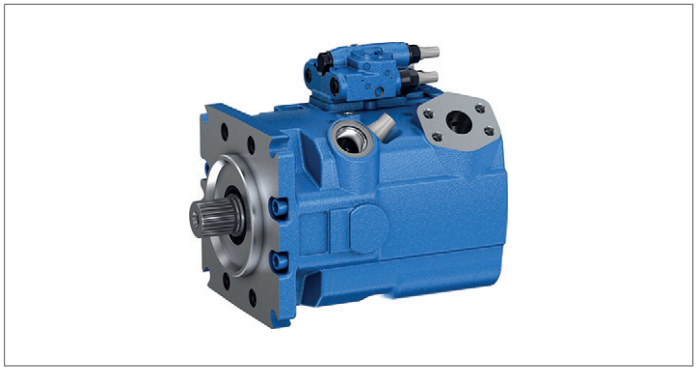
RE 92512/2024-01-08
Replaces: 2023-02-08

rexroth
A Bosch Company

Axial piston variable pump A15VO/A15VLO series 12



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

Features

- Variable pump with axial piston rotary group in swashplate design for hydrostatic drives in open circuit.
- For use in mobile applications.
- Flow is proportional to the drive speed and displacement.
- Flow can be infinitely varied by controlling the swashplate angle.
- Special control device program with dynamic control behavior and swivel angle sensor with Hall effect for fully electronified pump control.
- Noise-optimized throughout the entire operating range.
- The robust and low-wear swivel angle positioning allows for a long service life.
- Ready for Hybrid: ±100% swivel angles allow for regenerative operation in the motor quadrant area up to nominal pressure.
- Compact design
- High efficiency
- High power density
- U.S. Patent Numbers 8,261,654 and 8,418,599

Contents

Values in the US customary unit system are converted and rounded values. In case of doubt, only metric values are valid.

Type code

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

Axial piston unit			**110**	**145**	**175**	**210**	**280**	
01	Variable swashplate design, nominal pressure 350 bar (5100 psi), maximum pressure 420 bar (6100 psi)	Unpainted	●	●	●	●	●	**A15V**
		Painted	●	●	●	●	●	**LA15V**

Operating mode			**110**	**145**	**175**	**210**	**280**	
02	Pump, open circuit	Without charge pump	●	●	●	●	●	**O**
		With charge pump	–	●	●	●	●	**LO**

Size (NG)		**110**	**145**	**175**	**210**	**280**
03	Geometric displacement, see table of values on pages 9 and 10	**110**	**145**	**175**	**210**	**280**

Swiveling range			**110**	**145**	**175**	**210**	**280**	
04	One-sided swiveling	$V_{g\,max}$: + 50% to + 100% $V_{g\,min}$: - 5% to + 30%	●	●	●	●	●	**P**
	Two-sided swiveling[1]	$V_{g\,max}$: + 50% to + 100% $V_{g\,min}$: - 100% to - 50%	●	●	●	●	●	**M[2]**

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	No further controller, with code 00	
	Not for swiveling range "M"	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
			d) Load-sensing
		d) Load-sensing	No further controller, with code 00
	b) Pressure controller	No further controller, with code 00	
		b) Pressure controller[3]	No further controller, with code 00
			e) Override DG
		d) Load-sensing	No further controller, with code 00
		e) Override DG	No further controller, with code 00
	c) Stroke control	No further controller, with code 00	
	Not for swiveling range "M"	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) Not possible with charge pump (VLO).
2) Function "two-sided swiveling" only possible for decompression operation (mooring), if active operation as a motor is required, please contact us
3) Cannot be combined with the same pressure controller

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

Control device: Controller group a)					**110**	**145**	**175**	**210**	**280**	
a)	**Power controller**	Fixed setting			●	●	●	●	●	**LR**
		Override electric-proportional	Negative control	U = 12 V	●	●	●	●	●	**L3**
				U = 24 V	●	●	●	●	●	**L4**
		Hydraulic-proportional	Negative control		●	●	●	●	●	**L5**
			Positive control		●	●	●	●	●	**L6**
	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 With one-sided deflection	Fixed setting			●	●	●	●	●	**DR**
		Remote controlled hydraulically	Positive control		●	●	●	●	●	**DG**
		Electric-proportional with integrated pilot valve for external pilot pressure supply, not combinable with other controllers	Positive control	U = 24 V	○	○	○	○	●	**D2**

Controller group c)					**110**	**145**	**175**	**210**	**280**	
c)	Without additional controller				●	●	●	●	●	**00**
	Stroke control	Electric-proportional	Positive control	U = 12 V	●	●	●	●	●	**E1**
				U = 24 V	●	●	●	●	●	**E2**
			Negative control	U = 24 V	–	–	●	●	●	**E4**
		Hydraulic-proportional, pilot pressure	Negative control		●	●	●	●	●	**H3**
			Positive control		●	●	●	●	●	**H4**

Controller group d)					**110**	**145**	**175**	**210**	**280**	
d)	Without additional controller				●	●	●	●	●	**00**
	Load-sensing, pump pressure, internal	Fixed setting			●	●	●	●	●	**S0**[1]
		Electric-proportional	Positive control	U = 12 V	●	●	●	●	●	**S3**
			Positive control	U = 24 V	●	●	●	●	●	**S4**
	Pressure controller	Remote controlled hydraulically	Positive control		●	●	●	●	●	**DG**

Controller group e)					**110**	**145**	**175**	**210**	**280**	
e)	Without additional controller				●	●	●	●	●	**00**
	Override DG electric-proportional	With integrated pilot control valve and only in combination with DG	Positive control	U = 24 V	●	●	●	●	●	**T6**
			Negative control	U = 24 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	M		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**
	DEUTSCH - molded connector, 2-pin, without suppressor diode		●	●	●	●	●	**P**

Swivel angle sensor

			110	145	175	210	280	
10	Without swivel angle sensor		●	●	●	●	●	**0**
	With electric swivel angle sensor[3)] as per data sheet 95150	Power supply 5 V DC	●	●	●	●	●	**B**

Series

			110	145	175	210	280	
11	Series 1, index 2		●	●	●	●	●	**12**

Design of ports and fastening threads

			110	145	175	210	280	
12	Metric ports based on ISO 6149 with O-ring seal, metric fastening threads according to DIN 13		●	●	●	●	●	**M**

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**
	SAE J617	409-12	–	●	●	●	–	**G3**

Drive shaft (permissible input torque, see page 4)

			110	145	175	210	280	
16	Splined shaft ANSI B92.1a	1 3/4 in 13T 8/16 DP	●	●	●	●	●	**T1**
		2 in 15T 8/16 DP	–	●	●	●	●	**T2**
		2 1/4 in 17T 8/16 DP	–	–	–	–	●	**T3**
	Splined shaft DIN 5480	W45x2x21x9g	●	–	–	–	–	**A1**
		W50x2x24x9g	–	●	●	●	–	**A2**
		W60x2x28x9g	–	–	–	–	●	**A4**

Rotary group version

			110	145	175	210	280	
17	Standard version without charge pump		●	–	–	–	–	**E**
	Premium version, efficiency and speed optimized (version with and without charge pump)		–	●	●	●	●	**P**

● = Available o = On request – = Not available

1) For description, please refer to "Control device" and the tables from page 13
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	M		V					0	–	

Through drives (for mounting options, see page 69)

18	Flange SAE J744			Hub for splined shaft[1]								
	Diameter	Mounting[2]	Designation	Diameter		Designation	**110**	**145**	**175**	**210**	**280**	
	82-2 (A)		A1	5/8 in	9T 16/32DP	S2	●	●	●	●	●	**A1S2**
				3/4 in	11T 16/32DP	S3	●	●	●	●	●	**A1S3**
			A3	5/8 in	9T 16/32DP	S2	●	●	●	●	●	**A3S2**
				3/4 in	11T 16/32DP	S3	●	●	●	●	●	**A3S3**
	101-2 (B)		B1	7/8 in	13T 16/32DP	S4	●	●	●	●	●	**B1S4**
				1 in	15T 16/32DP	S5	●	●	●	●	●	**B1S5**
			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)		C1	1 1/4 in	14T 12/24DP	S7	●	●	●	●	●	**C1S7**
				1 1/2 in	17T 12/24DP	S9	●	●	●	●	●	**C1S9**
			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**
				1 3/8 in	21T 16/32 DP	V8	●	●	○	○	○	**C4V8**
	152-4 (D)		D4	1 1/4 in	14T 12/24DP	S7	●	●	●	●	○	**D4S7**
				1 3/8 in	21T 16/32 DP	V8	○	○	○	○	○	**D4V8**
				1 3/4 in	13T 8/16DP	T1	●	●	●	●	●	**D4T1**
	165-4 (E)		E4	1 3/4 in	13T 8/16DP	T1	–	–	●	●	●	**E4T1**
				2 in	15T 8/16DP	T2	–	–	●	●	●	**E4T2**
				2 1/4 in	17T 8/16DP	T3	–	–	–	–	●	**E4T3**
				W60x2x28x9g[3]		A4	–	–	–	–	●	**E4A4**
	Prepared for through drive, with pressure-resistant plugged cover. Observe the information on page 69. (see also data sheet 95581)						●	●	●	●	●	**U000**

Pressure sensors and other sensors

		110...280	
19	Without sensor	●	**0**

Standard/special version

		110...280	
20	Standard version	●	**0**
	Special version	●	**S**

● = Available ○ = On request – = Not available

Notice

- ▶ Note the project planning notes on page 77.
- ▶ 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 Internet configurator (is being prepared).
- ▶ For information on the mounting situation of combination pumps, see page 69.

1) In accordance with ANSI B92.1a
2) The through drives A3, B3, C3 are equipped with universal through drives. For painting units, observe the mounting holes pattern viewed on through drive with control at top.
3) Hub N60x2x28x8H according to DIN 5480

Hydraulic fluids

The variable pump A15V(L)O is designed for operation according to DIN 51524 HLP mineral oil.
Application instructions and requirements for hydraulic fluids should be taken from the following data sheets before the start of project planning:

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

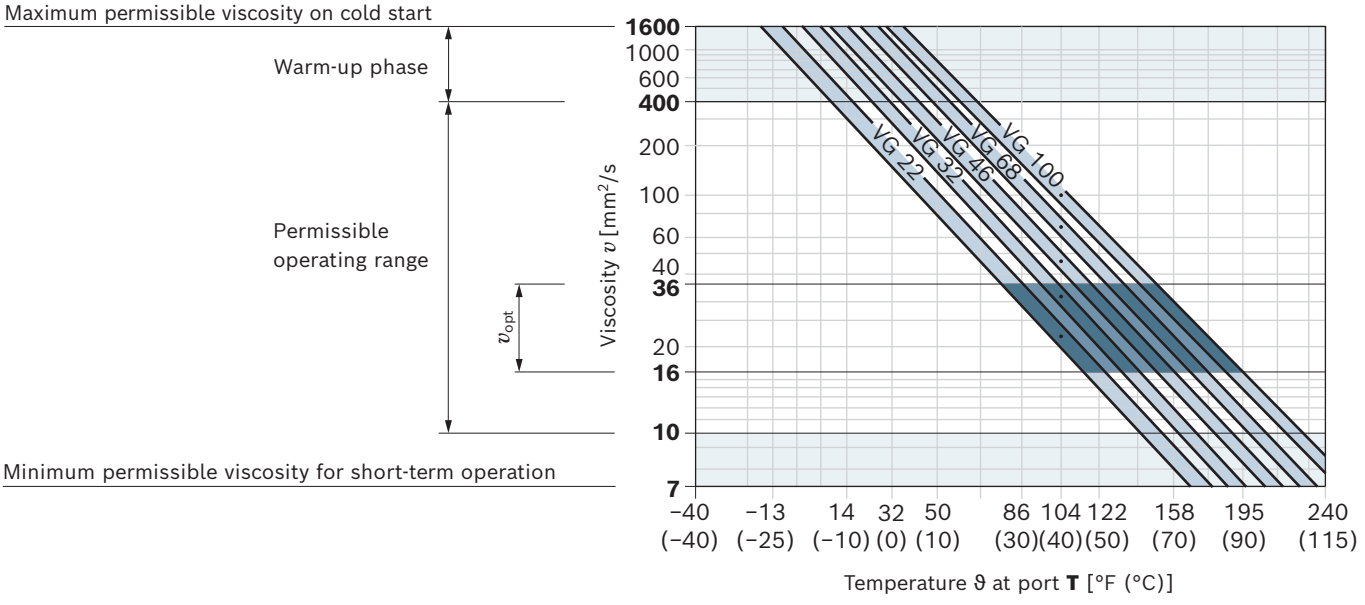
Selection of hydraulic fluid
Bosch Rexroth evaluates hydraulic fluids on the basis of the Fluid Rating according to the technical data sheet 90235.
Hydraulic fluids with positive evaluation in the Fluid Rating are listed in the following data sheet:
90245: Bosch Rexroth Fluid Rating List for Rexroth hydraulic components (pumps and motors)

Selection of hydraulic fluid shall make sure 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} ≤ 1600 mm²/s	NBR[2]	ϑ_{St} ≥ -40 °C (-40 °F)	t ≤ 3 min, without load (p ≤ 50 bar (725 psi)), n ≤ 1000 rpm Permissible temperature difference between the axial piston unit and hydraulic fluid in the system max. 25 K (45 °F)
		FKM	ϑ_{St} ≥ −25 °C (−13 °F)	
Warm-up phase	v = 1600 ... 400 mm²/s			t ≤ 15 min, p ≤ 0.7 × p_{nom} und n ≤ 0.5 × n_{nom}
Permissible operating range	v = 400 ... 10 mm²/s[1]	NBR[2]	ϑ ≤ +85 °C (+185 °F)	Measured at port **T**
		FKM	ϑ ≤ +110 °C (+ 230 °F)	
	v_{opt} = 36 ... 16 mm²/s			Optimal operating viscosity and efficiency range
Short-term operation	v_{min} = 10 ... 7 mm²/s	NBR[2]	ϑ ≤ +85 °C (+185 °F)	t ≤ 3 min, p ≤ 0.3 × p_{nom}, measured at port **T**
		FKM	ϑ ≤ +110 °C (+ 230 °F)	

▼ **Selection diagram**



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

2) Special version, please contact us

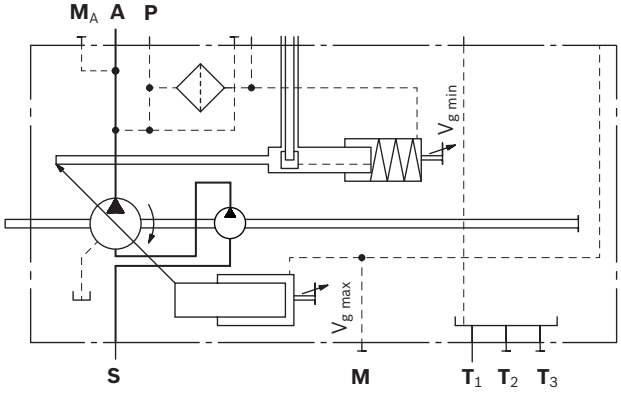
3) If the temperature cannot be adhered to due to extreme operating parameters, please contact us.

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 mm²/s (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 mm²/s:

- 73 °C at HLP 32
- 85 °C at HLP 46

Charge pump (impeller)

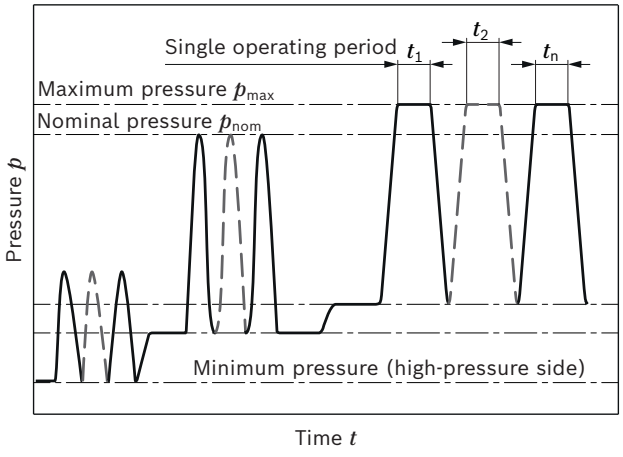
The charge pump is a centrifugal pump with which the A15VLO is filled and therefore can be operated at higher rotational speeds. This also facilitates cold starting at low temperatures and high viscosity of the hydraulic fluid. Externally increasing the inlet pressure is therefore unnecessary in most cases. Charging the reservoir with compressed air is not permissible.



Working pressure range

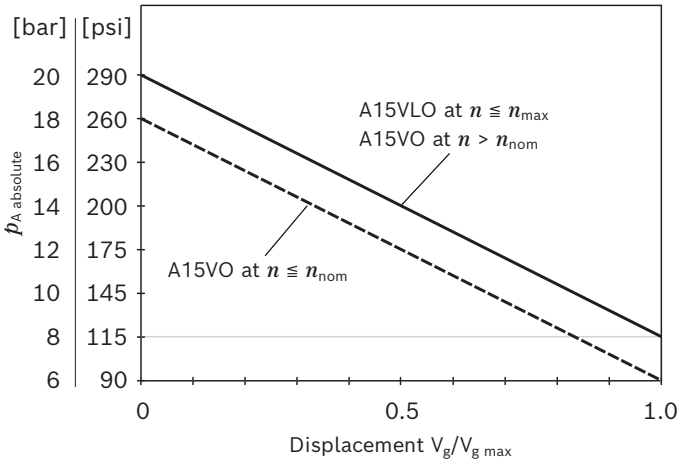
Pressure at working port A		**Definition**
Nominal pressure p_{nom}	350 bar (5100 psi)	The nominal pressure corresponds to the maximum design pressure.
Maximum pressure p_{max}	420 bar (6100 psi)	The maximum pressure corresponds to the maximum working pressure within a single operating period. The sum of single operating periods must not exceed the total operating period of 300 h.
Single operating period	< 1 s	
Load cycles	< 1 million	
Minimum pressure $p_{A\ absolute}$ (high-pressure side)		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 (see diagram on page 8 and footnote 4), Technical data on page 9 and 10).
Rate of pressure change $R_{A\ max}$	16000 bar/s (232000 psi/s)	Maximum permissible pressure build-up and reduction speed during a pressure change across the entire pressure range.
Pressure at suction port S (inlet)		
Version **without** charge pump (A15VO)		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 of the axial piston unit.
Minimum pressure $p_{S\ min}$	≥ 0.8 bar (12 psi) absolute	
Maximum pressure $p_{S\ max}$	≤ 30 bar (435 psi)	
Version **with** charge pump (A15VLO)		
Minimum pressure $p_{S\ min}$	≥ 0.7 bar (10.5 psi) absolute	
Maximum pressure $p_{S\ max}$	≤ 2 bar (30 psi) absolute	
Case pressure at port T_1, T_2, T_3		
Max. static pressure $p_{L\ max}$	3 bar (45 psi)	Maximum 1.2 bar (18 psi) higher than inlet pressure at port **S**, but not higher than $p_{L\ max.}$ A drain line to the reservoir is required.
Pressure peaks $p_{L\ peak}$	5 bar (75 psi)	t< 0.1 s
External control pressure P (type code position 08 version B and C)		
Minimum pressure p_{Pnom}	30 bar (435 psi)	Control systems with external control pressure supply need a control pressure appropriate to the adjustment time and size.
Maximum pressure p_{Pmax}	50 bar (725 psi)	

▼ **Pressure definition**



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

▼ **Minimum pressure (high-pressure side)**



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
Geometric displacement, per revolution			$V_{g\,max}$	cm^3	110.0	145.0	175.0	210.0	280.0
				in^3	6.71	8.85	10.68	12.81	17.09
			$V_{g\,min}$	cm^3	0	0	0	0	0
				in^3	0	0	0	0	0
Maximum rotational speed[1]	at $V_{g\,max}$[2] Version **E**		n_{nom}	rpm	2400	2300	2150	2000	1800
	at $V_{g\,max2}$) Version **P**				–	2300	2150	2100	1800
	at $V_g \leq V_{g\,max}$[3] Version **E**		n_{max}	rpm	2400	2300	2150	2000	1800
	at $Vg \leq V_{g\,max}$[3] Version **P**				–	2600	2500	2350[4]	2150[4]
Flow	at n_{nom} and $V_{g\,max}$ version **E**		q_v	l/min	264	334	376	420	504
			q_v	gpm	70	88	99	110	133
Power	at n_{nom}, $V_{g\,max}$ und Δp = 350 bar (5100 psi) Version **E**		P	kW	154	195	219	245	294
			P	hp	207	261	294	345	394
Torque	at $V_{g\,max}$ and Δp = 350 bar (5100 psi)[2]		M	Nm	613	808	975	1170	1560
				lb-ft	452	596	719	863	1151
Rotary stiffness of drive shaft	1 3/4 in 13T 8/16 DP	T1	c	kNm/rad	190	235	243	254	302
				lb-ft/rad	140137	173327	179227	187340	222744
	2 in 15T 8/16 DP	T2	c	kNm/rad	–	286	298	314	396
				lb-ft/rad	–	210942	219794	231595	292075
	2 1/4 in 17T 8/16 DP	T3	c	kNm/rad	–	–	–	–	519
				lb-ft/rad	–	–	–	–	382795
	W45x2x21x9g	A1	c	kNm/rad	242	–	–	–	–
				lb-ft/rad	178489	–	–	–	–
	W50x2x24x9g	A2	c	kNm/rad	–	334	357	381	–
				lb-ft/rad	–	246345	263309	281011	–
	W60x2x28x9g	A4	c	kNm/rad	–	–	–	–	645
				lb-ft/rad	–	–	–	–	475727
Moment of inertia of the rotary group		Version **E**	J_{TW}	kgm^2	0.022	0.035	0.045	0.06	0.105
				$lb\text{-}ft^2$	0.5221	0.8306	1.0679	1.4238	3.3222
		Version **P**	J_{TW}	kgm^2	–	0.035	0.045	0.06	0.097
				$lb\text{-}ft^2$	–	0.8306	1.0679	1.4238	2.3019
Maximum angular acceleration[5]		Version **E**	α	rad/s^2	7465	6298	5609	5014	3900
		Version **P**	α	rad/s^2	–	6298	5609	5014	4200
Case volume			V	l	2.2	2.7	3.6	4	6.5
				gal	0.58	0.71	0.95	1.06	1.72
Weight (without through drive) and with D4/E4 mounting flange, approx.			m	kg	64	79	97	111	143
				lbs	141	174	214	245	315

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

NG	Rotational speed [rpm]	Pressure on port A $p_{A\,absolute}$ [bar (psi)]	Swivel angle [%]
280	2300	at least 35 (510)	at least 10
210	2500	at least 35 (510)	at least 10

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.

Technical data

With charge pump (A15VLO) rotary group version P

Size			NG		145	175	210	280
Geometric displacement, per revolution			$V_{g\,max}$	cm^3	145.0	175.0	210.0	280.0
				in^3	8.85	10.68	12.81	17.09
			$V_{g\,min}$	cm^3	0	0	0	0
				in^3	0	0	0	0
Maximum rotational speed[1]	at $V_{g\,max}$[2]		n_{nom}	rpm	2600	2500	2350[4]	2150[4]
	at $V_g \le V_{g\,max}$		n_{max}	rpm	2600[3]	2500[3]	2350[4]	2150[4]
Flow	at n_{nom} and $V_{g\,max}$		q_v	l/min	377	438	493	602
				gpm	100	116	130	159
Power	at n_{nom}, $V_{g\,max}$ and Δp = 350 bar (5100 psi)		P	kW	220	255	288	351
				hp	295	342	386	471
Torque	at $V_{g\,max}$ and Δp = 350 bar (5100 psi)[2]		M	Nm	808	975	1170	1560
				lb-ft	596	719	863	1151
Rotary stiffness of drive shaft	1 3/4 in 13T 8/16 DP	T1	c	kNm/rad	235	243	254	302
				lb-ft/rad	173327	179227	187340	222744
	2 in 15T 8/16 DP	T2	c	kNm/rad	286	298	314	396
				lb-ft/rad	210942	219794	231595	292075
	2 1/4 in 17T 8/16 DP	T3	c	kNm/rad	–	–	–	519
				lb-ft/rad	–	–	–	382795
	W50x2x24x9g	A2	c	kNm/rad	334	357	381	–
				lb-ft/rad	246345	263309	281011	–
	W60x2x28x9g	A4	c	kNm/rad	–	–	–	645
				lb-ft/rad	–	–	–	475727
Moment of inertia of the rotary group			J_{TW}	kgm^2	0.035	0.047	0.063	0.1
				$lb\text{-}ft^2$	0.8306	1.0679	1.4238	2.3730
Maximum angular acceleration[5]			α	rad/s²	6298	5609	5014	4100
Case volume			V	l	2.9	3.6	3.7	5.6
				gpm	0.77	0.95	0.98	1.48
Weight (without through drive) and with D4/E4 mounting flange, approx.			m	kg	92	110	125	148
				lbs	203	243	276	326

1) The values are applicable:
   – for the optimum viscosity range from ν_{opt} = 36 to 16 mm²/s
   – with hydraulic fluid based on mineral oils
2) The values apply at absolute pressure p_{abs} = 1 bar (15 psi) at suction port **S**.
3) Maximum rotational speed (speed limit) for increased inlet pressure $p$absolute at suction port S and $V_g < V_{g\,max}$, see diagram on page 11.
4) The rotational speed can be increased under the following conditions:

NG	**Rotational speed** [rpm]	**Pressure on port A** $p_{A\,absolute}$ [bar (psi)]	**Swivel angle** [%]
280	2300	at least 35 (510)	at least 10
210	2500	at least 35 (510)	at least 10

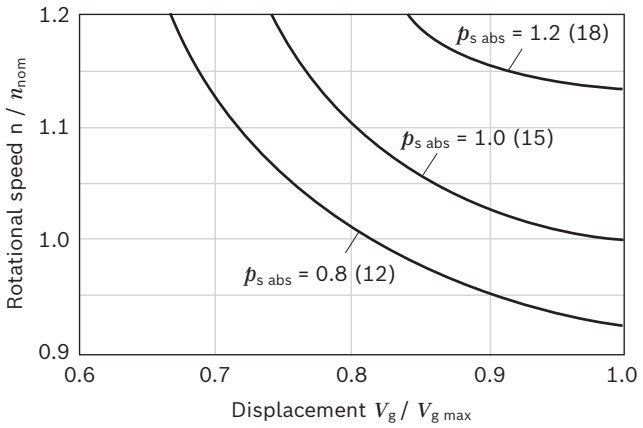
5) The data are valid for values between the minimum required and maximum permissible rotational speed. Valid for external excitation (e.g. diesel engine 2 to 8 times rotary frequency; cardan shaft twice the rotary frequency). The limit value is only valid for a single pump. The load capacity of the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

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

Key

V_g	=	Displacement per revolution [cm³ (in³)]
Δp	=	Differential pressure [bar (psi)]
n	=	Rotational speed [rpm]
η_v	=	Volumetric efficiency
η_{hm}	=	Hydraulic-mechanical efficiency
η_t	=	Total efficiency ($\eta_t = \eta_v \times \eta_{hm}$)

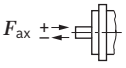
▼ **Maximum permissible rotational speed (speed limit)**
($p_{S\ absolute}$ = inlet pressure [bar (psi)])

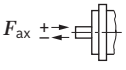


Notice

- The maximum permissible rotational speed n_{max} must not be exceeded (see table of values on page 9 and 10.

Permissible radial and axial loading on the drive shafts

Size	**NG**		**110**	**110**	**145**	**145**	**145**	**175**	**175**	**175**	**210**	**210**	**210**
Code			T1	A1	T1	T2	A2	T1	T2	A2	T1	T2	A2
Drive shaft	Ø		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
Maximum radial force at distance a (from shaft collar) 	$F_{q\ max}$	N	8000	8000	11000	11000	11000	12300	12300	14000	16925	16925	17000
		lb	1798	1798	2473	2473	2473	2765	2765	3147	3805	3805	3822
	a	mm	33.5	25	33.5	40	27.5	33.5	40	27	33.5	40	27
		in	1.32	0.98	1.32	1.57	1.08	1.32	1.57	1.06	1.32	1.57	1.06
Maximum axial force 	+ $F_{ax\ max}$	N	1200	1200	1350	1350	1350	1400	1400	1400	1450	1450	1450
		lb	270	270	304	304	304	315	315	315	326	326	326
	− $F_{ax\ max}$	N	500	500	600	600	600	650	650	650	700	700	700
		lb	112	112	135	135	135	146	146	146	157	157	157

Size	**NG**		**280**	**280**	**280**	**280**
Code			T1	T2	T3	A4
Drive shaft	Ø		1 3/4 in	2 in	2 1/4 in	W60
Maximum radial force at distance a (from shaft collar) 	$F_{q\ max}$	N	20000	20000	18000	23600
		lb	4496	4496	4046	5305
	a	mm	33.5	40	40	29
		in	1.32	1.57	1.57	1.14
Maximum axial force 	+ $F_{ax\ max}$	N	1800	1800	1800	1800
		lb	405	405	405	405
	− $F_{ax\ max}$	N	850	850	850	850
		lb	191	191	191	191

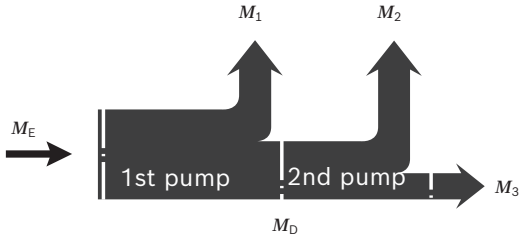
Notice

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

Size			NG		110	145	175	210	280
Torque at Vg max and Δp = 350 bar (5100 psi)[1]			M_{max}	Nm	610	808	975	1170	1560
				lb-ft	452	596	719	863	1151
Maximum input torque on drive shaft[2]									
	T1	1 3/4 in	$M_{E\ max}$	Nm	1640	1640	1640	1640	1640
				lb-ft	1210	1210	1210	1210	1210
	T2	2 in	$M_{E\ max}$	Nm	–	2670	2670	2670	2670
				lb-ft	–	1969	1969	1969	1969
	T3	2 1/4 in	$M_{E\ max}$	Nm	–	–	–	–	4380
				lb-ft	–	–	–	–	3231
	A1	W45	$M_{E\ max}$	Nm	2190	–	–	–	–
				lb-ft	1615	–	–	–	–
	A2	W50	$M_{E\ max}$	Nm	–	3140	3140	3140	–
				lb-ft	–	2316	2316	2316	–
	A4	W60	$M_{E\ max}$	Nm	–	–	–	–	5780
				lb-ft	–	–	–	–	4263
Maximum through-drive torque			$M_{D\ max}$	Nm	960	1110	1340	1915	2225
				lb-ft	708	819	988	1412	1641

▼ **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 21

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

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

Power controller

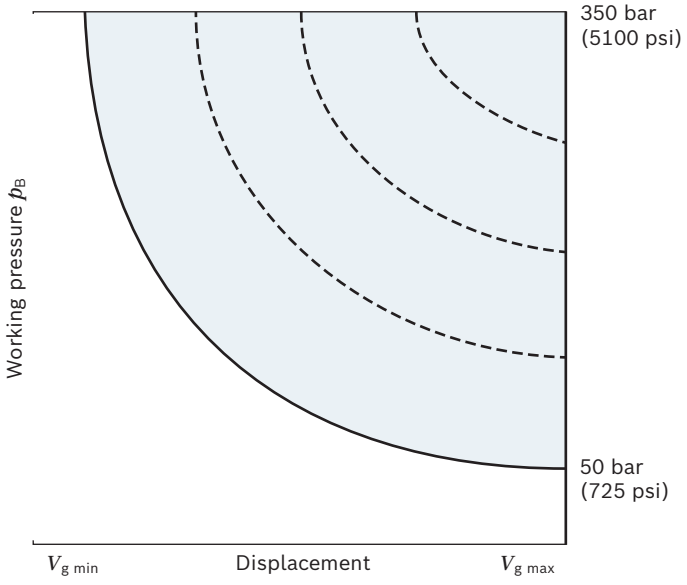
LR – Power controller, fixed setting

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 ($p_B \times V_g$ = 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 50 bar (725 psi) to 350 bar (5100 psi), see table on the right.
When ordering, state in plain text:

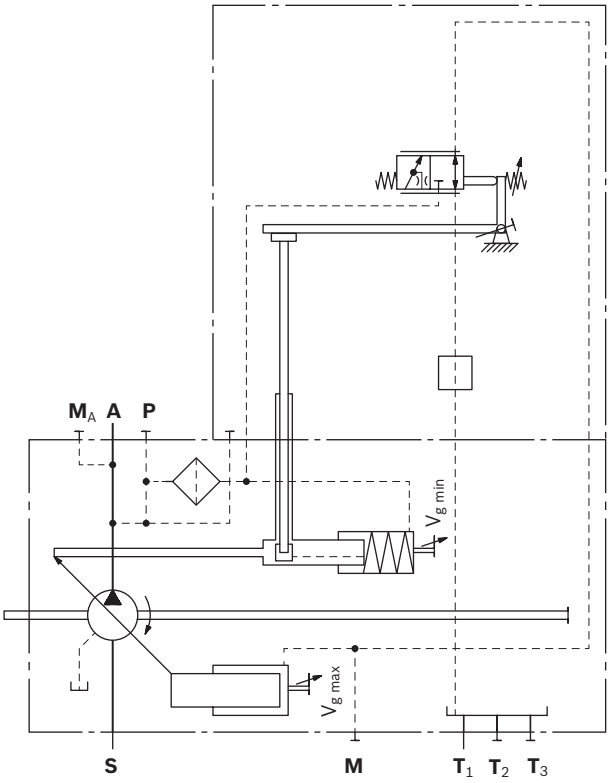
- Drive power P [kW]
- Drive speed n [rpm]
- Maximum flow $q_{V\,max}$ [l/min]

Please contact us if you need a performance chart.

▼ **Characteristic curve LR**



▼ **Circuit diagram LR**



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

L3/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.
If the control current signal is adjusted by a load limiting control, the power reduction of all consumers is reduced to match the available power from the diesel engine.

