



HYDRAULIC COMPONENTS
HYDROSTATIC TRANSMISSIONS
GEARBOXES - ACCESSORIES



Certified Company ISO 9001:2015 - 14001:2015

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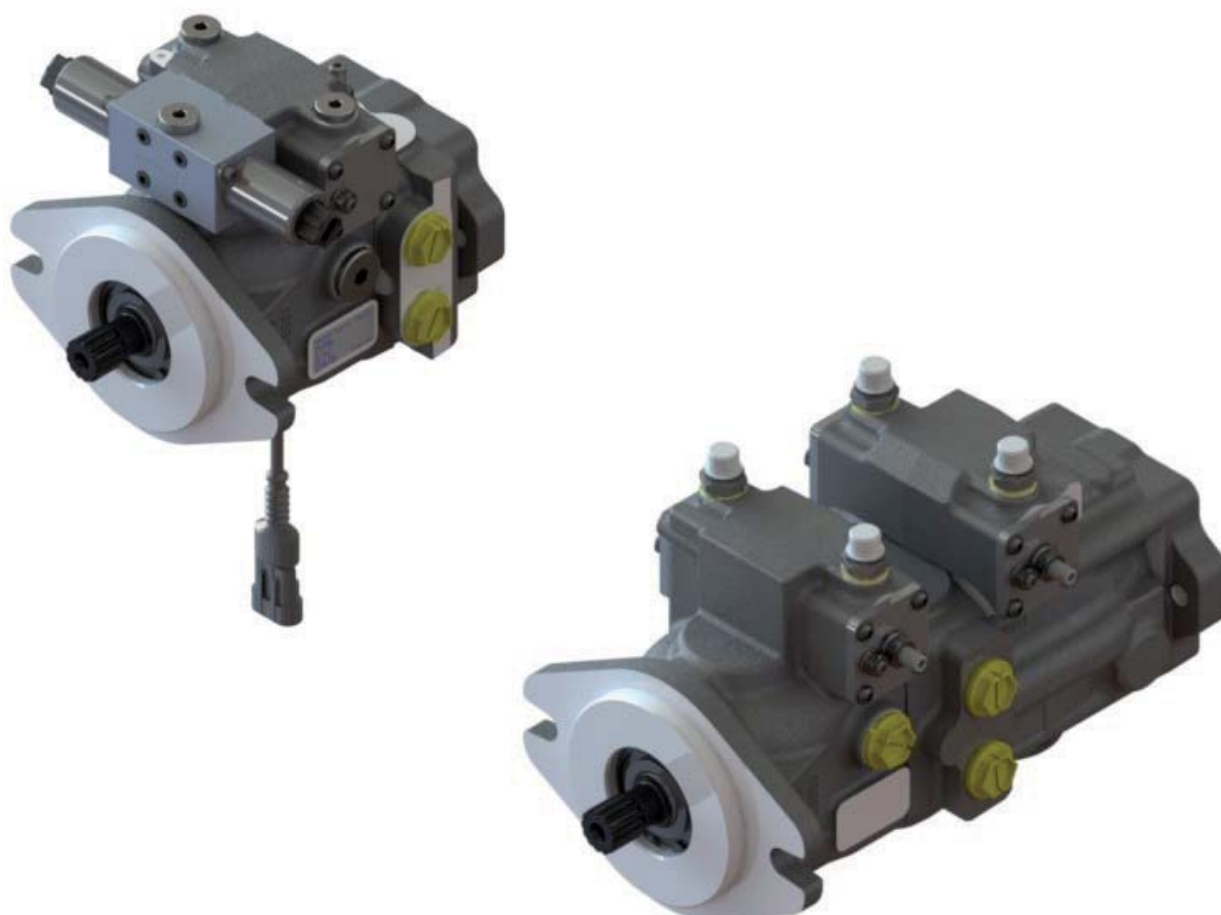
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HT 16 / M / 1017 / 1218 / E

THE PRODUCTION LINE OF HANSA-TMP

Variable Displacement Closed Loop System Axial Piston Pump

TPV - TPVTC 1500



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GENERAL INFORMATION

- The new TPV-TPVTC 1500 pumps are variable displacement axial piston pumps with swash-plate system, for closed loop hydrostatic transmissions, that offer the best power to weight ratio because of new innovative design and production technologies.
- The flow rate is proportional to the rotation speed and is continuously variable according to the angle of the swash-plate from "0" to maximum displacement.
- The TPV-TPVTC 1500 pumps are equipped with a boost pump, "gerotor" type of new design and high efficiency to keep the circuit pressurised, to compensate the oil leakages of the hydrostatic transmission, to avoid cavitation of the piston pump and to supply low pressure oil flow to the remote controls of the pumps and of the hydraulic transmission (max 3 MPa).
- Different types of hydraulic or proportional controls are available for remote regulation of the pump displacement by means of hydraulic or electric joysticks.
Pumps are also available with integrated sensors for the control of the speed, of the angular position of the swash-plate and of the oil pressure. These sensors allow a complete remote control of the pump by an external electronic system.
The mounting flange is according to SAE-B 2 bolt, the through-drive is according SAE-A 2 bolt.
Different other optionals are available for the TPV-TPVTC 1500 pumps.
- The piston pumps are to be considered as individual components for the purposes of Directive 98/37/EC, therefore have been built to be integrated into a circuit or to be assembled with other components to form a machine or system. They can be operated only after they have been installed in the machine/system which they are intended for.
- The TPV-TPVTC 1500 pumps must be used to create, manage and regulate oil flow in a closed loop system. Any other use should be considered improper.
- The pumps are built according to the technology normally used for this type of product. There is the risk of injury or damage to personnel during their installation and use if you do not respect the normal safety instructions or if used by untrained personnel.
- Before use, please read the Use and Maintenance Manual.

TECHNICAL SPECIFICATIONS

The housing and the distributor cover of the TPV-TPVTC 1500 pumps are made in cast iron.

The flow rate is proportional to the rotation speed and the displacement is continuously variable. It increases as the swash-plate angle moves from "0" to maximum position.

If the swash-plate is positioned out of the neutral position, the flow respectively follows one of the two directions.

Typical applications

- construction equipments
- green mowers
- zero turn machines
- agricultural machines
- utility vehicles
- forest vehicles
- logistic machines

Key features

- compact design
- integrated optionals
- high power to weight ratio
- low noise integrated boost pump

PUMP MODEL		TPV 17-9	TPV 18-9	TPV 19-9	TPV 21-9
Max. displacement	cm ³ /n	17,6	18,7	19,9	21,1
Flow rate ⁽¹⁾	l/min	59,6	63,3	67,4	73,6
Power ⁽¹⁾	kW	32	34	36	38
Boost pump displacement	cm ³ /n	5,8			
Continuous working pressure	MPa	30			
Max. pressure	MPa	35			
Max. relief valve setting	MPa	40			
Boost pressure relief valve setting ⁽²⁾	MPa	2			
Suction pressure	MPa	> = 0,08			
Max. housing pressure	MPa	0,2			
Minimum pump shaft speed	n/min	500			
Max. pump shaft speed	n/min	3.600			
Max. pump shaft peak speed	n/min	3.800			
Max. fluid temperature	°C	80			
Fluid viscosity	cSt	15-40			
Fluid contamination level		19/17/14 ISO 4406 (NAS 8)			
Weight dry (single pump) ⁽³⁾	kg	version SEI 14,5		version SHI 13	
Weight dry (tandem pump) ⁽³⁾	kg	version SEI 23,2		version SHI 21,3	

(1) 3.600 n/min and 30 MPa

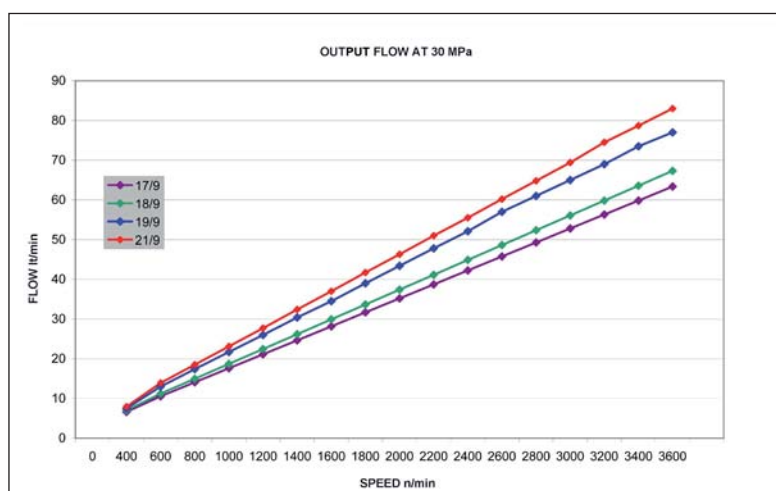
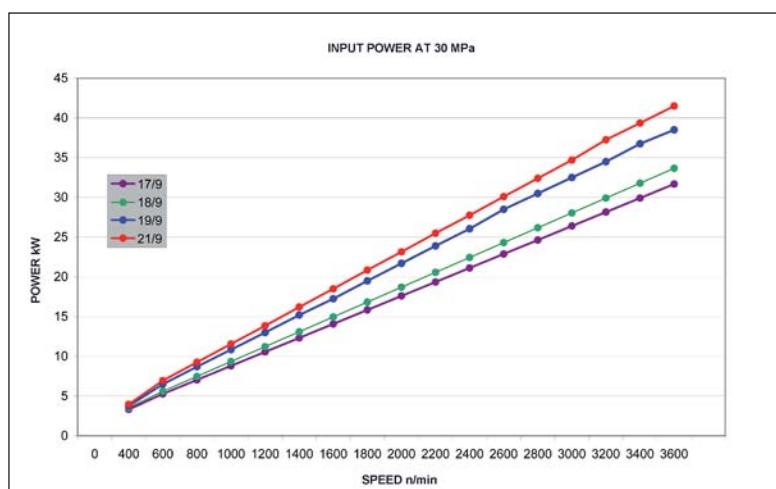
(2) 1.000 n/min

(3) Approximate values, the weight may vary depending on configuration and accessories

SYSTEM DESIGN PARAMETERS

HYDRAULIC MEASURE	USEFUL FORMULAS	CONVERSION FACTORS
Flow rate: Q = (l/min)	$Q = V [\text{cm}^3/\text{n}] \times \eta_v \times n \times 10^{-3}$	1 l/min = 0,2641 US Gal/min
Pressure: P = (MPa)		1 MPa = 145 PSI
Displacement: V = (cm ³ /n)		
Torque: M = (Nm)	$M = \frac{\Delta p [\text{MPa}] \times V [\text{cm}^3/\text{n}]}{6.283 \times \eta_m}$	1 Nm = 8,851 in lbs
Power: P = (kW)	$P = \frac{\Delta p [\text{MPa}] \times V [\text{cm}^3/\text{n}] \times n}{60 \times 1000 \times \eta_t}$	1 KW = 1,36 HP
Shaft speed: n = (rpm)		
Hydraulic efficiency: = η_v		
Mechanical efficiency: = η_m		
Overall efficiency: = η_t		
		1 mm = 0,0394 in
		1 kg = 2,205 lbs
		1 N = 0,2248 lbs

PERFORMANCE DIAGRAM



Performance diagrams

- The diagrams show the data of maximum speed and maximum continuous pressure.
- Data may vary depending on pump displacement.

Pressure

- Continuous pressure: is the average pressure for continuous work, which must not be exceeded, to ensure a correct and long lasting service of the pump.
- Maximum pressure: is the maximum allowable pressure for short periods and must never be exceeded.

Speed

- Continuous work speed: is the maximum recommended speed for continuous opera-

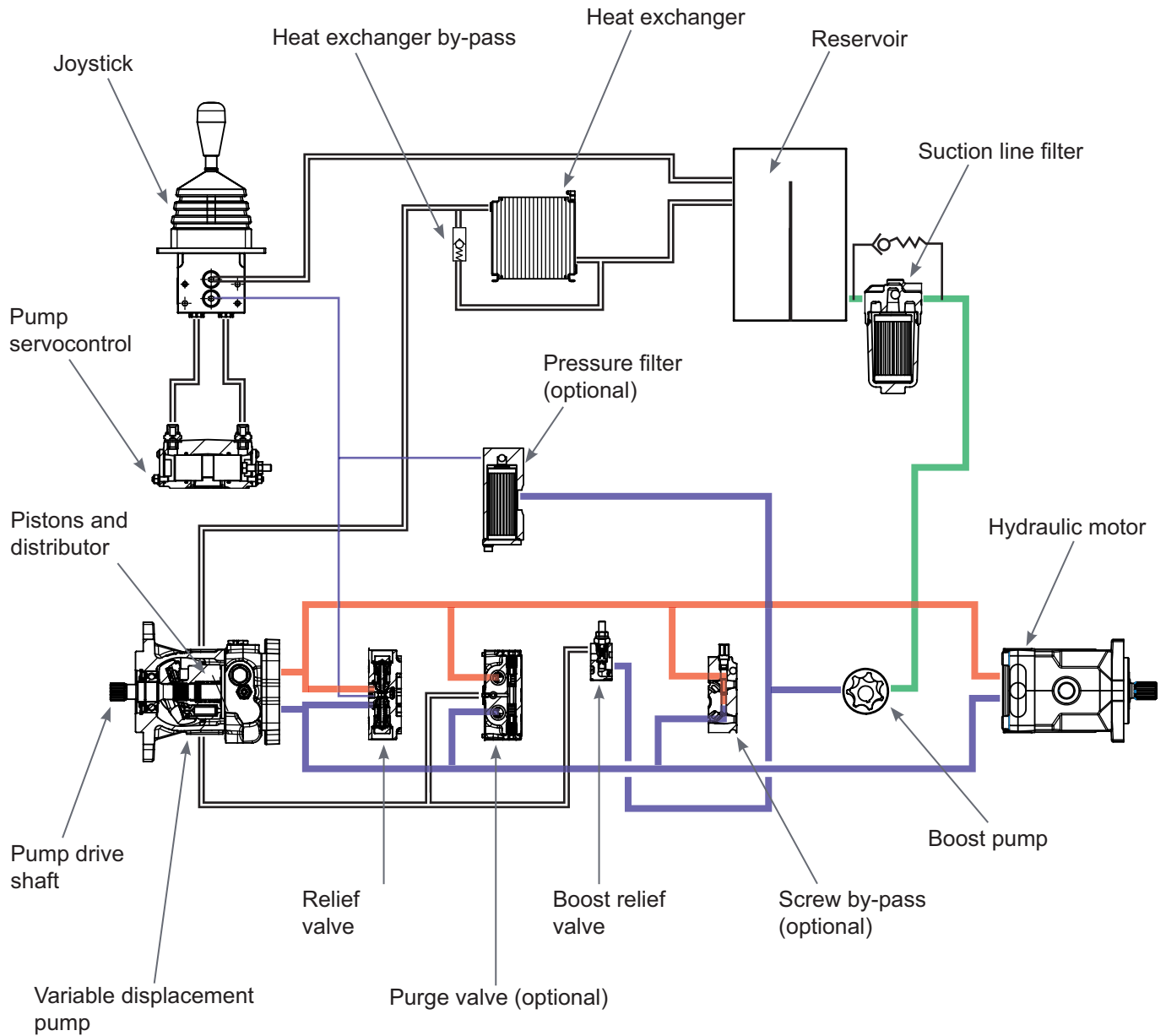
tion of the pump under full load.

- Maximum speed: is the maximum permissible speed for the pump for short periods and not fully loaded. The use of the pump with this speed can reduce the life and cause a loss of power or of the hydrostatic braking capacity.

Caution

Any damage caused to the pump can reduce or eliminate the hydrostatic braking capacity. It is therefore necessary to provide an auxiliary braking system capable of stopping and supporting the weight of the complete machine, in the event of loss of hydrostatic power.

HYDRAULIC DIAGRAM



COLOR INDICATIONS

■ LOW PRESSURE AND PILOT LINE

■ PRESSURE LINE

■ SUCTION LINE

□ DRAIN / RETURN LINE

INSTALLATION INSTRUCTIONS

Standards for the installation, start up and maintenance

- When mounting the pump above the minimum level of the tank, distance of the highest point of the pump over the oil level **MUST NOT** exceed 250 mm.
- To reduce the noise level typical of all piston pumps we recommend:
 - use hoses instead of pipes
 - limit to a minimum the length of eventual pipes
 - fix rigid pipe sections with special supports equipped with rubber vibration dampening devices
 - use pipes and hoses with a diameter according to the speed values below:

Suction line = $0,6 \div 1,2$ m / s

Drain = $1,5 \div 3,6$ m / s

Pressurized lines = max 6 m / s

- To calculate the speed of the oil in the lines refer to the formula below:

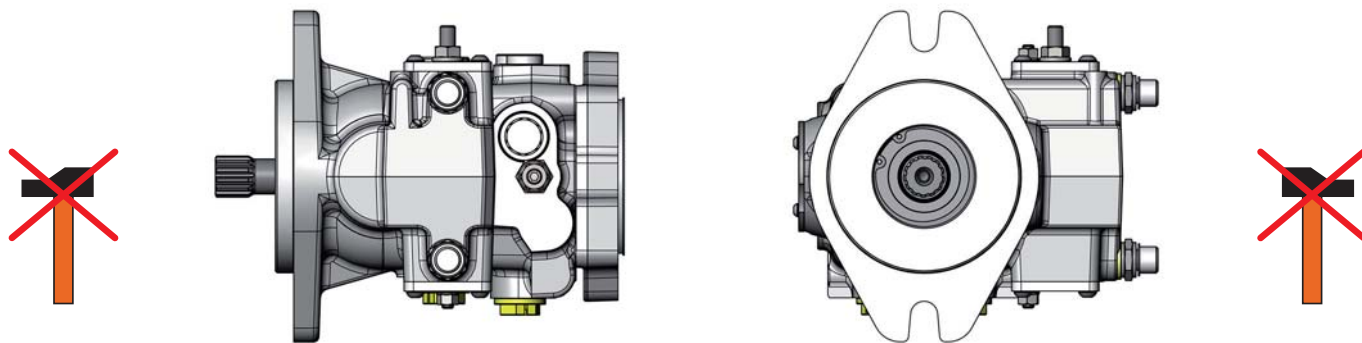
$$V = Q \cdot 21,22 / D$$

V = speed (m/s)

Q = flow rate (l/min)

D = internal pipe/hose diameter (mm)

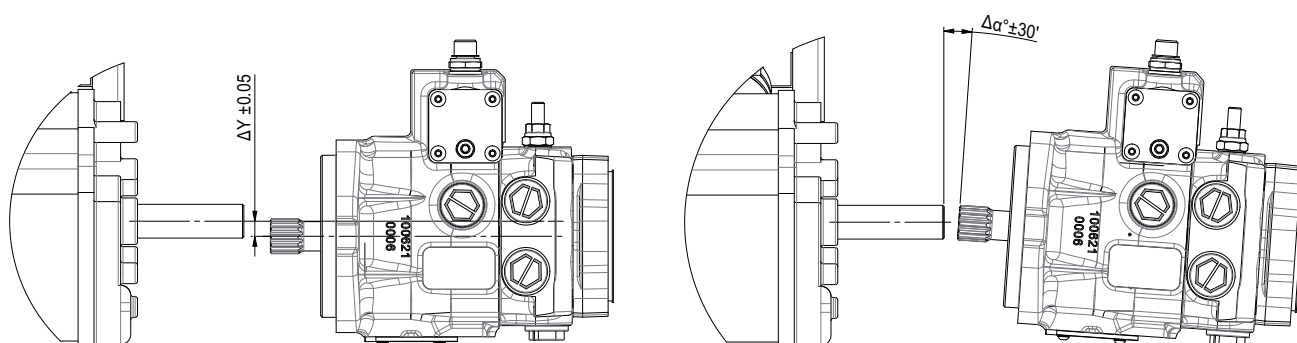
- In any case **NEVER** use pipes/hoses or fittings with diameter smaller than that of the corresponding ports on the pump. This indication is **ABSOLUTELY OBLIGATORY** for the drain line to avoid to pressurize the pump housing and extrude the lip seal of the pump shaft.
- During mounting cure the alignment of the pump, concentric with the drive shaft sleeve to prevent overloading of the bearing. See page 11.
- For the hydraulic system, we recommend using pipes/hoses washed internally with hydraulic oil or, even better, with solvent.
- Special care must be taken when cleaning the inside of the tank (painting is recommended after sand blasting).
- To improve the functionality of the boost pump, it is recommended to place it below minimum tank level.
- The pumps can be installed in any direction and position.
For further information contact our Technical Department.



(continued)

INSTALLATION INSTRUCTIONS**Shaft Coupling**

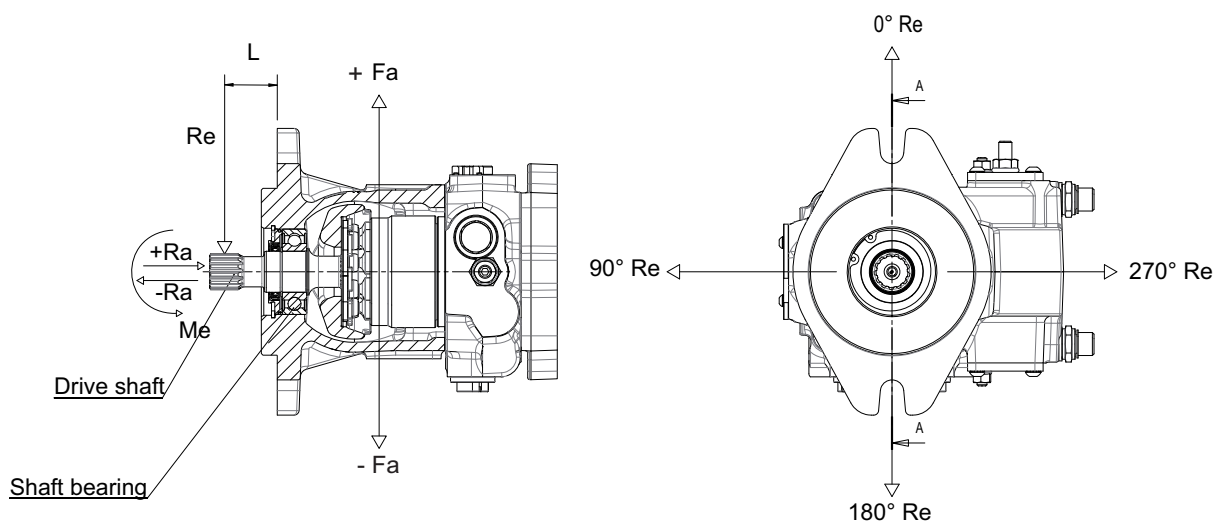
To connect the pump shaft to the engine flywheel or electric motor shaft use a flexible



coupling. The alignment must be within the tolerances indicated in the figures below. For an optimal function of the pump the shaft should not be subjected to radial or axial loads. In the presence of radial and axial loads

the maximum allowable values are shown below.

During the installation or removal, do not force the coupling of the pump shaft, but always use the threaded hole on the shaft.



		DIRECTION Re				
		ROTATION	0°	90°	180°	270°
RADIAL LOAD	Re	Right	1460 N	2500 N	4680 N	2500 N
		Left	4680 N	2500 N	1460 N	2500 N
AXIAL LOAD		+ Ra	1800 N			
		- Ra	1500 N			

(continued)

INSTALLATION

Start up

- Before starting fill the tank and the other components with new filtered oil. You should run a flushing of the complete hydraulic system (see Use and Maintenance Manual). Check that the low pressure value is correct (refer to the Use and Maintenance Manual).
- Restore the oil level in the tank.

Maintenance

- The first oil change should be made after 500 hours of operation, later change the oil every 2000 hours.
- The first replacement of the filter cartridge has to be made after 50 hours for a preliminary circuit cleaning. Then after further 500 hours.
- These frequencies have to be reduced in the case where the indicator shows the clogging of the filter cartridge and in case of operation in environments with a high level of contamination.



CAUTION

- Always work with the utmost attention to the moving parts; do not use loose or fluttering clothing.
- Do not approach rotating wheels, tracks, chains or shafts if not properly protected, or when they may start moving without notice.
- Do not loosen or disconnect fittings and pipes/hoses while the engine is running.
- Avoid oil leaks in order to prevent environmental pollution.

Load capacity of rear shaft (through drive shaft)

- The rear shaft is not able to carry radial loads.

HYDRAULIC FLUID

Viscosity

The maximum duration and the maximum efficiency are related to the optimum range of viscosity.

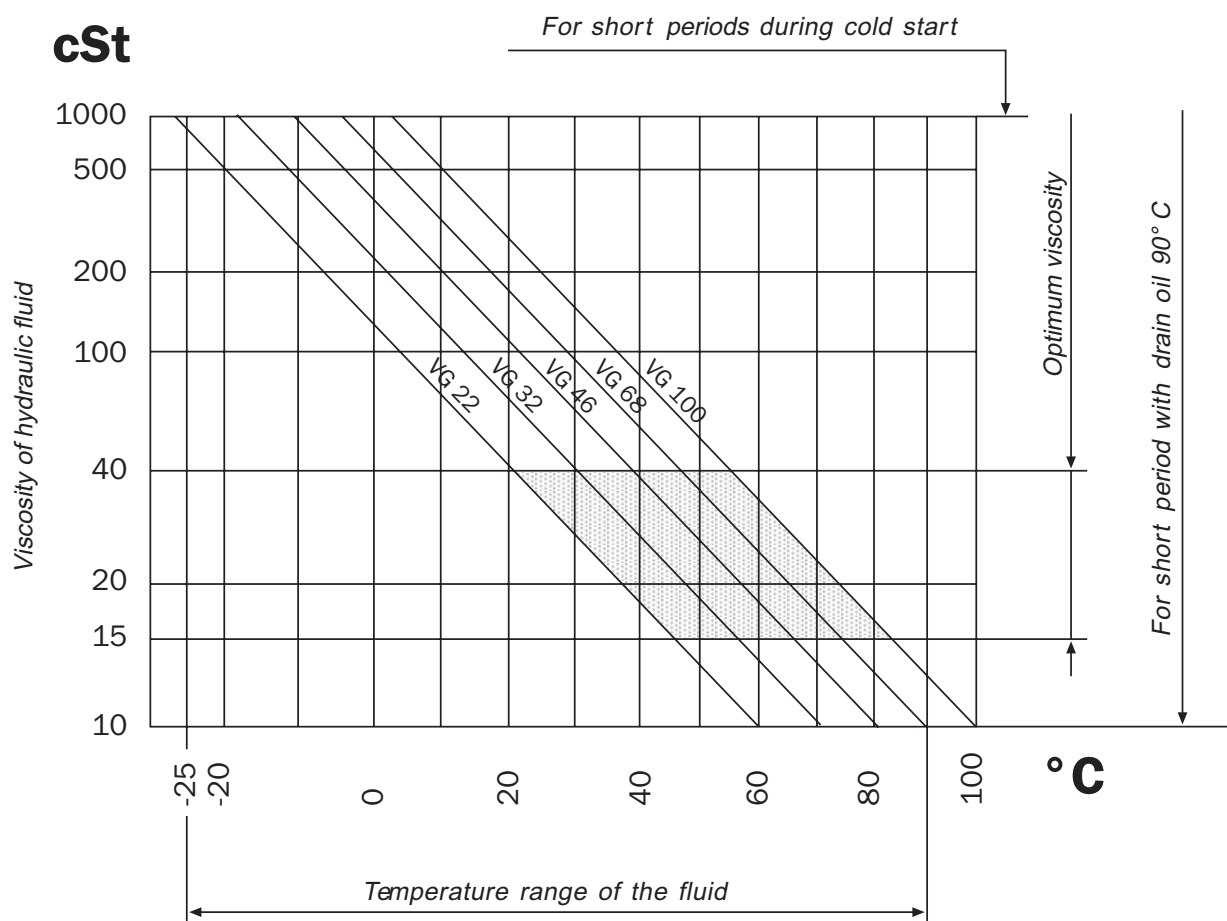
Viscosity = optimal operating viscosity 15 ÷ 40 cSt referred to the temperature of the closed circuit.

Minimum viscosity = 10 cSt for short moments and with the maximum temperature of the drain oil at 90 °C.

Max. viscosity = 1000 cSt for a few seconds, only during cold starting.

Working conditions

For working conditions apply the following limits:



HANSA - TMP cannot be held responsible concerning non compliance of these instructions and observance of safety regulations, although not covered by this document.

HYDRAULIC FLUID FILTRATION

The contaminating particles suspended in the hydraulic fluid cause the wear of the hydraulic mechanisms moving parts.

On hydraulic pumps these parts operate with very small dimensional tolerances.

In order to prolong the parts life, it is recommended to use a filter that maintains the hydraulic fluid contamination class at max.

8 according to NAS 1638

5 according to SAE, ASTM, AIA

19/17/14 according to ISO 4406

According to the type of application decided for the pump, it is necessary to use filtration elements with a filtration ratio of:

$$\beta_{(x)} 20 \div 30 \geq 75$$

making sure that this ratio does not worsen together with the increasing of the filter cartridge differential pressure. While the pump is working, its temperature increases (over 80° to 110°C) with negative effects on pump performances; as a consequence, it is important to observe a max. contamination level of:

7 according to NAS 1638

4 according to SAE, ASTM, AIA

18/16/13 according to ISO 4406

If these values cannot be secured, the component life will consequently be reduced and it is recommended to contact out Tech. Dept.

Suction filters

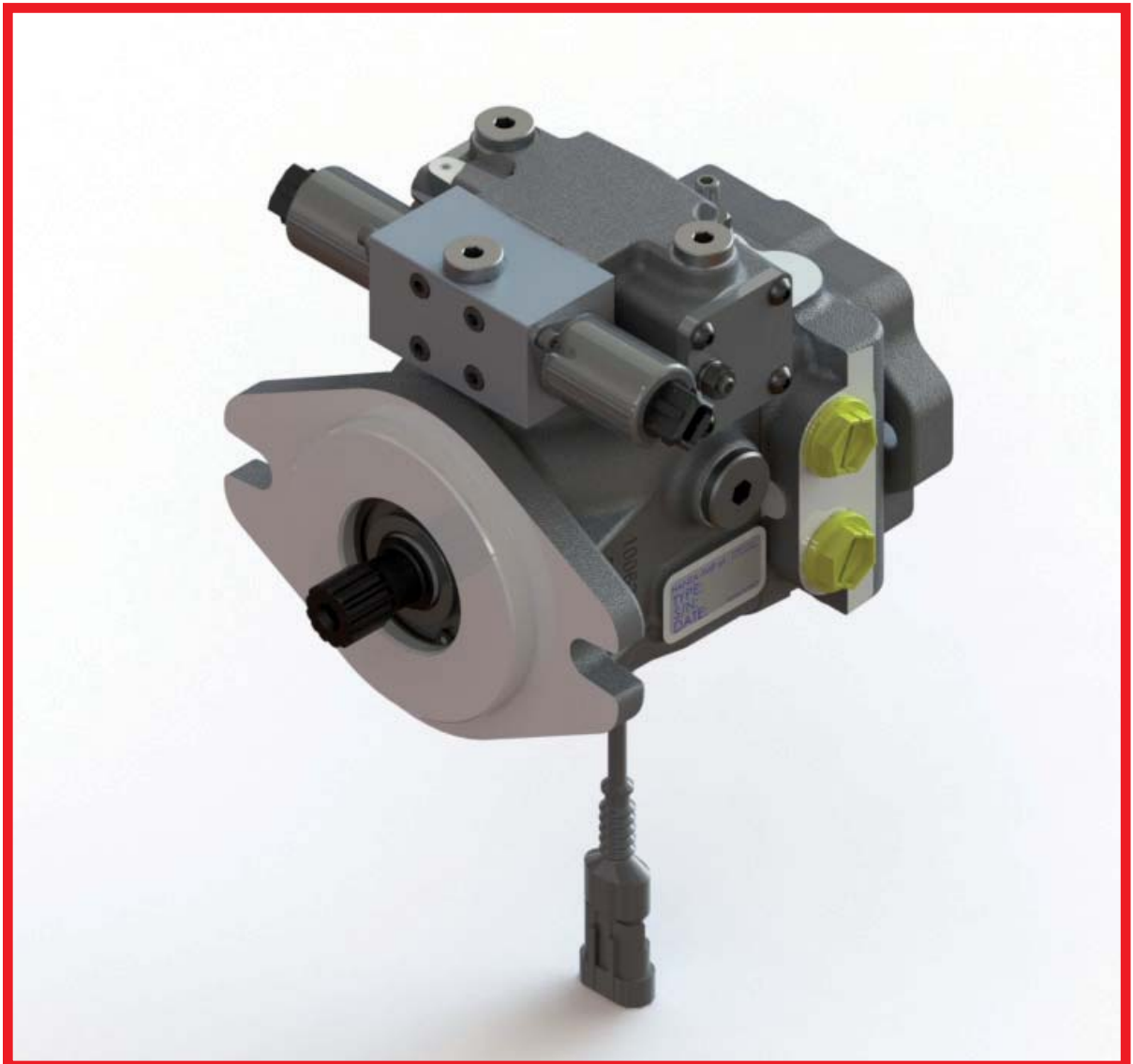
The suction filters will have a clogging indicator and bypass. The max. pressure drop of the filtration element must not exceed 0,04 absolute MPa (0,08 absolute MPa with cold start).

Filter assembling

The suction filter is mounted in the suction line. Check that the pressure before the boost pump is 0,08 absolute MPa, measured on the pump suction port (0,05 MPa for cold starting).

