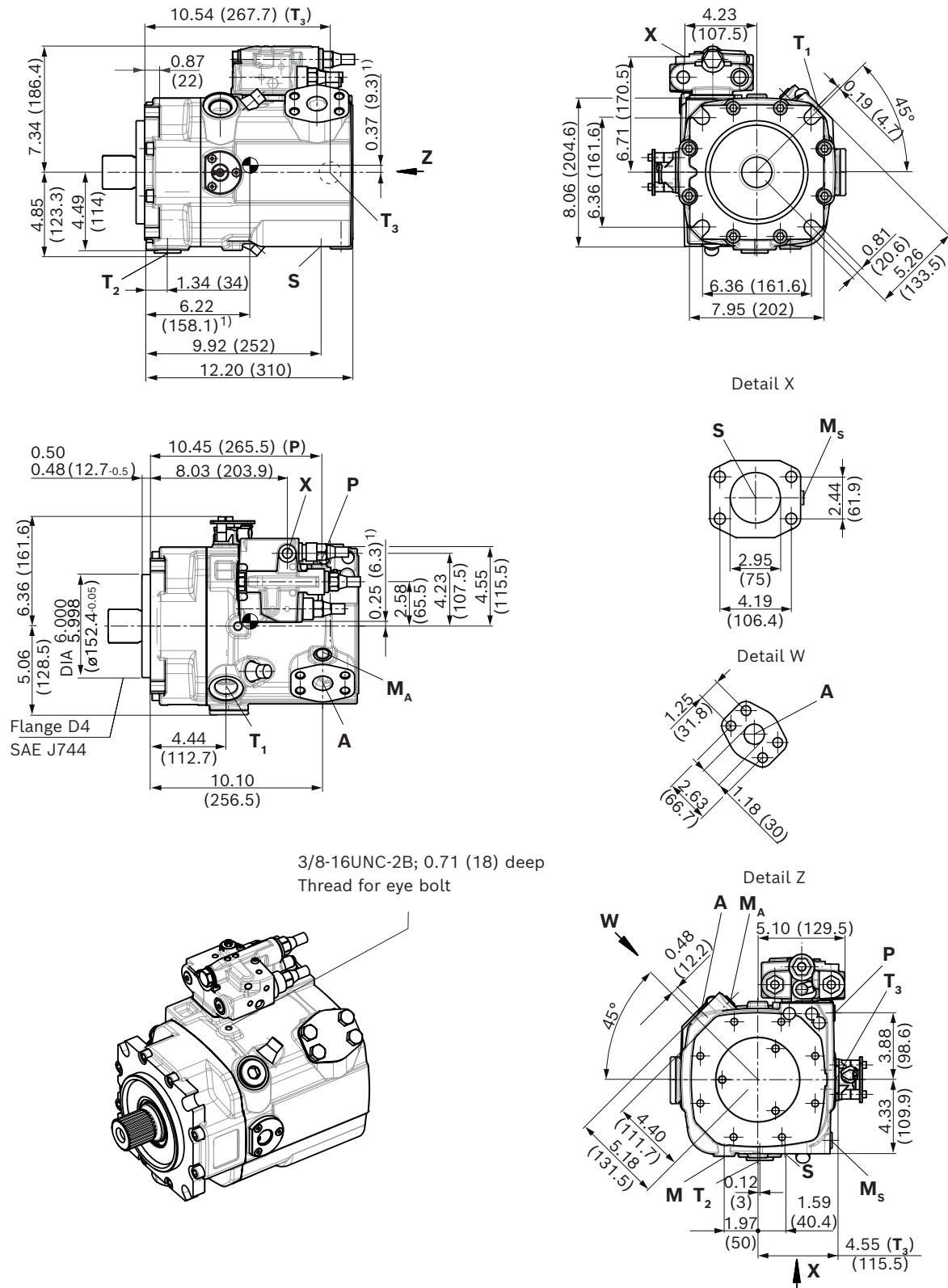
Notice

All controllers described with shuttle valve in **P**
(some contrary to standard as per type code digit 08)

Dimensions, size 145

LRDRS0 – Power controller with pressure controller, load-sensing and with electric swivel angle sensor

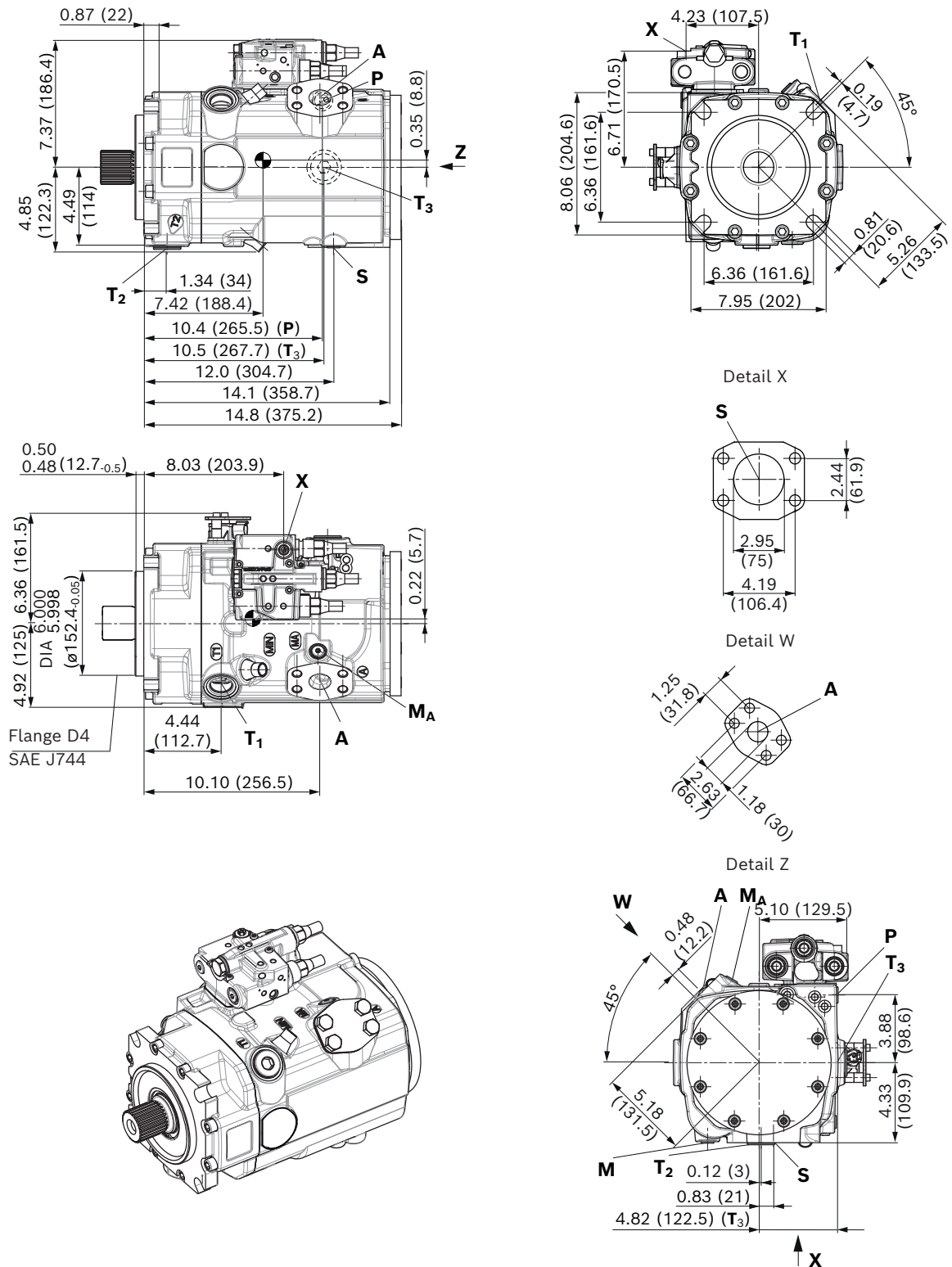
Without charge pump, clockwise rotation



1) Center of gravity

LRDRS0 – Power controller with pressure controller, load-sensing and with electric swivel angle sensor

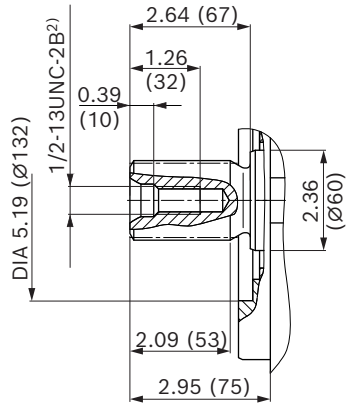
With charge pump, clockwise rotation



1) Center of gravity

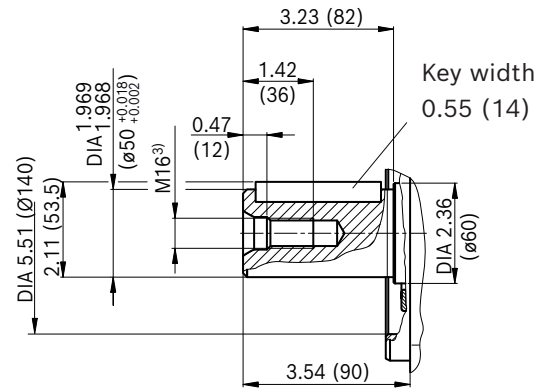
▼ **Splined shaft SAE J744**

T1 – 1 3/4 in 13T 8/16DP¹⁾

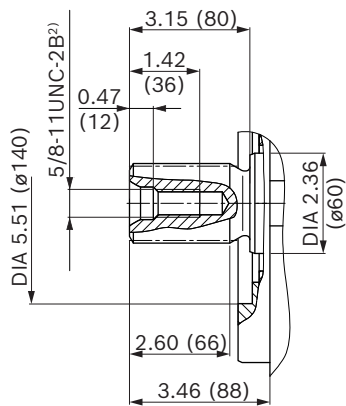


▼ **Parallel keyed shaft DIN 6885**

B2 – Ø50 A 14x9x80



T2 – 2 in 15T 8/16DP¹⁾



- 1) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5.
- 2) Center bore according to ASME B1.1 (thread according to ASME B1.1)
- 3) Center bore according to DIN 332 (thread according to DIN 13)

Ports		Standard	Size	$p_{\max}$ [psi (bar)] ¹⁾	State ⁴⁾
A	Working port	SAE J518	1 1/4 in	6100 (420)	O
	Fastening thread	ASME B1.1	1/2-13 UNC-2B; 0.75 (19) deep		
S	Suction port (without charge pump)	SAE J518	3 in	435 (30)	O
	Fastening thread	ASME B1.1	5/8-11 UNC-2B; 0.94 (24) deep		
S	Suction port (with charge pump)	SAE J518 ⁶⁾	3 in	30 (2)	O
	Fastening threads	ASME B1.1	5/8-11 UNC-2B; 0.94 (24) deep		
T₁	Drain port	ISO 11926 ²⁾	1 5/16 UN-2B; 0.79 (20) deep	75 (5)	O ³⁾
T₂	Drain port	ISO 11926 ²⁾	1 5/16 UN-2B; 0.79 (20) deep	75 (5)	X ³⁾
T₃	Drain port	ISO 11926 ²⁾	1 5/16 UN-2B; 0.79 (20) deep	75 (5)	X ³⁾
CR	Pilot signal (CR only)	ISO 11926	9/16-18 UNF-2B; 0.51 (13) deep	6100 (420)	O
PR	Pilot signal (PR only)	ISO 11926	9/16-18 UNF-2B; 0.51 (13) deep	6100 (420)	O
H3 to H6	Pilot signal (only on H3, H4, H5 and H6)	ISO 11926	9/16-18 UNF-2B; 0.51 (13) deep	6100 (420)	O
DP	Pilot pressure (only on DP)	ISO 11926	9/16-18 UNF-2B; 0.51 (13) deep	6100 (420)	O
DP₁	Measuring port pilot signal (DP)	ISO 11926	9/16-18 UNF-2B; 0.51 (13) deep	6100 (420)	X
X	Pilot signal	ISO 11926 ²⁾	9/16-18 UNF-2B; 0.51 (13) deep	6100 (420)	O
M	Measurement of stroking chamber pressure	ISO 11926 ⁶⁾	9/16-18 UNF-2B; 13 (0.51) deep	6100 (380)	X
M_A	Measuring pressure A	ISO 11926 ²⁾	9/16-18 UNF-2B; 0.51 (13) deep	6100 (420)	X
M_S	Measuring suction pressure (only A15VSO)	ISO 6149 ²⁾	9/16-18 UNF-2B; 0.51 (13) deep	435 (30)	X
P	External control pressure (type code position 8 version B or C = with external control pressure supply)	ISO 11926 ²⁾	9/16-18 UNF-2B; 0.51 (13) deep	725 (50)	O
	Port P is without function (type code position 8 version A = without external control pressure supply)	ISO 11926 ²⁾	3/4-16 UNF-2B; 0.50 (12.6) deep	6100 (420)	X

1) Depending on the application, momentary pressure peaks can occur.

Keep this in mind when selecting measuring devices and fittings.

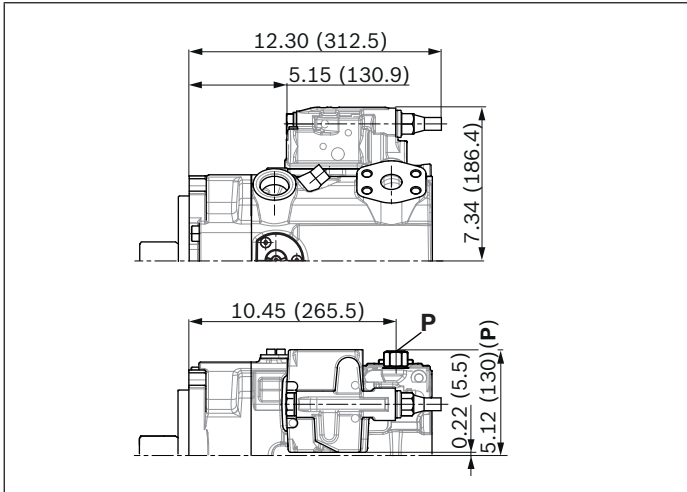
2) The countersink may be deeper than specified in the standard.

3) Depending on installation position, **T₁**, **T₂** or **T₃** must be connected (see also Installation instructions on pages 73 and 75).

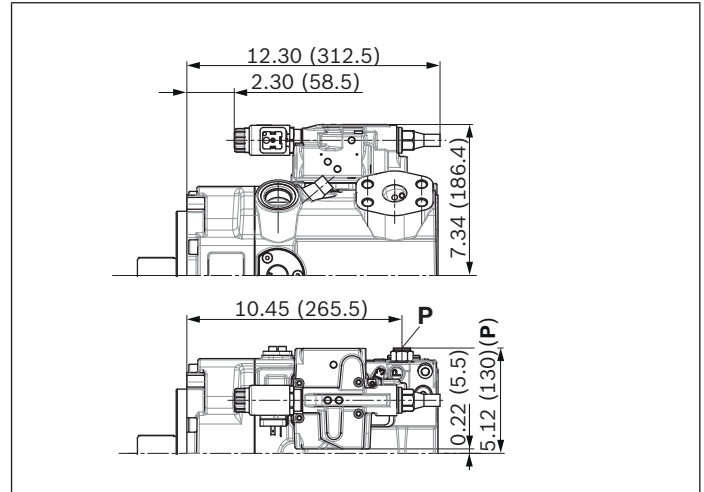
4) O = Must be connected (plugged on delivery)

X = Plugged (in normal operation)

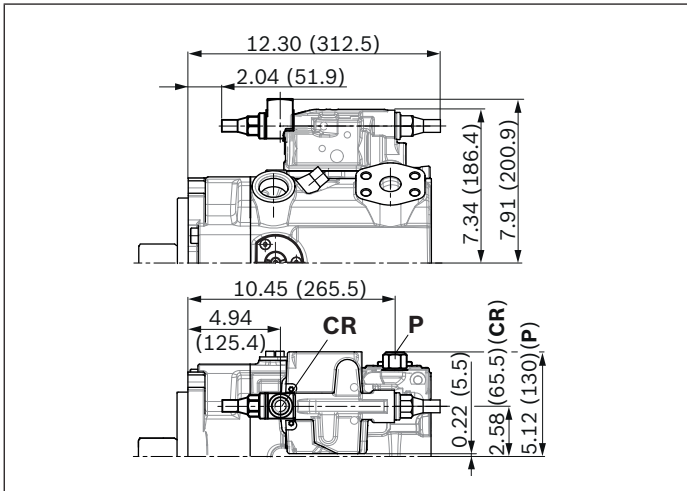
▼ **LR – Power controller, fixed setting**



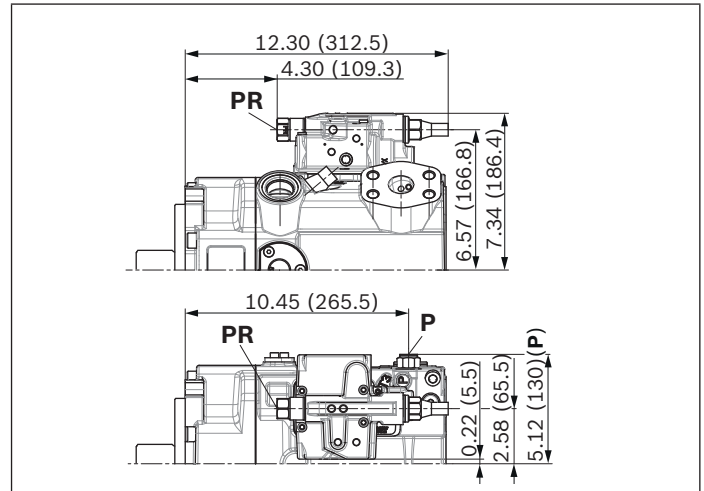
▼ **L4 – Power controller, electric-proportional override**



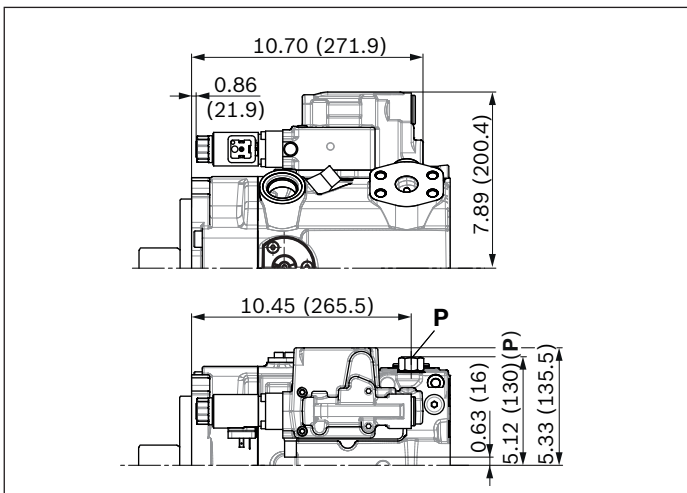
▼ **CR – Power controller, hydraulic-proportional override, high pressure, with stop**



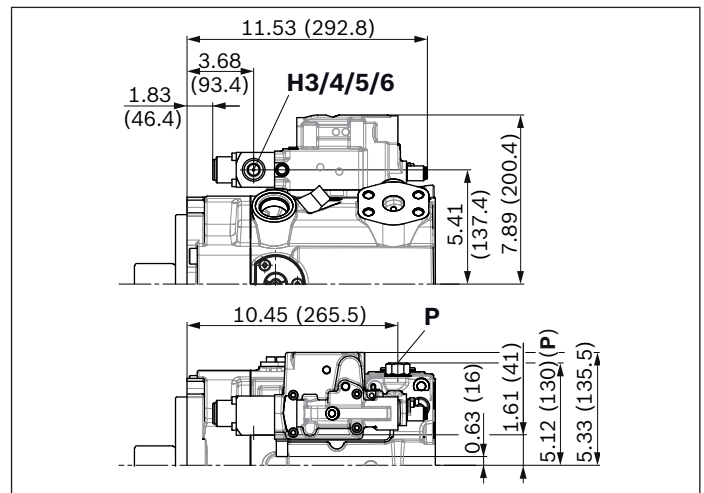
▼ **PR – Power controller, hydraulic-proportional override, high pressure, without stop**



