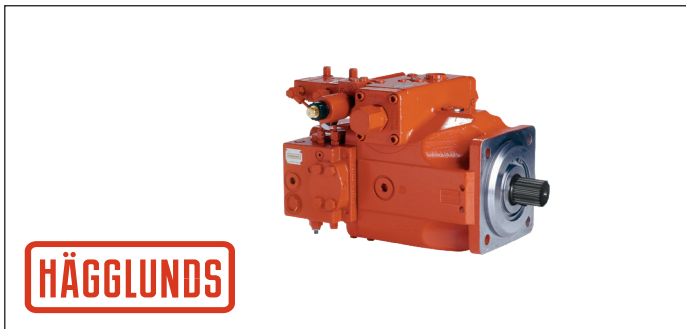


Axial-piston pump Häggglunds SP 250 to SP 750



- ▶ Sizes 250 to 750
- ▶ Nominal pressure 350 bar
- ▶ Maximum pressure 400 bar
- ▶ Closed circuit

Features

- ▶ Variable pump in axial piston swashplate design for hydrostatic drives in closed circuit
- ▶ The flow is proportional to the drive speed and displacement
- ▶ By controlling the swashplate angle, infinitely variable flow is possible
- ▶ The boost pump required for closed-circuit operation and the corresponding valve technology are integrated in the pump
- ▶ The integrated boost pump acts as a feed pump and pilot pressure supply
- ▶ Compact design with extremely short installation length
- ▶ Favorable power/weight ratio
- ▶ Low noise level
- ▶ Long service life
- ▶ High efficiency
- ▶ Electrohydraulic proportional control with neutral position in the event of a power failure
- ▶ Through drive and pump combination also possible with integrated boost pump

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Ordering code

In order to identify Hägglunds equipment exactly, the following ordering code is used. These ordering codes should be stated in full in all correspondence including serial number (SN), see Fig. 1, e.g. when ordering spare parts.

Example: Single Hägglunds SP pump

SP		250		S	R	-	V	-	EP	2437763	-	33
01		02		03	04		05		06	07		08

Example: Tandem combinations Hägglunds SP pump

SP		355+250		S	R	-	V	-	EP	2437763	-	33
01		02		03	04		05		06	07		08

01	Axial-piston pump	
	Superior pump	SP
02	Size. Displacement V_{gmax} [cm³]	
	250	250
	355	355
	500	500
	750	750
	Available tandem combinations see <i>Table 18</i>	
03	Drive shaft	
	Splined to DIN 5480	S
	Key shaft DIN 6885 (only spare pumps)	K
04	Direction of rotation	
	Clockwise	R
	Counter clockwise (optional)	L
05	Sealing material	
	FKM (Flourelastomer)	V
06	Control device	
	Electro-hydr. with prop. solenoid	EP
	Hydr. control, pilot press. dependent	HD
07	Identy number	
		1234567
08	Index	
	Serie 33	33
	Previous versions not mentioned	

For more information please contact your Bosch Rexroth representative

The SP-pump is of closed loop type, in sizes of 250 cc to 750 cc, with an integrated boost pump of gerotor type (see *Table 1* for sizes). The main pump is a variable axial piston type with swashplate design. For detailed information about shaft, ports, flanges, dimension see "*Dimensions*" page 12.

Table 1: Sizes of gerotor types

SP Pump	Charge pump size cm ³ /rev
SP 250	63
SP 355	80
SP 500	98
SP 750	143

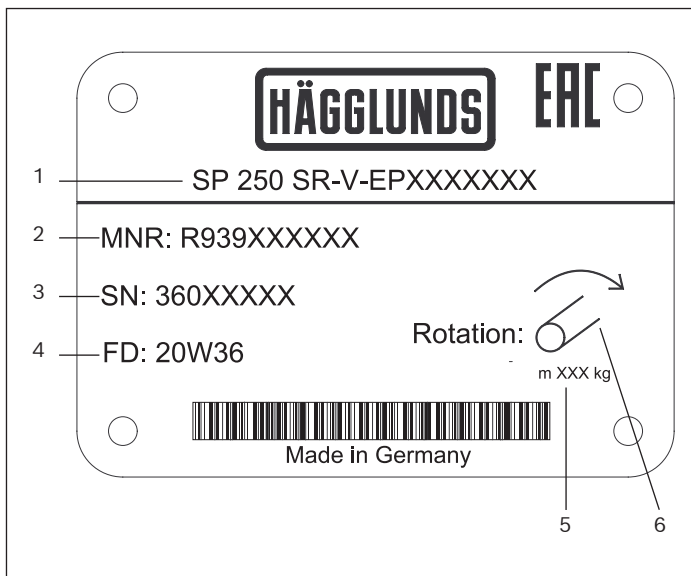


Fig. 1: Example identification plate

1. Type designation
2. Material number
3. Serial number
4. Manufacturing date
5. Net weight
6. Rotation direction viewed from shaft end

Observe some important issues with the SP pump

- Control device as standard is electrohydraulic, EPG see [RE 92084](#). An option is hydraulic control see [RE 92080](#)
- The different sizes of Hägglunds SP pumps has different versions, SP 250 and SP 500 are series 33 (efficiency optimized version). SP 355 and SP 750 are series 30 (standard version).
- Charge flow filtration is solved separate from the pump with the SP-pumps, the filter is not mounted on the pump.
Observe if the pump is used with a charge filtration then the channel between E1 and E2 will be blocked, see *Fig. 39 pos 12*. This is the only visible indicator that show the pump has blocked line. The pump has not a specific material number for this function.

Note!

If a pump will come in on service and E1 and E2 is plugged then the charge pump will break and also the house of main pump will be damaged if it is put in a test bench without removing the plug.

Hydraulic fluids

Hågglunds SP pumps is primarily designed for operation with hydraulic fluids according to ISO 11158 HM. Before the start of project planning, see data sheet [RE 15414](#), Hydraulic fluid quick reference, for detailed information on hydraulic fluids and specific additional demands.

Table 2: Applicable fluids

ISO 11158 (see 90220)	ISO 15380 (see 90221)
Mineral oil based and mineral oil related hydraulic fluids	Environmentally acceptable hydraulic fluids

Within these standards, not all fluid classes are allowed, some are recommended, and there are also additional demands (see data sheet RE 15414).

Details regarding the selection of hydraulic fluid

The hydraulic fluid should be selected such that the operating viscosity in the temperature range, as measured in the motor housing, is within optimum operation range, see *Fig. 2*. General recommendation is to have a system temperature of 50°C, see dotted line in *Fig. 2*. An ISO VG 68 fluid will render just above 40 cSt at this point. Hågglunds recommend to follow these points below.

- Recommended viscosity range for Hågglunds drive systems is 40 to 150 cSt.
- Running above 150 cSt or below 40 cSt results in reduced efficiency.
- Running above 400 cSt results in substantial efficiency loss.
- Starting at above 1000 cSt impact unnecessary strain on parts.
- Running below 30 cSt may impact service life.
- At no point on the component may the temperature be higher than 90 °C.

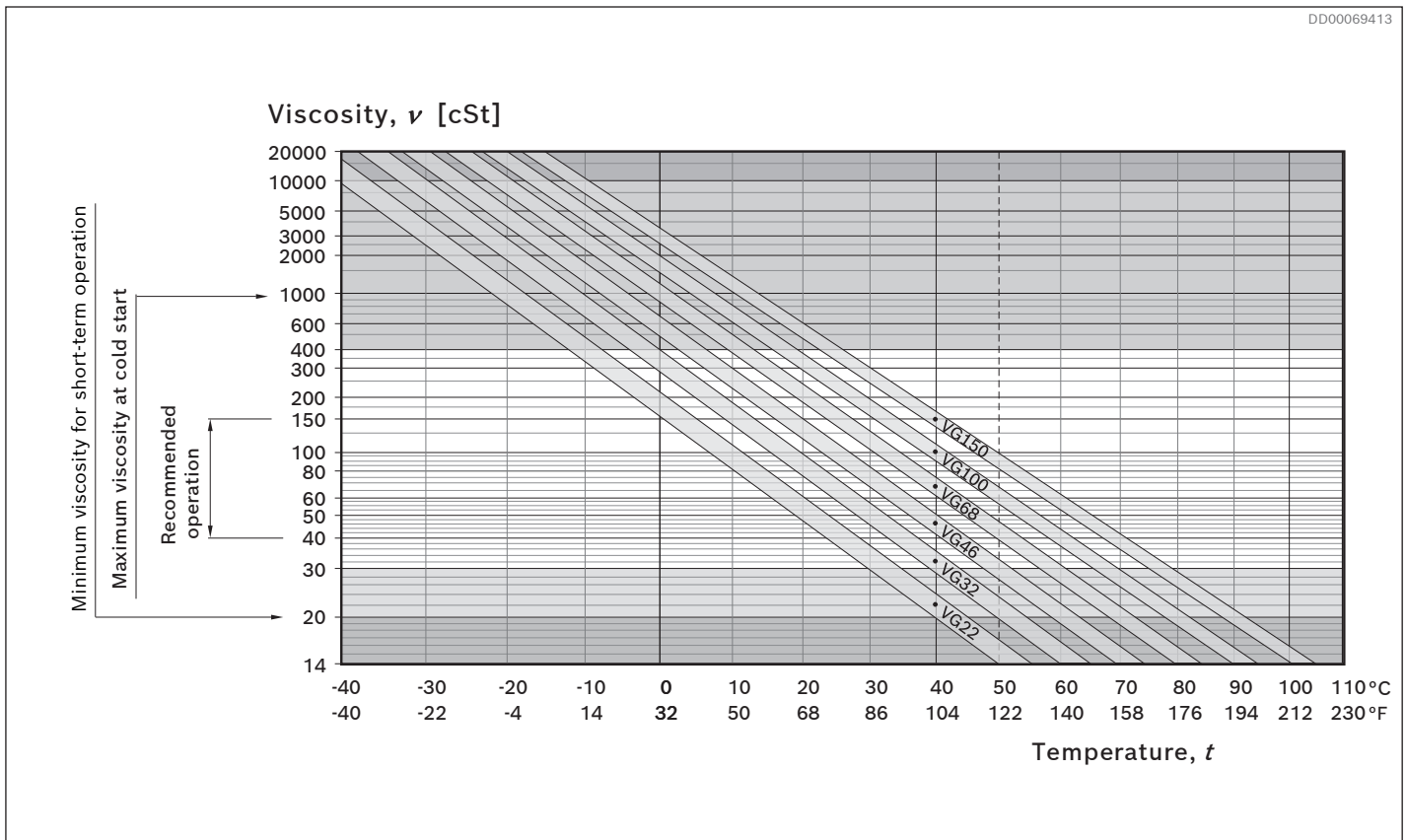


Fig. 2: Selection diagram for viscosity ranges with straight fluids, i.e. viscosity index 100

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 18/16/13 is to be maintained according to ISO 4406.

Depending on system and application, filter cartridges with at least $\beta_{10} \geq 75$ is recommended.

Bearing flushing

For the following operating conditions bearing flushing is required for reliable continuous operation:

- Applications with special fluids (non mineral oils), due to limited lubricity and narrow operating temperature range
- Operation with critical conditions of temperature and viscosity with mineral oil
- High installed power, see *Table 4*

Flushing is carried out via U-port, which is located in the front flange area of the pump. The flushing oil flows through the front bearing and leaves the system together with the leakage oil at the case drain port.

Recommended flushing flows for the various pump sizes:
See *Table 3*

These flushing flows create a pressure drop of approximately 3 bar between U-port and pump housing (including fitting).

Note. When using bearing flushing at U-port the throttle screw, which can be found at U-port, has to be turned in all the way to the stop.

Table 3: Recommended flushing flows

Size	Flushing flow, q_R l/min
250	10
355	15
500	20
750	30

Table 4: Installed electric motor power when flushing is required

Size	Installed electric motor power, kW	Installed electric motor power, hp
250	186	249
355	242	324
500	303	406
750	445	597

Shaft seal

Permissible pressure load

The service life of the shaft seal ring is affected by the rotational speed of the axial piston unit and the leakage pressure (case pressure). The service life of the shaft seal decreases with an increase in the frequency of pressure peaks and an increase in the mean differential pressure.

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

Case drain pressure

Table 5: Maximum case pressure (housing pressure)

p_L continuous	5 bar
p_L abs max	8 bar

T_1 must be unloaded to tank.

Working pressure range

Table 6: Allowed pressure and pressure settings

Pressure at working ports A or B		Definition	
Nominal pressure p_{nom} (see Fig. 4)	350 bar	The nominal pressure corresponds to the maximum design pressure.	
Maximum pressure p_{max} (see Fig. 4)	400 bar	The maximum pressure corresponds to the maximum working pressure within the single operating period. The sum of the single operating periods must not exceed the total operating period.	
Single operating period	1 s		
Total operating period	300 h		
Minimum pressure (high-pressure side) (see Fig. 4)	15 bar	Minimum pressure at the high-pressure side (A or B) which is required to prevent damage to the axial piston unit.	
Minimum pressure (low-pressure side)	Speed related (see Fig. 3)	Minimum pressure at the low-pressure side (A or B) which is required in order to prevent damage to the axial piston unit. The low pressure is present at port M_{K4} with the flushing slide deflected.	
Rate of pressure change $R_{A\ max}$	16000 bar/s	Maximum permissible speed of pressure build-up and reduction during a pressure change across the entire pressure range.	
Boost pressure			
Minimum boost pressure p_{Sp} (at n_{nom})	16 bar	NG250 to 500 series 30 Measuring port M_{K4} (Please contact Bosch Rexroth representative for coupled multiple pumps)	
	20 bar		NG750 series 30
	10 bar		NG250 to 500 series 33
Maximum static boost pressure $p_{Sp\ max}$	30 bar		
Permissible pressure peaks in boost pressure	minimum	4 bar	
	maximum	40 bar	
Pressure at suction port S (version with integrated boost pump)			
Minimum pressure $p_{S\ min}$	≥ 0.8 bar absolute	Minimum pressure at suction port S (inlet) that is required in order to avoid damage to the axial piston unit.	
Maximum pressure $p_{S\ max}$	30 bar absolute		
Control pressure for EP and HD control.			
Minimum required control pressure $p_{St\ min}$	30 bar + (Pn-Ps) for SP355 35 bar + (Pn-Ps)	Measuring port E_1 or E_2 Pn= pump in neutral, Ps= pump on stroke	