TPV 1500

VARIABLE DISPLACEMENT AXIAL PISTON PUMP



ORDER CODE

1500 0	TPV 1	17-9 2	CR 3	SS3 4	F2.1 5	SHI 6	OA 7	10 8	06 9	SA-R 10	000 11	1 12	00 13
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Page

1500	0 - Pump series = Pump TPV 1500	
TPV	1 - Pump model = Closed loop circuit pump	
	2 - Pump displacement 17-9 = 17,6 cm ³ /n 18-9 = 18,7 cm ³ /n 19-9 = 19,9 cm ³ /n 21-9 = 21,1 cm ³ /n	
CR CC	3 - Rotation = Clockwise rotation (right) = Counter-clockwise rotation (left)	
SS3	4 - Shaft (mounting side) = Splined shaft SAE-B (ANSI B92.1A - 13T - 16/32 D.P.)	19
F2.1	5 - Mounting flange = SAE-B 2 bolt - pilot diam. 101,6 mm	19
SHI SHIC SEI1.3 SEI2.3 SEI1.3D SEI2.3D SHIX SMIX SEIX1.3 SEIX2.3 SEIX1.3D SEIX2.3D	6 - Controls = Hydraulic servo control = Compact hydraulic servo control = Electro-proportional servo control 12V DC (AMP junior timer connector) = Electro-proportional servo control 24V DC (AMP junior timer connector) = Electro-proportional servo control 12V DC (Deutsch connector) = Electro-proportional servo control 24V DC (Deutsch connector) = Hydraulic servo control with feed back = Mechanical lever servo control with feed back = Electro-proportional servo control with feed back 12V DC (AMP junior timer connector) = Electro-proportional servo control with feed back 24V DC (AMP junior timer connector) = Electro-proportional servo control with feed back 12V DC (Deutsch connector) = Electro-proportional servo control with feed back 24V DC (Deutsch connector)	20 22 24 24 27 27 30 32 34 34 37 37
OA	7 - Control devices position = Position A	
	8 - Relief valve pressure setting 10 = 10 MPa 15 = 15 MPa 18 = 18 MPa 20 = 20 MPa 25 = 25 MPa 30 = 30 MPa 35 = 35 MPa 40 = 40 MPa	
00 06 06(xx)	9 - Boost pump = Without boost pump * = Standard pump (5,8 cm ³ /n) Standard setting: 2 MPa (hydraulic /electric servo control) at 1.000 n/min = Other pressure setting on request (between 2 and 3 MPa, please contact our Technical Department)	
	* Upon order, please provide information on maximum external charge flow.	
SA-R C-SA	10 - Through drive connection for rear pump = SAE-A 2 bolt female standard (ANSI B92.1a - 9T - 16/32 D.P.) = Closed cover (without rear fitting)	40 40

(continued)

ORDER CODE

Page

000 **11 - Displacements of the auxiliary gear pumps group 2 (SAE-A)**
= without pump

204 = 4,2 cm ³ /n	206 = 6,0 cm ³ /n	209 = 8,4 cm ³ /n	211 = 10,8 cm ³ /n
214 = 14,4 cm ³ /n	217 = 16,8 cm ³ /n	219 = 19,2 cm ³ /n	222 = 22,8 cm ³ /n
226 = 26,2 cm ³ /n	230 = 30,0 cm ³ /n	234 = 34,2 cm ³ /n	240 = 39,6 cm ³ /n

0 **12 - Voltage for optionals (where applicable)**
= Without
1 = 12V DC
2 = 24V DC

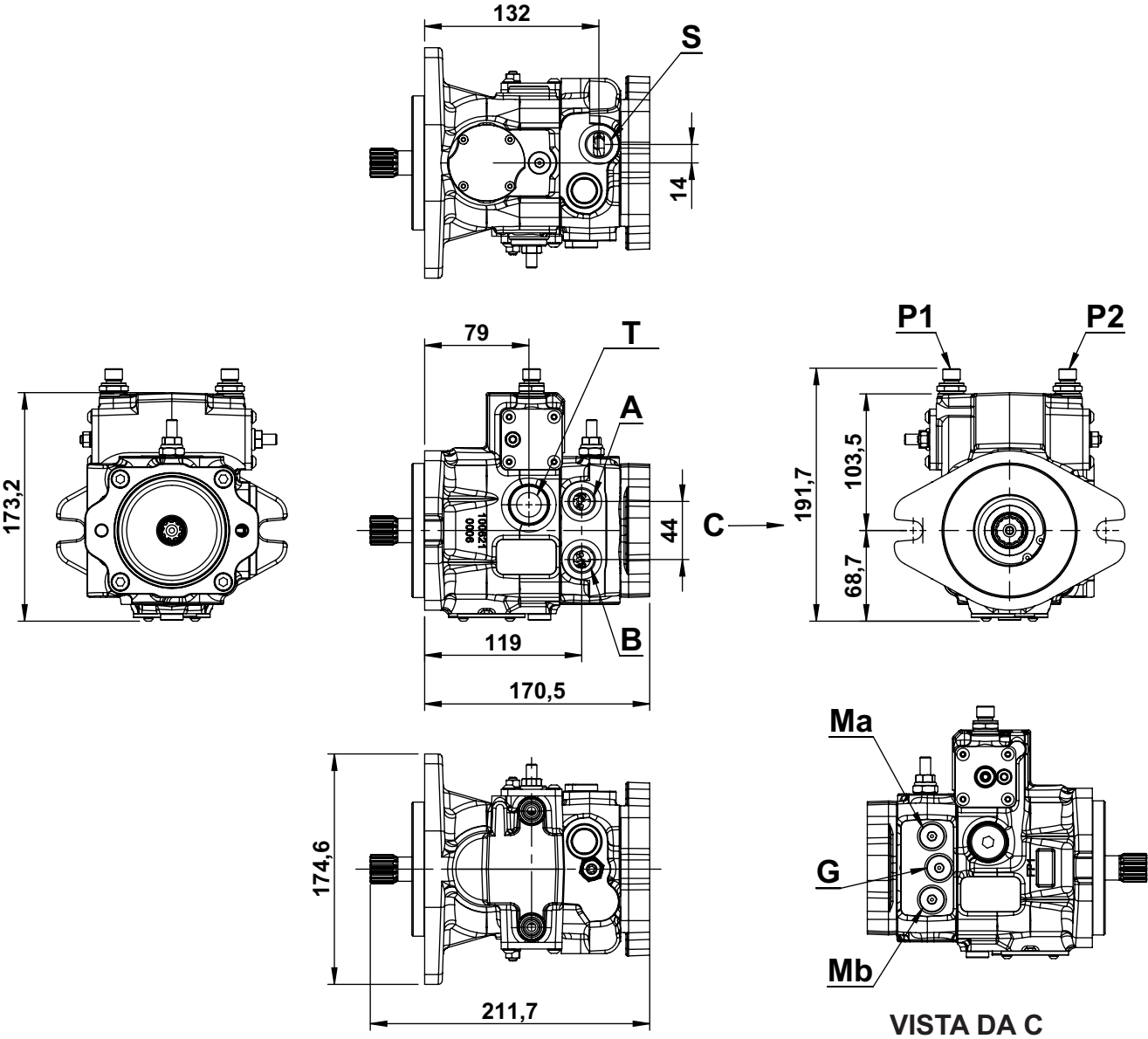
00 **13 - Optional**
= Without optional
FR = Pre-arranged for connection with external filter **41**
VS-SB = Purge valve with screw by-pass **42**
SB = Screw by-pass **43**
FLT = Filter without clogging indicator **44**
FLTI = Filter with clogging indicator **45**
MOB = Man on board **46**
RS = Angle sensor **48**
REV.S = RPM sensor **50**
PRS = Pressure sensor **52**
G/J/M/- = Port threads and restrictor diameter

	Servo control type	Port threads	Symbol
STANDARD	SEI	Plugged	-
	SHI	1/4" BSPP	G
ON REQUEST	SHI	JIC (7/16" - 20)	J
	SHI	METRIC (M12x1,5)	M

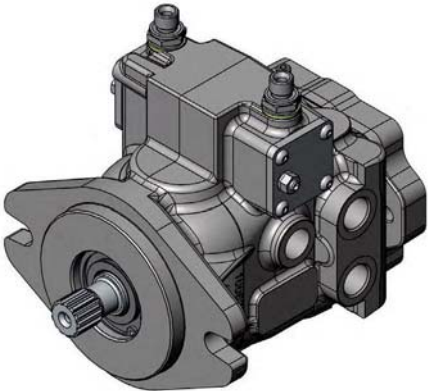
Example G/08 = 1/4" BSPP port threads and Ø 0,8 mm restrictor (SHI)
Example -/08 = Ø 0,8 mm restrictor (SEI)

Restrictor diameter (SHI/SEI)	
-	Without restrictor
06	Restrictor orifice ø 0,6 mm
08	Restrictor orifice ø 0,8 mm
10	Restrictor orifice ø 1,0 mm
12	Restrictor orifice ø 1,2 mm
16	Restrictor orifice ø 1,6 mm
20	Restrictor orifice ø 2,0 mm

GENERAL DIMENSIONS / PORTS



PORTS		
A - B	Main pressure ports	1/2" BSPP
T	Drain	1/2" BSPP
S	Suction	1/2" BSPP
G	Boost system pressure port	1/4" BSPP
P1 - P2	Servo control ports (male)	1/4" BSPP
Ma - Mb	Pressure gauge ports	1/4" BSPP



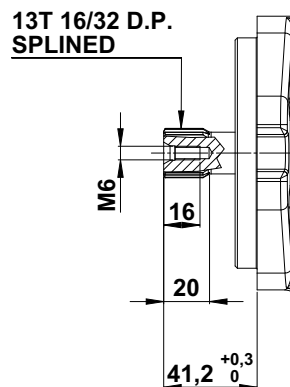
SHAFT OPTIONS AND MOUNTING FLANGES

SS3

SPLINED SHAFT 13T

Norm SAE-B ANSI B92.2-1970 CLASS 5

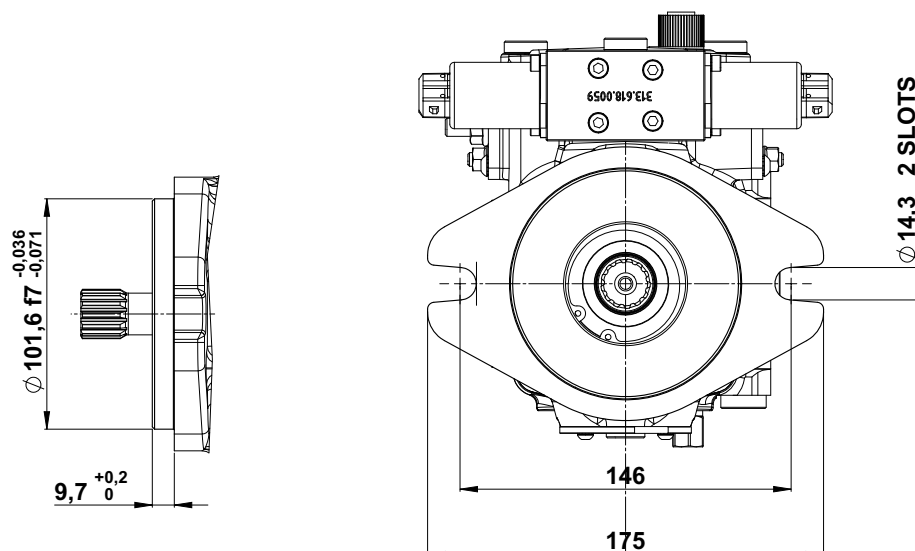
Max. torque = 320 Nm



Caution: in case of multiple pump applications the total torque requested must be limited to the above value.

F2.1

FLANGE SAE B - 2 BOLT



SHI

HYDRAULIC SERVO CONTROL

The pump displacement variation is obtained by adjusting the pressure on P1 and P2 servo control ports by means of a hydraulic proportional joystick (with integrated pressure reducing valves).

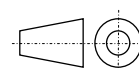
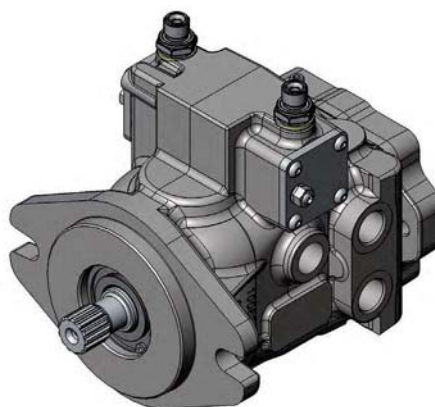
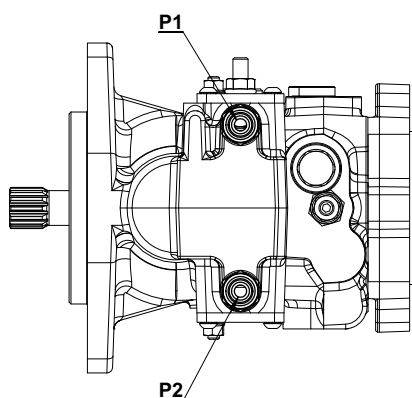
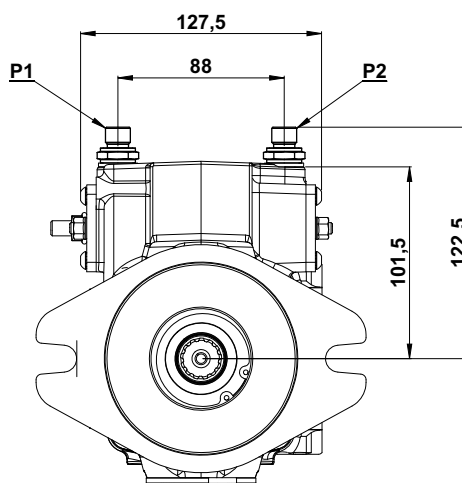
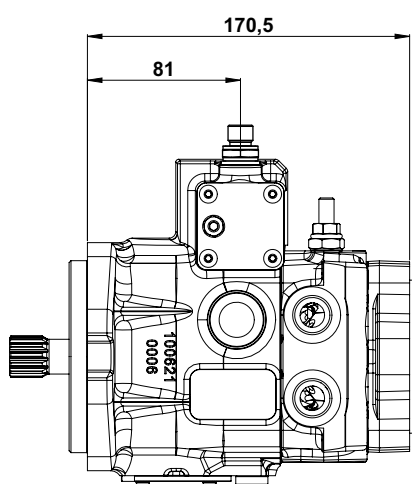
The servo control oil supply can be obtained by taking pressure from the boost pump (G port), see page 18.

The servo control return time can be adjusted by inserting a restrictor on the joystick supply line ($0,5 \div 1,2$ mm).

The servo control operation curve, in both directions, goes from 0,4 to 1,8 MPa (tolerance $\pm 5\%$).

The adjusting curve of the hydraulic joystick has to be a little wider ($0,3 \div 1,9$ MPa).

Suggested curves for HPV series Joysticks: CR062 (see HT 73/B/105/0417/E catalogue).

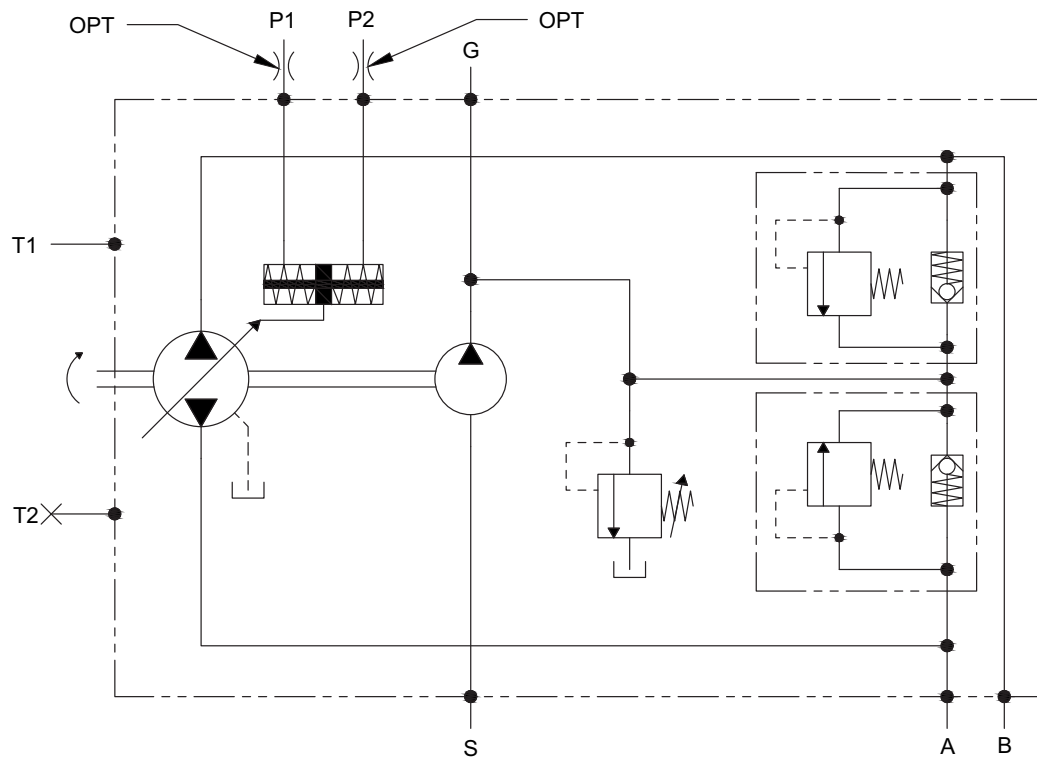


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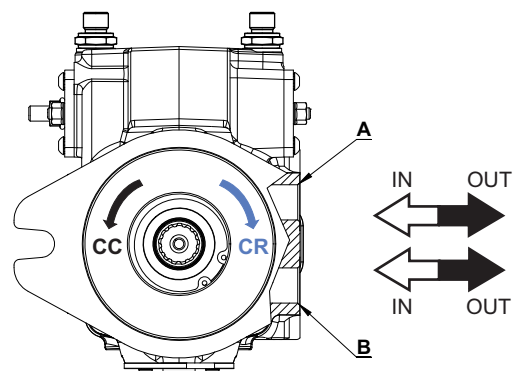
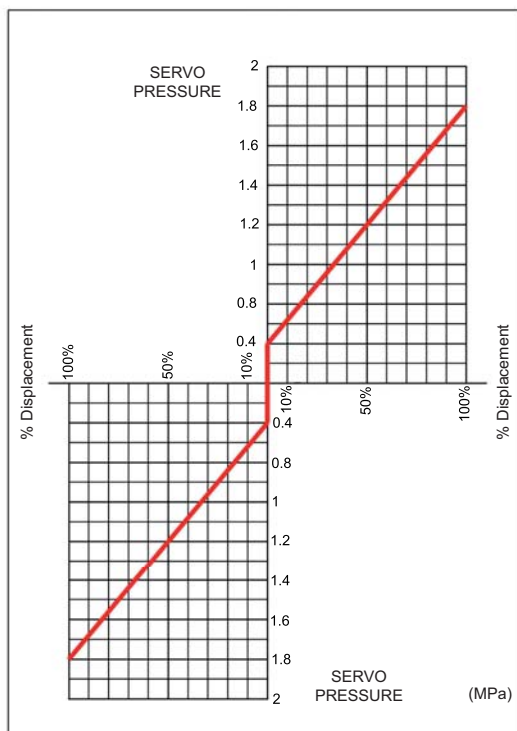
SHI

COMPACT HYDRAULIC SERVO CONTROL

HYDRAULIC DIAGRAM



SERVO PRESSURE - DISPLACEMENT GRAPHIC



FLOW DIRECTION	PUMP		
Rotation	Port	OUT	IN
Clockwise (CR)	P ₁	B	A
	P ₂	A	B
Counter clockwise (CC)	P ₁	A	B
	P ₂	B	A

SHIC

COMPACT HYDRAULIC SERVO CONTROL

(with side pilot ports)

The pump displacement variation is obtained by adjusting the pressure on P1 and P2 servo control ports by means of a hydraulic proportional joystick (with integrated pressure reducing valves).

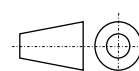
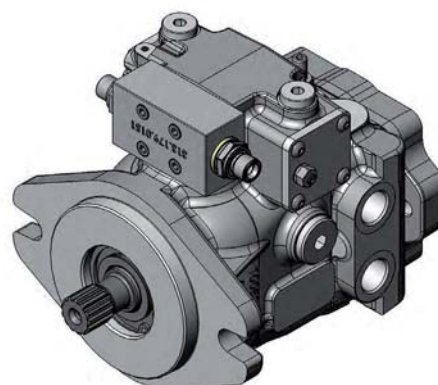
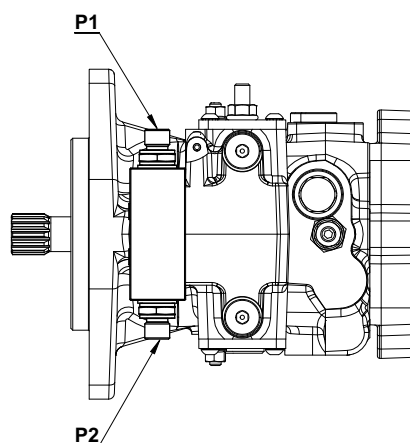
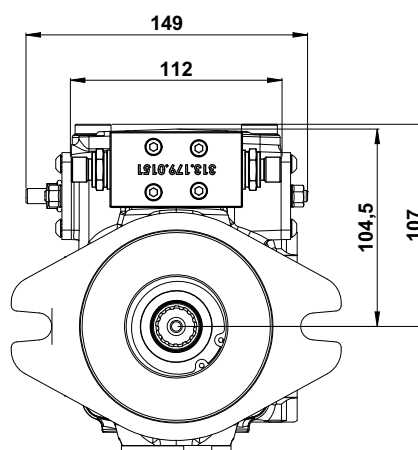
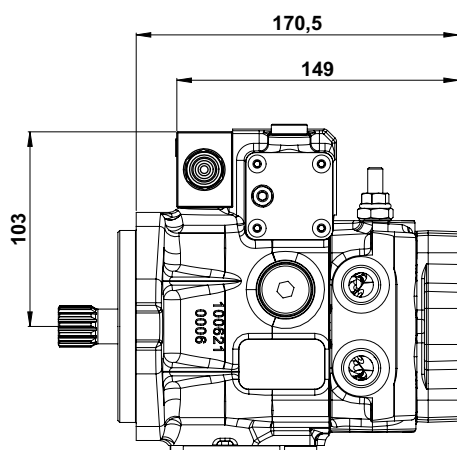
The servo control oil supply can be obtained by taking pressure from the boost pump (G port), see page 18.

The servo control return time can be adjusted by inserting a restrictor on the P1 and P2 ports on the pump (0,5 ÷ 1,2 mm).

The servo control operation curve, in both directions, goes from 0,4 to 1,8 MPa (tolerance $\pm 5\%$).

The adjusting curve of the hydraulic joystick has to be a little wider (0,3 ÷ 1,9 MPa).

Suggested curves for HPV series Joysticks: CR062 (see HT 73/B/105/0417/E catalogue).



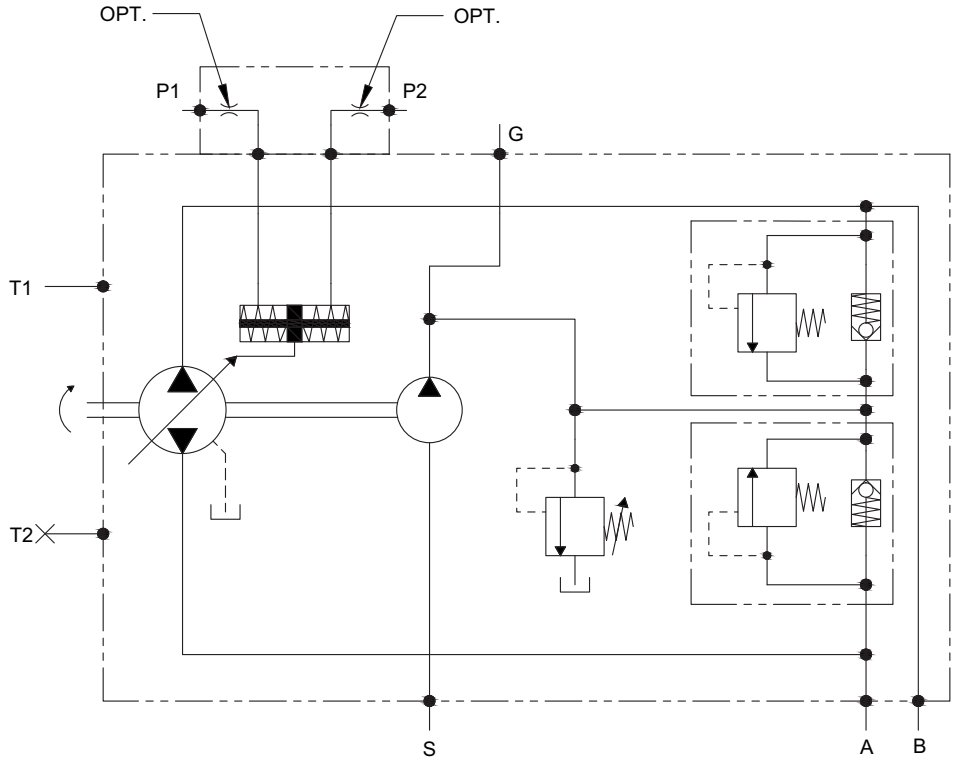
(continued)

SHIC

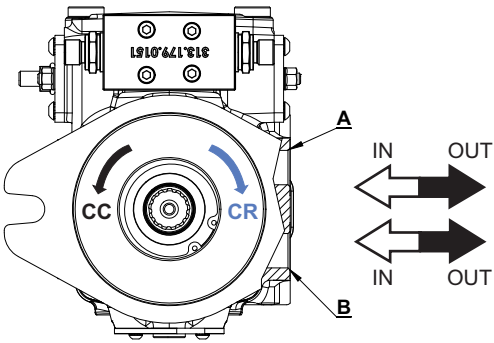
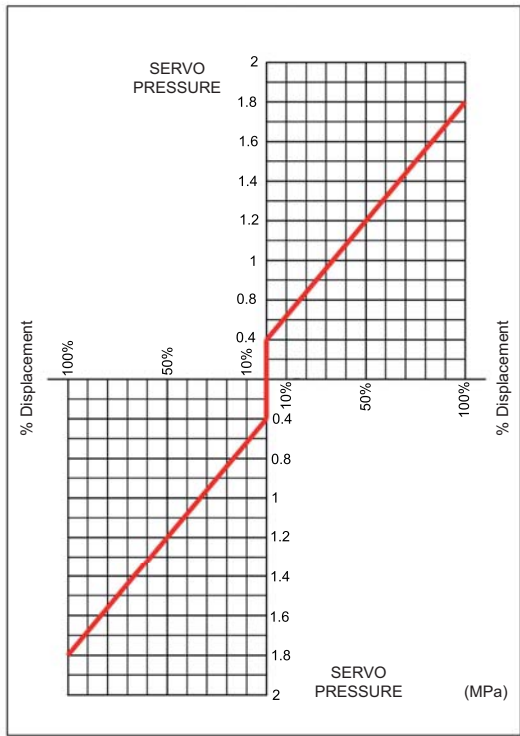
COMPACT HYDRAULIC SERVO CONTROL

(with side pilot ports)

HYDRAULIC DIAGRAM



SERVO PRESSURE - DISPLACEMENT GRAPHIC



FLOW DIRECTION	PUMP		
	Port	OUT	IN
Rotation			
Clockwise (CR)	P ₁ P ₂	B A	A B
Counter clockwise (CC)	P ₁ P ₂	A B	B A

SEI 1.3 (12V DC)

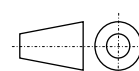
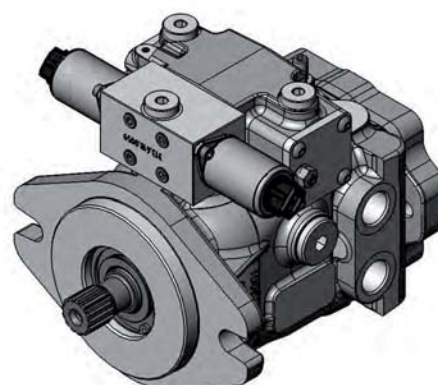
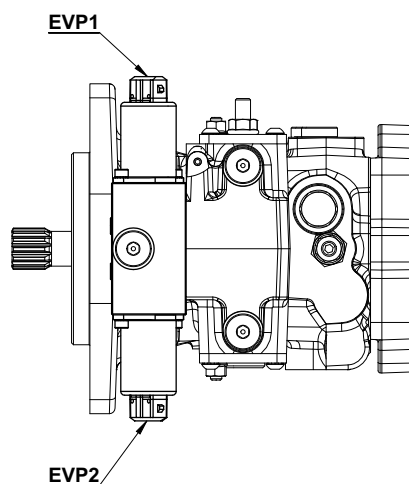
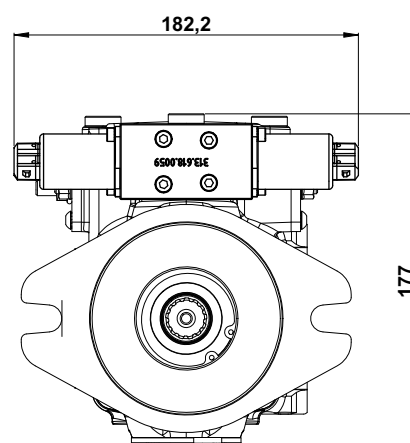
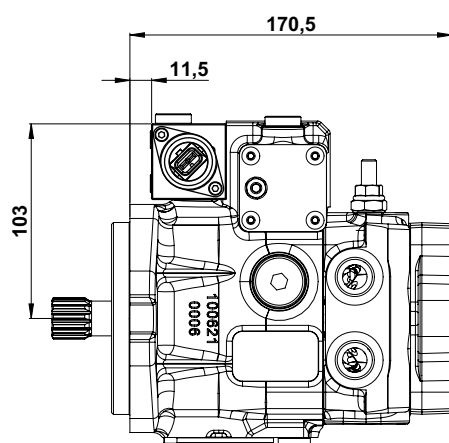
SEI 2.3 (24V DC)

ELECTRO-PROPORTIONAL SERVO CONTROL

(AMP junior timer connector)

The pump displacement variation is obtained by an electric signal, which varies approx.:

- from 315 to 630 mA (24V DC voltage)
- from 630 to 1260 mA (12V DC voltage)



(continued)

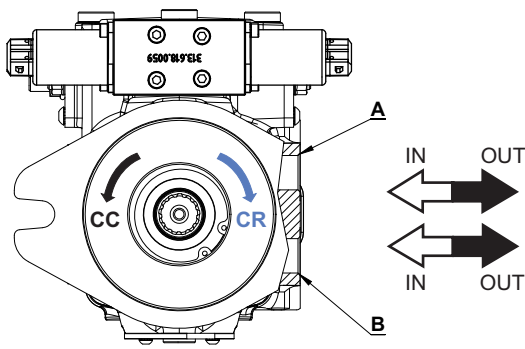
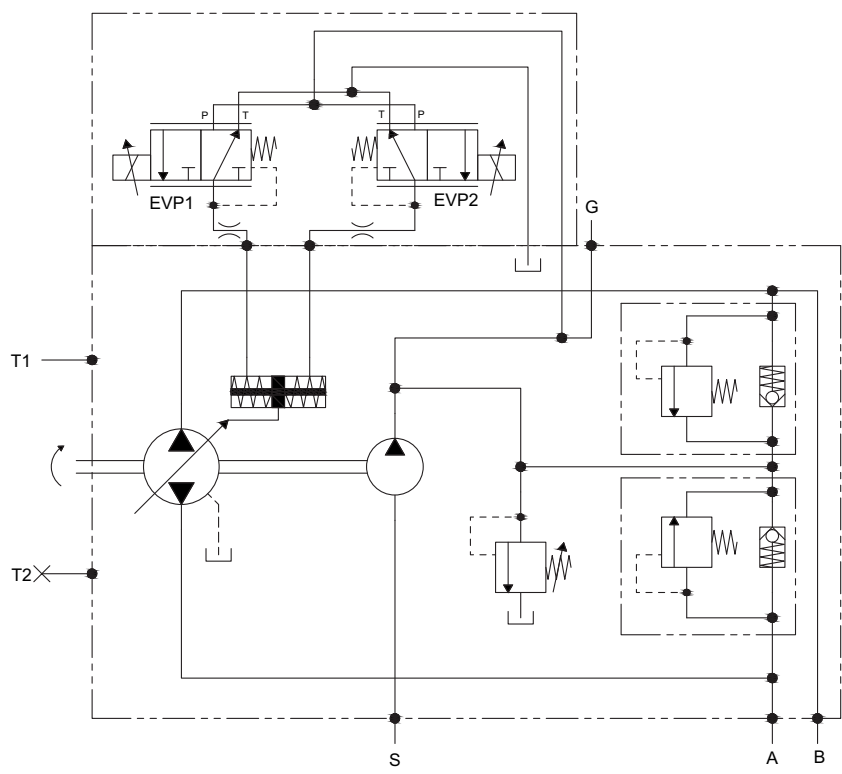
SEI 1.3 (12V DC)

SEI 2.3 (24V DC)

ELECTRO-PROPORTIONAL SERVO CONTROL

(AMP junior timer connector)

HYDRAULIC DIAGRAM



FLOW DIRECTION	PUMP		
Rotation	 EVP	OUT	IN
Clockwise (CR)	EVP1 EVP2	B A	A B
Counter clockwise (CC)	EVP1 EVP2	A B	B A

(continued)

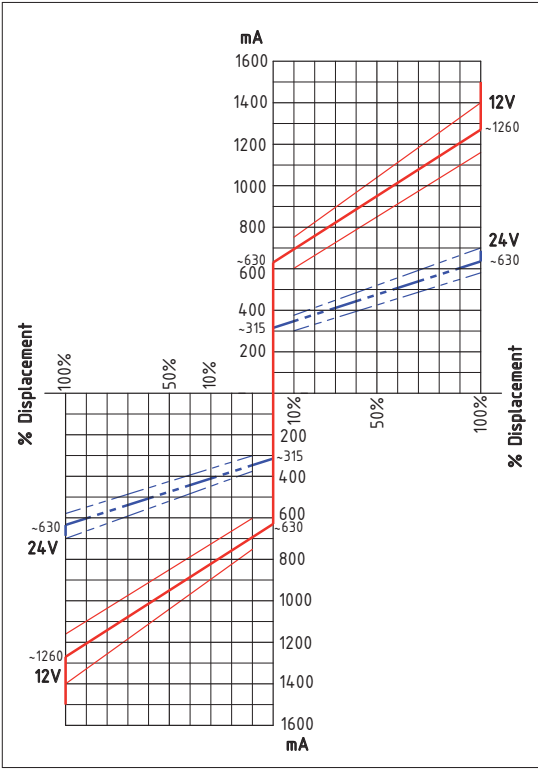
SEI 1.3 (12V DC)

SEI 2.3 (24V DC)

ELECTRO-PROPORTIONAL SERVO CONTROL

(AMP junior timer connector)

CURRENT-DISPLACEMENT GRAPHIC



ELECTRICAL FEATURES		
Voltage	12 V DC	24 V DC
Electric current	1500 mA	750 mA
Load resistance	4,72 $\Omega \pm 5\%$	20,8 $\Omega \pm 5\%$
Type of control	Current control	
	PWM 100 Hz (suggested)	
Type of connection	AMP Junior Timer	
Protection class	Until IP6K6 / IPX9K	

HYDRAULIC FEATURES	
Max. pressure (P, T)	pP= 5 MPa, pT= 3 MPa
Hysteresis (w/PWM)	<0,07 MPa (pA=2,0)
	<0,1 MPa (pA=2,5)
	<0,15 MPa (pA=3,5)
Filtration ratio	125 μm
Oil contamination level	Min. filtration ratio: 20/18/15
	According ISO 4406
	Hydraulic oil DIN 51524
Min./max. oil temperature	From -20 to +90°C

SEI 1.3D (12V DC)

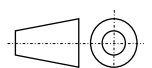
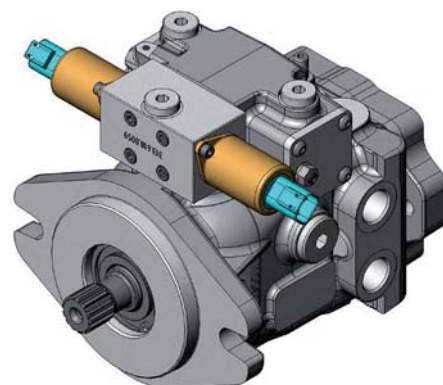
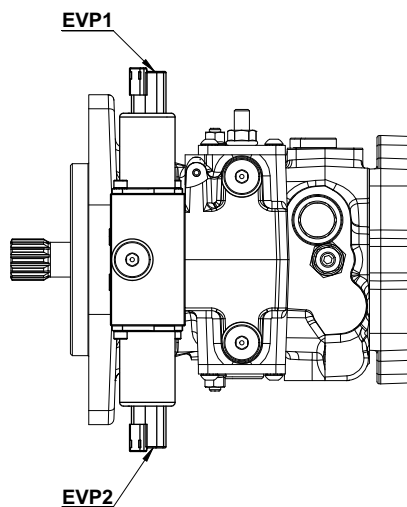
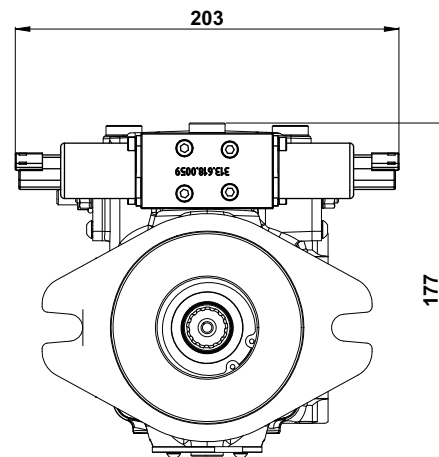
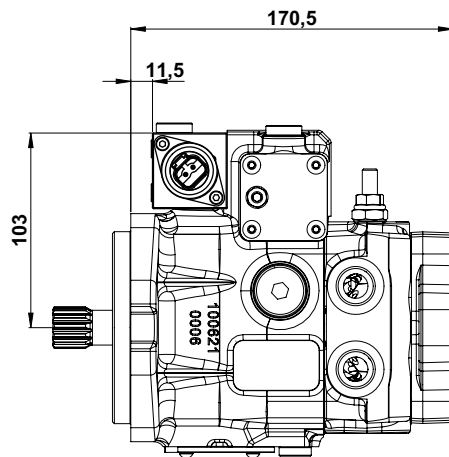
SEI 2.3D (24V DC)

ELECTRO-PROPORTIONAL SERVO CONTROL

(Deutsch connector)

The pump displacement variation is obtained by an electric signal, which varies approx.:

- from 315 to 630 mA (24V DC voltage)
- from 630 to 1260 mA (12V DC voltage)



(continued)

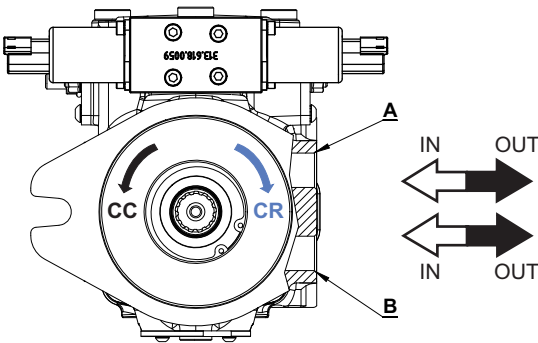
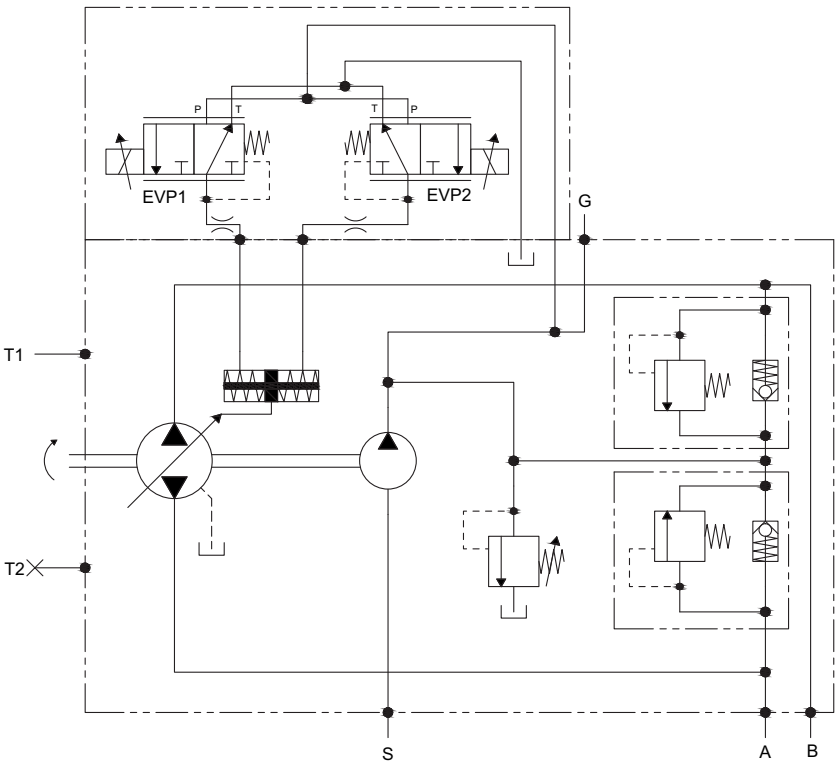
SEI 1.3D (12V DC)

SEI 2.3D (24V DC)

ELECTRO-PROPORTIONAL SERVO CONTROL

(Deutsch connector)

HYDRAULIC DIAGRAM

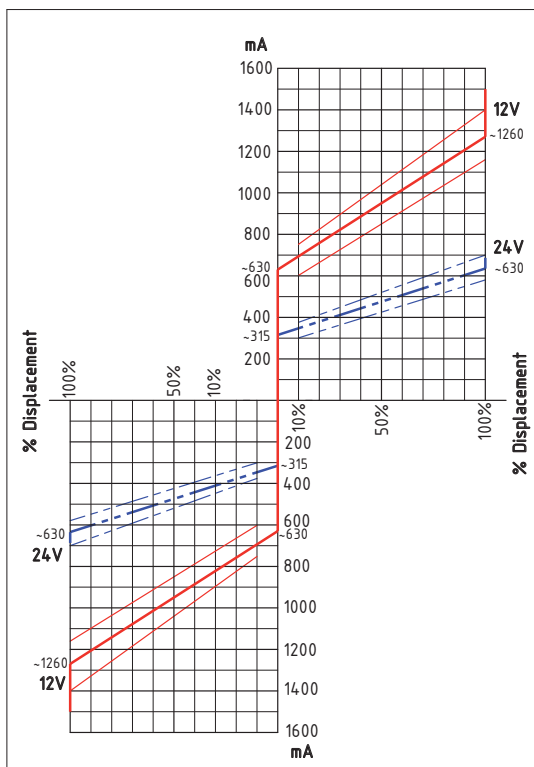


FLOW DIRECTION	PUMP		
Rotation	 EVP	OUT	IN
Clockwise (CR)	EVP1 EVP2	B A	A B
Counter clockwise (CC)	EVP1 EVP2	A B	B A

(continued)

SEI 1.3D (12V DC)**SEI 2.3D** (24V DC)**ELECTRO-PROPORTIONAL SERVO CONTROL**

(Deutsch connector)

CURRENT-DISPLACEMENT GRAPHIC**ELECTRICAL FEATURES**

Voltage	12 V DC	24 V DC
Electric current	1500 mA	750 mA
Load resistance	4,72 $\Omega \pm 5\%$	20,8 $\Omega \pm 5\%$
Type of control	Current control	
	PWM 100 Hz (suggested)	
Type of connection	DEUTSCH DT 04-2P	
Protection class	Until IP6K6 / IPX9K	

HYDRAULIC FEATURES

Max. pressure (P, T)	pP= 5 MPa, pT= 3 MPa
Hysteresis (w/PWM)	<0,07 MPa (pA=2,0)
	<0,1 MPa (pA=2,5)
	<0,15 MPa (pA=3,5)
Filtration ratio	125 μm
Oil contamination level	Min. filtration ratio: 20/18/15
	According ISO 4406
	Hydraulic oil DIN 51524
Min./max. oil temperature	From -20 to +90°C

SHIX

HYDRAULIC SERVO CONTROL WITH FEED BACK

The pump displacement variation is obtained by adjusting the pressure on P1 and P2 servo control ports by means of a hydraulic proportional joystick (with integrated pressure reducing valves).