Technical data, solenoid	L3	L4
Voltage	12 V (±20%)	24 V (±20%)
Control current		
Start of control	400 mA	200 mA
End of control	1200 mA	600 mA
Current limit	1.54 A	0.77 A
Nominal resistance (at 20 °C (68 °F))	5.5 Ω	22.7 Ω
Dither frequency	100 Hz	100 Hz
Duty cycle	100%	100%
Type of protection: see connector version page 72		

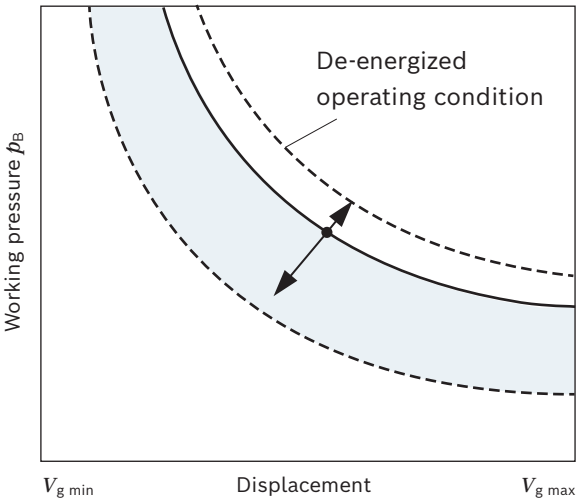
The following electronic control units and amplifiers are available for controlling the proportional solenoids:

BODAS Controllers RC Series	Data sheet
30	95205
31	95206
40	95207 and 95208
And application software	
Analog amplifier RA	95230

When ordering, state in plain text:

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

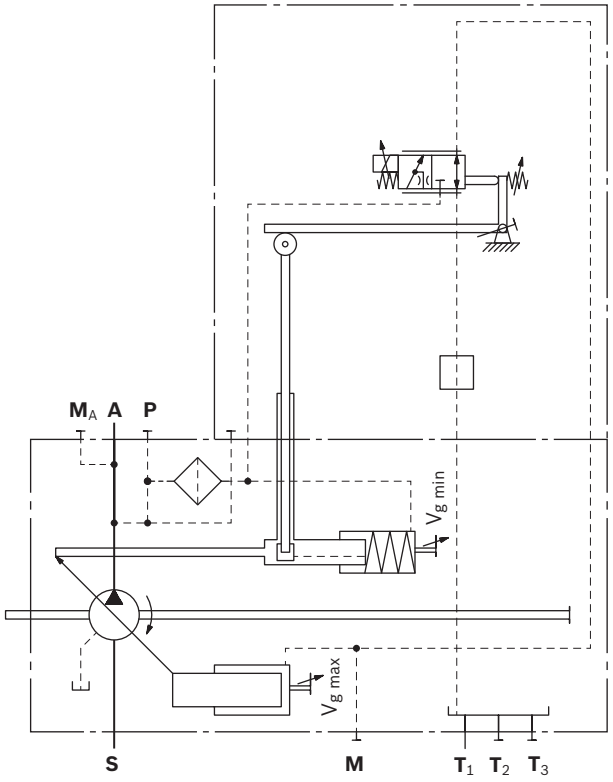
▼ **Effect of power override through current increase or de-energized operating condition**



Notice

In operating condition **L3** de-energized (jump 400 to 0 mA): Power increase by a factor of 2 of the table values.
In operating condition **L4** de-energized (jump 200 to 0 mA): Power increase by a factor of 1 of the table values.

▼ **Circuit diagram L3/L4**



Reduction of power by control current to the proportional solenoids with L3[1)]

LR3 – Power reduction/control current

[kW (hp)/100 mA]

	Rotational speed [rpm]		
Size	**1000**	**1500**	**1800**
110	6.1 (8.2)	9.2 (12.3)	11.0 (14.7)
145	7.4 (9.9)	11.1 (14.9)	13.3 (17.8)
175	8.4 (11.3)	12.6 (16.9)	15.1 (20.2)
210	9.4 (12.6)	14.1 (18.9)	16.9 (22.7)
280	11.4 (15.3)	17.1 (22.9)	20.5 (27.5)

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

LR4 – Power reduction/control current

[kW (hp)/100 mA]

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

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

L5 – Power controller, hydraulic-proportional override (negative control)

A pilot pressure acts against the adjustment spring of the power controller via a valve.
The mechanically adjusted basic power setting can be reduced by means of different pilot pressure settings.
Increasing pilot pressure = reduced power.

- Maximum permissible pilot pressure
  $p_{St\ max}$ = 100 bar (1450 psi)

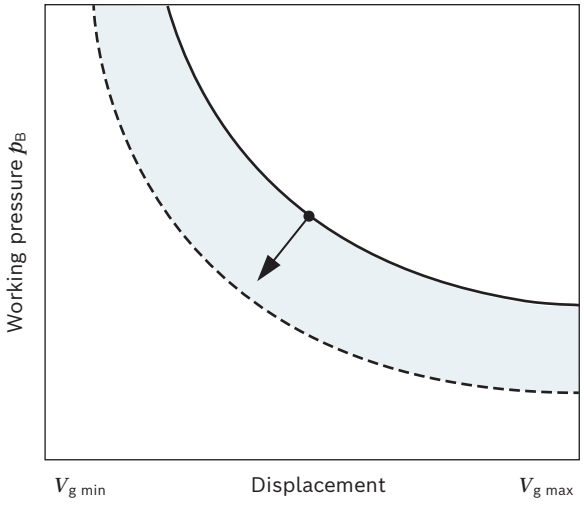
If the pilot pressure signal is adjusted by a load limiting control, the power reduction of all consumers is reduced to match the available power from the diesel engine.
Reduction of power by pilot pressure at port **L5**
Power reduction/pilot pressure [kW (hp)/bar (psi)]

	Rotational speed [rpm]		
Size	**1000**	**1500**	**1800**
110	2.3 (0.21)	3.5 (0.32)	4.1 (0.38)
145	2.8 (0.26)	4.2 (0.39)	5.0 (0.46)
175	3.2 (0.29)	4.8 (0.44)	5.8 (0.54)
210	3.6 (0.33)	5.4 (0.50)	6.5 (0.60)
280	4.4 (0.41)	6.6 (0.61)	7.9 (0.73)

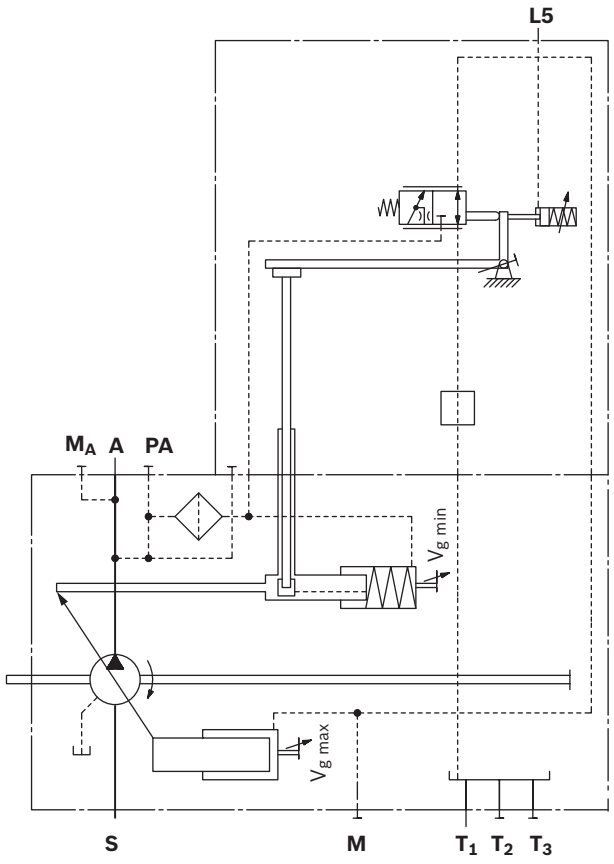
Values in the table are reference points. Determination of the exact power override on request.
When ordering, state in plain text:

- Drive power P [kW (hp)] at a pilot pressure p_{st} in **L5** of 5 bar (75 psi)
- Drive speed n [rpm]
- Maximum flow $q_{V\ max}$ [l/min (gpm)]

▼ **Effect of power override through pilot pressure increase**



▼ **Circuit diagram L5**



L6 – Power controller, hydraulic-proportional override (positive control)

A pilot pressure acts together with the adjustment spring of the power controller via a valve.

The mechanically adjusted basic power setting can be increased by means of different pilot pressure settings.

Increasing pilot pressure = increased power.

- Maximum permissible pilot pressure
  $p_{St\ max}$ = 100 bar (1450 psi)

If the pilot pressure signal is adjusted by a load limiting control, the power increase of all consumers is increased to match the available power from the diesel engine.

Power increase by pilot pressure at port **L6**

Power increase/pilot pressure [kW (hp)/bar (psi)]

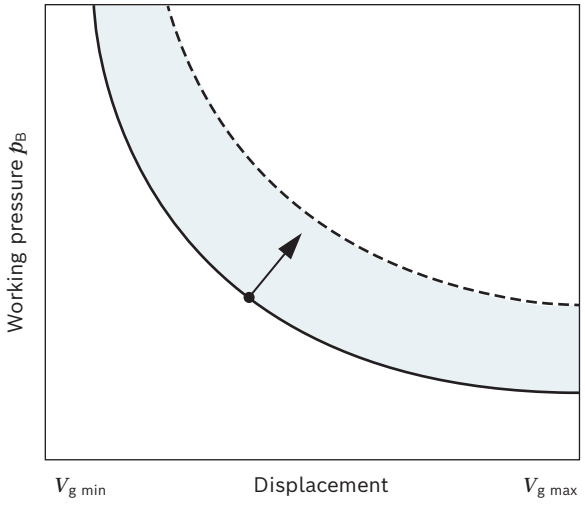
	Rotational speed [rpm]		
Size	**1000**	**1500**	**1800**
110	2.4 (0.22)	3.6 (0.33)	4.3 (0.40)
145	2.9 (0.27)	4.3 (0.40)	5.2 (0.48)
175	3.3 (0.30)	4.9 (0.45)	5.9 (0.54)
210	3.7 (0.34)	5.6 (0.52)	6.7 (0.62)
280	4.5 (0.42)	6.8 (0.63)	8.1 (0.75)

Values in the table are reference points. Determination of the exact power override on request.

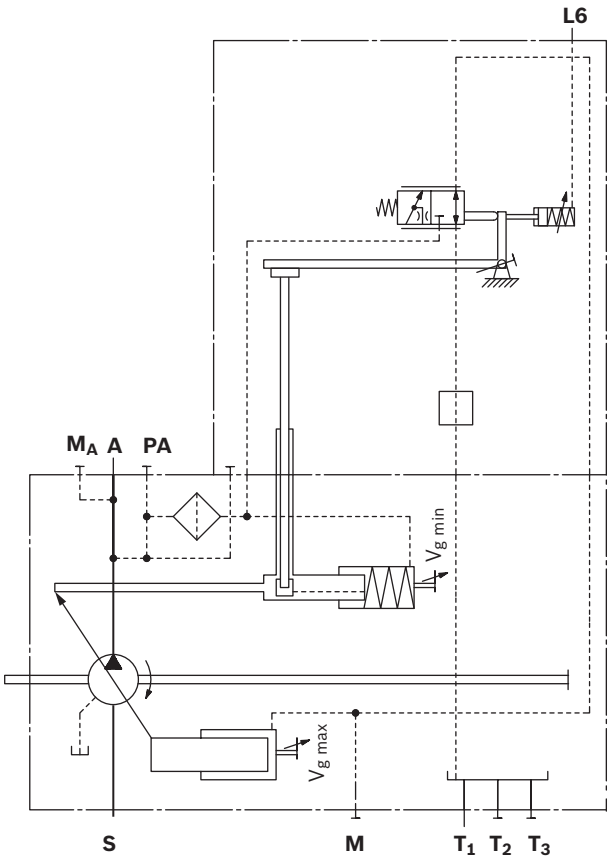
When ordering, state in plain text:

- Drive power P [kW (hp)] at a pilot pressure p_{st} in **L6** of 5 bar (75 psi)
- Drive speed n [rpm]
- Maximum flow $q_{V\ max}$ [l/min (gpm)]

▼ **Effect of power override through pilot pressure increase**



▼ **Circuit diagram L6**



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 $\mathbf{M}_A$ 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.

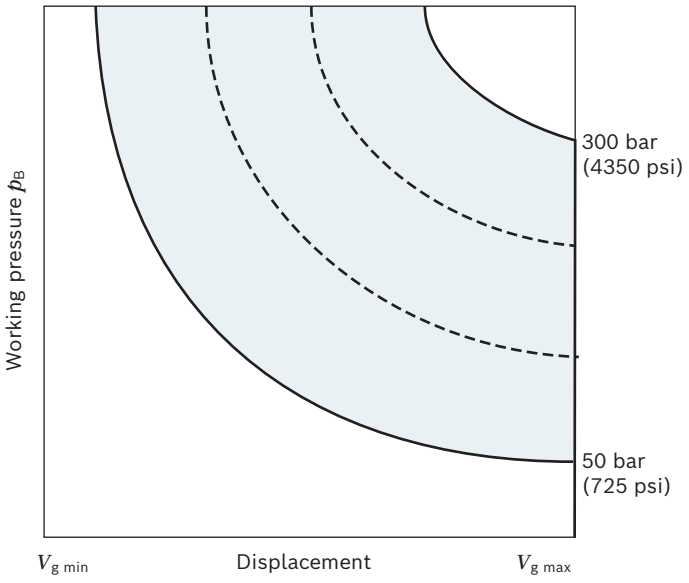
Power that is released by the pressure controller or other overrides remains unconsidered.

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

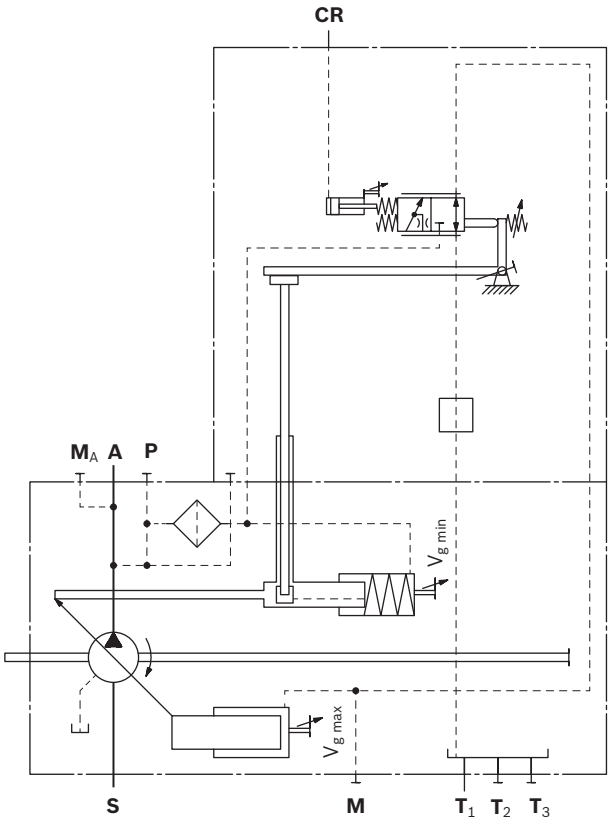
When ordering, please specify separately for each pump:

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

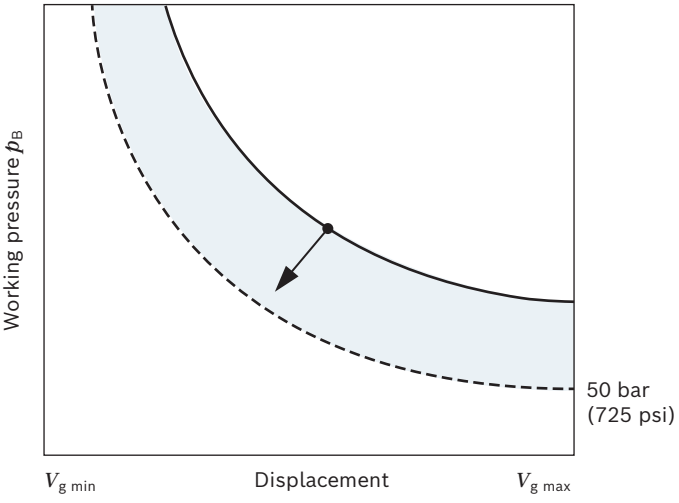
▼ **Characteristic curve CR**



▼ **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.

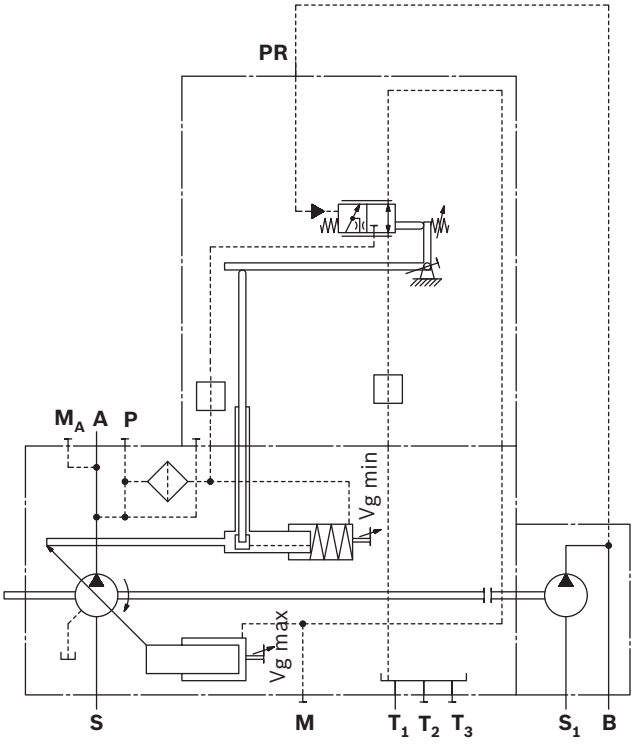
Power that is released by the pressure controller or other overrides remains unconsidered.

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

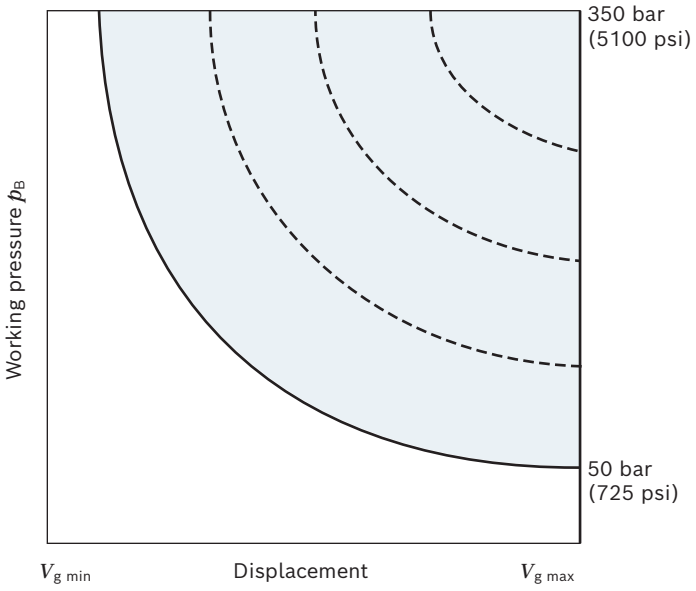
When ordering, state in plain text:

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

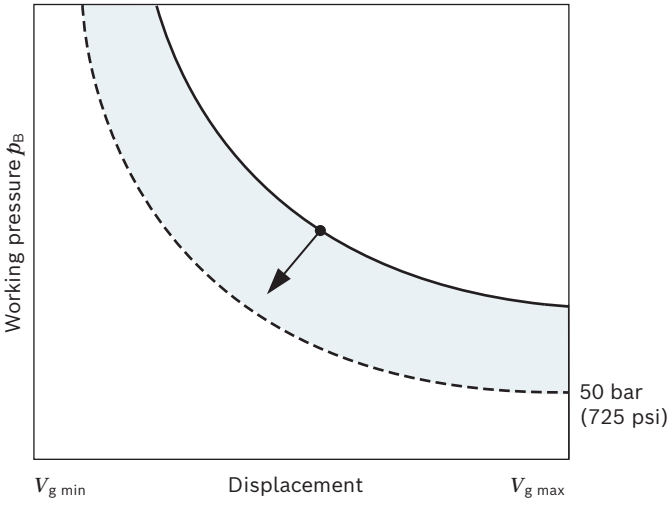
▼ **Circuit diagram PR**



▼ **Characteristic curve PR**



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



Stroke control

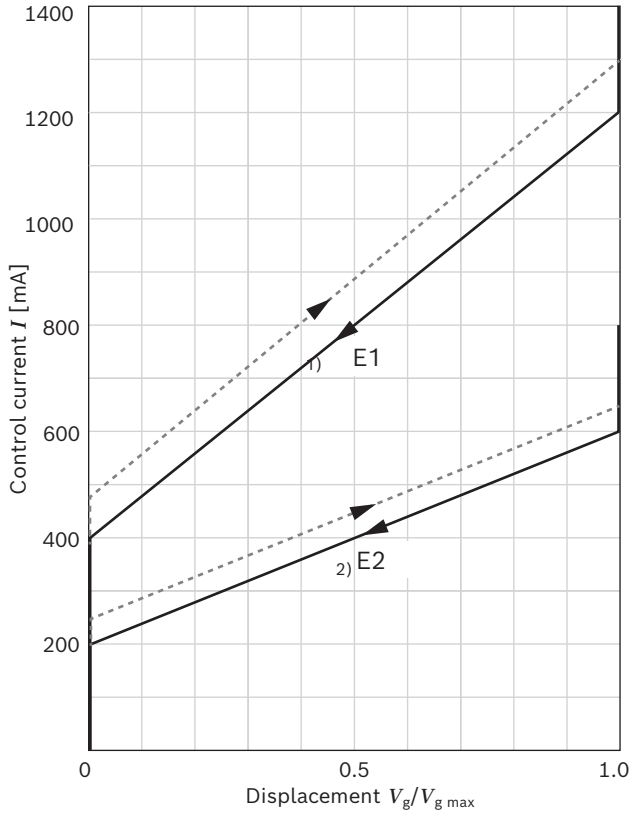
E1/E2 – Stroke control, electric, proportional (positive control)

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 depends on the selected basic position. $V_{g\,min}$ with letter C and $V_{g\,max}$ with A/B (see type code and/or circuit diagrams on page 21). With increasing control current the pump swivels to a greater 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 30 bar (435 psi), maximum 50 bar (725 psi).

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 E1/E2**



Technical data, solenoid	E1	E2
Voltage	12 V (±20%)	24 V (±20%)
Control current		
Start of control at $V_{g\,min}$	400 mA	200 mA
End of control at $V_{g\,max}$	1200 mA[1)]	600 mA[2)]
Current limit	1.54 A	0.77 A
Nominal resistance (at 20 °C (68 °F))	5.5 Ω	22.7 Ω
Dither frequency	100 Hz	100 Hz
Duty cycle	100%	100%
Type of protection: see connector version page 72		

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

BODAS Controllers RC Series	Data sheet
30	95205
31	95206
40	95207 and 95208
And application software	
Analog amplifier RA	95230

When ordering, state in plain text:

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

See circuit diagram on page 21

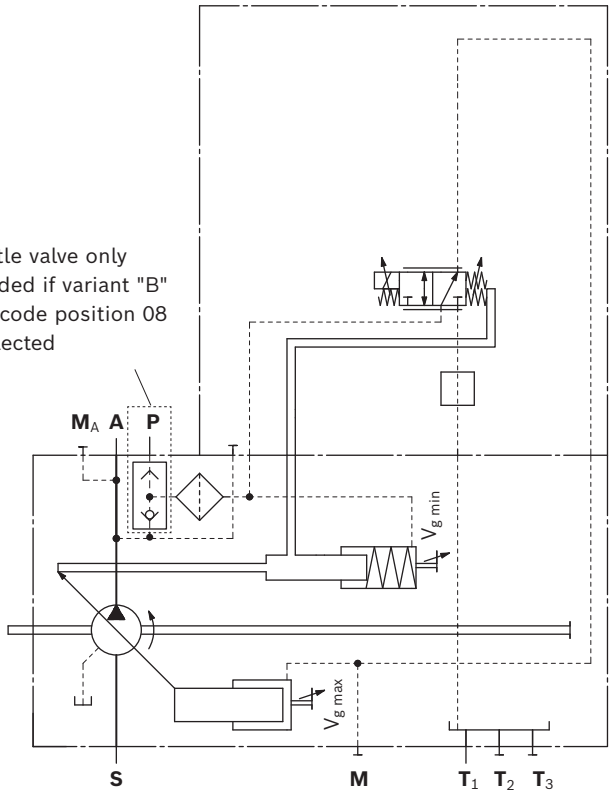
Notice!

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.

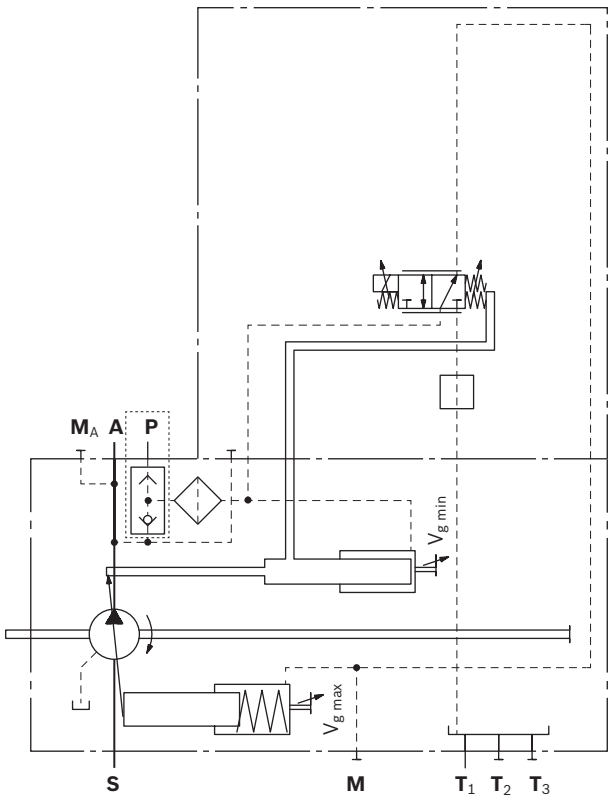
1) Because of the control hysteresis, a control current of up to 1300 mA may be required for the $V_{g\,max}$ position.
2) Because of the control hysteresis, a control current of up to 650 mA may be required for the $V_{g\,max}$ position.

▼ **Circuit diagram E1/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 E1/E2**
Basic position C,
depressurized at minimum
Swivel angle ($V_{g\,min}$)



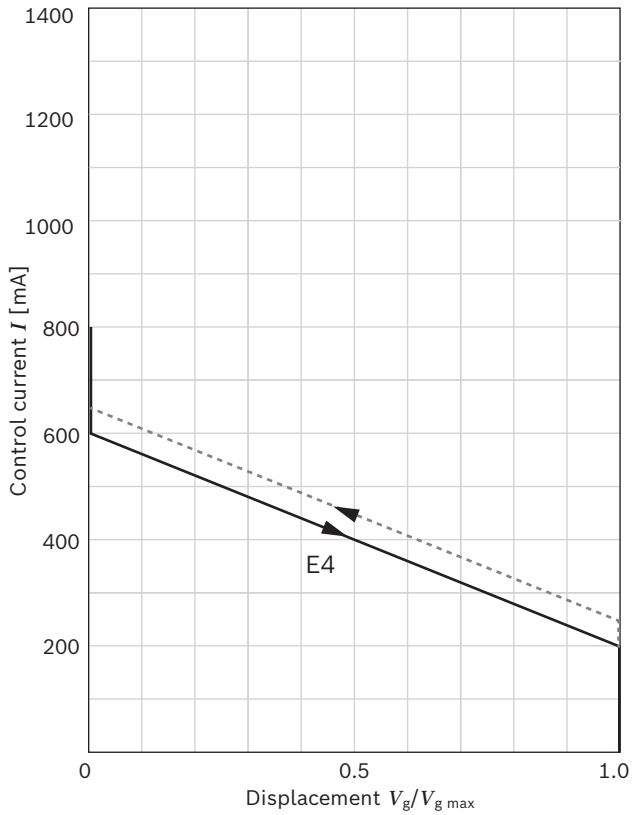
E4 – Stroke control electric-proportional (negative control)

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 $V_{g\,max}$.
The mechanical depressurized basic position is $V_{g\,max}$ (see type code 08, letter A/B).
With decreasing control current the pump swivels to a greater 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 position $V_{g\,min}$ or from a low working pressure, port **P** must be supplied with an external control pressure of at least 30 bar (435 psi), maximum 50 bar (725 psi).

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 E4**



Technical data, solenoid	E4
Voltage	24 V (±20%)
Control current	
Start of control at $V_{g\,max}$	200 mA
End of control at $V_{g\,min}$	600 mA[1)]
Current limit	0.77 A
Nominal resistance (at 20 °C (68 °F))	22.7 Ω
Dither frequency	100 Hz
Duty cycle	100%
Type of protection: see connector version page 72	

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

BODAS Controllers RC Series	Data sheet
30	95205
31	95206
40	95207 and 95208
And application software	
Analog amplifier RA	95230

When ordering, state in plain text:

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

See circuit diagram on page 23

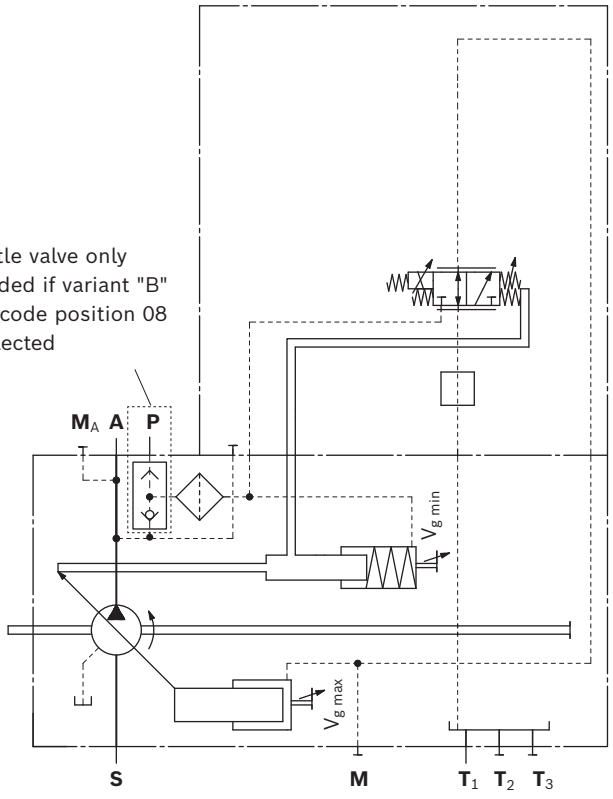
Notice!

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 $V_{g\,min}$ position.

▼ **Circuit diagram E4**
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



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 $V_{g\,max}$.

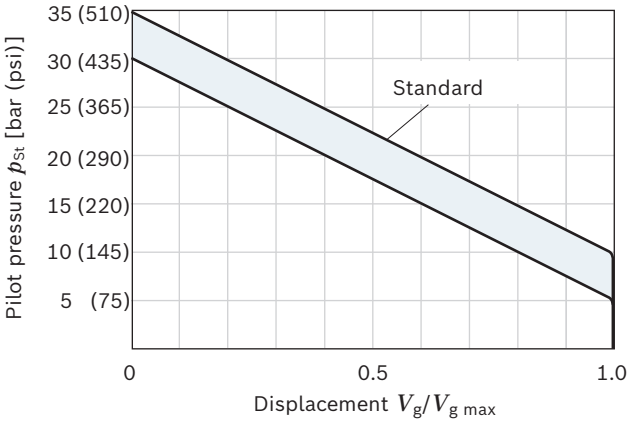
The mechanical depressurized basic position is $V_{g\,max}$ (see type code 08, letter B).

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

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 30 bar (435 psi), maximum 50 bar (725 psi).

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 H3 (negative)**

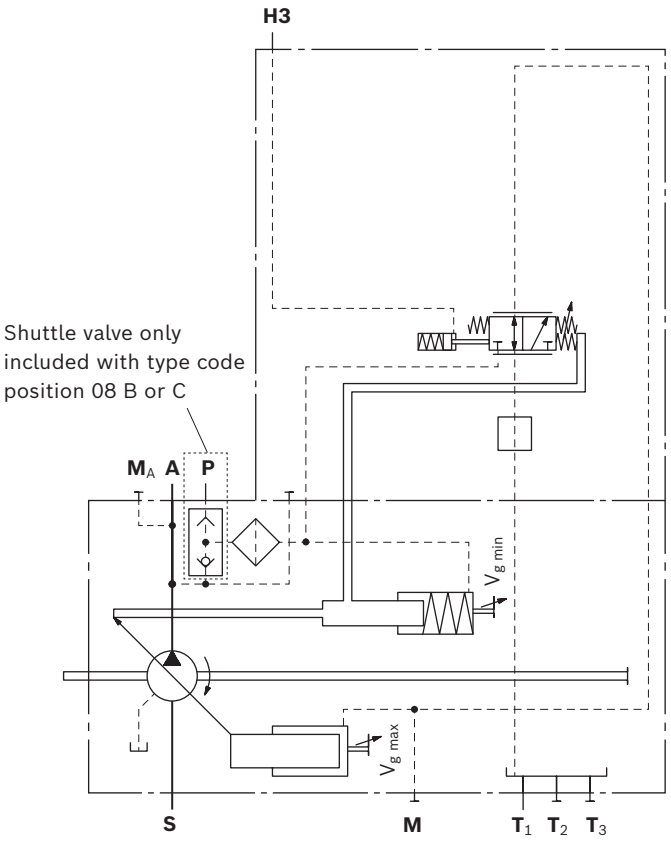


Pilot pressure increase $V_{g\,max}$ to $V_{g\,min}$: Δp = 25 bar (365 psi)

When ordering, state in plain text:

- Beginning of control [bar (psi)] at $V_{g\,max}$

▼ **Circuit diagram H3**



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

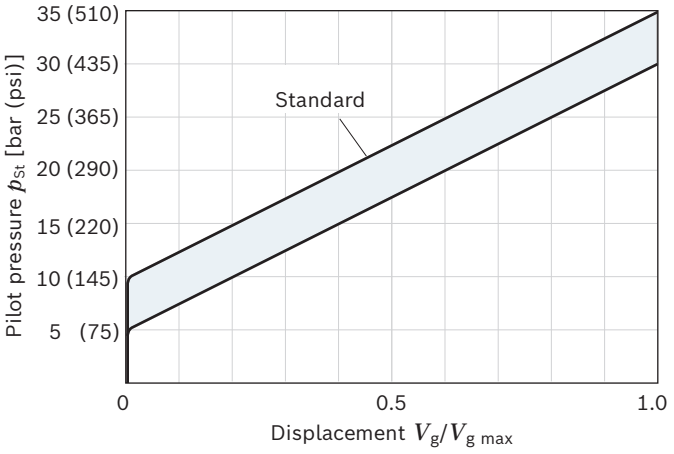
The required control fluid is taken from the working pressure or the external control pressure applied to port **P**.