▼ **E2/E6 – Stroke control electric-proportional**

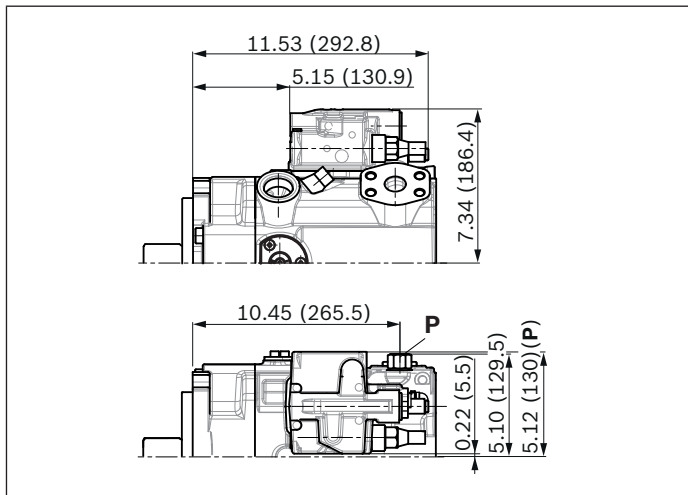
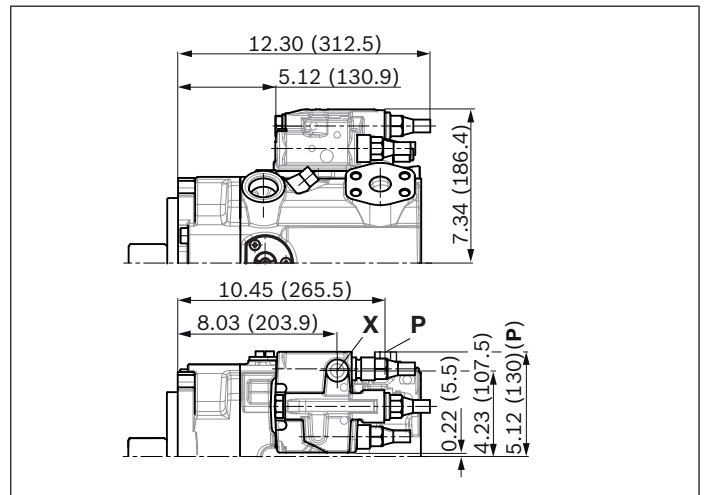
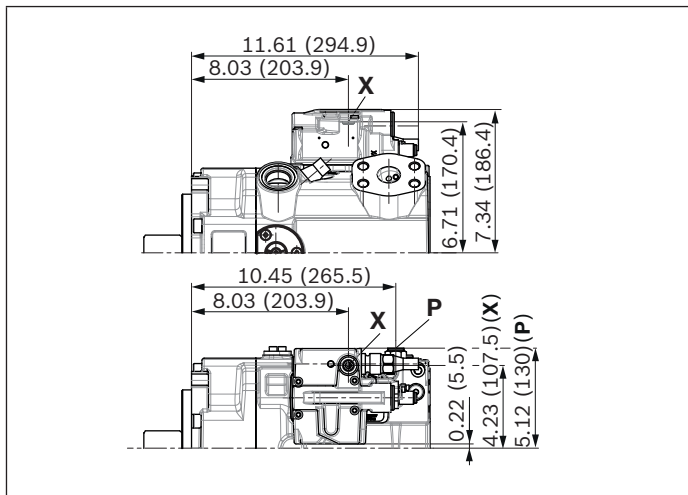
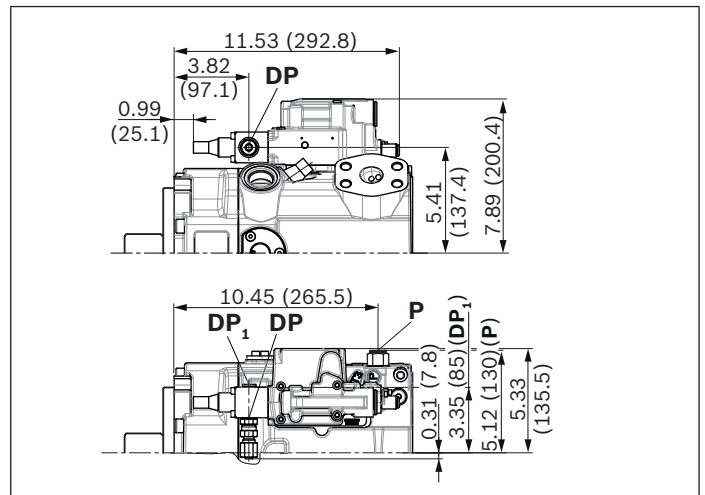
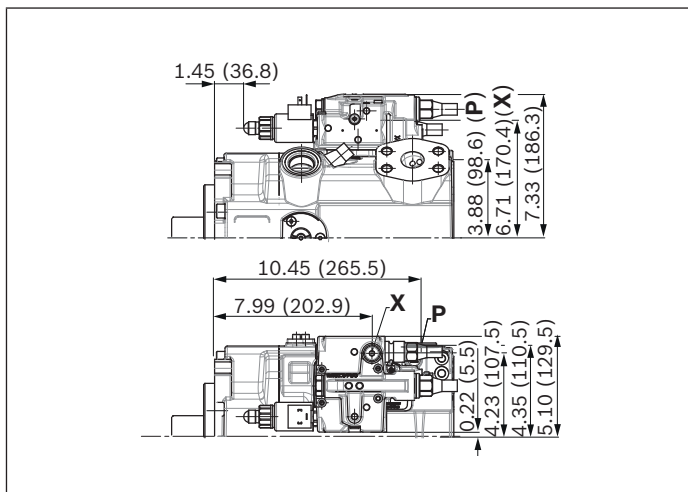
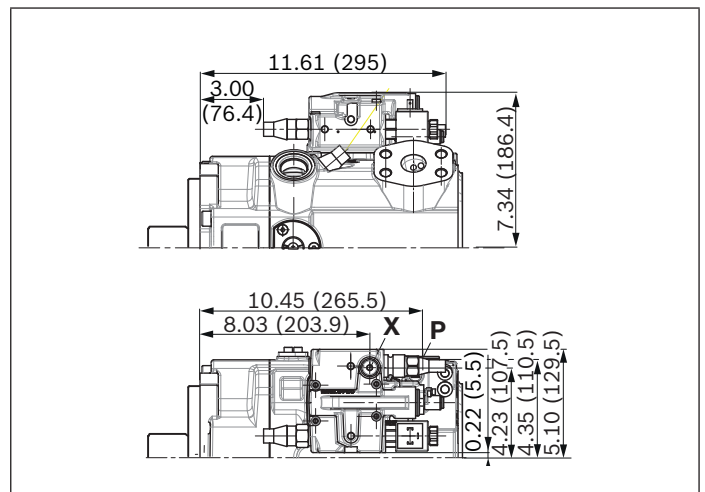


▼ **H3/4/5/6 – Stroke control, hydraulic-prop., pilot pressure**



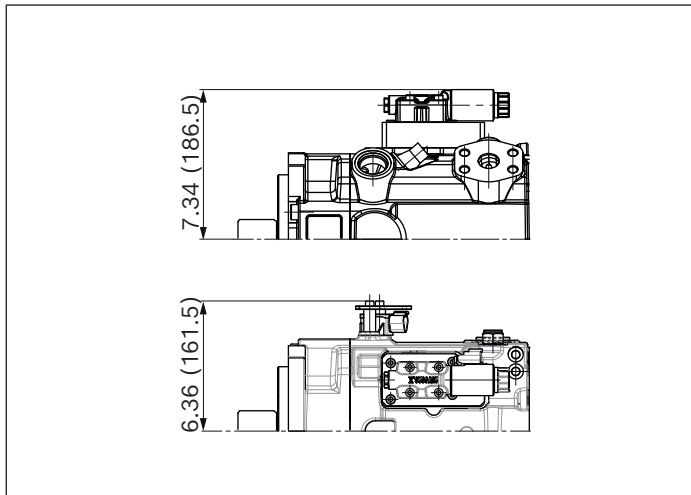
Notice

All controllers described with shuttle valve in **P**
(some contrary to standard as per type code digit 08)

▼ **DR – Pressure controller, fixed setting**▼ **LRDRS0 – Power controller with pressure controller and load-sensing, fixed setting**▼ **DG – Pressure controller, hydraulic, remote controlled**▼ **DP – Pressure controller, for parallel operation**▼ **DGT6/DGT8 – With integrated pilot control valve, electric-proportional override**▼ **DGV2 – Mounted electric directional valve and pressure relief valve (only in combination with pressure controller)****Notice**

All controllers described with shuttle valve in **P**
(some contrary to standard as per type code digit 08)

▼ **U7 – Electrohydraulic control system
(positive control)**

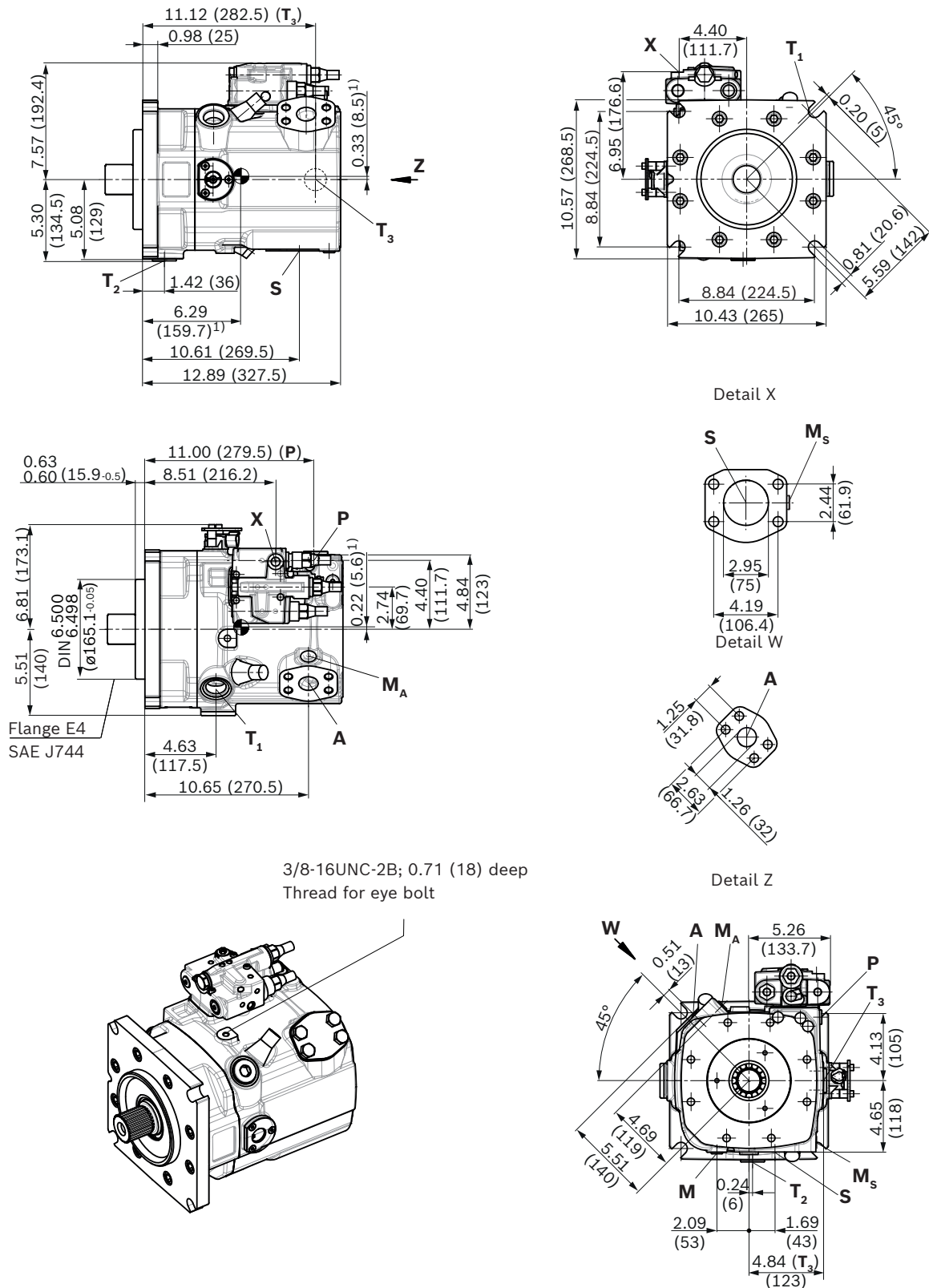


Notice

All controllers described with shuttle valve in **P**
(some contrary to standard as per type code digit 08)

Dimensions, size 175**LRDRS0 – Power controller with pressure controller, load-sensing and with electric swivel angle sensor**

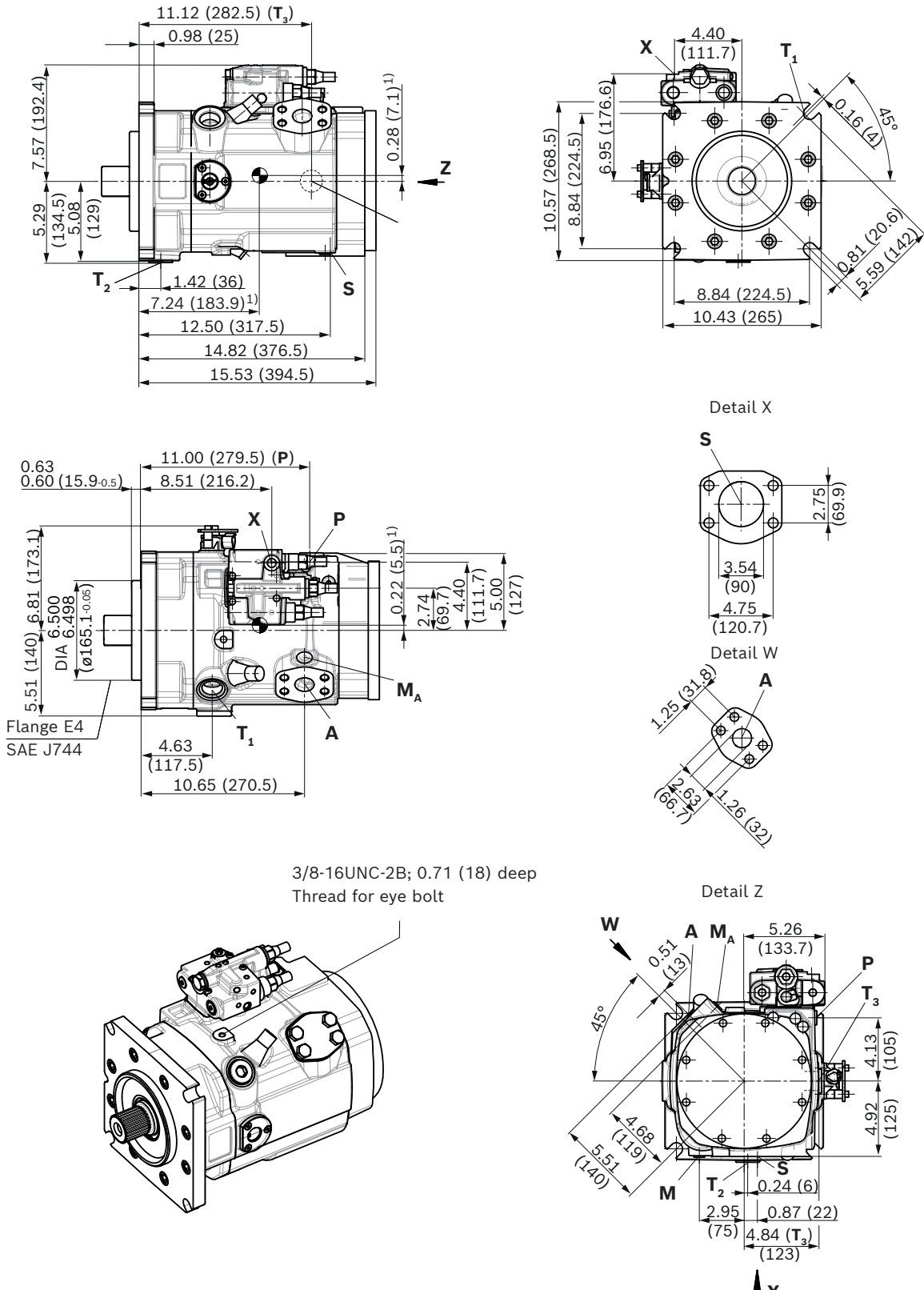
Without charge pump, clockwise rotation



1) Center of gravity

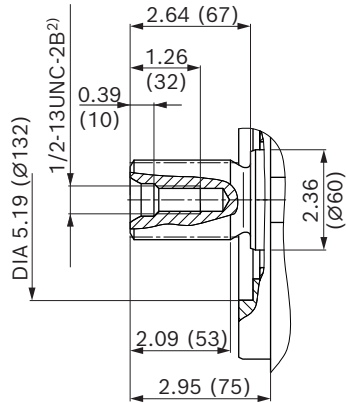
LRDRS0 – Power controller with pressure controller, load-sensing and with electric swivel angle sensor

With charge pump, clockwise rotation

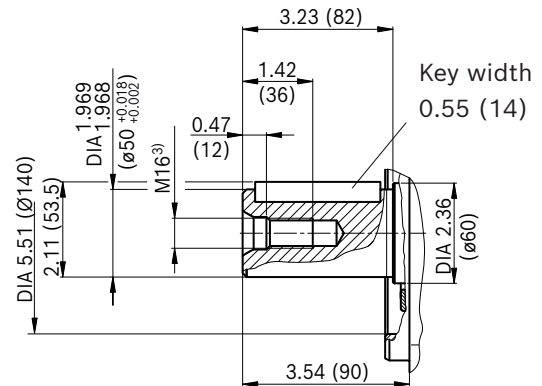
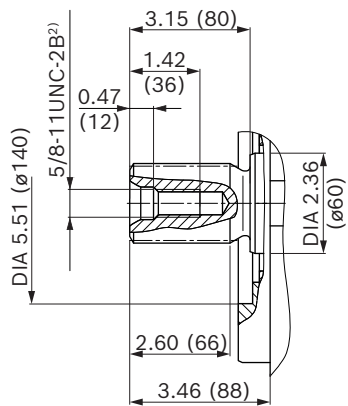


¹⁾ Center of gravity

▼ Splined shaft SAE J744

T1 – 1 3/4 in 13T 8/16DP¹⁾

▼ Parallel keyed shaft DIN 6885

B2 – Ø50 A 14x9x80**T2** – 2 in 15T 8/16DP¹⁾

- 1) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5.
- 2) Thread according to ASME B1.1
- 3) Center bore according to DIN 332 (thread according to DIN 13)