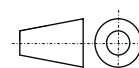
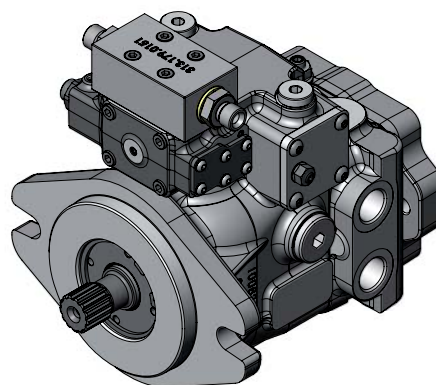
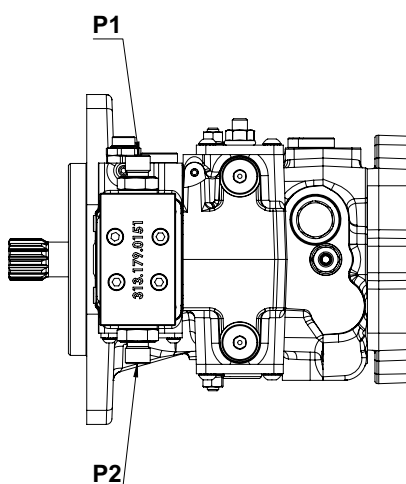
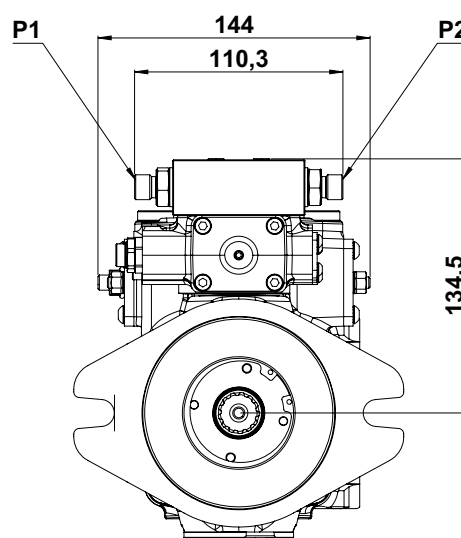
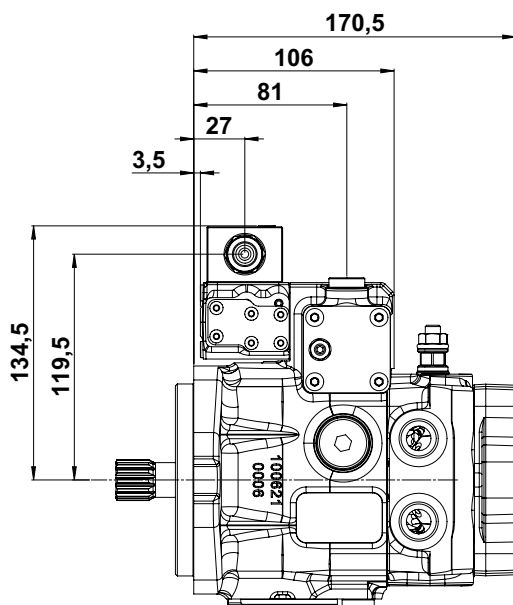
The servo control oil supply can be obtained by taking pressure from the boost pump (G port), see page 18.

The servo control return time can be adjusted by inserting a restrictor on the joystick supply line ($0,5 \div 1,2$ mm).

The servo control operation curve, in both directions, goes from 0,4 to 1,8 MPa (tolerance ± 5 %).

The adjusting curve of the hydraulic joystick has to be a little higher ($0,3 \div 1,9$ MPa).

Suggested curves for HPV series Joysticks: CR096 (see HT 73/B/105/0417/E catalogue).

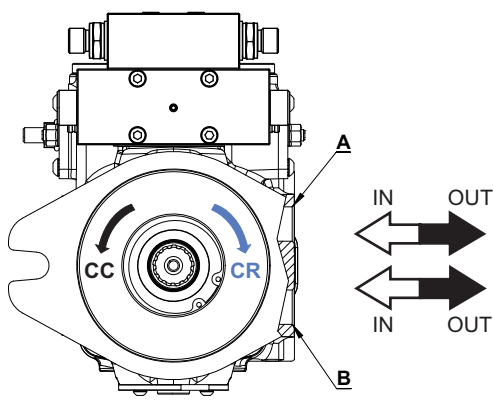
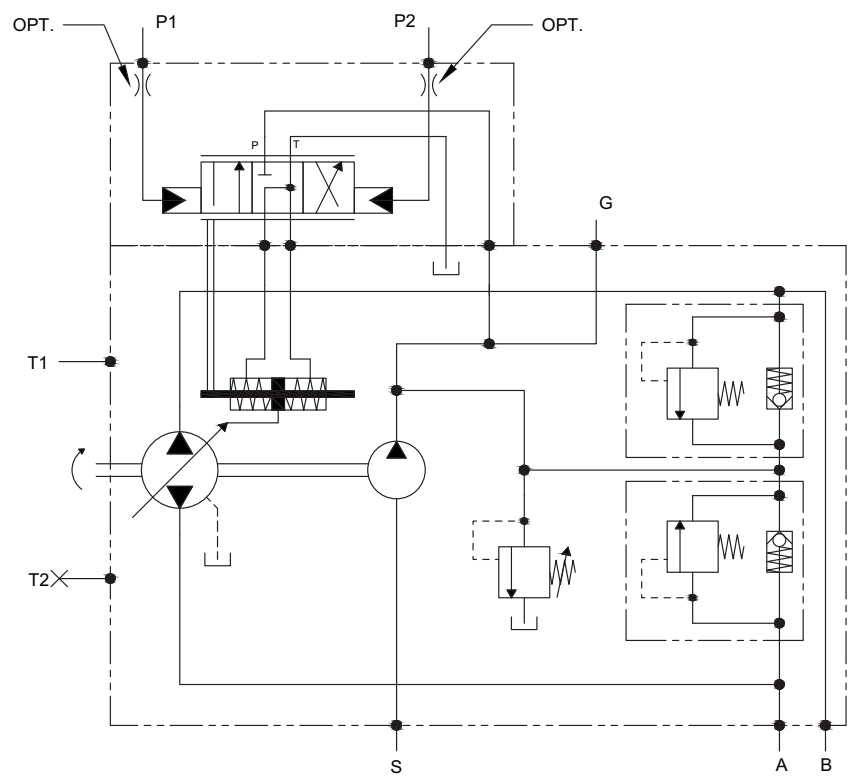


(continued)

SHIX

HYDRAULIC SERVO CONTROL WITH FEED BACK

HYDRAULIC DIAGRAM

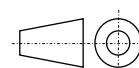
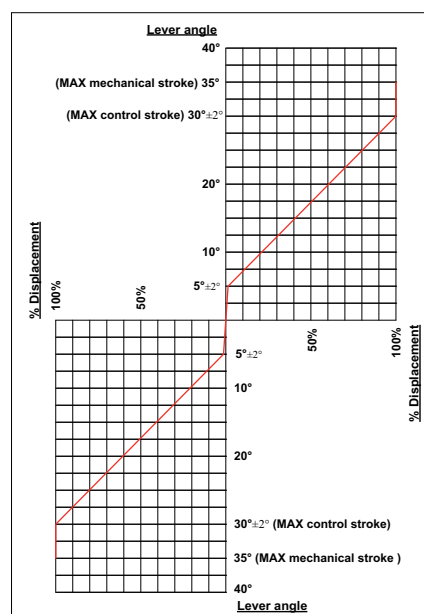
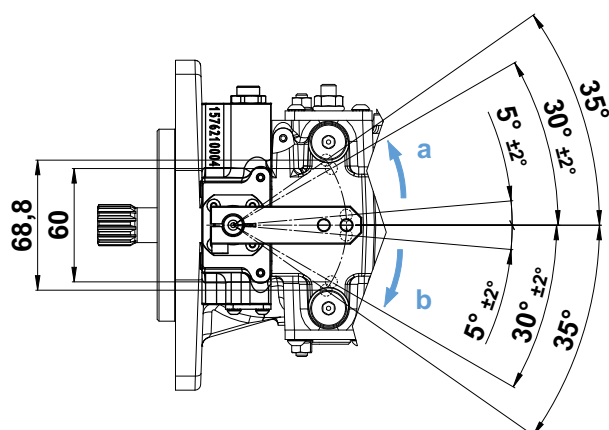
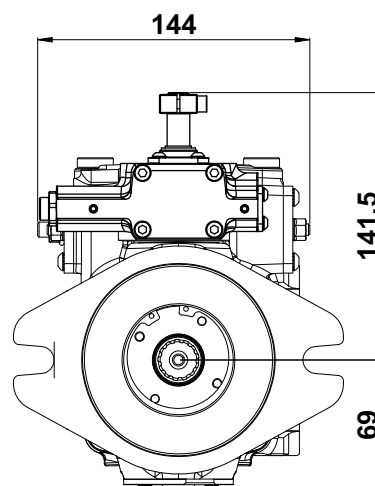
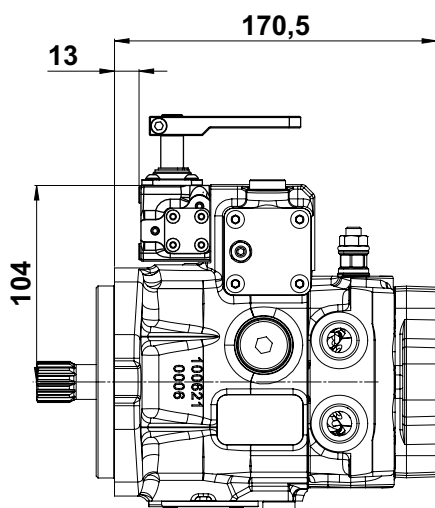
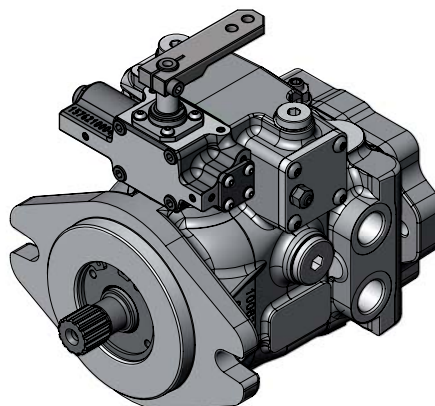


FLOW DIRECTION	PUMP		
	Port	OUT	IN
Clockwise (CR)	P ₁	A	B
	P ₂	B	A
Counter clockwise (CC)	P ₁	B	A
	P ₂	A	B

SMIX

MANUAL LEVER CONTROL WITH FEED BACK

The pump displacement variation is directly related to the angle position of the lever.

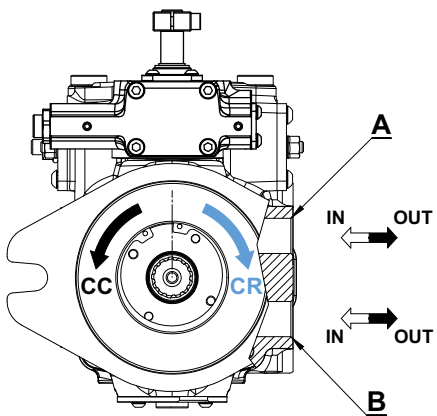
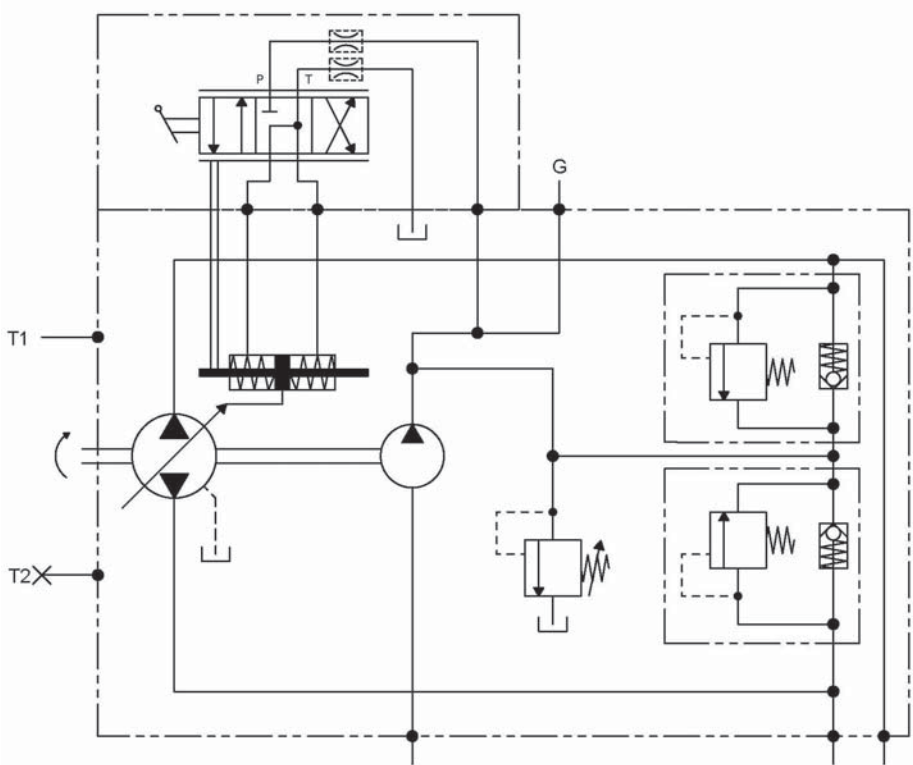


(continued)

SMIX

MANUAL LEVER CONTROL WITH FEED BACK

HYDRAULIC DIAGRAM



FLOW DIRECTION	PUMP		
	Port	OUT	IN
Clockwise (CR)	a	B	A
	b	A	B
Counter clockwise (CC)	a	A	B
	b	B	A

SEIX 1.3 (12V DC)

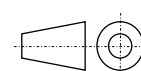
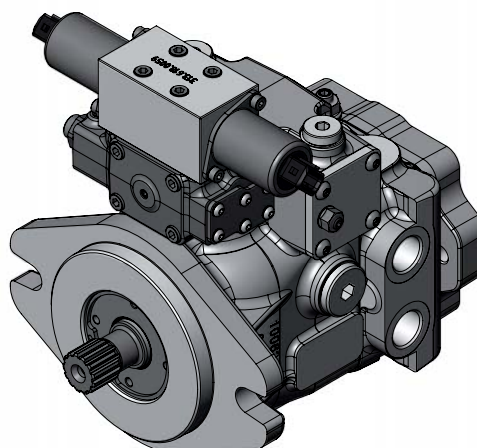
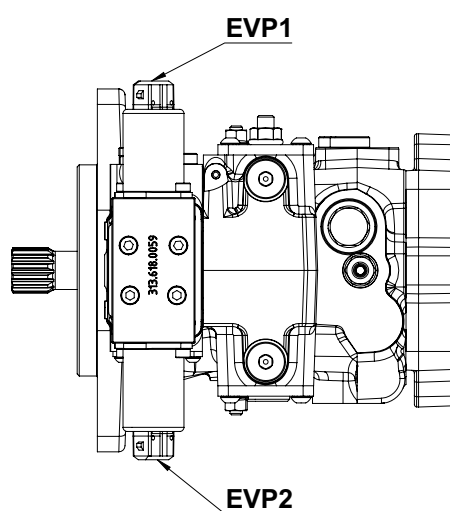
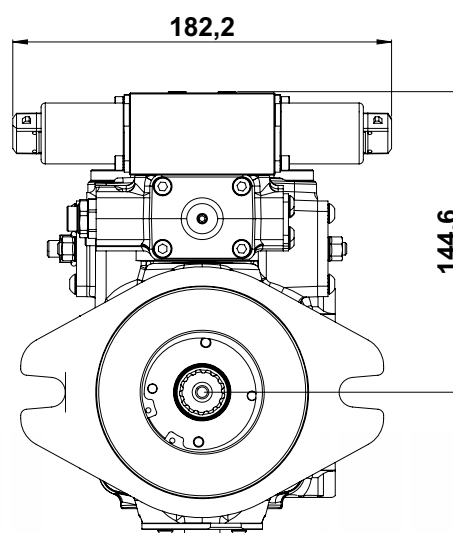
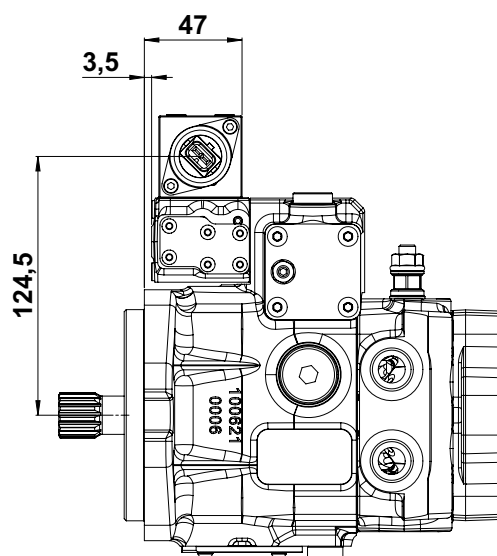
SEIX 2.3 (24V DC)

ELECTRO-PROPORTIONAL SERVO CONTROL WITH FEED BACK

(AMP junior timer connector)

The pump displacement variation is obtained by an electric signal, which varies approx.:

- from 315 to 630 mA (24V DC voltage)
- from 630 to 1260 mA (12V DC voltage)



(continued)

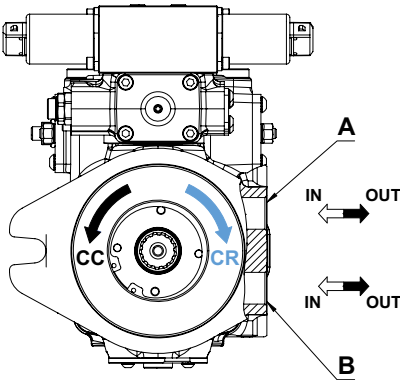
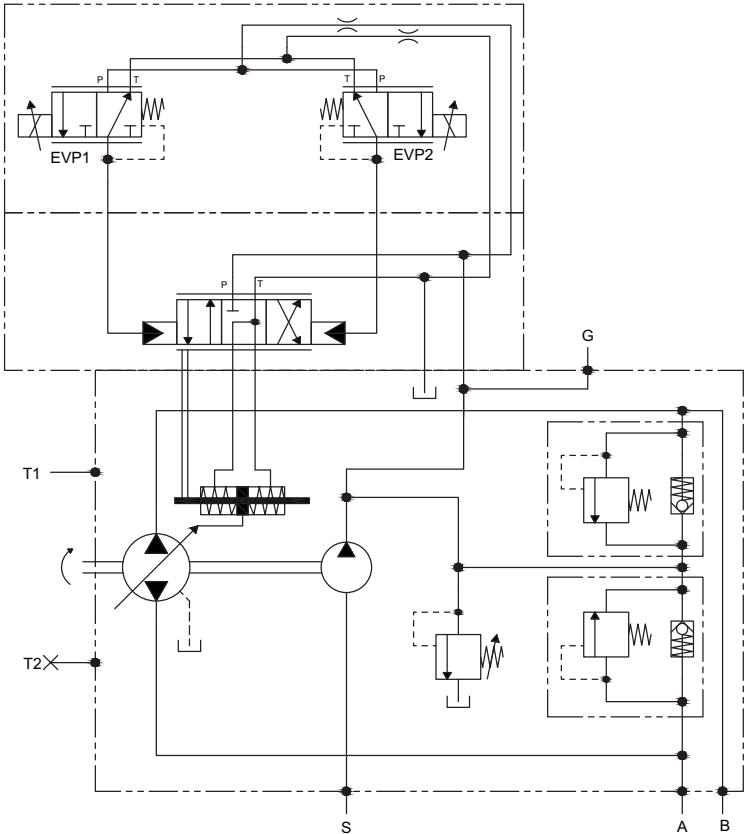
SEIX 1.3 (12V DC)

SEIX 2.3 (24V DC)

ELECTRO-PROPORTIONAL SERVO CONTROL WITH FEED BACK

(AMP junior timer connector)

HYDRAULIC DIAGRAM



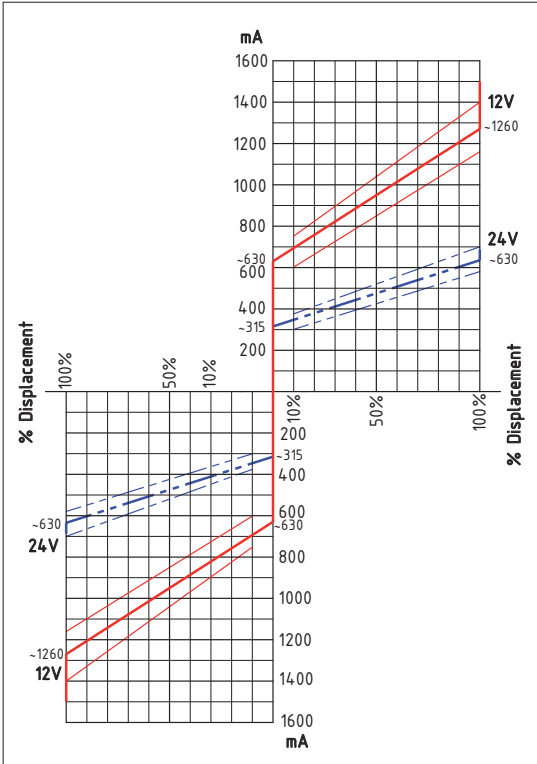
FLOW DIRECTION	PUMP		
Rotation	 EVP	OUT	IN
Clockwise (CR)	EVP1 EVP2	A B	B A
Counter clockwise (CC)	EVP1 EVP2	B A	A B

(continued)

SEIX 1.3 (12V DC)
SEIX 2.3 (24V DC)

ELECTRO-PROPORTIONAL SERVO CONTROL WITH FEED BACK _____
(AMP junior timer connector)

CURRENT-DISPLACEMENT GRAPHIC



ELECTRICAL FEATURES		
Voltage	12 V DC	24 V DC
Electric current	1500 mA	750 mA
Load resistance	4,72 Ω ± 5%	20,8 Ω ± 5%
Type of control	Current control	
	PWM 100 Hz (suggested)	
Type of connection	AMP Junior Timer	
Protection class	Until IP6K6 / IPX9K	

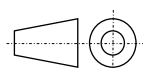
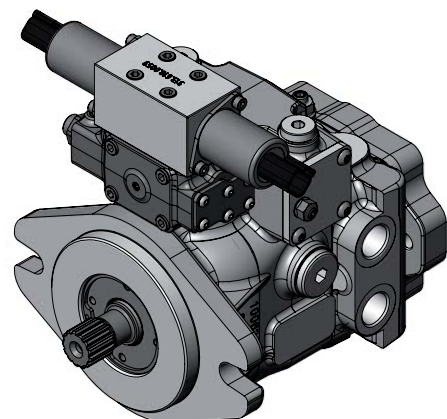
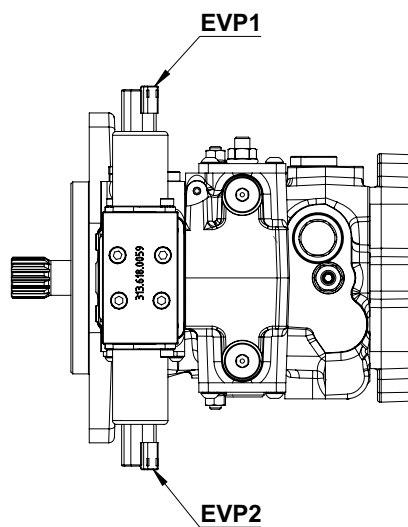
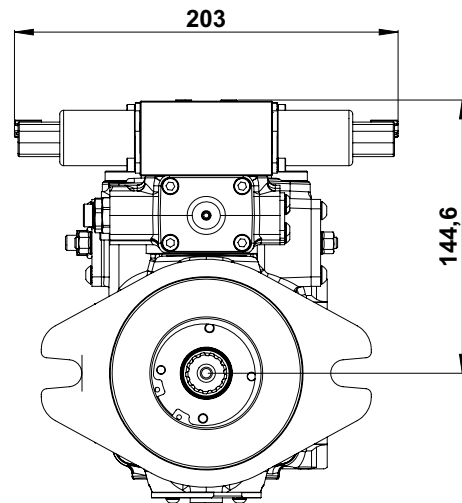
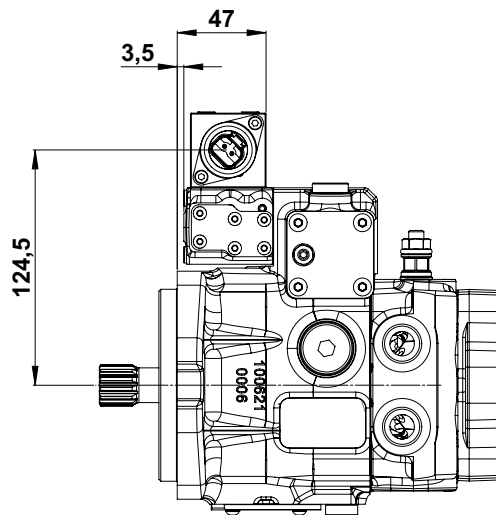
HYDRAULIC FEATURES	
Max. pressure (P, T)	pP= 5 MPa, pT= 3 MPa
Hysteresis (w/PWM)	<0,07 MPa (pA=2,0)
	<0,1 MPa (pA=2,5)
	<0,15 MPa (pA=3,5)
Filtration ratio	125 μm
Oil contamination level	Min. filtration ratio: 20/18/15
	According ISO 4406
	Hydraulic oil DIN 51524
Min./max. oil temperature	From -20 to +90°C

SEIX 1.3D (12V DC)
SEIX 2.3D (24V DC)**ELECTRO-PROPORTIONAL SERVO CONTROL WITH FEED BACK**

(Deutsch connector)

The pump displacement variation is obtained by an electric signal, which varies approx.:

- from 315 to 630 mA (24V DC voltage)
- from 630 to 1260 mA (12V DC voltage)



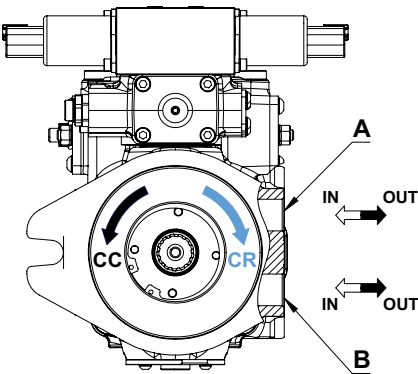
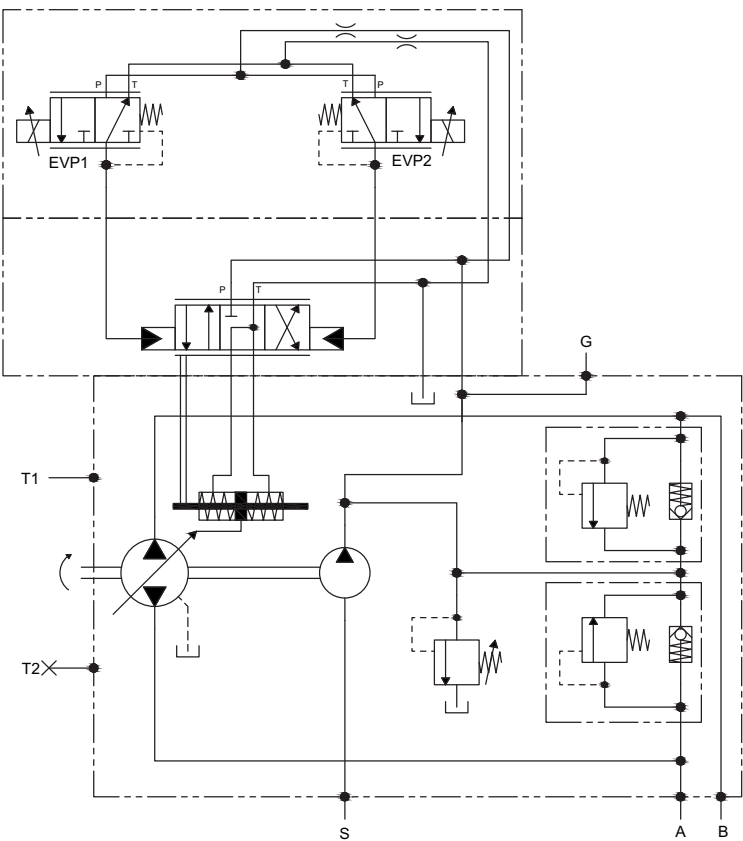
(continued)

SEIX 1.3D (12V DC)
SEIX 2.3D (24V DC)

ELECTRO-PROPORTIONAL SERVO CONTROL WITH FEED BACK

(Deutsch connector)

HYDRAULIC DIAGRAM

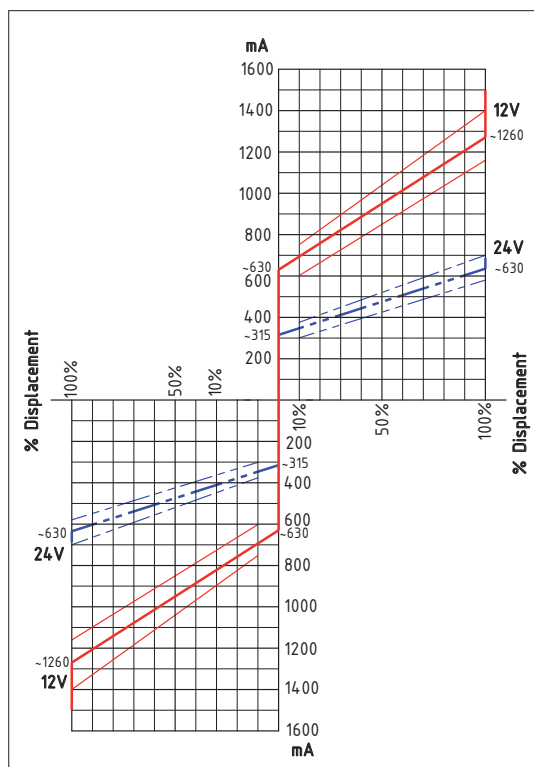


FLOW DIRECTION	PUMP		
Rotation	 EVP	OUT	IN
Clockwise (CR)	EVP1 EVP2	A B	B A
Counter clockwise (CC)	EVP1 EVP2	B A	A B

(continued)

SEIX 1.3D (12V DC)**SEIX 2.3D** (24V DC)**ELECTRO-PROPORTIONAL SERVO CONTROL WITH FEED BACK**

(Deutsch connector)

CURRENT-DISPLACEMENT GRAPHIC**ELECTRICAL FEATURES**

Voltage	12 V DC	24 V DC
Electric current	1500 mA	750 mA
Load resistance	4,72 $\Omega \pm 5\%$	20,8 $\Omega \pm 5\%$
Type of control	Current control	
	PWM 100 Hz (suggested)	
Type of connection	DEUTSCH DT 04-2P	
Protection class	Until IP6K6 / IPX9K	

HYDRAULIC FEATURES

Max. pressure (P, T)	pP= 5 MPa, pT= 3 MPa
Hysteresis (w/PWM)	<0,07 MPa (pA=2,0)
	<0,1 MPa (pA=2,5)
	<0,15 MPa (pA=3,5)
Filtration ratio	125 μm
Oil contamination level	Min. filtration ratio: 20/18/15
	According ISO 4406
	Hydraulic oil DIN 51524
Min./max. oil temperature	From -20 to +90°C

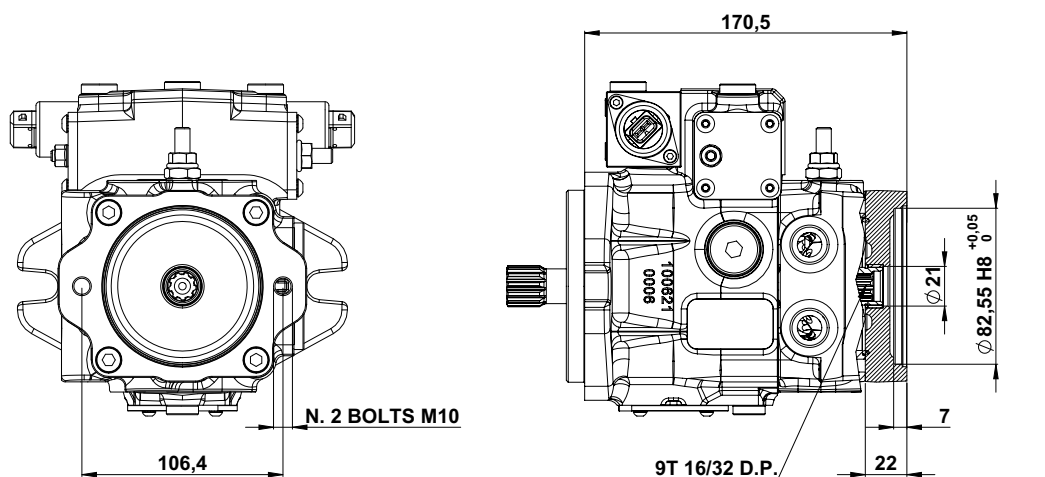
THROUGH DRIVE OPTION

SA-R

FLANGE SAE A - 2 BOLT

ISO 3019-7

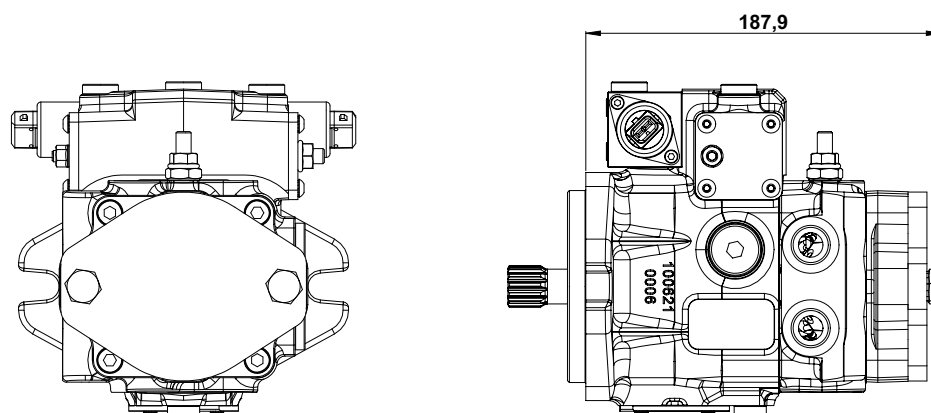
Max. torque = 120 Nm



ANSI B92.1-1970 CLASS 7

C-SA

CLOSED COVER WITHOUT REAR FITTING

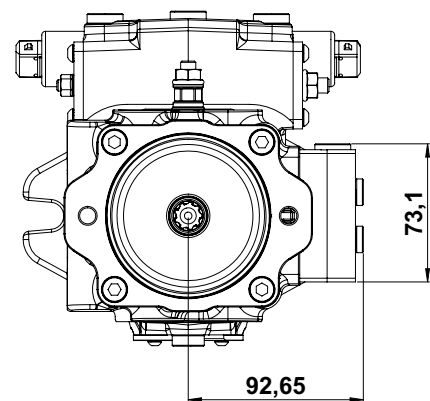
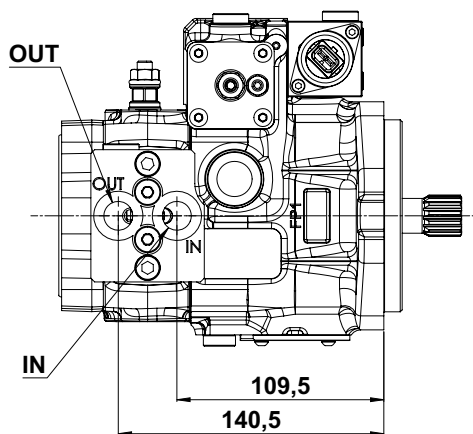
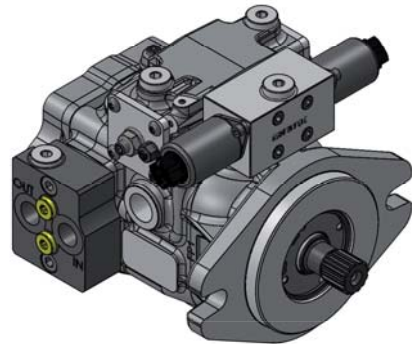


OPTIONAL FR

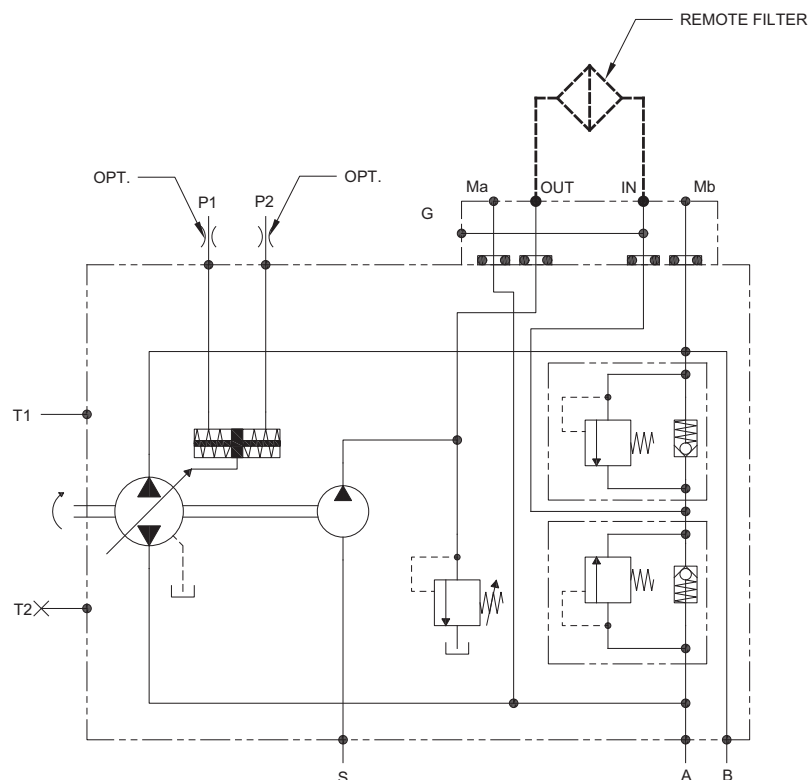
PRE-ARRANGED FOR CONNECTION WITH EXTERNAL FILTER

The pre-arrangement for the connection with an external filter allows the filtration of the oil of the boost pump under pressure.