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 30 bar (435 psi), maximum 50 bar (725 psi).

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)**

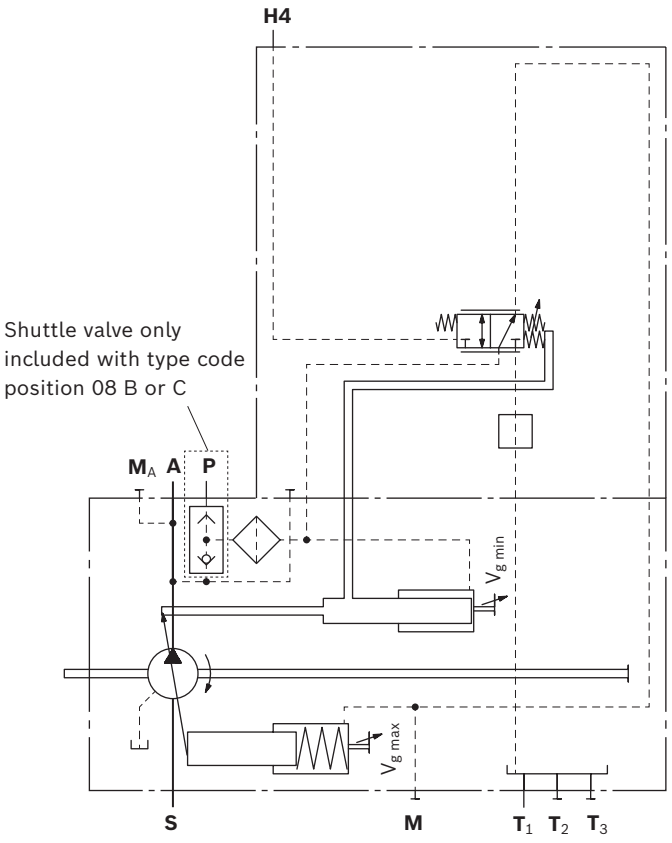


Pilot pressure increase $V_{g\,min}$ to $V_{g\,max}$: Δp = 25 bar (365 psi)

When ordering, state in plain text:

- Beginning of control [bar (psi)] 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.

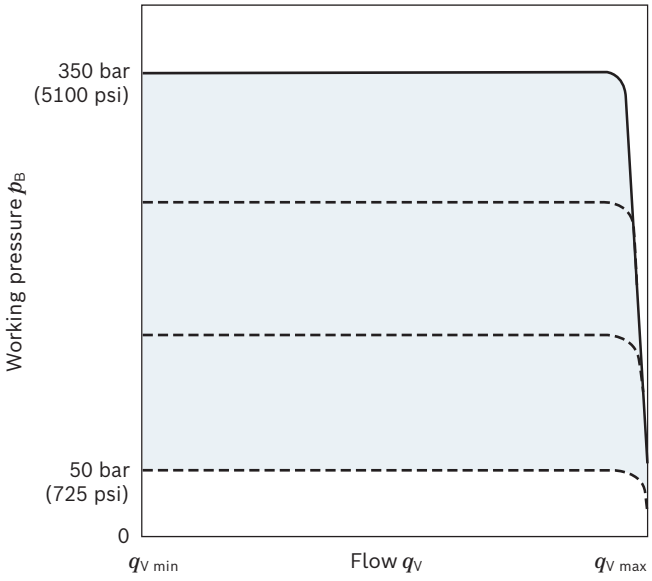
Pressure controller

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

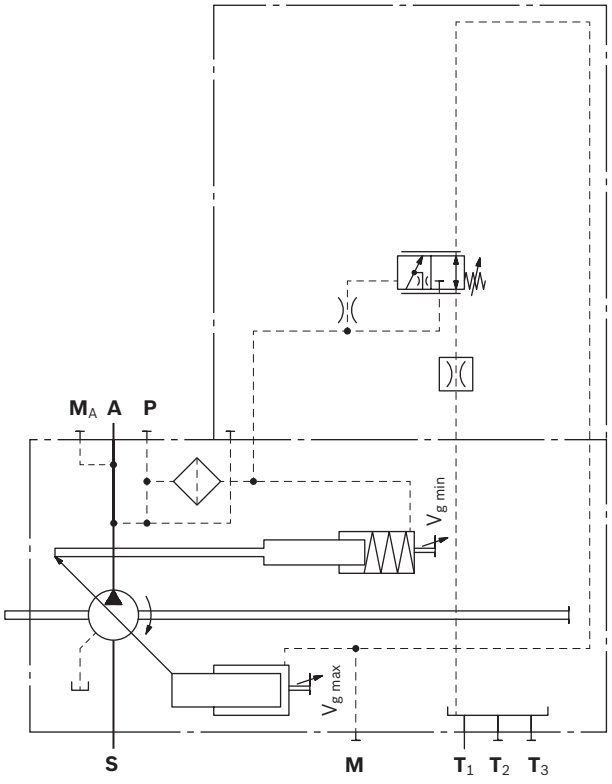
The pressure controller limits the maximum pressure at the pump outlet within the control range of the variable pump. The variable pump only supplies as much hydraulic fluid as is required by the consumers. If the working pressure exceeds the pressure command value at the pump outlet within the control 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 beginning of pressure control 50 bar (725 psi) to 350 bar (5100 psi), 350 bar (5100 psi) is standard.

▼ **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.

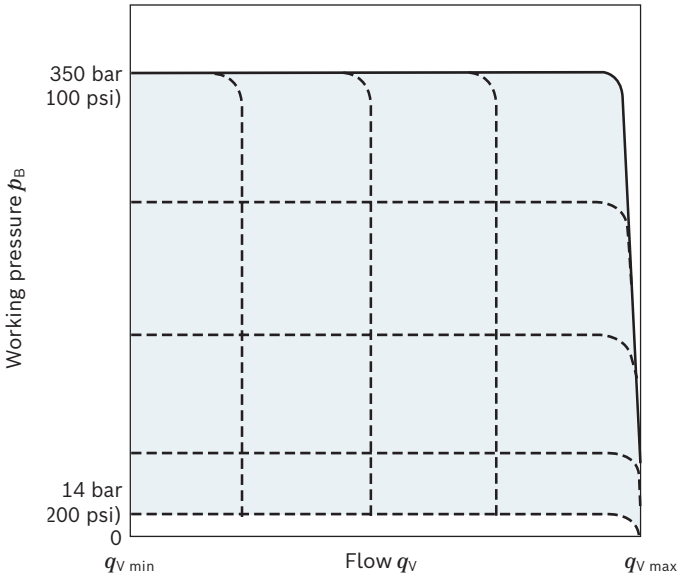
The load-sensing controller compares the pressure upstream of the metering orifice to the one downstream of the orifice and keeps the pressure drop (differential pressure Δp) occurring here and thus the flow constant. If the differential pressure Δp at the metering orifice rises, the pump is swiveled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

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

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

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

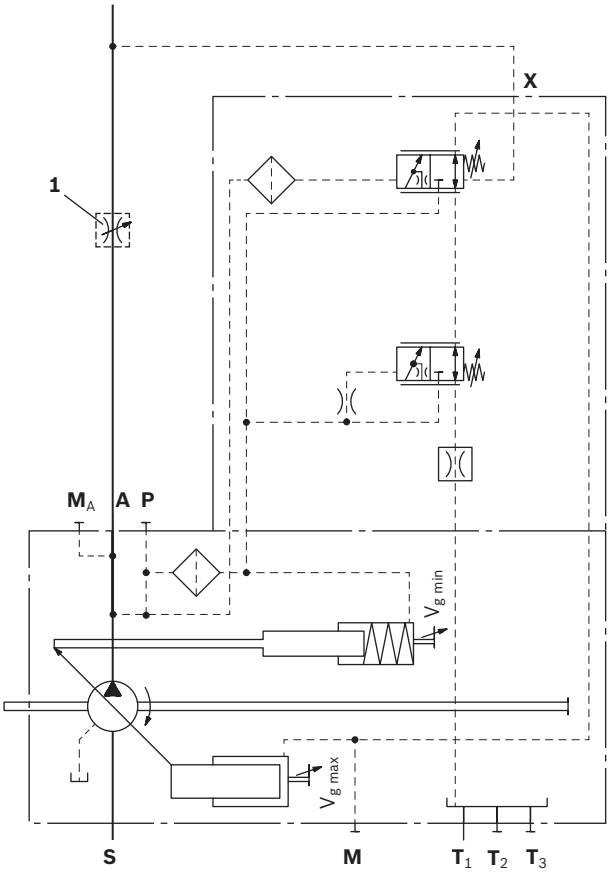
▼ **Characteristic curve DRS0**



When ordering, state in plain text:

- Pressure setting p [bar (psi)] at pressure controller DR
- Differential pressure Δp [bar (psi)] 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 14 bar (200 psi) to 25 bar (365 psi)
- Recommended value 20 bar (290 psi) (standard)
- Control volume at X: about 1.6 l/min (0.42 gpm) (static) at Δp 20 bar (290 psi)

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
- Working pressure p in bar (psi) (test pressure for DG)
- Differential pressure Δp in bar (psi)
- Drive speed n in rpm
- Maximum flow $q_{V\,max}$ in l/min (gpm)

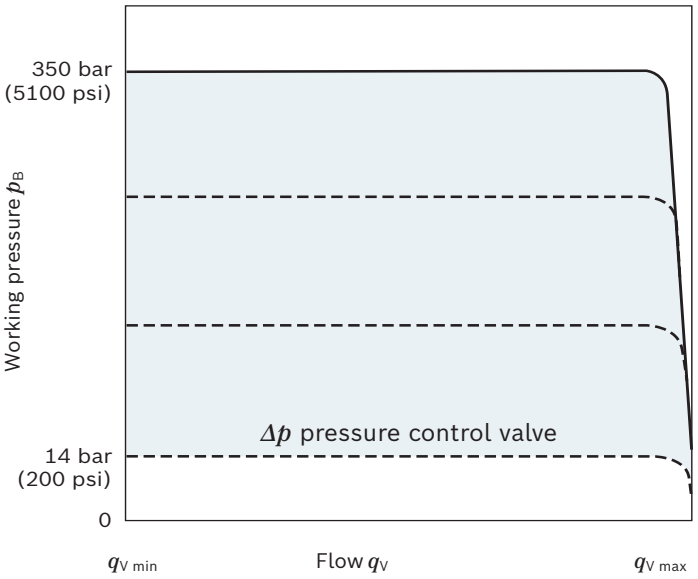
Note for setting remote-controlled pressure control

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:

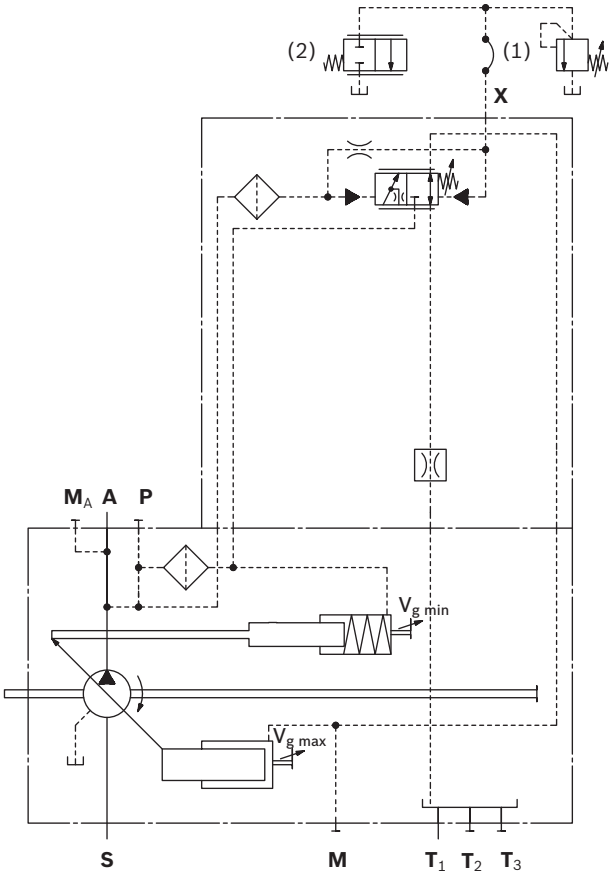
- External pressure relief valve 330 bar (4800 psi)
- Differential pressure on pressure control valve 20 bar (290 psi)
- Resulting pressure control of 330 + 20 = 350 bar (4810 + 290 = 5100 psi)

▼ **Characteristic curve DG**



For function and description of pressure control DR, see page 25

▼ **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)

D2 – Proportional pressure controller with one-side swiveling, electric override (positive control)

The pressure controller keeps the pressure in a hydraulic system constant within its control range even under varying flow conditions. The variable pump only supplies as much hydraulic fluid as is required by the consumers. If the working pressure exceeds the setpoint value at the integrated pressure control valve, the pump is automatically swiveled back to reduce the control differential.

- Basic position in depressurized state: $V_{g\,max}$
- Pressure controller basic setting: 32 bar (470 psi)/300 mA

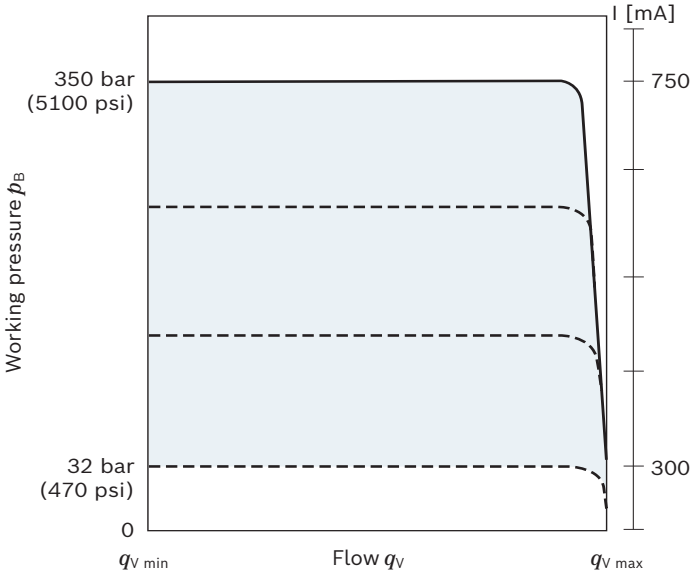
The basic setting of the pressure controller can be overridden. The pressure controller value is proportional to the electrical current acting on the solenoids of the pressure reducing valve.

- Pressure setting overridden: 32 bar (470 psi)/300 mA to 350 bar (5100 psi)/750 mA
- Auxiliary pressure for controlling D2 at port Y: p_{min} = 40 bar (580 psi); p_{max} = 50 bar (725 psi). Port **X** acts solely as a measuring port (p_{max} 50 bar (725 psi)). Pressurization leads to an impermissible increase in pressure.

Notice

Applying current above the limit of 750 mA to the proportional solenoid results in an impermissible increase in pressure.
Make sure that currents above the permissible limit are not applied to the proportional solenoid.

▼ **Characteristic curve D2**

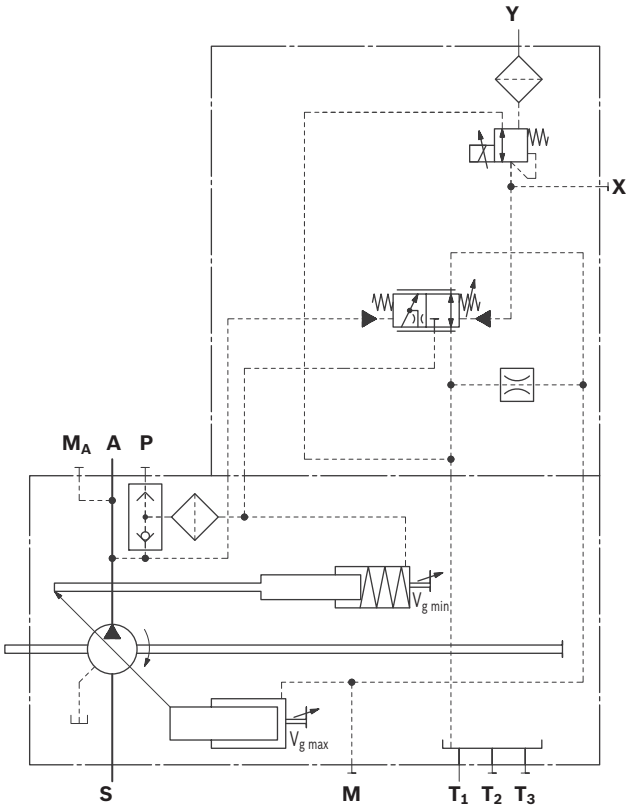


Technical data, solenoid	D2
Voltage	24 V
Control current	
Start of control at $V_{g\,min}$	300 mA
End of control at $V_{g\,max}$	750 mA
Current limit	750 mA
Nominal resistance (at 20 °C (68 °F))	12 Ω
Dither frequency	200 Hz
Duty cycle	100%
Type of protection: see connector version page 72	

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

BODAS Controllers RC Series	Data sheet
30	95205
31	95206
40	95207 and 95208
And application software	
Analog amplifier RA	95230

▼ **Circuit diagram D2**



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

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

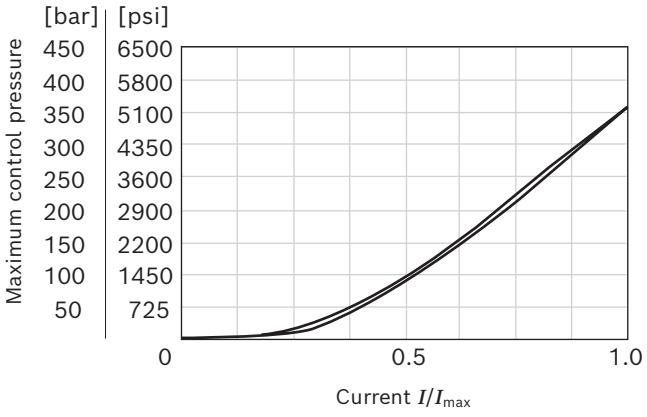
- Fixed value at Δp 14 bar (200 psi).
- Fixed pressure pilot valve: 336 bar (4870 psi)
- Maximum pressure p_{max} [bar (psi)] (pressure at port **A**) with 1200 mA current: 350 bar (5100 psi)

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 (5100 psi): KBPS**R**8AA/HCG24K40V

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

▼ **Characteristic curve T6**

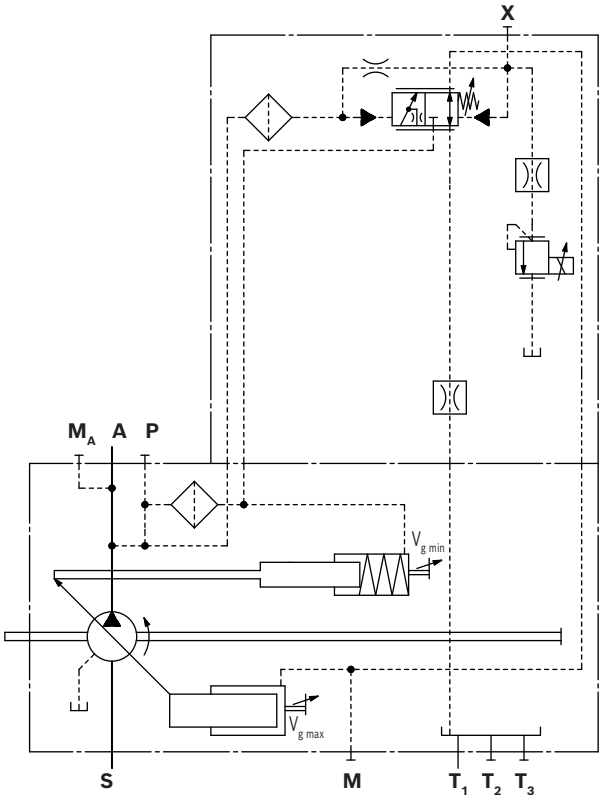


Technical data, solenoid	T6
Voltage	24 V
Control current	
Minimum pressure p_{min}	0 mA
Maximum pressure p_{max}	1200 mA
Maximum rated current	1200 mA
Nominal resistance (at 20 °C (68 °F))	4.8 Ω
Dither frequency	200 Hz
Duty cycle	100%
Type of protection: see connector version page 72	

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

BODAS Controllers RC Series	Data sheet
30	95205
31	95206
40	95207 and 95208
And application software	
Analog amplifier RA	95230

▼ **Circuit diagram DGT6**



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

The remote controlled pressure controller DG 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 14 bar (200 psi).

When ordering, state pressure setting in plain text:

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

Pilot valve T8

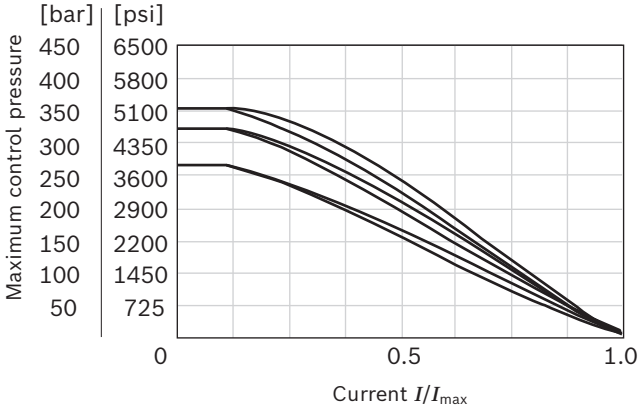
The electro proportional pressure relief valve is directly controlled with a negative control as cartridge version (see data sheet 18139-05).

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

200...250 bar (2900...3600 psi): KBPS**N**8BA/HCG24K40V
251...315 bar (3640...4550 psi): KBPS**P**8BA/HCG24K40V
316...350 bar (4580...5100 psi): KBPS**R**8BA/HCG24K40V

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

▼ **Characteristic curve T8**

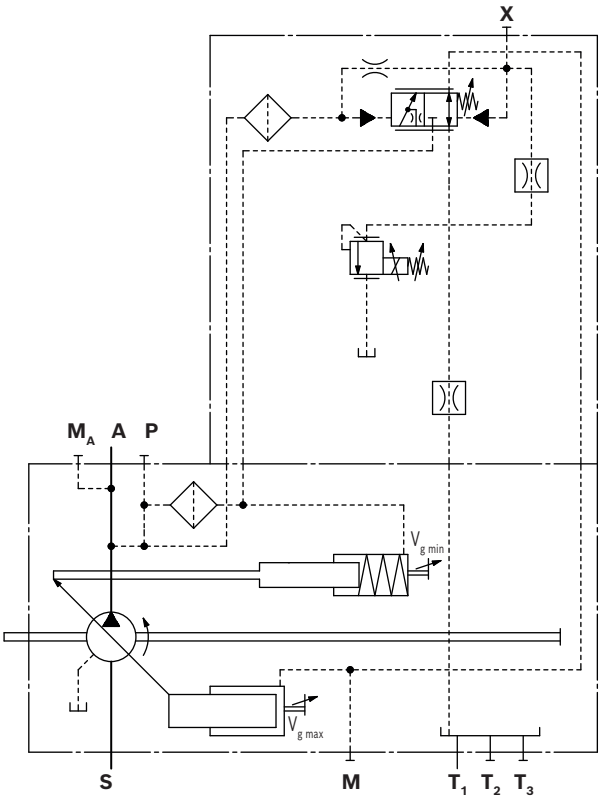


Technical data, solenoid	T8
Voltage	24 V
Control current	
Maximum pressure p_{max}	0 mA
Minimum pressure p_{min}	1200 mA
Maximum rated current	1200 mA
Nominal resistance (at 20 °C (68 °F))	4.8 Ω
Dither frequency	200 Hz
Duty cycle	100%
Type of protection: see connector version page 72	

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

BODAS Controllers RC Series	Data sheet
30	95205
31	95206
40	95207 and 95208
And application software	
Analog amplifier RA	95230

▼ **Circuit diagram DGT8**



S3/S4 – Load-sensing controller, electric-proportional override (negative control)

A control current acts against the adjustment spring of the load-sensing controller via a proportional solenoid.
The mechanically adjusted differential pressure can be reduced by means of different control current settings.
Increasing control current = reduced differential pressure.

- Reduced differential pressure/control current= at S3 3.1 bar (45 psi)/ 200 mA
  At S4 3.1 bar (45 psi)/ 100 mA

Technical data, solenoid	S3	S4
Voltage	12 V (±20%)	24 V (±20%)
Control current		
Start of control	400 mA	200 mA
End of control	1200 mA	600 mA
Current limit	1.54 A	0.77 A
Nominal resistance (at 20 °C (68 °F))	5.5 Ω	22.7 Ω
Dither frequency	100 Hz	100 Hz
Duty cycle	100%	100%
Type of protection: see connector version page 72		

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

BODAS Controllers RC series	Data sheet
30	95205
31	95206
40	95207 and 95208
And application software	
Analog amplifier RA	95230

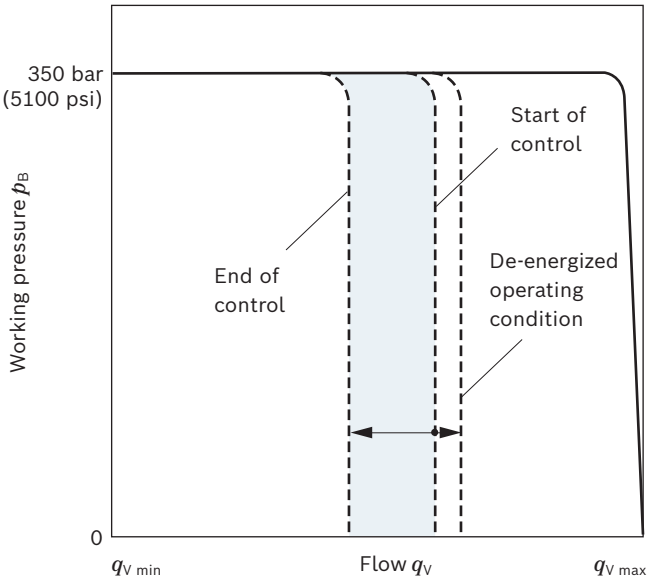
When ordering, state in plain text:

- Differential pressure setting Δp [bar (psi)] at control current 200 mA.

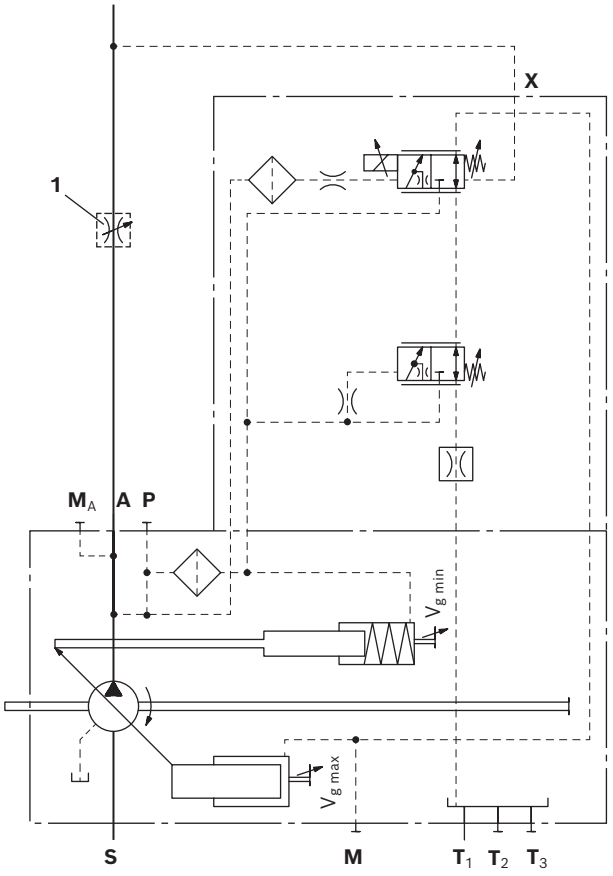
$\Delta p_{\text{metering orifice}} = p_{\text{pump}} - p_{\text{consumer}}$

- Setting range for Δp 20 bar (290 psi) to 30 bar (435 psi) at 200 mA
- Standard setting 20 bar (290 psi) at 200 mA

▼ **Characteristic curve DRS4**



Circuit diagram DRS4



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

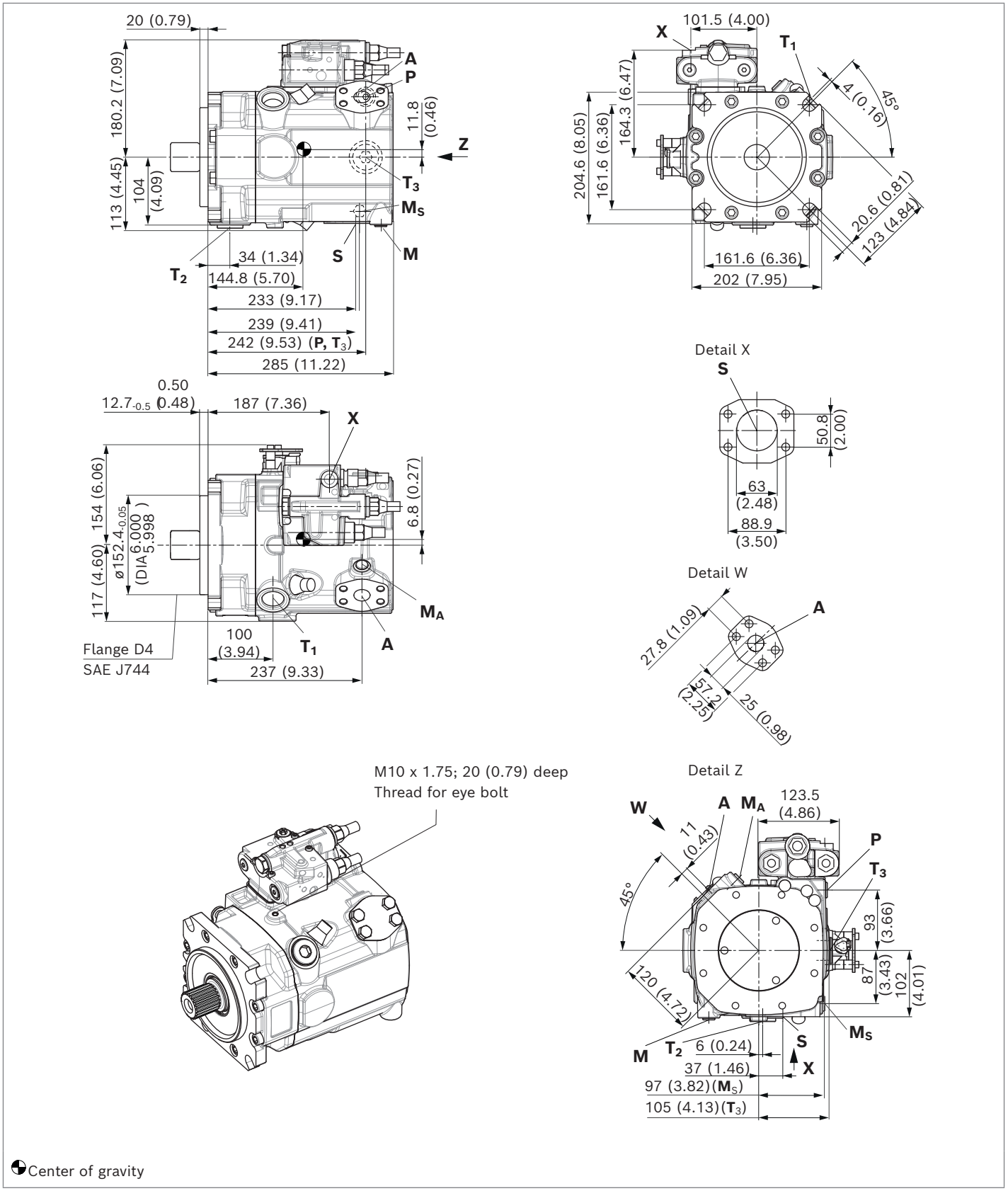
Notice

- In operating condition S3 de-energized (jump 400 to 0 mA): Increased differential pressure by 3.2 bar (45 psi).
- In operating condition S4 de-energized (jump 200 to 0 mA): Increased differential pressure by 3.2 bar (45 psi).