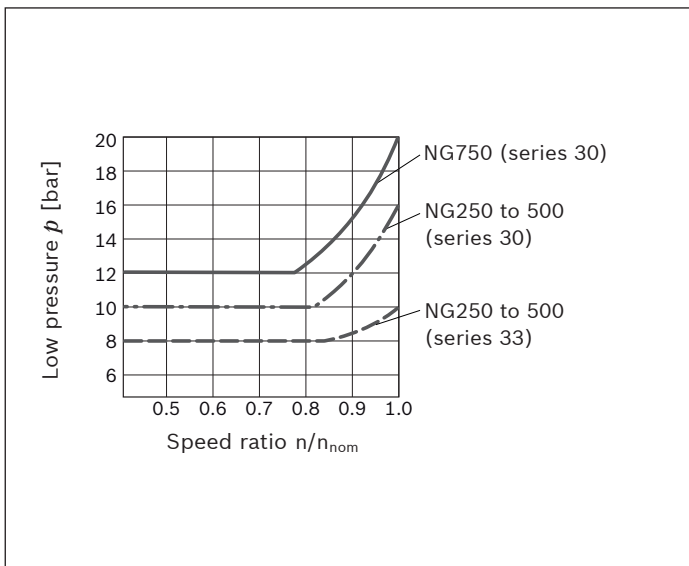


Fig. 3: Required low pressure depending on the speed ratio

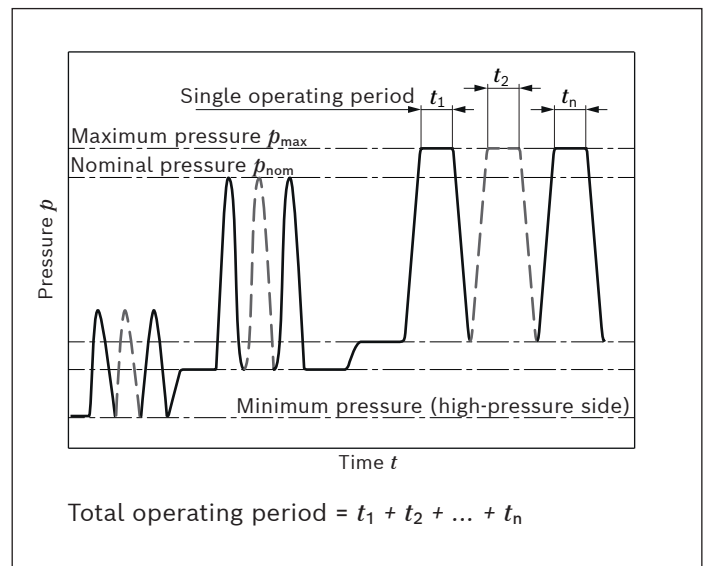


Fig. 4: Working pressure

Notice

Working pressure range valid when using hydraulic fluids based on mineral oils. Values for other hydraulic fluids, please contact your Bosch Rexroth representative

Technical data

Table 7: Technical data

Size		NG		250	355	500	750
Displacement, geometric, per revolution	Variable pump	$V_{g \max}$	cm ³	250	355	500	750
	Integrated boost pump	$V_{g \text{ Sp}}$	cm ³	63	80	98	143
Rotational speed ¹⁾	maximum at $V_{g \max}$	n_{nom}	rpm	2200	2000	1800	1600
	minimal ²⁾	n_{min}	rpm	800	800	800	800
Flow (variable pump) at $V_{g \max}$ and	n_{max}	q_v	L/min	550	710	900	1200
	$n_E = 1500$ rpm	q_{vE}	L/min	375	533	750	1125
Power ³⁾ at $V_{g \max}$, $\Delta p = 350$ bar and	n_{max}	P	kW	321	414	525	700
	$n_E = 1500$ rpm	P_E	kW	219	311	438	656
Torque ³⁾ at $V_{g \max}$ and	$\Delta p = 350$ bar	T	Nm	1391	1976	2783	4174
	$\Delta p = 100$ bar	T	Nm	398	564	795	1193
Rotary stiffness of drive shaft	P	c	kNm/rad	527	800	1145	1860
	Z	c	kNm/rad	543	770	1209	1812
Moment of inertia for rotary group		J_{TW}	kgm ²	0.0959	0.19	0.3325	0.66
Maximum angular acceleration ⁴⁾		α	rad/s ²	775	600	540	400
Case volume		V	L	10	8	14	19
Weight (pump with EP control and integrated boost pump without filter) approx.		m	kg	260	275	390	520

Table 8: Equations for characteristics

Determining the characteristics	
Flow	$q_v = \frac{V_g \cdot n \cdot \eta_v}{1000}$ [l/min]
Torque	$T = \frac{V_g \cdot \Delta p}{20 \cdot \pi \cdot \eta_{mh}}$ [Nm]
Power	$P = \frac{2 \pi \cdot T \cdot n}{60000} = \frac{q_v \cdot \Delta p}{600 \cdot \eta_t}$ [kW]
Key	
V_g	= Displacement per revolution [cm ³]
Δp	= Differential pressure [bar]
n	= Rotational speed [rpm]
η_v	= Volumetric efficiency
η_{mh}	= Mechanical-hydraulic efficiency
η_t	= Total efficiency ($\eta_t = \eta_v \cdot \eta_{mh}$)

- The values are applicable:
 - for the optimum viscosity see "Hydraulic fluids" page 4
 - for hydraulic fluid based on mineral oils
- Lower values on request
- Without boost pump
- 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 connecting parts must be considered.

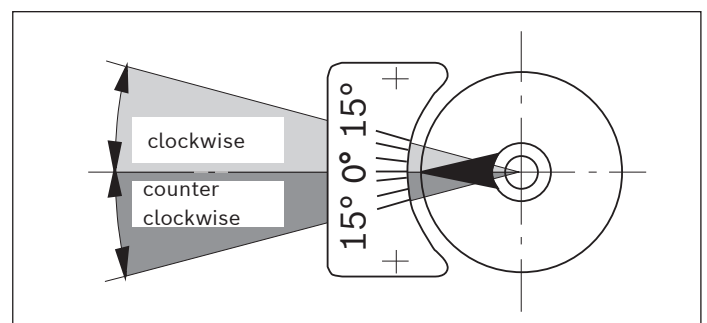
Notice

- ▶ 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 testing the loads by means of experiment or calculation / simulation and comparison with the permissible values.

Table 9: Flow direction

Direction of rotation of pump shaft		Swiveling range*
clockwise	counter-clockwise	
B to A	A to B	clockwise
A to B	B to A	counter-clockwise