The filter is not included and must be with a by-pass, filtration level 10 μm and must be of suitable size for the flow-rate of the boost pump.



HYDRAULIC DIAGRAM



OPTIONAL VS-SB

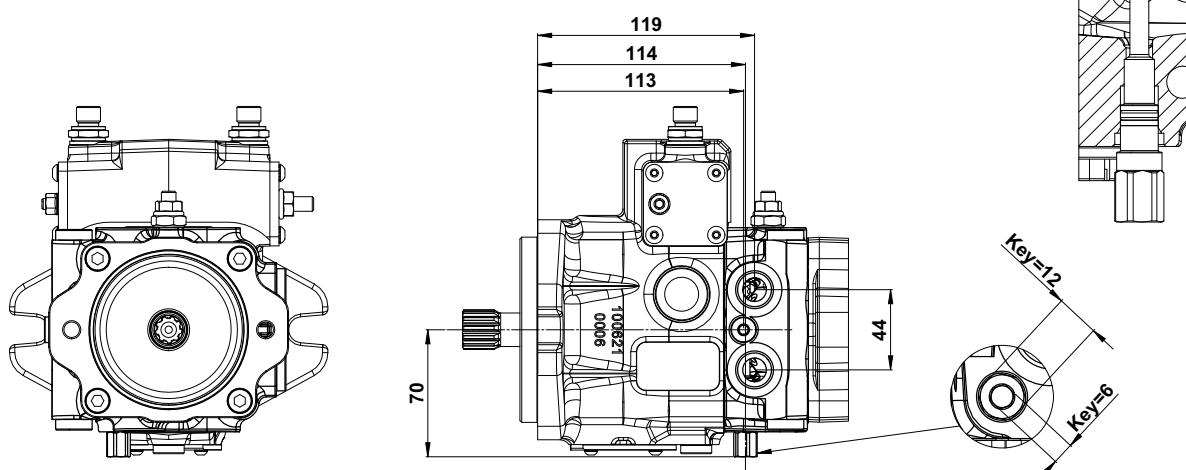
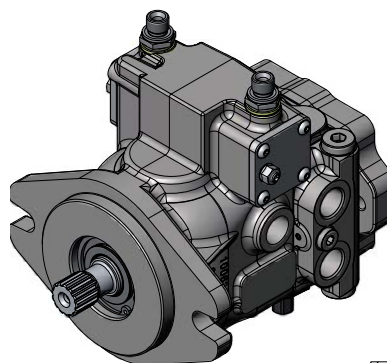
PURGE VALVE WITH SCREW BY-PASS

For the TPV-TPVTC 1500 pumps is available an integrated purge valve (loop flushing).

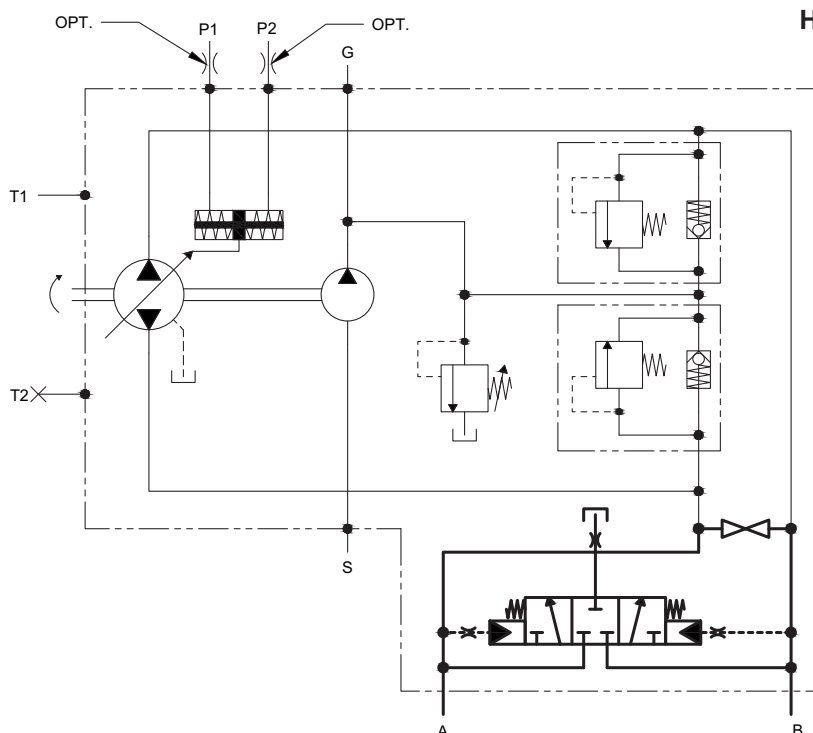
The valve consists of a spring centered shuttle spool connecting automatically the low pressure line (boost) with the reservoir removing heat from the system.

The quantity of the flushing oil is a function of the low system pressure (boost) and the size of the orifice on the valve (flow rate of 2,5 l/min at 2 MPa of boost pressure and 1 mm flow restrictor; different flow restrictors are available referred to the system pressure). The spool shifts at a differential pressure of

about 0,8 MPa (116 PSI).



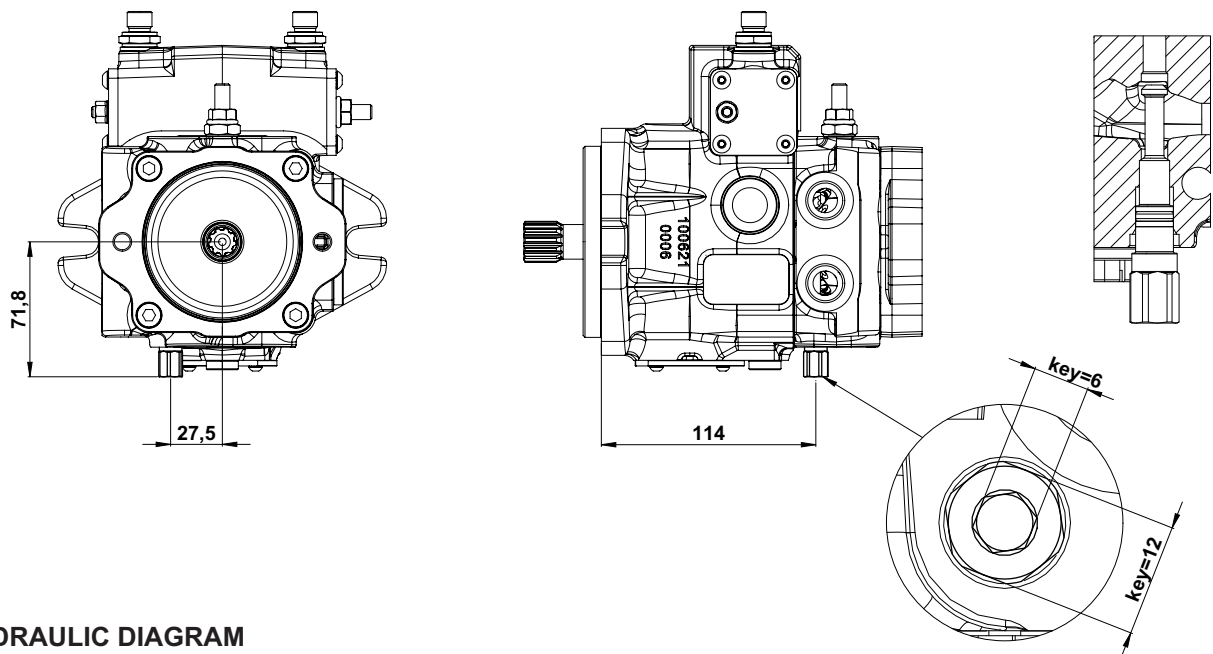
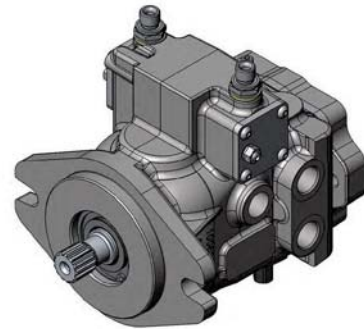
HYDRAULIC DIAGRAM



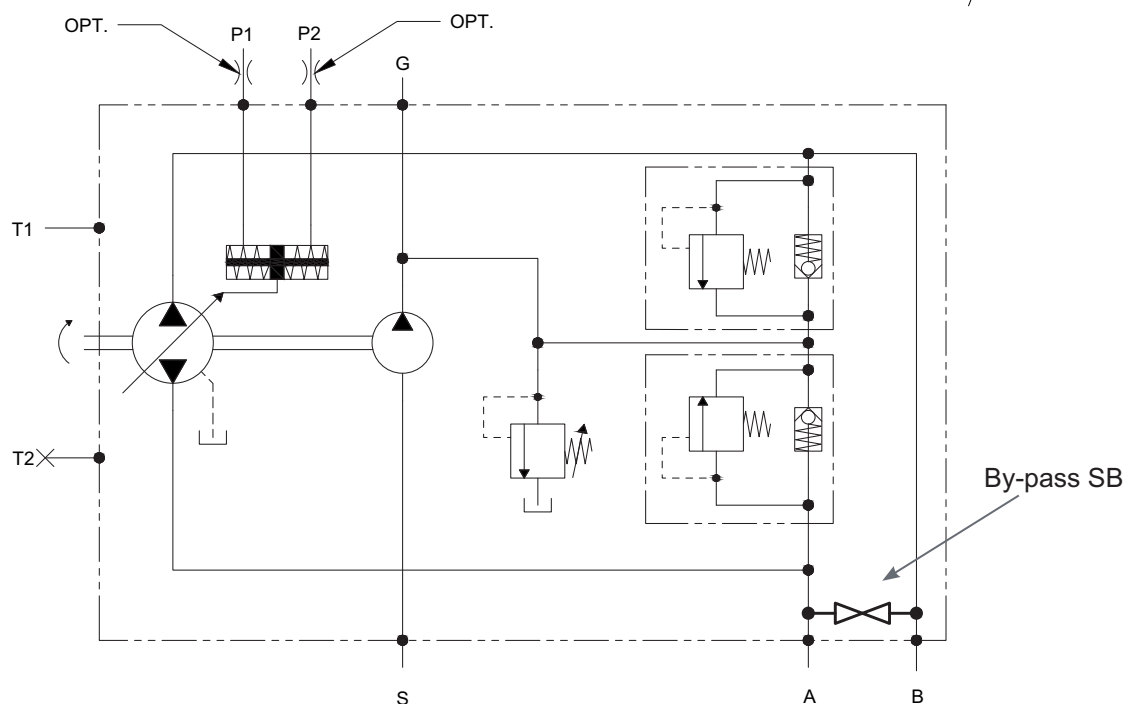
OPTIONAL SB

SCREW BY- PASS

To by pass the oil flow from one direction to the other, with the pump not running or in emergency condition, a by pass screw can be actuated to connect the 2 lines of the hydraulic system. The orifice is completely open after 4 counter-clockwise rotations of the screw.



HYDRAULIC DIAGRAM



OPTIONAL FLT

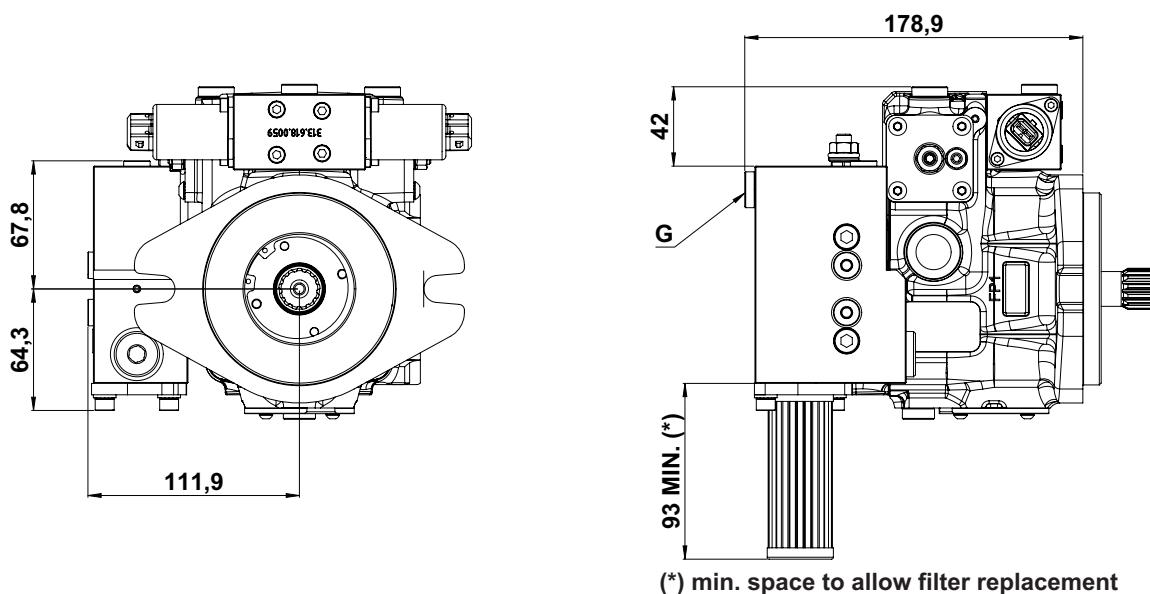
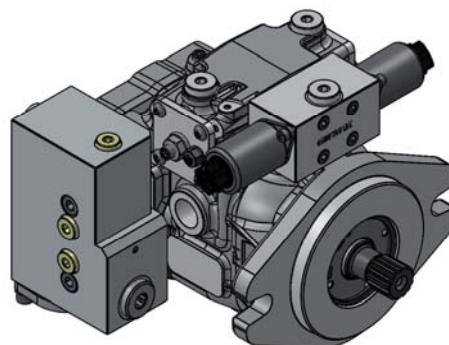
FILTER WITHOUT CLOGGING INDICATOR

To assure the oil filtration of the boost circuit, an optional filter is available, directly flanged to the pump.

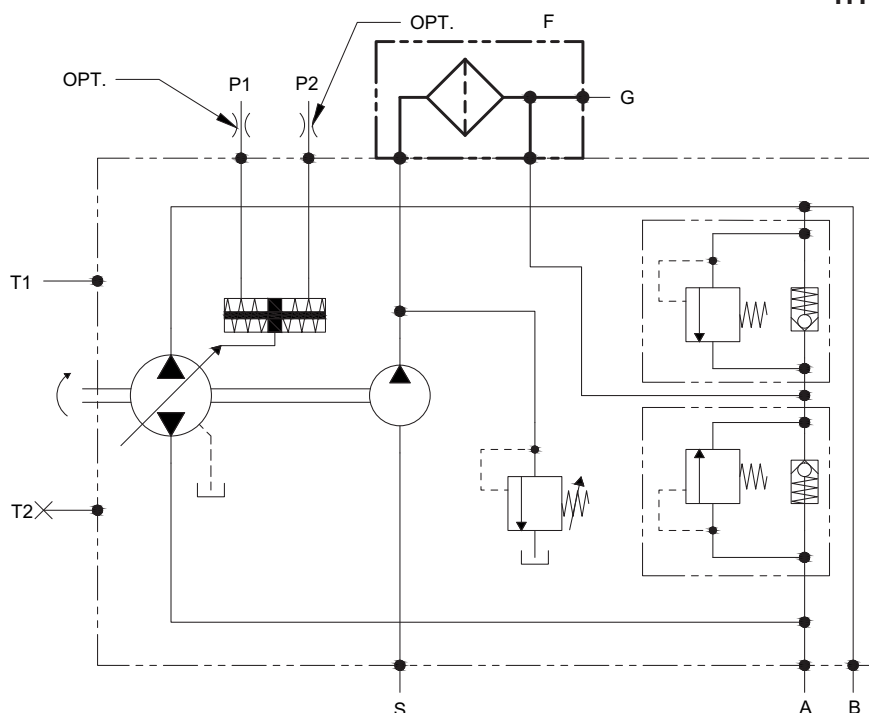
Efficiency:

10 μm (C) at $\beta = 200$ according to ISO 16889

12 μm (C) at $\beta = 1000$ according to ISO 16889



HYDRAULIC DIAGRAM



OPTIONAL FLTI

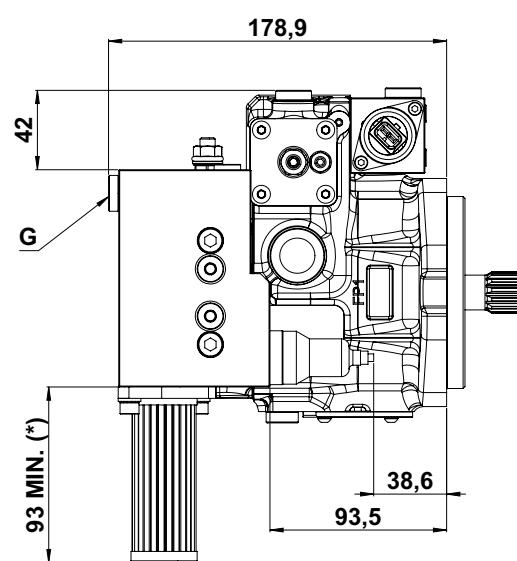
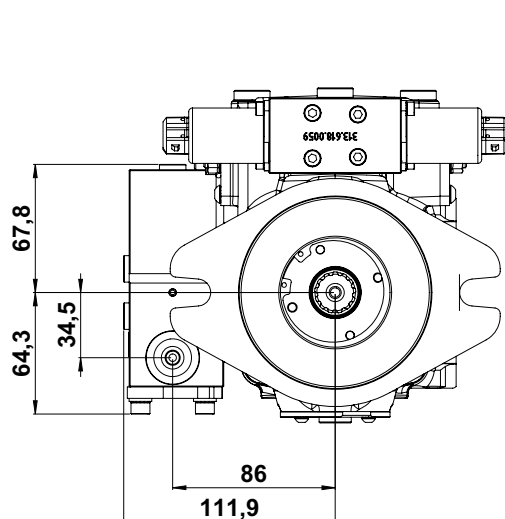
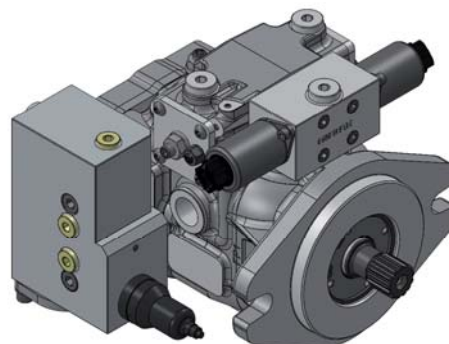
FILTER WITH CLOGGING INDICATOR

To assure the oil filtration of the boost circuit, an optional filter, with clogging indicator, is available directly flanged to the pump. The clogging indicator is set at 0,13 MPa.

Efficiency:

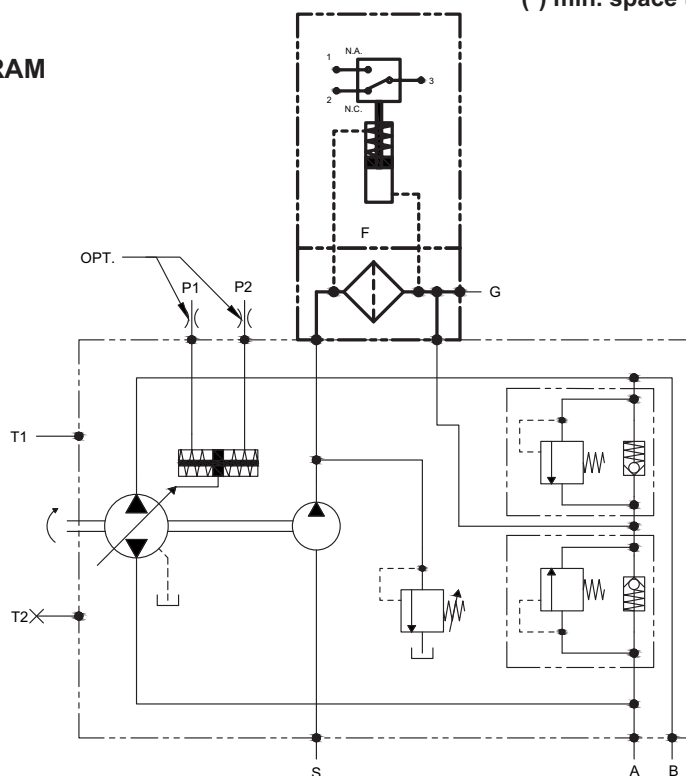
10 $\mu\text{m(C)}$ at $\beta = 200$ according to ISO 16889

12 $\mu\text{m(C)}$ at $\beta = 1000$ according to ISO 16889



(*) min. space to allow filter replacement

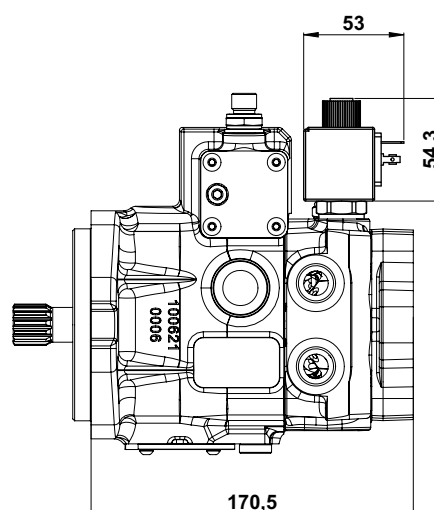
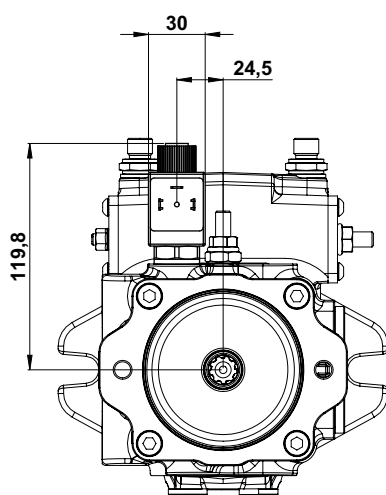
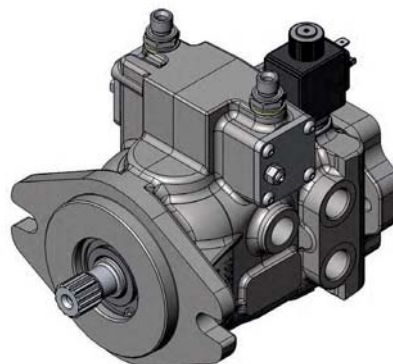
HYDRAULIC DIAGRAM



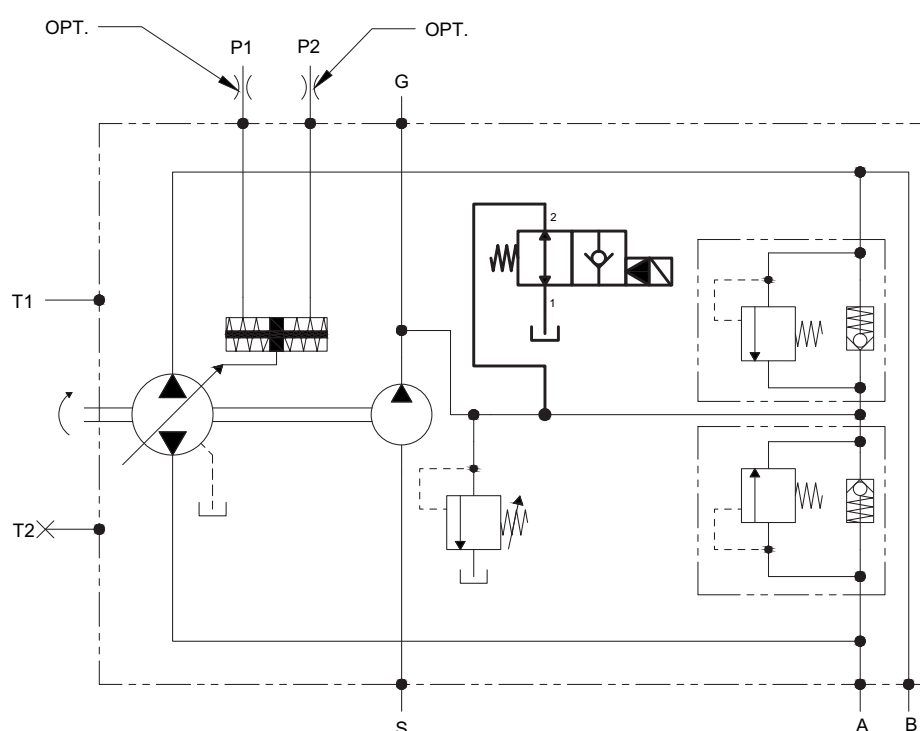
OPTIONAL MOB

MAN ON BOARD

On the pump a normally open electrical operate valve can be fitted. The valve allow the flow delivery only when energized. This function is used to increase the safety of the machine. The solenoid valve is available for 12V or 24V DC voltage.



HYDRAULIC DIAGRAM



(continued)

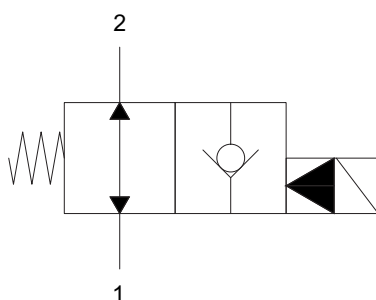
OPTIONAL MOB

MAN ON BOARD

TECHNICAL FEATURES

VALVE MOB - Hydraulic characteristics	
Max. operating pressure	30 MPa
Max. flow	40 lt/min.
Internal leakage	max. 5 drops/min. at 30 MPa
Response time	energized 20 ms
De-energized	30 ms
Temperature range	from -20°C to 90°C

VALVE MOB - Electrical characteristics	
Power	18 W
Various voltage options available	(AC/DC)
Wire insulation	Class H
Duty factor	ED 100%
Supply power tolerance	+ 10%, - 15% (DC)
Ambient temperature	from -30°C to 60°C
Several connection options available	

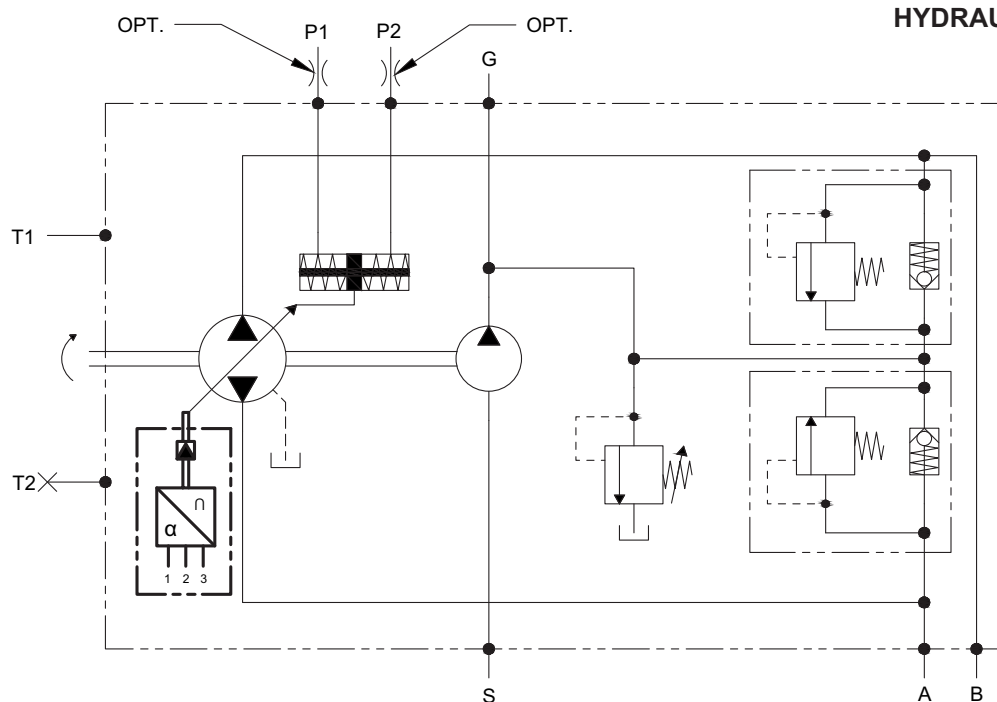
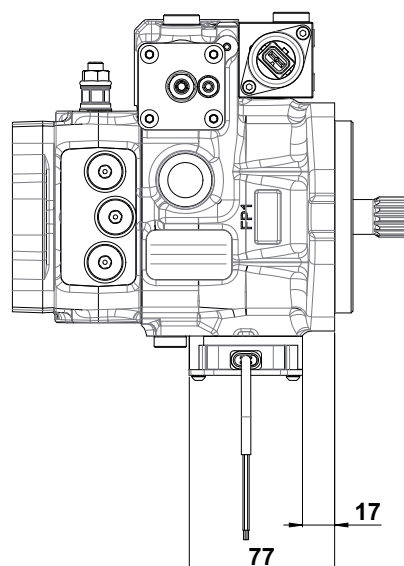
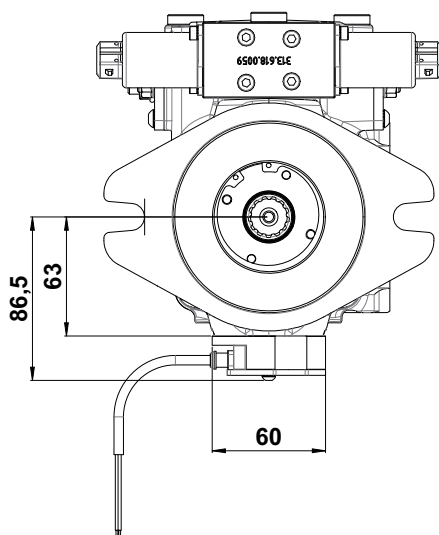
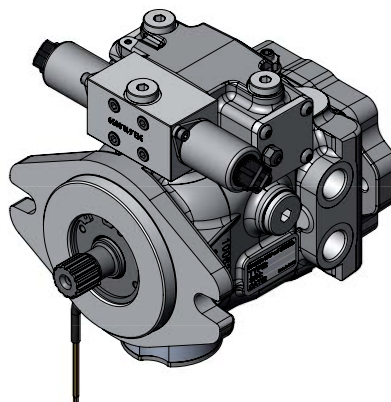


OPTIONAL RS

ANGLE SENSOR

An electronic angle sensor, to measure the swash plate position, is available for the TPV-TPVTC 1500 pumps.

The signal can be used for a remote control of the pump performance. The technical features of the sensor are shown on the next page.