Dimensions, size 110

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

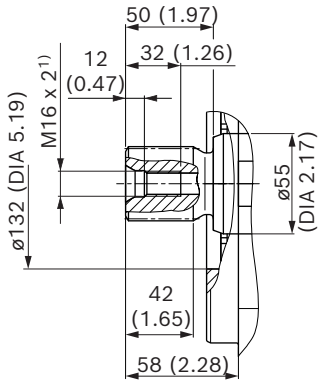
Without charge pump, clockwise rotation



Center of gravity

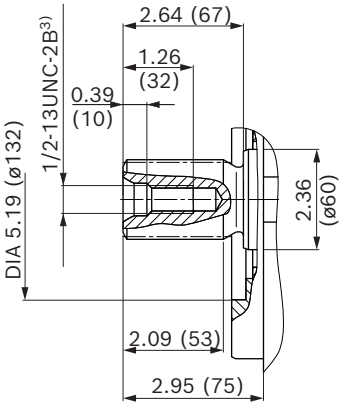
▼ **Splined shaft DIN 5480**

A1 – W45x2x21x9g



▼ **Splined shaft SAE J744**

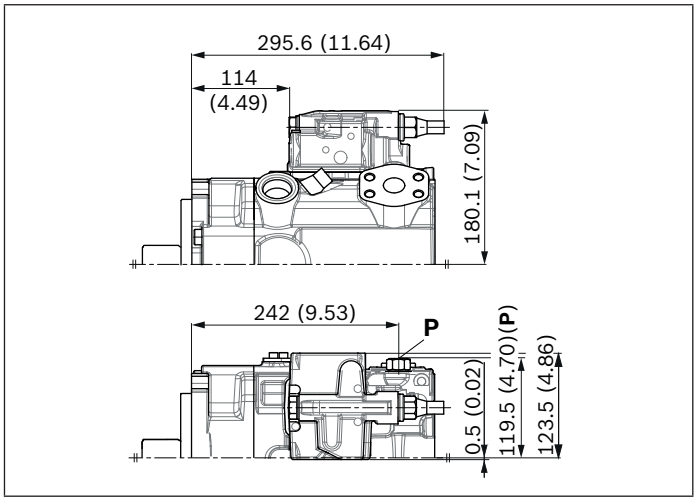
T1 – 1 3/4 in 13T 8/16 DP1)



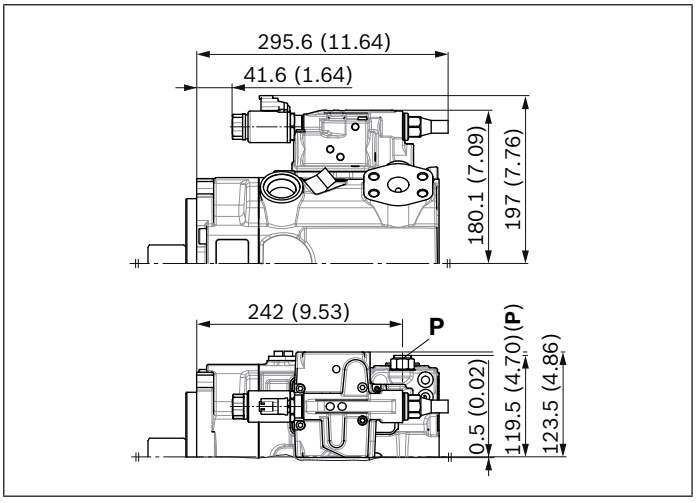
Ports		Standard	Size	p_{max} [bar (psi)][4]	State[8]
A	Working port Fastening thread	SAE J518[5] DIN 13	1 in M12 × 1.75; 18 (0.71) deep	420 (6100)	O
S	Suction port (without charge pump) Fastening thread	SAE J518[5] DIN 13	2 1/2 in M12 × 1.75; 18 (0.71) deep	30 (435)	O
T_1	Drain port	ISO 6149[6]	M33 × 2; 19 (0.75) deep	5 (75)	O[7]
T_2	Drain port	ISO 6149[6]	M33 × 2; 19 (0.75) deep	5 (75)	X[7]
T_3	Drain port	ISO 6149[6]	M33 × 2; 19 (0.75) deep	5 (75)	X[7]
CR	Pilot signal (CR only)	ISO 6149	M14 × 1.5; 11.5 (0.45) deep	420 (6100)	O
PR	Pilot signal (PR only)	ISO 6149	M14 × 1.5; 11.5 (0.45) deep	420 (6100)	O
H3, **H4**	Pilot signal (H3 and H4 only)	ISO 6149	M14 × 1.5; 11.5 (0.45) deep	100 (1450)	O
L5, L6	Override power controller (only with L5 and L6)	ISO 6149	M14 × 1.5; 11.5 (0.45) deep	100 (1450)	O
X	Pilot signal (S0, S3/S4 and DG only)	ISO 6149[6]	M14 × 1.5; 11.5 (0.45) deep	420 (6100)	O
M	Measurement of stroking chamber pressure	ISO 6149[6]	M14 × 1.5; 12 (0.47) deep	380 (5500)	X
M_A	Measuring pressure **A**	ISO 6149[6]	M14 × 1.5; 12 (0.47) deep	420 (6100)	X
M_S[9]	Measuring suction pressure	ISO 6149[6]	M14 × 1.5; 12 (0.47) deep	30 (435)	X
P	External control pressure (Type code position 8 version B or C = with external control pressure supply)	ISO 6149[6]	M14 × 1.5; 11.5 (0.45) deep	50 (725)	O
	Port **P** is without function (Type code position 8 version A = without external control pressure supply)	ISO 6149[6]	M18 × 1.5; 14.5 (0.57) deep	420 (6100)	X

1) Center bore according to DIN 332 (thread according to DIN 13)
2) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
3) Thread according to ASME B1.1
4) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
5) Metric fastening thread is a deviation from standard.
6) The countersink may be deeper than specified in the standard.
7) Depending on installation position, **T_1**, **T_2** or **T_3** must be connected (see also Installation instructions on pages 74 and 75).
8) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)
9) Only for A15VO with swivel angle sensor.

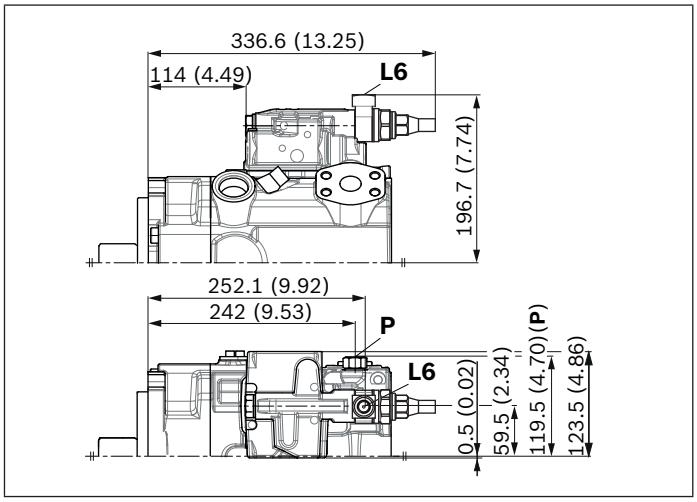
▼ **LR** – Power controller, fixed setting



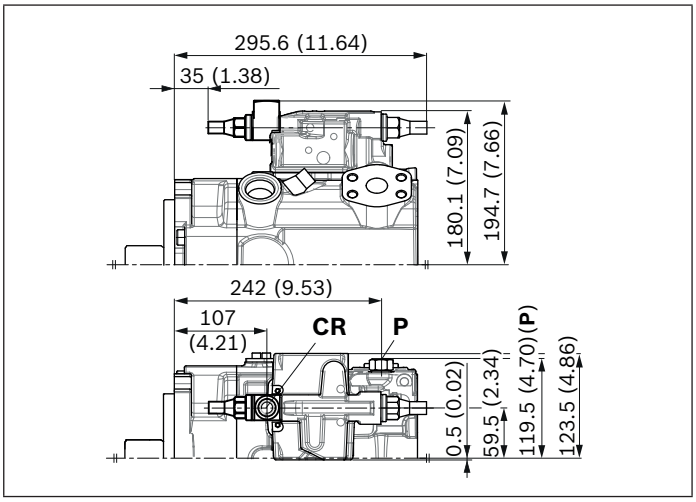
▼ **L3/L4** – Power controller, electric-proportional override



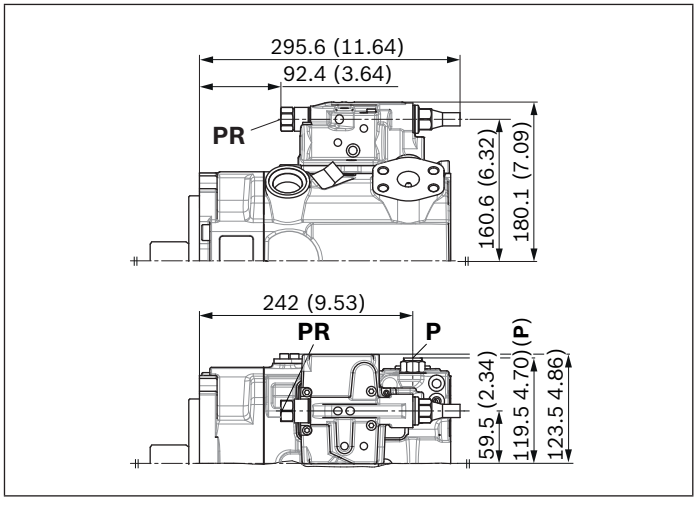
▼ **L5/L6** – Power controller, hydraulic-proportional override



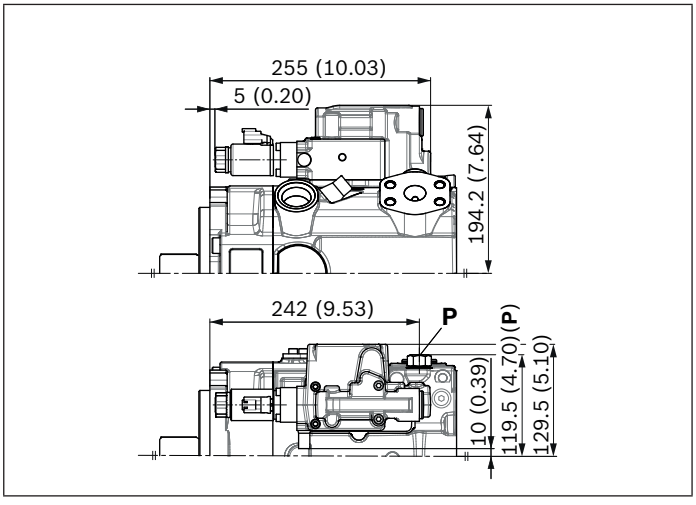
▼ **CR** – Power controller, hydraulic-proportional override, high pressure, with stop



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



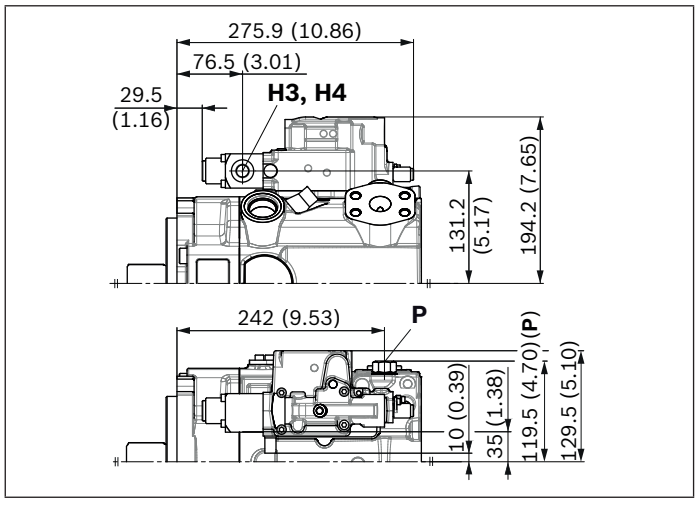
▼ **E1/E2** – Stroke control electric-proportional



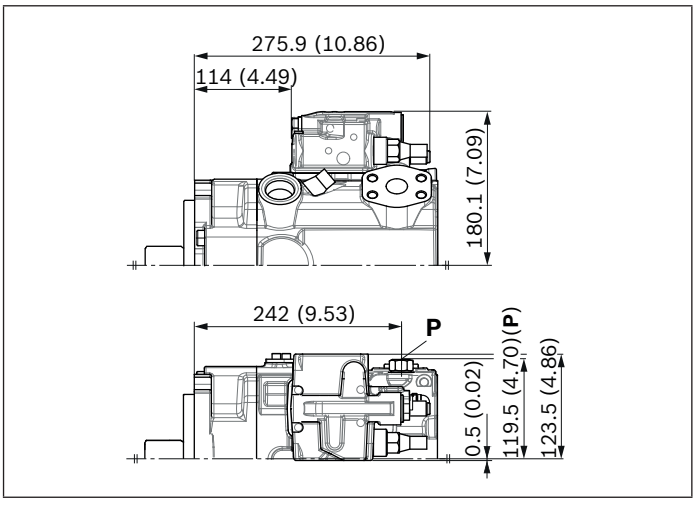
Notice

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

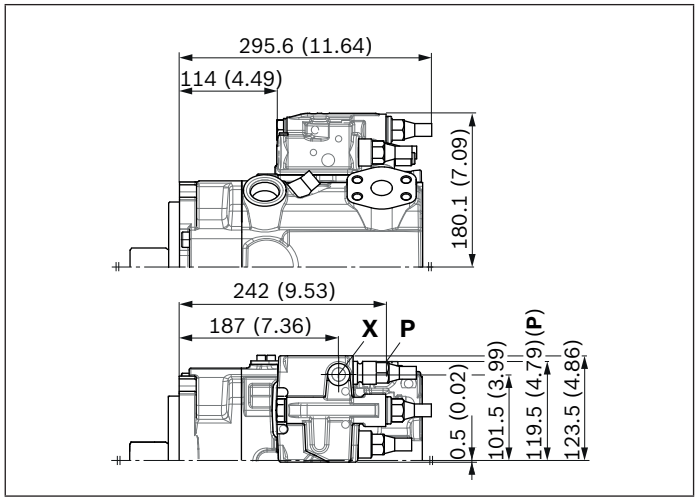
▼ **H3/H4** – Stroke control, hydraulic-proportional, pilot pressure



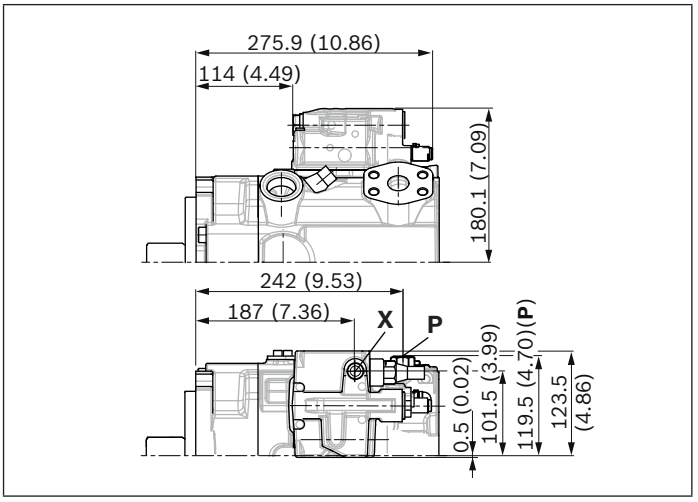
▼ **DR** – Pressure controller, fixed setting



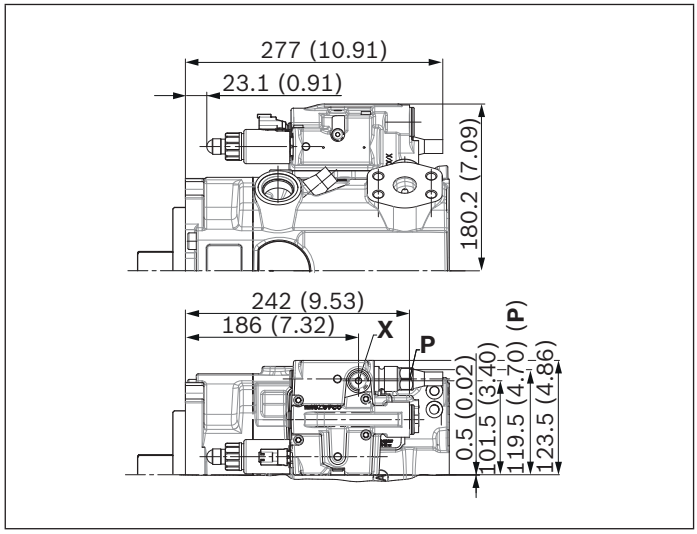
▼ **LRDRS0** – Power controller with pressure controller and load-sensing, fixed setting



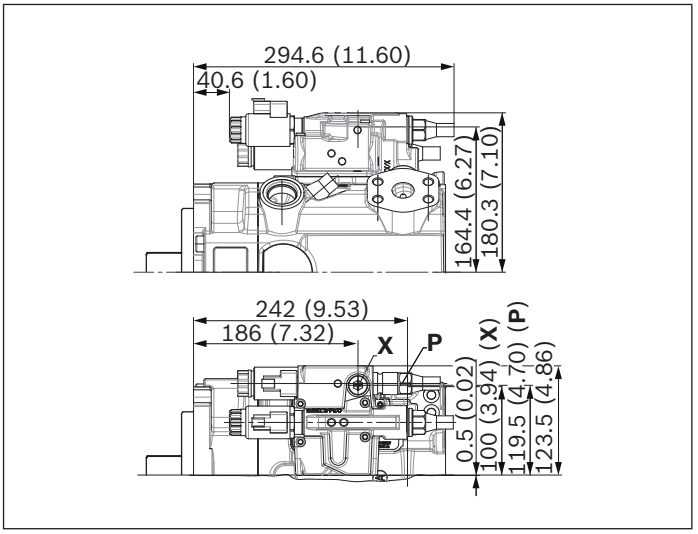
▼ **DG** – Pressure controller, hydraulic, remote controlled



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



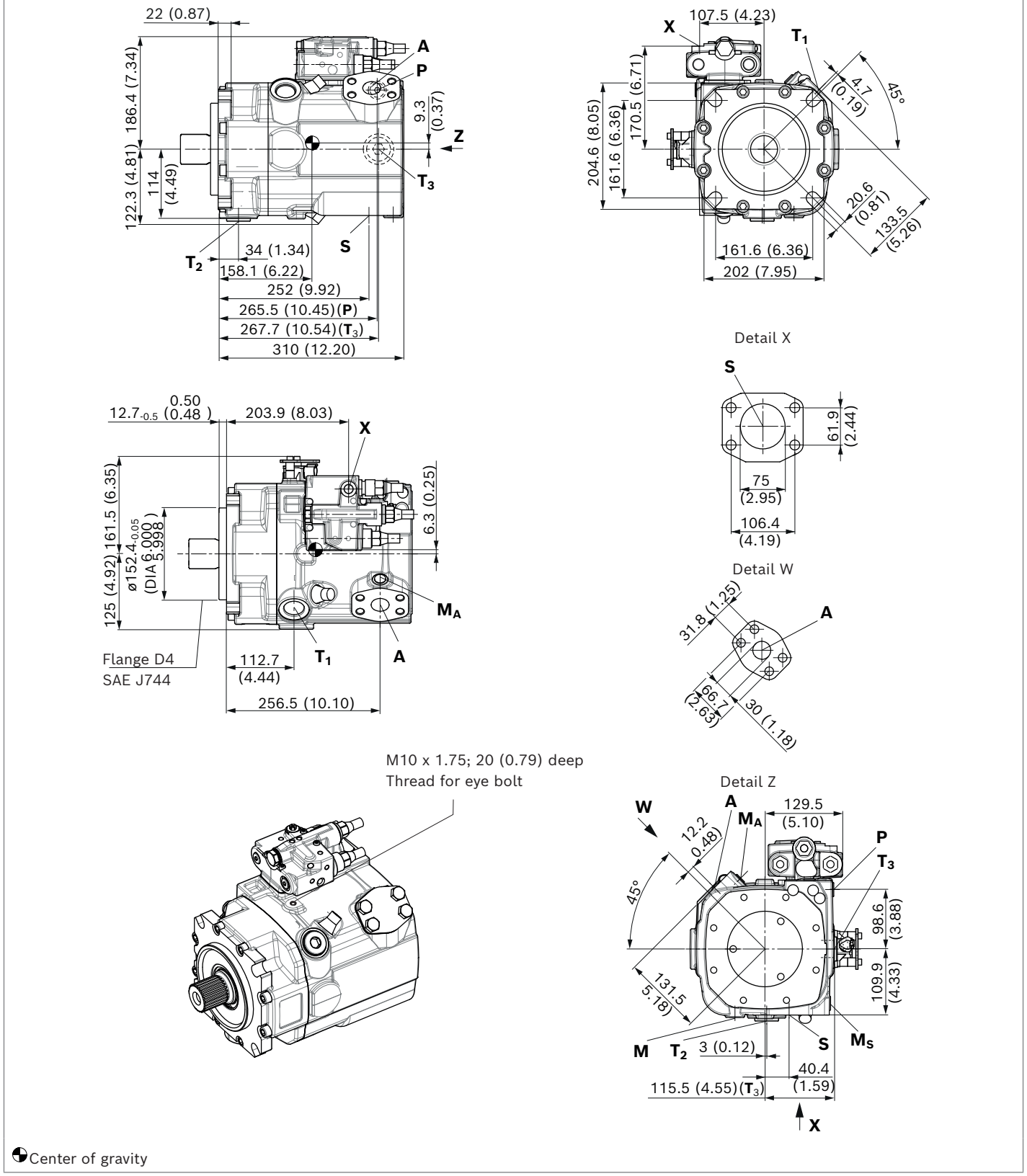
▼ **S3/S4** – Load-sensing, internal pressure, electric-proportional



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

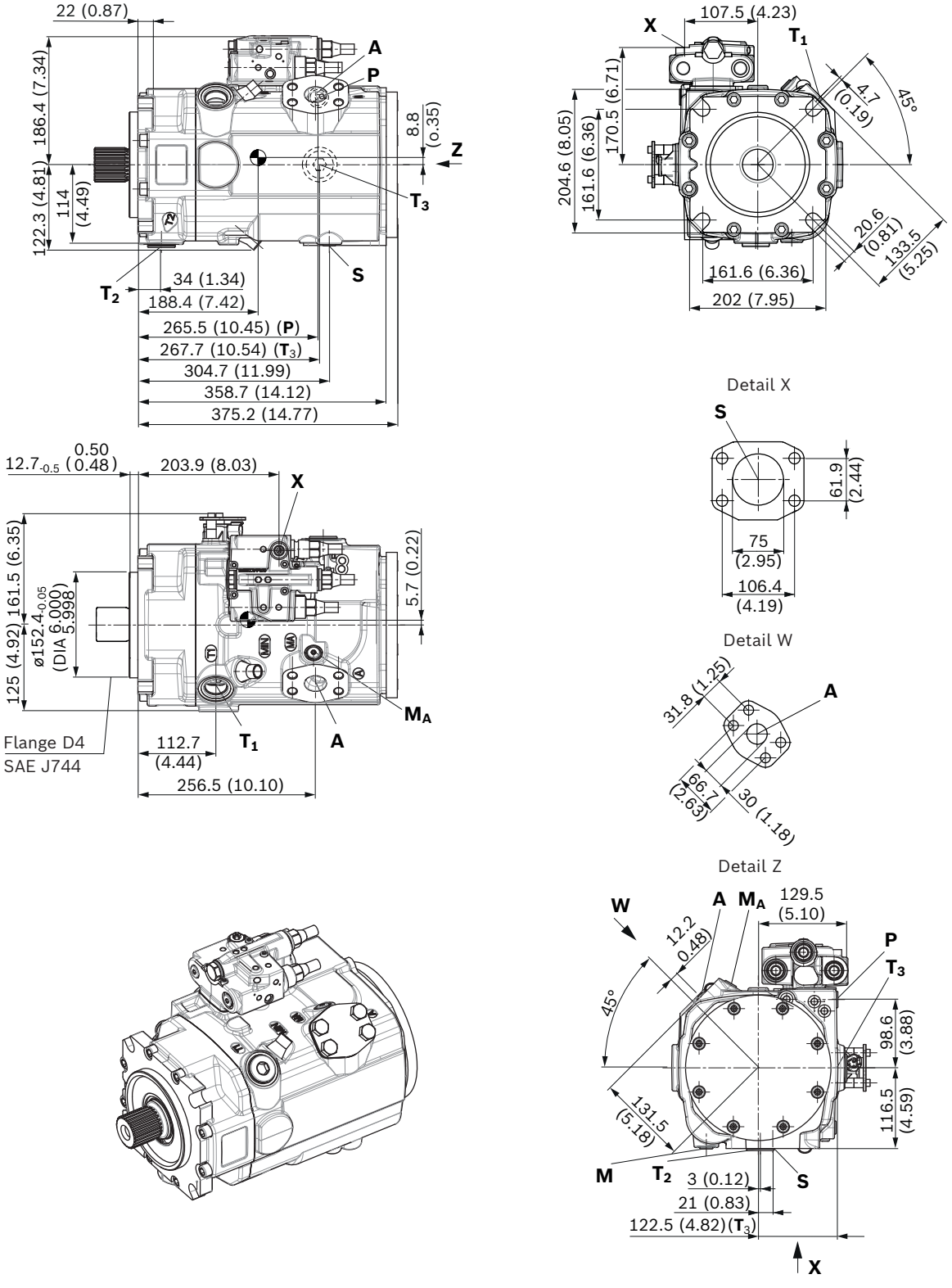
Dimensions, size 145

LRDRS0 – Power controller with pressure controller, load-sensing and with electric swivel angle sensor
Without charge pump, clockwise rotation



Center of gravity

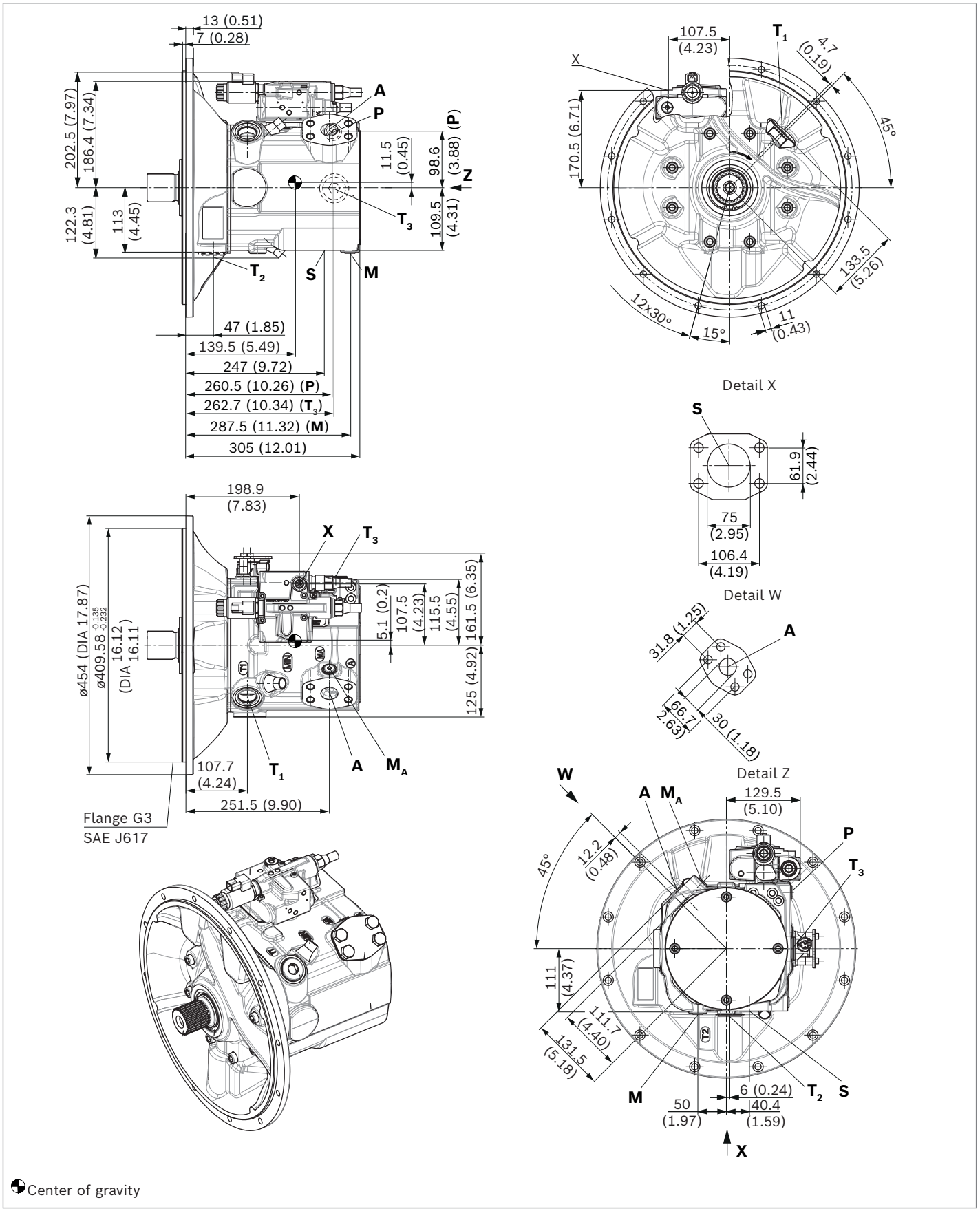
LRDRS0 – Power controller with pressure controller, load-sensing and with electric swivel angle sensor
With charge pump, clockwise rotation



Center of gravity

L4S0 – Power controller electric-proportional, load-sensing and with electric swivel angle sensor

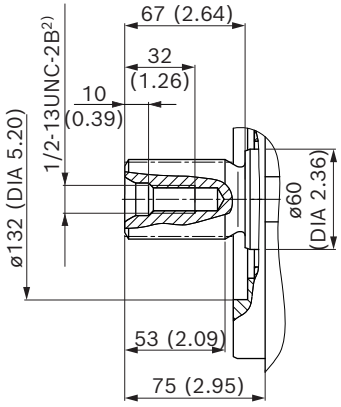
Mounting flange G3 based on SAE J617; 409-12; without charge pump



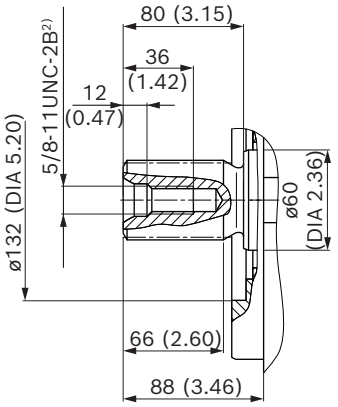
Center of gravity

▼ **Splined shaft SAE J744**

T1 – 1 3/4 in 13T 8/16DP[1)]

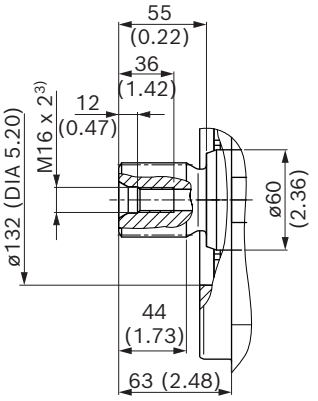


T2 – 2 in 15T 8/16 DP[1)]



▼ **Splined shaft DIN 5480**

A2 – W50x2x24x9g

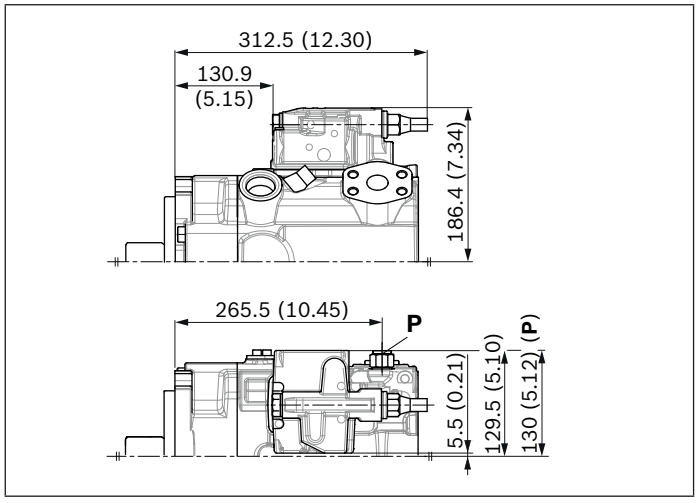


1) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Thread according to ASME B1.1
3) Center bore according to DIN 332 (thread according to DIN 13)

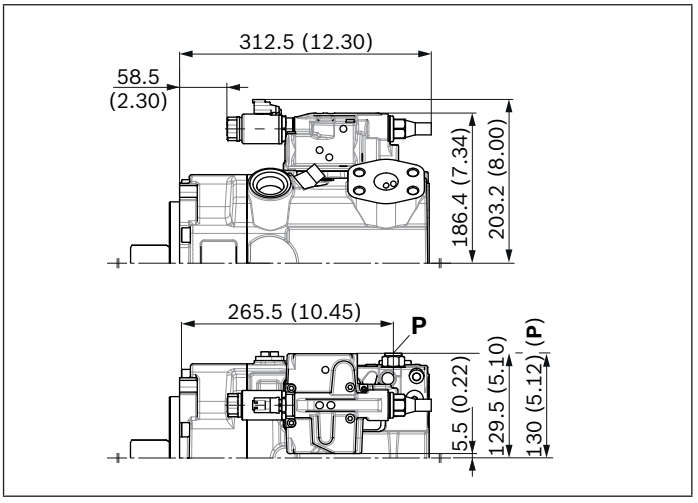
Ports		Standard	Size	p_{max} [bar (psi)][4]	State[8]
A	Working port Fastening thread	SAE J518[5] DIN 13	1 1/4 in M14 × 2; 22 (0.87) deep	420 (6100)	O
S	Suction port (without charge pump) Fastening thread	SAE J518[5] DIN 13	3 in M16 × 2; 24 (0.94) deep	30 (435)	O
S	Suction port (with charge pump) Fastening thread	SAE J518[5] DIN 13	3 in M16 × 2; 24 (0.94) deep	2 (30)	O
$\mathbf{T}_1$	Drain port	ISO 6149[6]	M33 × 2; 19 (0.75) deep	5 (75)	O[7]
$\mathbf{T}_2$	Drain port	ISO 6149[6]	M33 × 2; 19 (0.75) deep	5 (75)	X[7]
$\mathbf{T}_3$	Drain port	ISO 6149[6]	M33 × 2; 19 (0.75) deep	5 (75)	X[7]
CR	Pilot signal (CR only)	ISO 6149	M14 × 1.5; 11.5 (0.45) deep	420 (6100)	O
PR	Pilot signal (PR only)	ISO 6149	M14 × 1.5; 11.5 (0.45) deep	420 (6100)	O
H3, **H4**	Pilot signal (H3 and H4 only)	ISO 6149	M14 × 1.5; 11.5 (0.45) deep	100 (1450)	O
L5, L6	Override power controller (only with L5 and L6)	ISO 6149	M14 × 1.5; 11.5 (0.45) deep	100 (1450)	O
X	Pilot signal (S0, S3/S4 and DG only)	ISO 6149[6]	M14 × 1.5; 11.5 (0.45) deep	420 (6100)	O
M	Measurement of stroking chamber pressure	ISO 6149[6]	M14 × 1.5; 12 (0.47) deep	380 (5500)	X
$\mathbf{M}_A$	Measuring pressure A	ISO 6149[6]	M14 × 1.5; 12 (0.47) deep	420 (6100)	X
$\mathbf{M}_S$[9]	Measuring suction pressure	ISO 6149[6]	M14 × 1.5; 12 (0.47) deep	30 (435)	X
P	External control pressure (type code position 8 version B or C = with external control pressure supply)	ISO 6149[6]	M14 × 1.5; 11.5 (0.45) deep	50 (725)	O
	Port **P** is without function (Type code position 8 version A = without external control pressure supply)	ISO 6149[6]	M18 x 1.5; 14.5 (0.57) deep	420 (6100)	X

4) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
5) Metric fastening thread is a deviation from standard.
6) The countersink may be deeper than specified in the standard.
7) Depending on installation position, $\mathbf{T}_1$, $\mathbf{T}_2$ or $\mathbf{T}_3$ must be connected (see also Installation instructions on pages 74 and 75).
8) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)
9) Only for A15VO with swivel angle sensor.