* cf. swivel angle indicator see Fig. 5


Fig. 5: Swiveling indicator

Total efficiency

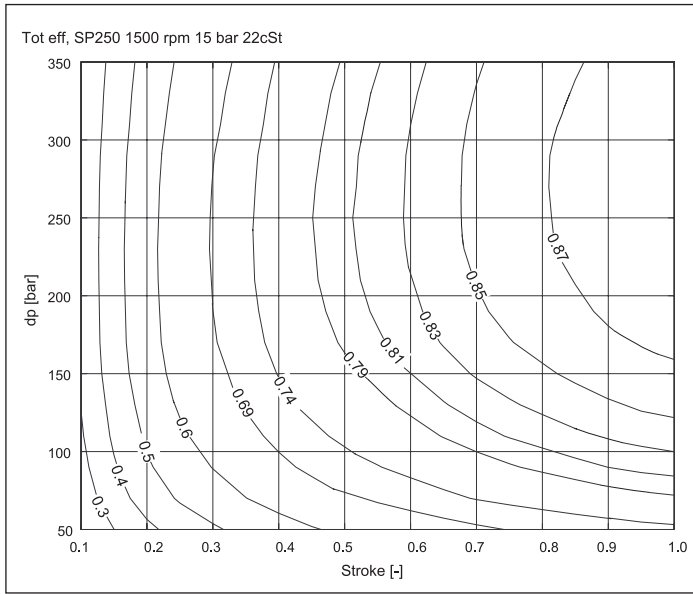


Fig. 6: SP 250 1500 rpm

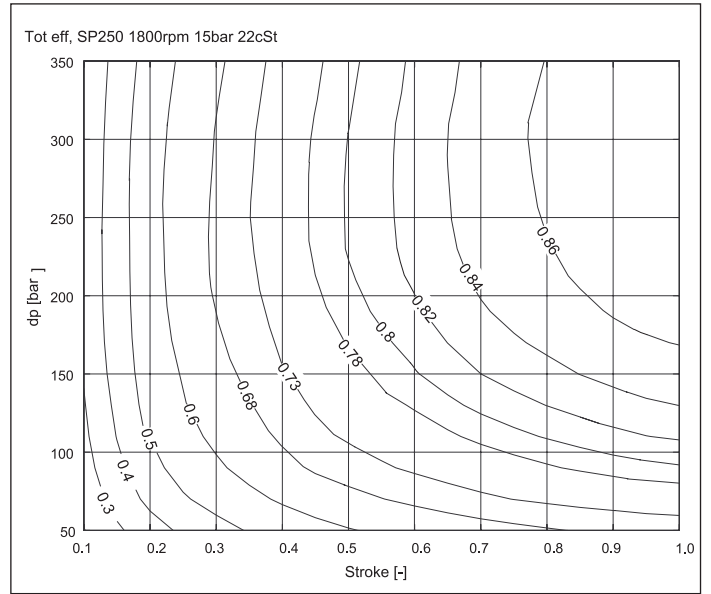


Fig. 7: SP 250 1800 rpm

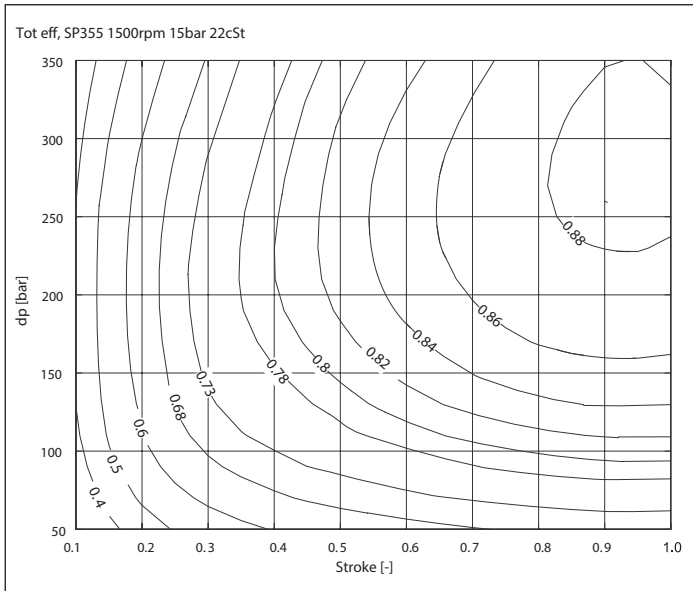


Fig. 8: SP 355 1500 rpm

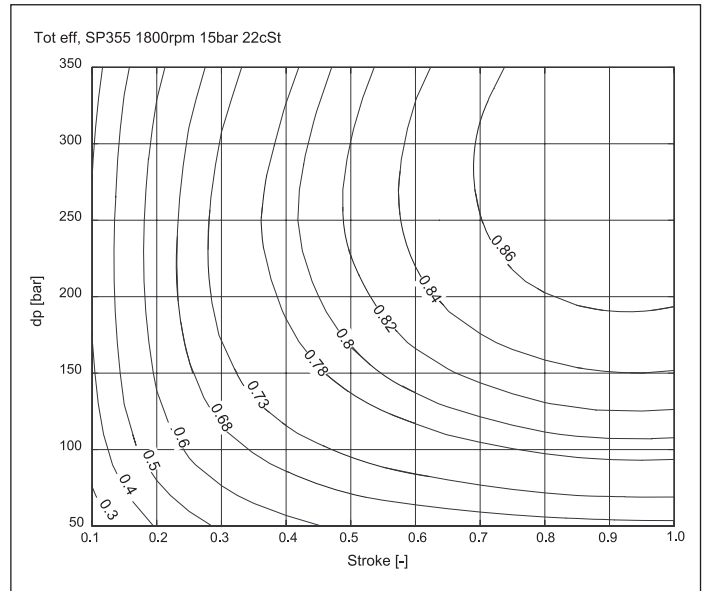


Fig. 9: SP 355 1800 rpm

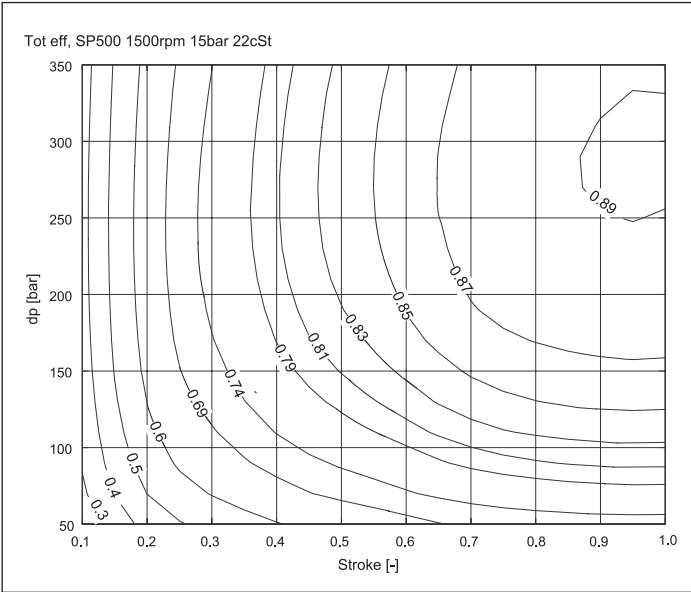


Fig. 10: SP 500 1500 rpm

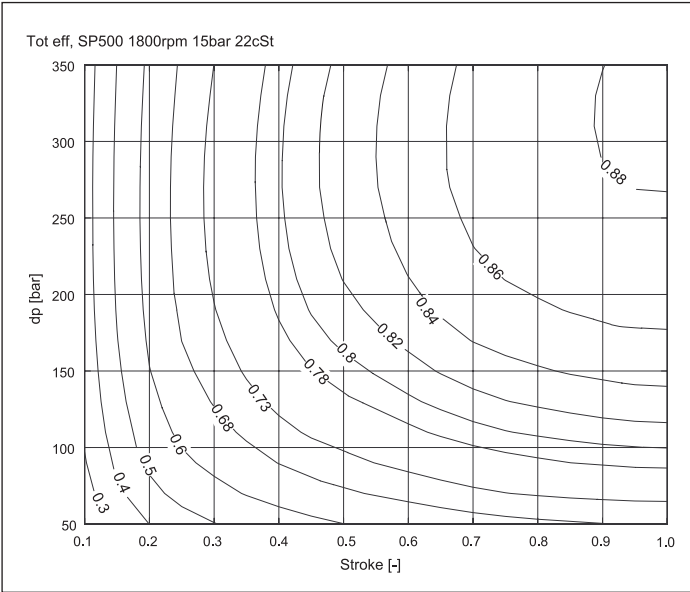


Fig. 12: SP 500 1800 rpm

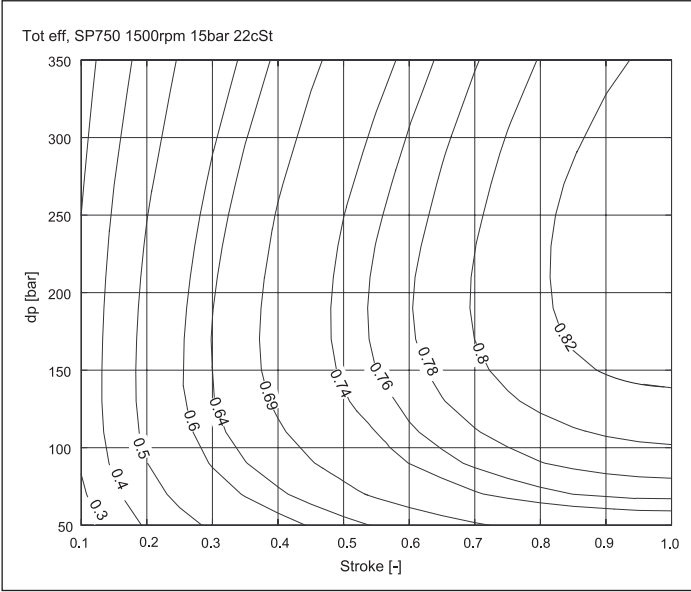


Fig. 11: SP 750 1500 rpm

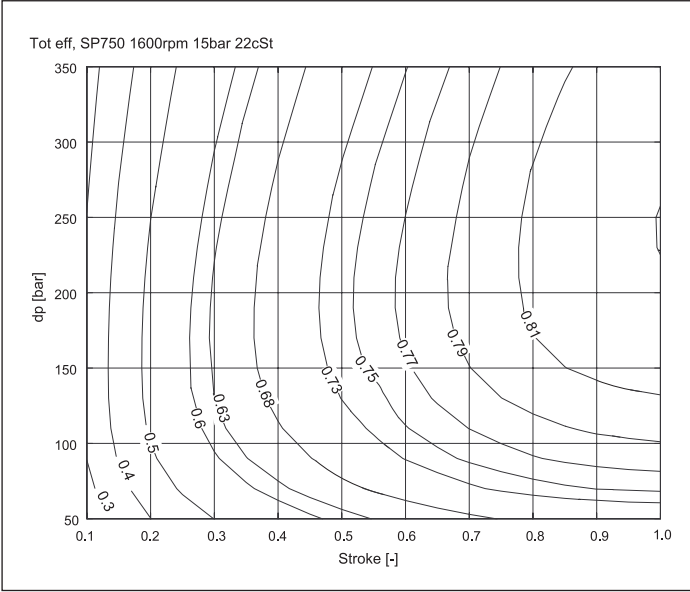
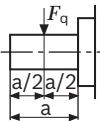
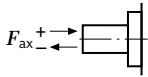


Fig. 13: SP 750 1600 rpm

Table 10: Permissible radial and axial forces of the drive shafts

Size	NG		250	355	500	750	
Drive shaft							
Maximum radial force at X/2		$F_{q \max}$	N	2000	2200	2500	3000
Maximum axial force		$+ F_{ax \max}$	N	1800	2000	2000	2000
		$- F_{ax \max}$	N				

Note
 Special requirements apply in the case of belt drives.
 Please contact your Bosch Rexroth representative.

Table 11: Permissible input and through-drive torques

Size	NG		250	355	500	750	
Torque at $V_{g \max}$ and $\Delta p = 350 \text{ bar}^1$	T_{\max}	Nm	1391	1976	2783	4174	
Maximum input torque at drive shaft ²⁾							
	Splined shaft S	$T_{E \max}$	Nm	2782	3952	5566	8348
	Shaft key K	$T_{E \max}$	Nm	2300	3557	5200	7513
Maximum through-drive torque				$T_{D \max} = T_{E \max}$			

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

Note
 The standard SP pump has a splined shaft. Key shaft only for spare pump

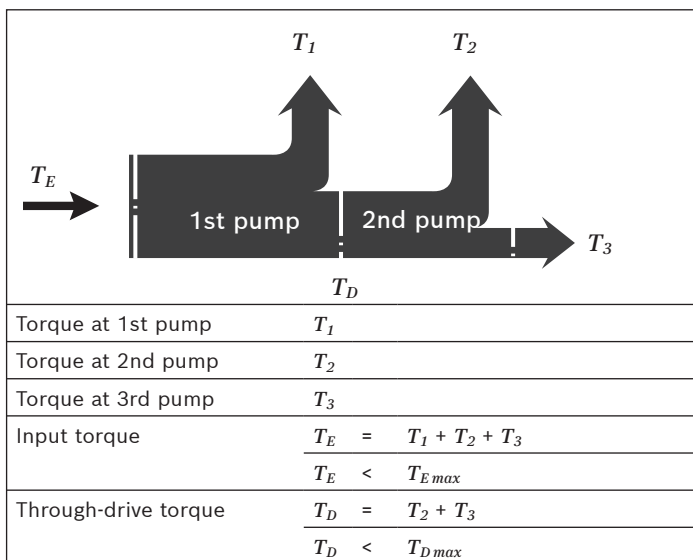


Fig. 14: Distribution of torques

Overview of control devices

EP – proportional control, electrohydraulic

(see data sheet [RE 92084](#))

The EP control adjusts the pump displacement proportionally to the current at the solenoid. Current-regulated control units with pulse-width modulation are recommended for controlling the solenoids. With integrated boost pump, the control is supplied internally with the control pressure from the boost circuit. This saves using a separate control pressure pump.

- Remote pressure control EP(G)

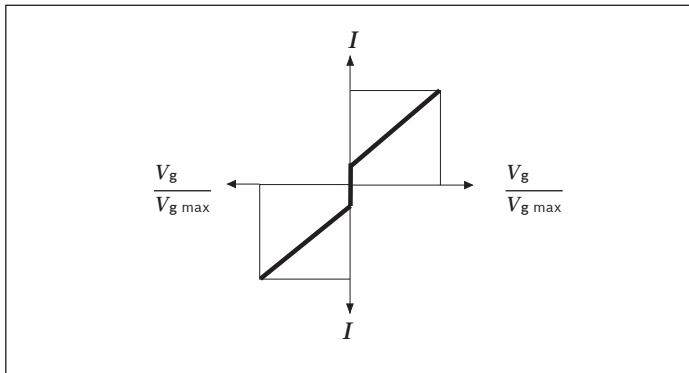


Fig. 15: Characteristic curve SP 500/750 EP

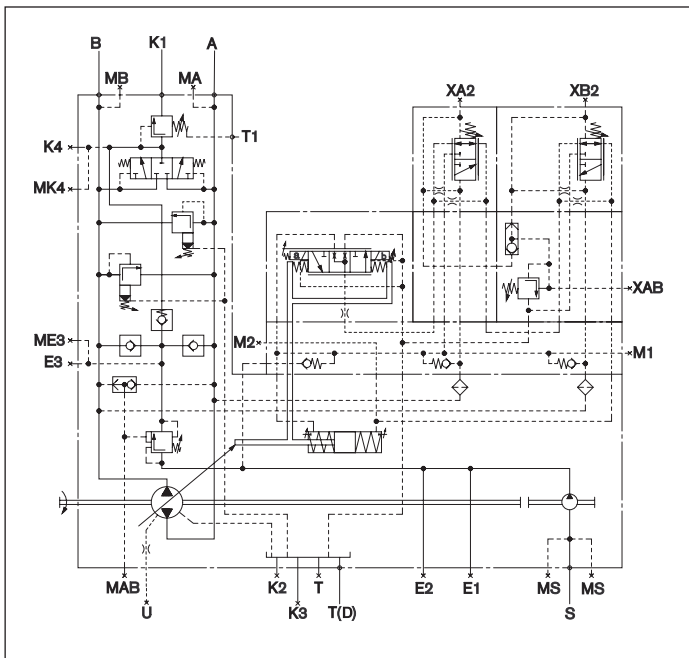


Fig. 16: Circuit diagram, example SP 500/750 EP

HD – Proportional control, hydraulic, pilot-pressure related

(see data sheet [RE 92080](#))
 Stepless adjustment of the pump displacement according to the pilot pressure. The control is proportional to the specified pilot pressure setpoint value (difference between X_1 , X_2).

With integrated boost pump, the control is supplied internally with the control pressure from the boost circuit. This saves using a separate control pressure pump.

Optional:

- Control characteristics (HD1)

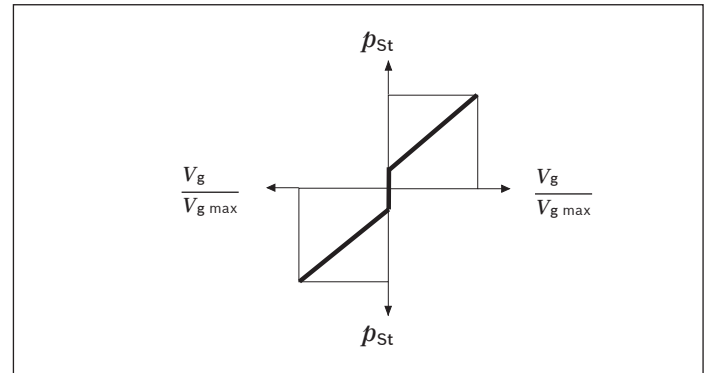


Fig. 17: Characteristic curve SP 500/750 HD1

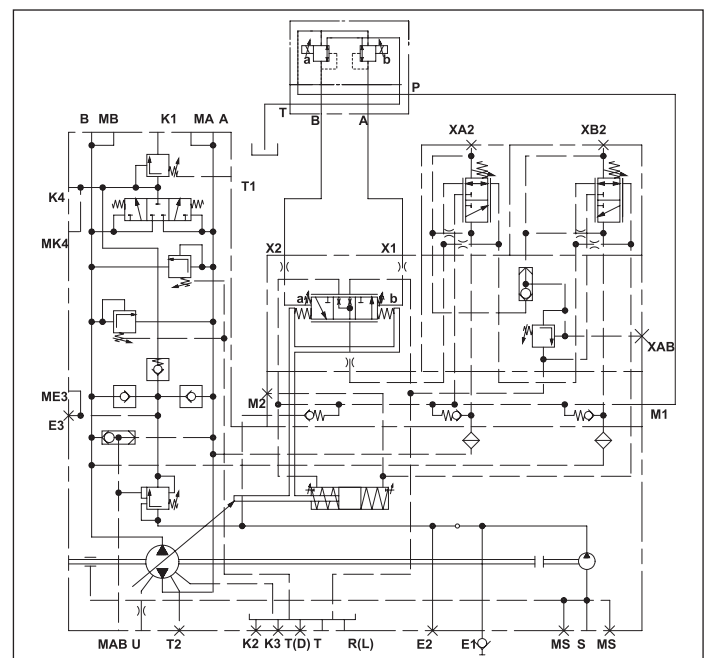


Fig. 18: Circuit diagram, example SP 500/750 HD1

Dimensions

Hägglunds SP 250

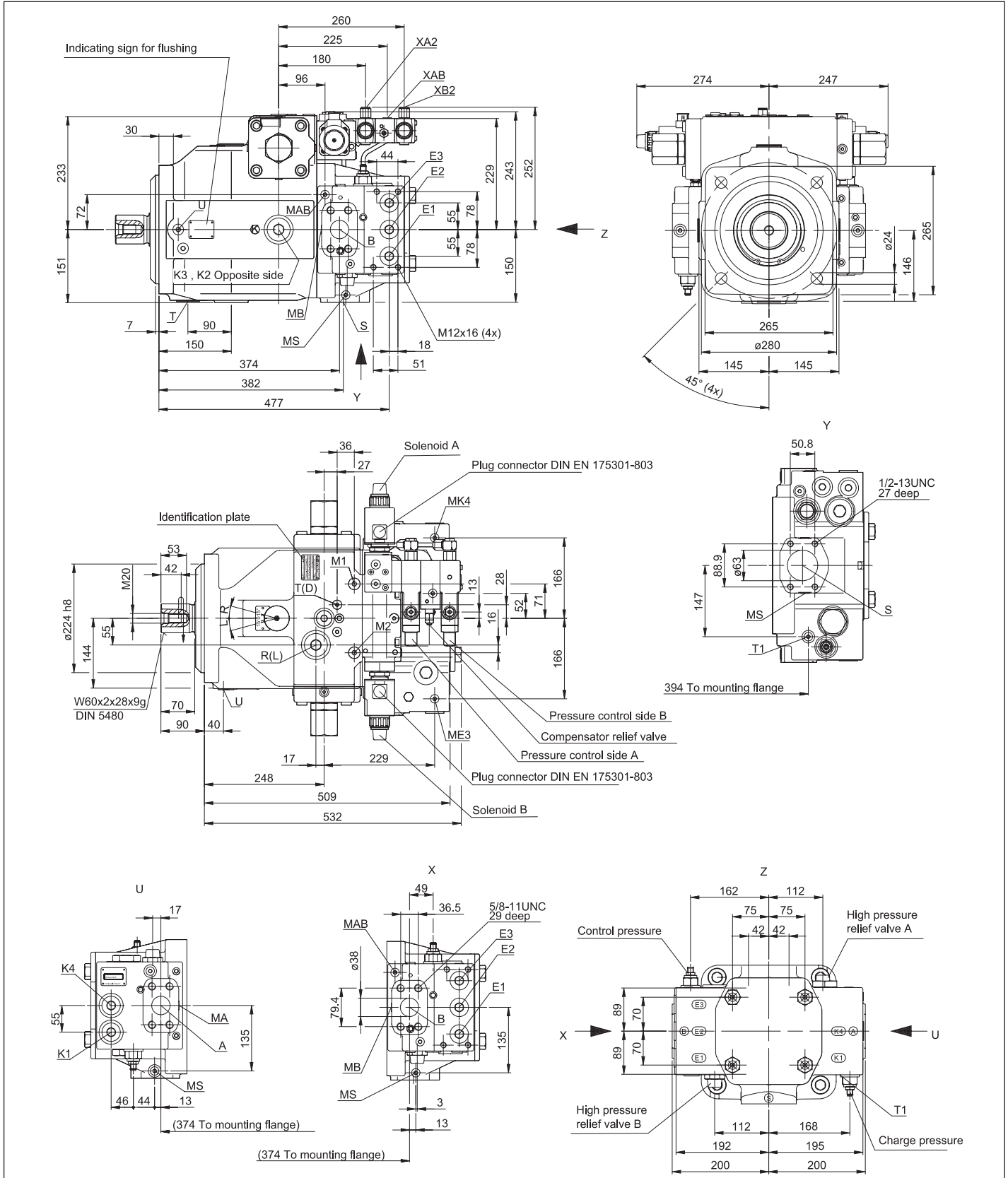


Fig. 19: Dimension SP 250

Table 12: Connections SP 250

Ports	Description	Size	p_{max} [bar] ¹⁾	State ⁵⁾
A, B	Pressure port	SAE 1 1/2" code 62	400	O
S	Suction port	SAE 2 1/2" code 61 ²⁾	30	O ⁶⁾
MA, MB, MAB	Measuring port operating pressure	9/16-18UNF-2B	400	X
MS	Measuring port suction pressure	9/16-18UNF-2B	30	X
T	Oil discharge	1 5/8-12UNF-2B ³⁾	4	X ⁴⁾
T1	Drain port flushing pressure relief valve	9/16-18UNF-2B	4	O
E1	To filter	1 5/16-12UNF-2B	40	X ⁷⁾
E2	From filter	1 5/16-12UNF-2B	40	X ⁷⁾
K1	Flushing port	1 5/16-12UNF-2B	5	O
K2, K3	Flushing port	1 5/8-12UNF-2B ³⁾	4	X ⁴⁾
R(L)	Return resp, aeration	1 5/8-12UNF-2B	4	O ⁴⁾
U	Flushing port (bearing flushing)	3/4-16UNF-2B ³⁾	7	X
E3	Boost port (external)	1 5/16-12UNF-2B	40	X
ME3	Measuring port boost pressure	9/16-18UNF-2B	40	X
K4	Accumulator port	1 5/16-12UNF-2B	40	X
MK4	Measuring port flushing pressure	9/16-18UNF-2B	40	X
M1, M2	Measuring port control pressure	M18 × 1.5	400	X
XA, XB, XAB	Pilot pressure port , pressure control	9/16-18UNF-2B	350	X
T(D)	Drain	M14 × 1.5	4	X