(continued)

OPTIONAL RS

ANGLE SENSOR

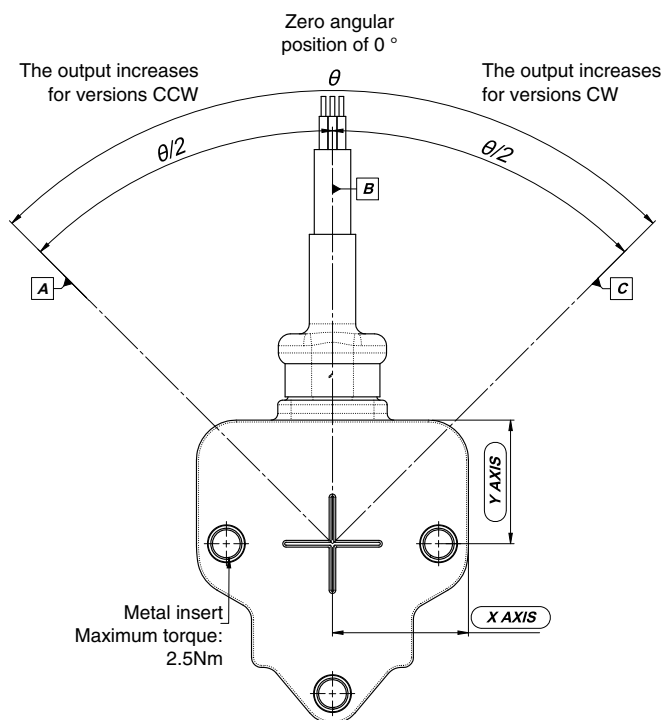
TECHNICAL FEATURES

Operating voltage: +5 Vdc**Output signal:** +0.5 Vdc...+4.5 Vdc output with power +5 Vdc: it is recommended a load resistance > 10 K Ω **Current consumption:** 4.5 V -> 20mA**Angular range:** $\pm 20^\circ$ **Resolution (20°C):** 12 bit (analog output)**Linearity error (20°C):** $\pm 0.5^\circ$ FS**Load resistance:** > 10 kohm**Centre position:** 2.5 V**Reverse connection protected:** yes**Delay time of output signal:** 4 ms**Temperature range:** -40°C...+85°C (higher

values on request); thermal drift < 50 ppm/°C

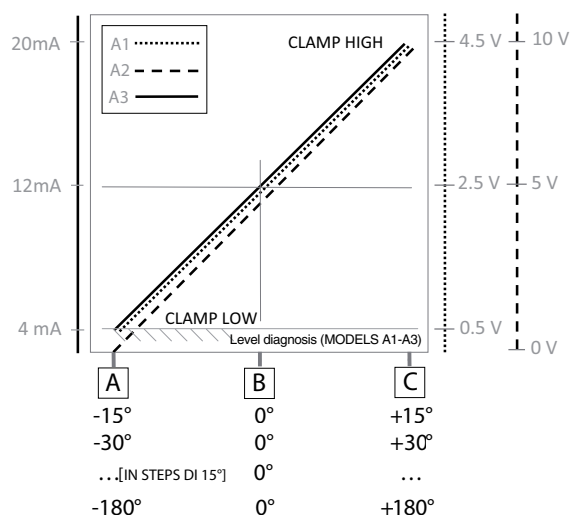
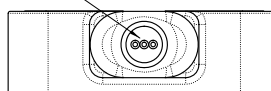
IP protection class: AMP IP67**Rotation:** clockwise CW single**Cable length:** 1 meter

CABLE VERSION



Ref.	CW Output
A	Output: 0.5Vdc
B	Zero angular position of 0°
C	Output: 4.5Vdc

CLOCKWISE CW SINGLE DIRECTION OF ROTATION 1

cable output - PUR sheath
conductors 22 AWG

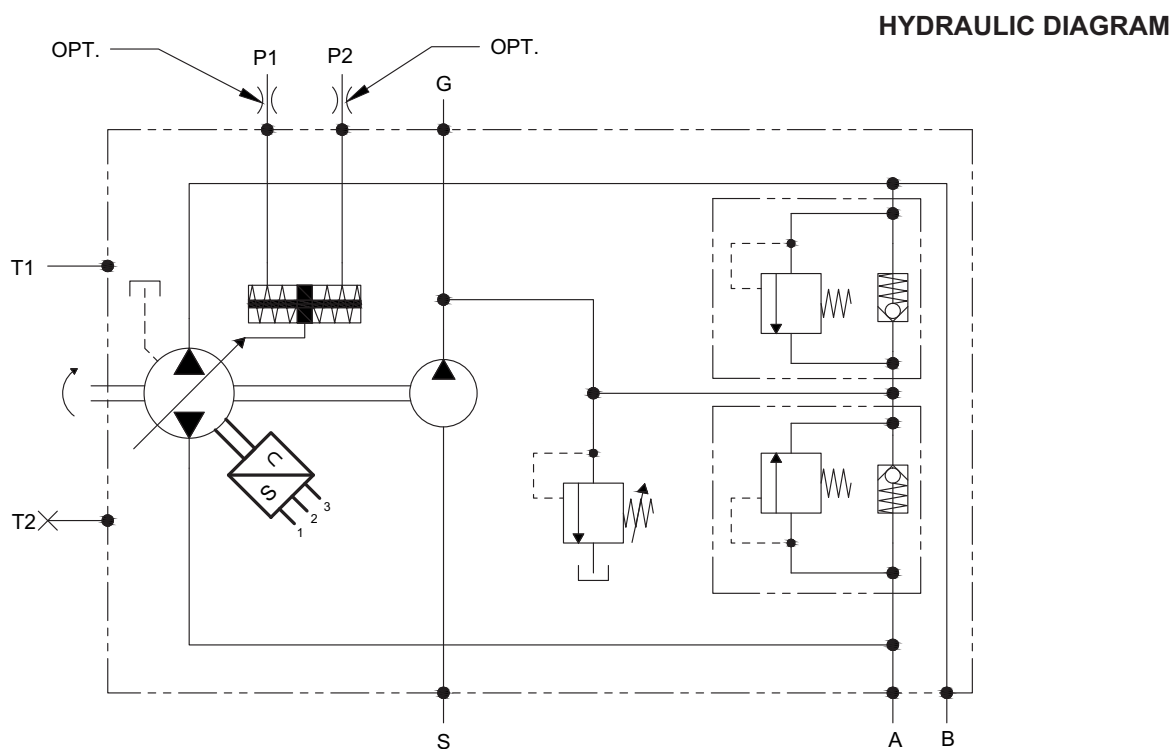
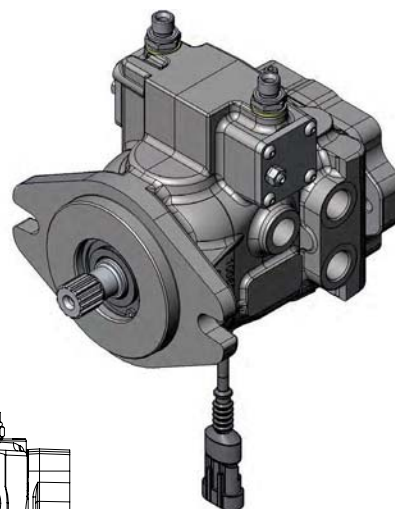
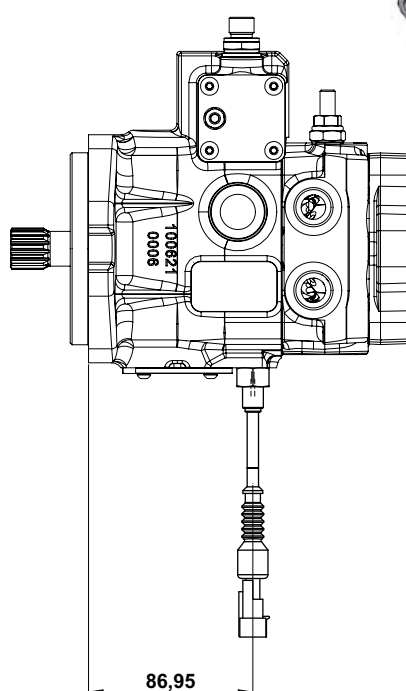
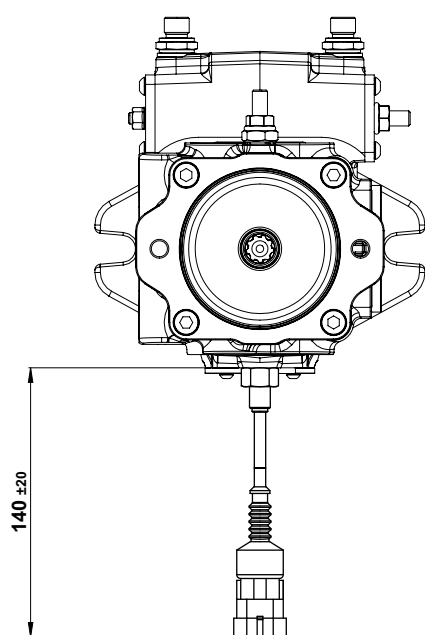
CONNECTIONS

BLACK GROUND 1
RED + SUPPLY 1
YELLOW OUTPUT 1

OPTIONAL REV.S

SPEED SENSOR

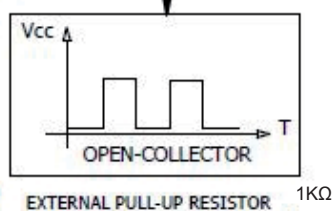
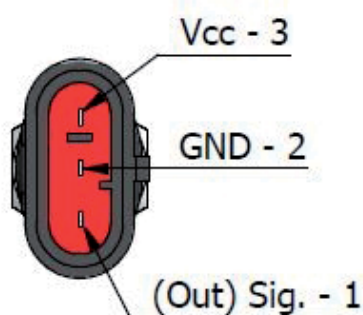
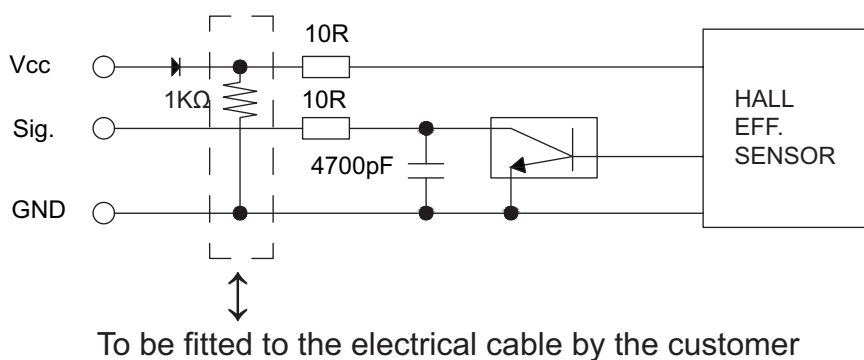
A speed sensor is available to monitor the pump shaft revolution speed. The technical features are shown on the next page.



(continued)

OPTIONAL REV.S**SPEED SENSOR****TECHNICAL FEATURES****Operating voltage:** 4.5-30 V DC**Output current:** max 25 mA**Maximum target:** 15 kHz**Internal resistance:** $140 \pm 30 \Omega$ **Insulation resistance:** 145 M Ω (500 V)**Protected by polarity inversion:** yes**Output signal (freq):** open collector (NPN)**Mechanical shock:** 4 g (1mm/80Hz)**Electro magnetic compatibility:** B.C.I.

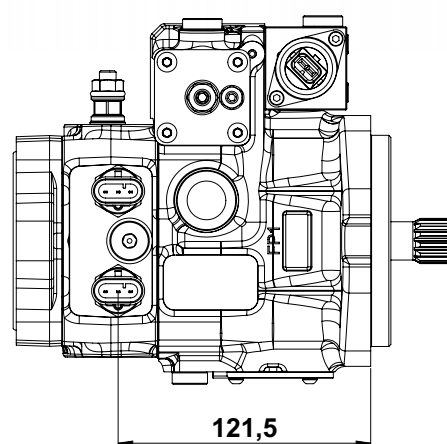
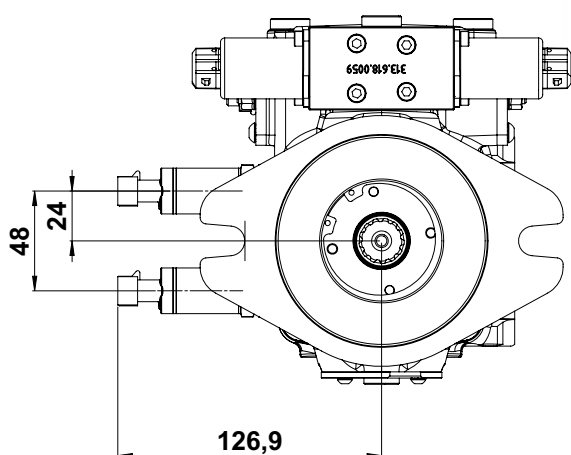
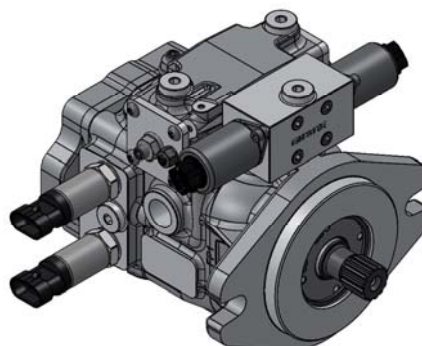
-Class "C" 100 mA, 1÷400 MHz

Reverse polarity protection: -30 Vdc for 1h**Overload protection:** 30 mA for 5'**Overvoltage protection:** 35 V for 5'**Short circuit protection:** to ground for 5'
to Vcc for 5'**Output transite voltage protection:** V_{BR} min
31,35 max 34,65**Temperature range:** -20 / +90°C**Protection class:** IP 67**Tightening torque:** 25 NmOutput pins are protected against 2000 V
electrostatic discharge according to HMB**Output signal/revolution** = 1**SENSOR FUNCTIONAL SCHEME**

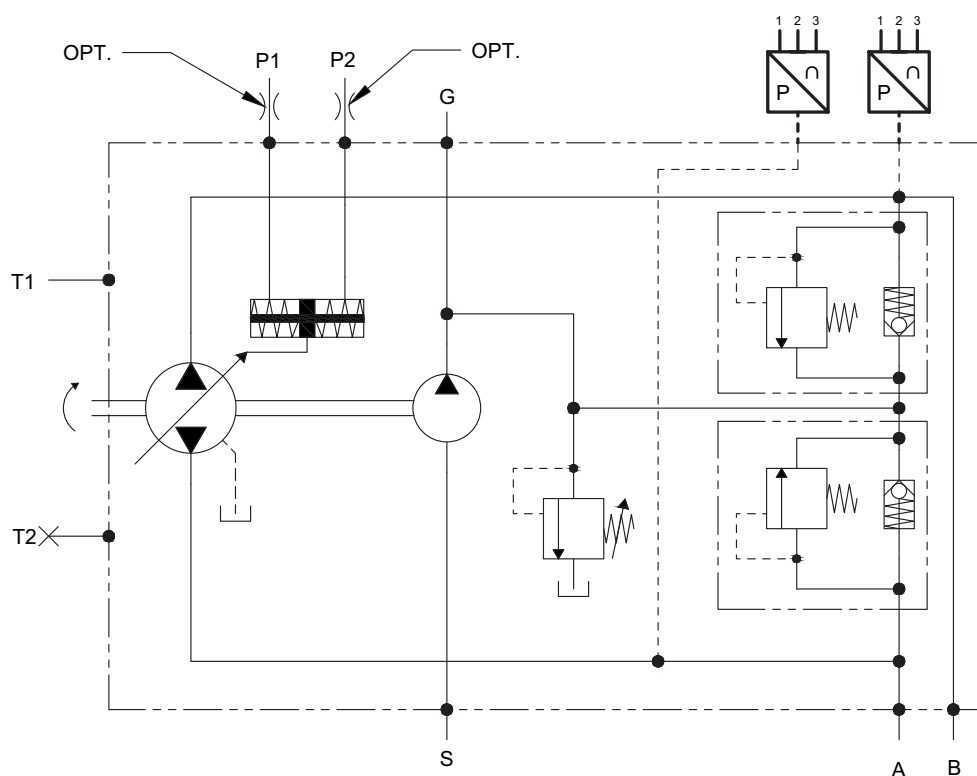
OPTIONAL PRS

PRESSURE SENSOR

The TPV-TPVTC 1500 pumps can fit a pressure sensor to monitor the working pressure. These information sent and processed by an electronic remote system allow a continuous remote control of the pump performance. The technical features are shown on the next page.



HYDRAULIC DIAGRAM



(continued)

OPTIONAL PRS

PRESSURE SENSOR

TECHNICAL FEATURES

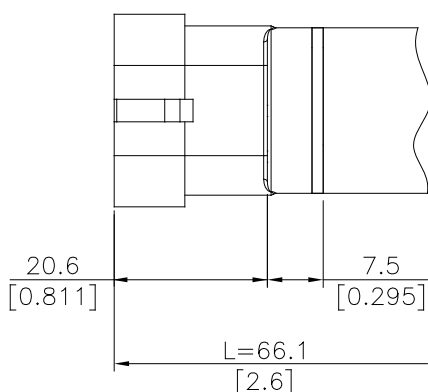
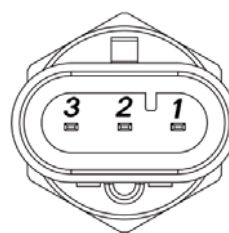
Pressure range: 0-40 MPa**Over pressure, max permitted:** 80 MPa**Burst pressure:** 150 MPa**Power supply U_B :** 5 ± 0.25 Volt DC**Signal output, ratiometric @5V:** 4.5 V (X)**Error levels, signal output:** < 0.5 V and > 4.5 Volt**Response time:** fast (< 1 msec)**Accuracy (IEC 61298-2):** $\pm 0.25\%$ FS BFSL**Max load, R_A :** $\geq 5K\Omega$ **Temperature range:**

- Operating temperature range (process): from -40°C to $+125^\circ\text{C}$

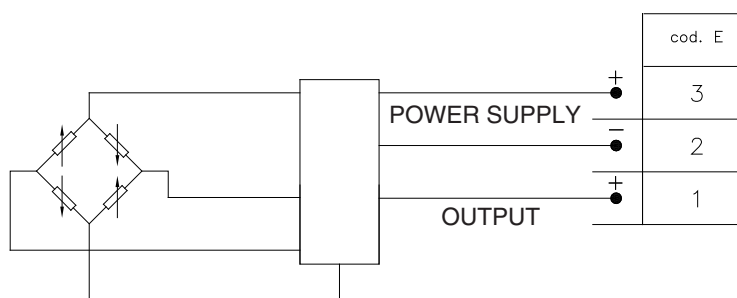
- Operating temperature range (environment): from -40°C to $+105^\circ\text{C}$

- Compensated temperature range: from -20°C to $+85^\circ\text{C}$

- Storage temperature range: from -40°C to $+125^\circ\text{C}$

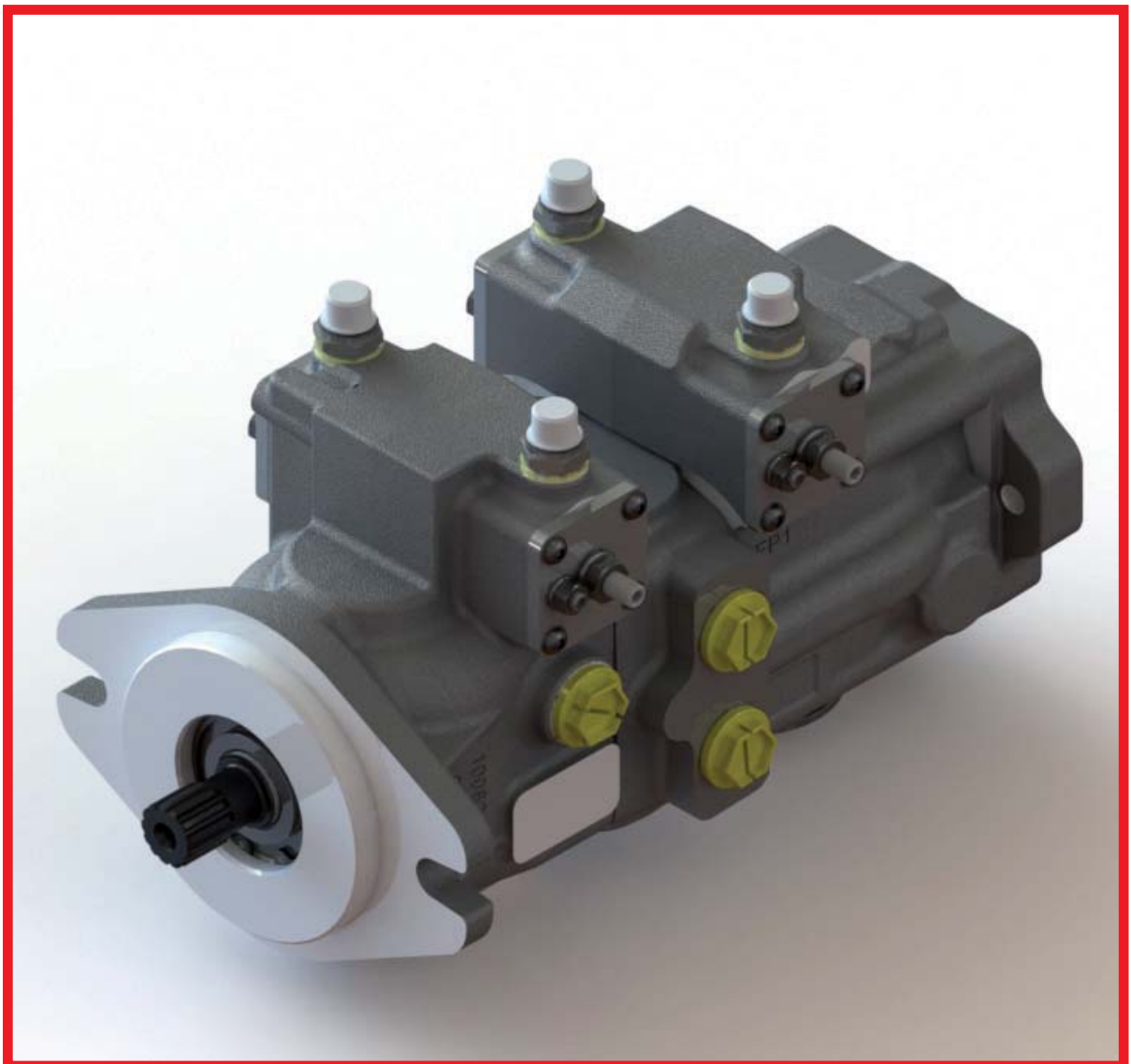
CE conformity acc. to: according to EU 2014/30**Mechanical shock:** 100g / 11 msec according to IEC 60068-2-27**Vibration resonance:** 20g max at 10...2000 Hz according to IEC 60068-2-6**IP protection class:** IP65 / IP67**Weight:** 80-120 gr. Nominal**Electric connector:** AMP Superseal 1.5 (3-pin)**Hydraulic connection:** G 1/4 gas male (DIN 3852-E)**S - Connector AMP Superseal 1.5 (3-pin)****S – AMP Superseal 1.5**

Protection rating IP67



TPVTC 1500

COMPACT VARIABLE DISPLACEMENT AXIAL PISTON PUMP



ORDER CODE

1500	TPVTC	17-9	17-9	CR	SS3	F2.1	SHI	SHI	OA	OA	30	30	06	SA-R	000	1	00
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17

Page

1500	0 - Pump series = Pump TPV 1500																
TPVTC	1 - Pump model = Compact tandem pump for closed loop circuit																
	2 - Primary pump displacement 17-9 = 17,6 cm ³ /n 18-9 = 18,7 cm ³ /n 19-9 = 19,9 cm ³ /n 21-9 = 21,1 cm ³ /n																
	3 - Secondary pump displacement 17-9 = 17,6 cm ³ /n 18-9 = 18,7 cm ³ /n 19-9 = 19,9 cm ³ /n 21-9 = 21,1 cm ³ /n																
CR	4 - Rotation = Clockwise rotation (right)																
CC	= Counter-clockwise rotation (left)																
SS3	5 - Shaft (mounting side) = Splined shaft SAE-B (ANSI B92.1A - 13T - 16/32 D.P.)																
F2.1	6 - Mounting flange = SAE-B 2 bolt - pilot diam. 101,6 mm																
SHI	7 - Controls primary pump = Hydraulic servo control																
SHIC	= Compact hydraulic servo control																
SEI1.3	= Electro-proportional servo control 12V DC (AMP junior timer connector)																
SEI2.3	= Electro-proportional servo control 24V DC (AMP junior timer connector)																
SEI1.3D	= Electro-proportional servo control 12V DC (Deutsch connector)																
SEI2.3D	= Electro-proportional servo control 24V DC (Deutsch connector)																
SHIX	= Hydraulic servo control with feed back																
SMIX	= Mechanical lever servo control with feed back																
SEIX1.3	= Electro-proportional servo control with feed back 12V DC (AMP junior timer connector)																
SEIX2.3	= Electro-proportional servo control with feed back 24V DC (AMP junior timer connector)																
SEIX1.3D	= Electro-proportional servo control with feed back 12V DC (Deutsch connector)																
SEIX2.3D	= Electro-proportional servo control with feed back 24V DC (Deutsch connector)																
SHI	8 - Controls secondary pump = Hydraulic servo control																
SHIC	= Compact hydraulic servo control																
SEI1.3	= Electro-proportional servo control 12V DC (AMP junior timer connector)																
SEI2.3	= Electro-proportional servo control 24V DC (AMP junior timer connector)																
SEI1.3D	= Electro-proportional servo control 12V DC (Deutsch connector)																
SEI2.3D	= Electro-proportional servo control 24V DC (Deutsch connector)																
SHIX	= Hydraulic servo control with feed back																
SMIX	= Mechanical lever servo control with feed back																
SEIX1.3	= Electro-proportional servo control with feed back 12V DC (AMP junior timer connector)																
SEIX2.3	= Electro-proportional servo control with feed back 24V DC (AMP junior timer connector)																
SEIX1.3D	= Electro-proportional servo control with feed back 12V DC (Deutsch connector)																
SEIX2.3D	= Electro-proportional servo control with feed back 24V DC (Deutsch connector)																
OA	9 - Control device position primary pump = Position A																

(continued)

ORDER CODE

Page

10 - Control device position secondary pump		
OA	= Position A	
11 - Relief valve pressure setting primary pump		
	10 = 10 MPa 15 = 15 MPa 18 = 18 MPa 20 = 20 MPa	
	25 = 25 MPa 30 = 30 MPa 35 = 35 MPa 40 = 40 MPa	
12 - Relief valve pressure setting secondary pump		
	10 = 10 MPa 15 = 15 MPa 18 = 18 MPa 20 = 20 MPa	
	25 = 25 MPa 30 = 30 MPa 35 = 35 MPa 40 = 40 MPa	
13 - Boost pump		
00	= Without boost pump *	
06	= Standard pump (5,8 cm ³ /n)	
	Standard setting: 2 MPa (hydraulic /electric servo control) at 1.000 n/min	
06(xx)	= Other pressure setting on request (between 2 and 3 MPa, please contact our Technical Department)	
* Upon order, please provide information on maximum external charge flow.		
14 - Through drive connection for rear pump		
SA-R	= SAE-A 2 bolt female standard (ANSI B92.1a - 9T - 16/32 D.P.)	80
C-SA	= Closed cover (without rear fitting)	80
15 - Displacements of the auxiliary gear pumps group 2 (SAE-A)		
000	= without pump	
	204 = 4,2 cm ³ /n 206 = 6,0 cm ³ /n 209 = 8,4 cm ³ /n 211 = 10,8 cm ³ /n	
	214 = 14,4 cm ³ /n 217 = 16,8 cm ³ /n 219 = 19,2 cm ³ /n 222 = 22,8 cm ³ /n	
	226 = 26,2 cm ³ /n 230 = 30,0 cm ³ /n 234 = 34,2 cm ³ /n 240 = 39,6 cm ³ /n	
16 - Voltage for optionals (where applicable)		
0	= Without	
1	= 12V DC	
2	= 24V DC	
17 - Optional		
00	= Without optional	
VS-SB	= Purge valve with screw by-pass	82
SB	= Screw by-pass	83
MOB	= Man on board	84
RS	= Angle sensor	86
REV.S	= RPM sensor	88
PRS	= Pressure sensor	90
G/J/M/-	= Port threads and restrictor diameter	

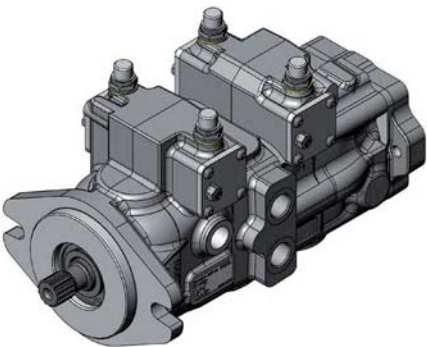
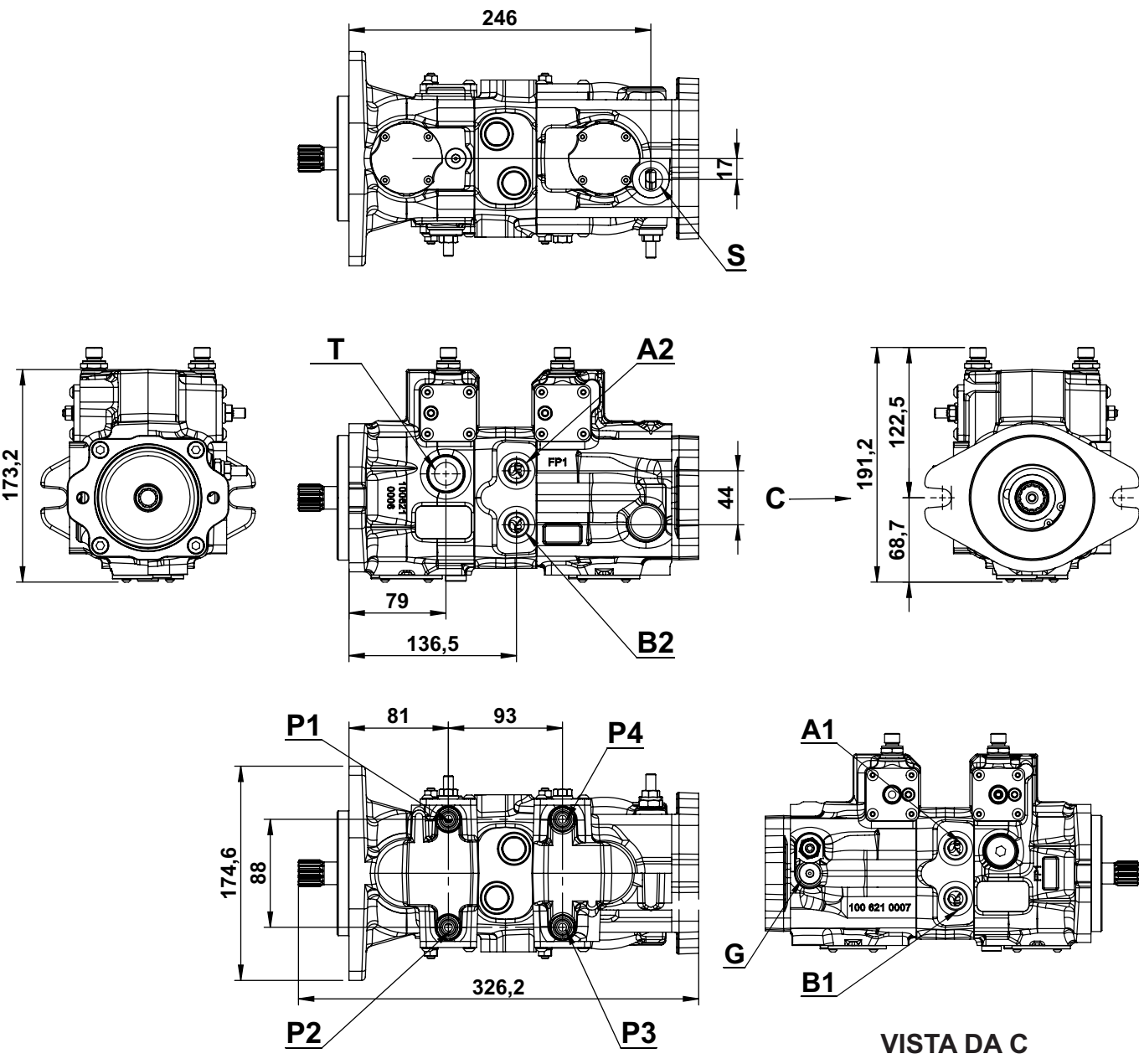
	Servo control type	Port threads	Symbol
STANDARD	SEI	Plugged	-
	SHI	1/4" BSPP	G
ON REQUEST	SHI	JIC (7/16" - 20)	J
	SHI	METRIC (M12x1,5)	M

Example G/08 = 1/4" BSPP port threads and Ø 0,8 mm restrictor (SHI)

Example -/08 = Ø 0,8 mm restrictor (SEI)

Restrictor diameter (SHI/SEI)	
-	Without restrictor
06	Restrictor orifice Ø 0,6 mm
08	Restrictor orifice Ø 0,8 mm
10	Restrictor orifice Ø 1,0 mm
12	Restrictor orifice Ø 1,2 mm
16	Restrictor orifice Ø 1,6 mm
20	Restrictor orifice Ø 2,0 mm

GENERAL DIMENSIONS / PORTS AND PIPES



PORTS		
A ₁ - B ₁	Main pressure ports 1	1/2" BSPP
A ₂ - B ₂	Main pressure ports 2	1/2" BSPP
T	Drain line	1/2" BSPP
S	Suction line	1/2" BSPP
G	Boost system pressure port	1/4" BSPP
P1 - P2	Servo control ports (male) pump 1	1/4" BSPP
P3 - P4	Servo control ports (male) pump 2	1/4" BSPP

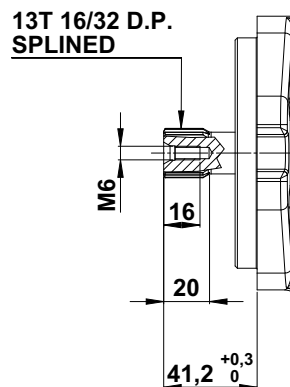
SHAFT OPTIONS AND MOUNTING FLANGES

SS3

SPLINED SHAFT SAE B 13T

Norm ANSI B92.2-1970 CLASS 5

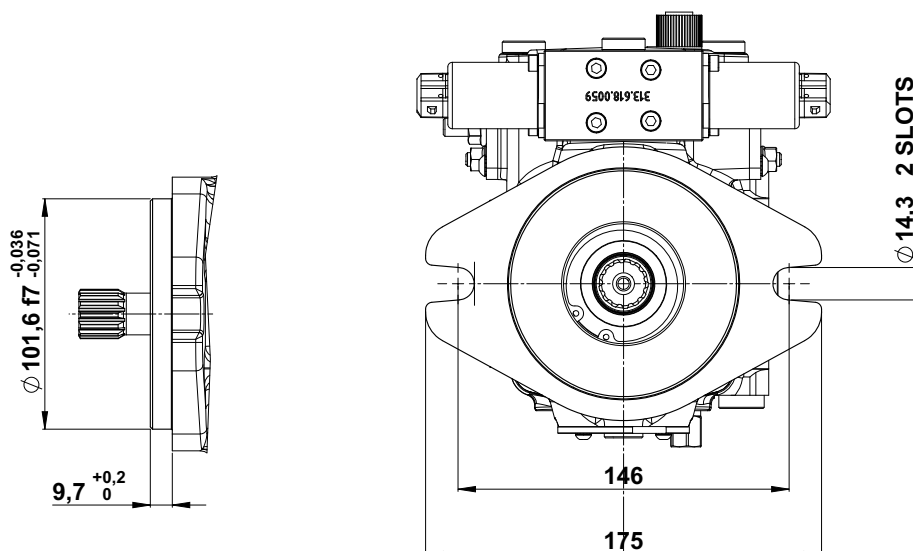
Max. torque = 320 Nm



Caution: in case of multiple pump applications the total torque requested must be limited to the above value.

F2.1

FLANGE SAE B - 2 BOLT



SHI

HYDRAULIC SERVO CONTROL

The pump displacement variation is obtained by adjusting the pressure on P1-P2-P3-P4 servo control ports by means of a hydraulic proportional joystick (with integrated pressure reducing valves).

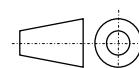
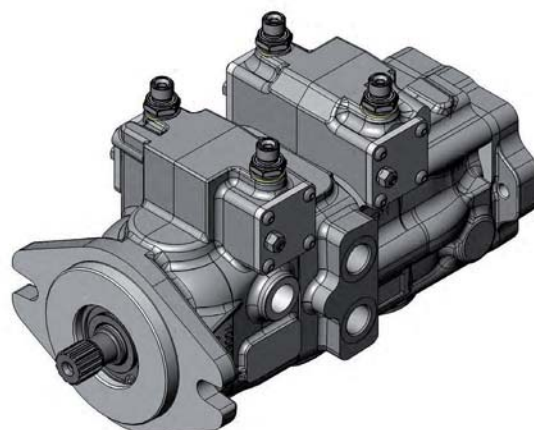
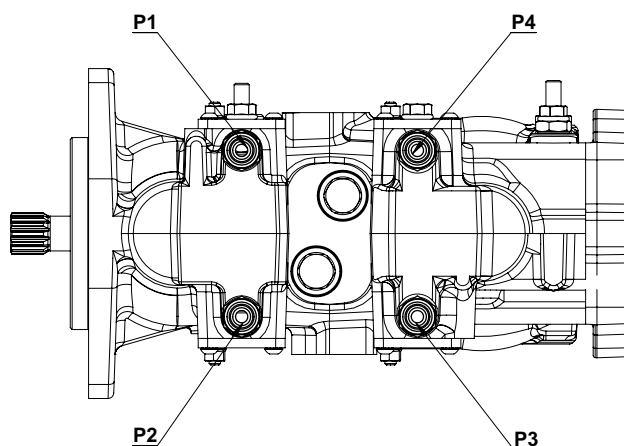
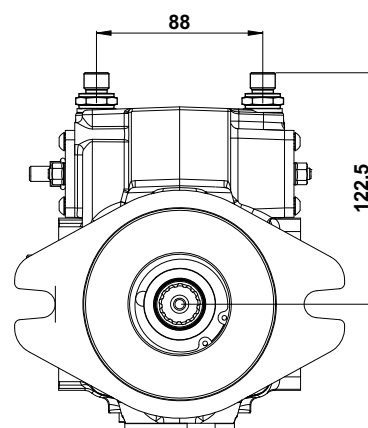
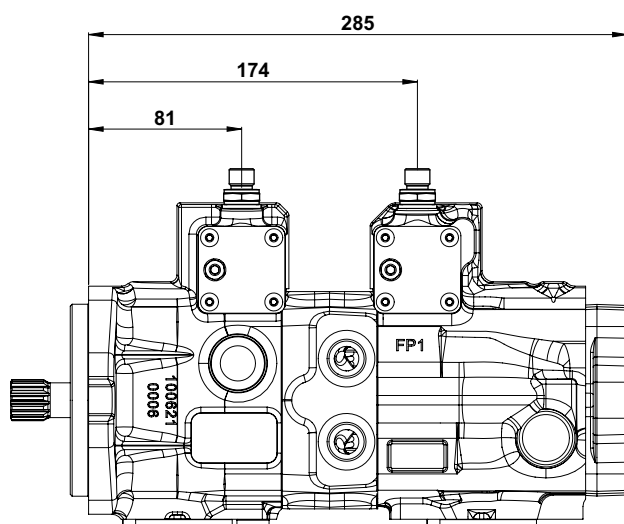
The servo control oil supply can be obtained by taking pressure from the boost pump (G port), see page 58.