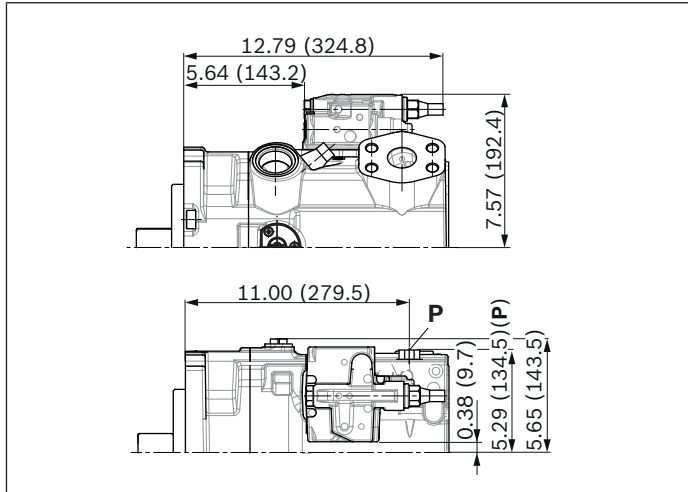
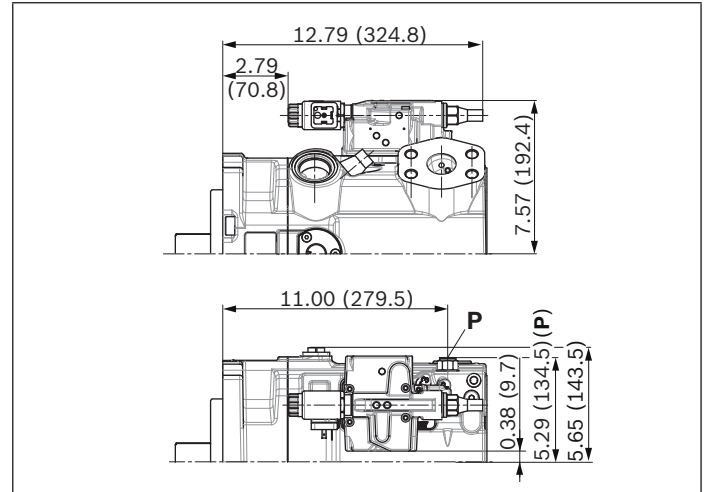
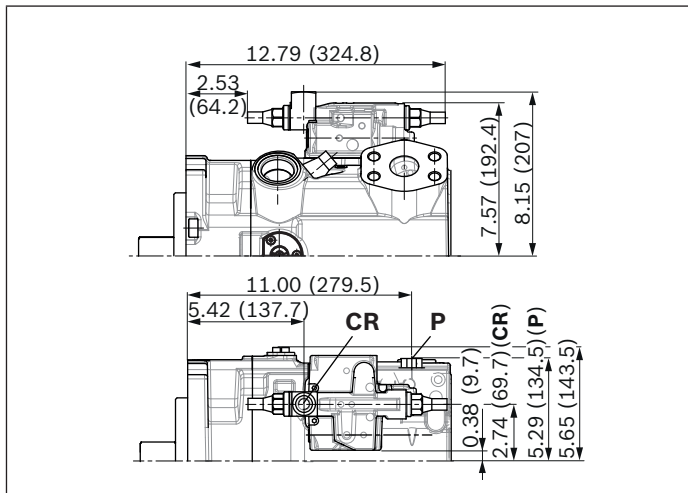
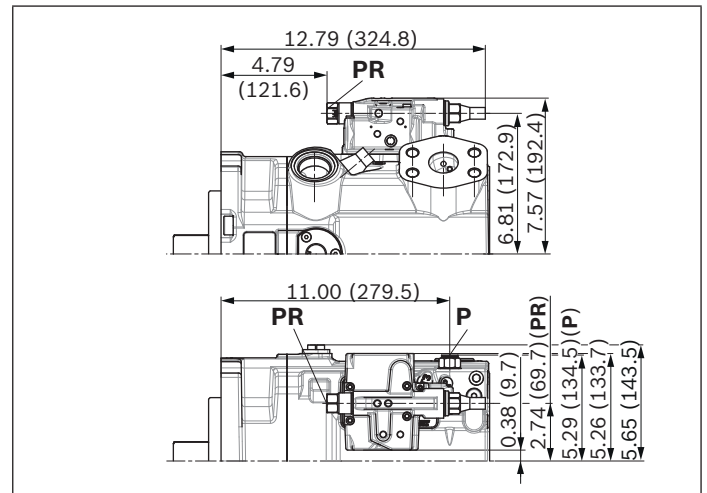
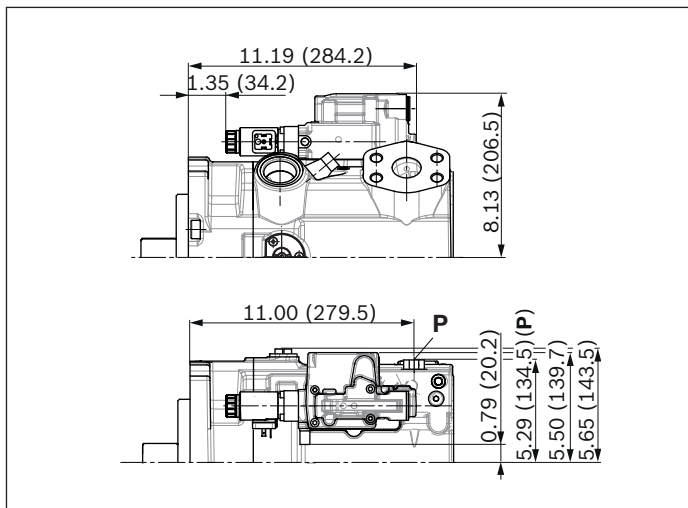
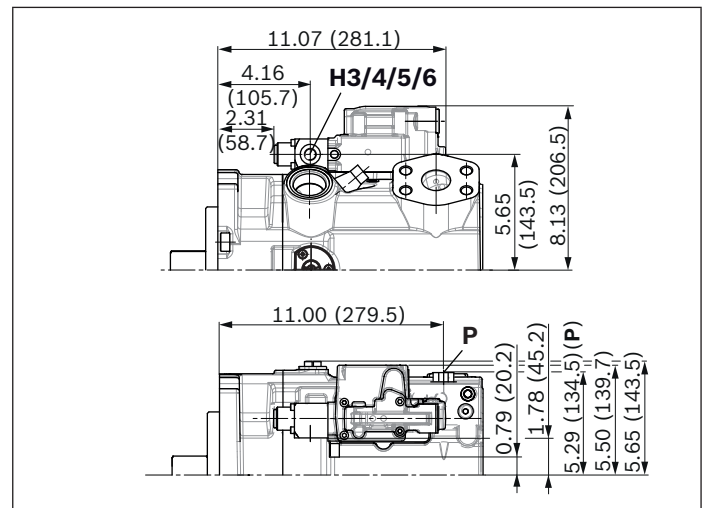
Ports		Standard	Size	$p_{\max}$ [psi (bar)] ¹⁾	State ⁴⁾
A	Working port	SAE J518	1 1/4 in	6100 (420)	O
	Fastening thread	ASME B1.1	1/2-13UNC-2B; 0.75 (19) deep		
S	Suction port (without charge pump)	SAE J518	3 in	435 (30)	O
	Fastening thread	ASME B1.1	5/8-11UNC-2B; 0.94 (24) deep		
S	Suction port (with charge pump)	SAE J518	3 1/2 in	30 (2)	O
	Fastening threads	ASME B1.1	5/8-11UNC-2B; 0.94 (24) deep		
T₁	Drain port	ISO 11926 ²⁾	1 5/16UN-2B; 0.75 (19) deep	75 (5)	O ³⁾
T₂	Drain port	ISO 11926 ²⁾	1 5/16UN-2B; 0.75 (19) deep	75 (5)	X ³⁾
T₃	Drain port	ISO 11926 ²⁾	1 5/16UN-2B; 0.75 (19) deep	75 (5)	X ³⁾
CR	Pilot signal (CR only)	ISO 11926	9/16-18UNF-2B; 0.51 (13) deep	1450 (100)	O
PR	Pilot signal (PR only)	ISO 11926	9/16-18UNF-2B; 0.51 (13) deep	1450 (100)	O
H3 to H6	Pilot signal (only on H3, H4, H5 and H6)	ISO 11926	9/16-18UNF-2B; 0.51 (13) deep	1450 (100)	O
X	Pilot signal	ISO 11926 ²⁾	9/16-18UNF-2B; 0.51 (13) deep	6100 (420)	O
DP	Pilot pressure (only on DP)	ISO 11926 ²⁾	9/16-18UNF-2B; 0.51 (13) deep	6100 (420)	O
DP₁	Measuring port pilot signal (DP)	ISO 11926 ²⁾	9/16-18UNF-2B; 0.51 (13) deep	6100 (420)	X
M	Measurement of stroking chamber pressure	ISO 11926 ⁶⁾	9/16-18UNF-2B; 13 (0.51) deep	6100 (380)	X
M_A	Measuring pressure A	ISO 11926 ²⁾	9/16-18UNF-2B; 0.51 (13) deep	6100 (420)	X
M_S	Measuring suction pressure (only A15VSO)	ISO 11926 ²⁾	9/16-18UNF-2B; 0.51 (13) deep	435 (30)	X
P	External control pressure (type code position. 8 version B or C = with external control pressure supply)	ISO 11926 ²⁾	9/16-18UNF-2B; 0.51 (13) deep	725 (50)	O
	Port P is without function (type code position 8 version A = without external control pressure supply)	ISO 11926 ⁶⁾	3/4-16UNF-2B; 0.50 (12.6) deep	6100 (420)	X

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

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

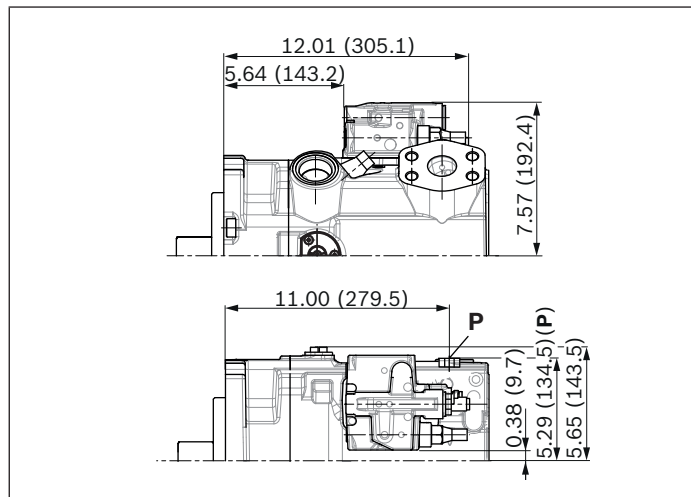
3) Depending on installation position, **T₁**, **T₂** or **T₃** must be connected (see also Installation instructions on pages 73 and 75).

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

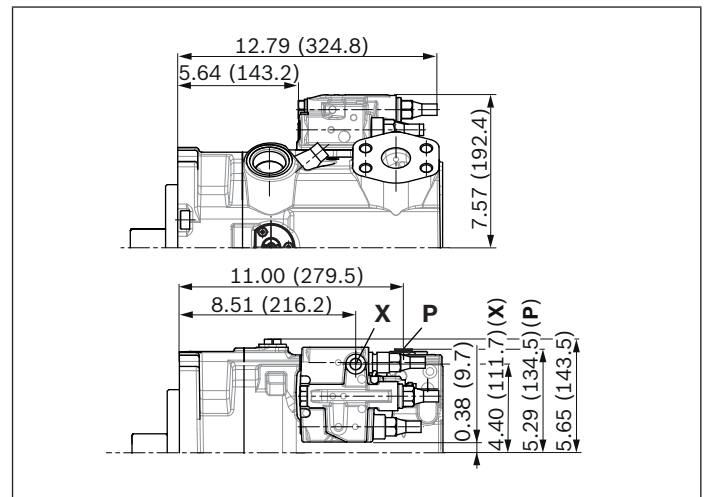
▼ **LR – Power controller, fixed setting**▼ **L4 – Power controller, electric-proportional override**▼ **CR – Power controller, hydraulic-proportional override, high pressure, with stop**▼ **PR – Power controller, hydraulic-proportional override, high pressure, without stop**▼ **E2/E6 – Stroke control electric-proportional**▼ **H3/4/5/6 – Stroke control, hydraulic-prop., pilot pressure****Notice**

All controllers described with shuttle valve in **P**
(some contrary to standard as per type code digit 08)

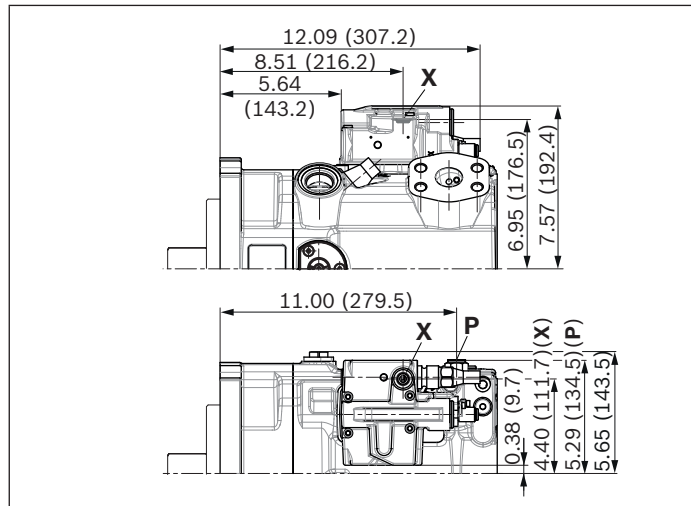
▼ **DR – Pressure controller, fixed setting**



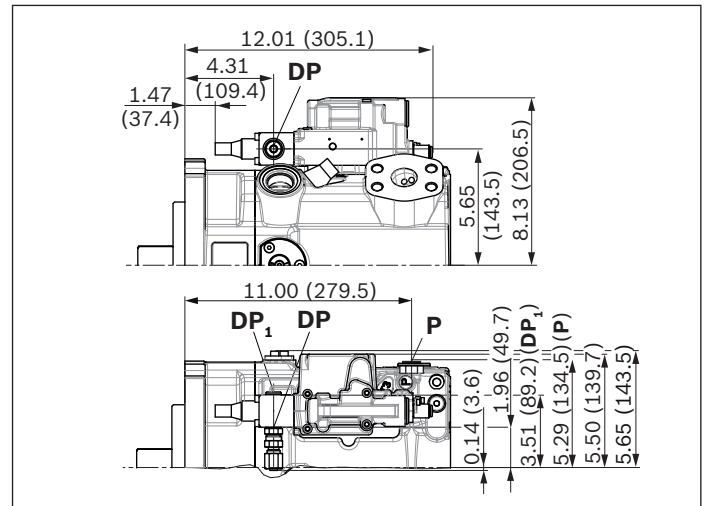
▼ **LRDRS0 – Power controller with pressure controller and load-sensing, fixed setting**



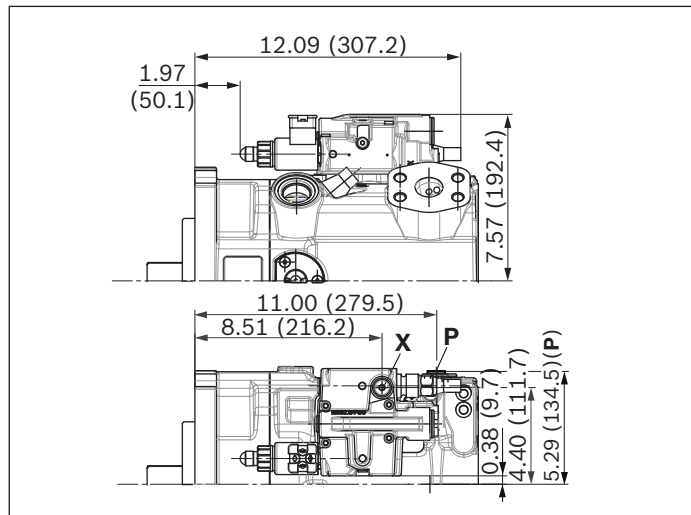
▼ **DG – Pressure controller, hydraulic, remote controlled**



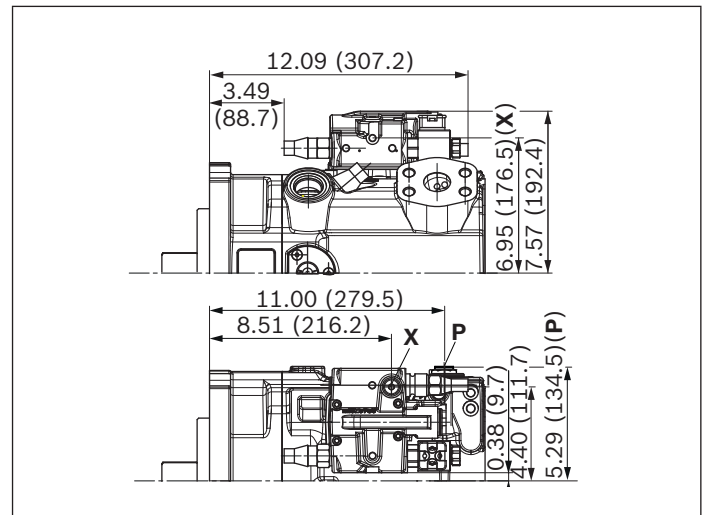
▼ **DP – Pressure controller, for parallel operation**



▼ **DGT6/DGT8 – With integrated pilot control valve, electric-proportional override**



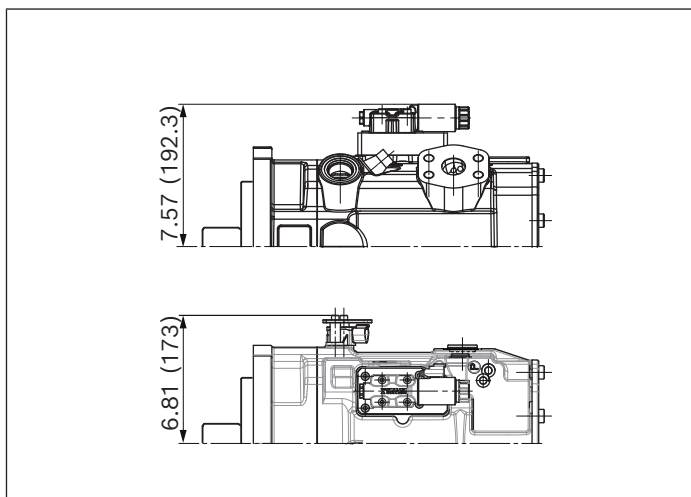
▼ **DGV2 – Mounted electric directional valve and pressure relief valve (only in combination with pressure controller)**



Notice

All controllers described with shuttle valve in **P**
(some contrary to standard as per type code digit 08)

▼ **U7 – Electrohydraulic control system
(positive control)**



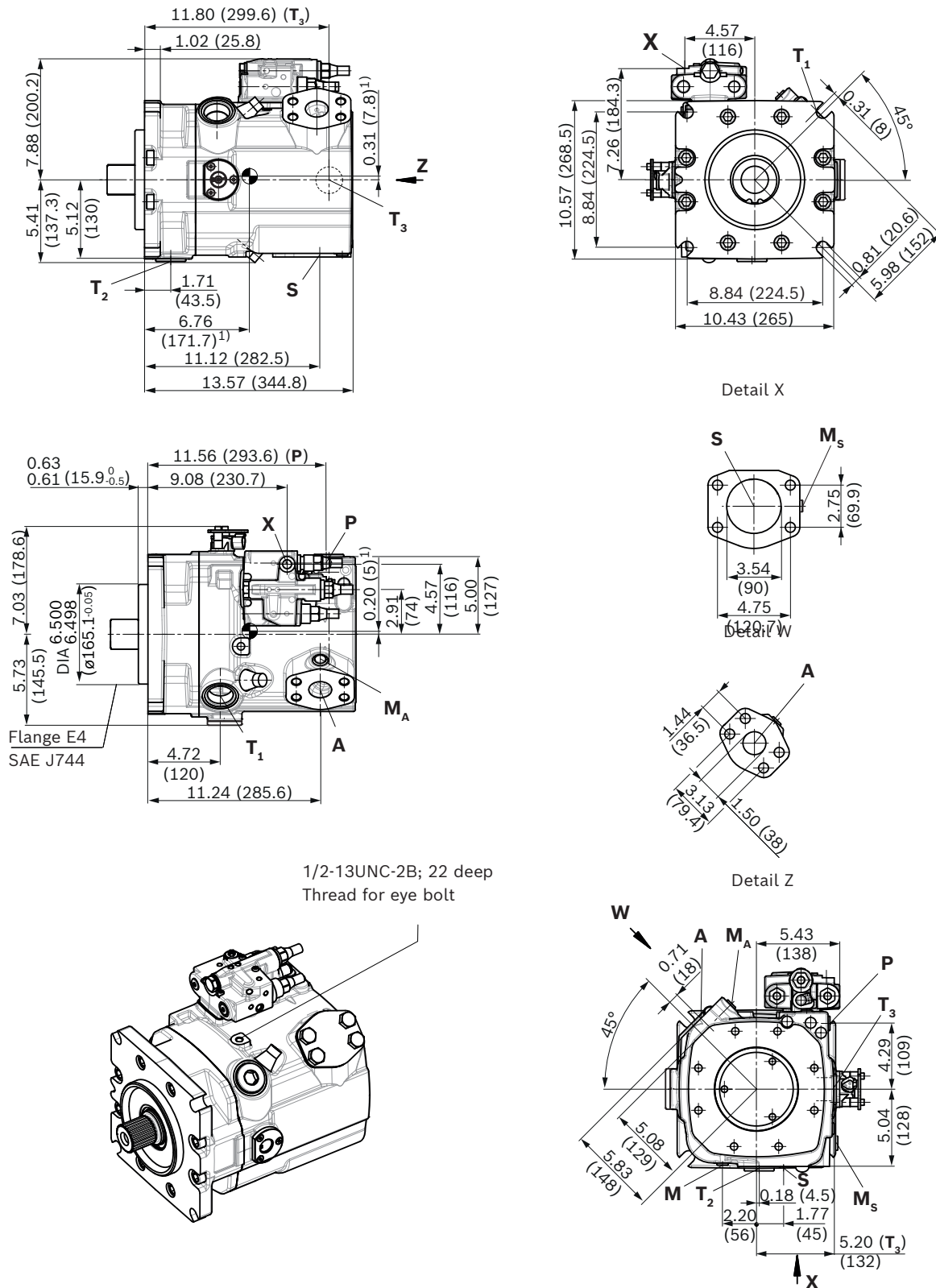
Notice

All controllers described with shuttle valve in **P**
(some contrary to standard as per type code digit 08)