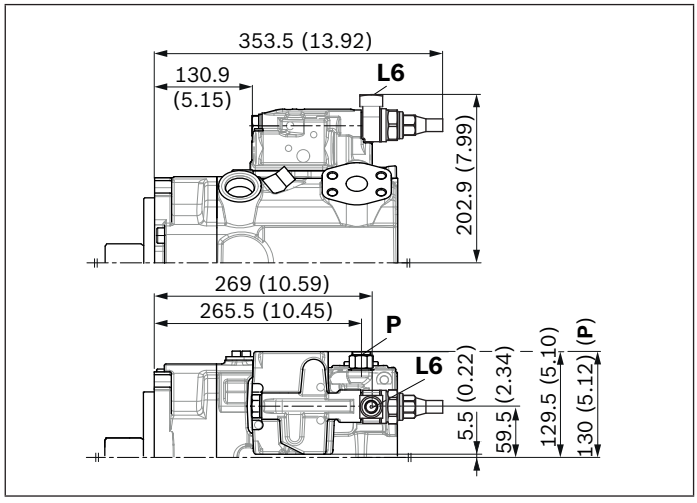
▼ **LR** – Power controller, fixed setting



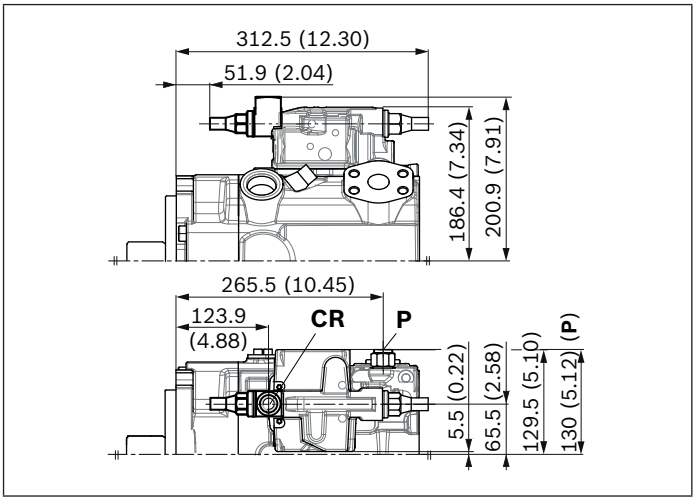
▼ **L3/L4** – Power controller, electric-proportional override



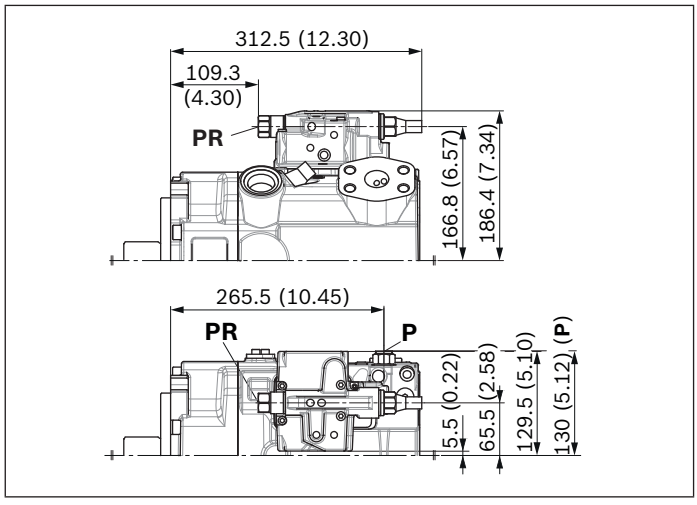
▼ **L5/L6** – Power controller, hydraulic override



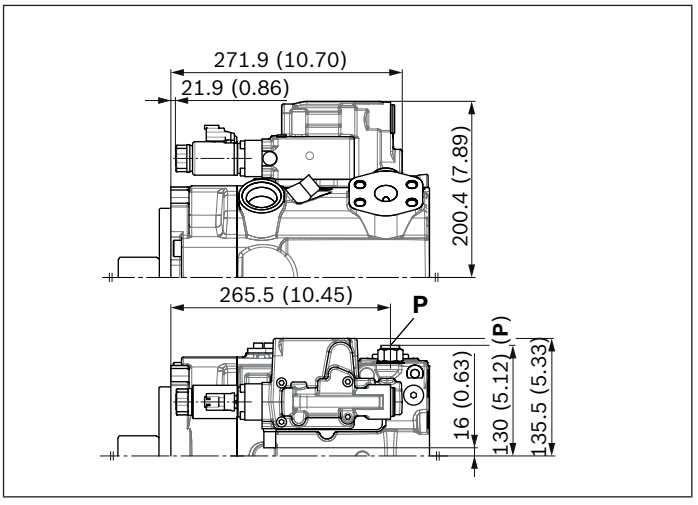
▼ **CR** – Power controller, hydraulic-proportional override, high pressure, with stop



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

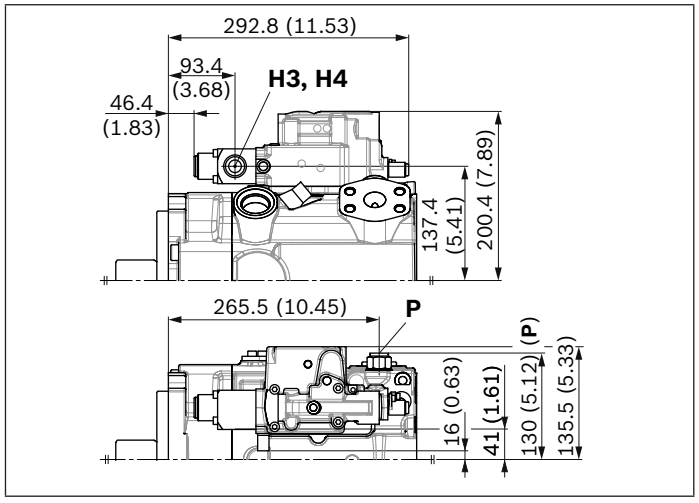


▼ **E1/E2** – Stroke control electric-proportional

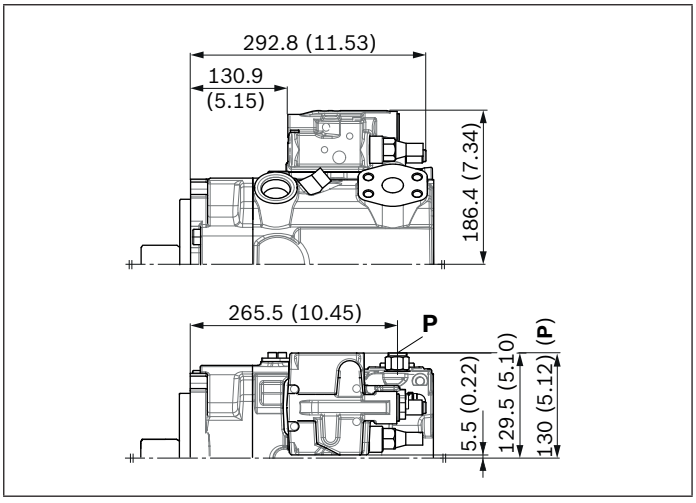


Notice
All controllers described with shuttle valve in **P**
(some contrary to standard as per type code position 08)

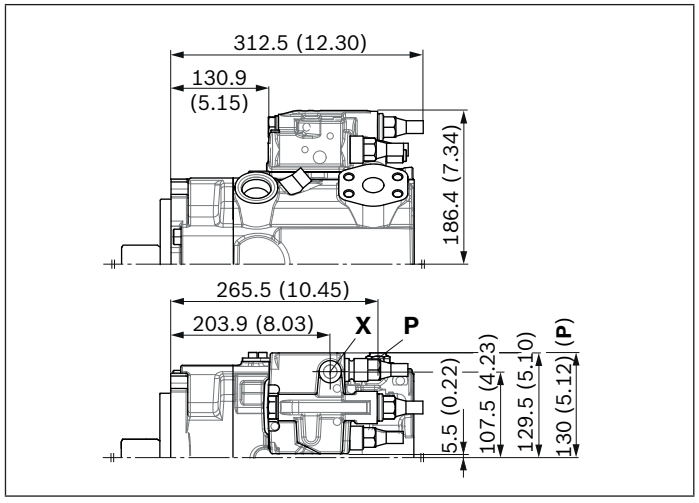
▼ **H3/H4** – Stroke control, hydraulic-proportional, pilot pressure



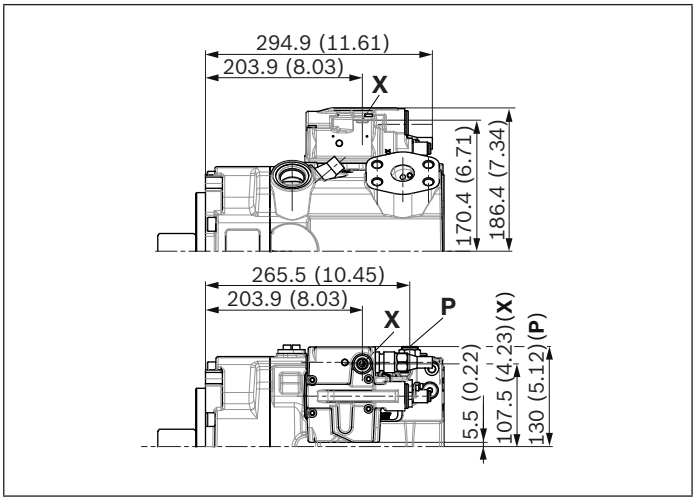
▼ **DR** – Pressure controller, fixed setting



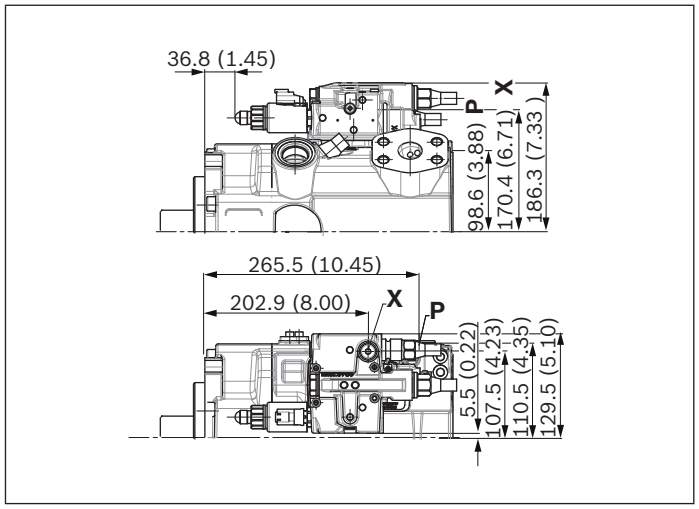
▼ **LRDRS0** – Power controller with pressure controller and load-sensing, fixed setting



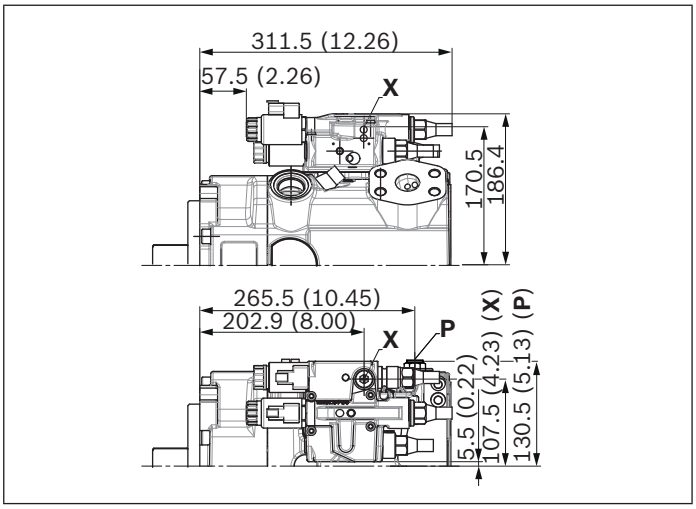
▼ **DG** – Pressure controller, hydraulic, remote controlled



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



▼ **S3/S4** – Load-sensing, internal pressure, electric-proportional

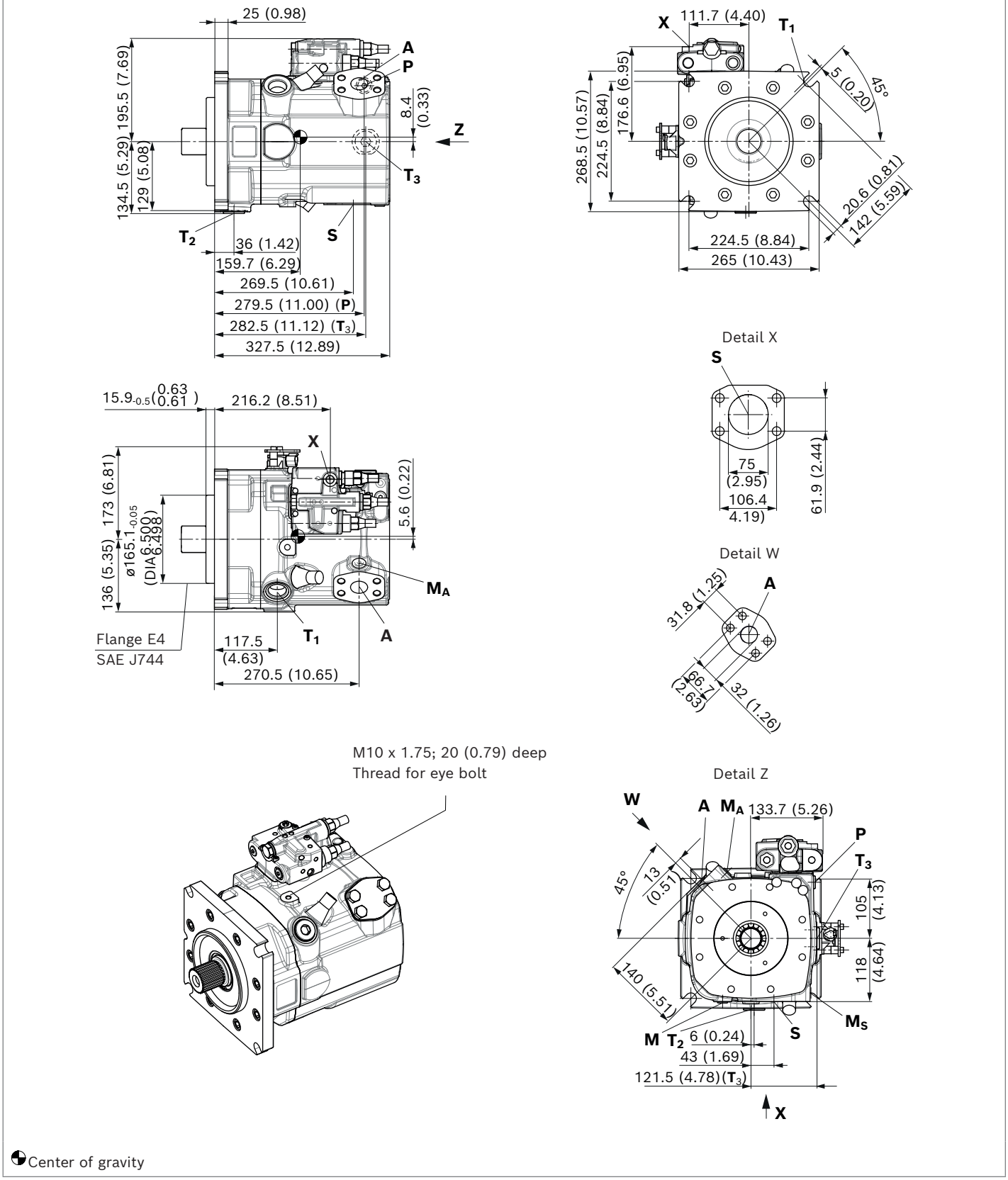


Notice

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

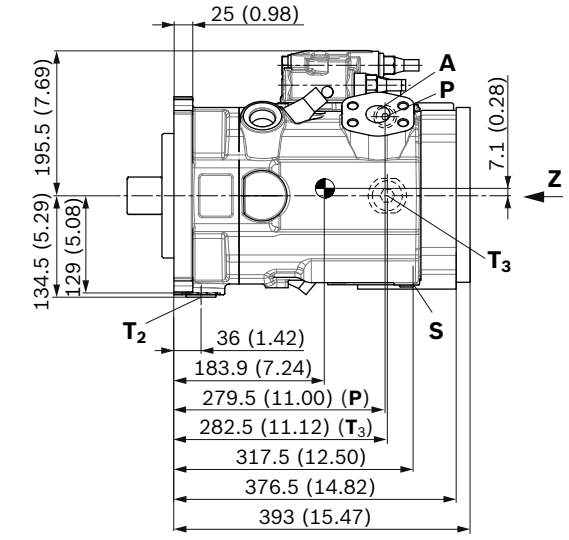
Dimensions, size 175

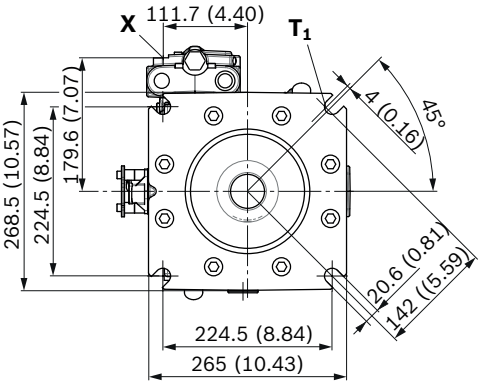
LRDRS0 – Power controller with pressure controller, load-sensing and with electric swivel angle sensor
Without charge pump, clockwise rotation

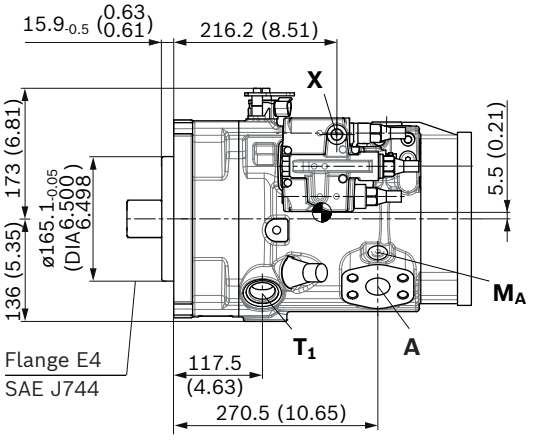


Center of gravity

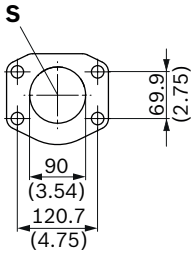
LRDRS0 – Power controller with pressure controller, load-sensing and with electric swivel angle sensor
With charge pump, clockwise rotation



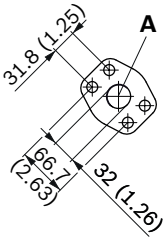




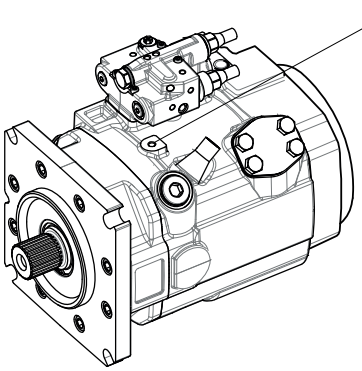
Detail X



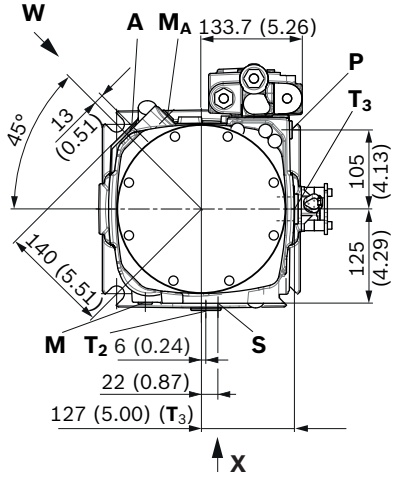
Detail W



M10 x 1.75; 20 (0.79) deep
Thread for eye bolt

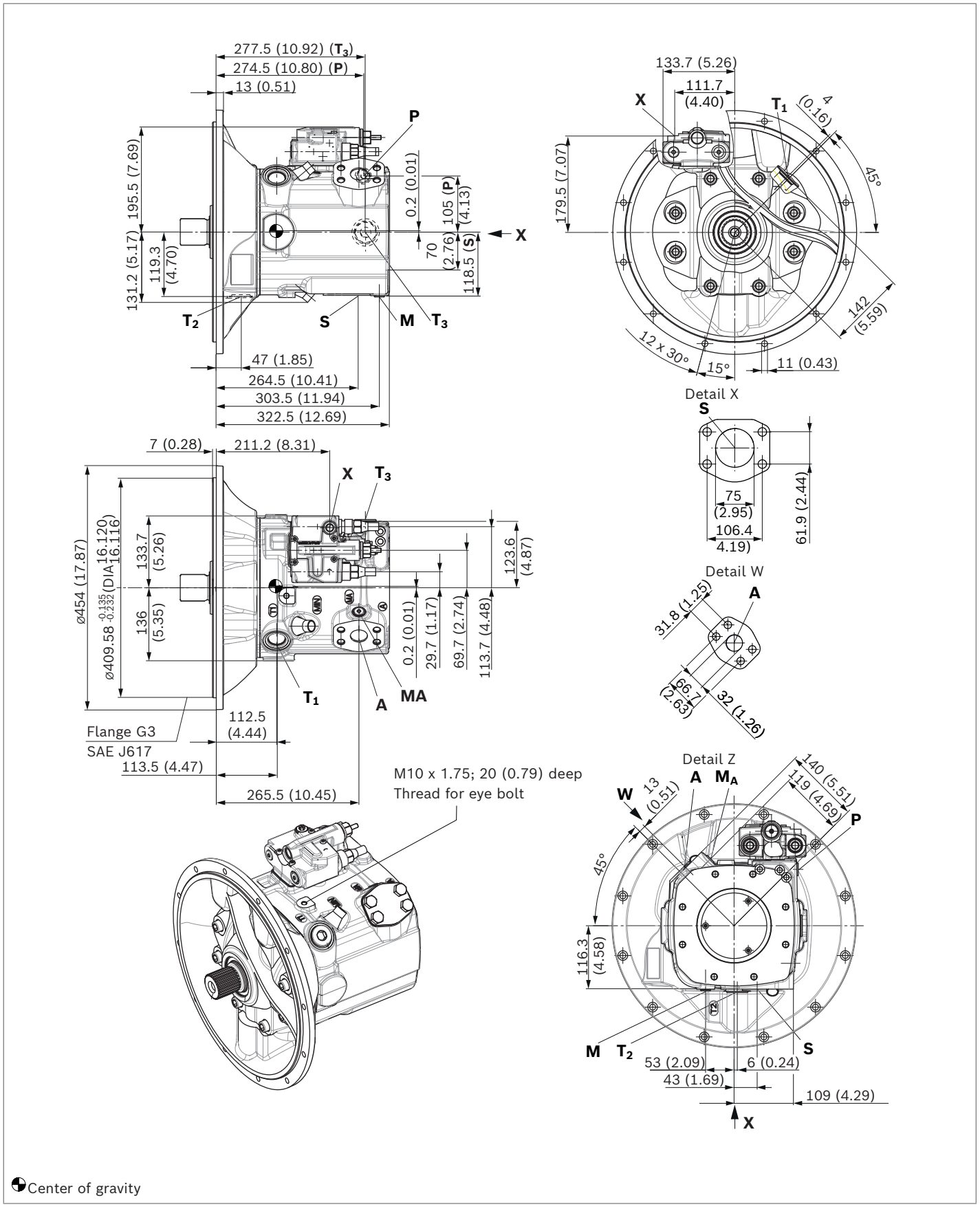


Detail Z



Center of gravity

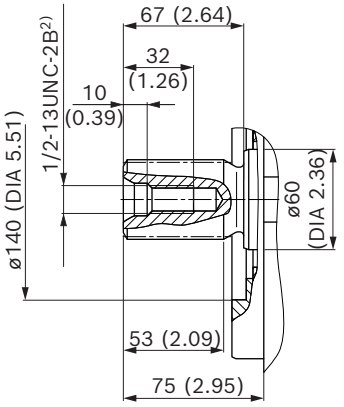
LRDRS0 – Power controller with pressure controller, load-sensing and without electric swivel angle sensor
Mounting flange G3 based on SAE J617; 409-12; without charge pump



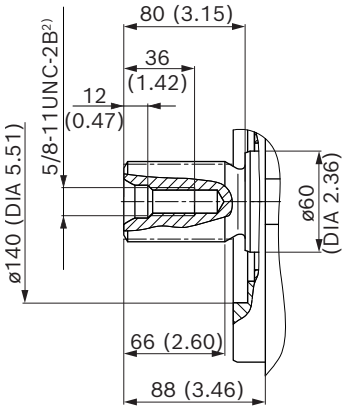
Center of gravity

▼ **Splined shaft SAE J744**

T1 – 1 3/4 in 13T 8/16DP[1)]

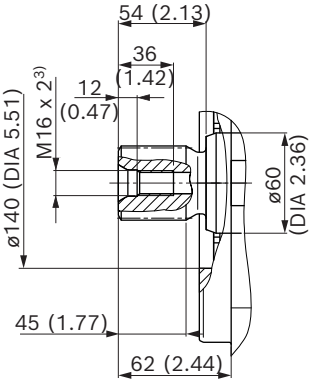


T2 – 2 in 15T 8/16DP[1)]



▼ **Splined shaft DIN 5480**

A2 – W50x2x24x9g

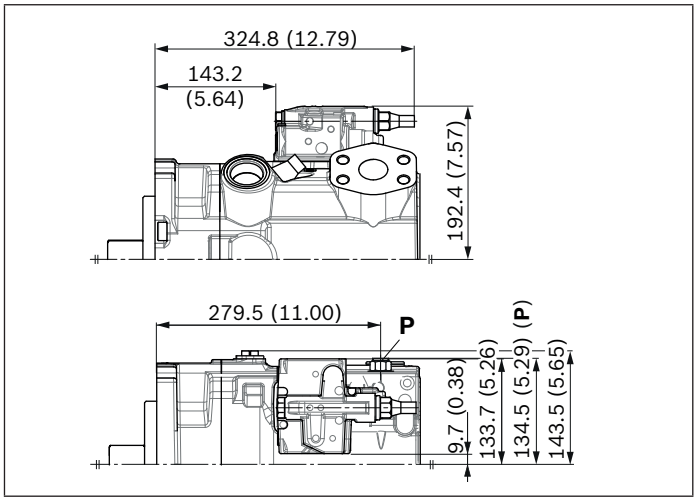


1) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Thread according to ASME B1.1
3) Center bore according to DIN 332 (thread according to DIN 13).

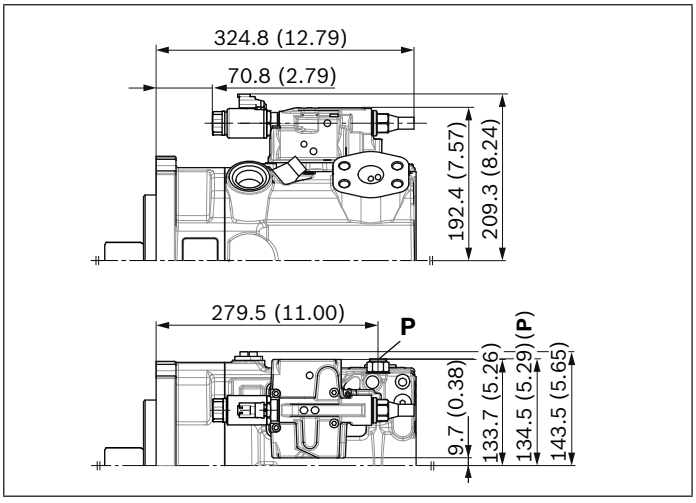
Ports		Standard	Size[4]	p_{max} [bar (psi)][5]	State[9]
A	Working port Fastening thread	SAE J518[6] DIN 13	1 1/4 in M14 × 2; 22 (0.87) deep	420 (6100)	O
S	Suction port (without charge pump) Fastening thread	SAE J518[6] DIN 13	3 in M16 × 2; 24 (0.94) deep	30 (435)	O
S	Suction port (with charge pump) Fastening thread	SAE J518[6] DIN 13	3 1/2 in M16 × 2; 24 (0.94) deep	2 (30)	O O
T_1	Drain port	ISO 6149[7]	M33 × 2; 19 (0.75) deep	5 (75)	O[8]
T_2	Drain port	ISO 6149[7]	M33 × 2; 19 (0.75) deep	5 (75)	X[8]
T_3	Drain port	ISO 6149[7]	M33 × 2; 19 (0.75) deep	5 (75)	X[8]
CR	Pilot signal (CR only)	ISO 6149	M14 × 1.5; 11.5 (0.45) deep	100 (1450)	O
PR	Pilot signal (PR only)	ISO 6149	M14 × 1.5; 11.5 (0.45) deep	100 (1450)	O
H3, **H4**	Pilot signal (H3 and H4 only)	ISO 6149	M14 × 1.5; 11.5 (0.45) deep	100 (1450)	O
L5, L6	Override power controller (only with L5 and L6)	ISO 6149	M14 × 1.5; 11.5 (0.45) deep	100 (1450)	O
X	Pilot signal (S0, S3/S4 and DG only)	ISO 6149[7]	M14 × 1.5; 11.5 (0.45) deep	420 (6100)	O
M	Measurement of stroking chamber pressure	ISO 6149[7]	M14 × 1.5; 12 (0.47) deep	380 (5500)	X
M_A	Measuring pressure **A**	ISO 6149[7]	M14 × 1.5; 12 (0.47) deep	420 (6100)	X
M_S[10]	Measuring suction pressure	ISO 6149[7]	M14 × 1.5; 12 (0.47) deep	30 (435)	X
P	External control pressure (Type code position 8 version B or C = with external control pressure supply)	ISO 6149[7]	M14 × 1.5; 11.5 (0.45) deep	50 (725)	O
	Port **P** is without function (Type code position 8 version A = without external control pressure supply)	ISO 6149[7]	M18 x 1.5; 14.5 (0.57) deep	420 (6100)	X

4) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
5) Metric fastening thread is a deviation from standard.
6) The countersink may be deeper than specified in the standard.
7) Depending on installation position, **T_1**, **T_2** or **T_3** must be connected (see also Installation instructions on pages 74 and 75).
8) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)
9) Only for A15VO with swivel angle sensor.