The servo control return time can be adjusted by inserting a restrictor on the joystick supply line ($0,5 \div 1,2$ mm).

The servo control operation curve, in both directions, goes from 0,4 to 1,8 MPa (tolerance ± 5 %).

The adjusting curve of the hydraulic joystick has to be a little wider ($0,3 \div 1,9$ MPa).

Suggested curves for HPV series Joysticks: CR062 (see HT 73/B/105/0417/E catalogue).

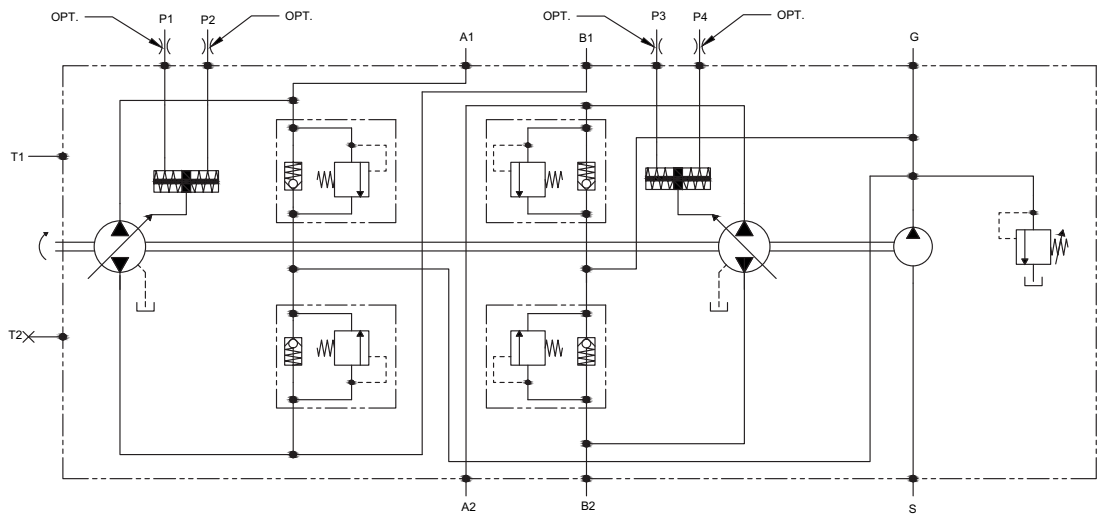


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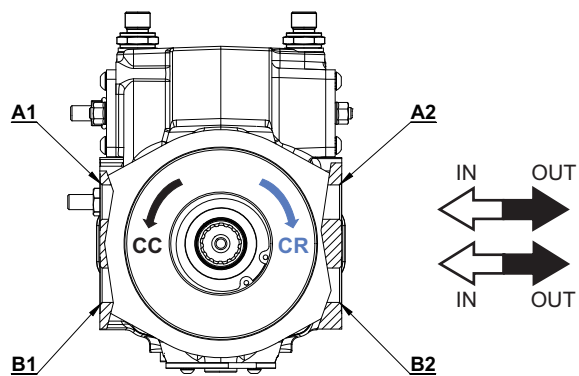
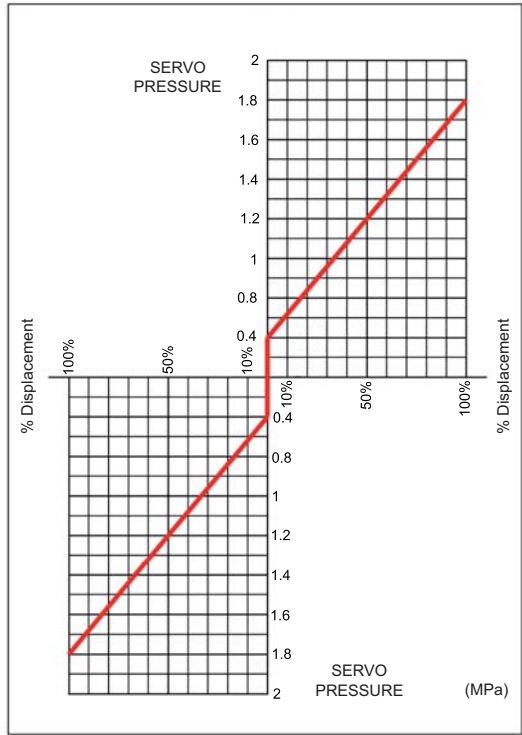
SHI

COMPACT HYDRAULIC SERVO CONTROL

HYDRAULIC DIAGRAM



SERVO PRESSURE - DISPLACEMENT GRAPHIC



FLOW DIRECTION	PRIMARY PUMP			SECONDARY PUMP		
	Port	OUT	IN	Port	OUT	IN
Clockwise (CR)	P ₁ P ₂	B ₁ A ₁	A ₁ B ₁	P ₃ P ₄	A ₂ B ₂	B ₂ A ₂
Counter clockwise (CC)	P ₁ P ₂	A ₁ B ₁	B ₁ A ₁	P ₃ P ₄	B ₂ A ₂	A ₂ B ₂

SHIC

COMPACT HYDRAULIC CONTROL

(with side pilot ports)

The pump displacement variation is obtained by adjusting the pressure on P1-P2-P3-P4 servo control ports by means of a hydraulic proportional joystick (with integrated pressure reducing valves).

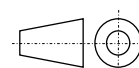
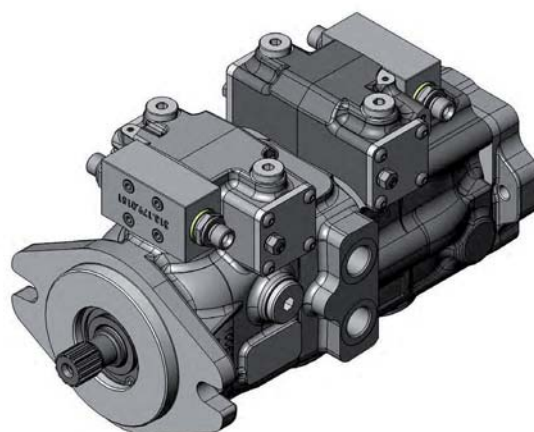
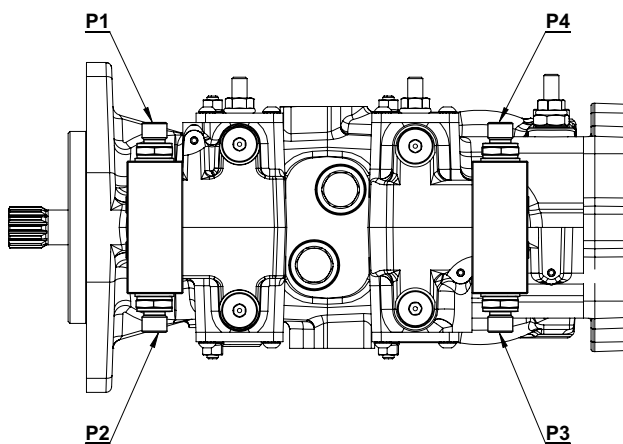
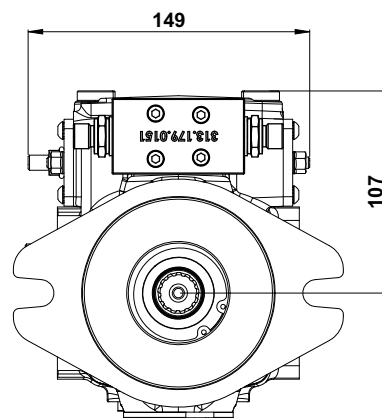
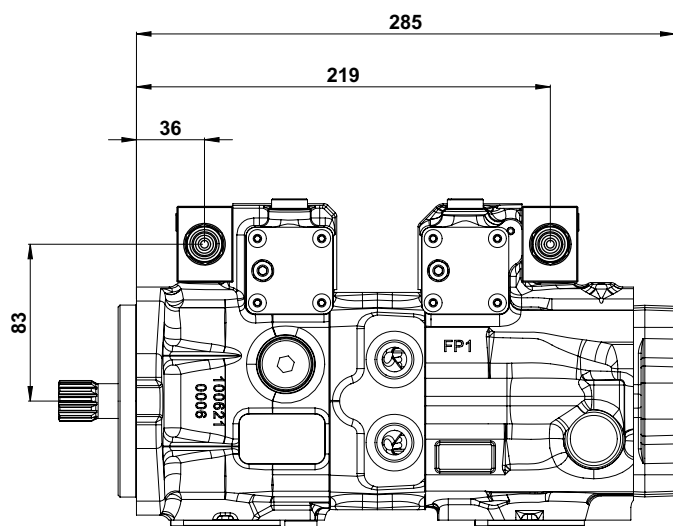
The servo control oil supply can be obtained by taking pressure from the boost pump (G port), see page 58.

The servo control return time can be adjusted by inserting a restrictor on the P1 and P2 ports on the pump (0,5 ÷ 1,2 mm).

The servo control operation curve, in both directions, goes from 0,4 to 1,8 MPa (tolerance $\pm 5\%$).

The adjusting curve of the hydraulic joystick has to be a little wider (0,3 ÷ 1,9 MPa).

Suggested curves for HPV series Joysticks: CR062 (see HT 73/B/105/0417/E catalogue).



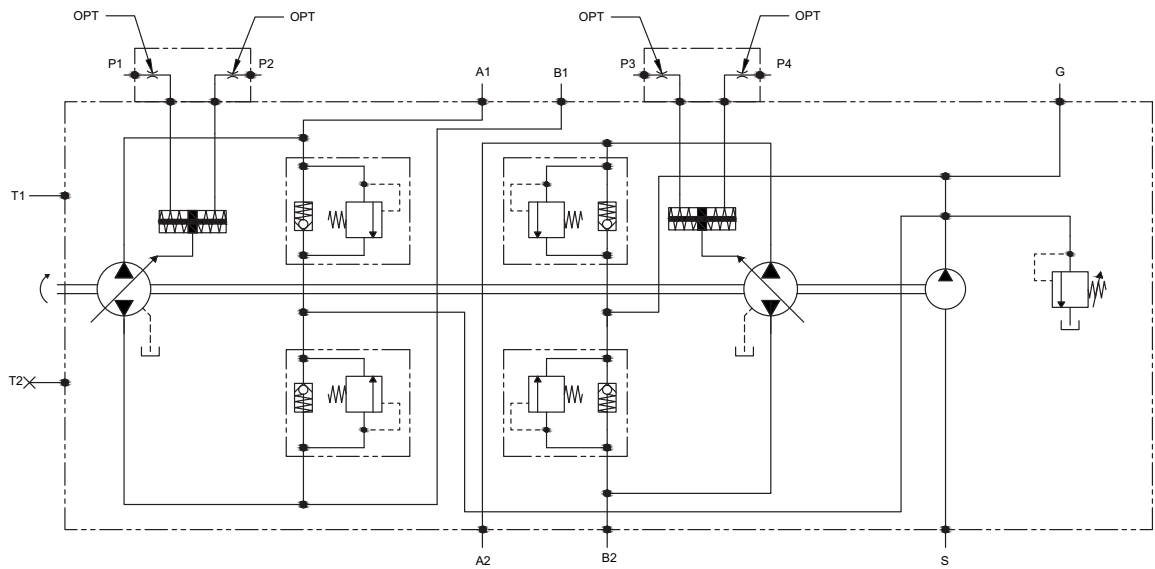
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SHIC

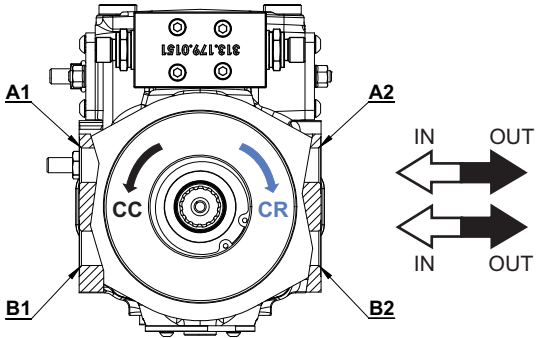
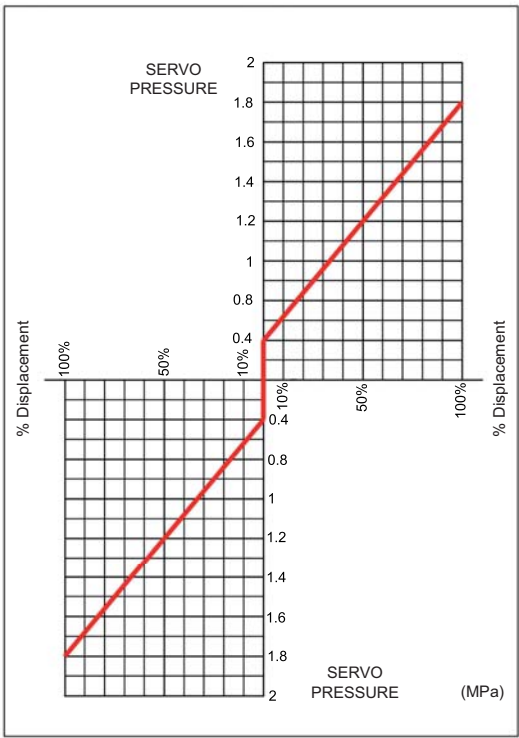
COMPACT HYDRAULIC CONTROL

(with side pilot ports)

HYDRAULIC DIAGRAM



SERVO PRESSURE - DISPLACEMENT GRAPHIC



FLOW DIRECTION	PRIMARY PUMP			SECONDARY PUMP		
	Port	OUT	IN	Port	OUT	IN
Rotation						
Clockwise (CR)	P ₁ P ₂	B ₁ A ₁	A ₁ B ₁	P ₃ P ₄	A ₂ B ₂	B ₂ A ₂
Counter clockwise (CC)	P ₁ P ₂	A ₁ B ₁	B ₁ A ₁	P ₃ P ₄	B ₂ A ₂	A ₂ B ₂

SEI 1.3 (12V DC)

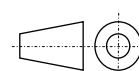
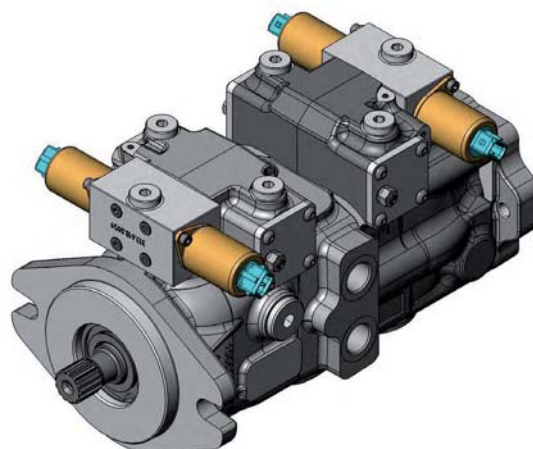
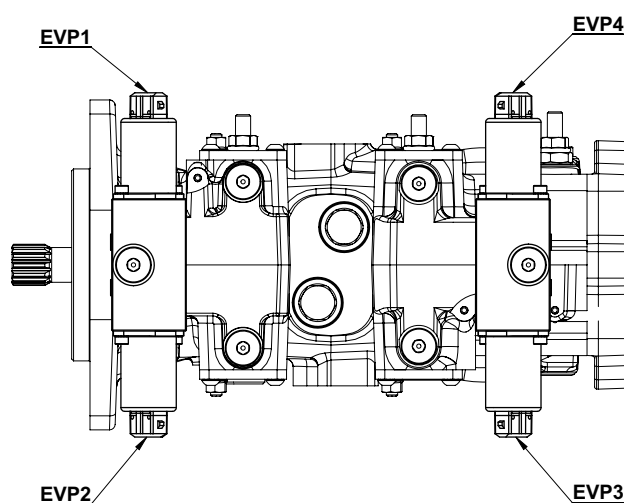
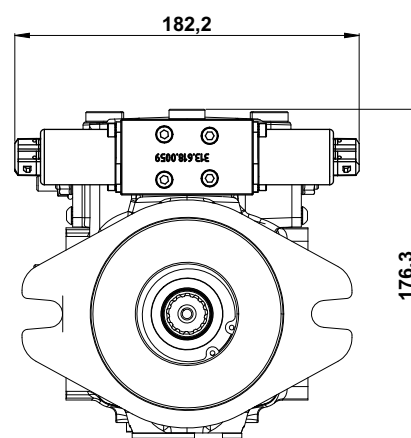
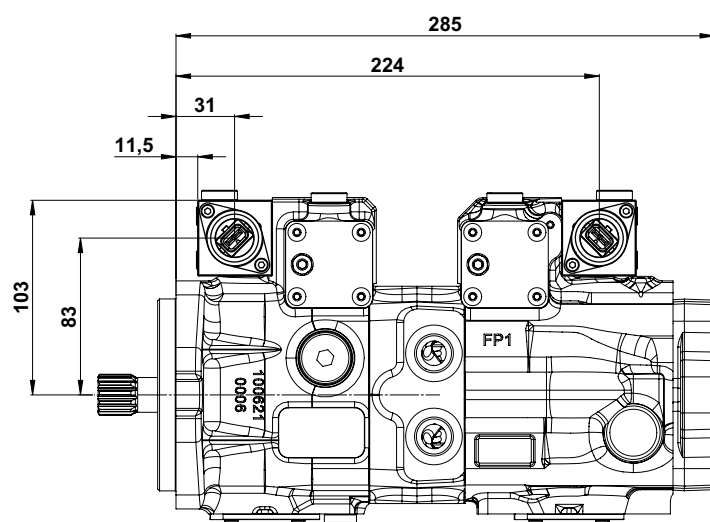
SEI 2.3 (24V DC)

ELECTRO-PROPORTIONAL SERVO CONTROL

(AMP junior timer connector)

The pump displacement variation is obtained by an electric signal, which varies approx.:

- from 315 to 630 mA (24V DC voltage)
- from 630 to 1260 mA (12V DC voltage)



(continued)

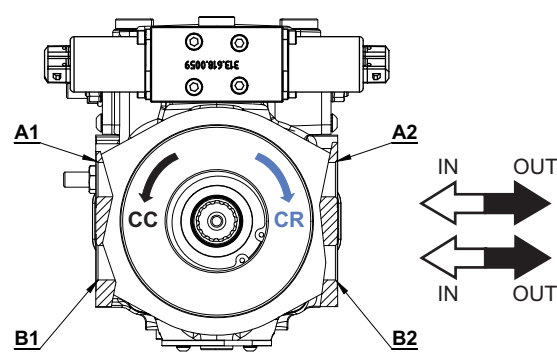
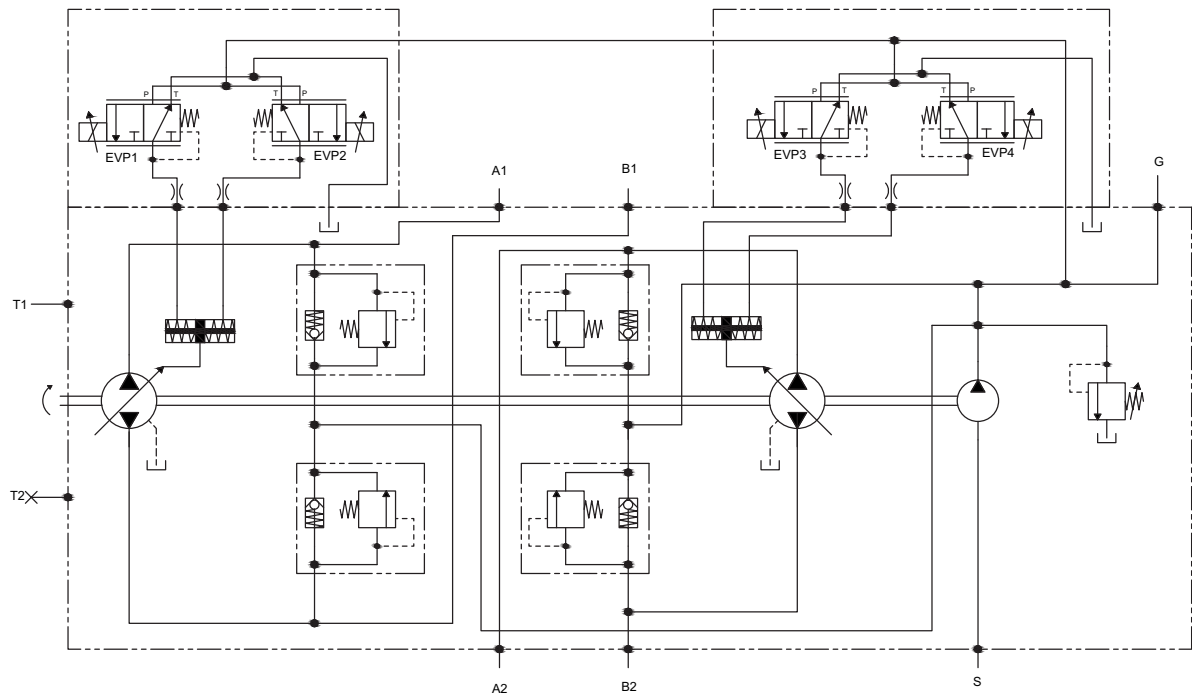
SEI 1.3 (12V DC)

SEI 2.3 (24V DC)

ELECTRO-PROPORTIONAL SERVO CONTROL

(AMP junior timer connector)

HYDRAULIC DIAGRAM



FLOW DIRECTION	PRIMARY PUMP			SECONDARY PUMP		
Rotation	 EVP	OUT	IN	 EVP	OUT	IN
Clockwise (CR)	EVP1 EVP2	B ₁ A ₁	A ₁ B ₁	EVP3 EVP4	A ₂ B ₂	B ₂ A ₂
Counter clockwise (CC)	EVP1 EVP2	A ₁ B ₁	B ₁ A ₁	EVP3 EVP4	B ₂ A ₂	A ₂ B ₂

(continued)

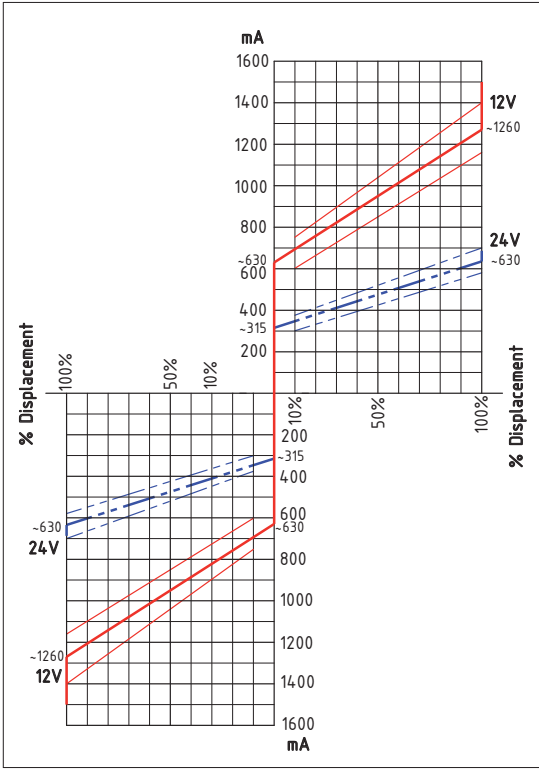
SEI 1.3 (12V DC)

SEI 2.3 (24V DC)

ELECTRO-PROPORTIONAL SERVO CONTROL

(AMP junior timer connector)

CURRENT-DISPLACEMENT GRAPHIC



ELECTRICAL FEATURES		
Voltage	12 V DC	24 V DC
Electric current	1500 mA	750 mA
Load resistance	4,72 Ω ± 5%	20,8 Ω ± 5%
Type of control	Current control	
	PWM 100 Hz (suggested)	
Type of connection	AMP Junior Timer	
Protection class	Until IP6K6 / IPX9K	

HYDRAULIC FEATURES	
Max. pressure (P, T)	pP= 5 MPa, pT= 3 MPa
Hysteresis (w/PWM)	<0,07 MPa (pA=2,0)
	<0,1 MPa (pA=2,5)
	<0,15 MPa (pA=3,5)
Filtration ratio	125 μm
Oil contamination level	Min. filtration ratio: 20/18/15
	According ISO 4406
	Hydraulic oil DIN 51524
Min./max. oil temperature	From -20 to +90°C

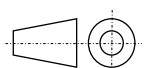
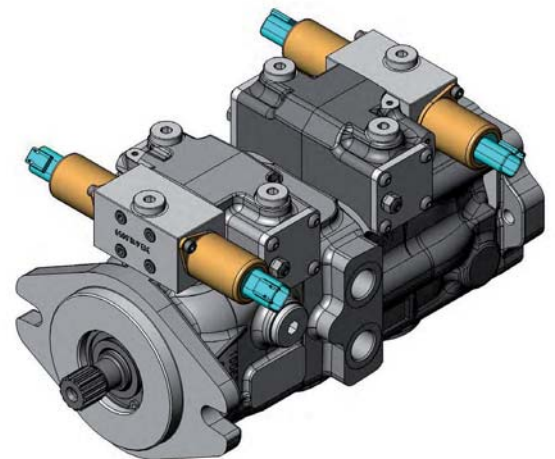
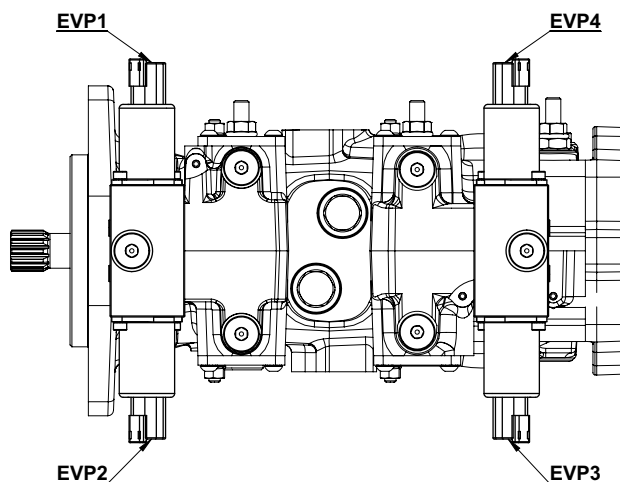
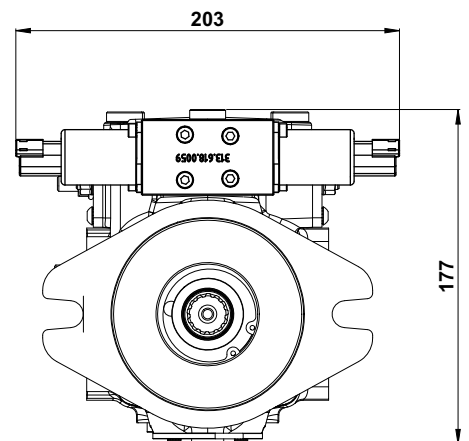
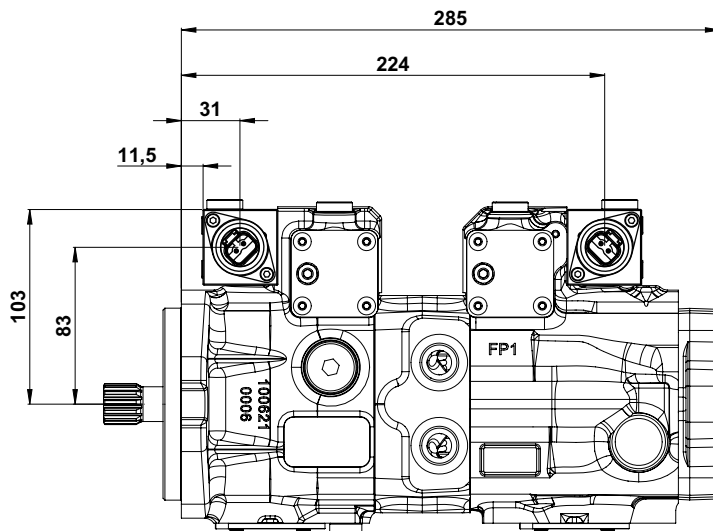
SEI 1.3D (12V DC)
SEI 2.3D (24V DC)

ELECTRO-PROPORTIONAL SERVO CONTROL

(Deutsch connector)

The pump displacement variation is obtained by an electric signal, which varies approx.:

- from 315 to 630 mA (24V DC voltage)
- from 630 to 1260 mA (12V DC voltage)



(continued)

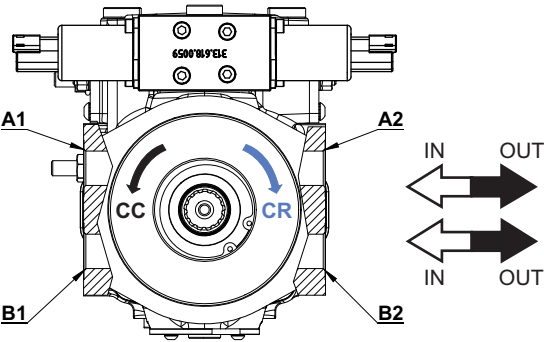
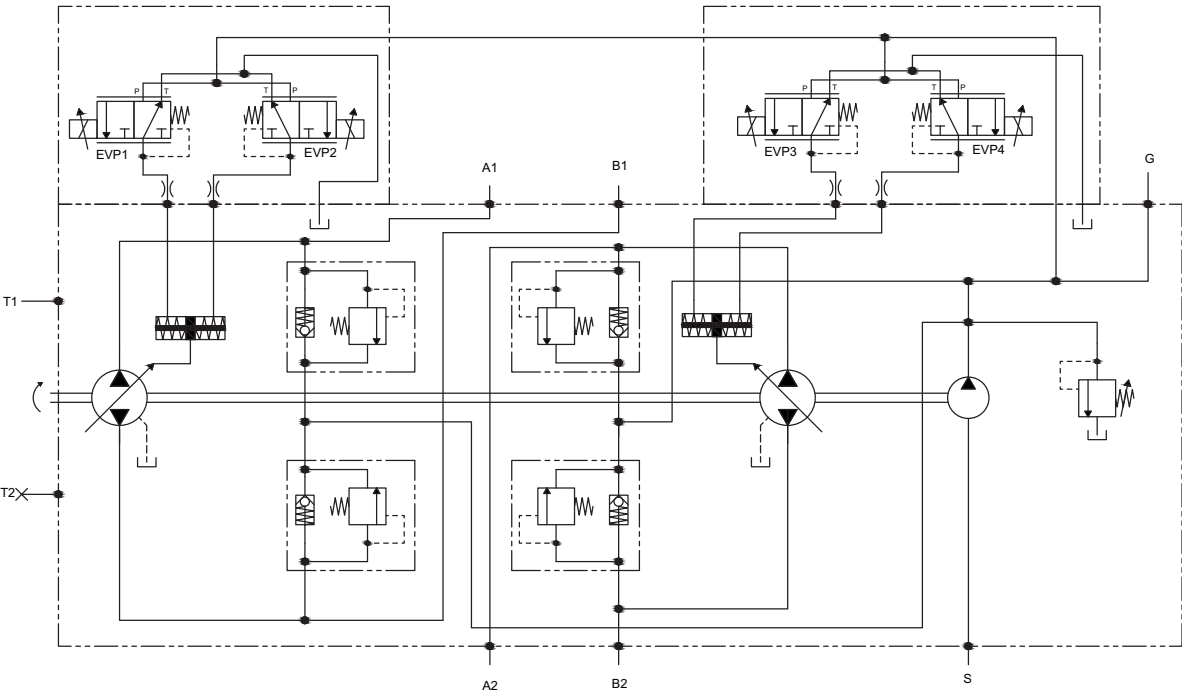
SEI 1.3D (12V DC)

SEI 2.3D (24V DC)

ELECTRO-PROPORTIONAL SERVO CONTROL

(Deutsch connector)

HYDRAULIC DIAGRAM

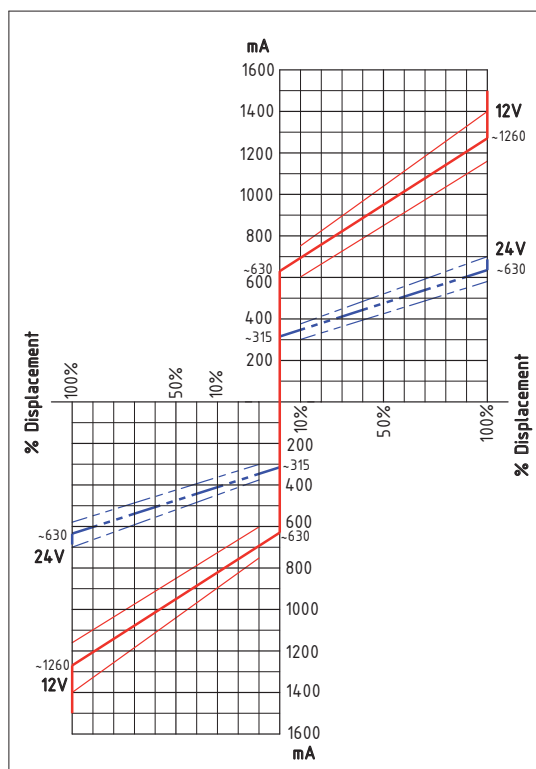


FLOW DIRECTION	PRIMARY PUMP			SECONDARY PUMP		
Rotation	 EVP	OUT	IN	 EVP	OUT	IN
Clockwise (CR)	EVP1 EVP2	B ₁ A ₁	A ₁ B ₁	EVP3 EVP4	A ₂ B ₂	B ₂ A ₂
Counter clockwise (CC)	EVP1 EVP2	A ₁ B ₁	B ₁ A ₁	EVP3 EVP4	B ₂ A ₂	A ₂ B ₂

(continued)

SEI 1.3D (12V DC)**SEI 2.3D** (24V DC)**ELECTRO-PROPORTIONAL SERVO CONTROL**

(Deutsch connector)

CURRENT-DISPLACEMENT GRAPHIC**ELECTRICAL FEATURES**

Voltage	12 V DC	24 V DC
Electric current	1500 mA	750 mA
Load resistance	4,72 $\Omega \pm 5\%$	20,8 $\Omega \pm 5\%$
Type of control	Current control	
	PWM 100 Hz (suggested)	
Type of connection	DEUTSCH DT 04-2P	
Protection class	Until IP6K6 / IPX9K	

HYDRAULIC FEATURES

Max. pressure (P, T)	pP= 5 MPa, pT= 3 MPa
Hysteresis (w/PWM)	<0,07 MPa (pA=2,0)
	<0,1 MPa (pA=2,5)
	<0,15 MPa (pA=3,5)
Filtration ratio	125 μ m
Oil contamination level	Min. filtration ratio: 20/18/15
	According ISO 4406
	Hydraulic oil DIN 51524
Min./max. oil temperature	From -20 to +90°C

SHIX

HYDRAULIC SERVO CONTROL WITH FEED BACK

The pump displacement variation is obtained by adjusting the pressure on P1-P2-P3-P4 servo control ports by means of a hydraulic proportional joystick (with integrated pressure reducing valves).

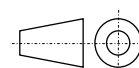
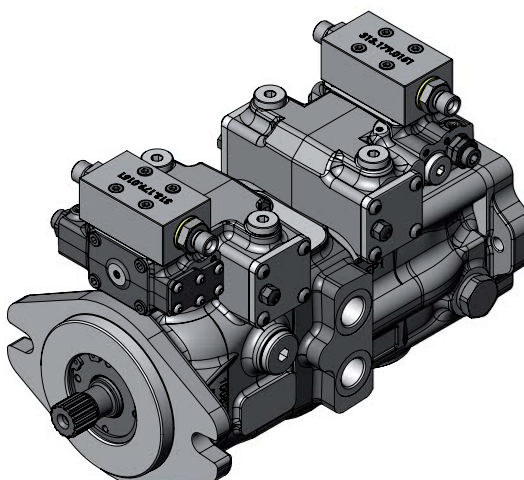
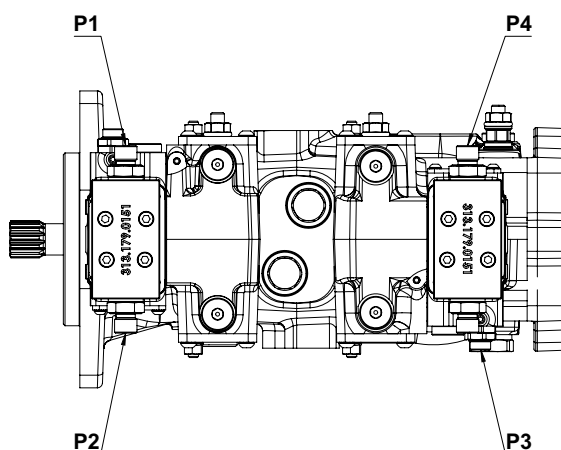
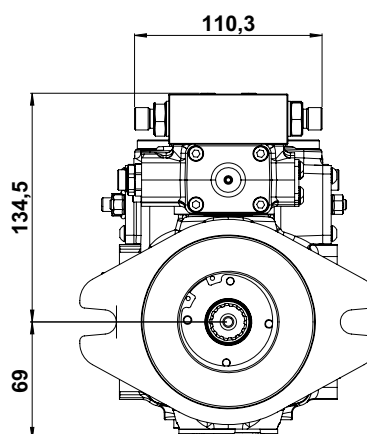
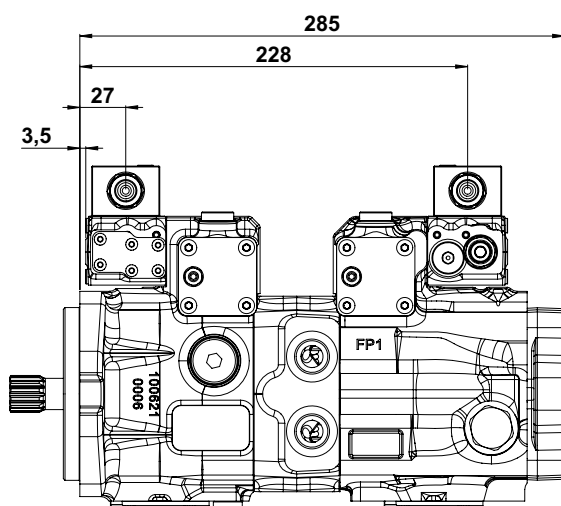
The servo control oil supply can be obtained by taking pressure from the boost pump (G port), see page 58.