Dimensions, size 210

LRDRS0 – Power controller with pressure controller, load-sensing and with electric swivel angle sensor

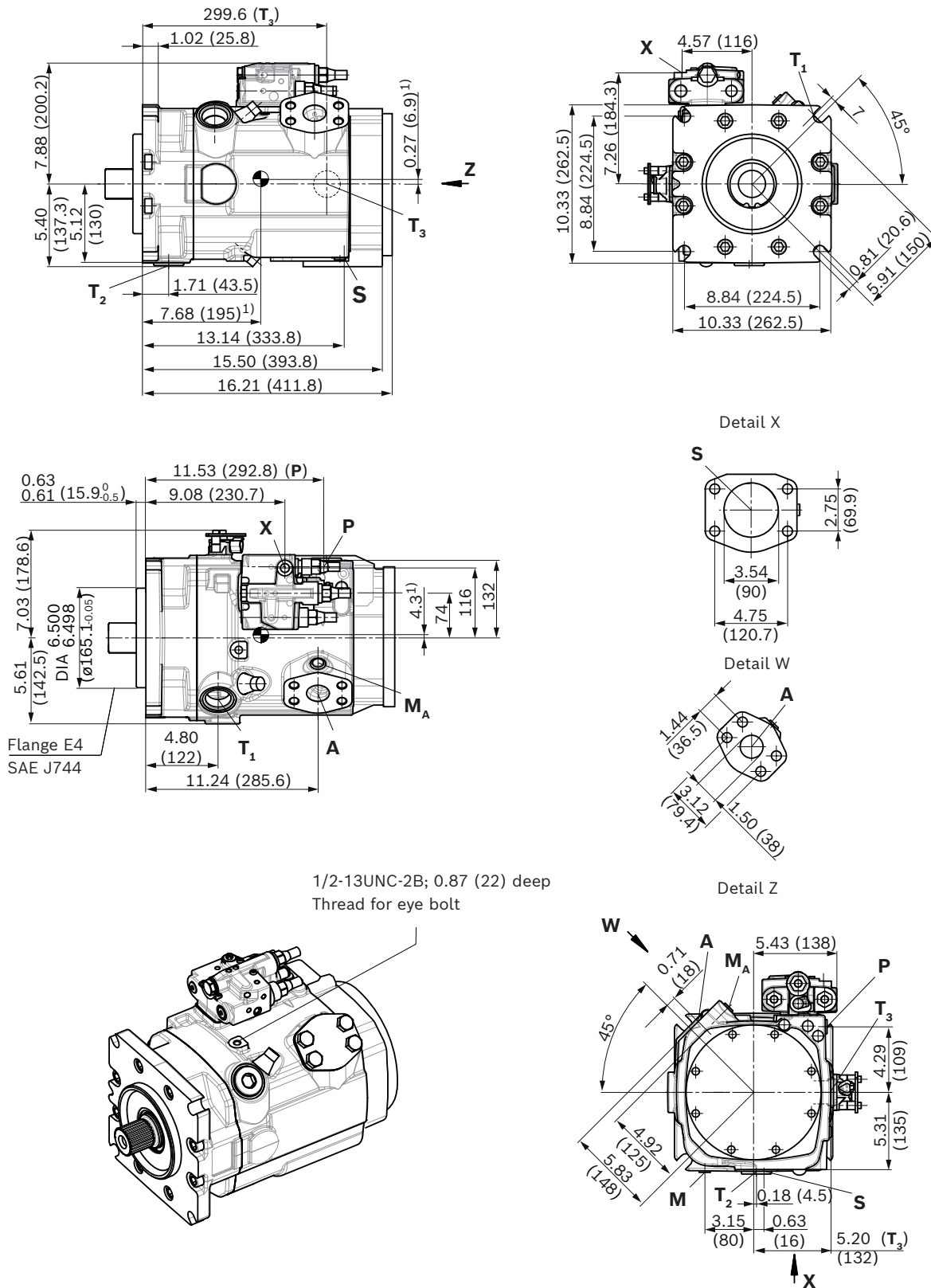
Without charge pump, clockwise rotation



1) Center of gravity

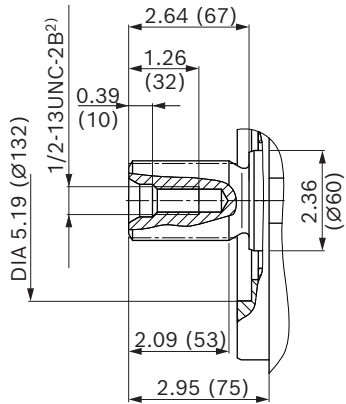
LRDRS0 – Power controller with pressure controller, load-sensing and with electric swivel angle sensor

With charge pump, clockwise rotation



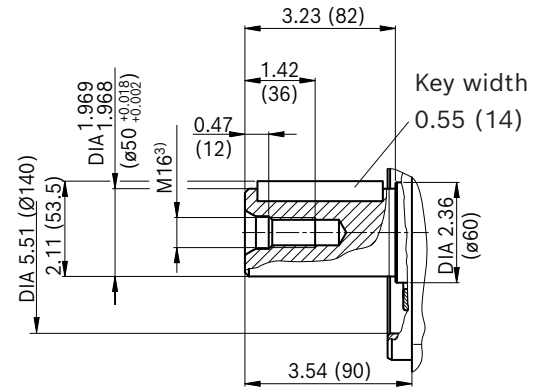
▼ **Splined shaft SAE J744**

T1 – 1 3/4 in 13T 8/16DP¹⁾

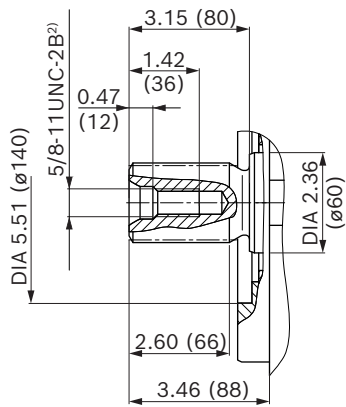


▼ **Parallel keyed shaft DIN 6885**

B2 – Ø50 A 14x9x80



T2 – 2 in 15T 8/16DP¹⁾



- 1) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5.
- 2) Thread according to ASME B1.1
- 3) Center bore according to DIN 332 (thread according to DIN 13)

Ports		Standard	Size	$p_{\max}$ [psi (bar)] ¹⁾	State ⁴⁾
A	Working port fastening thread	SAE J518 ASME B1.1	1 1/2 in 5/8-11UNC-2B; 1.18 (30) deep	6100 (420)	O
S	Suction port (without charge pump) fastening thread	SAE J518 ASME B1.1	3 1/2 in 5/8-11UNC-2B; 1.18 (30) deep	435 (30)	O
S	Suction port (with charge pump) fastening threads	SAE J518 ASME B1.1	3 1/2 in 5/8-11UNC-2B; 1.18 (30) deep	30 (2)	O
T₁	Drain port	ISO 11926 ²⁾	1 5/8-12UN-2B; 0.79 (20) deep	75 (5)	O ³⁾
T₂	Drain port	ISO 11926 ²⁾	1 5/8-12UN-2B; 0.79 (20) deep	75 (5)	X ³⁾
T₃	Drain port	ISO 11926 ²⁾	1 5/8-12UN-2B; 0.79 (20) deep	75 (5)	X ³⁾
CR	Pilot signal (CR only)	ISO 11926	9/16-18UNF-2B; 0.51 (13) deep	6100 (420)	O
PR	Pilot signal (PR only)	ISO 11926	9/16-18UNF-2B; 0.51 (13) deep	6100 (420)	O
H3 to H6	Pilot signal (only on H3, H4, H5 and H6)	ISO 11926	9/16-18UNF-2B; 0.51 (13) deep	1450 (100)	O
X	Pilot signal	ISO 11926 ²⁾	9/16-18UNF-2B; 0.51 (13) deep	6100 (420)	O
DP	Pilot pressure (only on DP)	ISO 11926 ²⁾	9/16-18UNF-2B; 0.51 (13) deep	6100 (420)	O
DP₁	Measuring port pilot signal (DP)	ISO 11926 ²⁾	9/16-18UNF-2B; 0.51 (13) deep	6100 (420)	X
M	Measurement of stroking chamber pressure	ISO 11926 ²⁾	9/16-18UNF-2B; 13 (0.51) deep	6100 (380)	X
M_A	Measuring pressure A	ISO 11926 ²⁾	9/16-18UNF-2B; 0.51 (13) deep	6100 (420)	X
M_S	Measuring suction pressure (only A15VSO)	ISO 11926 ²⁾	9/16-18UNF-2B; 0.51 (13) deep	435 (30)	X
P	External control pressure (type code position 8 version B or C = with external control pressure supply)	ISO 11926 ²⁾	9/16-18UNF-2B; 0.51 (13) deep	725 (50)	O
	Port P is without function (Type code position 8 version A = without external control pressure supply)	ISO 11926 ²⁾	3/4-16UNF-2B; 0.50 (12.6) deep	6100 (420)	X

1) Depending on the application, momentary pressure peaks can occur.

Keep this in mind when selecting measuring devices and fittings.

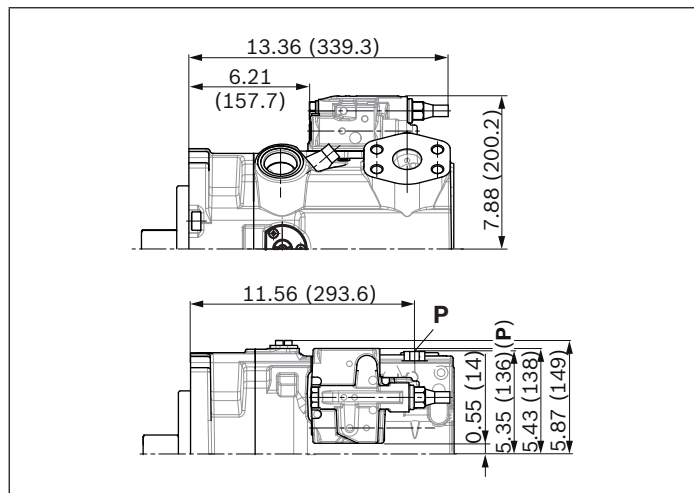
2) The countersink may be deeper than specified in the standard.

3) Depending on installation position, **T₁**, **T₂** or **T₃** must be connected (see also Installation instructions on pages 73 and 75).

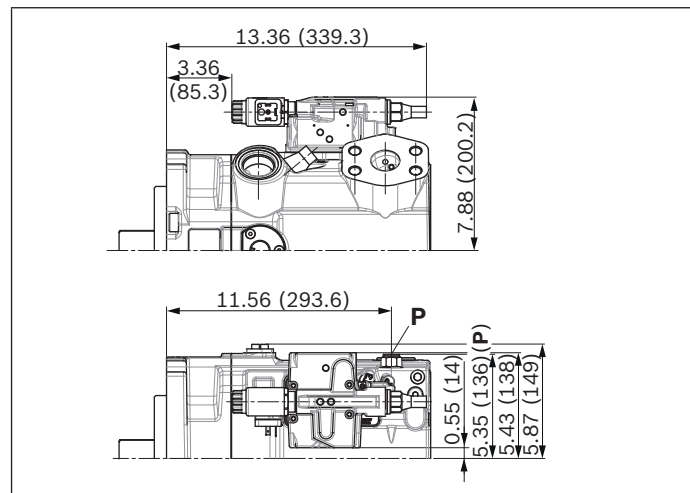
4) O = Must be connected (plugged on delivery)

X = Plugged (in normal operation)

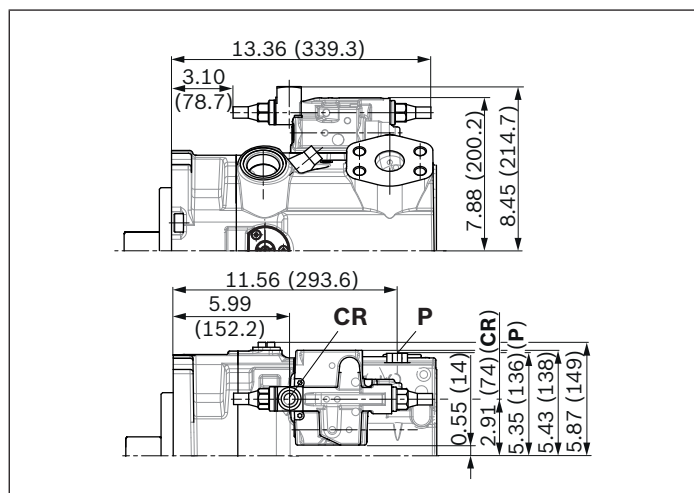
▼ **LR – Power controller, fixed setting**



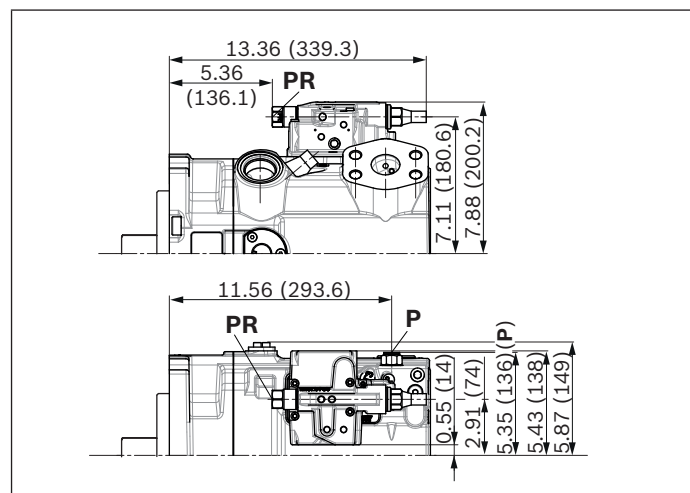
▼ **L4 – Power controller, electric-proportional override**



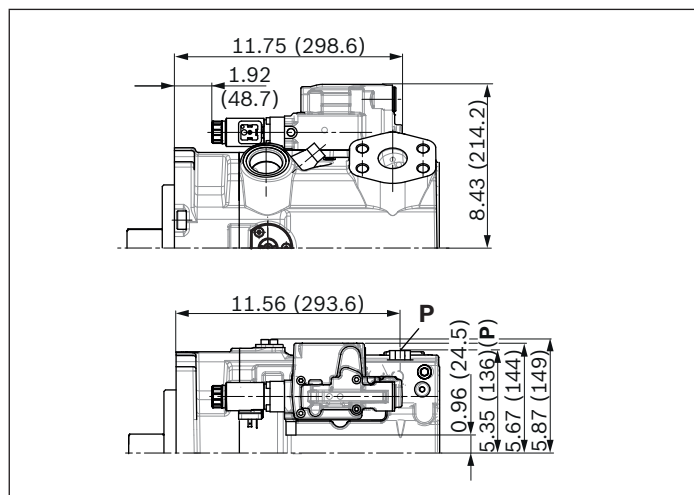
▼ **CR – Power controller, hydraulic-proportional override, high pressure, with stop**



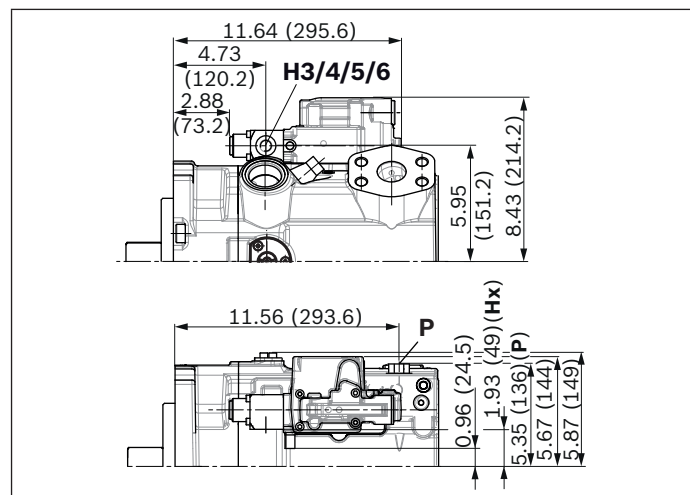
▼ **PR – Power controller, hydraulic-proportional override, high pressure, without stop**



▼ **E2/E6 – Stroke control electric-proportional**

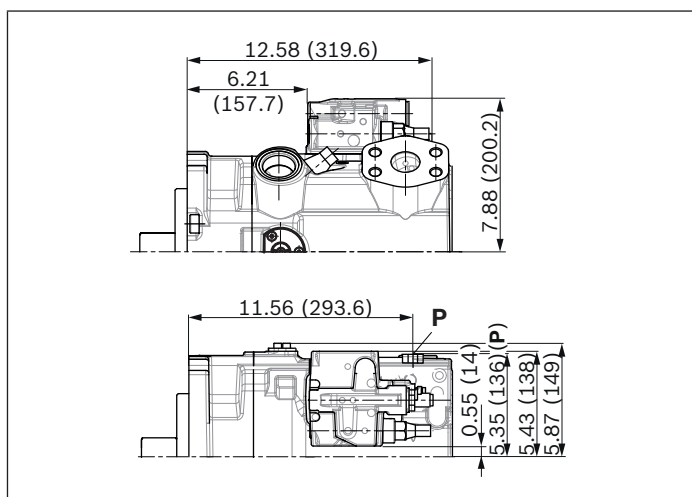
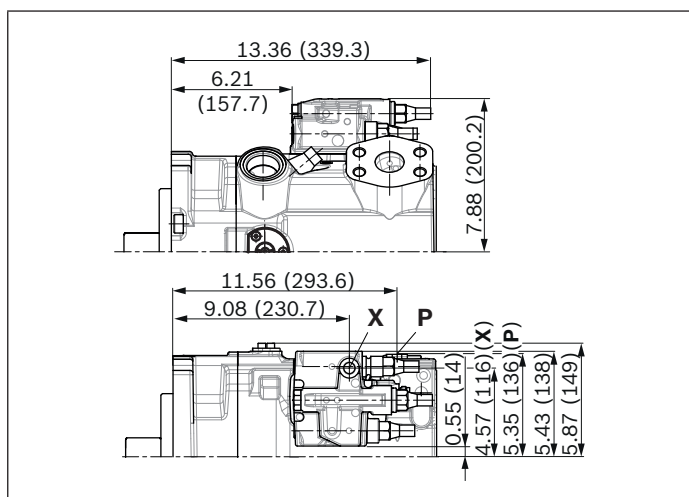
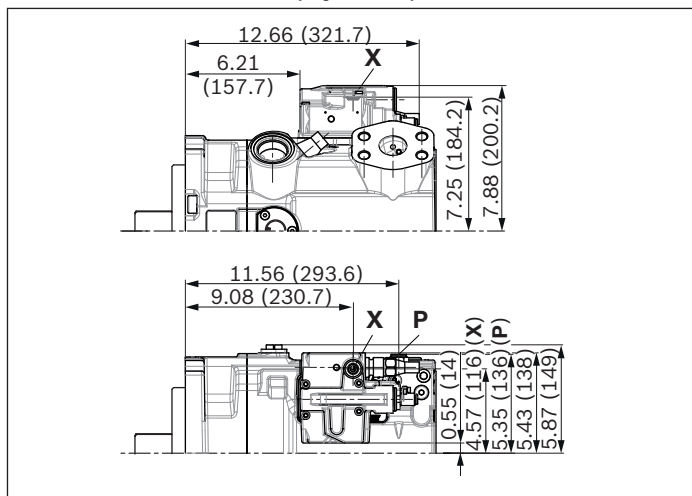
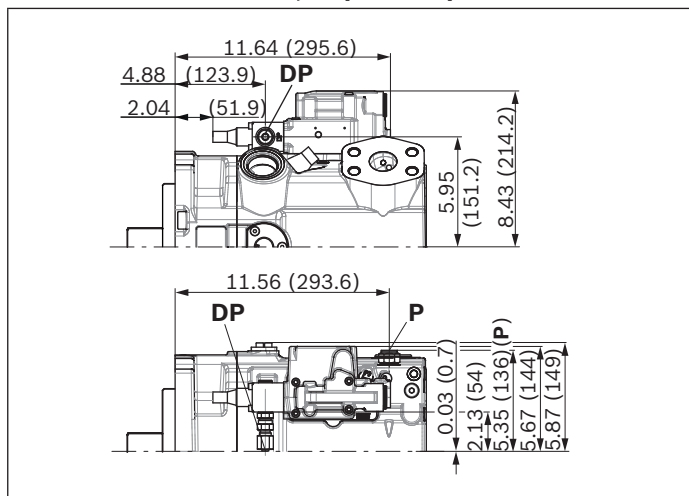
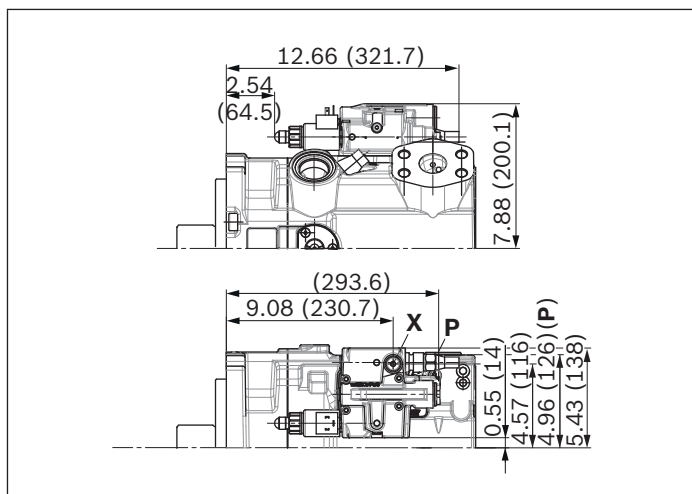
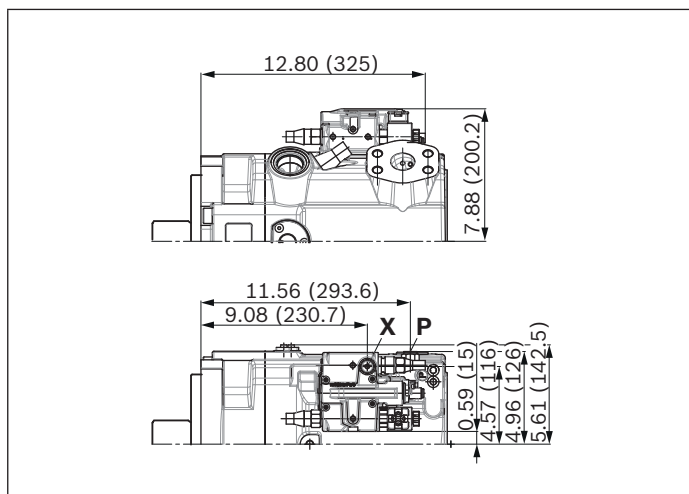