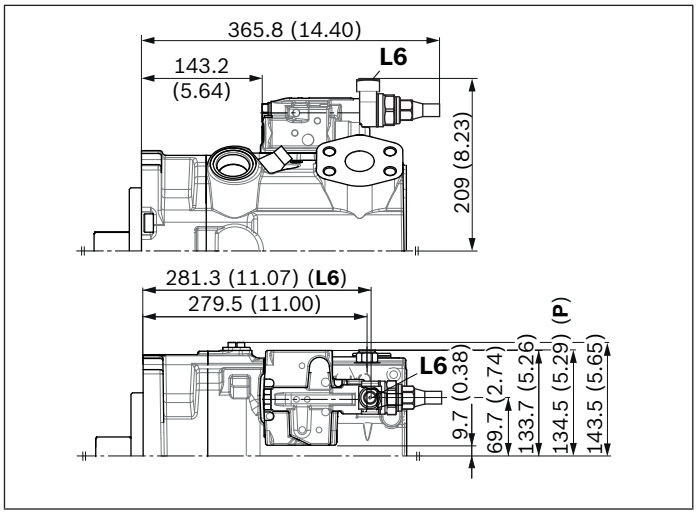
▼ **LR** – Power controller, fixed setting



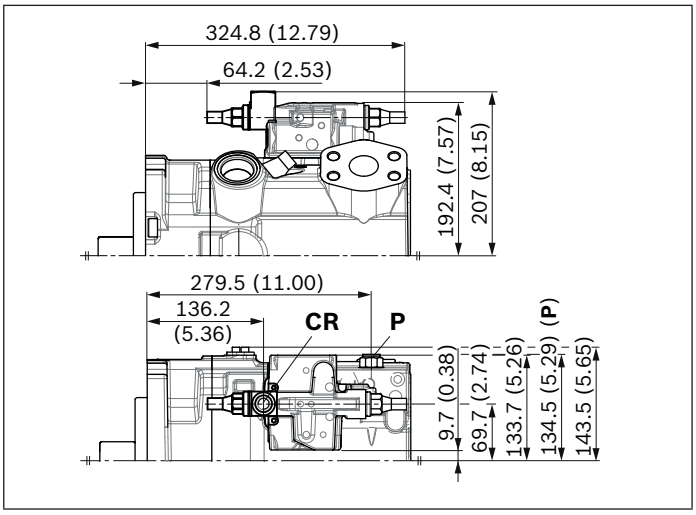
▼ **L3/L4** – Power controller, electric-proportional override



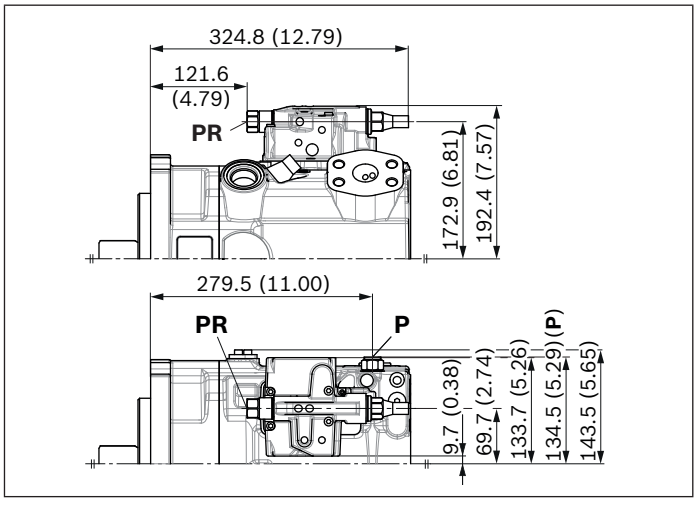
▼ **L5/L6** – Power controller, hydraulic override



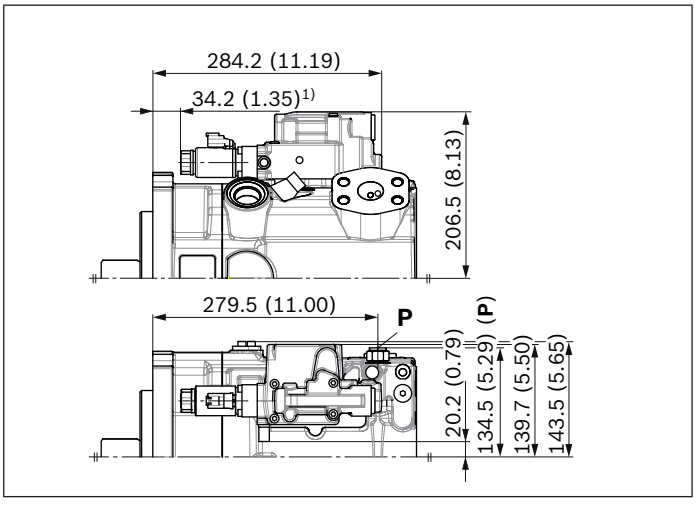
▼ **CR** – Power controller, hydraulic-proportional override, high pressure, with stop



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



▼ **E1/E2; E4** – Stroke control electric-proportional

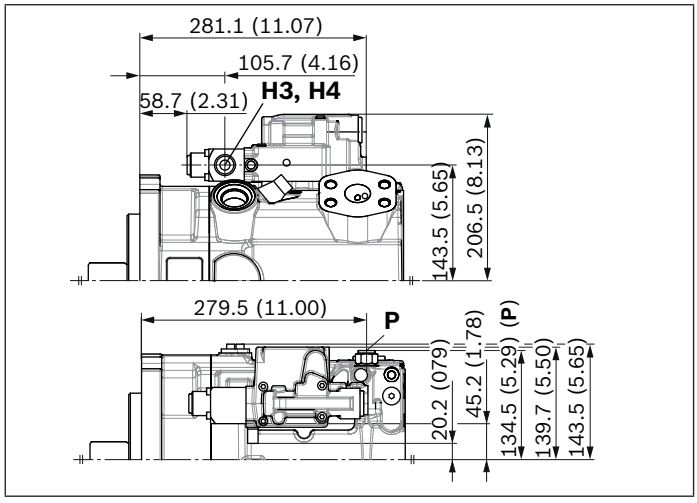


Notice

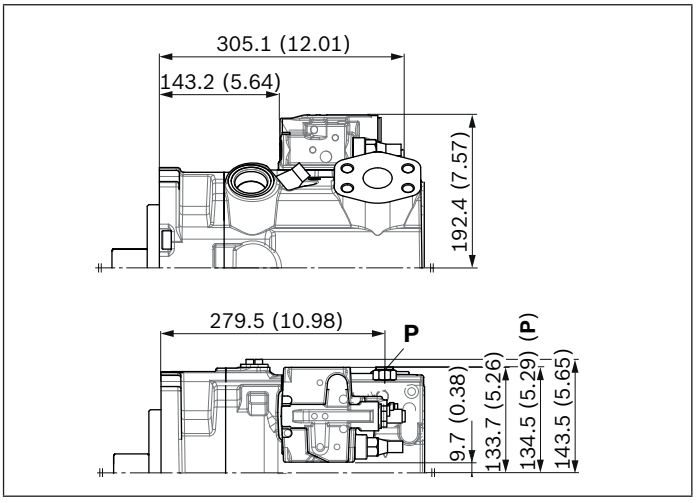
All controllers described with shuttle valve in **P**
(some contrary to standard as per type code position 08)

1) 15.7 (0.62) for E4 control

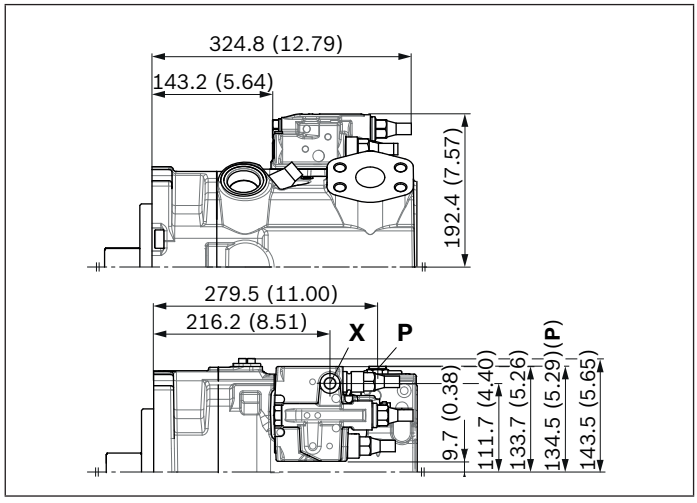
▼ **H3/H4** – Stroke control, hydraulic-proportional, pilot pressure



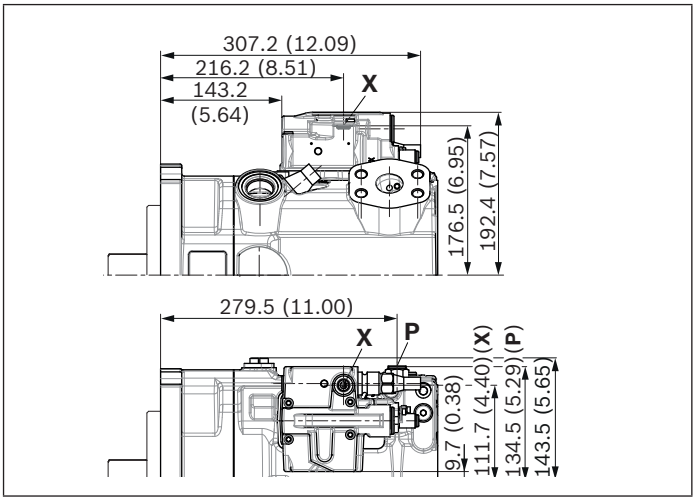
▼ **DR** – Pressure controller, fixed setting



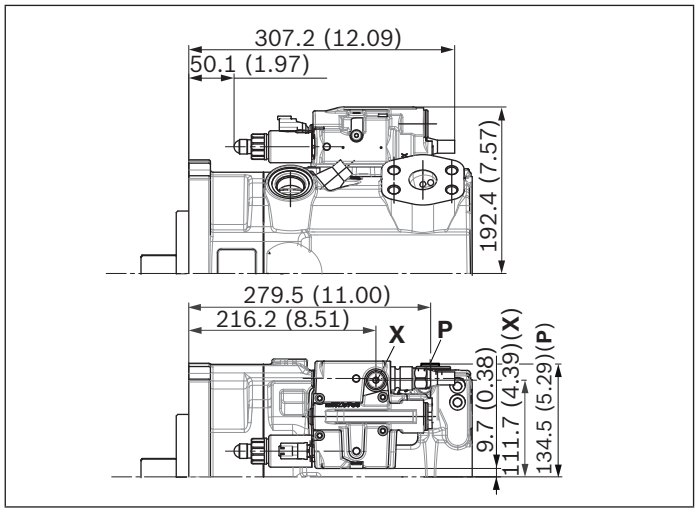
▼ **LRDRS0** – Power controller with pressure controller and load-sensing, fixed setting



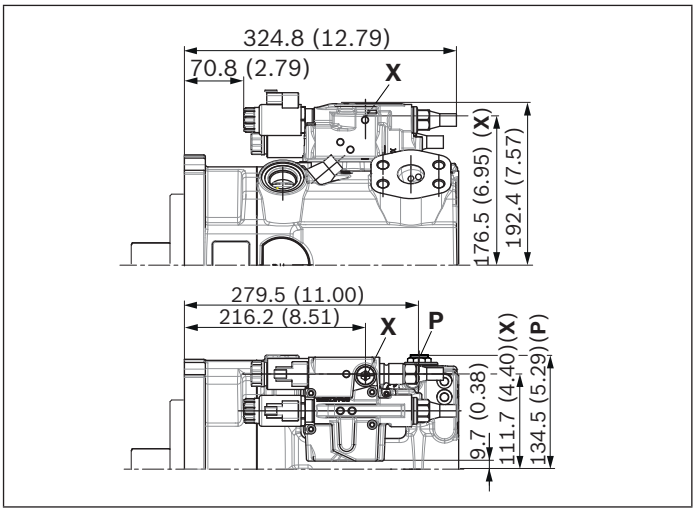
▼ **DG** – Pressure controller, hydraulic, remote controlled



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



▼ **S3/S4** – Load-sensing, internal pressure, electric-proportional

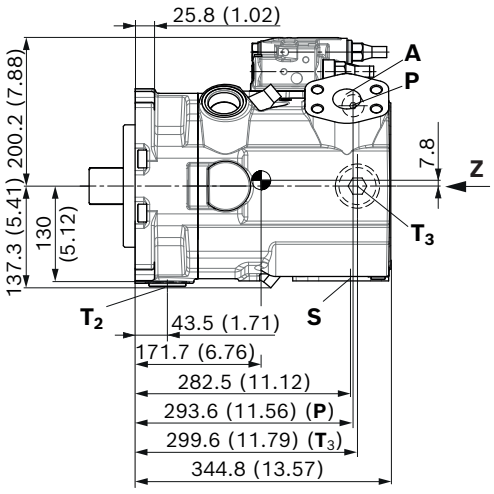


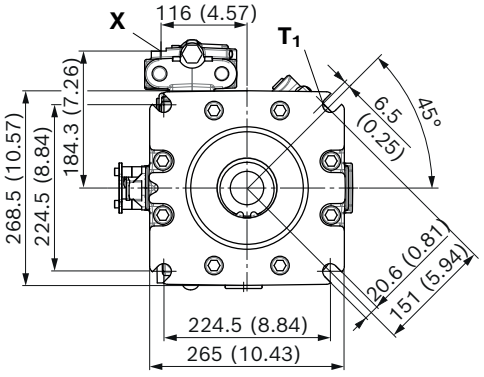
Notice

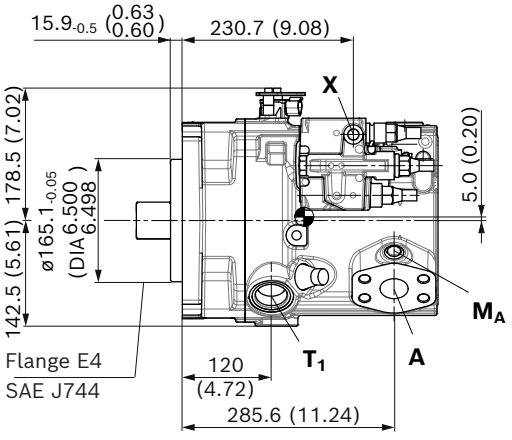
All controllers described with shuttle valve in **P**
(some contrary to standard as per type code position 08)

Dimensions, size 210

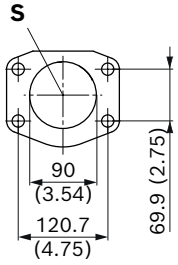
LRDRS0 – Power controller with pressure controller, load-sensing and with electric swivel angle sensor
Without charge pump, clockwise rotation



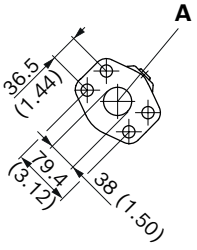




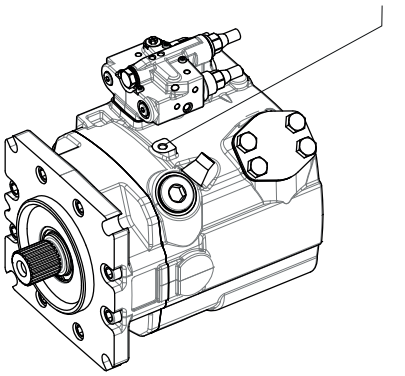
Detail X



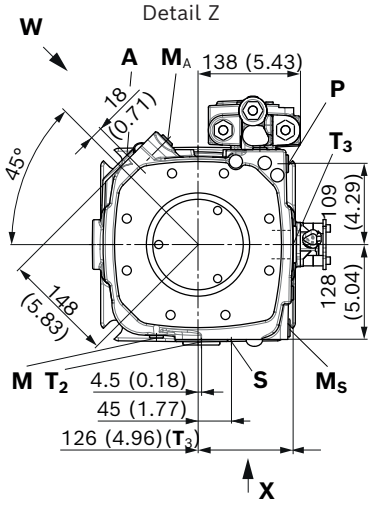
Detail W



M12 x 1.75; 22 (0.87) deep
Thread for eye bolt

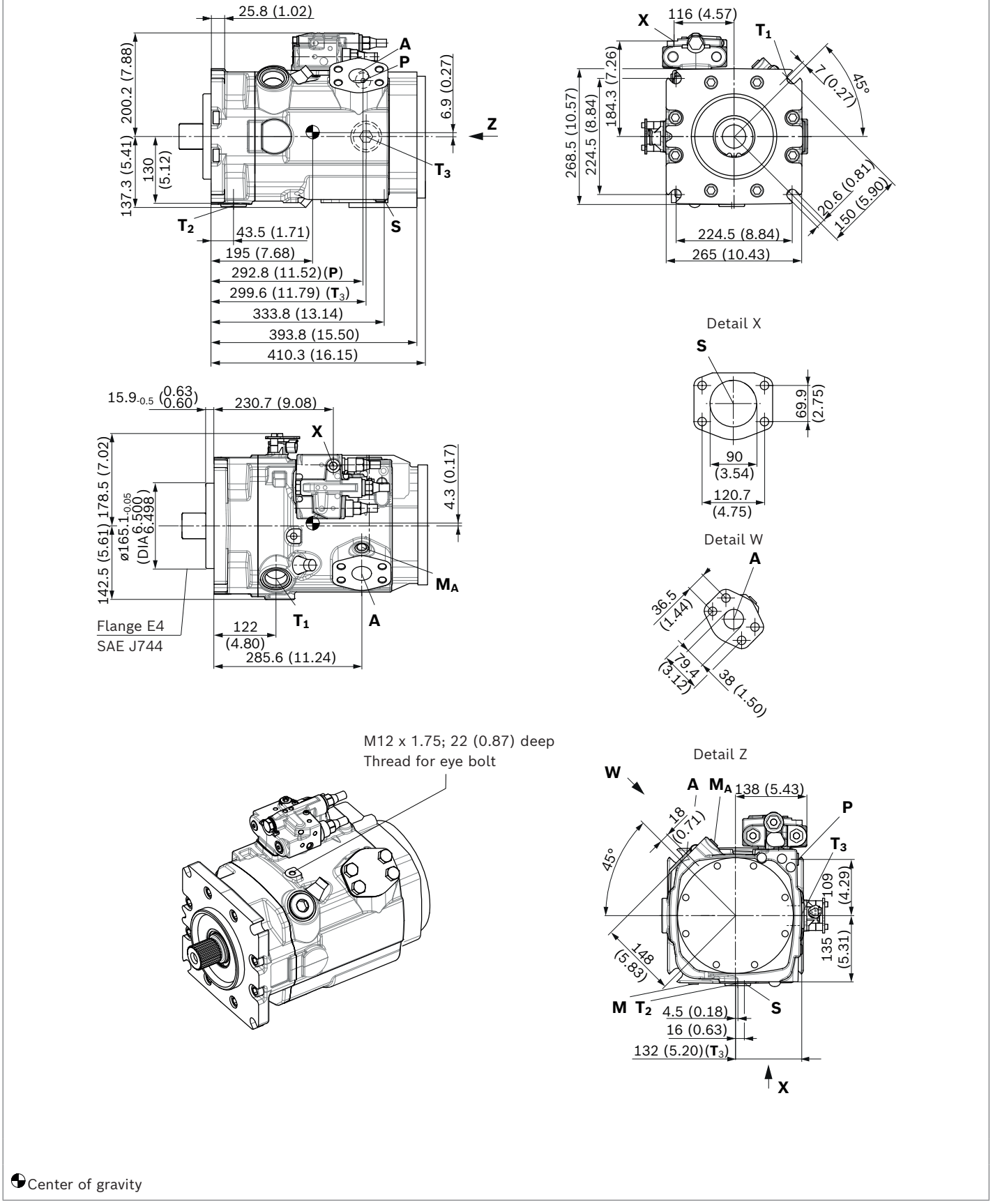


Detail Z



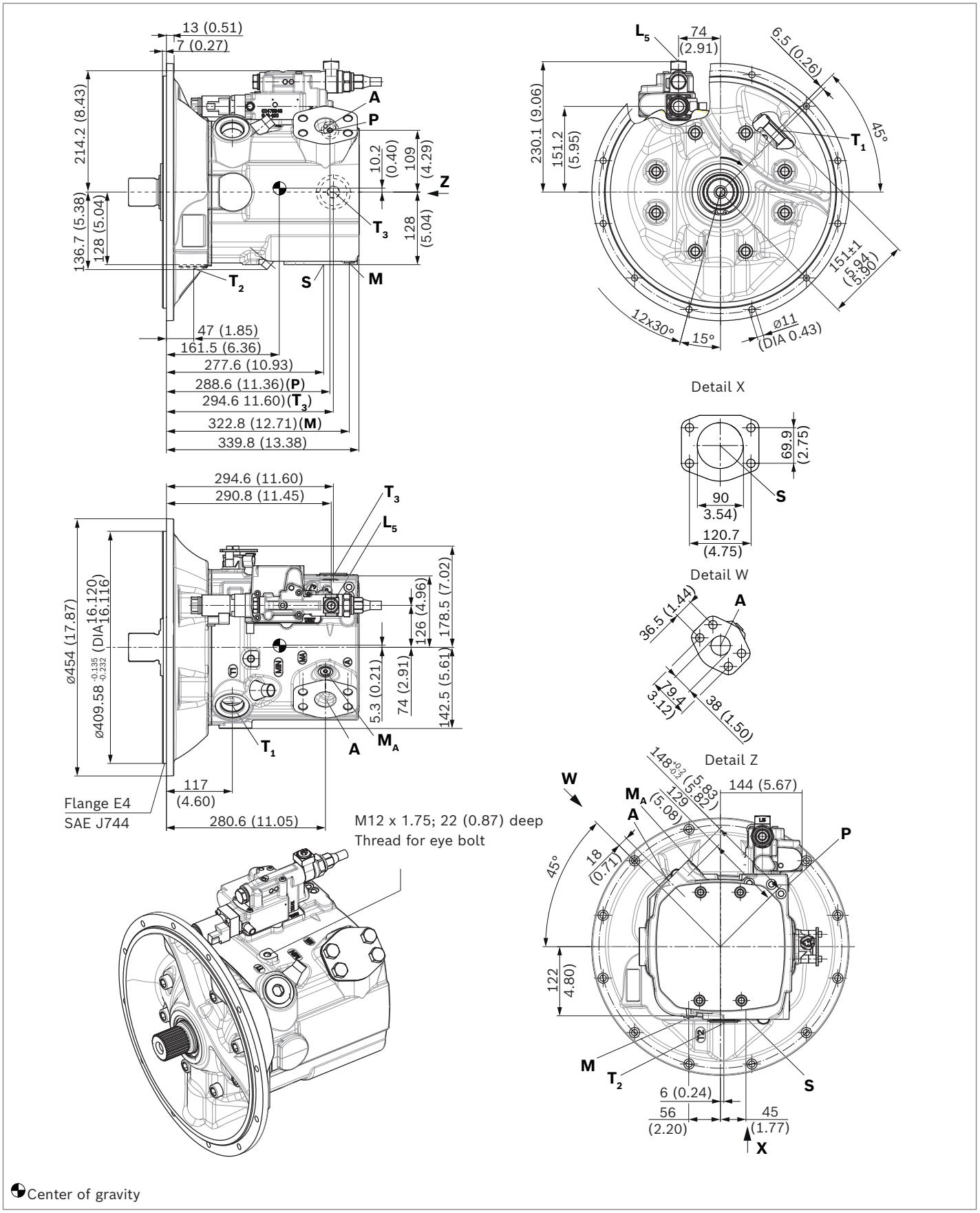
Center of gravity

LRDRS0 – Power controller with pressure controller, load-sensing and with electric swivel angle sensor
With charge pump, clockwise rotation



Center of gravity

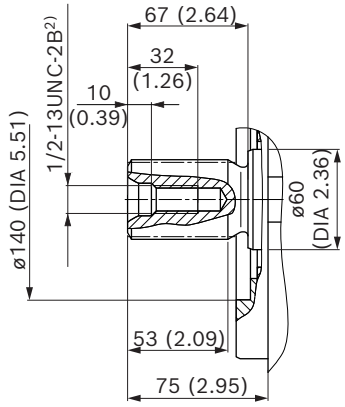
L5E2 – Power controller with pressure controller, load-sensing and with electric swivel angle sensor
Mounting flange G3 based on SAE J617; 409-12; without charge pump



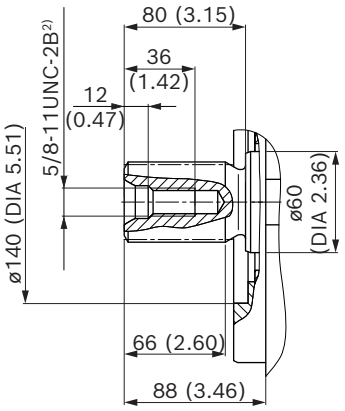
Center of gravity

▼ **Splined shaft SAE J744**

T1 – 1 3/4 in 13T 8/16DP[1)]

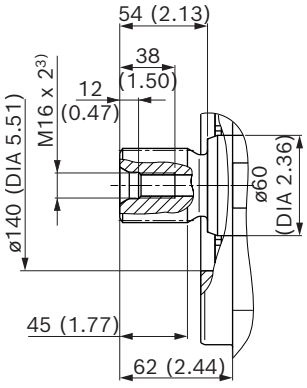


T2 – 2 in 15T 8/16DP[1)]



▼ **Splined shaft DIN 5480**

A2 – W50x2x24x9g

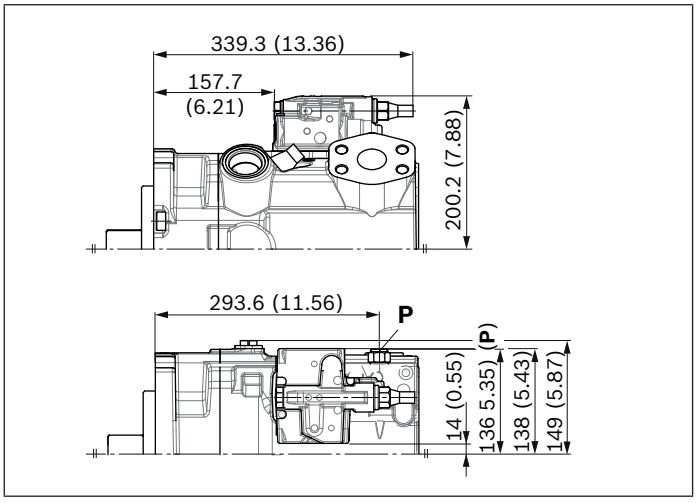


1) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Thread according to ASME B1.1
3) Center bore according to DIN 332 (thread according to DIN 13)

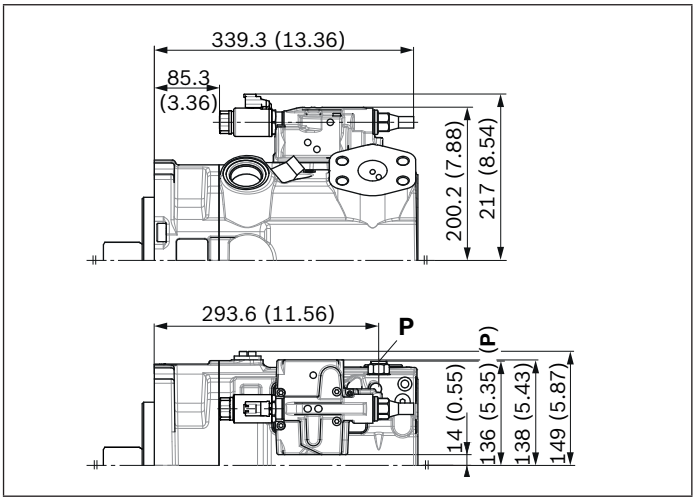
Ports		Standard	Size	p_{max} [bar (psi)][4]	State[8]
A	Working port Fastening thread	SAE J518[5] DIN 13	1 1/2 in M16 x 2; 24 (0.94) deep	420 (6100)	O
S	Suction port (without charge pump) Fastening thread	SAE J518[5] DIN 13	3 1/2 in M16 x 2; 24 (0.94) deep	30 (435)	O
S	Suction port (with charge pump) Fastening thread	SAE J518[5] DIN 13	3 1/2 in M16 x 2; 24 (0.94) deep	2 (30)	O
T_1	Drain port	ISO 6149[6]	M42 x 2; 19.5 (0.77) deep	5 (75)	O[7]
T_2	Drain port	ISO 6149[6]	M42 x 2; 19.5 (0.77) deep	5 (75)	X[7]
T_3	Drain port	ISO 6149[6]	M42 x 2; 19.5 (0.77) deep	5 (75)	X[7]
CR	Pilot signal (CR only)	ISO 6149	M14 x 1.5; 11.5 (0.45) deep	420 (6100)	O
PR	Pilot signal (PR only)	ISO 6149	M14 x 1.5; 11.5 (0.45) deep	420 (6100)	O
H3, **H4**	Pilot signal (H3 and H4 only)	ISO 6149	M14 x 1.5; 11.5 (0.45) deep	100 (1450)	O
L5, L6	Override power controller (only with L5 and L6)	ISO 6149	M14 x 1.5; 11.5 (0.45) deep	100 (1450)	O
X	Pilot signal (S0, S3/S4 and DG only)	ISO 6149[6]	M14 x 1.5; 11.5 (0.45) deep	420 (6100)	O
M	Measurement of stroking chamber pressure	ISO 6149[6]	M14 x 1.5; 12 (0.47) deep	380 (5500)	X
M_A	Measuring pressure **A**	ISO 6149[6]	M14 x 1.5; 12 (0.47) deep	420 (6100)	X
M_S[9]	Measuring suction pressure	ISO 6149[6]	M14 x 1.5; 12 (0.47) deep	30 (435)	X
P	External control pressure (Type code position 8 version B or C = with external control pressure supply)	ISO 6149[6]	M14 x 1.5; 11.5 (0.45) deep	50 (725)	O
	Port **P** is without function (Type code position 8 version A = without external control pressure supply)	ISO 6149[6]	M18 x 1.5; 14.5 deep	420 (6100)	X

4) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
5) Metric fastening thread is a deviation from standard.
6) The countersink may be deeper than specified in the standard.
7) Depending on installation position, T_1, T_2 or T_3 must be connected (see also Installation instructions on pages 74 and 75).
8) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)
9) Only for A15VO with swivel angle sensor.

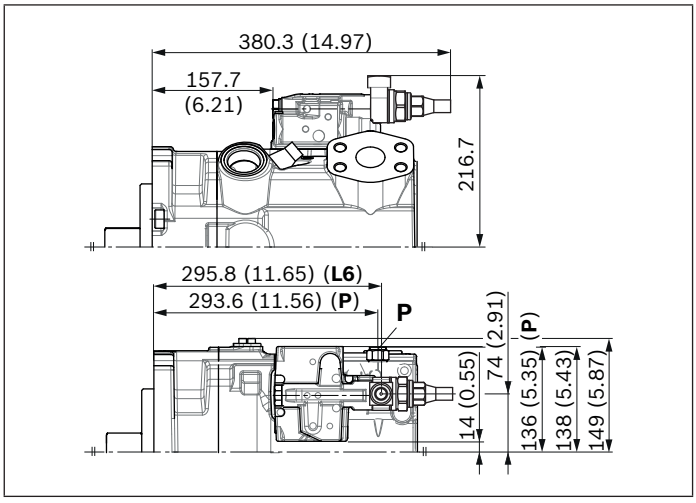
▼ **LR** – Power controller, fixed setting



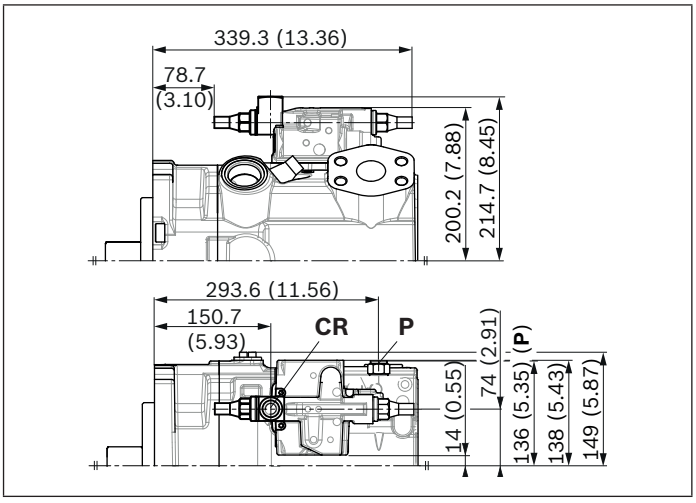
▼ **L3/L4** – Power controller, electric-proportional override



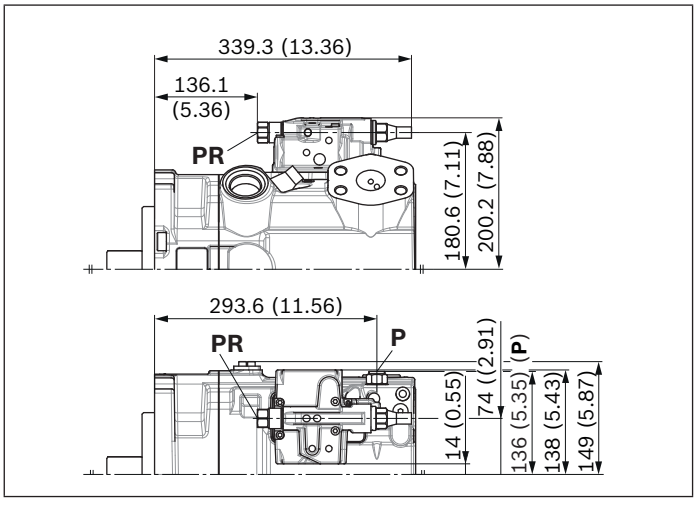
▼ **L5/L6** – Power controller, hydraulic override



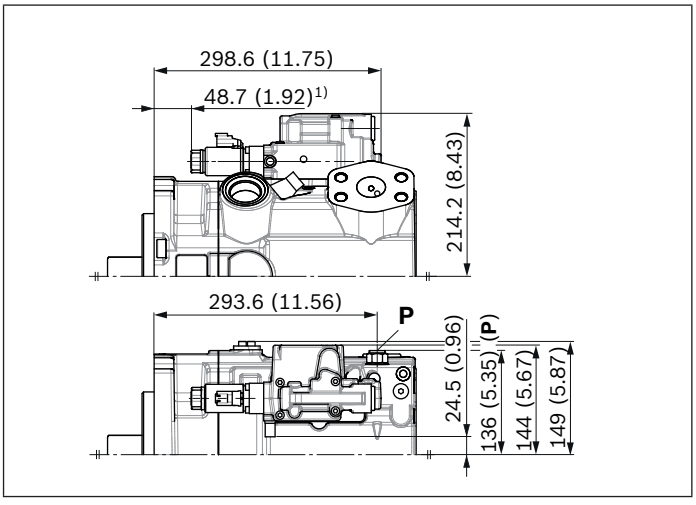
▼ **CR** – Power controller, hydraulic-proportional override, high pressure, with stop



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



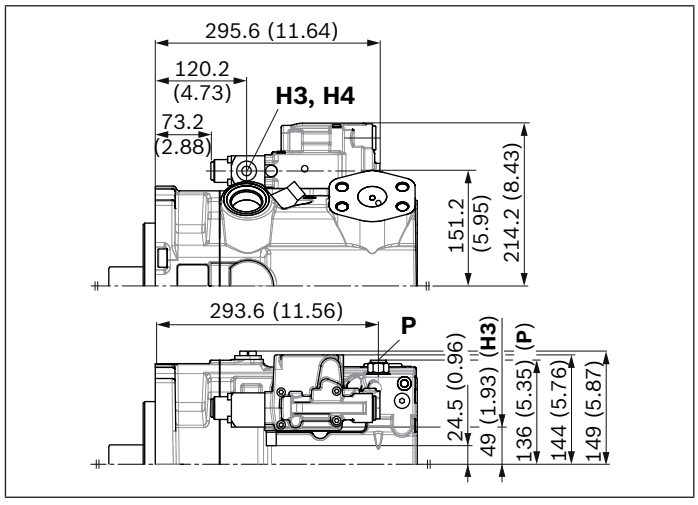
▼ **E1/E2; E4** – Stroke control electric-proportional