The servo control return time can be adjusted by inserting a restrictor on the joystick supply line ($0,5 \div 1,2$ mm).

The servo control operation curve, in both directions, goes from 0,4 to 1,8 MPa (tolerance ± 5 %).

The adjusting curve of the hydraulic joystick has to be a little wider ($0,3 \div 1,9$ MPa).

Suggested curves for HPV series Joysticks: CR096 (see HT 73/B/105/0417/E catalogue).

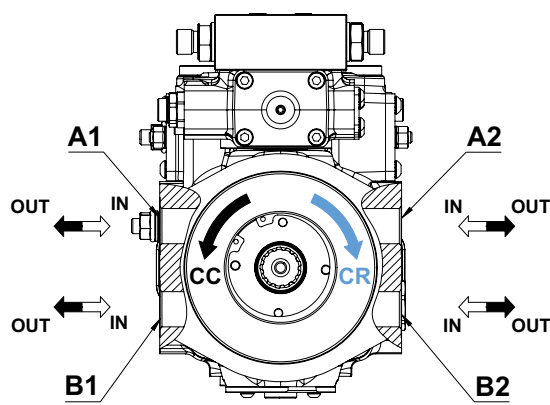
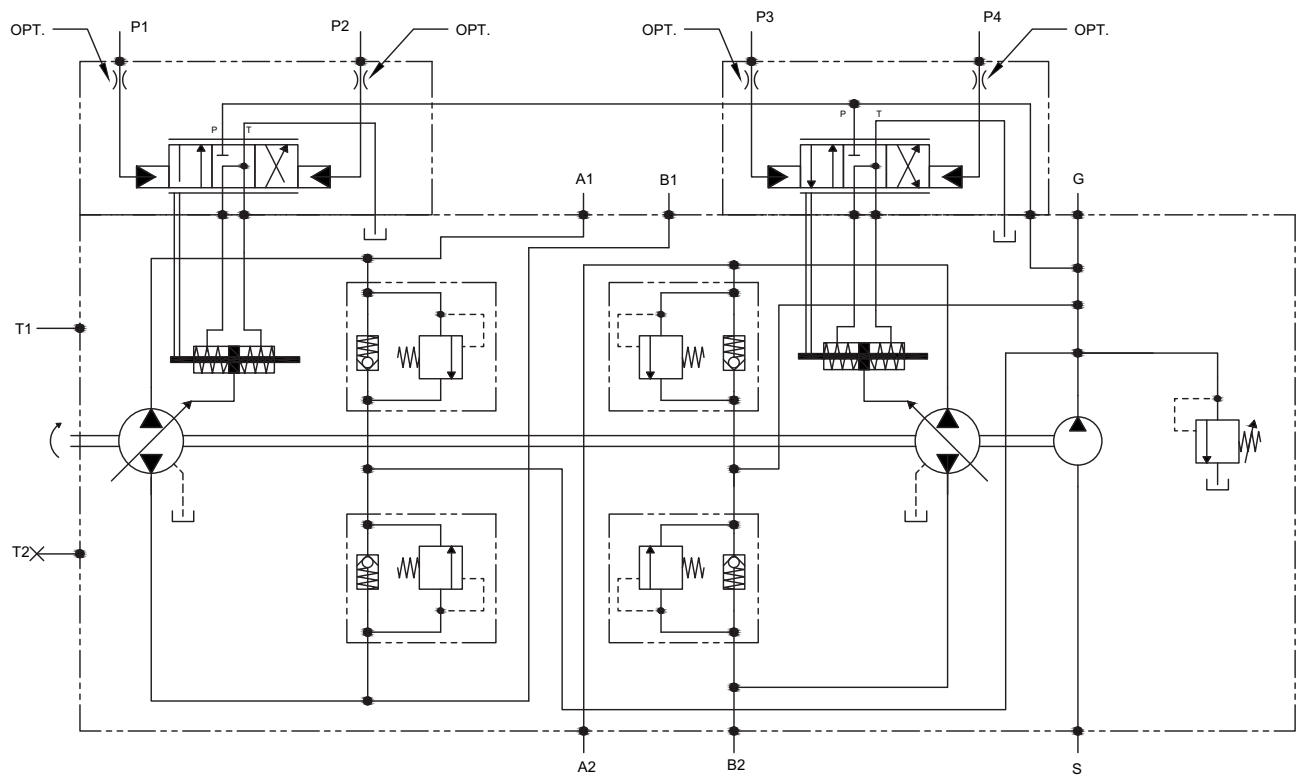


(continued)

SHIX

HYDRAULIC SERVO CONTROL WITH FEED BACK

HYDRAULIC DIAGRAM

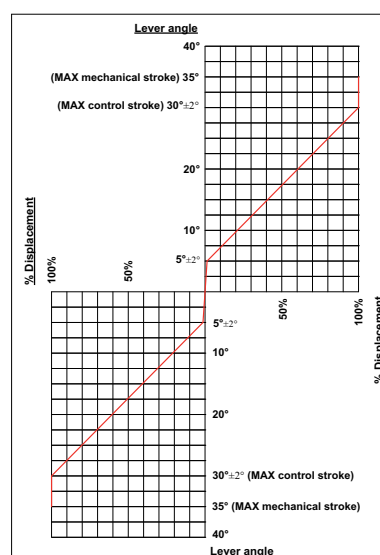
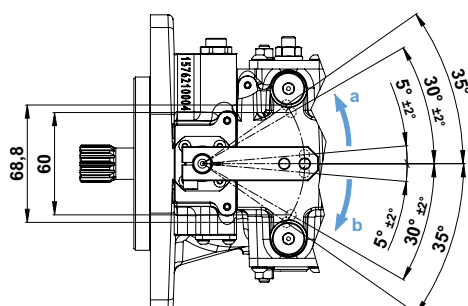
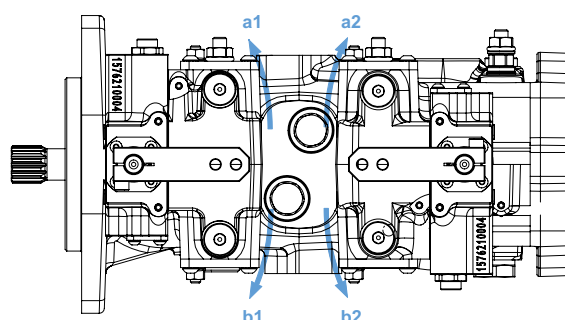
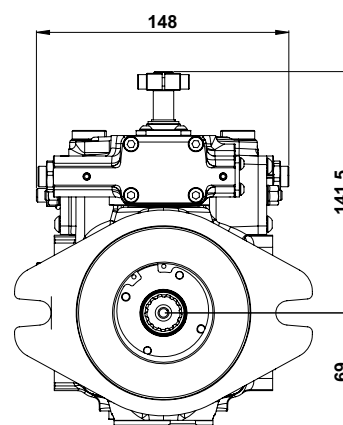
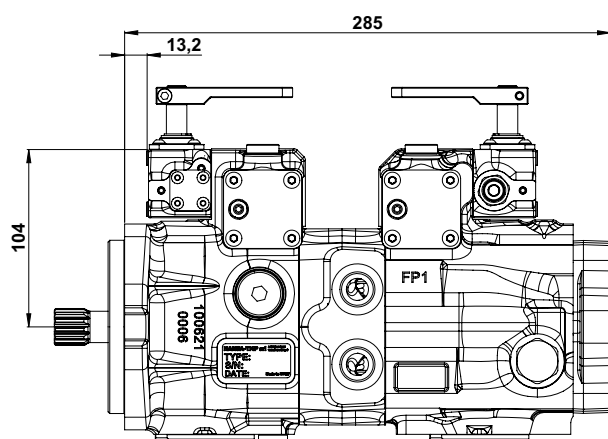
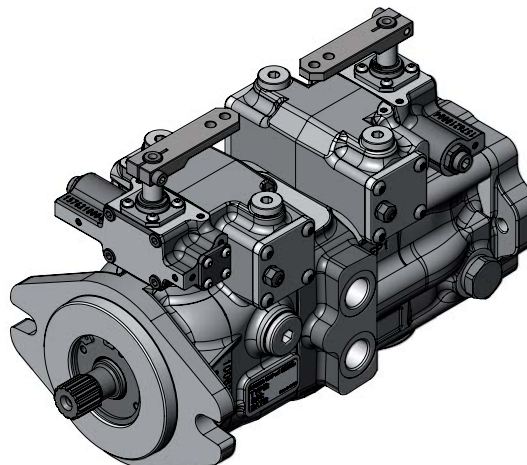


FLOW DIRECTION	PRIMARY PUMP			SECONDARY PUMP		
Rotation	Port	OUT	IN	Port	OUT	IN
Clockwise (CR)	P ₁	A ₁	B ₁	P ₃	B ₂	A ₂
	P ₂	B ₁	A ₁	P ₄	A ₂	B ₂
Counter clockwise (CC)	P ₁	B ₁	A ₁	P ₃	A ₂	B ₂
	P ₂	A ₁	B ₁	P ₄	B ₂	A ₂

SMIX

MANUAL LEVER CONTROL WITH FEED BACK

The pump displacement variation is directly related to the angle position of the lever.

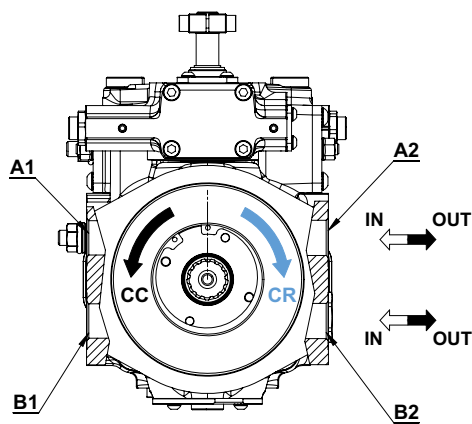
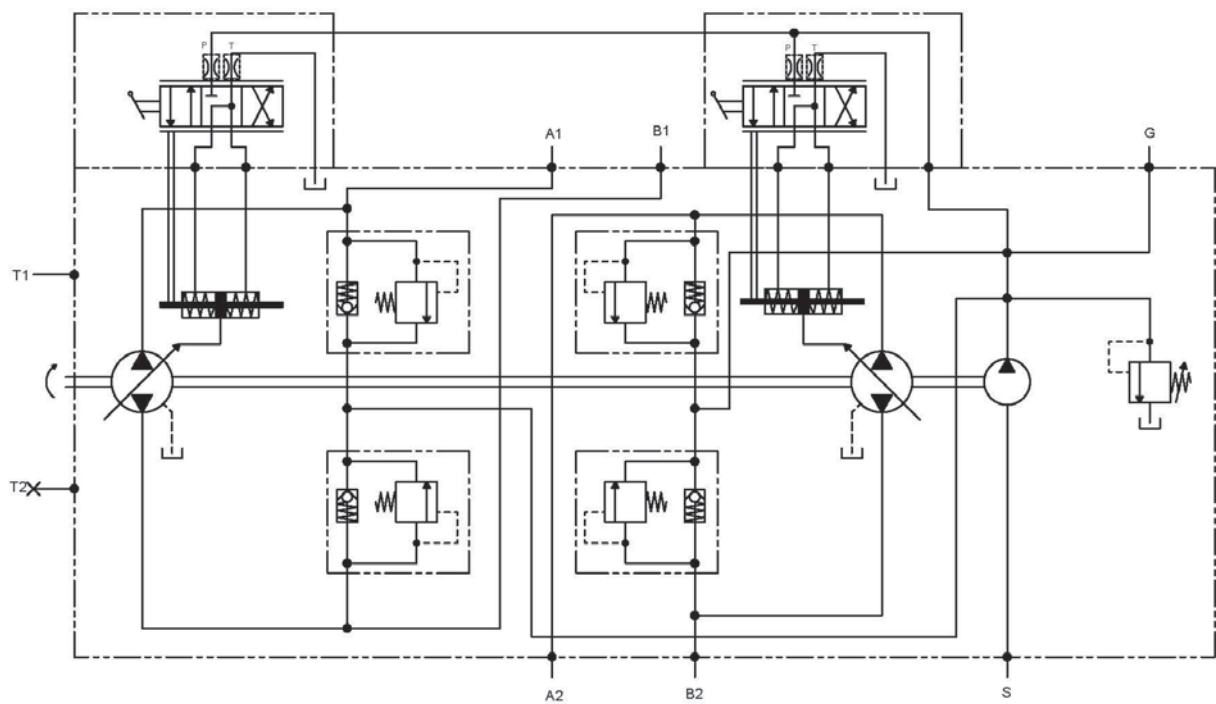


(continued)

SMIX

MANUAL LEVER CONTROL WITH FEED BACK

HYDRAULIC DIAGRAM



FLOW DIRECTION	PRIMARY PUMP			SECONDARY PUMP		
Rotation	Port	OUT	IN	Port	OUT	IN
Clockwise (CR)	a ₁	B ₁	A ₁	a ₂	A ₂	B ₂
	b ₁	A ₁	B ₁	b ₂	B ₂	A ₂
Counter clockwise (CC)	a ₁	A ₁	B ₁	a ₂	B ₂	A ₂
	b ₁	B ₁	A ₁	b ₂	A ₂	B ₂

SEIX 1.3 (12V DC)

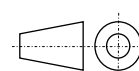
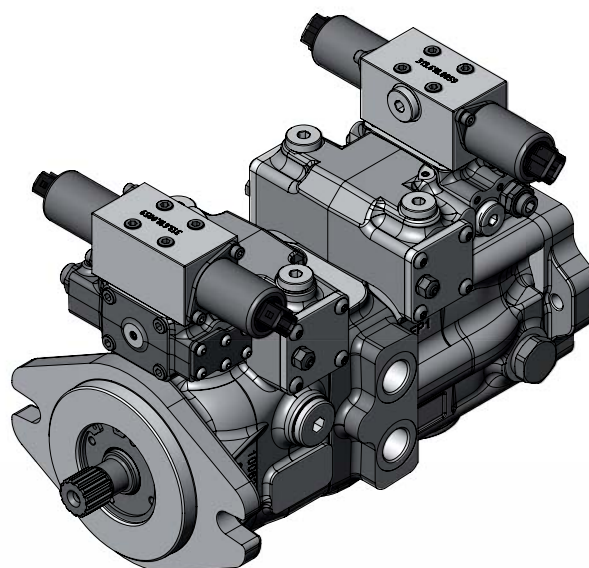
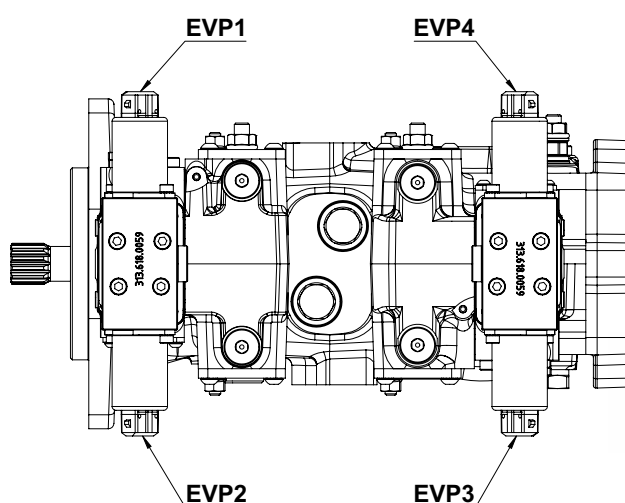
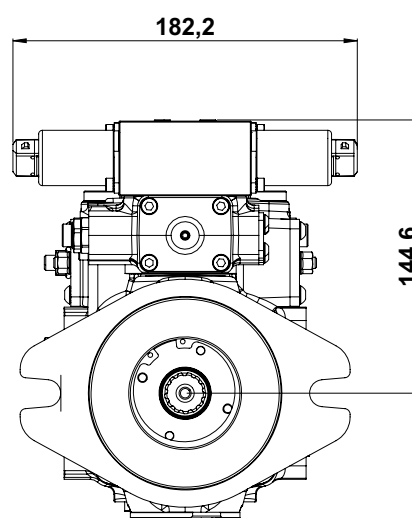
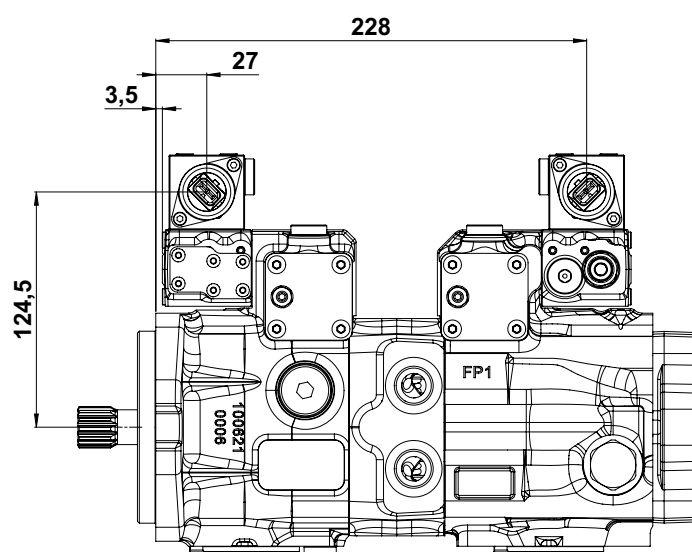
SEIX 2.3 (24V DC)

ELECTRO-PROPORTIONAL SERVO CONTROL WITH FEED BACK

(AMP junior timer connector)

The pump displacement variation is obtained by an electric signal, which varies approx.:

- from 315 to 630 mA (24V DC voltage)
- from 630 to 1260 mA (12V DC voltage)



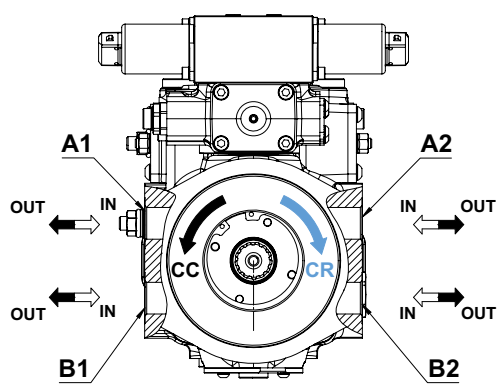
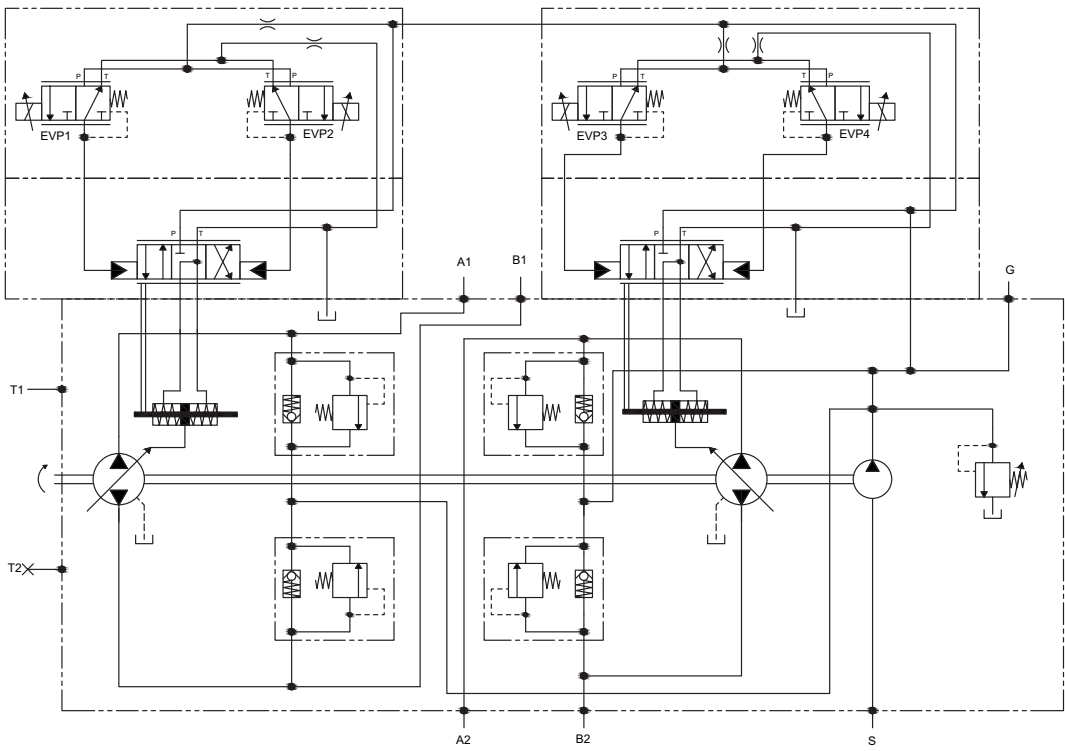
(continued)

SEIX 1.3 (12V DC)
SEIX 2.3 (24V DC)

ELECTRO-PROPORTIONAL SERVO CONTROL WITH FEED BACK

(AMP junior timer connector)

HYDRAULIC DIAGRAM



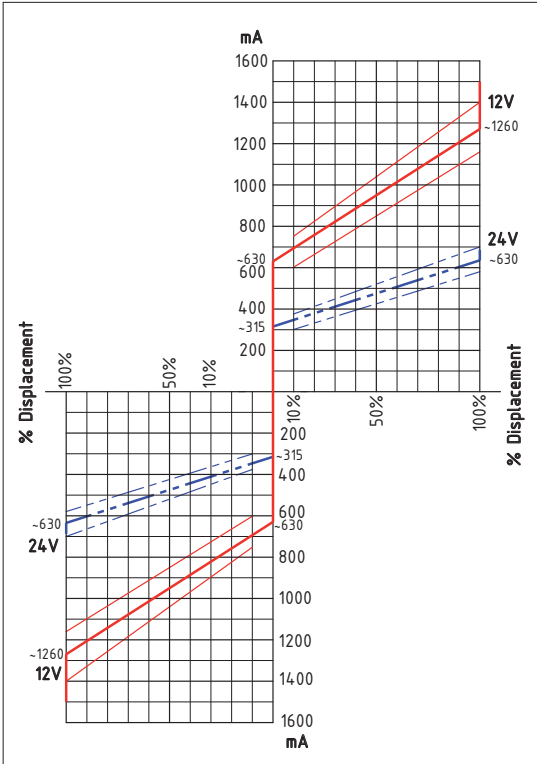
FLOW DIRECTION	PRIMARY PUMP			SECONDARY PUMP		
Rotation	 EVP	OUT	IN	 EVP	OUT	IN
Clockwise (CR)	EVP1 EVP2	A ₁ B ₁	B ₁ A ₁	EVP3 EVP4	B ₂ A ₂	A ₂ B ₂
Counter clockwise (CC)	EVP1 EVP2	B ₁ A ₁	A ₁ B ₁	EVP3 EVP4	A ₂ B ₂	B ₂ A ₂

(continued)

SEIX 1.3 (12V DC)
SEIX 2.3 (24V DC)

ELECTRO-PROPORTIONAL SERVO CONTROL WITH FEED BACK _____
(AMP junior timer connector)

CURRENT-DISPLACEMENT GRAPHIC



ELECTRICAL FEATURES		
Voltage	12 V DC	24 V DC
Electric current	1500 mA	750 mA
Load resistance	4,72 $\Omega \pm 5\%$	20,8 $\Omega \pm 5\%$
Type of control	Current control	
	PWM 100 Hz (suggested)	
Type of connection	AMP Junior Timer	
Protection class	Until IP6K6 / IPX9K	

HYDRAULIC FEATURES	
Max. pressure (P, T)	pP= 5 MPa, pT= 3 MPa
Hysteresis (w/PWM)	<0,07 MPa (pA=2,0)
	<0,1 MPa (pA=2,5)
	<0,15 MPa (pA=3,5)
Filtration ratio	125 μm
Oil contamination level	Min. filtration ratio: 20/18/15
	According ISO 4406
	Hydraulic oil DIN 51524
Min./max. oil temperature	From -20 to +90°C

SEIX 1.3D (12V DC)

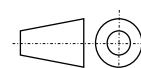
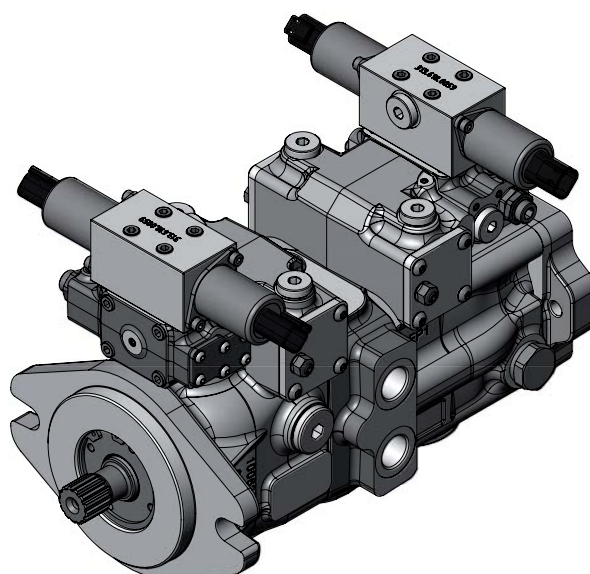
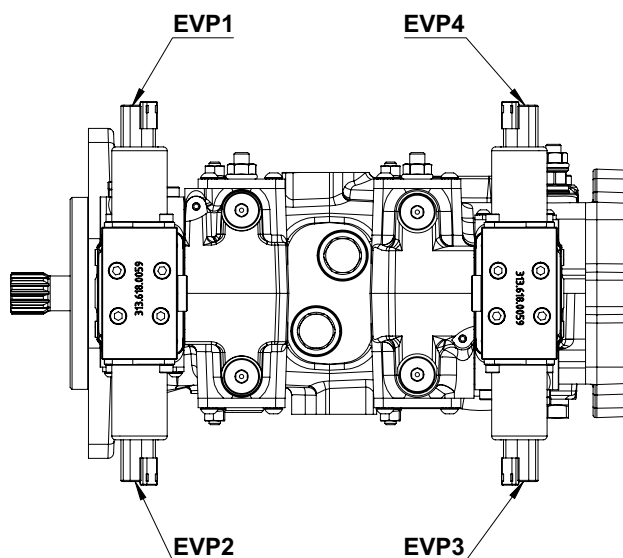
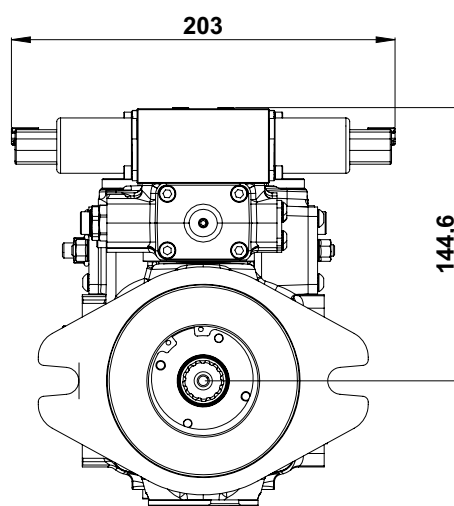
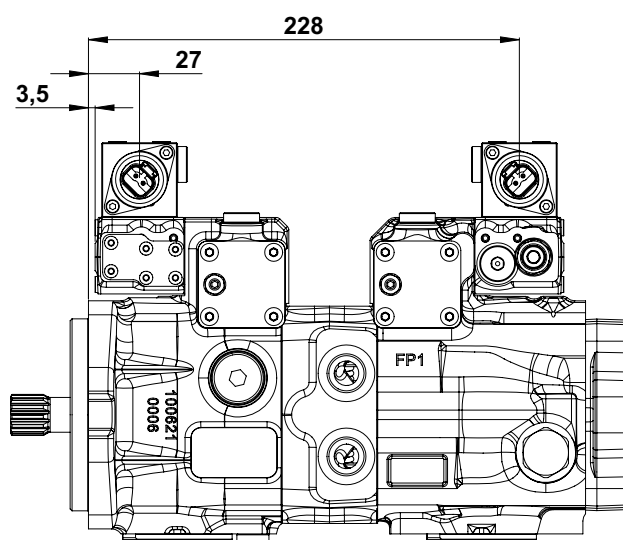
SEIX 2.3D (24V DC)

ELECTRO-PROPORTIONAL SERVO CONTROL WITH FEED BACK

(Deutsch connector)

The pump displacement variation is obtained by an electric signal, which varies approx.:

- from 315 to 630 mA (24V DC voltage)
- from 630 to 1260 mA (12V DC voltage)



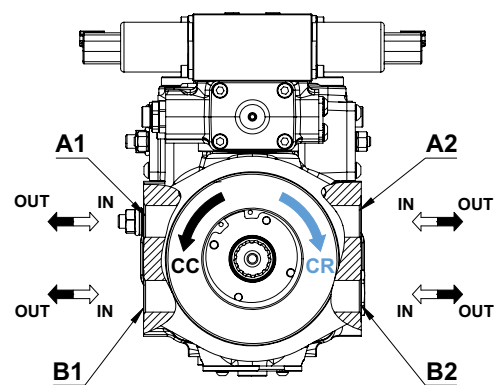
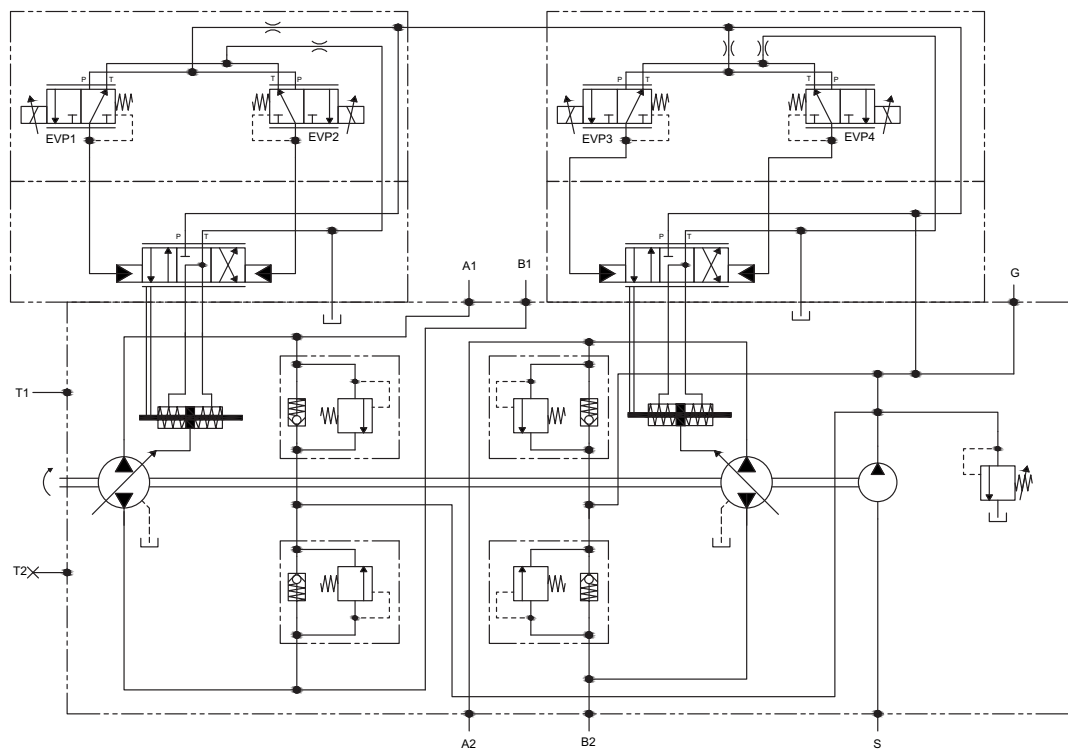
(continued)

SEIX 1.3D (12V DC)
SEIX 2.3D (24V DC)

ELECTRO-PROPORTIONAL SERVO CONTROL WITH FEED BACK

(Deutsch connector)

HYDRAULIC DIAGRAM

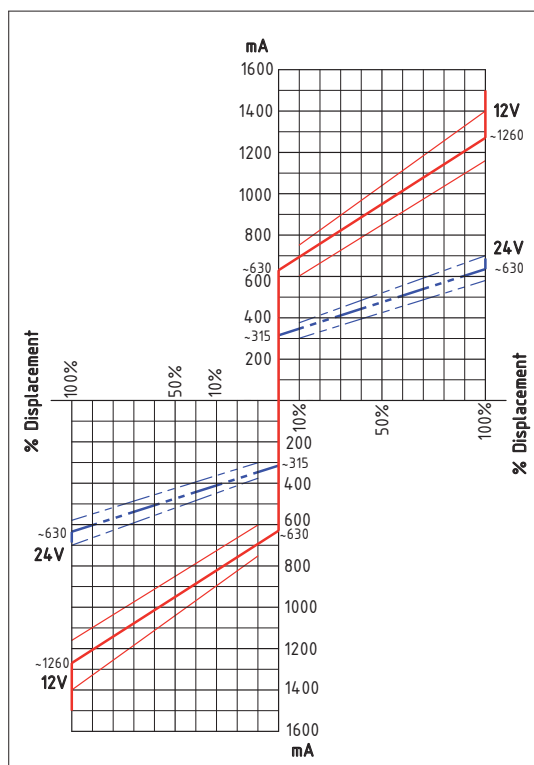


FLOW DIRECTION	PRIMARY PUMP			SECONDARY PUMP		
Rotation	 EVP	OUT	IN	 EVP	OUT	IN
Clockwise (CR)	EVP1 EVP2	A ₁ B ₁	B ₁ A ₁	EVP3 EVP4	B ₂ A ₂	A ₂ B ₂
Counter clockwise (CC)	EVP1 EVP2	B ₁ A ₁	A ₁ B ₁	EVP3 EVP4	A ₂ B ₂	B ₂ A ₂

(continued)

SEIX 1.3D (12V DC)**SEIX 2.3D** (24V DC)**ELECTRO-PROPORTIONAL SERVO CONTROL WITH FEED BACK**

(Deutsch connector)

CURRENT-DISPLACEMENT GRAPHIC**ELECTRICAL FEATURES**

Voltage	12 V DC	24 V DC
Electric current	1500 mA	750 mA
Load resistance	4,72 $\Omega \pm 5\%$	20,8 $\Omega \pm 5\%$
Type of control	Current control	
	PWM 100 Hz (suggested)	
Type of connection	DEUTSCH DT 04-2P	
Protection class	Until IP6K6 / IPX9K	

HYDRAULIC FEATURES

Max. pressure (P, T)	pP= 5 MPa, pT= 3 MPa
Hysteresis (w/PWM)	<0,07 MPa (pA=2,0)
	<0,1 MPa (pA=2,5)
	<0,15 MPa (pA=3,5)
Filtration ratio	125 μm
Oil contamination level	Min. filtration ratio: 20/18/15
	According ISO 4406
	Hydraulic oil DIN 51524
Min./max. oil temperature	From -20 to +90°C