▼ **H3/4/5/6 – Stroke control, hydraulic-prop., pilot pressure**



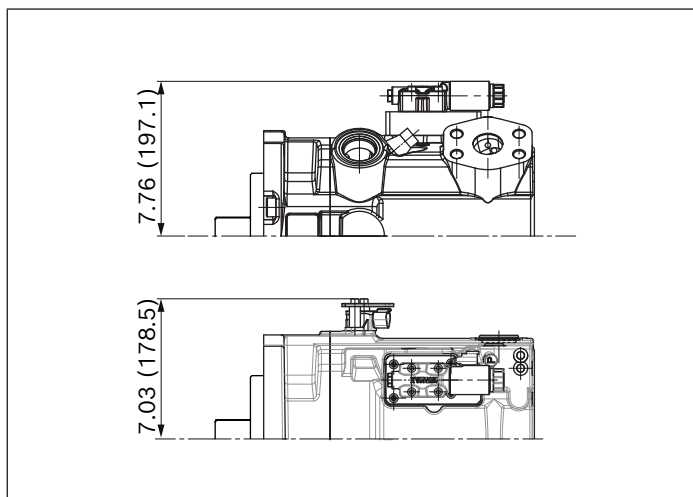
Notice

All controllers described with shuttle valve in **P**
(some contrary to standard as per type code digit 08)

▼ **DR – Pressure controller, fixed setting**▼ **LRDRS0 – Power controller with pressure controller and load-sensing, fixed setting**▼ **DG – Pressure controller, hydraulic, remote controlled**▼ **DP – Pressure controller, for parallel operation**▼ **DGT6/DGT8 – With integrated pilot control valve, electric-proportional override**▼ **DGV2 – Mounted electric directional valve and pressure relief valve (only in combination with pressure controller)****Notice**

All controllers described with shuttle valve in **P**
(some contrary to standard as per type code digit 08)

▼ **U7 – Electrohydraulic control system
(positive control)**

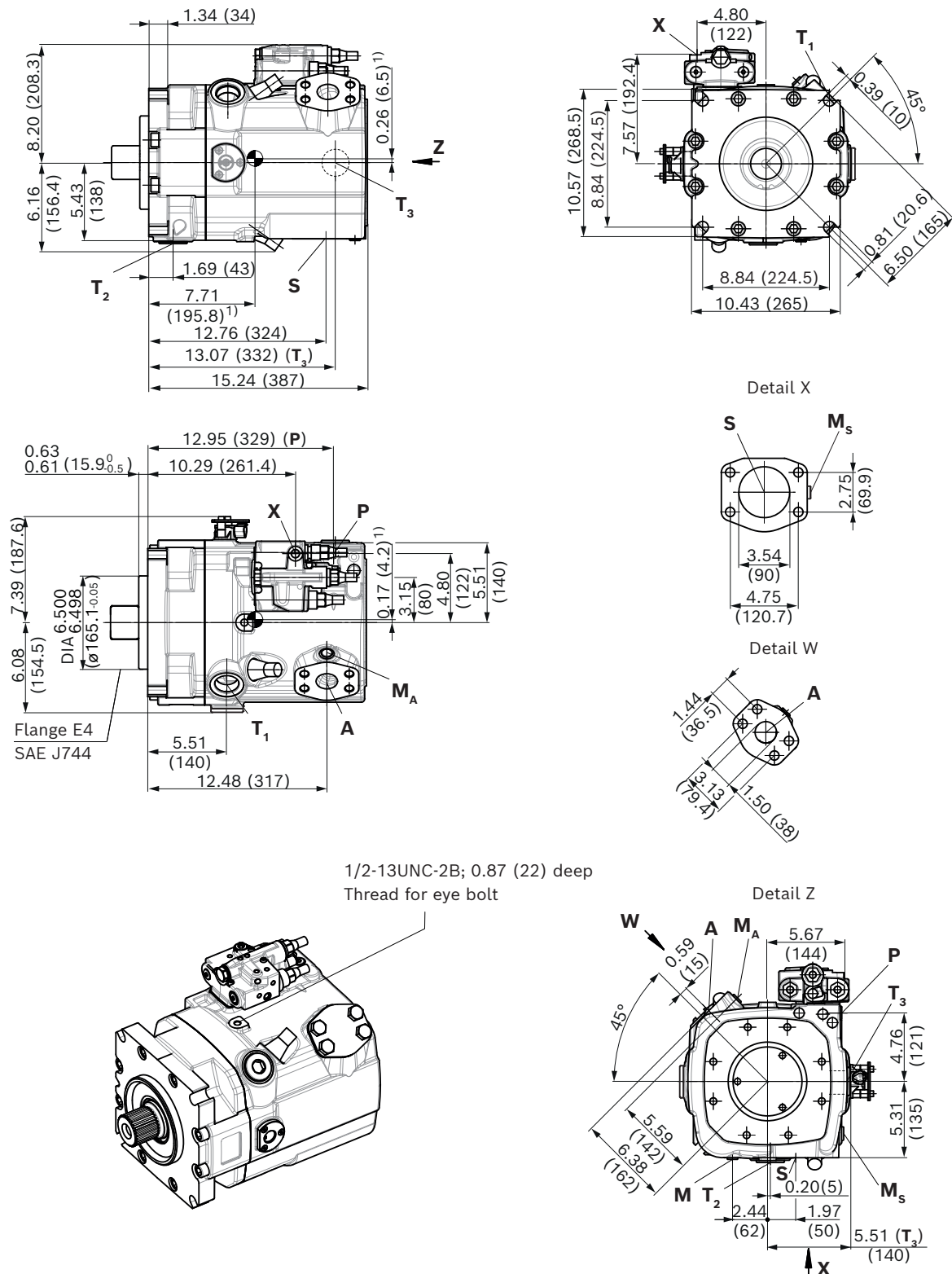


Notice

All controllers described with shuttle valve in **P**
(some contrary to standard as per type code digit 08)

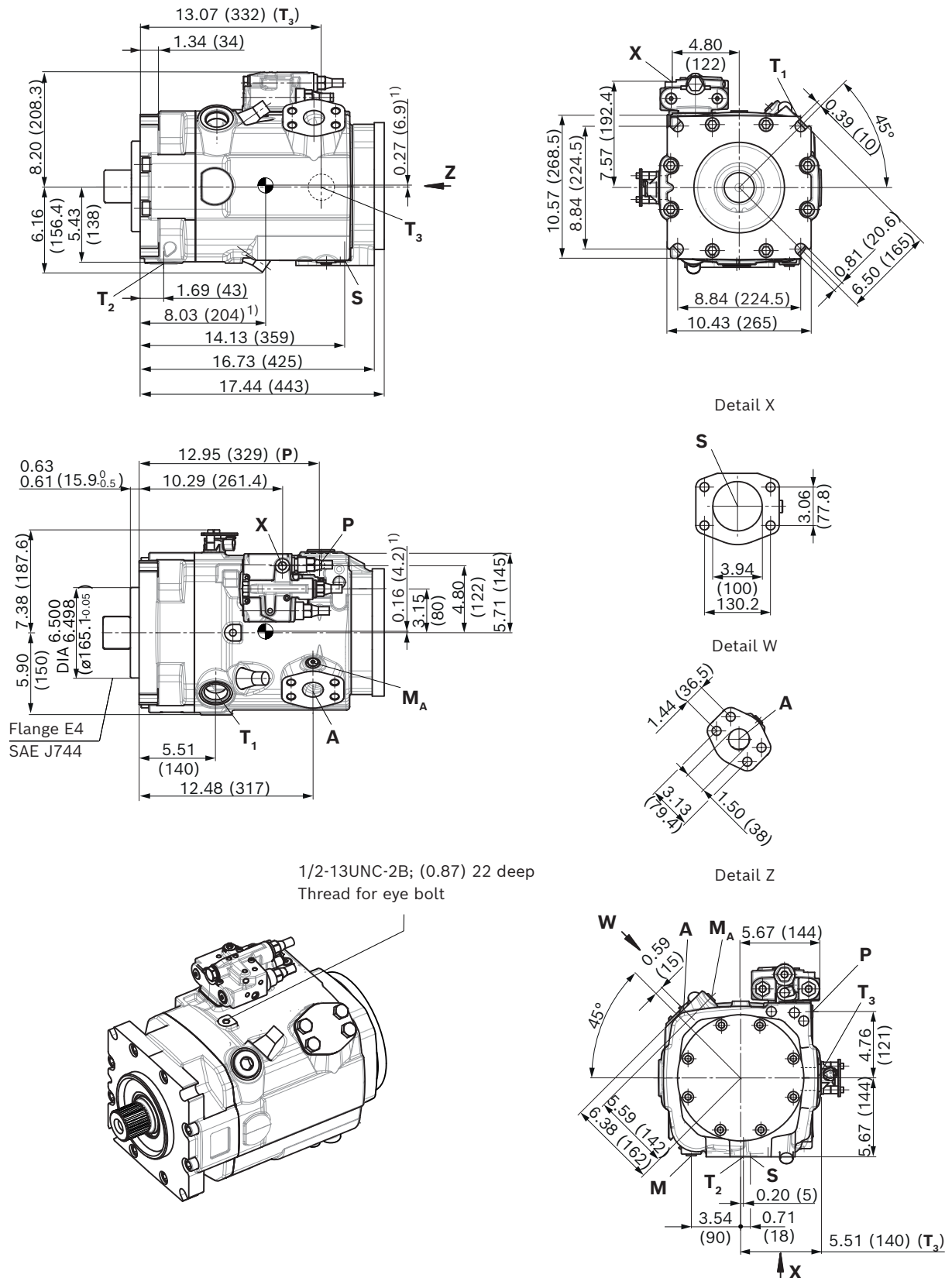
Dimensions, size 280**LRDRS0 – Power controller with pressure controller, load-sensing and with electric swivel angle sensor**

Without charge pump, clockwise rotation

¹⁾ Center of gravity

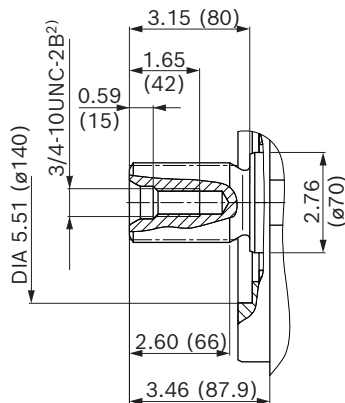
LRDRS0 – Power controller with pressure controller, load-sensing and with electric swivel angle sensor

With charge pump, clockwise rotation

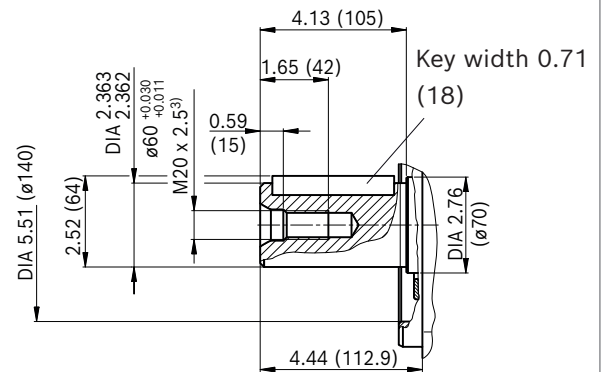


1) Center of gravity

▼ Splined shaft SAE J744

T3 – 2 1/4 in 17T 8/16DP¹⁾

▼ Parallel keyed shaft DIN 6885

B4 – Ø60 A 18x11x100

Ports	Standard	Size ⁴⁾	p_{max} [psi (bar)] ⁴⁾	State ⁷⁾
A	Working port fastening thread	SAE J518 ASME B1.1	1 1/2 in 5/8-11UNC-2B; 35 ⁹⁾ (1.38) deep	6100 (420) O
S	Suction port (without charge pump) fastening thread	SAE J518 ASME B1.1	3 1/2 in 5/8-11UNC-2B; 35 ⁹⁾ (1.38) deep	435 (30) O
S	Suction port (with charge pump) fastening threads	SAE J518 ASME B1.1	4 in 5/8-11UNC-2B; 35 ⁹⁾ (1.38) deep	30 (2) O
T₁	Drain port	ISO 11926 ⁵⁾	1 5/8UN-2B; 0.79 (20) deep	75 (5) O ⁶⁾
T₂	Drain port	ISO 11926 ⁵⁾	1 5/8UN-2B; 0.79 (20) deep	75 (5) X ⁶⁾
T₃	Drain port	ISO 11926 ⁵⁾	1 5/8UN-2B; 0.79 (20) deep	75 (5) X ⁷⁾
CR	Pilot signal (CR only)	ISO 11926	9/16-18UNF-2B; 0.51 (13) deep	6100 (420) O
PR	Pilot signal (PR only)	ISO 11926	9/16-18UNF-2B; 0.51 (13) deep	6100 (420) O
H3 to H6	Pilot signal (only on H3, H4, H5 and H6)	ISO 11926	9/16-18UNF-2B; 0.51 (13) deep	1450 (100) O
X	Pilot signal	ISO 11926 ⁵⁾	9/16-18UNF-2B; 0.51 (13) deep	6100 (420) O
DP	Pilot pressure (only on DP)	ISO 11926 ⁵⁾	9/16-18UNF-2B; 0.51 (13) deep	6100 (420) O
DP₁	Measuring port pilot signal (DP)	ISO 11926 ⁵⁾	9/16-18UNF-2B; 0.51 (13) deep	6100 (420) X
M	Measurement of stroking chamber pressure	ISO 11926 ⁵⁾	9/16-18UNF-2B; 13 (0.51) deep	6100 (380) X
M_A	Measuring pressure A	ISO 11926 ⁵⁾	9/16-18UNF-2B; 13 (0.51) deep	6100 (420) X
M_S	Measuring suction pressure (only A15VSO)	ISO 11926 ⁵⁾	9/16-18UNF-2B; 0.51 (13) deep	435 (30) X
P	External control pressure (type code position 8 version B or C = with external control pressure supply)	ISO 11926 ⁵⁾	9/16-18UNF-2B; 0.51 (13) deep	725 (50) O
	Port P is without function (Type code position 8 version A = without external control pressure supply)	ISO 11926 ⁵⁾	3/4-16UNF-2B; 12.6 (0.50) deep	6100 (420) X

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

2) Thread according to ASME B1.1

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

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

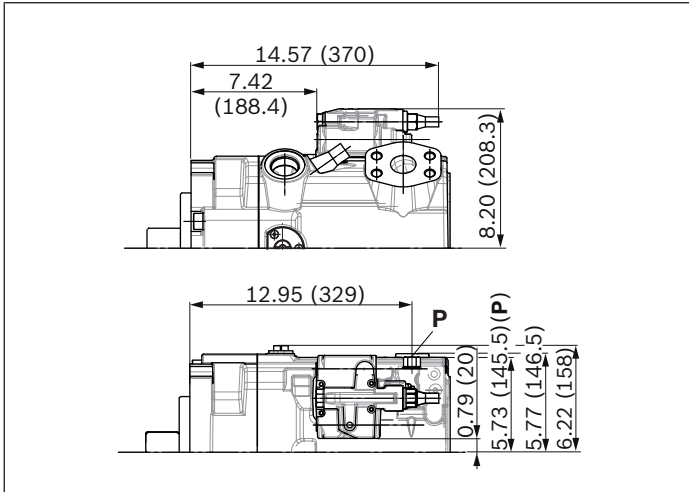
5) The countersink may be deeper than specified in the standard.

6) Depending on installation position, T1, T2 or T3 must be connected (see also Installation instructions on pages 73 and 75).