- 1) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
- 2) Only dimensions according to SAE J518, metric fastening thread is a deviation from standard.
- 3) The countersink can be deeper than that specified in the standard.
- 4) Depending on the installation position, T, K₂, K₃ or R(L) must be connected (see also "Installation instructions" page 28)
- 5) O = Must be connected (plugged when delivered)
X = Plugged (in normal operation)
- 6) Always plugged when delivered without charge pump
- 7) Open when using charge filter

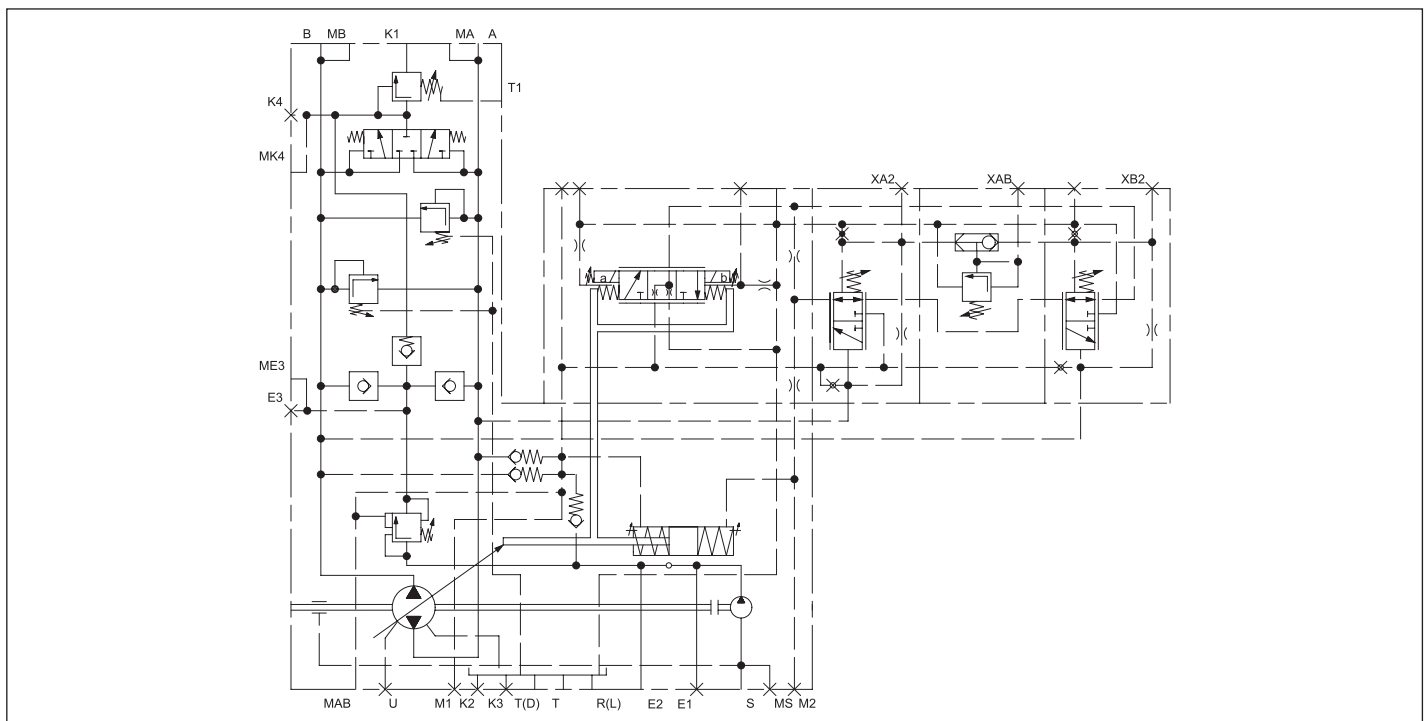


Fig. 20: Hydraulic circuit for SP 250

Table 13: Ports SP 355

Ports	Description	Size	p_{max} [bar] ¹⁾	State ⁵⁾
A, B	Pressure port	SAE 1 1/2" code 62	400	O
S	Suction port	SAE 2 1/2" code 61 ²⁾	30	O ⁶⁾
MA, MB, MAB	Measuring port operating pressure	9/16-18UNF-2B	400	X
MS	Measuring port suction pressure	9/16-18UNF-2B	30	X
T	Oil discharge	1 5/8-12UNF-2B ³⁾	4	X ⁴⁾
T1	Drain port flushing pressure relief valve	9/16-18UNF-2B	4	O
E1	To filter	1 5/16-12UNF-2B	40	X ⁷⁾
E2	From filter	1 5/16-12UNF-2B	40	X ⁷⁾
K1	Flushing port	1 5/16-12UNF-2B	5	O
K2, K3	Flushing port	1 5/8-12UNF-2B ³⁾	4	X ⁴⁾
R(L)	Return resp, aeration	1 5/8-12UNF-2B	4	O ⁴⁾
U	Flushing port (bearing flushing)	3/4-16UNF-2B ³⁾	7	X
E3	Boost port (external)	1 5/16-12UNF-2B	40	X
ME3	Measuring port boost pressure	9/16-18UNF-2B	40	X
K4	Accumulator port	1 5/16-12UNF-2B	40	X
MK4	Measuring port flushing pressure	9/16-18UNF-2B	40	X
M1, M2	Measuring port control pressure	M18 × 1.5	400	X
XA, XB, XAB	Pilot pressure port , pressure control	9/16-18UNF-2B	350	X
T(D)	Drain	M14 × 1.5	4	X

- 1) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
- 2) Only dimensions according to SAE J518, metric fastening thread is a deviation from standard.
- 3) The countersink can be deeper than that specified in the standard.
- 4) Depending on the installation position, T, K₂, K₃ or R(L) must be

connected (see also "Installation instructions" page 28)

5) O = Must be connected (plugged when delivered)

X = Plugged (in normal operation)

6) Always plugged when delivered without charge pump

7) Open when using charge filter

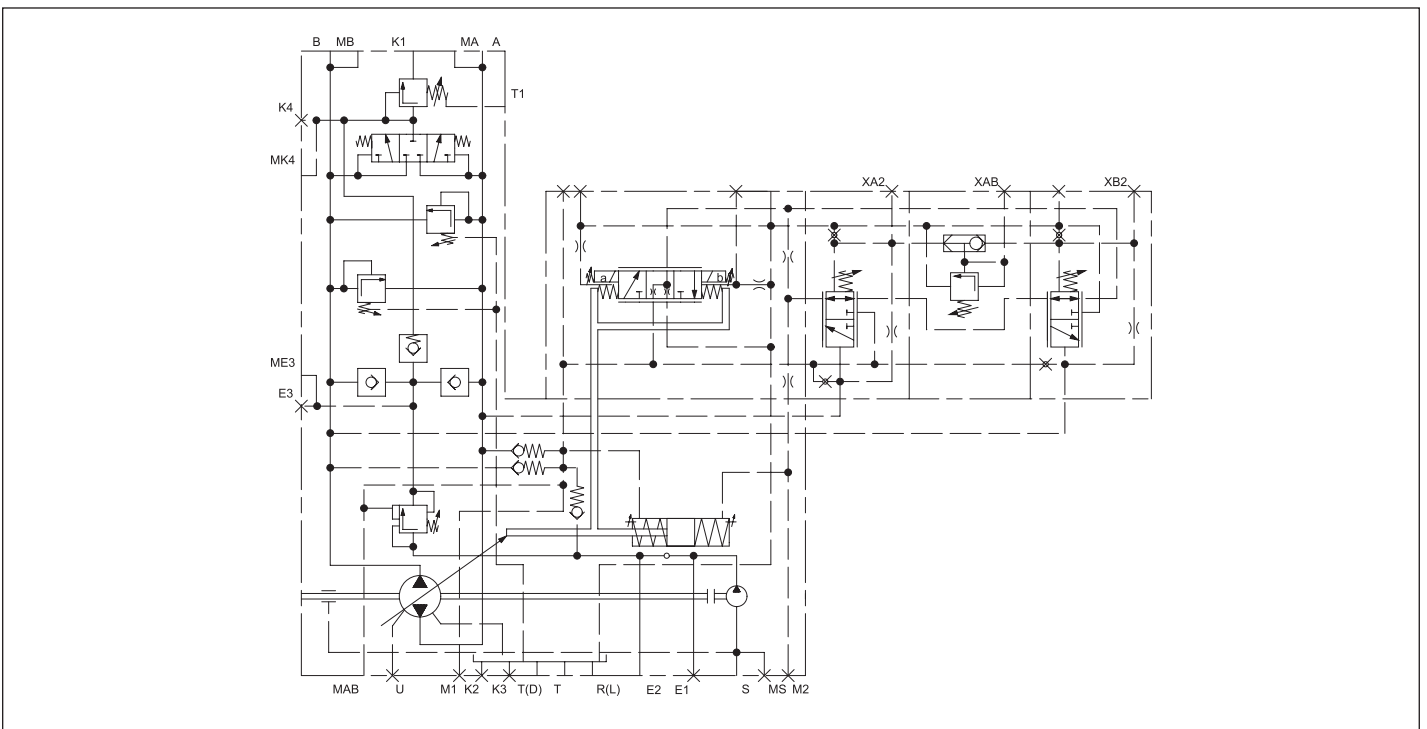


Fig. 22: Hydraulic circuit for SP 355

Table 14: Ports SP 500

Ports	Description	Size	p_{max} [bar] ¹⁾	State ⁵⁾
A, B	Pressure port	SAE 2" code 62	400	O
S	Suction port	SAE 2 1/2" code 61 ²⁾	30	O ⁶⁾
MA, MB, MAB	Measuring port operating pressure	9/16-18UNF-2B	400	X
MS	Measuring port suction pressure	9/16-18UNF-2B	30	X
T	Oil discharge	1 7/8-12UNF-2B ³⁾	4	X ⁴⁾
T1	Drain port flushing pressure relief valve	9/16-18UNF-2B	4	O
E1	To filter	1 5/16-12UNF-2B	40	X ⁷⁾
E2	From filter	1 5/16-12UNF-2B	40	X ⁷⁾
K1	Flushing port	1 5/16-12UNF-2B	5	O
K2, K3	Flushing port	1 7/8-12UNF-2B ³⁾	4	X ⁴⁾
R(L)	Return resp, aeration	1 7/8-12UNF-2B	4	O ⁴⁾
U	Flushing port (bearing flushing)	3/4-16UNF-2B ³⁾	7	X
E3	Boost port (external)	1 5/16-12UNF-2B	40	X
ME3	Measuring port boost pressure	9/16-18UNF-2B	40	X
K4	Accumulator port	1 5/16-12UNF-2B	40	X
MK4	Measuring port flushing pressure	9/16-18UNF-2B	40	X
M1	Measuring port control pressure	M22×1.5	400	X
M2	Measuring port control pressure	M14×1.5	350	X
XA, XB, XAB	Pilot pressure port , pressure control	9/16-18UNF-2B	4	X
T(D)	Drain	M18×1.5	4	X

- 1) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
- 2) Only dimensions according to SAE J518, metric fastening thread is a deviation from standard.
- 3) The countersink can be deeper than that specified in the standard.
- 4) Depending on the installation position, T, K₂, K₃ or R(L) must be connected (see also "Installation instructions" page 28)
- 5) O = Must be connected (plugged when delivered)
X = Always plugged (in normal operation)
- 6) Plugged when delivered without charge pump
- 7) Open when using charge filter