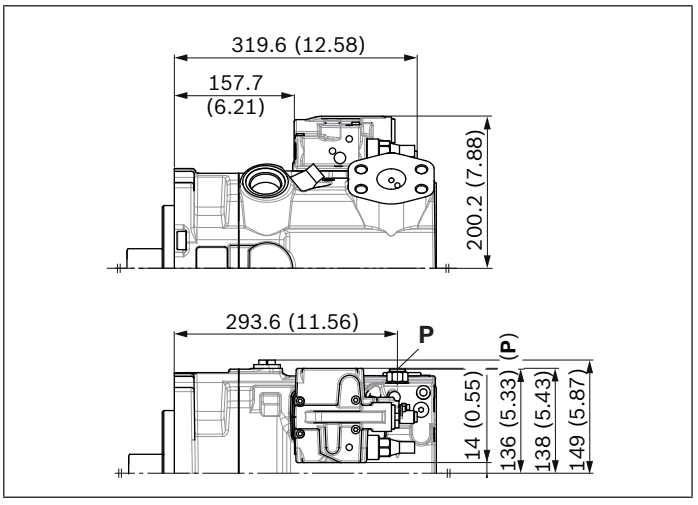
Notice
All controllers described with shuttle valve in **P**
(some contrary to standard as per type code position 08)

1) 30.2 (1.19) for E4 control

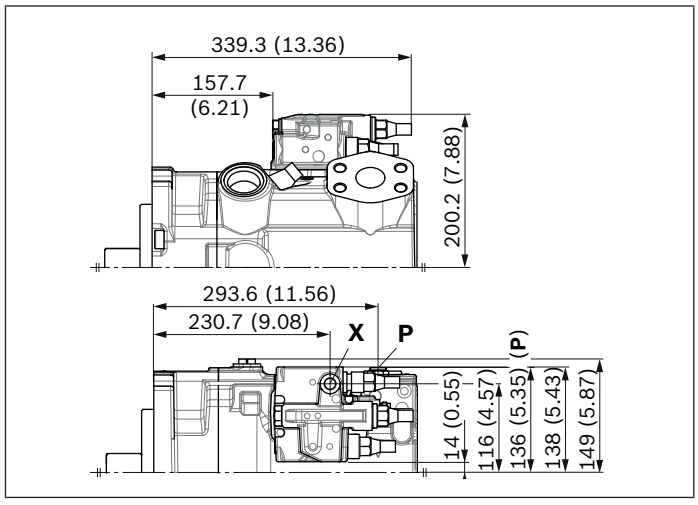
▼ **H3/H4** – Stroke control, hydraulic-proportional, pilot pressure



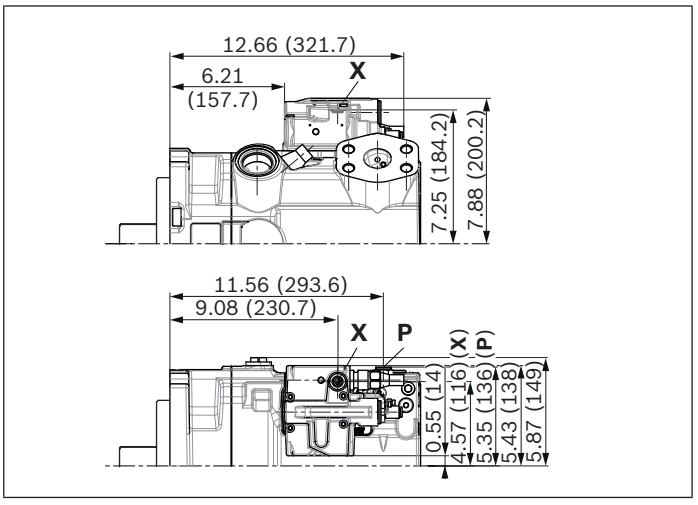
▼ **DR** – Pressure controller, fixed setting



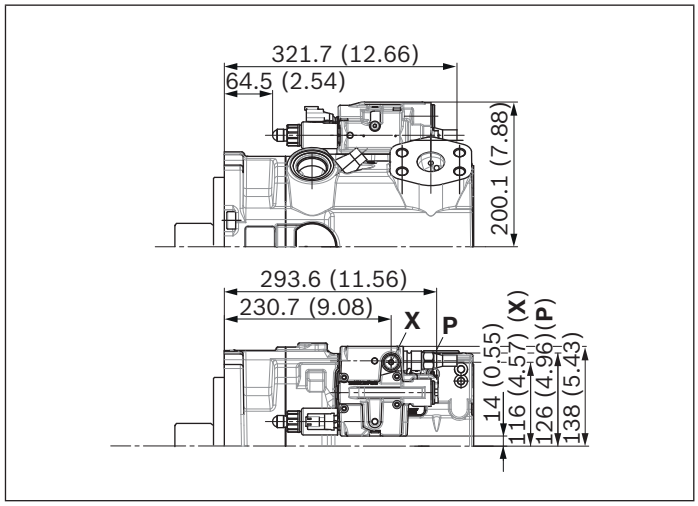
▼ **LRDRS0** – Power controller with pressure controller and load-sensing, fixed setting



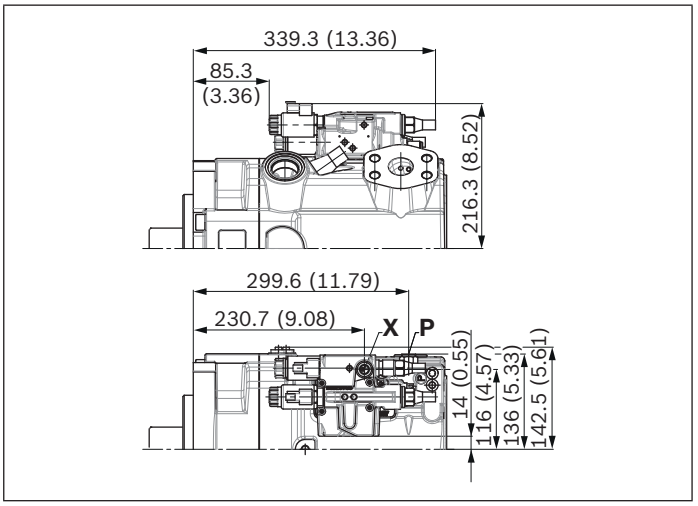
▼ **DG** – Pressure controller, hydraulic, remote controlled



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



▼ **S3/S4** – Load-sensing, internal pressure, electric-proportional

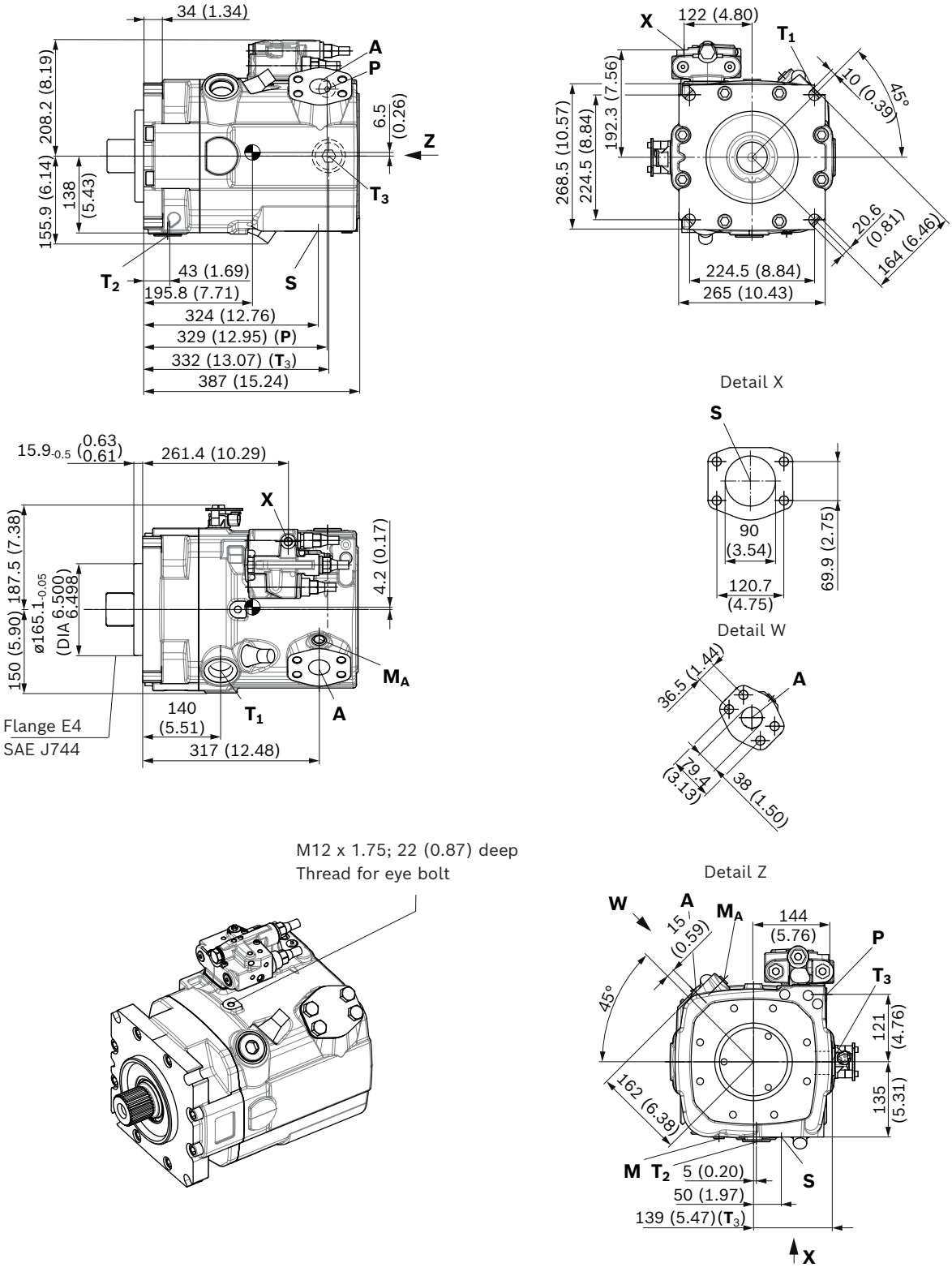


Notice

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

Dimensions, size 280

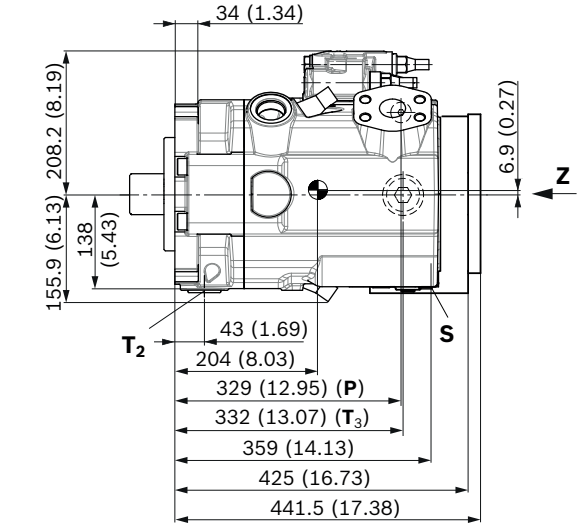
LRDRS0 – Power controller with pressure controller, load-sensing and with electric swivel angle sensor
Without charge pump, clockwise rotation

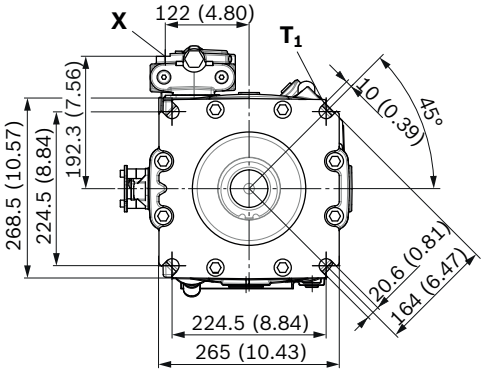


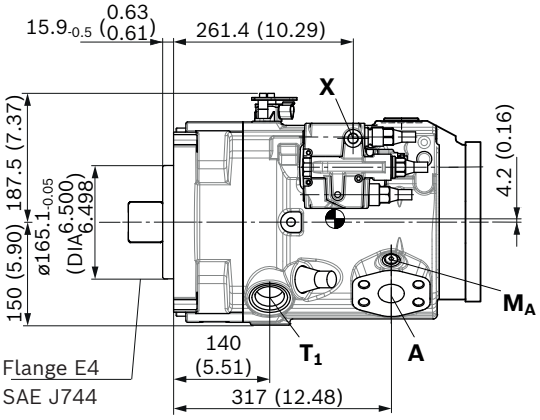
Center of gravity

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

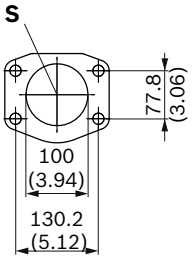
With charge pump, clockwise rotation



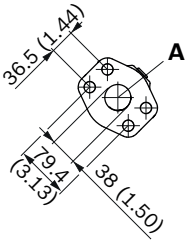




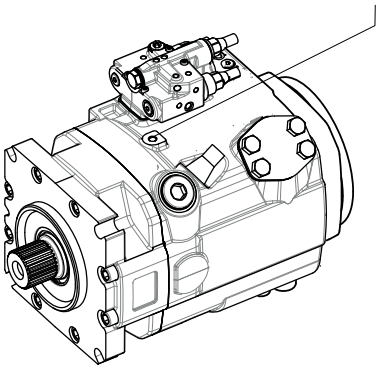
Detail X



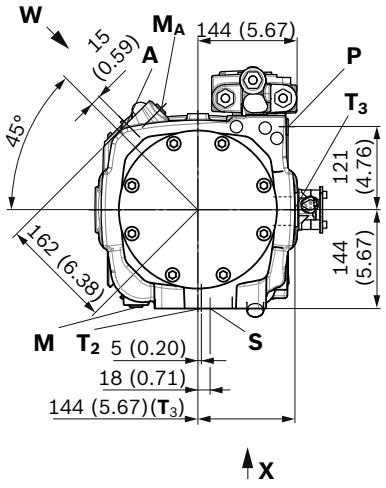
Detail W



M12 x 1.75; 22 (0.87) deep
Thread for eye bolt



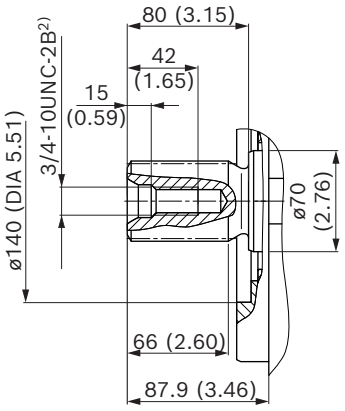
Detail Z



Center of gravity

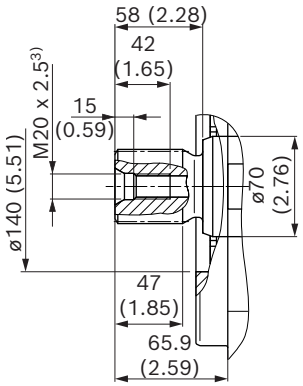
▼ **Splined shaft SAE J744**

T3 – 2 1/4 in 17T 8/16DP[1)]



▼ **Splined shaft DIN 5480**

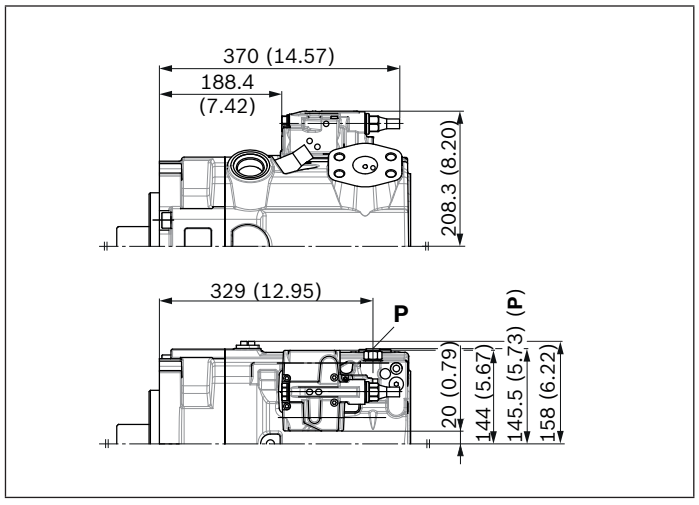
A4 – W60x2x28x9g



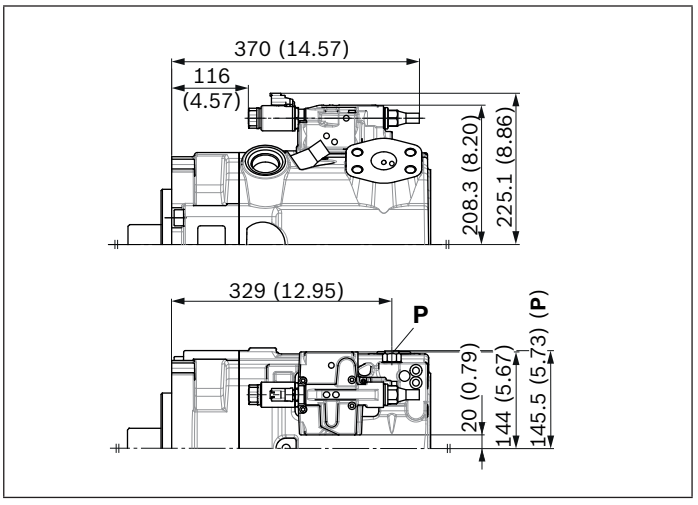
Ports		Standard	Size	p_{max} [bar (psi)][4)]	State[8)]
A	Working port Fastening thread	SAE J518[5)] DIN 13	1 1/2 in M16 x 2; 24 (0.94) deep	420 (6100)	O
S	Suction port (without charge pump) Fastening thread	SAE J518[5)] DIN 13	3 1/2 in M16 x 2; 24 (0.94) deep	30 (435)	O
S	Suction port (with charge pump) Fastening thread	SAE J518[5)] DIN 13	4 in M16 x 2; 24 (0.94) deep	2 (30)	O
$\mathbf{T}_1$	Drain port	ISO 6149[6)]	M42 x 2; 19.5 (0.77) deep	5 (75)	O[7)]
$\mathbf{T}_2$, $\mathbf{T}_3$	Drain port	ISO 6149[6)]	M42 x 2; 19.5 (0.77) deep	5 (75)	X[7)]
CR	Pilot signal (CR only)	ISO 6149	M14 x 1.5; 11.5 (0.45) deep	420 (6100)	O
PR	Pilot signal (PR only)	ISO 6149	M14 x 1.5; 11.5 (0.45) deep	420 (6100)	O
H3, **H4**	Pilot signal (H3 and H4 only)	ISO 6149	M14 x 1.5; 11.5 (0.45) deep	100 (1450)	O
L5, L6	Override power controller (only with L5 and L6)	ISO 6149	M14 x 1.5; 11.5 (0.45) deep	100 (1450)	O
X	Pilot signal (S0, S3/S4 and DG only)	ISO 6149[6)]	M14 x 1.5; 11.5 (0.45) deep	420 (6100)	O
Y	Port for pilot pump (only with D2)	ISO 6149[6)]	M14 x 1.5; 11.5 (0.45) deep	50 (725)	O
M	Measurement of stroking chamber pressure	ISO 6149[6)]	M14 x 1.5; 12 (0.47) deep	380 (5500)	X
$\mathbf{M}_A$	Measuring pressure **A**	ISO 6149[6)]	M14 x 1.5; 12 (0.47) deep	420 (6100)	X
$\mathbf{M}_S$[9)]	Measuring suction pressure	ISO 6149[6)]	M14 x 1.5; 12 (0.47) deep	30 (435)	X
P	External control pressure (Type code position 8 version B or C = with external control pressure supply)	ISO 6149[6)]	M14 x 1.5; 11.5 (0.45) deep	50 (725)	O
	Port **P** is without function (Type code position 8 version A = without external control pressure supply)	ISO 6149[6)]	M18 x 1.5; 14.5 (0.57) deep	420 (6100)	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) Metric fastening thread is a deviation from standard.
6) The countersink may be deeper than specified in the standard.
7) Depending on installation position, $\mathbf{T}_1$, $\mathbf{T}_2$ or $\mathbf{T}_3$ must be connected (see also Installation instructions on pages 74 and 75).
8) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)
9) Only for A15VO with swivel angle sensor.

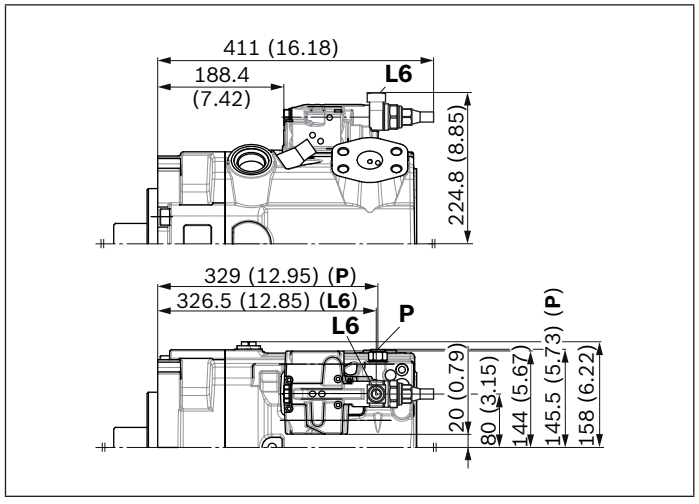
▼ **LR** – Power controller, fixed setting



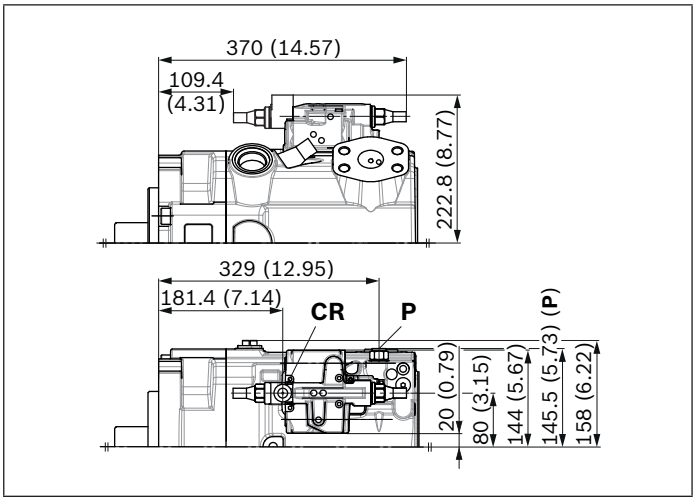
▼ **L3/L4** – Power controller, electric-proportional override



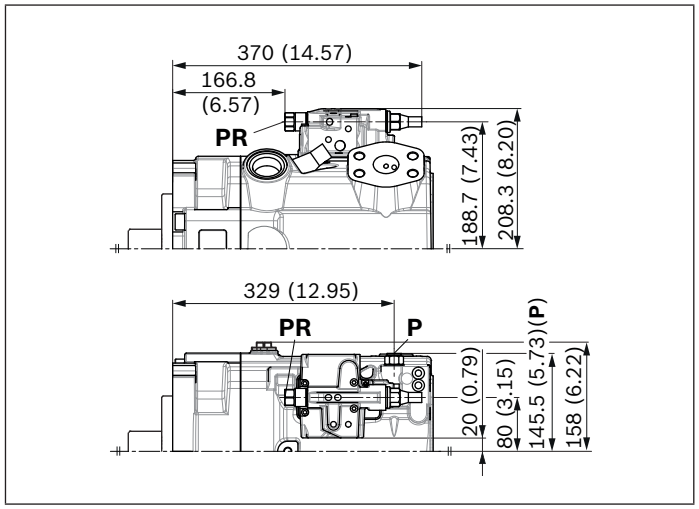
▼ **L5/L6** – Power controller, hydraulic override



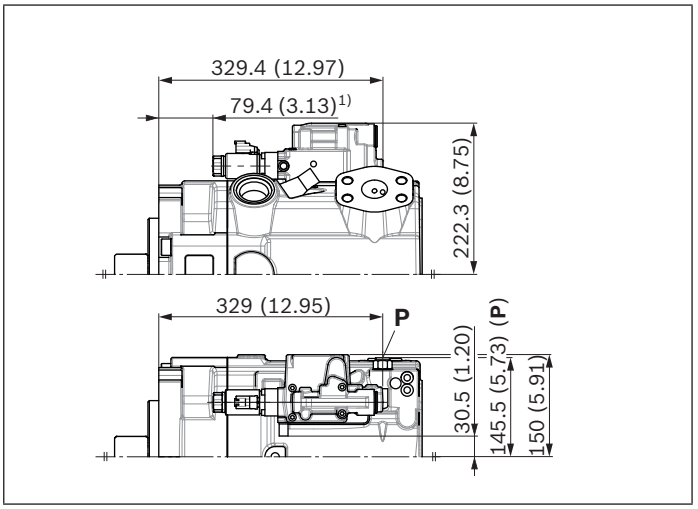
▼ **CR** – Power controller, hydraulic-proportional override, high pressure, with stop



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



▼ **E1/E2; E4** – Stroke control electric-proportional

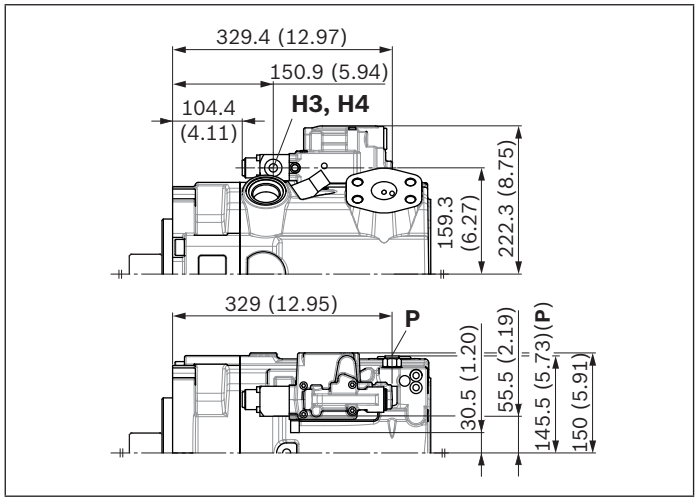


Notice

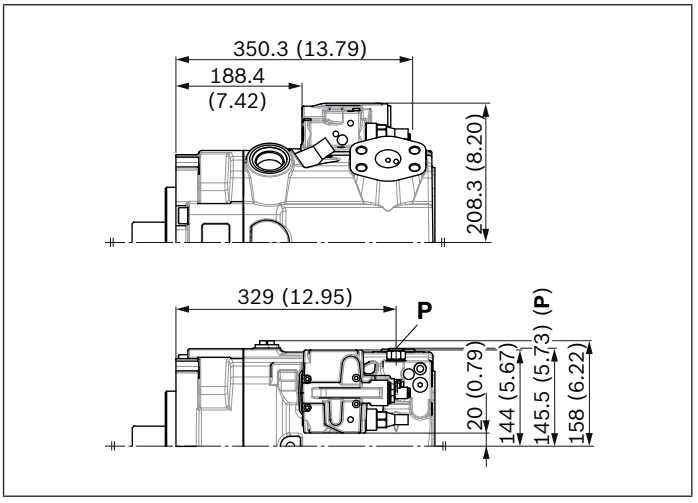
All controllers described with shuttle valve in **P**
(some contrary to standard as per type code position 08)

1) 60.9 (2.40) for E4 control

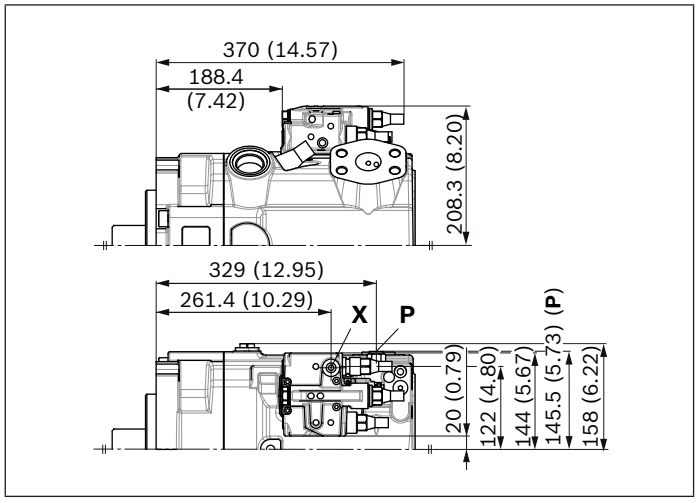
▼ **H3/H4** – Stroke control, hydraulic-proportional, pilot pressure



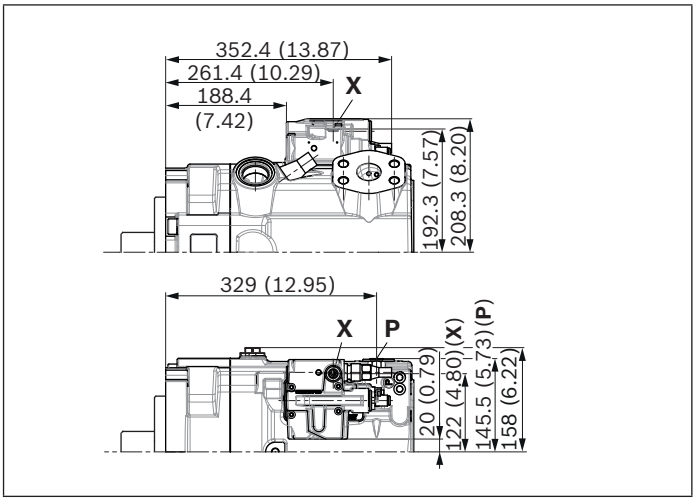
▼ **DR** – Pressure controller, fixed setting



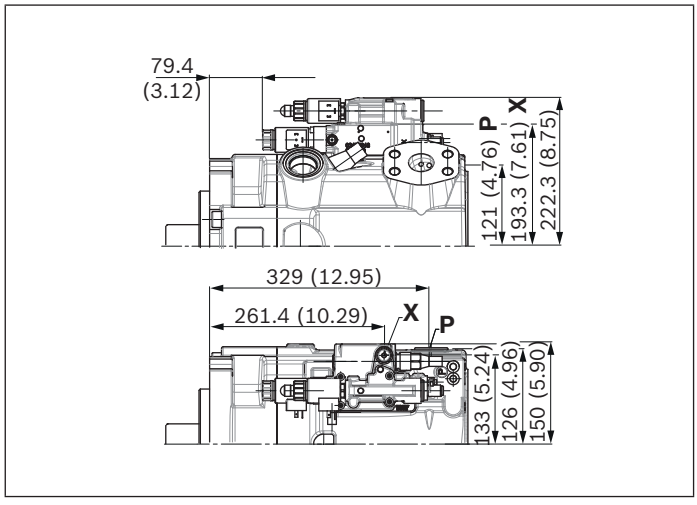
▼ **LRDRS0** – Power controller with pressure controller and load-sensing, fixed setting



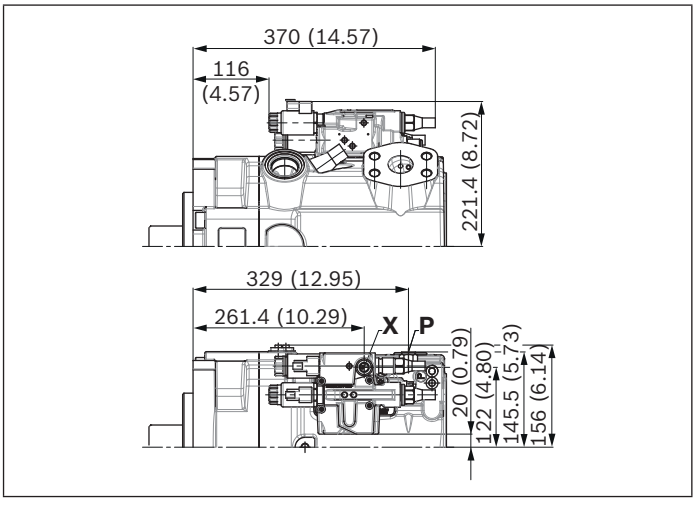
▼ **DG** – Pressure controller, hydraulic, remote controlled



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

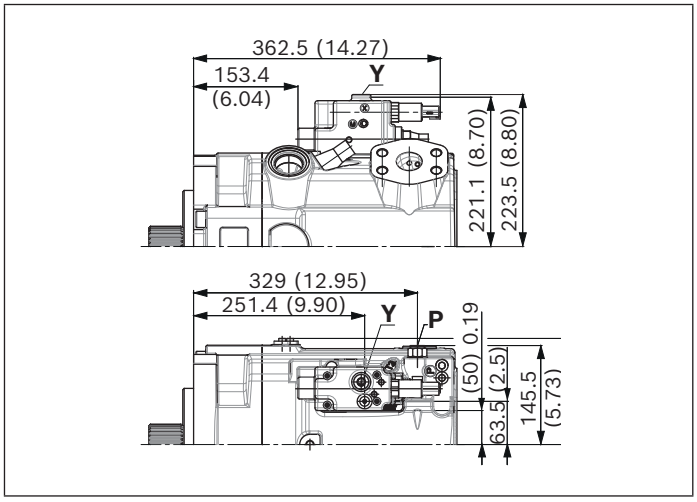


▼ **S3/S4** – Load-sensing, internal pressure, electric-proportional



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

▼ **D2** – pressure controller; electric-proportional with integrated pilot valve for external pilot pressure supply



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

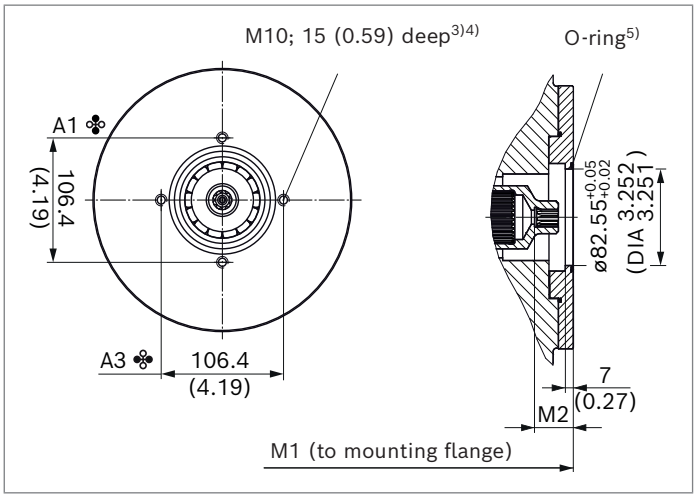
Observe the safety information for the D2 controller in instruction manual 92511-01-B.