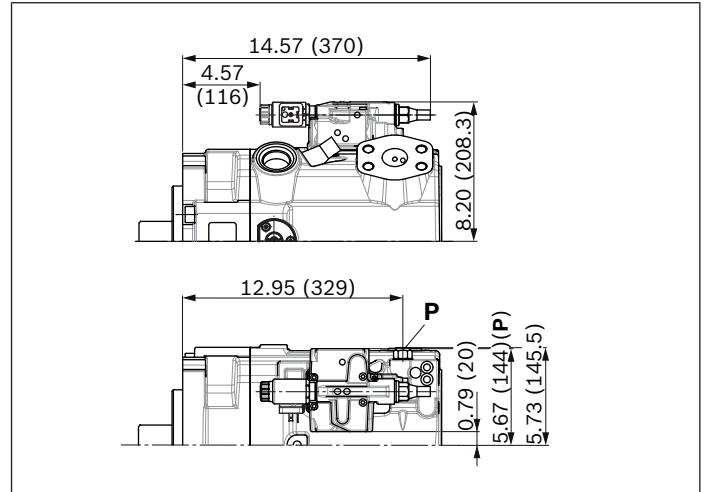
7) O = Must be connected (plugged on delivery)

X = Plugged (in normal operation)

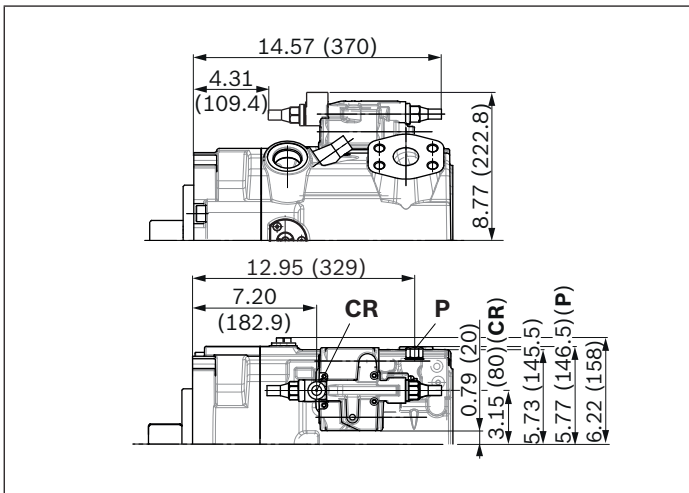
▼ **LR – Power controller, fixed setting**



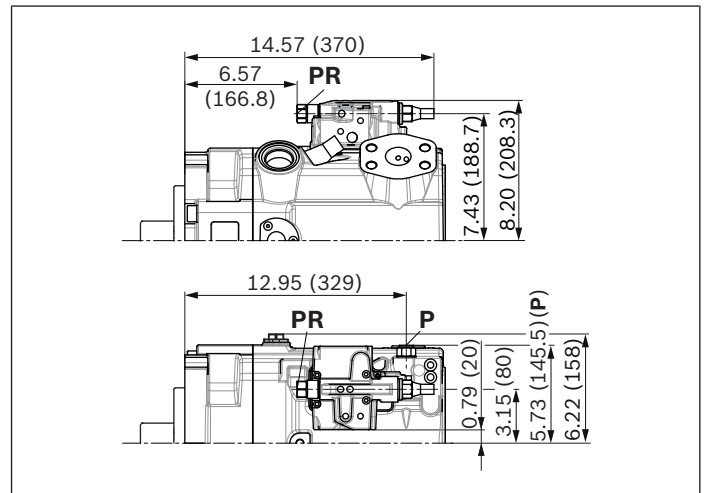
▼ **L4 – Power controller, electric-proportional override**



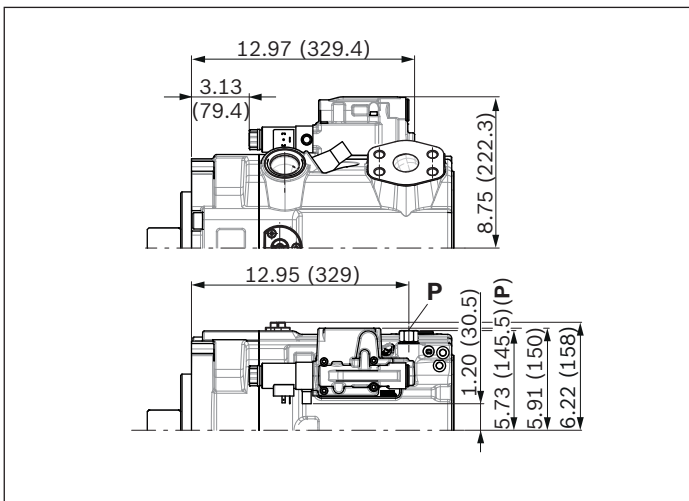
▼ **CR – Power controller, hydraulic-proportional override, high pressure, with stop**



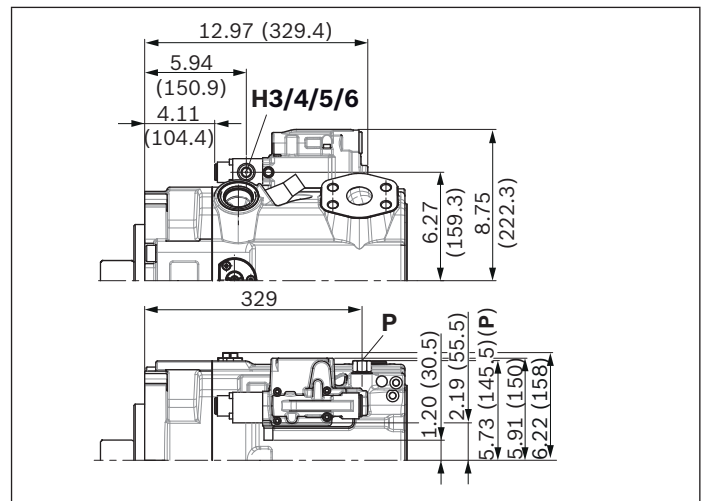
▼ **PR – Power controller, hydraulic-proportional override, high pressure, without stop**



▼ **E2/E6 – Stroke control electric-proportional**

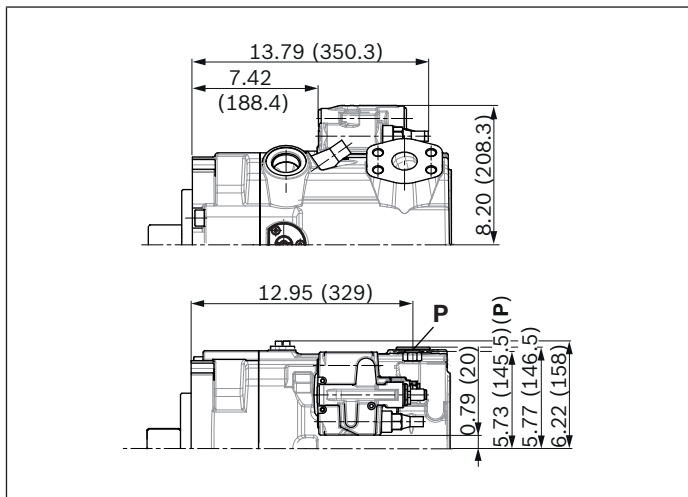
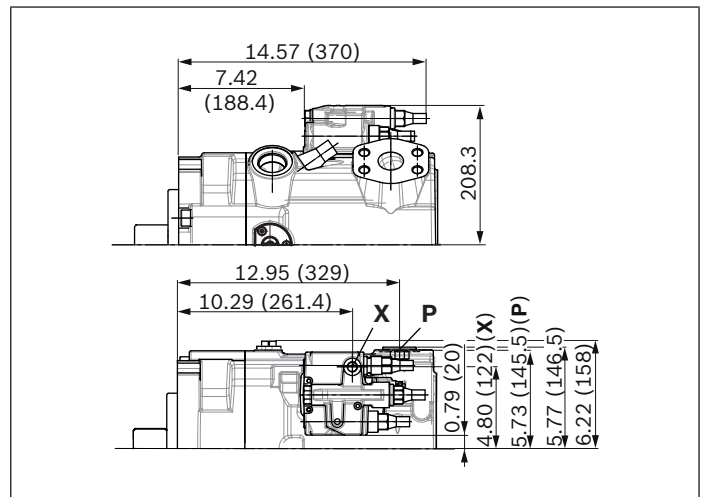
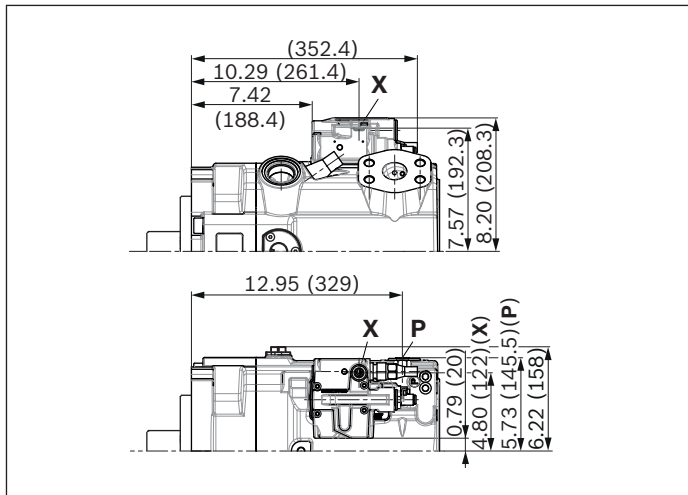
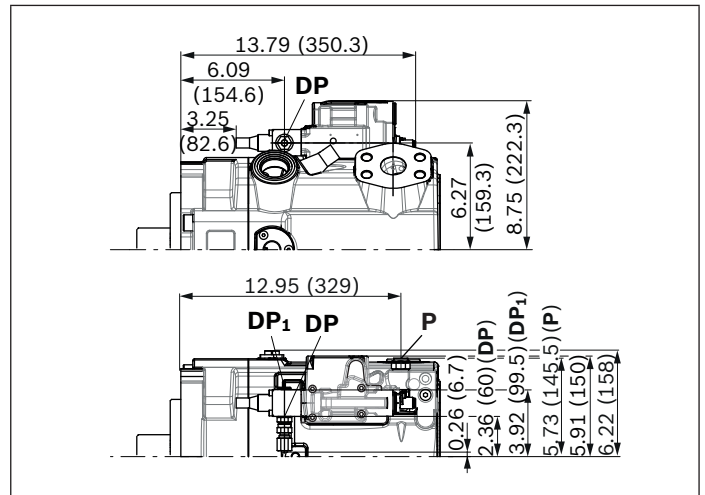
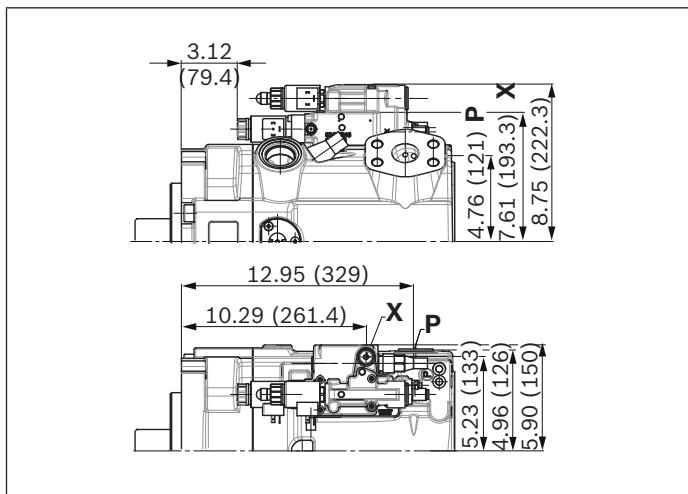
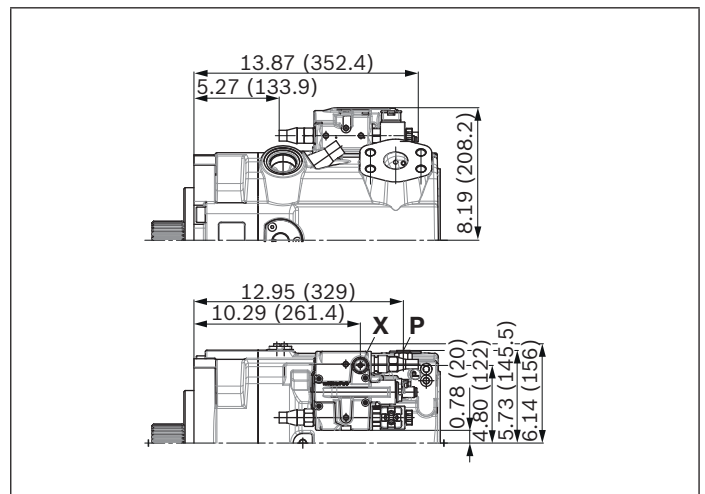


▼ **H3/4/5/6 – Stroke control, hydraulic-prop., pilot pressure**



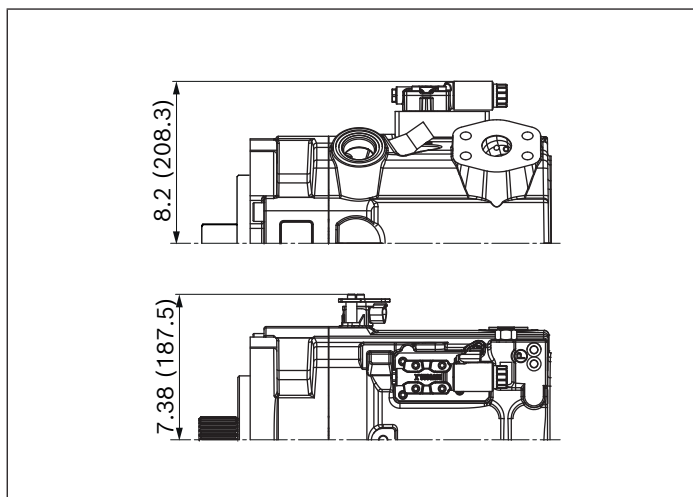
Notice

All controllers described with shuttle valve in **P**
(some contrary to standard as per type code digit 08)

▼ **DR – Pressure controller, fixed setting**▼ **LRDRS0 – Power controller with pressure controller and load-sensing, fixed setting**▼ **DG – Pressure controller, hydraulic, remote controlled**▼ **DP – Pressure controller, for parallel operation**▼ **DGT6/DGT8 – With integrated pilot control valve, electric-proportional override**▼ **DGV2 – Mounted electric directional valve and pressure relief valve (only in combination with pressure controller)****Notice**

All controllers described with shuttle valve in **P**
(some contrary to standard as per type code digit 08)

▼ **U7 – Electrohydraulic control system
(positive control)**



Notice

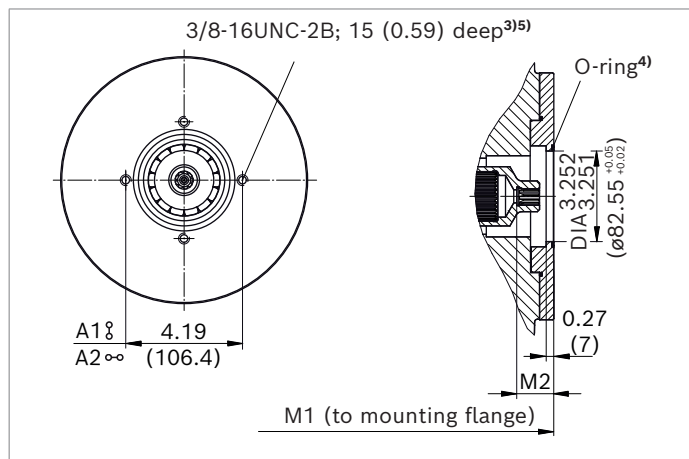
All controllers described with shuttle valve in **P**
(some contrary to standard as per type code digit 08)

Dimensions, through drive

Flange SAE J744			Hub for splined shaft ²⁾			Availability across sizes					Code
Diameter	Attachment ¹⁾	Designation	Diameter	Designation		110	145	175	210	280	
82-2 (A)	⊗	A3	5/8 in	9T 16/32DP	S2	●	●	●	●	●	A3S2
101-2 (B)	⊗	B3	7/8 in	13T 16/32DP	S4	●	●	●	●	●	B3S4
			1 in	15T 16/32DP	S5	●	●	●	●	●	B3S5
	⊘	B5	7/8 in	13T 16/32DP	S4	●	●	●	●	●	B5S4
			1 in	15T 16/32DP	S5	●	●	●	●	●	B5S5

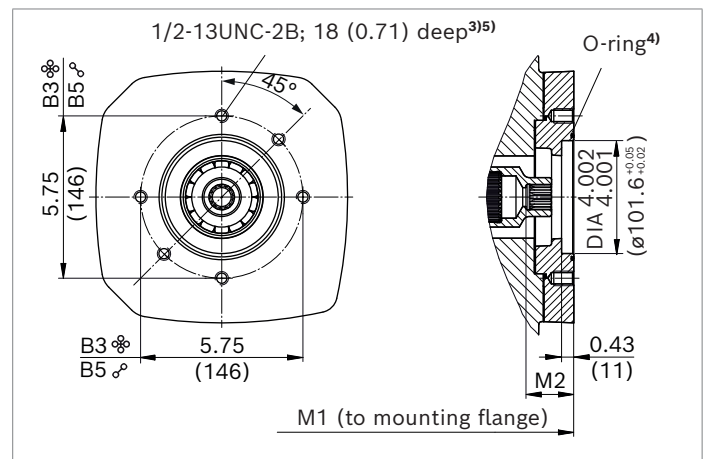
● = Available ⊘ = On request

▼ 82-2 (A)



A3S2	NG	M1	M2
Without charge pump	110	11.85 (301)	1.39 (34)
	145	12.83 (326)	1.57 (40)
	175	13.41 (340.5)	1.33 (33.8)
	210	14.09 (357.8)	1.33 (33.8)
	280	15.75 (400)	1.33 (33.8)
With charge pump	145	14.75 (374.7)	1.57 (40)
	175	15.33 (389.5)	1.33 (33.8)
	210	16.02 (406.8)	1.33 (33.8)
	280	17.24 (438)	1.33 (33.8)

▼ 101-2 (B)



B3S4, B5S4	NG	M1	M2
Without charge pump	110	12.28 (312)	1.69 (43)
	145	13.27 (337)	1.69 (43)
	175	13.96 (354.5)	1.69 (43)
	210	14.64 (371.8)	1.69 (43)
	280	16.30 (414)	1.69 (43)
With charge pump	145	15.19 (386)	1.69 (43)
	175	15.88 (403.5)	1.69 (43)
	210	16.56 (420.8)	1.69 (43)
	280	17.79 (452)	1.69 (43)

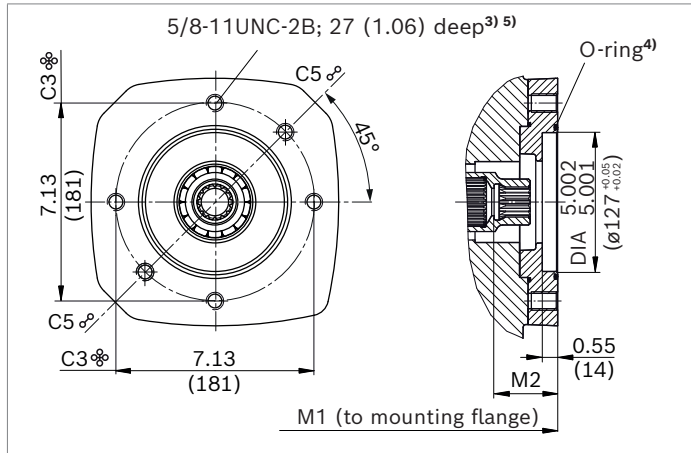
B3S5, B5S5	NG	M1	M2
without charge pump	110	12.28 (312)	1.89 (48)
	145	13.27 (337)	1.89 (48)
	175	13.97 (355)	1.89 (48)
	210	14.65 (372.3)	1.89 (48)
	280	16.31 (414.5)	1.89 (48)
with charge pump	145	15.18 (385.7)	1.89 (48)
	175	15.90 (404)	1.89 (48)
	210	16.58 (421.3)	1.89 (48)
	280	17.81 (452.5)	1.89 (48)

- 1) Mounting holes pattern viewed on through drive with control at top
- 2) According to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
- 3) Thread according to ASME B1.1.
- 4) O-ring included in the scope of delivery
- 5) Design recommended according to VDI 2230, screw quality 8.8 according to ISO 898-1

Flange SAE J744			Splined shaft ²⁾			Availability across sizes					Code
Diameter	Attachment ¹⁾	Designation	Diameter		Designation	110	145	175	210	280	
127-2 (C)		C3	1 1/4 in	14T 12/24DP	S7	●	●	●	●	●	C3S7
			1 1/2 in	17T 12/24DP	S9	●	●	●	●	●	C3S9
		C5	1 1/4 in	14T 12/24DP	S7	○	○	●	●	●	C5S7
127-4 (C)		C4	1 1/4 in	14T 12/24DP	S7	●	●	●	●	○	C4S7

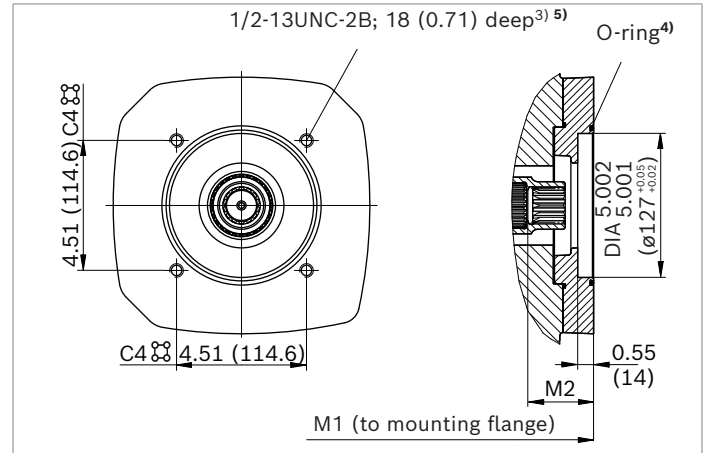
● = Available ○ = On request

▼ 127-2 (C)