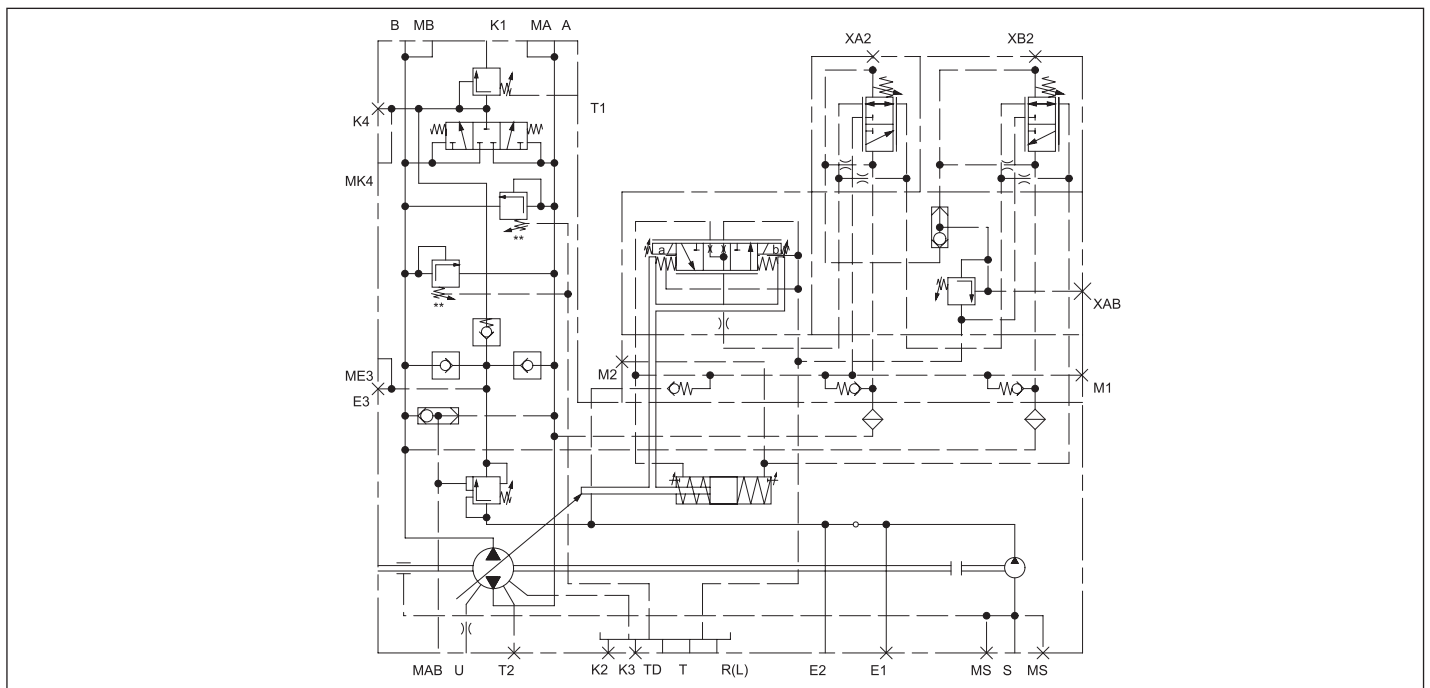


Fig. 24: Hydraulic circuit for SP 500

Hägglunds SP 750

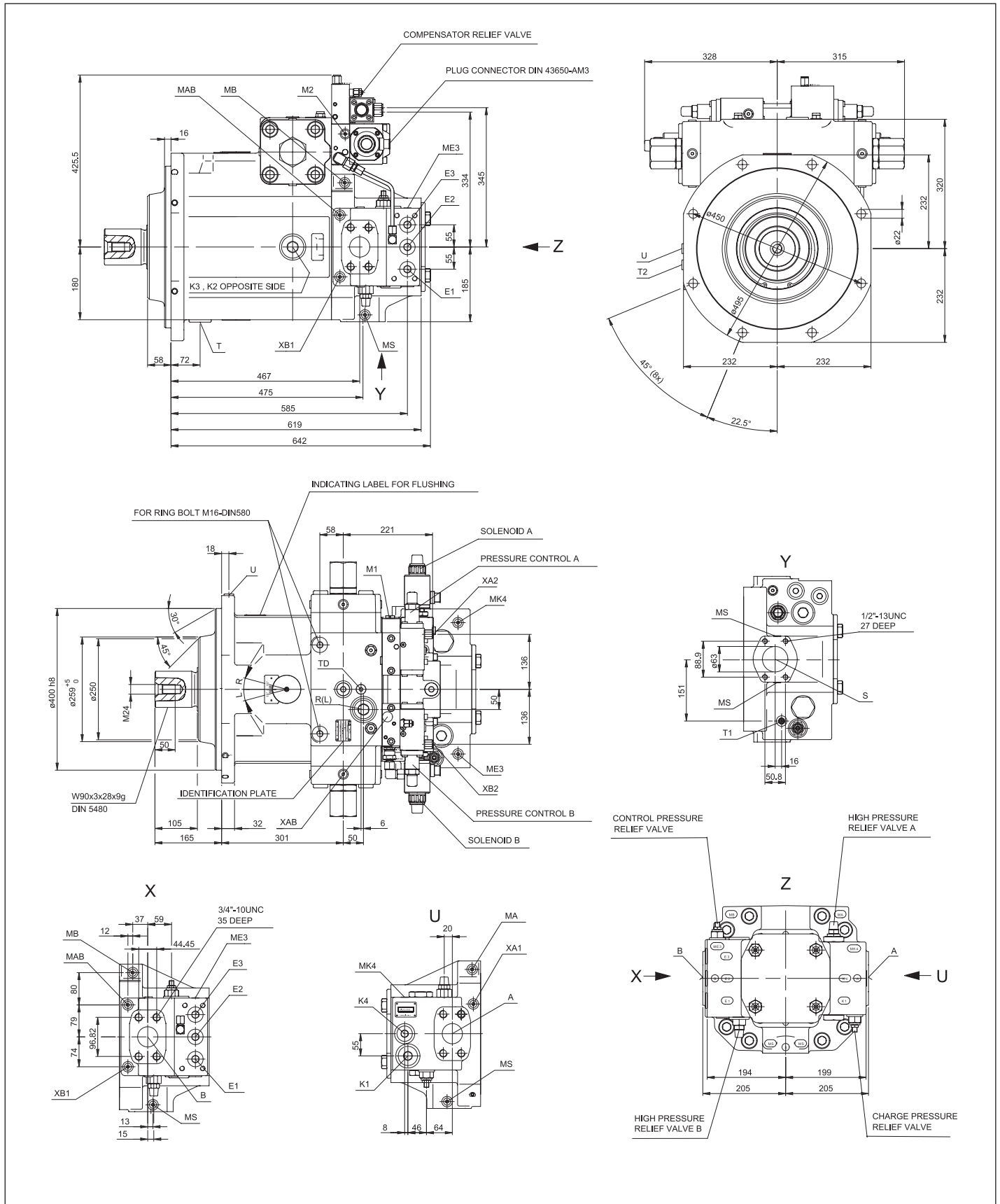


Fig. 25: Dimension SP 750

Table 15: Ports SP 750

Ports	Description	Size	p_{max} [bar] ¹⁾	State ⁵⁾
A, B	Pressure port	SAE 2" code 62	400	O
S	Suction port	SAE 2 1/2" code 61 ²⁾	30	O ⁶⁾
MA, MB, MAB	Measuring port operating pressure	9/16-18UNF-2B	400	X
MS	Measuring port suction pressure	9/16-18UNF-2B	30	X
T	Oil discharge	1 7/8-12UNF-2B ³⁾	4	X ⁴⁾
T1	Drain port flushing pressure relief valve	9/16-18UNF-2B	4	O
E1	To filter	1 5/16-12UNF-2B	40	X ⁷⁾
E2	From filter	1 5/16-12UNF-2B	40	X ⁷⁾
K1	Flushing port	1 5/8-12UNF-2B	5	O
K2, K3	Flushing port	1 7/8-12UNF-2B ³⁾	4	X ⁴⁾
R(L)	Return resp, aeration	1 7/8-12UNF-2B	4	O ⁴⁾
U	Flushing port (bearing flushing)	3/4-16UNF-2B ³⁾	7	X
E3	Boost port (external)	1 5/16-12UNF-2B	40	X
ME3	Measuring port boost pressure	9/16-18UNF-2B	40	X
K4	Accumulator port	1 5/16-12UNF-2B	40	X
MK4	Measuring port flushing pressure	9/16-18UNF-2B	40	X
M1	Measuring port control pressure	M22×1.5	400	X
M2	Measuring port control pressure	M14×1.5	350	X
XA, XB, XAB	Pilot pressure port , pressure control	9/16-18UNF-2B	4	X
T(D)	Drain	M18×1.5	4	X

- 1) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
- 2) Only dimensions according to SAE J518, metric fastening thread is a deviation from standard.
- 3) The countersink can be deeper than that specified in the standard.
- 4) Depending on the installation position, T, K₂, K₃ or R(L) must be connected (see also "Installation instructions" page 28)
- 5) O = Must be connected (plugged when delivered)
X = Plugged (in normal operation)
- 6) Always plugged when delivered without charge pump
- 7) Open when using charge filter

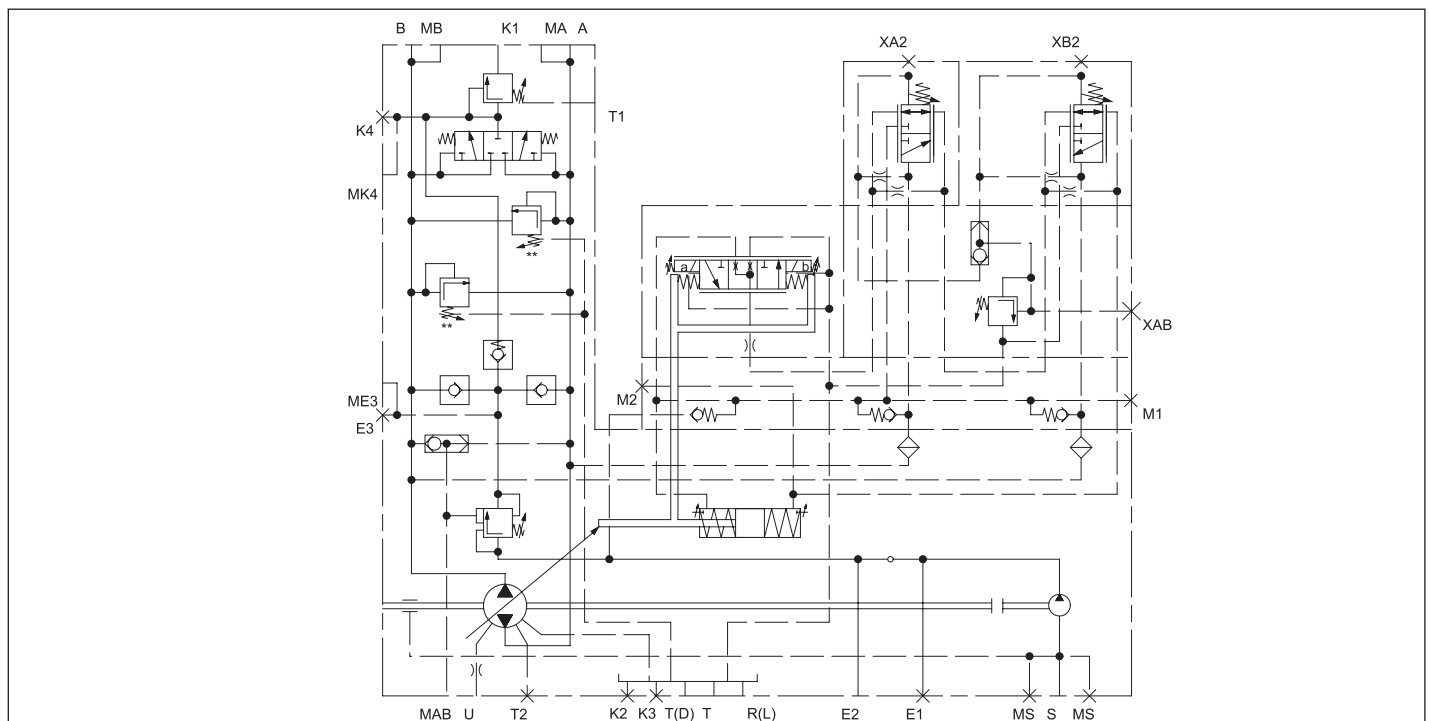


Fig. 26: Hydraulic circuit for SP 750

Through drive

Hägglunds SP can be supplied with through drive despite the integrated boost pump, in accordance with the type code for tandem combinations on page 2. When ordering combination pumps, the type designations of the 1st and 2nd pump must be connected by a “+”.

- Order example:
SP 355+250 SR-V-EP2437763

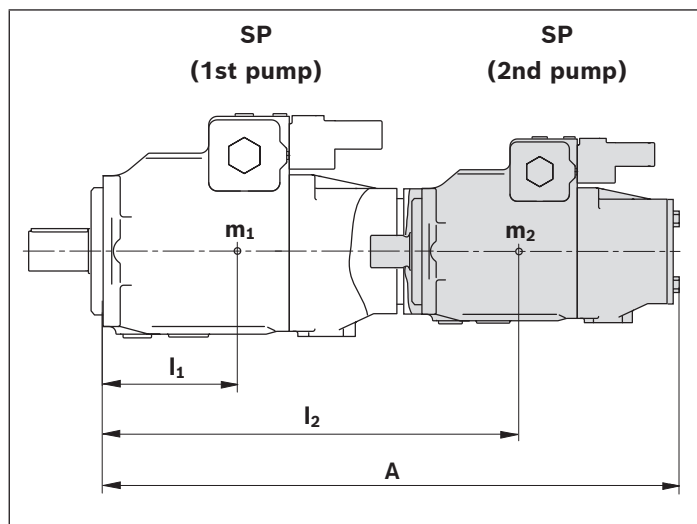


Fig. 27: Tandem pump

Through drive kit

The scope of delivery include: hub, mounting bolts, seal and, if applicable, an intermediate flange. See Table 18 for material numbers to the different through drive kits.