Dimensions for through drives

Flange SAE J744			Hub for splined shaft[1]			Availability across sizes					Code
Diameter	Mounting[2]	Designation	Diameter		Designation	110	145	175	210	280	
82-2 (A)	⌀	A1	5/8 in	9T 16/32DP	S2	●	●	●	●	●	A1S2
			3/4 in	11T 16/32DP	S3	●	●	●	●	●	A1S3
	⌀	A3	5/8 in	9T 16/32DP	S2	●	●	●	●	●	A3S2
			3/4 in	11T 16/32DP	S3	●	●	●	●	●	A3S3

● = Available o = On request

▼ **82-2 (A)**



A1S2, A3S2	NG	M1	M2
Without charge pump	110	301 (11.85)	34 (1.39)
	145	326 (12.83)	34 (1.39)
	175	340.5 (13.41)	33.8 (1.33)
	210	357.8 (14.09)	33.8 (1.33)
	280	400 (15.75)	33.8 (1.33)
With charge pump	145	374.7 (14.75)	40 (1.57)
	175	389.5 (15.33)	33.8 (1.33)
	210	406.8 (16.02)	33.8 (1.33)
	280	438 (17.24)	33.8 (1.33)

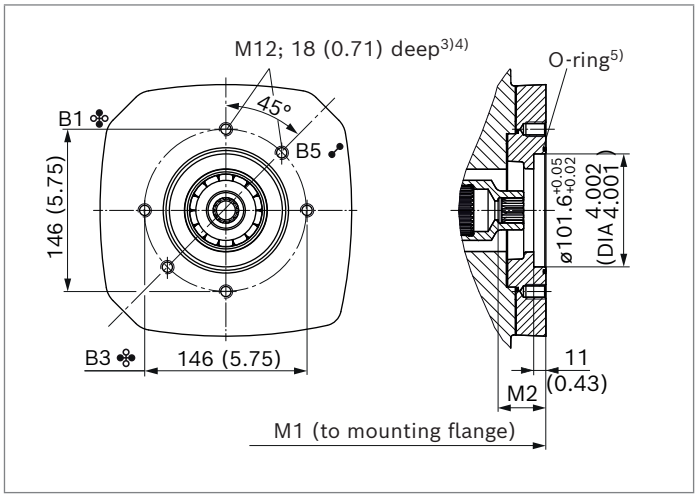
A1S3, A3S3	NG	M1	M2
Without charge pump	110	301 (11.85)	40 (1.57)
	145	326 (12.83)	40 (1.57)
	175	340.5 (13.41)	40 (1.57)
	210	357.8 (14.09)	40 (1.57)
	280	400 (15.75)	40 (1.57)
With charge pump	145	374.7 (14.75)	40 (1.57)
	175	389.5 (15.33)	40 (1.57)
	210	406.8 (16.02)	40 (1.57)
	280	438 (17.24)	40 (1.57)

1) According to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Mounting holes pattern viewed on through drive with control at top
3) Thread according to DIN 13
4) Design recommended according to VDI 2230, screw grade 8.8 according to ISO 898-1
5) O-ring included in the scope of delivery

Flange SAE J744			Hub for splined shaft[1]			Availability across sizes					Code
Diameter	Mounting[2]	Designation	Diameter		Designation	110	145	175	210	280	
101-2 (B)		B1	7/8 in	13T 16/32DP	S4	●	●	●	●	●	B1S4
			1 in	15T 16/32DP	S5	●	●	●	●	●	B1S5
		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

▼ **101-2 (B)**



B1S4, B3S4, B5S4	NG	M1	M2
Without charge pump	110	312 (12.28)	43 (1.69)
	145	337 (13.27)	43 (1.69)
	175	355 (13.97)	43 (1.69)
	210	372.3 (14.65)	43 (1.69)
	280	414.5 (16.31)	43 (1.69)
With charge pump	145	385.7 (15.19)	43 (1.69)
	175	404 (15.90)	43 (1.69)
	210	421.3 (16.58)	43 (1.69)
	280	452.5 (17.81)	43 (1.69)

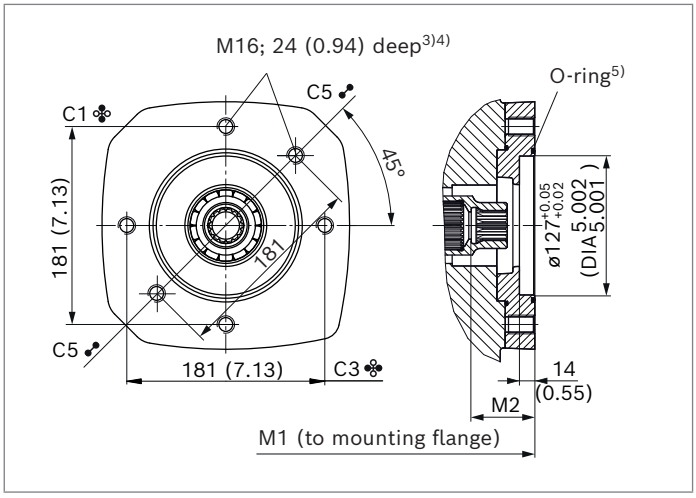
B1S5, B3S5, B5S5	NG	M1	M2
Without charge pump	110	312 (12.28)	48 (1.89)
	145	337 (13.27)	48 (1.89)
	175	355 (13.97)	48 (1.89)
	210	372.3 (14.65)	48 (1.89)
	280	414.5 (16.31)	48 (1.89)
With charge pump	145	385.7 (15.18)	48 (1.89)
	175	404 (15.90)	48 (1.89)
	210	421.3 (16.58)	48 (1.89)
	280	452.5 (17.81)	48 (1.89)

1) According to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Mounting holes pattern viewed on through drive with control at top
3) Thread according to DIN 13
4) Design recommended according to VDI 2230, screw grade 8.8 according to ISO 898-1
5) O-ring included in the scope of delivery

Flange SAE J744			Hub for splined shaft[1]			Availability across sizes					Code
Diameter	**Mounting[2]**	**Designation**	**Diameter**		**Designation**	**110**	**145**	**175**	**210**	**280**	
127-2 (C)		C1	1 1/4 in	14T 12/24DP	S7	●	●	●	●	●	C1S7
			1 1/2 in	17T 12/24DP	S9	●	●	●	●	●	C1S9
		C3	1 1/4 in	14T 12/24DP	S7	●	●	●	●	●	C3S7
			1 1/2 in	17T 12/24DP	S9	●	●	●	●	●	C3S9
		C5	1 1/4 in	14 12/24DP	S7	○	●	●	●	●	C5S7

● = Available ○ = On request

▼ **127-2 (C)**



C1S7, C3S7	NG	M1	M2
Without charge pump	110	323 (12.72)	58 (2.28)
	145	348 (13.70)	58 (2.28)
	175	354.5 (13.96)	58.1 (2.29)
	210	371.8 (14.64)	58.1 (2.29)
	280	414 (16.30)	58.1 (2.29)
With charge pump	145	396.7 (15.62)	58 (2.28)
	175	403.5 (15.89)	58.1 (2.29)
	210	420.8 (16.57)	58.1 (2.29)
	280	452 (17.80)	58.1 (2.29)

C1S9, C3S9	NG	M1	M2
Without charge pump	110	323 (12.72)	64 (2.52)
	145	348 (13.70)	64 (2.52)
	175	359.5 (14.15)	64 (2.52)
	210	376.8 (14.83)	64 (2.52)
	280	414 (16.30)	63.8 (2.51)
With charge pump	145	396.7 (15.62)	64 (2.52)
	175	408.5 (16.08)	64 (2.52)
	210	425.8 (16.76)	64 (2.52)
	280	452 (17.80)	63.8 (2.51)

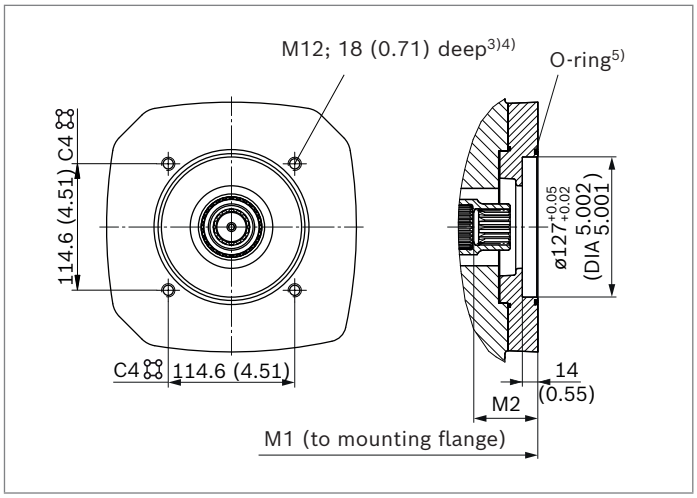
C5S7	NG	M1	M2
Without charge pump	145	348 (13.70)	58 (2.28)
	175	354.5 (13.96)	58 (2.28)
	210	371.8 (14.64)	58 (2.28)
	280	414 (16.30)	58 (2.28)
With charge pump	145	396.7 (15.62)	58 (2.28)
	175	403.5 (15.89)	58 (2.28)
	210	420.8 (16.57)	58 (2.28)
	280	452 (17.80)	58 (2.28)

1) According to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Mounting holes pattern viewed on through drive with control at top
3) Thread according to DIN 13
4) Design recommended according to VDI 2230, screw grade 8.8 according to ISO 898-1
5) O-ring included in the scope of delivery

Flange SAE J744			Hub for splined shaft[1]			Availability across sizes					Code
Diameter	**Mounting[2]**	**Designation**	**Diameter**		**Designation**	**110**	**145**	**175**	**210**	**280**	
127-4 (C)	⌘	C4	1 1/4 in	14T 12/24DP	S7	●	●	●	●	o	C4S7
			1 3/8 in	21T 16/32DP	V8	●	●	o	o	o	C4V8

● = Available o = On request

▼ **127-4 (C)**



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

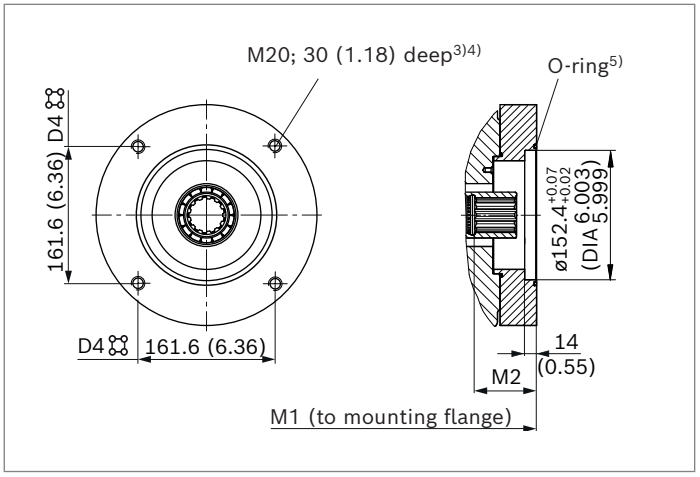
C4V8	NG	M1	M2
Without charge pump	110	323 (12.72)	58 (2.28)
	145	348 (13.70)	58 (2.28)
With charge pump	145	396.7 (15.62)	58 (2.28)

1) According to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Mounting holes pattern viewed on through drive with control at top
3) Thread according to DIN 13
4) Design recommended according to VDI 2230, screw grade 8.8 according to ISO 898-1
5) O-ring included in the scope of delivery

Flange SAE J744			Hub for splined shaft[1]		Availability across sizes					Code
Diameter	Mounting[2]	Designation	Diameter	Designation	110	145	175	210	280	
152-4 (D)	⌘	D4	1 3/4 in 13T 8/16DP	T1	●	●	●	●	●	D4T1
			1 1/4 in 14T 12/24DP	S7	●	●	●	●	○	D4S7
165-4 (E)	⌘	E4	1 3/4 in 13T 8/16DP	T1	–	–	●	●	●	E4T1
			2 in 15T 8/16DP	T2	–	–	●	●	●	E4T2
			2 1/4 in 17T 8/16DP	T3	–	–	–	–	●	E4T3
			W60x2x28x9g[6]	A4	–	–	–	–	●	E4A4

● = Available ○ = On request

▼ **152-4 (D)**

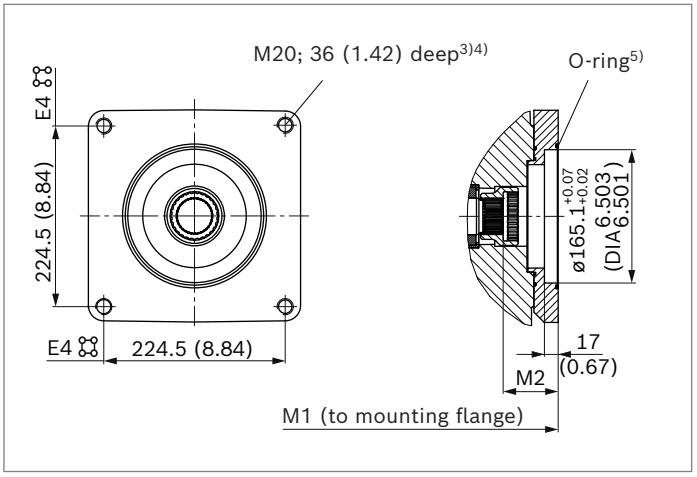


D4T1	NG	M1	M2
Without charge pump	110	336 (13.23)	77 (3.03)
	145	361 (14.21)	76.8 (3.02)
	175	372.5 (14.67)	76.8 (3.02)
	210	389.8 (15.35)	76.8 (3.02)
	280	432 (17.01)	77 (3.03)
With charge pump	145	409.7 (16.13)	76.8 (3.02)
	175	421.5 (16.59)	76.8 (3.02)
	210	438.8 (17.28)	76.8 (3.02)
	280	470 (18.50)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

D4S7	NG	M1	M2
Without charge pump	110	325 (12.8)	60 (2.36)
	145	350 (13.78)	60 (2.36)
	175	354.5 (13.96)	58 (2.28)
	210	371.8 (14.64)	58 (2.28)
With charge pump	145	399 (15.71)	60 (2.36)
	175	403.5 (15.88)	58 (2.28)
	210	420.8 (16.57)	58 (2.28)

1) In accordance with ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Mounting holes pattern viewed on through drive with control at top
3) Observe thread according to DIN 13.

▼ **165-4 (E)**



E4T1	NG	M1	M2
Without charge pump	175	355 (13.98)	77 (3.03)
	210	389.8 (15.35)	77 (3.03)
	280	432 (17.00)	77 (3.03)
With charge pump	175	421.5 (16.59)	77 (3.03)
	210	438.8 (17.27)	77 (3.03)
	280	470 (18.50)	77 (3.03)

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

E4T3	NG	M1	M2
Without charge pump	280	445 (17.52)	90 (3.54)
With charge pump	280	483 (19.02)	90 (3.54)

E4A4	NG	M1	M2
Without charge pump	280	423 (16.65)	68 (2.68)
With charge pump	280	461 (18.15)	68 (2.68)

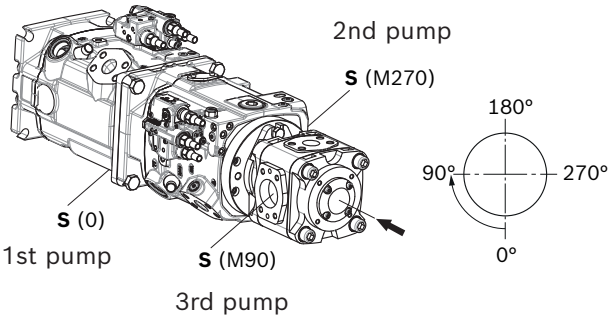
4) Design recommended according to VDI 2230, screw grade 8.8 according to ISO 898-1
5) O-ring included in the scope of delivery
6) Hub N60x2x28x8H according to DIN 5480

Overview of mounting options

Through drive[1]			Mounting options – 2nd pump						
Flange	**Hub for splined shaft**	**Code**	**A15VO/1x NG (shaft)**	**A1VO/10 NG (shaft)**	**A10VO/3x NG (shaft)**	**A4VG/32 NG (shaft)**	**A4VG/40 NG (shaft)**	**A10VO/5x NG (shaft)**	**External gear pump**
82-2 (A)	5/8 in	A_S2	–	–	18 (U)	–	–	10, 18 (U)	Series F[2]
	3/4 in	A_S3		18 (S3) 28 (S3)	18 (S, R)			10 (S), 18 (S, R)	
101-2 (B)	7/8 in	B_S4	–	18 (S4) 28 (S4) 35 (S4)	28 (S, R); 45 (U, W)	–	–	28 (S, R); 45 (U, W)	Series N[2]
	1 in	B_S5	–	35 (S5)	45 (S, R)	28 (S)	–	45 (R, S); 60, 63 (U, W) 72 (U, W)	PGH4
127-2 (C)	1 1/4 in	C_S7	–	–	71 (R) (S) 88 (R) (S)	40, 56, 71 (S)	45, 65 (S7)	85, 100 (U, W)	–
	1 1/2 in	C_S9	–	–	100 (S)	–	45, 65 (S9)	85, 100 (S)	PGH5
	1 1/4 in	C5S7		–	71 (S, R) 88 (S, R) 100 (U, W)			85, 100 (U, W)	
127-4 (C)	1 1/4 in	C4S7	–	–	71 (R) (S) 88 (R) (S)	–	65 (S7)	60, 63 (S, R) 72 (S, R); 85 (U, W)	–
	1 3/8 in	C4V8	–	–	–	–	85, 110 (V8)	–	–
152-4 (D)	1 1/4 in	D4S7	–	–	100 (U, W)	90 (U)	–	–	–
	1 3/8 in	D4V8	–	–	–	–	85, 110 (V8)	–	–
	1 3/4 in	D4T1	110, 145 (T1)	–	140 (S)	90, 125 (S)	145 (T1)	–	–
165-4 (E)	1 3/4 in	E4T1	–	–	–	180, 250 (S)	145, 175 (T1)	–	–
	2 in	E4T2	175, 210 (T2)	–	–	–	145 (T2)	–	–
	2 1/4 in	E4T3	280 (T3)	–	–	180, 250 (T)	175 (T3)	–	–
	W60	E4A4	280 (A4)	–	–	–	–	–	–

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 Alignment port **S**	**2nd pump** Mounting angle to 1st pump	**3rd pump** Mounting angle to 1st pump
Example: **without code**	**-M270**	**-M90**



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

A15VO 280....+A15VO....145....-**M270**
A15VO 280....+A15VO....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 A15VO

Size			110	145	175	210	280
Permissible moment of inertia	$T_{m\ perm.}$	Nm	3859	5163	6498	7886	11427
		lb-ft	2846	3808	4793	5816	8428
Permissible moment of inertia for dynamic mass acceleration 10 g (= 98.1 m/s2)	$T_{m\ perm.}$	Nm	386	516	650	789	1143
		lb-ft	285	381	479	582	843
Weight (A15VO...DR.)	m	kg	64	79	97	111	143
		lbs	114	174	214	245	315
Distance from center of gravity	l_1	mm	144.80	158.1	159.7	171.7	195.8
		inch	5.7	6.22	6.29	6.76	7.71

Permissible moment of inertia A15VLO

Size			145	175	210	280
Permissible moment of inertia	$T_{m\ perm.}$	Nm	7002	8420	10053	12617
		lb-ft	5164	6210	7415	9306
Permissible moment of inertia for dynamic mass acceleration 10 g (= 98.1 m/s2)	$T_{m\ perm.}$	Nm	700	842	1005	1262
		lb-ft	516	621	741	931
Weight (A15VO...DR.)	m	kg	92	110	125	148
		lbs	203	243	276	326
Distance from center of gravity	l_1	mm	188.4	183.9	195	204
		inch	7.42	7.24	7.68	8.03

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:

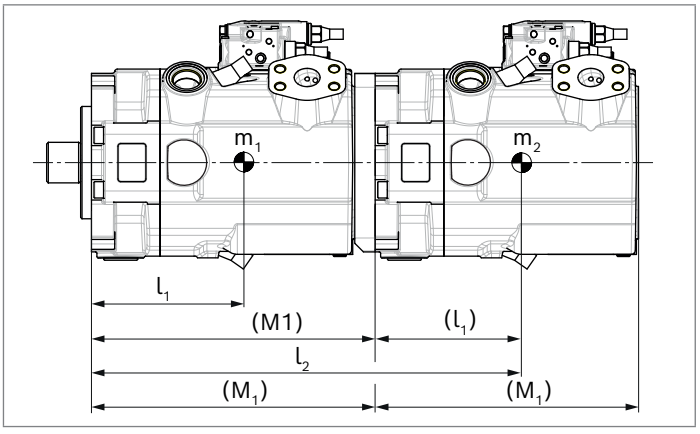
A15VO280PLRDR.00A00/12MRVE4A41SE4A40-0+A15VO280PLRDR.00A00/12MRVE4A41SU0000-0-M...

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/s^2).

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

Notice

The combination pump type code is shown in shortened form in the order confirmation.



m_1, m_2, $m_{3...}$	Weight of pump	[kg (lbs)]
l_1, l_2, $l_{3...}$	Distance from center of gravity	[mm (inch)]
n	Quantity g (n × 9.81 m/s^2)	

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

Calculation for multiple pumps
l_1 = Front pump distance from center of gravity (values from "Permissible moments of inertia" table)
l_2 = Dimension "M_1" from through drive drawings (from page 64) + l_1 of the 2nd pump
l_3 = Dimension "M_1" from through drive drawings (from page 64) of the 1st pump + "M_1" of the 2nd pump + l_1 of the 3rd Pump

Combination pumps A15V(L)O + A15V(L)O

For type code designation for mounting orientation see "Mounting situation combination pumps in relation to each other" on page 69.

Total length A

A15VO (1st pump)	A15VO (2nd pump)						A15VLO (2nd pump)				
	NG110	NG145	NG175	NG210	NG280	NG280	NG145	NG175	NG210	NG280	NG280
	D4T1	D4T1	E4T2	E4T2	E4A4	E4T3	D4T1	E4T2	E4T2	E4A4	E4T3
NG110	621 (24.45)	–	–	–	–	–	–	–	–	–	–
NG145	646 (25.43)	671 (26.42)	–	–	–	–	736.2 (28.98)	–	–	–	–
NG175	657.5 (25.89)	682.5 (26.87)	713 (28.07)	–	–	–	747.7 (29.44)	780 (30.71)	–	–	–
NG210	674.8 (26.57)	699.8 (27.55)	730.3 (28.75)	747.6 (29.43)	–	–	765 (30.12)	797.3 (31.00)	814.6 (32.07)	–	–
NG280	717 (28.23)	742 (29.21)	772.5 (30.41)	789.8 (31.09)	810 (31.90)	832 (32.76)	807.2 (31.78)	839.5 (33.05)	856.8 (33.73)	866 (34.09)	888 (34.96)

A15VLO (1st pump)	A15VO (2nd pump)						A15VLO (2nd pump)				
	NG110	NG145	NG175	NG210	NG280	NG280	NG145	NG175	NG210	NG280	NG280
	D4T1	D4T1	E4T2	E4T2	E4A4	E4T3	D4T1	E4T2	E4T2	E4A4	E4T3
NG 145	694.7 (27.35)	719.7 (28.33)	–	–	–	–	784.9 (30.90)	–	–	–	–
NG175	706.5 (27.81)	731.5 (28.80)	762 (30.00)	–	–	–	796.7 (31.37)	829 (32.64)	–	–	–
NG210	723.8 (28.50)	748.8 (29.48)	779.3 (30.68)	796.6 (31.36)	–	–	814 (32.05)	846.3 (33.32)	863.6 (34.00)	–	–
NG280	755 (29.72)	780 (30.71)	810.5 (31.91)	827.8 (32.59)	848 (33.39)	870 (34.25)	845.2 (33.28)	877.5 (34.55)	894.8 (35.23)	904 (35.59)	926 (36.46)

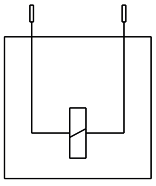
Connector for solenoids

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.

Swivel angle sensor SWS20 series 06

(Order option 10, code B)

Description

The swivel angle sensor serves the contactless detection of the swivel angle of axial piston units in the swivel axis using a Hall-effect based sensor IC. The determined measurement value is converted into an analog signal. The sensor can be used in stationary and in mobile applications.

For further information, see data sheet 95150.

Available variants

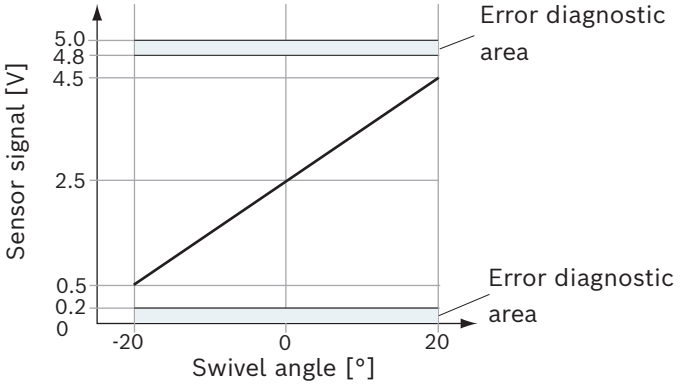
- **SWS20RA05/06V-0** (material number R902584102) Ratiometric output signal 0.5 to 4.5 V at 5 V supply voltage
- **SWS20FE24/06V-0** (material number R902584101) Fixed output signal 0.5 to 4.5 V DC at 8 to 32 V DC supply voltage

Features

- Measuring range ± 20°
- The determined angle value is output as an analog voltage signal
- Integrated electronic fault detection
- Shock and vibration resistance
- Type of protection (with mating connector and cable plugged) IP69K (DIN 40050 part 9), IPX5 and IPX7 (DIN EN 60529)

Output characteristic curve

Characteristic curve applies to unloaded output



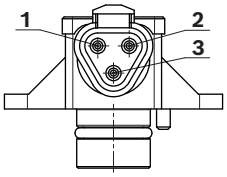
Notice

- An error occurs when a signal value from the sensor is in the blue range.

Notice

- Further information such as type codes, technical data, dimensions, safety instructions for the swivel angle sensor and information on environment and EMC conditions can be found in the associated data sheet 95150.
- Painting the sensor with electrostatic charge is not permitted (danger: ESD damage)

Pin assignment



PIN	Connection	
1	Supply voltage	U_B
2	Ground	GND
3	Sensor signal	OUT

Electrostatic discharge (ESD)

According to ISO 10605: 2001

- Contact discharge (probe touches the sensor) ±8 kV (sensor operated actively and passively)
- Air discharge (arc between probe and sensor) ±15 kV (sensor operated actively and passively)

Mating connector DEUTSCH DT06-3S-EP04

Consisting of	Quantity	Material number
Housing, 3-pin	1	DT06-3S-EP04
Wedge	1	W3S
Sockets	3	0462-201-16141

The mating connector is not included in the scope of delivery.

This can be supplied by Bosch Rexroth on request. (Order number: R902603524).

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.
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 $h_{S\ max}$ = 800 mm (31.50 inch). The minimum suction pressure at port **S** must also not fall below 0.8 bar (12 psi) absolute (without charge pump) or 0.7 bar (11 psi) 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 **7**.
Further installation positions are available upon request.
Recommended installation positions: **1** and **2**

Key	
F	Filling / Air bleeding
S	Suction port
T	Drain port
SB	Baffle (baffle plate)
$\mathbf{h}_{t\ min}$	Minimum required immersion depth (200 mm (7.87 inch))
$\mathbf{h}_{min}$	Minimum required distance to reservoir bottom (100 mm (3.94 inch))
$\mathbf{h}_{ES\ min}$	Minimum height required to prevent axial piston unit from draining (25 mm (1 inch))
$\mathbf{h}_{S\ max}$	Maximum permissible suction height (800 mm (31.50 inch))

Notice

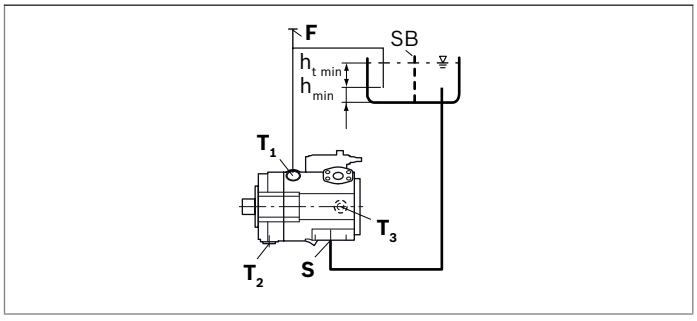
Port **F** is part of the external piping and must be provided on the customer side to make filling and air bleeding easier.

Below-reservoir installation (recommended)

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

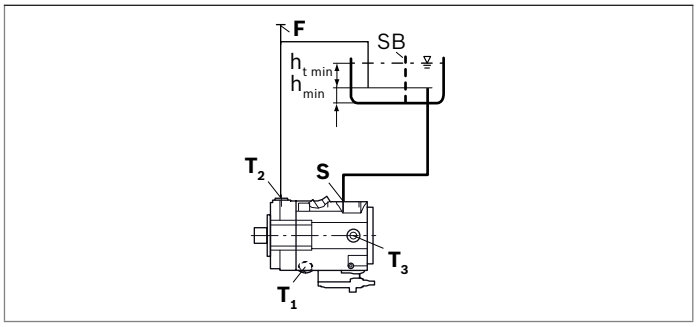
▼ **Installation position 1**

Air bleed[1)]	Filling
T_1 (**F**)	**S** + T_1



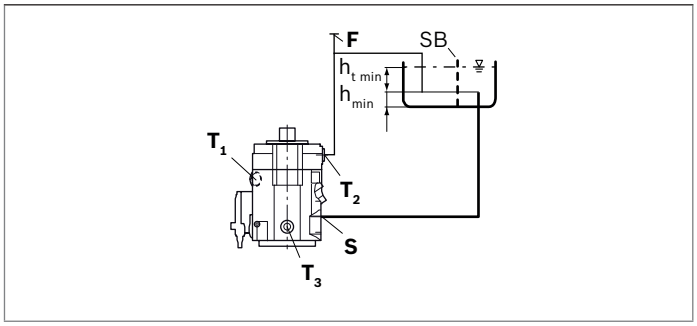
▼ **Installation position 2**

Air bleed	Filling
T_2 (**F**)	**S** + T_2



▼ **Installation position 3**

Air bleed	Filling
T_2 (**F**)	**S** + T_2

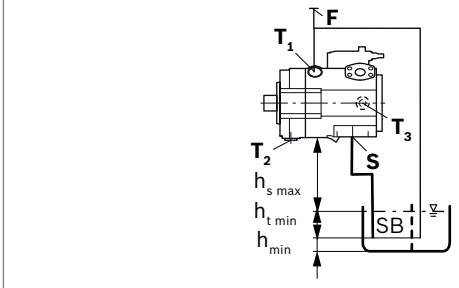


Above-reservoir installation

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 25 mm (1 in) at port T_2 is required in position 5. Observe the maximum permissible suction height $h_{S\,max}$ = 800 mm (31.50 inch).

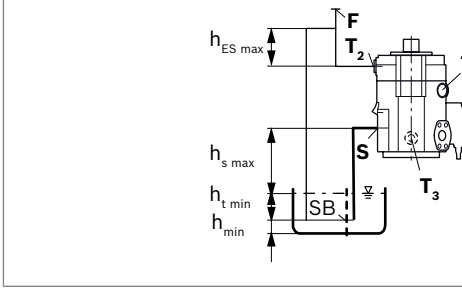
▼ **Installation position 4**

Air bleed[1)]	Filling
T_1 (**F**)	T_1 (**F**)



▼ **Installation position 5**

Air bleed	Filling
T_2 (**F**)	T_2 (**F**)



For key, see page 74

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.

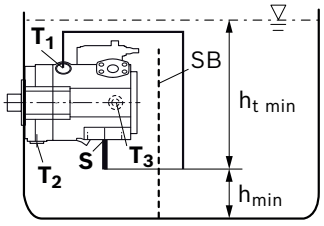
If the minimum fluid level is equal to or below the upper edge of the pump, see chapter "**Above-reservoir installation**".

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

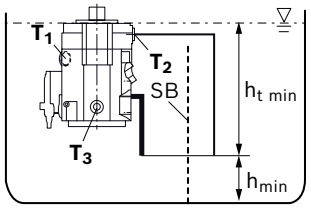
Notice

- We recommend to provide the suction port **S** with a suction pipe and for the drain port $\mathbf{T_1}$ or $\mathbf{T_2}$ 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 6**

Air bleed[1)]	Filling
$\mathbf{T_1}$	$\mathbf{T_1}$
	The housing of the axial piston unit is to be filled via $\mathbf{T_1}$ before the piping is attached.

▼ **Installation position 7**

Air bleed	Filling
$\mathbf{T_2}$	$\mathbf{T_2}$
	The housing of the axial piston unit is to be filled via $\mathbf{T_2}$ before the piping is attached.

For key, see page 74

Project planning notes

- The A15V(L)O axial piston variable pump is intended for use in the 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 configuration variants 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 electric) is not a safeguard against pressure overload. Therefore, a pressure relief valve must be provided in the hydraulic system (integrated into the pump or externally in the 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.
- Please note that a hydraulic system is an oscillating system. This can lead, for example, to the stimulation the natural frequency within the hydraulic system during operation at constant rotational speed over a long period of time. The excitation frequency of the pump is 9 times the rotational speed frequency. This can be prevented, for example, 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} 380 bar (5500 psi).
  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.

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