C3S7	NG	M1	M2
Without charge pump	110	12.72 (323)	2.28 (58)
	145	13.70 (348)	2.28 (58)
	175	13.96 (354.5)	2.29 (58.1)
	210	14.64 (371.8)	2.29 (58.1)
	280	16.30 (414)	2.29 (58.1)
With charge pump	145	15.62 (396.7)	2.28 (58)
	175	15.89 (403.5)	2.29 (58.1)
	210	16.57 (420.8)	2.29 (58.1)
	280	17.80 (452)	2.29 (58.1)
C3S9	NG	M1	M2
Without charge pump	110	12.72 (323)	2.52 (64)
	175	14.15 (359.5)	2.52 (64)
	210	14.83 (376.8)	2.52 (64)
	280	16.30 (414)	2.52 (64)
With charge pump	145	16.30 (414)	2.52 (64)
	175	16.10 (409)	2.52 (64)
	210	16.76 (425.8)	2.52 (64)
	280	17.80 (452)	2.52 (64)
C5S7	NG	M1	M2
without charge pump	175	13.96 (354.5)	2.28 (58)
	210	14.64 (371.8)	2.28 (58)
	280	16.30 (414)	2.28 (58)
with charge pump	175	15.89 (403.5)	2.28 (58)
	210	16.57 (420.8)	2.28 (58)
	280	17.80 (452)	2.28 (58)

▼ 127-4 (C)



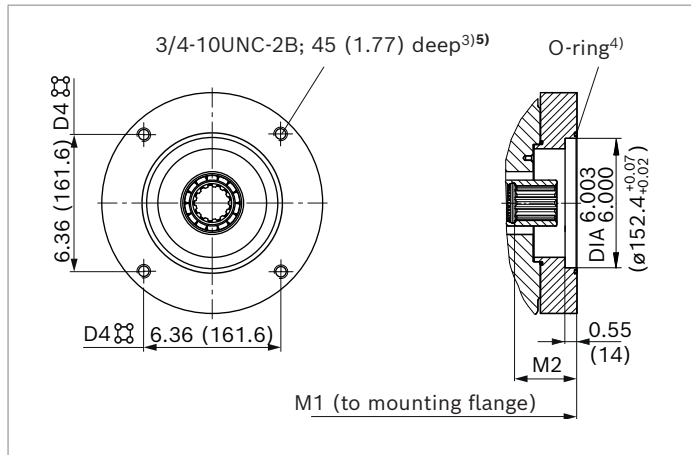
C4S7	NG	M1	M2
without charge pump	110	12.72 (323)	2.28 (58)
	145	13.70 (348)	2.28 (58)
	175	13.96 (354.5)	2.28 (58)
	210	14.64 (371.8)	2.28 (58)
	280	16.30 (414)	2.28 (58)
with charge pump	145	15.62 (396.7)	2.28 (58)
	175	15.89 (403.5)	2.28 (58)
	210	16.57 (420.8)	2.28 (58)

- 1) Mounting holes pattern viewed on through drive with control at top.
- 2) Hub for splined shaft according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
- 3) Thread according to ASME B1.1.
- 4) O-ring included in the scope of delivery
- 5) Design recommended according to VDI 2230, screw quality 8.8 according to ISO 898-1

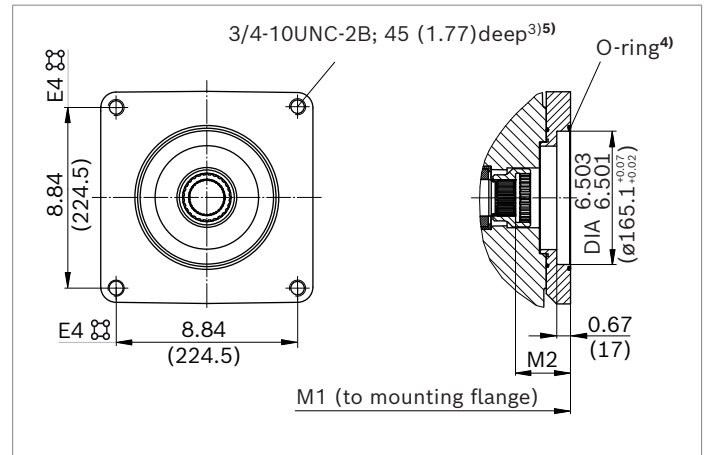
Flange SAE J744			Hub for splined shaft ²⁾			Availability over sizes					Code
Diameter	Attachment ¹⁾	Designation	Diameter		Designation	110	145	175	210	280	
152-4 (D)		D4	1 3/4 in 13T 8/16DP		T1	●	●	●	●	●	D4T1
			2 in 15T 8/16DP		T2	-	○	○	○	○	D4T2
165-4 (E)		E4	2 in 15T 8/16DP		T2	-	-	●	●	●	E4T2
			2 1/4 in 17T 8/16DP		T3	-	-	-	-	●	E4T3

● = Available ○ = On request

▼ 152-4 (D)



▼ 165-4 (E)



D4T1	NG	M1	M2
without charge pump	110	13.23 (336)	3.03 (77)
	145	14.21 (361)	3.02 (76.8)
	175	14.67 (372.5)	3.02 (76.8)
	210	15.35 (389.8)	3.02 (76.8)
	280	17.01 (432)	3.03 (77)
with charge pump	145	16.13 (409.7)	3.02 (76.8)
	175	16.59 (421.5)	3.02 (76.8)
	210	17.28 (438.8)	3.02 (76.8)
	280	18.50 (470)	3.03 (77)

E4T2	NG	M1	M2
without charge pump	175	15.18 (385.5)	3.54 (90)
	210	15.86 (402.8)	3.54 (90)
	280	17.52 (445)	3.54 (90)
	175	17.11 (434.5)	3.54 (90)
with charge pump	210	17.79 (451.8)	3.54 (90)
	280	19.02 (483)	3.54 (90)
E4T3	NG	M1	M2
without charge pump	280	17.52 (445)	3.54 (90)
with charge pump	280	19.02 (483)	3.54 (90)

- 1) Mounting holes pattern viewed on through drive with control at top.
- 2) Hub for splined shaft according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
- 3) Thread according to ASME B1.1.
- 4) O-ring included in the scope of delivery
- 5) Design recommended according to VDI 2230, screw quality 8.8 according to ISO 898-1

Overview of mounting options

Through drive ¹⁾		Mounting options – 2nd pump					
Flange SAE J744	Hub for splined shaft	Code	A15VSO/10 A15VLO/10 Size (shaft)	A10VSO/31 NG (shaft)	A10VSO/32 NG (shaft)	A10V0/52 and 53 NG (shaft)	External gear pump
82-2 (A)	5/8 in	A3S2	–	–	–	10, 18 (U)	Series F NG4 to 22 ²⁾
101-2 (B)	7/8 in	B3S4	–	–	–	28 (R, S); 45 (U, W)	Series N NG20 to 36 ²⁾
	1 in	B3S5	–	–	–	45 (R, S); 60, 63 (U, W)	PGH4
	7/8 in	B5S4	–	28 (S, R)		28 (R, S); 45 (U, W)	
	1 in	B5S5	–	45 (S, R)		45 (R, S); 60, 63 (U, W)	
127-2 (C)	1 1/4 in	C3S7	–	–	–	85, 100 (U, W)	–
	1 1/2 in	C3S9	–	–	–	85, 100 (S)	PGH5
	1 1/4 in	C5S7	–	71 (R) (S) 88 (R) (S) 100 (U, W)	–	85, 100 (U, W)	
	1 1/4 in	C4S7	–	71 (R) (S) 88 (R) (S)	–	60, 63 (S, R) 72 (S, R) 85 (U, W)	
152-4 (D)	1 3/4 in	D4T1	110 (T1)	140 (S)	140, 180 (S)	–	–
	2 in	D4T2	145 (T2)	–	–	–	–
165-4 (E)	2 in	E4T2	175; 210 (T2)	–	–	–	–
	2 1/4 in	E4T3	280 (T3)	–	–	–	–

Mounting situation combination pumps in relation to each other

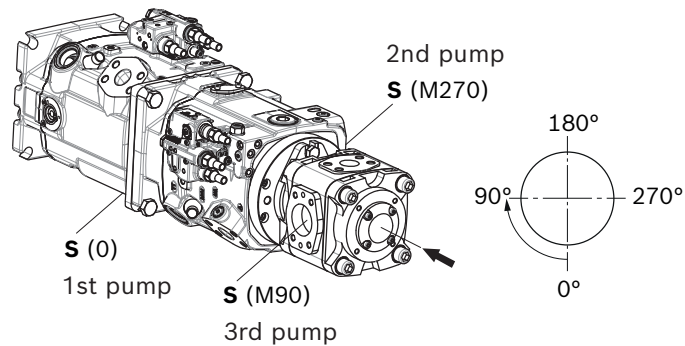
Port **S** of the relevant mounting unit in relation to port **S** of the first pump is always used as orientation.

Below, you will find an example with three attachment pumps:

1st pump	2nd pump	3rd pump
Alignment port S	Mounting angle to 1st pump	Mounting angle to 1st pump

Example:

without code	-M270	-M90
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Details of the mounting situation are provided following the order designation for the relevant combination or mounting unit.

Alignment clockwise viewed on through drive.

Order example

A15VSO 280....+A15VSO....145....-M270

A15VSO 280....+A15VSO....145....-M270+PGH....-M90

Notice

► Each through drive is plugged with a **non-pressure-resistant** cover. If the A15 is to be operated without through drive unit, the unit has to be rebuilt to U000 and closed by means of a pressure-resistant cover before the commissioning (see also instruction manual).

1) Additional through drives are available on request

2) Bosch Rexroth recommends special versions of the external gear pumps. Please contact us.

Permissible mass moment of inertia

Based on mounting flange on primary pump

Permissible moment of inertia A15VSO

Size			110	145	175	210	280
Permissible moment of inertia	$T_{m \text{ perm.}}$	lb-ft	2846	3808	4793	5816	8428
		(Nm)	(3859)	(5163)	(6498)	(7886)	(11427)
Permissible moment of inertia for dynamic mass acceleration 10 g (= 98.1 m/s ²)	$T_{m \text{ perm.}}$	lb-ft	285	381	479	582	843
		(Nm)	(386)	(516)	(650)	(789)	(1143)
Weight (A15VSO...DR.)	m	lbs (kg)	141 (64)	174 (79)	214 (97)	245 (111)	315 (143)
Distance from center of gravity	l_1	inch (mm)	5.7 (144.80)	6.22 (158.1)	6.29 (159.7)	6.76 (171.7)	7.71 (195.8)

Permissible moment of inertia A15VLO

Size			145	175	210	280
Permissible moment of inertia	$T_{m \text{ perm.}}$	lb-ft	5164	6210	7415	9306
		(Nm)	(7002)	(8420)	(10053)	(12617)
Permissible moment of inertia for dynamic mass acceleration 10 g (= 98.1 m/s ²)	$T_{m \text{ perm.}}$	lb-ft	516	621	741	931
		(Nm)	(700)	(842)	(1005)	(1262)
Weight (A15VSO...DR.)	m	lbs (kg)	203 (92)	243 (110)	276 (125)	326 (148)
Distance from center of gravity	l_1	inch (mm)	7.42 (188.4)	7.24 (183.9)	7.68 (195)	8.03 (204)

By using combination pumps, it is possible to have independent circuits without the need for splitter gearboxes. When ordering combination pumps the type designations for the first and the second pump must be joined by a "+" and the mounting situation must be added as described on page 67.

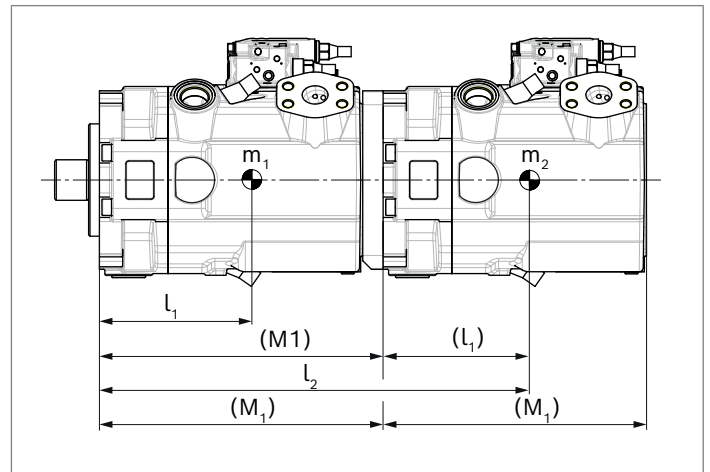
Order example:

A15VO280PLRDR.00A00/12MRVE4A41SE4A40-0+

A15VO280PLRDR.00A00/12MRVE4A41SU0000-0-M...

A tandem pump, with two pumps of equal size, is permissible without additional supports, assuming that the dynamic mass acceleration does not exceed the maximum of 10 g (= 98.1 m/s²).

For combination pumps consisting of more than two pumps, the mounting flange must be calculated for the permissible mass torque and support if necessary.



$m_1, m_2, m_3...$	Weight of pump	[lbs (kg)]
$l_1, l_2, l_3...$	Distance from center of gravity	[inch (mm)]
n	Quantity g ($n \times 9.81 \text{ m/s}^2$)	

$$T_m = (m_1 \times l_1 + m_2 \times l_2 + m_3 \times l_3) \times \frac{n \times g}{1000} \text{ [lb-ft (Nm)]}$$

Calculation for multiple pumps

l_1 = Front pump distance from center of gravity
(values from "Permissible moments of inertia" table)

l_2 = Dimension "M₁" from through drive drawings (from page 65)
+ l_1 of the 2nd pump

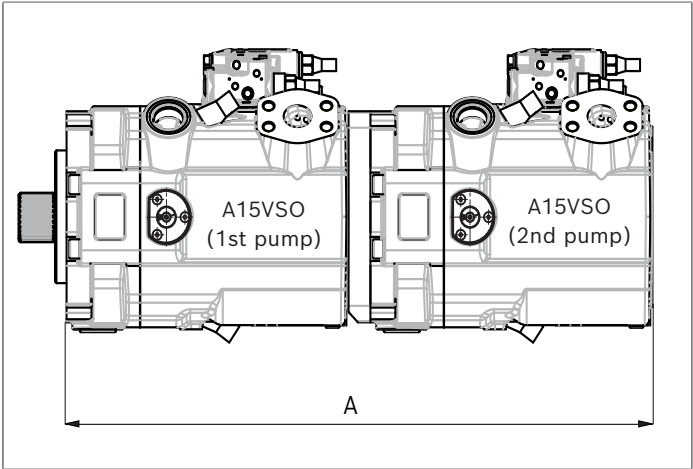
l_3 = Dimension "M₁" from through drive drawings (from page 65)
of the 1st pump + "M₁" of the 2nd pump + l_1 of the 3rd pump

Combination pumps A15V... + A15V...

Total length A

A15VSO (1st pump)	A15VSO (2nd pump)					A15VLO (2nd pump)			
	NG110	NG 145	NG175	NG210	NG280	NG145	NG175	NG210	NG280
	D4T1	D4T1	E4T2	E4T2	E4T3	D4T1	E4T2	E4T2	E4T3
NG110	24.45 (621)	–	–	–	–	–	–	–	–
NG145	25.43 (646)	26.42 (671)	–	–	–	28.98 (736.2)	–	–	–
NG175	25.88 (657.5)	26.87 (682.5)	28.07 (713)	–	–	29.44 (747.7)	30.71 (780)	–	–
NG210	26.57 (674.8)	27.55 (699.8)	28.75 (730.3)	29.43 (747.6)	–	30.12 (765)	31.39 (797.3)	32.07 (814.6)	–
NG280	28.23 (717)	29.21 (742)	30.41 (772.5)	31.09 (789.8)	32.76 (832)	31.78 (807.2)	33.05 (839.5)	33.73 (856.8)	34.90 (886.5)

A15VLO (1st pump)	A15VSO (2nd pump)					A15VLO (2nd pump)			
	NG110	NG 145	NG175	NG210	NG280	NG145	NG175	NG210	NG280
	D4T1	D4T1	E4T2	E4T2	E4T3	D4T1	E4T2	E4T2	E4T3
NG145	27.35 (694.7)	28.33 (719.7)	–	–	–	30.90 (784.9)	–	–	–
NG175	27.81 (706.5)	28.80 (731.5)	30.00 (762)	–	–	31.37 (796.7)	32.64 (829)	–	–
NG210	28.50 (723.8)	29.48 (748.8)	30.68 (779.3)	31.36 (796.6)	–	32.05 (814)	33.32 (846.3)	34.00 (863.6)	–
NG280	29.72 (755)	30.71 (780)	31.91 (810.5)	32.59 (827.8)	34.25 (870)	33.28 (845.2)	34.55 (877.5)	35.23 (894.8)	36.40 (924.5)



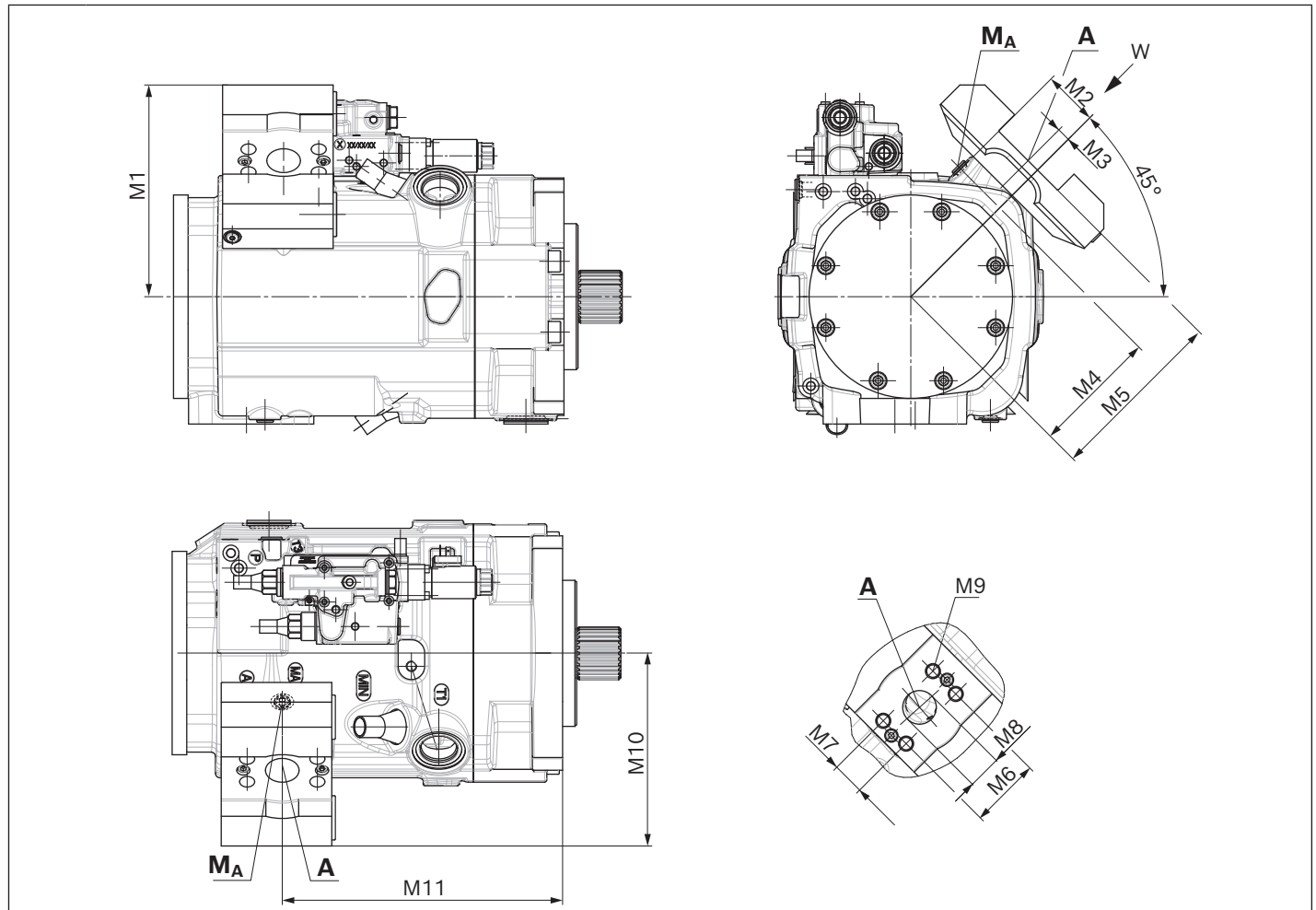
Pre compression volume for pulsation reduction (PCV)

The PCV reduces the pressure pulsation applied to the system by the pump. Reducing the flow pulsation can lead to a reduction of pressure pulsation of up to 50% at the operating point and on the system side.