End cover

All single pumps are equipped with end cover, a fluid-tight, pressure-tight cover. In tandem combination is this removed from the 1st pump and replaced with through drive.

$$T_m = (m_1 \cdot l_1 + m_2 \cdot l_2 + m_3 \cdot l_3) \frac{1}{102} \text{ [Nm]}$$

m_1, m_2 [kg]
 l_1, l_2 [mm]

Table 16: Total length A

SP (1st pump)	SP (2nd pump with end cover)		
	250	355	500
250	1079 mm	–	–
355	1086 mm	1114 mm	–
500	1143 mm	1150 mm	1235 mm

Table 17: Permissible mass torque

Size			250	355	500	750
Permissible mass torque	T_m	Nm	9300	9300	15600	19500
Permissible mass torque for dynamic mass acceleration $10g \triangleq 98.1 \text{ m/s}^2$	T_m	Nm	930	930	1560	1950
Weight	$m_1, m_2^{*)}$	kg	260	275	390	520
Distance from center of gravity	l_1	mm	270	280	300	330
	l_2	mm	See Table 18			

*) For SP 40 to SP 180 see RE 15328

Overview of mounting options on SP

Table 18: Through drive kit for SP combinations

First pump	Second pump ¹⁾	Material number through drive kit ¹⁾	l ₂ mm
250	40	R902463213	692
250	71	R902454043	714
250	125	R902455342	741
250	180	R902459647	751
250	250	R902430247	817
355	40	R902463213	699
355	71	R902454043	721
355	125	R902455342	748
355	180	R902459647	758
355	250	R902430247	824
355	355	R902424579	855
500	40	R902466240	735
500	71	R902466238	757
500	125	R902454402	784
500	180	R902459654	794
500	250	R902424238	881
500	355	R902475323	891
500	500	R902422331	911

1) Hub for spline shaft according to DIN 5480 (e.g. W32)

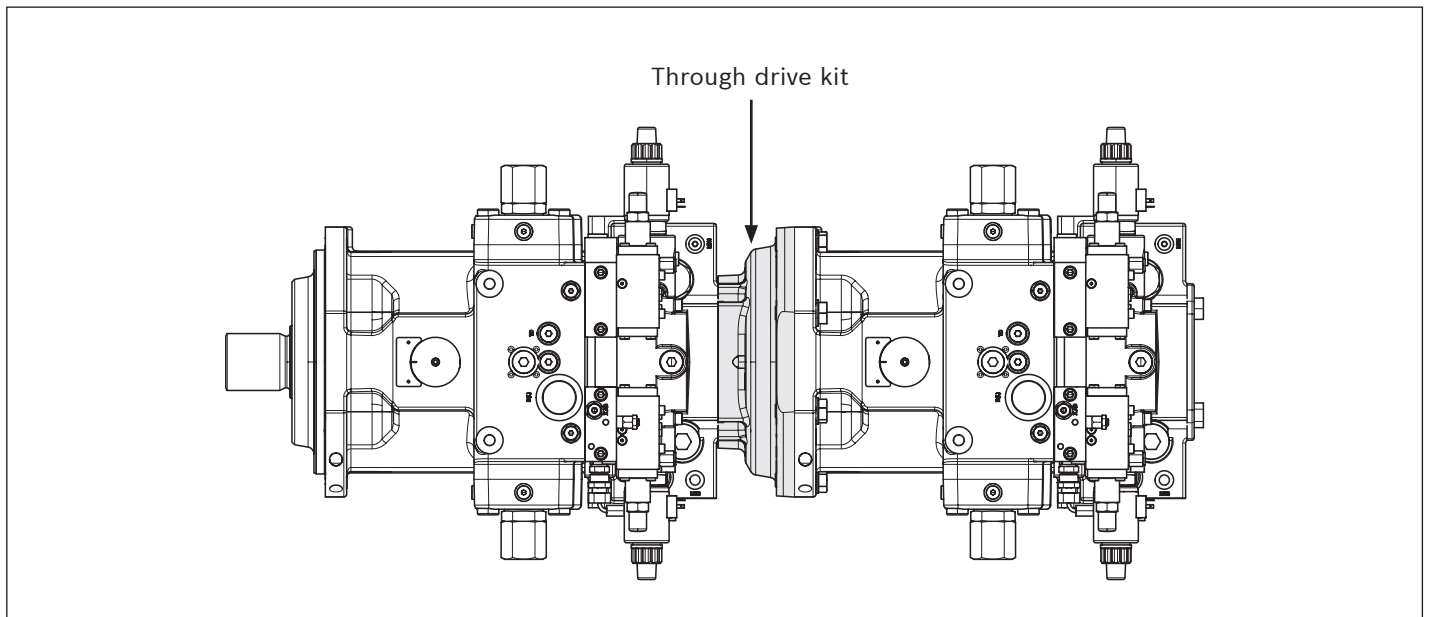


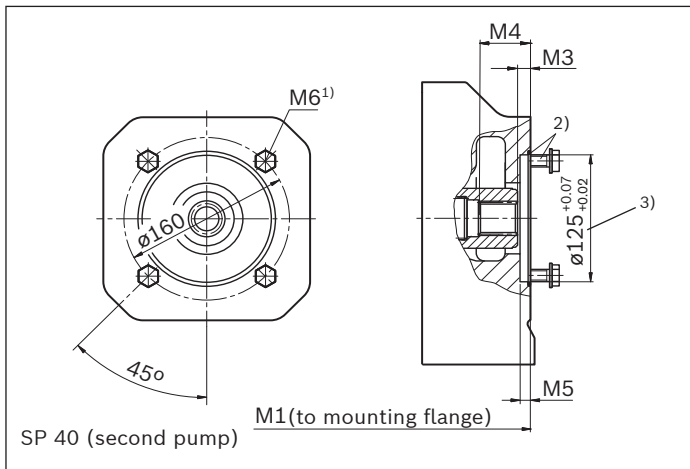
Fig. 28: Through drive kit

Dimensions through drive

Table 19: Dimensions through drive

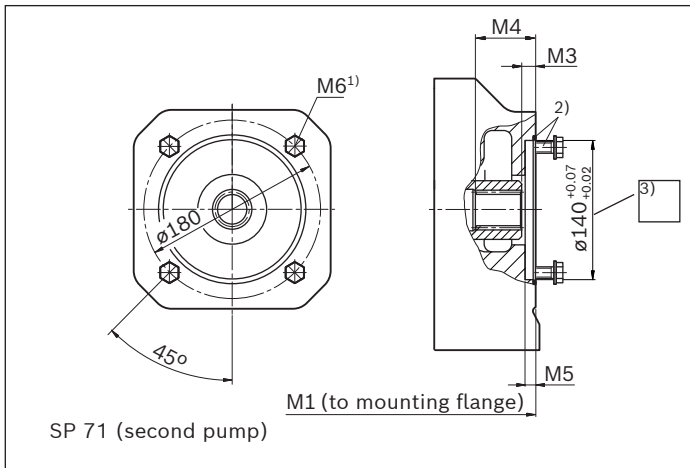
Flange ISO 3019-2 Diameter	Hub for splined shaft DIN 5480	Availability over sizes		
		250	355	500
125, 4-hole	W32x2x14x9 g	○	●	●
140, 4-hole	W40x2x18x9 g	○	○	●
160, 4-hole	W50x2x24x9 g	●	●	●
224, 4-hole	W60x2x28x9 g	●	○	○

● = Available ○ = On request



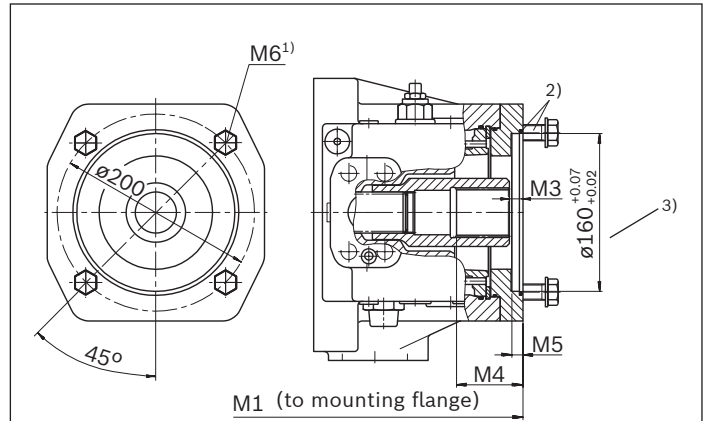
First pump Size	M1	M3	M4	M5	M6
355	539	11.5	46	10	M12; 18 deep
500	575	12.5	51	10	

Fig. 29: Dimensions through drive SP 40



First pump Size	M1	M3	M4	M5	M6
355	541	12.5	60	10	M12; 14.5 deep
500	577	14.5	50	10	

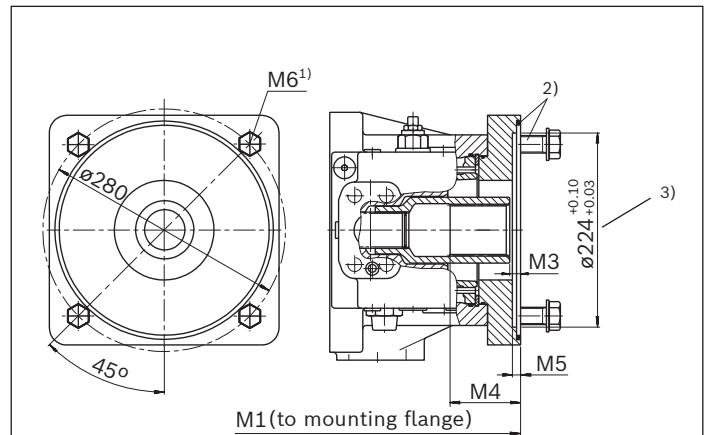
Fig. 30: Dimensions through drive SP 71



SP 125/SP 180 (second pump)

First pump Size	M1	M3	M4	M5	M6
250	531	12.5	66	10	M16; 22 deep
355	538	12.5	66	10	
500	574	12.5	67	10	

Fig. 31: Dimensions through drive SP 125/SP 180



SP 250 (second pump)

First pump Size	M1	M3	M4	M5	M6
250	547	12.5	81	8	M20; 30 deep
355	554	12.5	81	8	
500	611	12.5	81	8	

Fig. 32: Dimensions through drive SP 250

- 1) Thread according to DIN 13, see instruction manual for details on tightening torques
- 2) Four mounting bolts and O-ring seal are included in the scope of delivery.
- 3) Flange dimension second pump

Table 20: Dimensions through drive

Flange ISO 3019-2 Diameter	Hub for splined shaft DIN 5480	Availability over sizes		
		250	355	500
224, 4-hole	W70x3x22x9 g	○	●	●
315, 8-hole	W80x3x25x9 g	○	○	●

● = Available ○ = On request

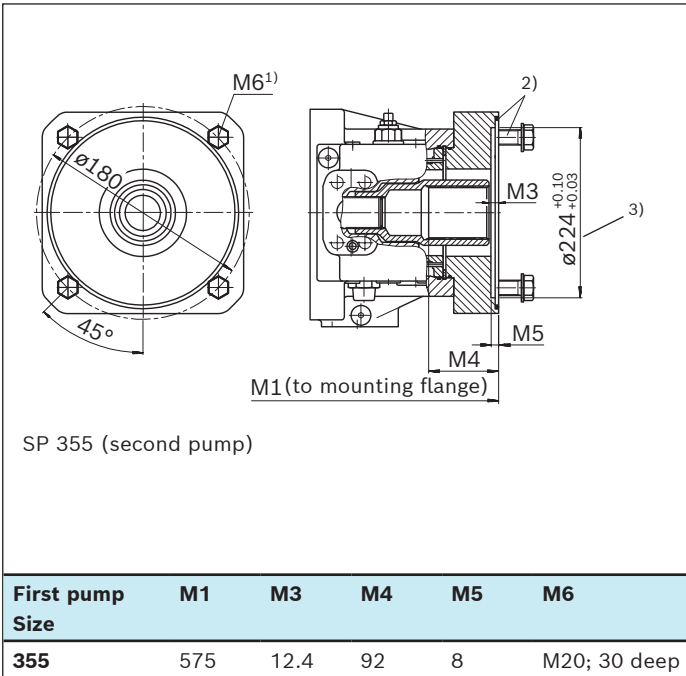


Fig. 33: Dimensions through drive SP 355

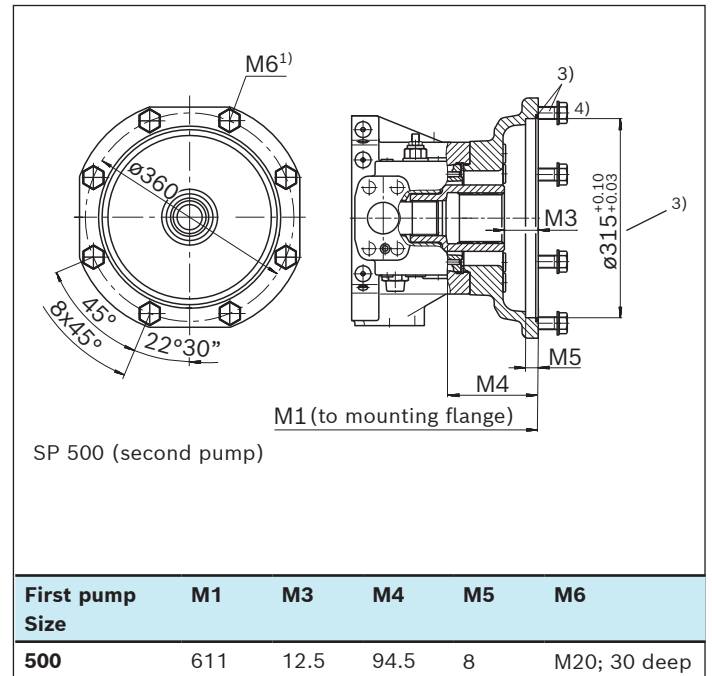


Fig. 34: Dimensions through drive SP 500

- 1) Thread according to DIN 13, see instruction manual for details on tightening torques
- 2) Four mounting bolts and O-ring seal are included in the scope of delivery.

- 3) Flange dimension second pump
- 4) Eight mounting bolts and O-ring seal are included in the scope of delivery.

Integrated boost pump and valve technology

(see Fig. 36 for position references)

Pressure compensator valve (Pos. 2)

The SP pump has one common internal pressure compensator relief valve (2) for both sides, A and B. For different pressure setting between the sides, two external pressure relief valves must be added. The valves are connected to XA (A-port compensator setting) and XB (B-port compensator setting). The external valves must be drained to tank.

Observe that relief valve (2) must be set on a higher pressure level than the two external relief valves. These relief valves must be ordered separately and must be installed on site. (They are not mounted on the pump) (Spare part pump). If pump is in a new manufacturing of a drive unit then these will of course be mounted in the drive unit.

Standard value that is set on pressure compensation is 350 bar, if other value is needed add a comment when ordering the pump.

High-pressure relief valve (Pos. 5)

Two pilot-operated pressure relief valves use pressure limitation to prevent damage to the hydraulic pump resulting from overpressure. A pressure relief valve is assigned to each pressure side.

Protection is provided by reducing the high pressure to the low pressure side.

The pressure limitation is set by default to pressure compensator (2) + 40 bar, if another setting is required add that as a comment when order the pump.

Boost pressure

To prevent damage to the system, low pressure monitoring is recommended, which monitors the static pressure component. Port M_{K4} are suitable, also M_{E3} can be used. In this datasheet all values for charge pressure monitoring are referred to M_{K4} . For normal operations, 15bar (measured in M_{K4}) charge pressure is set. For operation in applications where dynamic pressure drops may occur a higher charge pressure value must be set.

The series 33 pumps can have 10 bar, but the lowest allowed pressure 8 bar (under 2 seconds) is the same for both series 30 and 33, so in practice the level 15 bar is also used for series 33 pumps.

For shock load applications use an accumulator in K_4 .

Integrated boost pump (Pos. 9)

Sizes see Table 1

Control pressure relief valve (for EP and HD) (Pos. 8)

Direct operated, high-pressure-related relief.

At low working pressure, the auxiliary pump pressure is regulated to the set value (e.g. 32 bar). This pressure is needed by the HD and EP controls to swivel out reliably. Using this valve saves the use of a separate control pressure pump.

If the working pressure exceeds the pressure of the boost pump, control is provided by the check valve via the high pressure. At the same time, the increase in working pressure relieves the control pressure relief valve.

The boost pump pressure is hereby reduced to the set boost pressure (e.g. 15 bar).

This function leads to energy savings, improved efficiency and a longer service life of the auxiliary pump.

For setting values, see Table 6.

Control fluid filter (Pos. 10)

The HD and EP controls of the sizes 500 and 750 with internal control pressure supply from the high pressure are equipped with 0.2 mm coarse dirt filters as standard.

Flushing valve (Pos. 4)

To open the flushing valve safely, the pressure differential between **A** and **B** is required, as shown in Fig. 35. The required pressure differential depends on the rotational speed and the size. The circuit temperature needs to be monitored to avoid any damage to the system.

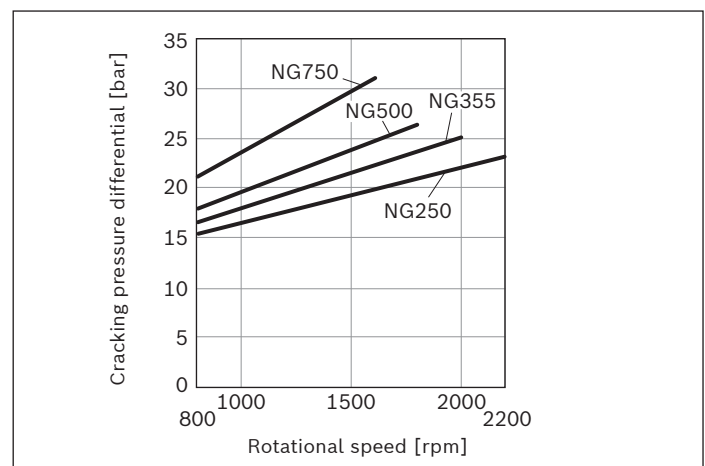


Fig. 35: Cracking pressure differential for flushing valve

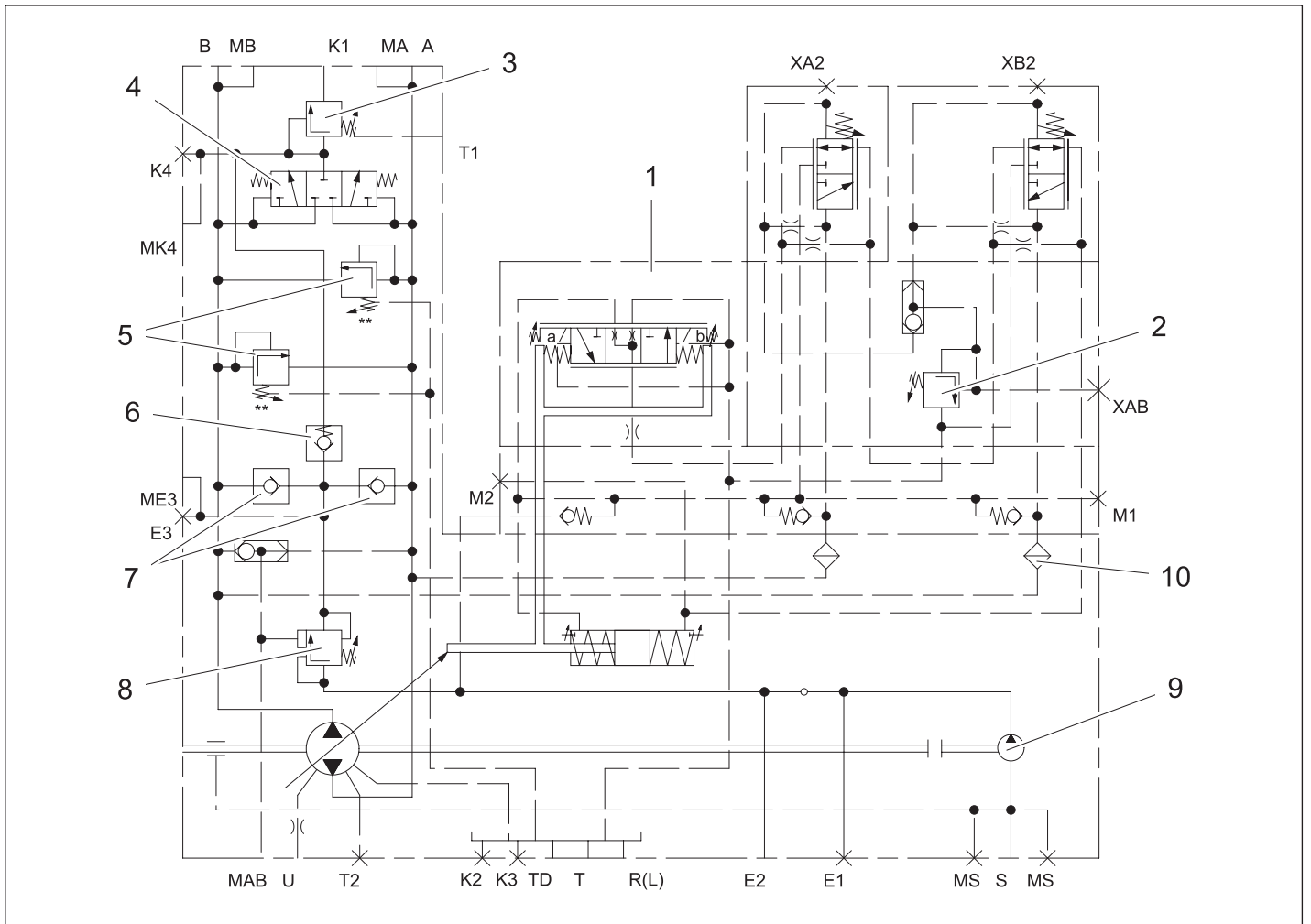


Fig. 36: Example circuit diagram SP 500

Table 21: Component descriptions

Components	
1	EPG control
2	Pressure relief valve
3	Boost-pressure relief valve
4	Flushing valve
5	High-pressure relief valves
6	Bypass valve
7	Boost check valves
8	Control pressure relief valve
9	Integrated boost pump
10	Control fluid filter for HD and EP (sizes 500 and 750)

External boost pressure supply

Without integrated boost pump

Port **E₂** is used for flow from external charge pump. SP-pump without internal charge pump, a dummy kit is installed where the internal charge pump should be, S-port is plugged and channel between **E₁** and **E₂** is plugged, see Fig. 37.

SP-pumps that have active flushing of shaft seal (series 33) must be handled different compared to series 30 (No active flushing). Fig. 38 shows an extra line to **E₄** and **T₂** connected to tank. To achieve flushing and drainage the pump must be fitted with plugs, shown in Fig. 38).

Note!

Instructions above must be fulfilled to avoid damage of the pump!

For the location and dimensions of the port **E₂**, see Fig. 40 and Table 24

Table 22: Connections

Ports		P_{max} [bar]	State
E₂	Boost pressure supply for version without filter	40	O
A, B	Working line (pressure port)	400	O
S	Suction port (only for version F)	30	O
M_A, M_B, M_{AB}	Measuring working pressure A/B	400	X
M_S	Measuring suction	30	X
T	Fluid drain	4	X
T₂	Drain active flushing	4	X
E₁	Filter, supply	40	X
E₂	Filter, return (for version with filter)	40	X
E₃	Boost pressure supply	40	X
E₄	Inlet active flushing	40	X
K₁	Flushing port	5	O
K₂, K₃	Fluid filling + air bleeding	4	X
R(L)	Return flow (drain port)	4	O
U	Bearing flushing	7	X
M_{E3}	Measuring boost pressure	40	X
K₄	Accumulator port	40	X
M_{K4}	Measuring boost pressure	40	X
M₁	Measuring stroking chamber pressure	400	X
M₂	Measuring stroking chamber pressure	400	X

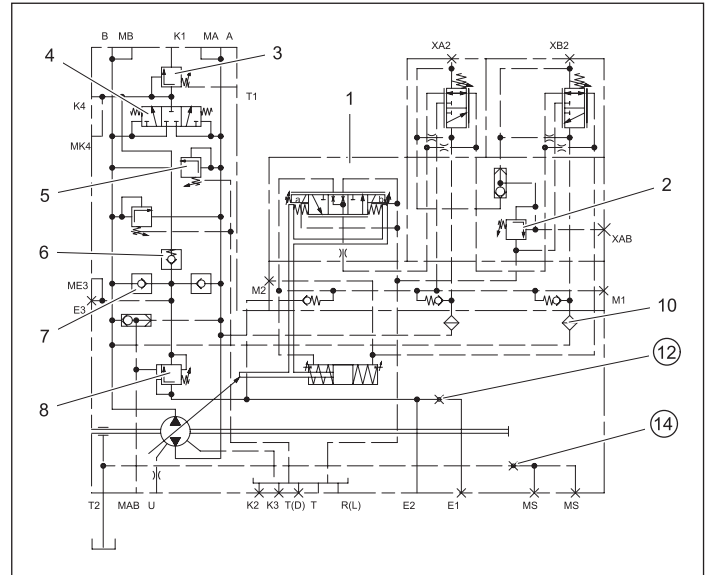


Fig. 37: Example circuit diagram SP 500 S30 without integrated charge pump

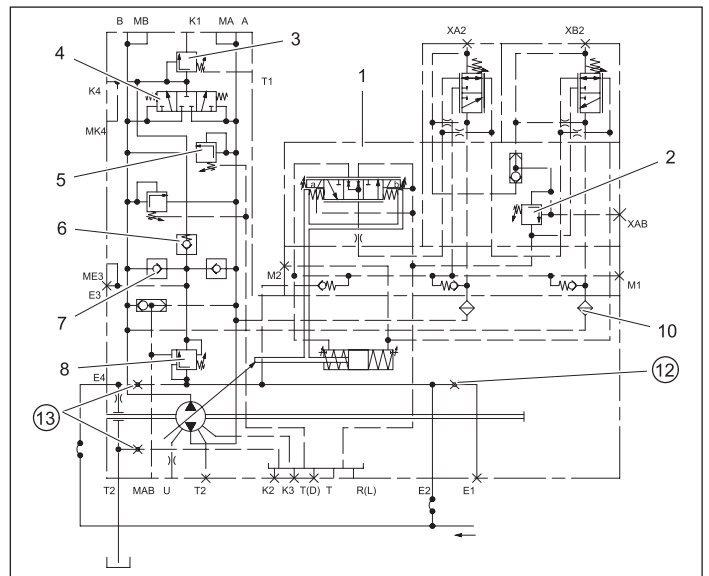


Fig. 38: Example circuit diagram SP 500 S33 without integrated charge pump

Table 23: Component descriptions

Components	
1	EP control
2	Pressure relief valve
3	Boost-pressure relief valve
4	Flushing valve
5	High-pressure relief valves
6	Bypass valve
7	Boost check valves
8	Control pressure relief valve
10	Control fluid filter for HD and EP (sizes 500 and 750)
12, 13, 14	Plug (observe different sizes)

Filtration types¹⁾

Regardless of the selected boost circuit filtration, the HD and EP controls in sizes 500 and 750 are equipped with 0.2 mm control fluid coarse dirt filters as standard (see Fig. 39, pos 10.)

Without filter in the boost circuit

SP pumps are normally not configured for boost circuit filtration.

Ports **E₁** and **E₂** are delivered plugged, pressure-proof and internally connected.

Ports for external boost circuit filtration

A boost circuit filter can be connected to these ports later on (see Fig. 39 pos 11).

Ports **E₁** and **E₂** are intended for a filter port.

The internal passage between **E₁** and **E₂** must be plugged (pos. 12) for this purpose.

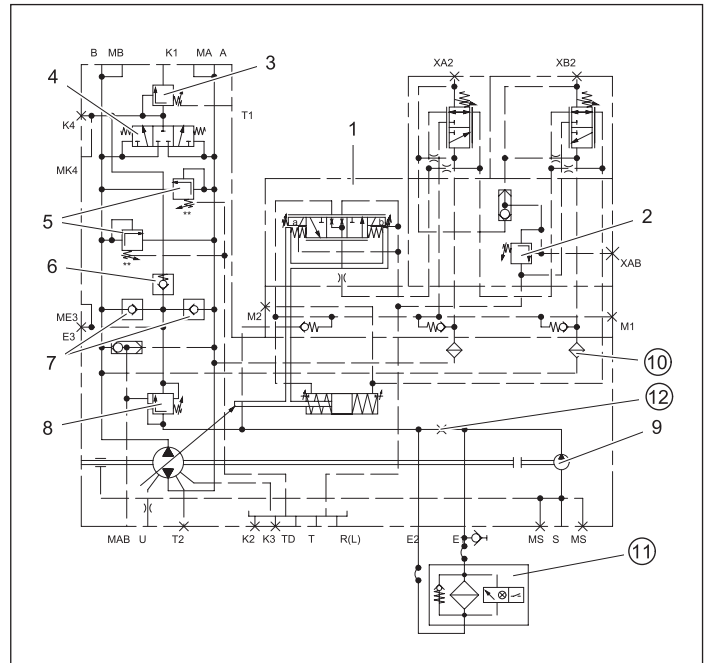


Fig. 39: Example Circuit diagram SP 500¹⁾

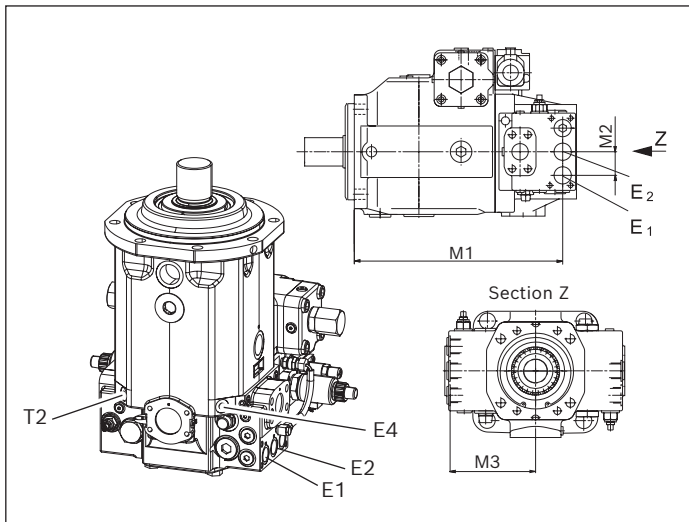


Fig. 40: Port locations

Table 24: Distance and port dimensions

Size	M1	M2	M3	Port E1/E2
250	477	55	193	1 5/16-12UNF-2B 18 deep
355	484	55	193	1 5/16-12UNF-2B 18 deep
500	520	55	193	1 5/16-12UNF-2B 18 deep
750	585	55	194	1 5/16-12UNF-2B 18 deep

Table 25: Max pressure in filtration ports

Ports		p_{max} [bar]
E1	Filter, supply	40
E2	Filter, return	40

Table 26: Component description

Components	
1	EPG control
2	Pressure relief valve
3	Boost-pressure relief valve
4	Flushing valve
5	High-pressure relief valves
6	Bypass valve
7	Boost check valves
8	Control pressure relief valve
9	Integrated boost pump
10	Control fluid filter for HD and EP (sizes 500 and 750)
11	Filter with bypass
12	Plug

1) For components see Table 26 and ports, Table 12, Table 13, Table 14 and Table 15

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.