Depending on the mechanical design of the working machine, in our experience machine noise is reduced quite significantly.

The pre compression volume can be ordered via order item 17 code V.

▼ Dimensions A15VLO 280 with PCV



NG	M1	M2	M3	M4	M5	M6	M7	M8	M9 ⁴⁾	M10	M11
280	9.43	2.44	0.59	5.59	7.97	3.13	1.44	DIA 1.5	M16 x 2; 2.54	8.59	12.5
	(239.4)	(62)	(15)	(142)	(202.5)	3.12	1.43		(64.5) deep		
						(79.4±0.2)	(36.5±0.2)	Ø38		(218.1)	(317)

Ports		Standard	Size	$p_{\max}$ [psi (bar)] ¹⁾	State ³⁾
A	Working port fastening thread see M9	SAE J518	1 1/2 in	6100 (420)	O
MA	Measure port presser in A	ISO 6149 ²⁾	M14 x 1.5; 0.47 (12) deep	6100 (420)	X

Further ports see page 59

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

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

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

X = Plugged (in normal operation)

4) Fastening thread according to DIN 13

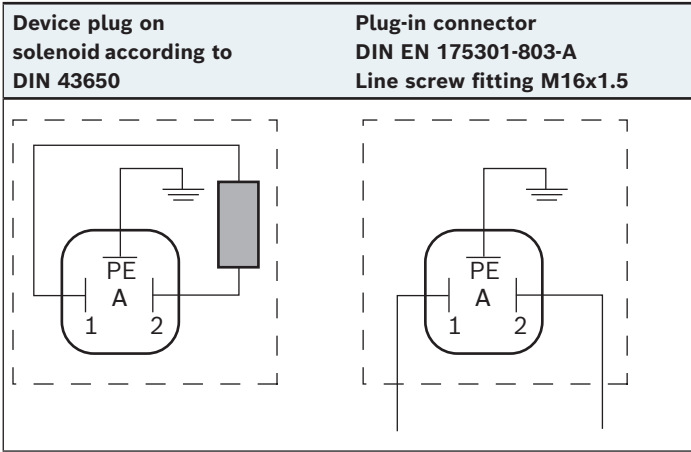
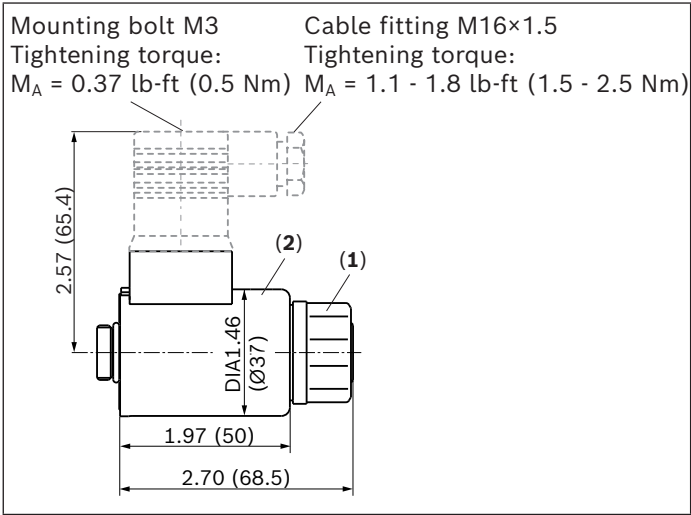
Connector for solenoids

HIRSCHMANN DIN EN 175 301-803-A /ISO 4400

Without bidirectional suppressor diode _____ H

Type of protection according to DIN/EN 60529 _____ IP65

The seal ring in the cable fitting is suitable for lines of diameter 0.18 inch to 0.39 inch (4.5 mm to 10 mm).
The plug-in connector is not included in the scope of delivery.
It can be supplied by Bosch Rexroth on request (material number: R902602623).

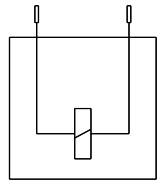


Notice
If necessary, you can change the position of the connector by turning the solenoid body.
The procedure is defined in the instruction manual.

DEUTSCH DT04-2P-EP04

Molded, 2-pin, without bidirectional suppressor diode.
There is the following type of protection with the mounted mating connector:
► IP67 (DIN/EN 60529) and
► IP69K (DIN 40050-9)

▼ **Switching symbol**



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

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

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

Notice
If necessary, you can change the position of the connector by turning the solenoid body.
The procedure is defined in the instruction manual 92512-01-B.

Notice
► Only the dead weight (<1 N) of the connection cable with a length of 5.91 inch (150 mm) may act on the plug-in connection and the solenoid coil with coil nut. Other forces and vibrations are not permissible. This can be realized e.g. by fixing the cable to the same vibration system.

Installation instructions

General

The axial piston unit must be filled with hydraulic fluid and air bled during commissioning and operation. This must also be observed following a longer standstill as the axial piston unit may empty via the hydraulic lines. Particularly in the installation position "drive shaft upwards," filling and air bleeding must be carried out completely as there is, for example, a danger of dry running.

The case drain leakage in the housing area must be directed to the reservoir via the highest available drain port (**T**₁, **T**₂, **T**₃).

For combination pumps, the leakage must be drained off at each single pump.

If a shared drain line is used for several units, make sure that the respective case pressure in each unit is not exceeded. The shared drain line must be dimensioned to ensure that the maximum permissible case pressure of all connected units is not exceeded in any operating condition, particularly at cold start. If this is not possible, separate drain line must be laid, if necessary.

To prevent the transmission of structure-borne noise, use elastic elements to decouple all connecting lines from all vibration-capable components (e.g. reservoir, frame parts). Under all operating conditions, the suction lines and the drain lines must flow into the reservoir below the minimum fluid level. The permissible suction height h_s results from the total pressure loss. However, it must not be higher than $h_{s \max} = 31.50$ inch (800 mm). The minimum suction pressure at port **S** must also not fall below 12 psi (0.8 bar) absolute (without charge pump) or 10 psi (0.7 bar) absolute (with charge pump) during operation and during a cold start.

Make sure to provide adequate distance between suction line and drain line for the reservoir design. This prevents the heated return flow from being drawn directly back into the suction line.

Notice

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

Installation position

See the following examples **1** to **9**.

Further installation positions are available upon request.

Recommended installation position: **1** and **2**

Key	
F	Filling / Air bleeding
S	Suction port
T	Drain port
SB	Baffle (baffle plate)
$h_{t \min}$	Minimum required immersion depth (7.87 inch (200 mm))
$h_{\min}$	Minimum required distance to reservoir bottom (3.94 inch (100 mm))
$h_{ES \min}$	Minimum height required to prevent axial piston unit from draining (0.98 inch (25 mm))
$h_{S \max}$	Maximum permissible suction height (31.50 inch (800 mm))

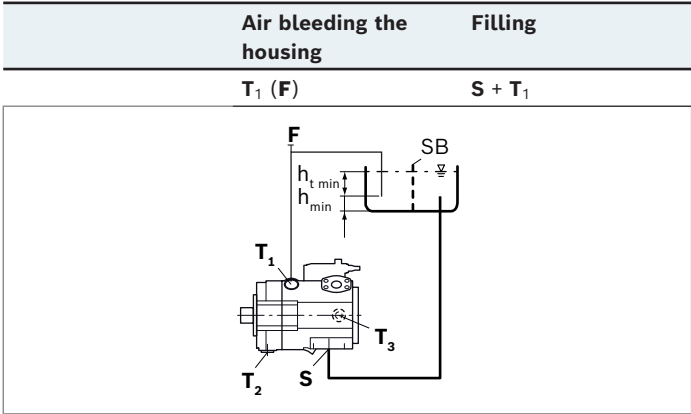
Notice

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

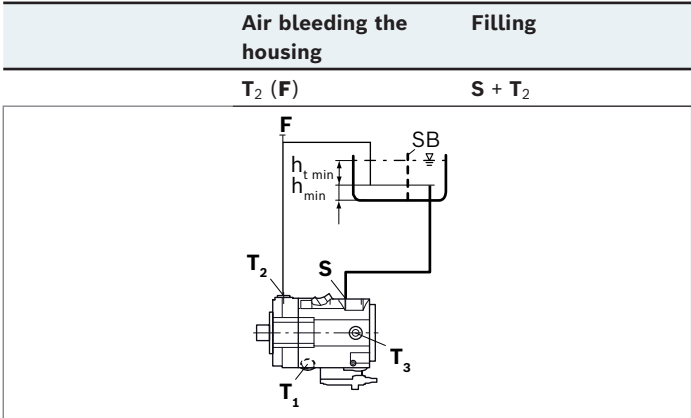
Below-reservoir installation (standard)

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

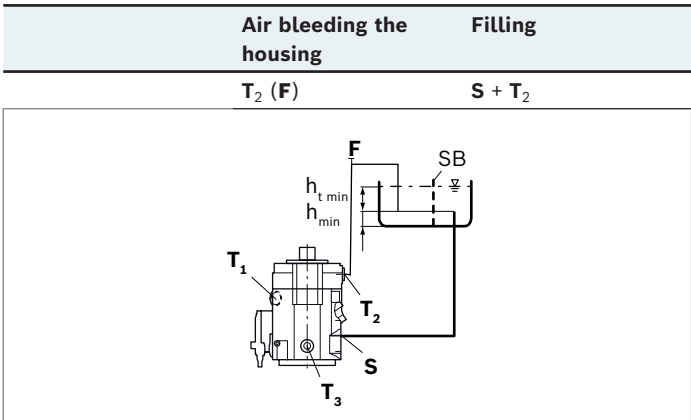
▼ Installation position 1



▼ Installation position 2



▼ Installation position 2

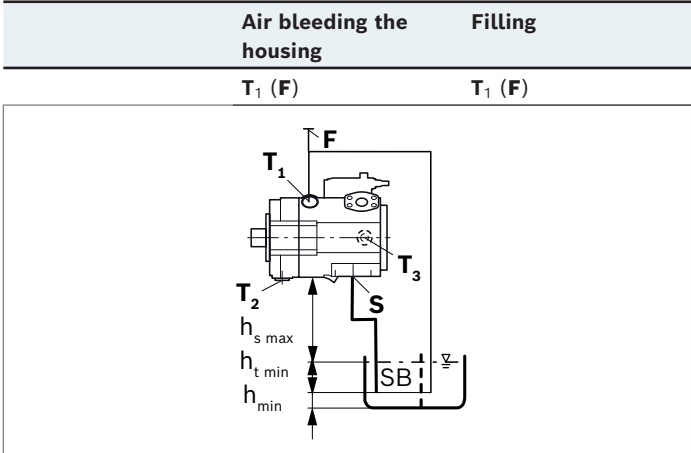


For the key, see page 73.

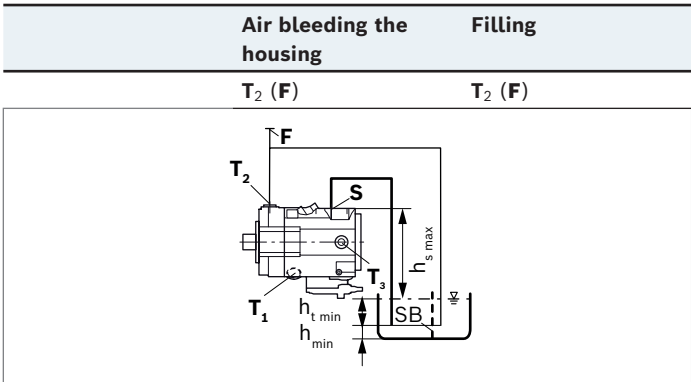
Above-reservoir installation

Above-reservoir installation means that the axial piston unit is installed above the minimum fluid level of the reservoir. To prevent the axial piston unit from draining, a height difference $h_{ES\ min}$ of at least 0.98 inch (25 mm) at port T₂ is required in position 6. Observe the maximum permissible suction height $h_{S\ max} = 31.50$ inch (800 mm).

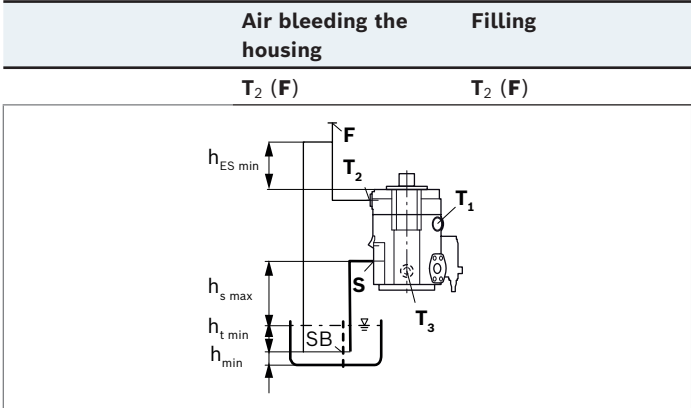
▼ Installation position 4



▼ Installation position 5



▼ Installation position 6



Inside-reservoir installation

Inside-reservoir installation is when the axial piston unit is installed in the reservoir below the minimum fluid level. The axial piston unit is completely below the hydraulic fluid.

If the minimum fluid level is equal to or below the upper edge of the pump, see chapter "**Above-reservoir installation**".

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

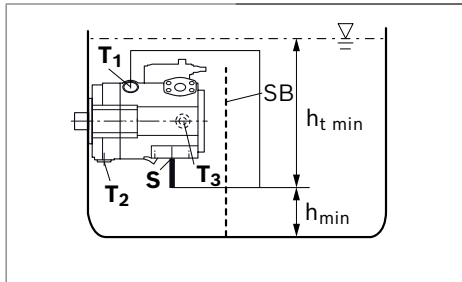
Exception

Installation of the pump with E2/E6 control only with HIRSCHMANN connector and if mineral hydraulic fluids are used and the fluid temperature in the reservoir does not exceed 176 °F (80 °C).

Notice

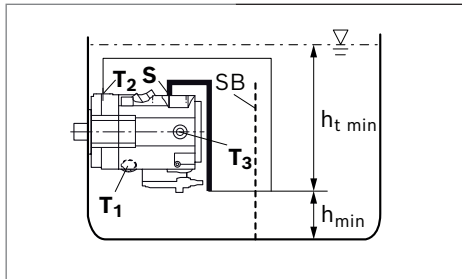
- We recommend to provide the suction port **S** with a suction pipe and for the drain port **T₁** or **T₂** to be piped. In this case, the other drain port must be plugged. The housing of the axial piston unit must be filled before fitting the piping and filling the reservoir with hydraulic fluid.

▼ Installation position 7

Air bleeding the housing	Filling
	

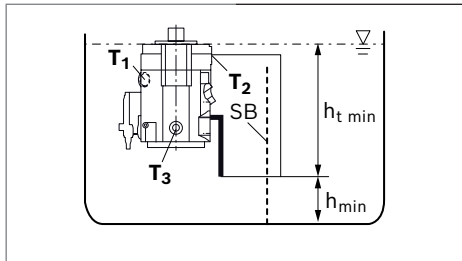
The housing of the axial piston unit is to be filled via **T₁** before attachment of the piping

▼ Installation position 8

Air bleeding the housing	Filling
	

The housing of the axial piston unit is to be filled via **T₂** before attachment of the piping

▼ Installation position 9

Air bleeding the housing	Filling
	

The housing of the axial piston unit is to be filled via **T₂** before attachment of the piping

For the key, see page 73.

Project planning notes

- ▶ The A15VS(L)O axial piston variable pump is intended to be used in open circuit.
- ▶ Project planning, installation and commissioning of the axial piston units requires the involvement of skilled personnel.
- ▶ Before using the axial piston unit, please read the corresponding instruction manual completely and thoroughly. If necessary, this can be requested from Bosch Rexroth.
- ▶ Before finalizing your design, please request a binding installation drawing.
- ▶ The specified data and notes contained herein must be observed.
- ▶ Depending on the operating conditions of the axial piston unit (working pressure, fluid temperature), the characteristic curve may shift.
- ▶ The characteristic curve may also shift due to the dither frequency or control electronics.
- ▶ Preservation: Our axial piston units are supplied as standard with preservation protection for a maximum of 12 months. If longer preservation protection is required (maximum 24 months), please specify this in plain text when placing your order. The preservation periods apply under optimal storage conditions, details of which can be found in the data sheet 90312 or the instruction manual.
- ▶ Not all versions of the product are approved for use in a safety function according to ISO 13849. Please consult the proper contact at Bosch Rexroth if you require reliability parameters (e.g., MTTF_d) for functional safety.
- ▶ Depending on the type of control used, electromagnetic effects can be produced when using solenoids. Use of the recommended direct current (DC) on the electromagnet does not produce any electromagnetic interference (EMI) nor is the electromagnet influenced by EMI. A possible electromagnetic interference (EMI) exists if the solenoid is supplied with modulated direct current (e.g. PWM signal). The machine manufacturer should conduct appropriate tests and take appropriate measures to ensure that other components or operators (e.g. with a pacemaker) are not affected by this potentiality.
- ▶ Pressure control (hydraulic or electronic) is not an adequate safeguard against pressure overload. A pressure relief valve should therefore be provided in the hydraulic system. In this connection, observe the technical limits of the pressure relief valve.
- ▶ For controllers requiring external pilot pressure, sufficient control fluid must be provided to the associated ports to ensure the required pilot pressures for the respective controller function. These controllers are subject to leakage due to their design. An increase in control fluid demand has to be anticipated over the total operating time. The design of the control fluid supply must thus be sufficiently large. If the control fluid is too low, the respective controller function may be impaired and undesired system behavior may result.
- ▶ For drives that are operated for a long period with constant rotational speed, the natural frequency of the hydraulic system can be stimulated by the excitation frequency of the pump (rotational speed frequency ×9). This can be prevented with suitably designed hydraulic lines.
- ▶ Please note the details regarding the tightening torques of port threads and other threaded joints in the instruction manual.
- ▶ The ports and fastening threads are designed for the $p_{\max}$ permissible pressures of the respective ports, see the connection tables. The machine or system manufacturer must ensure that the connecting elements and lines correspond to the specified application conditions (pressure, flow, hydraulic fluid, temperature) with the necessary safety factors.
- ▶ The service ports and function ports are only intended to accommodate hydraulic lines.
- ▶ Abrupt closing of valves in the hydraulic system may cause pressure surges in pressure lines and/or control lines (water hammer effect). These pressure surges may reduce the service life of the pump already above a pressure in the working line of $p_{\max}$ 5500 psi (380 bar).
In this case, please contact us.

Safety instructions

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

Related documentation

Product-specific documentation

Document type	Title	Document number
Data sheet	Hall-effect swivel angle sensor SWS series 06	95150
	Valve amplifier for proportional directional valves without electrical position feedback	30232
	Pressure transducer for hydraulic applications; type HM20	30272
	Pressure relief valve, direct operated type DBD	25402
	Proportional pressure relief valve, direct operated, with or without integrated digital electronics (OBED) type DBET, DBETE and DBETA	29263
	Proportional pressure relief valve, direct acting, rising characteristic curve KBPS.8A	18139-04
	Proportional pressure relief valve, direct operated, decreasing characteristic curve KBPS.8B	18139-05
	Universal through drive for axial piston variable pumps A10VSO, A10VO, A10VZO, A4VSO, A4VBO, A15VSO/A15VLO and A15V(L)O	95581
	Storage and preservation of axial piston units	90312
Operating instructions	Axial piston variable pump A15VSO, A15VLO series 12	92802-01-B
	Axial piston variable pump A15VO, A15VLO series 12	92512-01-B

Documentation for hydraulic fluids

Document type	Title	Document number
Data sheet	Hydraulic fluids based on mineral oils and related hydrocarbons	90220
	Environmentally acceptable hydraulic fluids	90221
	Fire-resistant, water-free hydraulic fluids (HFDR/HFDU)	90222
	Rating of hydraulic fluids used in Rexroth hydraulic components (pumps and motors)	90235
	Bosch Rexroth Fluid Rating List for Rexroth hydraulic components (pumps and motors)	90245

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