With particular regard to the “drive shaft upwards” installation position, we recommend bearing flushing to lubricate the front bearing and shaft seal at port **U**. See page 5.

The leakage in the housing area must be directed to the reservoir via the highest drain port (**T**, **R(L)**, **K₂**, **K₃**).

If a shared drain line is used for several units, make sure that the respective case pressure 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 operational conditions, particularly at cold start. If this is not possible, separate reservoir lines must be installed if necessary.

To achieve favorable noise values, decouple all connecting lines using elastic elements and avoid above-reservoir installation.

In 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 overall loss of pressure, it must not, however, be higher than $h_{s\ max} = 800\ \text{mm}$. The minimum suction pressure at port **S** must also not fall below 0.8 bar absolute during operation.

For external boost pressure supply please refer to the attachment pump data sheet for details on the minimum suction pressure.

When designing the reservoir, ensure that there is adequate spacing between the suction line and the drain line. This minimizes oil turbulence and carries out degassing, which prevents the heated hydraulic fluid from being sucked directly back in again.

Installation position

See the following examples (1 to 8) in Fig. 41 to Fig. 48. Further installation positions are available upon request. Usually in Hägglunds Drive Units the installation example 4 in Fig. 44 is used

Note!

You can expect installation examples **2**, **3**, **6** and **7** to affect the closed loop control. Due to gravity, dead weight and case pressure, minor characteristic shifts and actuating time changes may occur.

Table 27: Important ports and distances when pump is installed

Key	
S	Suction port
T , K₂ , K₃ , R(L)	Fluid filling + air bleeding (drain port)
A , B	Pressure port
U	Bearing flushing port
SB	Baffle (baffle plate)
h_{t min}	Minimum required immersion depth (200 mm)
h_{min}	Minimum required distance to the reservoir bottom (100 mm)
h_{s max}	Maximum permissible suction height 800 mm. To be sure always check boost pump specification!

Below-reservoir installation (recommended)

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

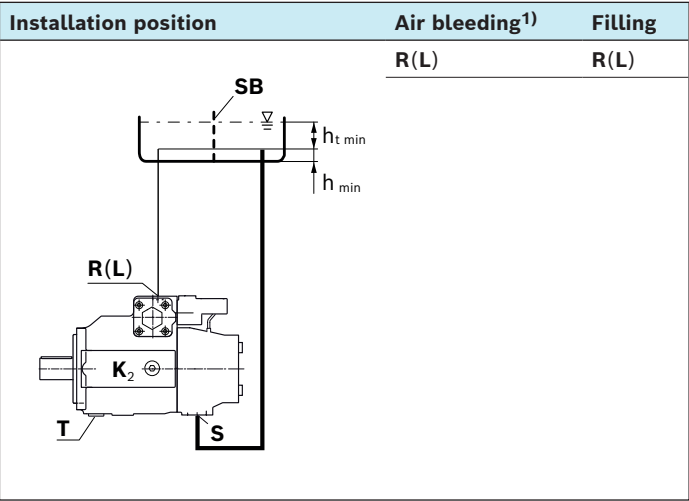


Fig. 41: Example 1

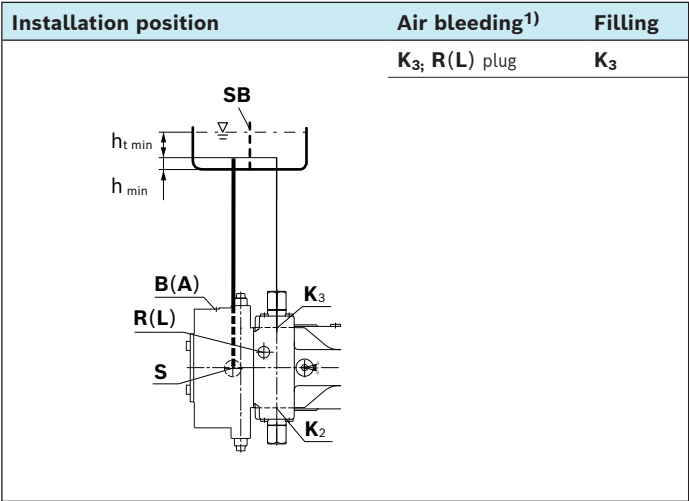


Fig. 43: Example 3

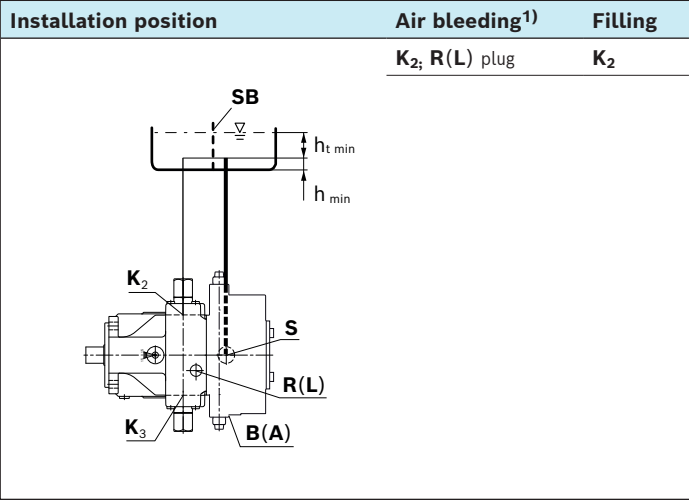


Fig. 42: Example 2

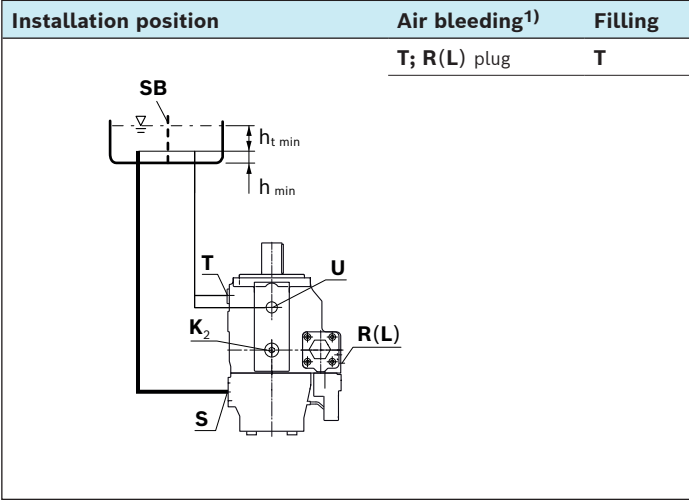


Fig. 44: Example 4

1) To air bleed the stroking chamber, use the highest port on the control (see control data sheet)

Above-reservoir installation

Above-reservoir installation means that the axial piston unit is installed above the minimum fluid level of the reservoir.

A check valve in the drain line is to be avoided. Exceptions may be permissible, please contact your Bosch Rexroth representative.

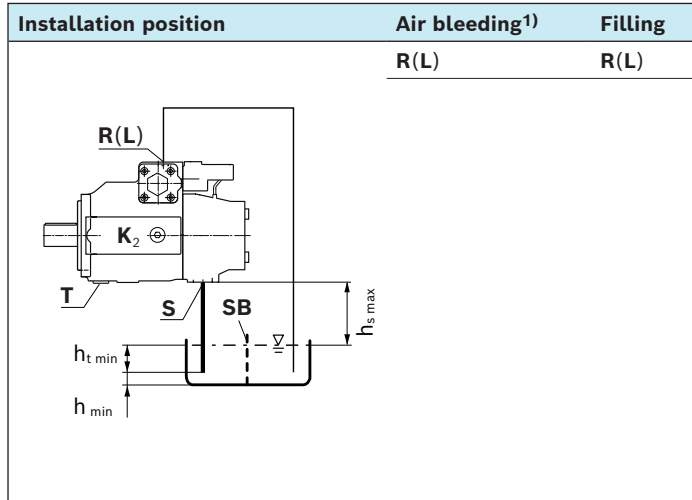


Fig. 45: Example 5

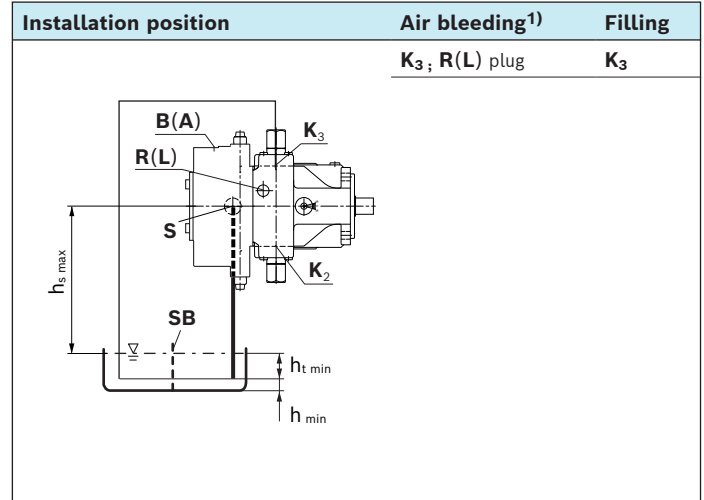


Fig. 47: Example 7

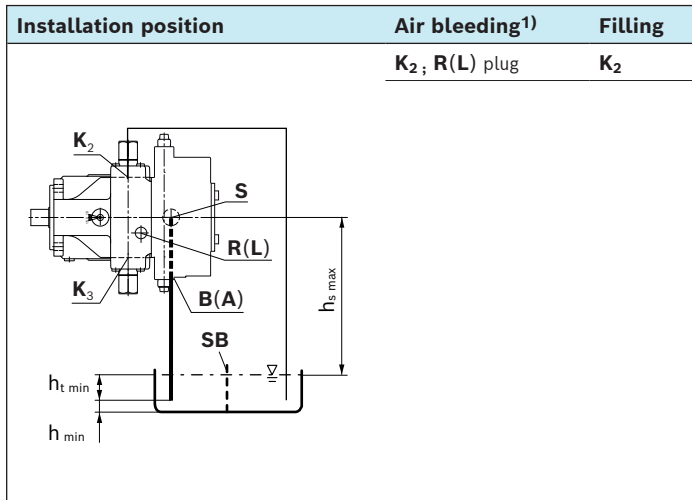


Fig. 46: Example 6

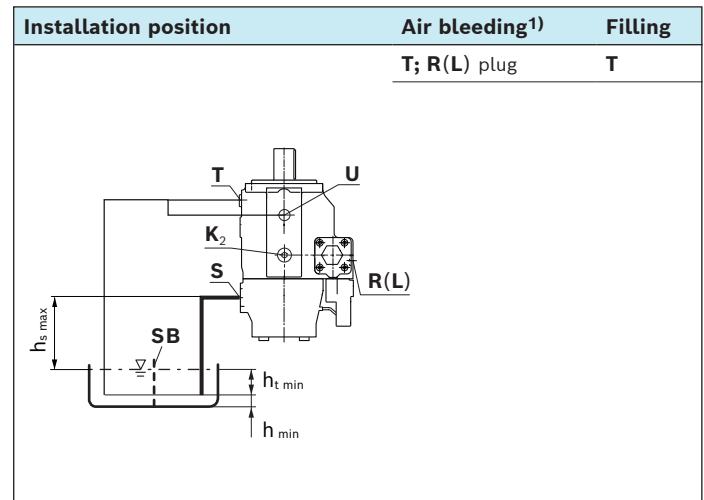


Fig. 48: Example 8

1) To air bleed the stroking chamber, use the highest port on the control (see control data sheet)

Project planning notes

- ▶ The pump SP is designed to be used in closed circuit.
- ▶ The project planning, installation and commissioning of the axial piston unit requires the involvement of qualified skilled personnel.
- ▶ Before using the axial piston unit, please read the corresponding instruction manual ([92105-01-B](#)) completely and thoroughly. If necessary, this can be requested from Bosch Rexroth.
- ▶ The specified data and notes contained herein must be observed.
- ▶ Preservation: Our axial piston units are supplied as standard with preservative protection for a maximum of 12 months. If longer preservative 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 in the instruction manual.
- ▶ Depending on the operating conditions of the axial piston unit (working pressure, fluid temperature), the characteristic curve may shift.
- ▶ Not all versions of the product are approved for use in a safety function according to ISO 13849. Please consult the responsible contact person at Bosch Rexroth if you require reliability parameters (e.g. MTTF_d) for functional safety.









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. impure hydraulic fluid, abrasion, or residual dirt from components). As a result, the hydraulic fluid flow and the build-up of torque in the axial piston unit can no longer respond correctly to the operator's specifications. Even the use of various filter elements (external or internal flow filtration) will not rule out a fault but merely reduce the risk. The machine/system manufacturer must test whether remedial measures are needed on the machine for the application concerned in order to bring the driven consumer into a safe position (e.g. safe stop) and ensure any measures are properly implemented.

Related documents

For more information of pump in drive systems see documents in *Table 28*

Table 28: Related documents

Title	Document no	Document type
 Hägglunds DUE drive unit	RE 15325	Data sheet
 Hägglunds DUC drive unit	RE 15326	Data sheet
 Hydraulic Fluids Based on Mineral Oil and Related Hydrocarbons	90220	Data sheet
 Environmentally Acceptable Hydraulic Fluids	90221	Data sheet
 Axial piston variable pump A4CSG Series 3x	92105	Data sheet
 Hägglunds DUE drive unit	RE 15325-WA	Installation & Maintenance manual
 Hägglunds DUC drive unit	RE 15326 WA	Installation & Maintenance manual
 Axial piston variable pump A4CSG series 3x	92105-01-B	Instruction manual

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