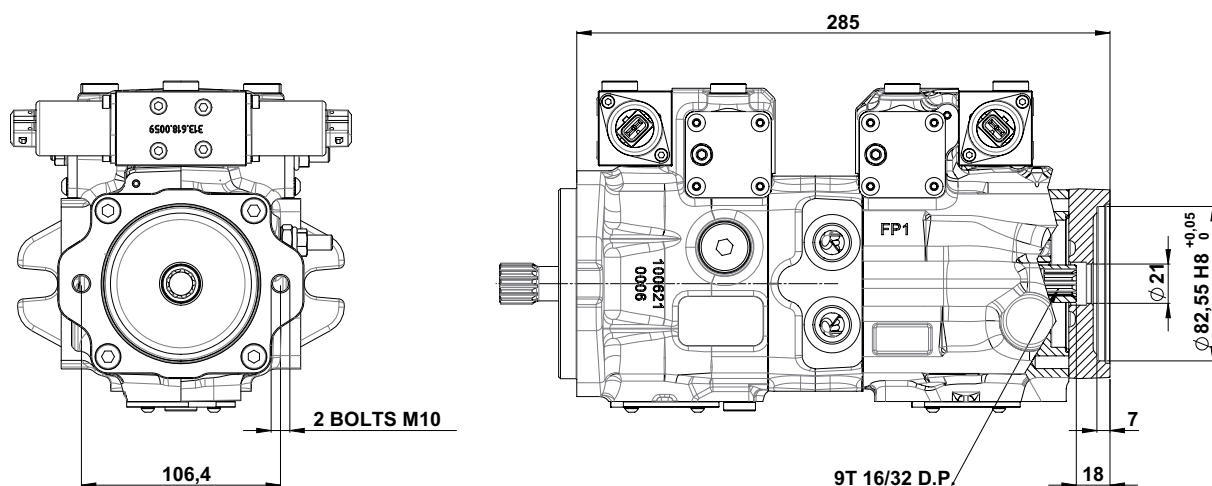
THROUGH DRIVE OPTIONS

SA-R

FLANGE SAE A - 2 BOLTS

ISO 3019-7

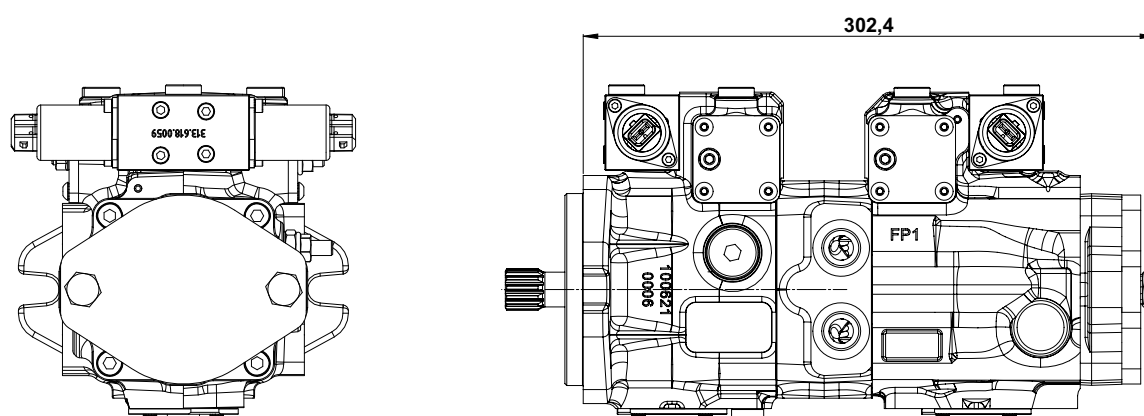
Max. torque = 120 Nm



ANSI B92.1-1970 CLASS 7 SAE B

C-SA

CLOSED COVER WITHOUT REAR FITTING



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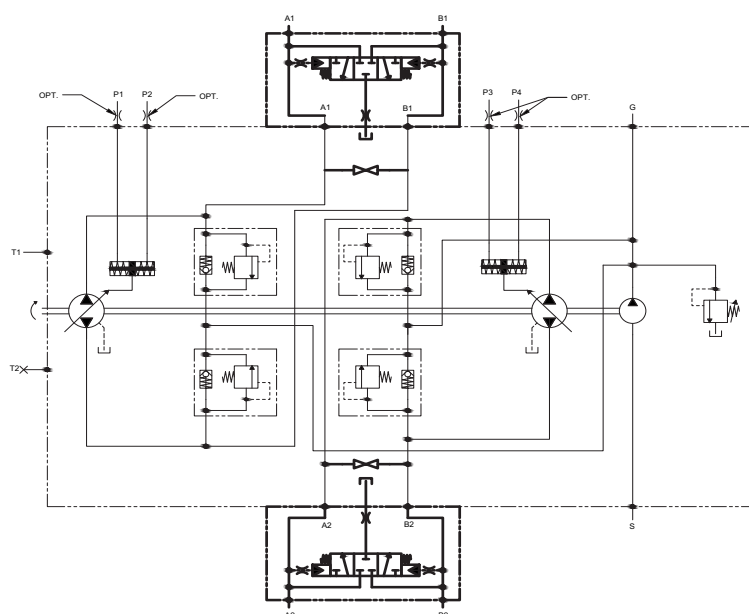
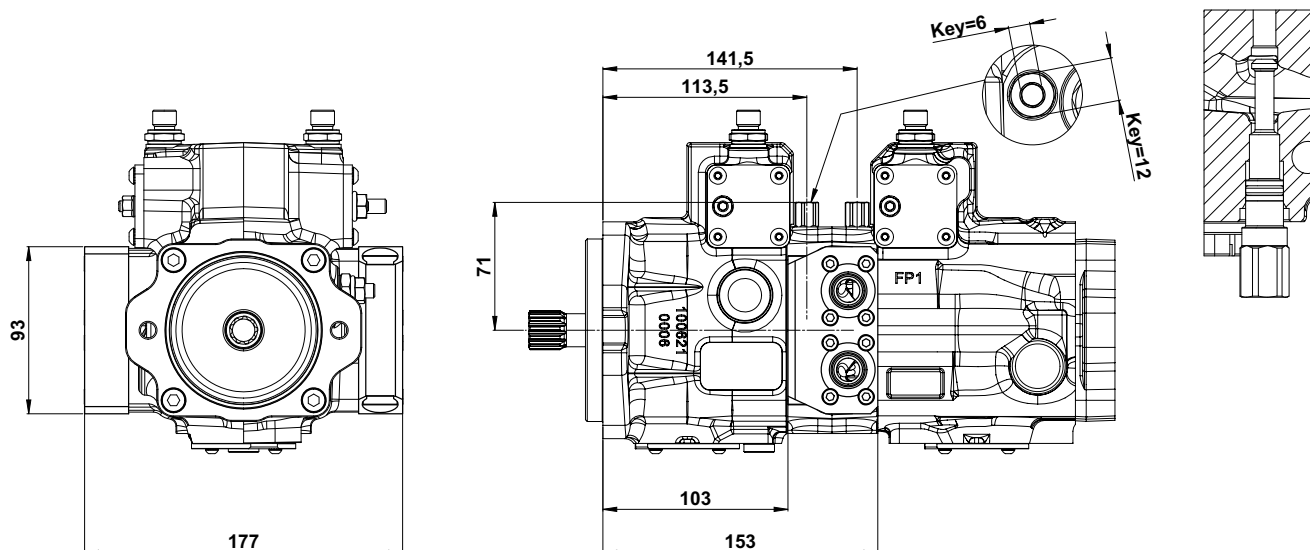
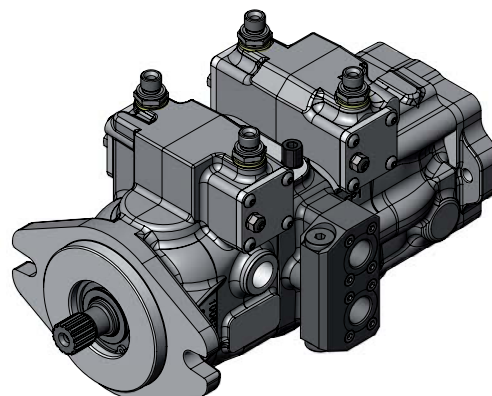
OPTIONAL VS-SB

PURGE VALVE WITH SCREW BY-PASS

For the TPV-TPVTC 1500 pumps is available an integrated purge valve (loop flushing).

The valve consists of a spring centered shuttle spool connecting automatically the low pressure line (boost) with the reservoir removing heat from the system.

The quantity of the flushing oil is a function of the low system pressure (boost) and the size of the orifice on the valve (different orifices are available referred to the system pressure). The spool shifts at a differential pressure of about 0,8 MPa (116 PSI).

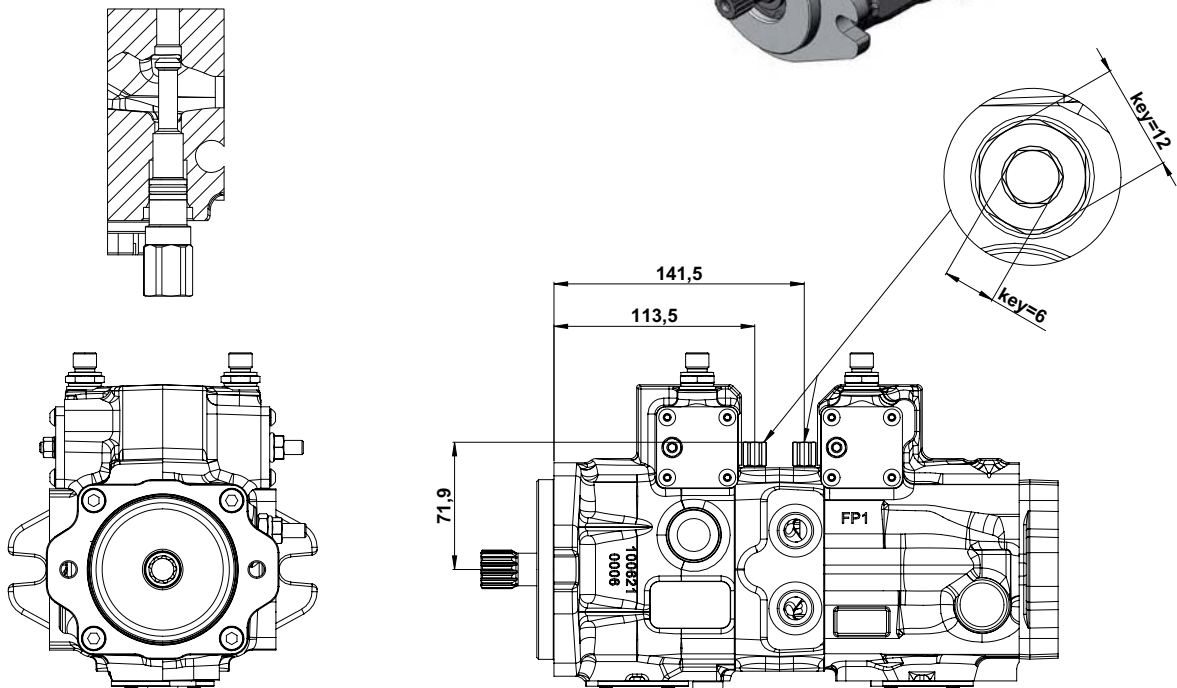
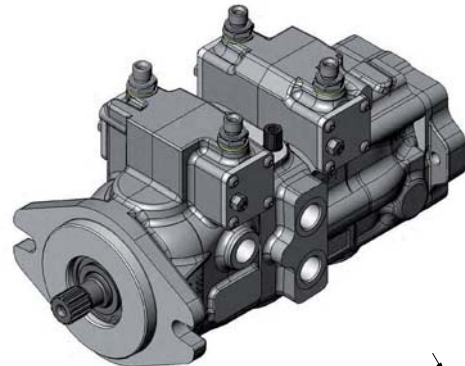


HYDRAULIC DIAGRAM

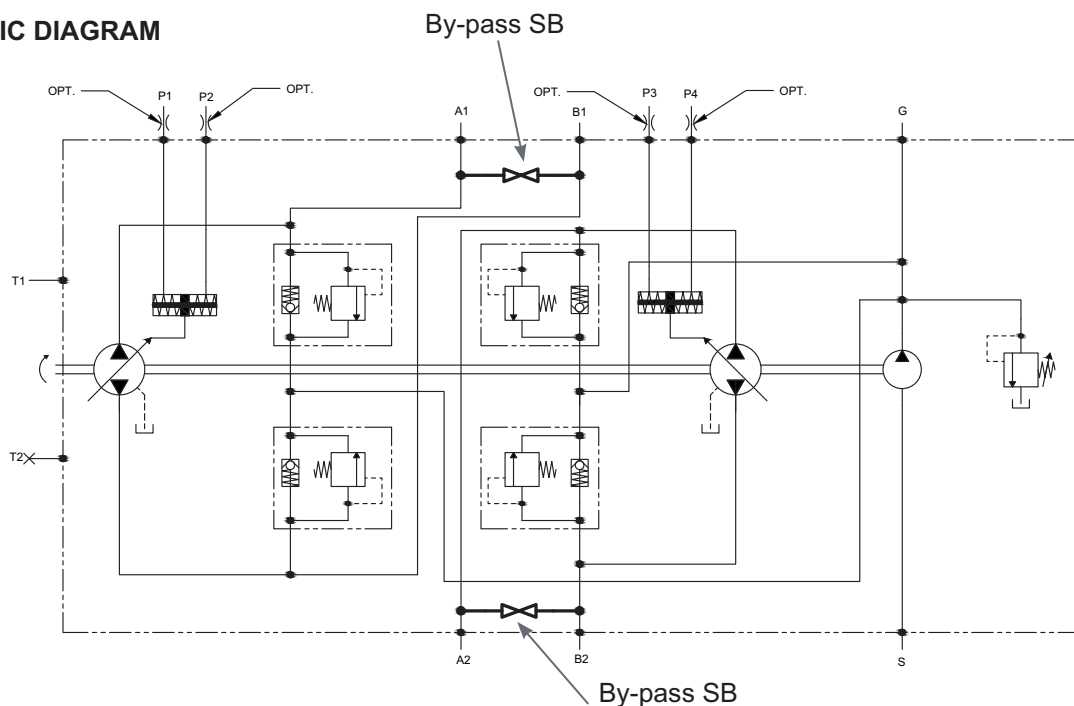
OPTIONAL SB

SCREW BY-PASS

To by pass the oil flow from one direction to the other, with the pump not running or in emergency condition a by pass screw can be actuated to connect the 2 lines of the hydraulic system. The orifice is completely open after 4 counter-clockwise rotations of the screw.



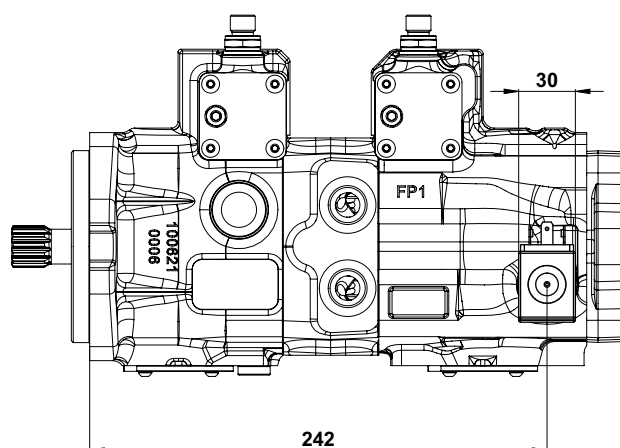
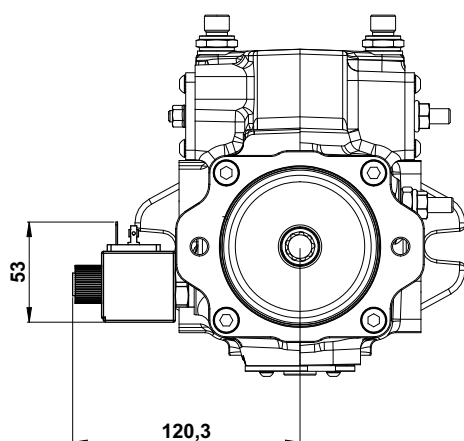
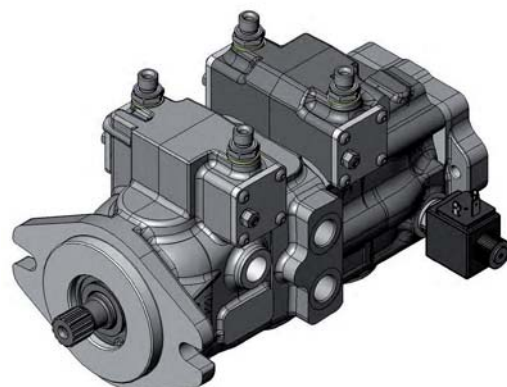
HYDRAULIC DIAGRAM



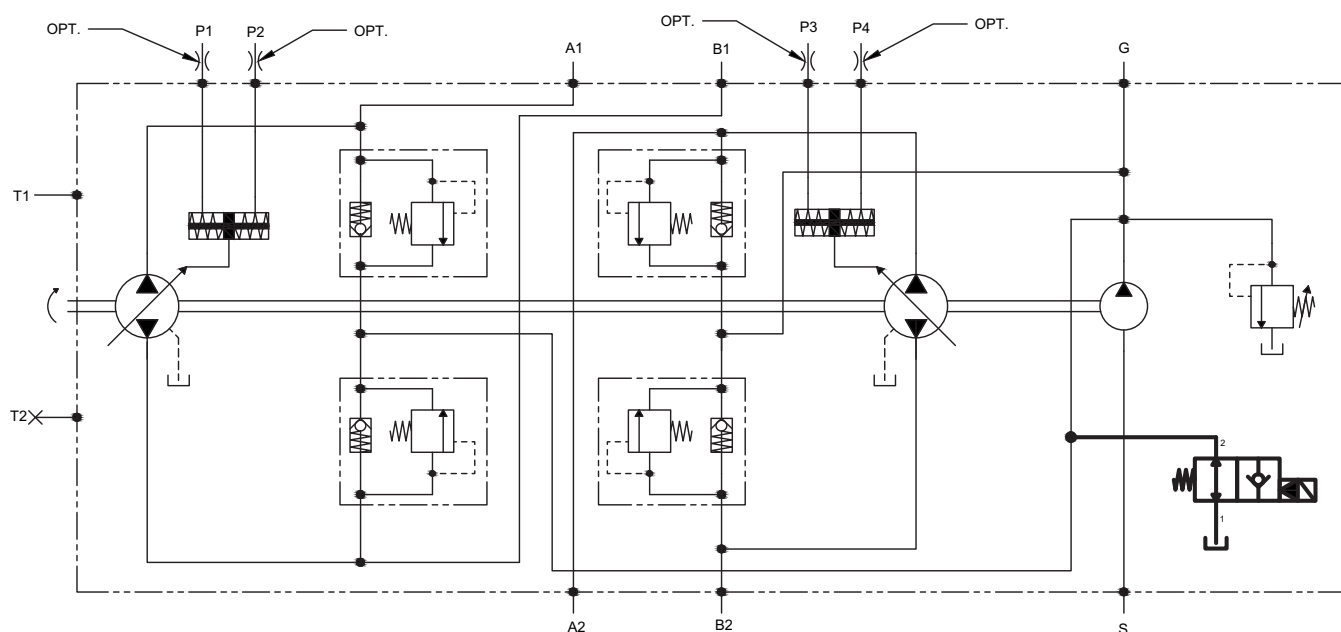
OPTIONAL MOB

MAN ON BOARD

On the pump a normally open electrical operate valve can be fitted. The valve allow the flow delivery only when energized. This function is used to increase the safety of the machine. The solenoid valve is available for 12V or 24V DC voltage.



HYDRAULIC DIAGRAM



(continued)

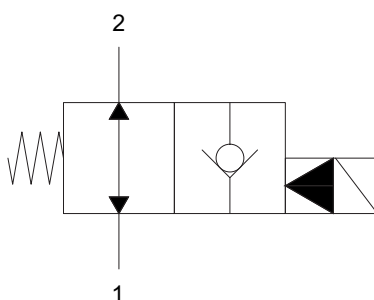
OPTIONAL MOB

MAN ON BOARD

TECHNICAL FEATURES

VALVE MOB - Hydraulic characteristics	
Max. operating pressure	30 MPa
Max. flow	40 lt/min.
Internal leakage	max. 5 drops/min. at 30 MPa
Response time	energized 20 ms
De-energized	30 ms
Temperature range	from -20°C to 90°C

VALVE MOB - Electrical characteristics	
Power	18 W
Various voltage options available	(AC/DC)
Wire insulation	Class H
Duty factor	ED 100%
Supply power tolerance	+ 10%, - 15% (DC)
Ambient temperature	from -30°C to 60°C
Several connection options available	

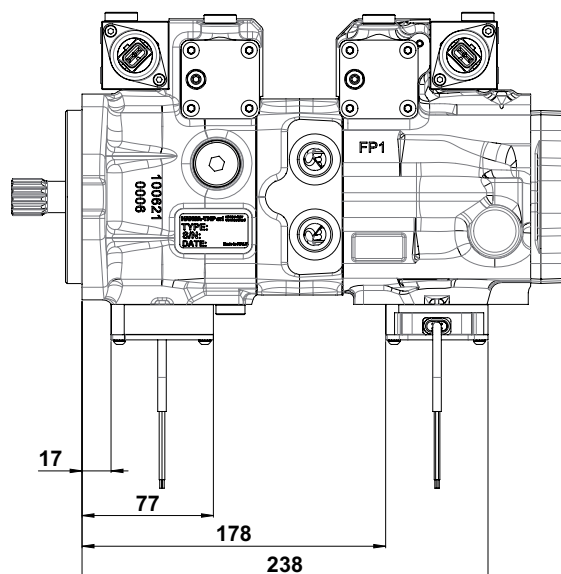
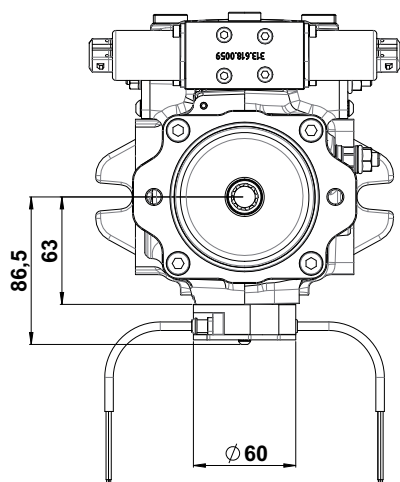
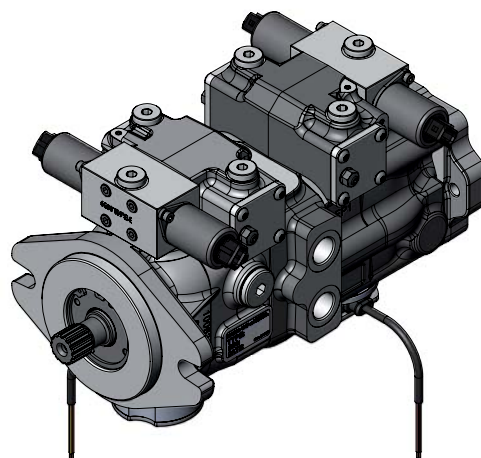


OPTIONAL RS

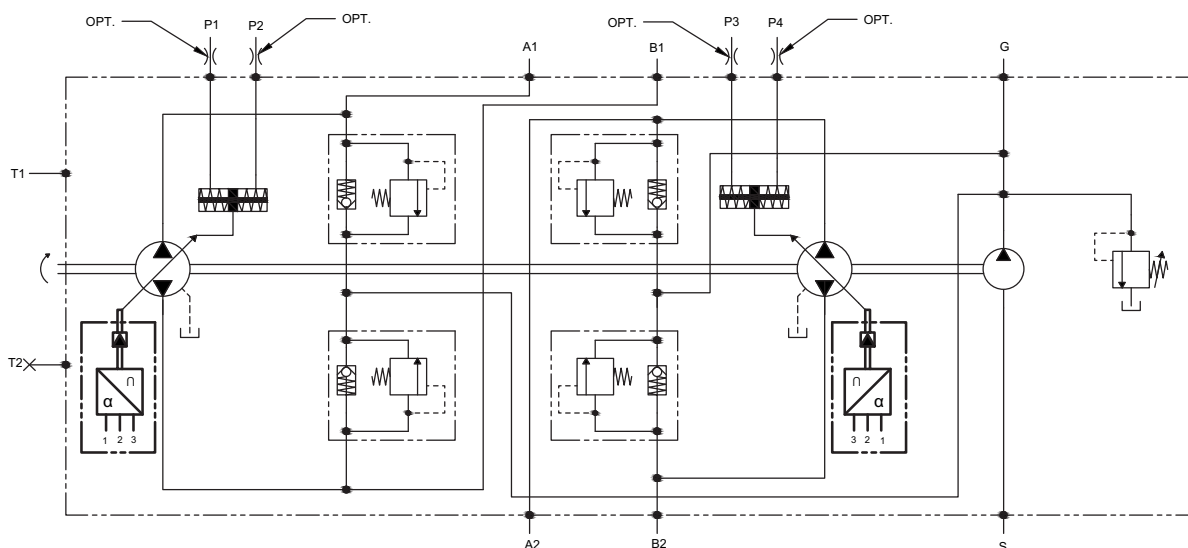
ANGLE SENSOR

An electronic angle sensor, to measure the swash plate position, is available for the TPV-TPVTC 1500.

The electronic signal can be used for a remote control of the pump performance. The technical features of the sensor are shown on the next page.



HYDRAULIC DIAGRAM



(continued)

OPTIONAL RS

ANGLE SENSOR

TECHNICAL FEATURES

Operating voltage: +5 Vdc

Output signal: +0.5 Vdc...+4.5 Vdc output with power +5 Vdc: it is recommended a load resistance > 10 K Ω

Current consumption: 4.5 V -> 20mA

Angular range: $\pm 20^\circ$

Resolution (20°C): 12 bit (analog output)

Linearity error (20°C): $\pm 0.5^\circ$ FS

Load resistance: > 10 kohm

Centre position: 2.5 V

Reverse connection protected: yes

Delay time of output signal: 4 ms

Temperature range: -40°C...+85°C (higher

values on request); thermal drift < 50 ppm/°C

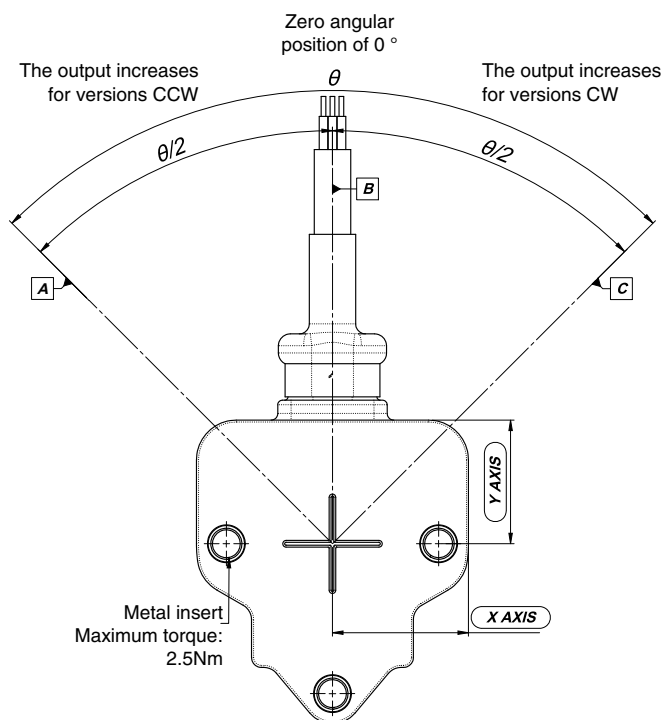
IP protection class: AMP IP67

Rotation: clockwise CW single

Cable length: 1 meter

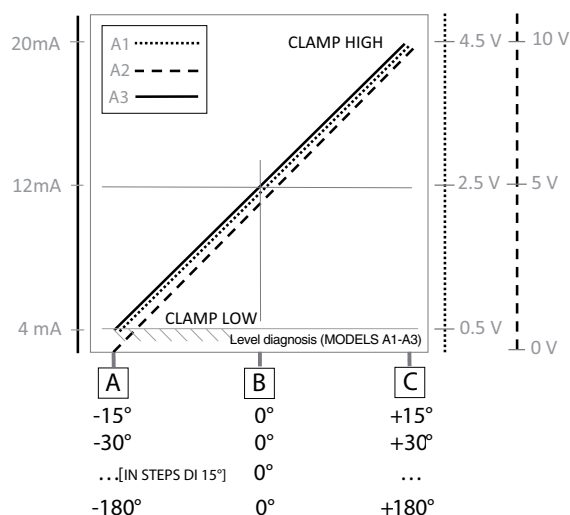


CABLE VERSION

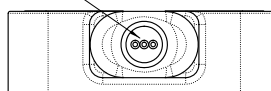


Ref.	CW Output
A	Output: 0.5Vdc
B	Zero angular position of 0°
C	Output: 4.5Vdc

CLOCKWISE CW SINGLE DIRECTION OF ROTATION 1



cable output - PUR sheath
conductors 22 AWG



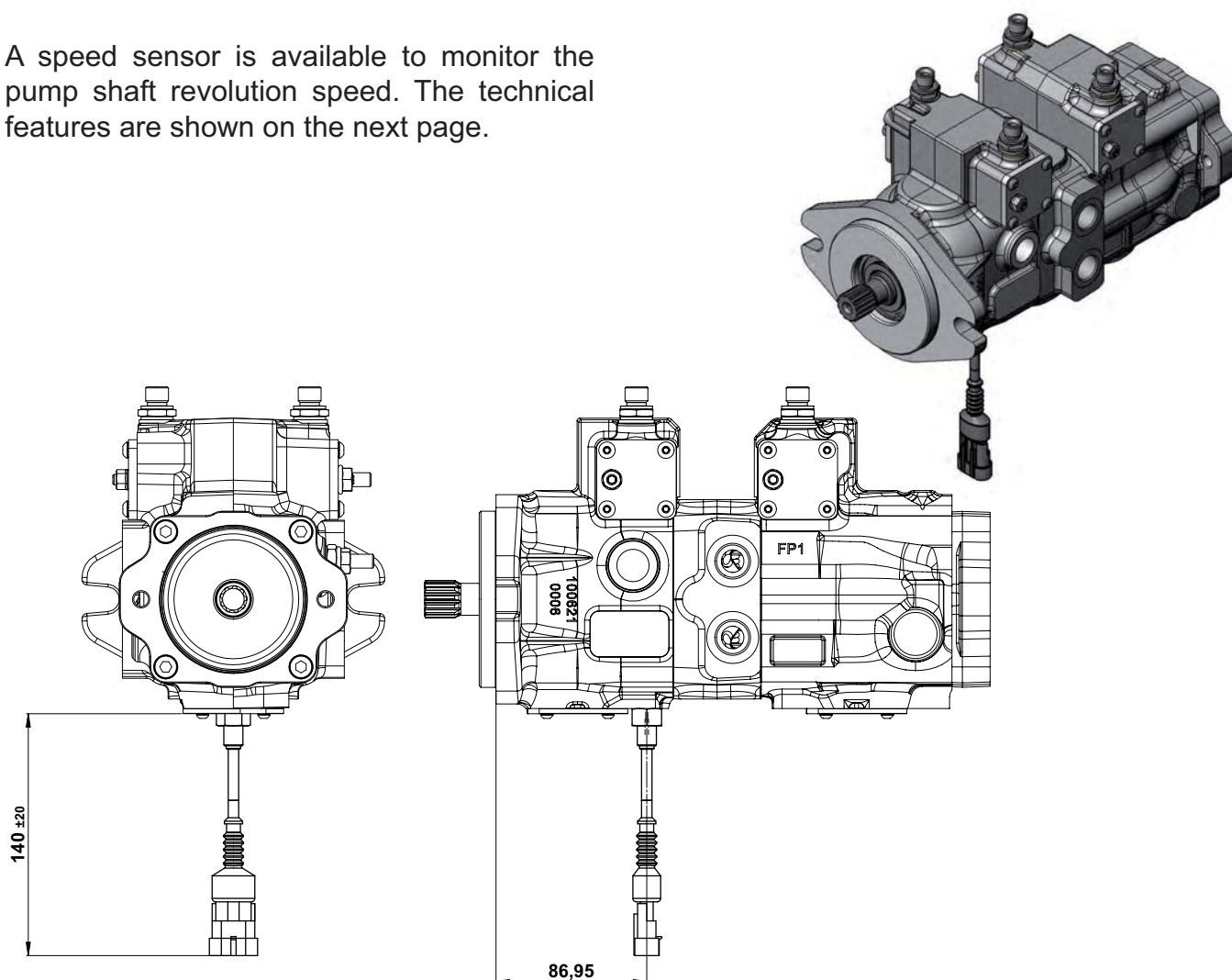
CONNECTIONS

BLACK GROUND 1
RED + SUPPLY 1
YELLOW OUTPUT 1

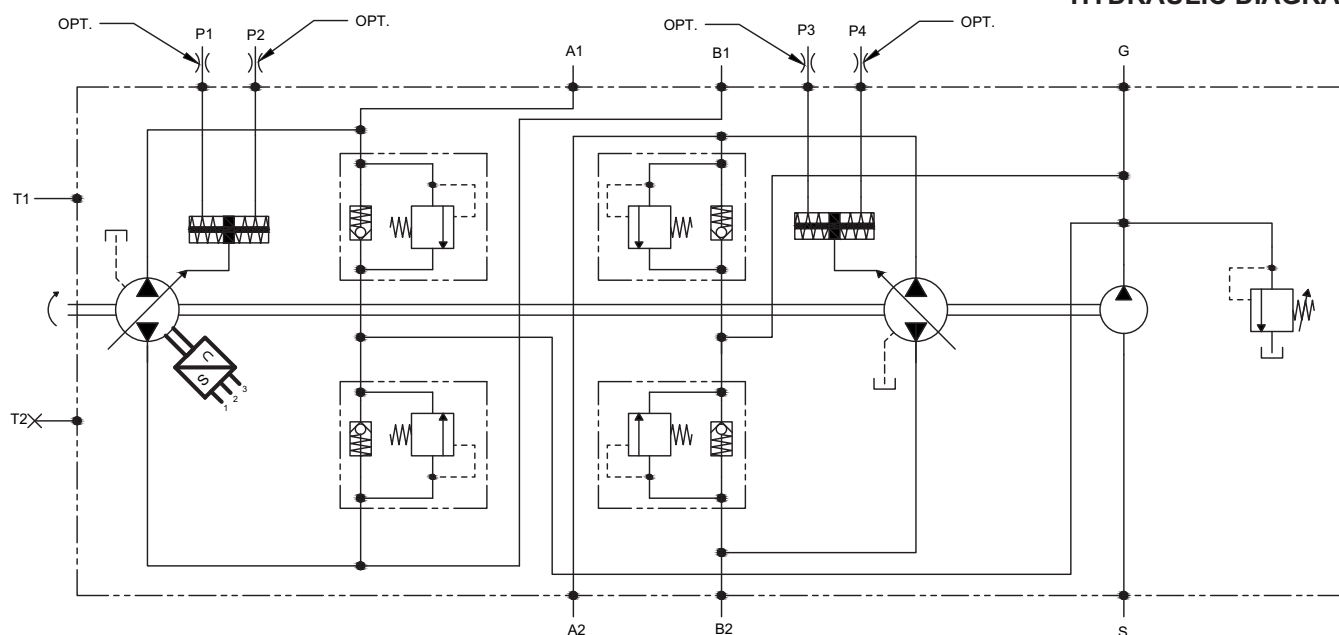
OPTIONAL REV.S

SPEED SENSOR

A speed sensor is available to monitor the pump shaft revolution speed. The technical features are shown on the next page.



HYDRAULIC DIAGRAM



(continued)

OPTIONAL REV.S

SPEED SENSOR

TECHNICAL FEATURES

Operating voltage: 4.5-30 V DC

Output current: max 25 mA

Maximum target: 15 kHz

Internal resistance: 140 ±30 Ω

Insulation resistance: 145 MΩ (500 V)

Protected by polarity inversion: yes

Output signal (freq): open collector (NPN)

Mechanical shock: 4 g (1mm/80Hz)

Electro magnetic compatibility: B.C.I.

-Class "C" 100 mA, 1÷400 MHz

Reverse polarity protection: -30 Vdc for 1h

Overload protection: 30 mA for 5'

Overvoltage protection: 35 V for 5'

Short circuit protection: to ground for 5'
to Vcc for 5'

Output transite voltage protection: V_{BR} min
31,35 max 34,65

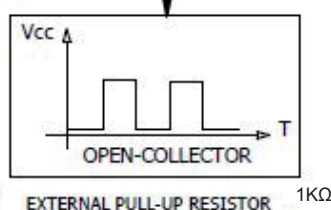
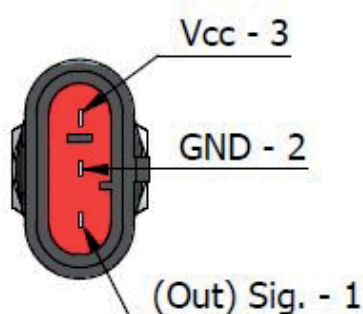
Temperature range: -40 / +150°C

Protection class: IP 67

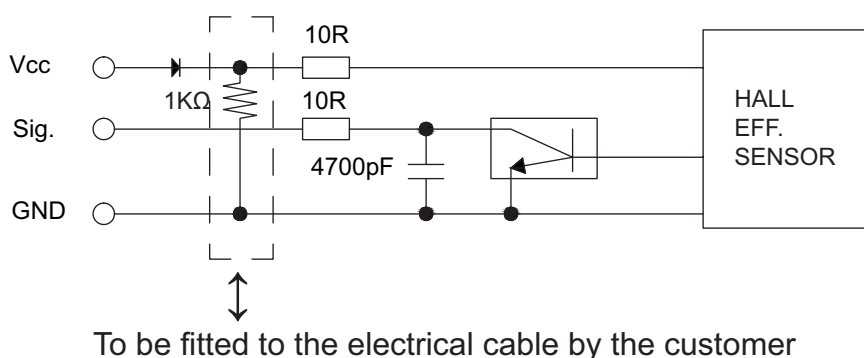
Tightening torque: 25 Nm

Output pins are protected against 2000 V
electrostatic discharge according to HMB

Output signal/revolution = 1



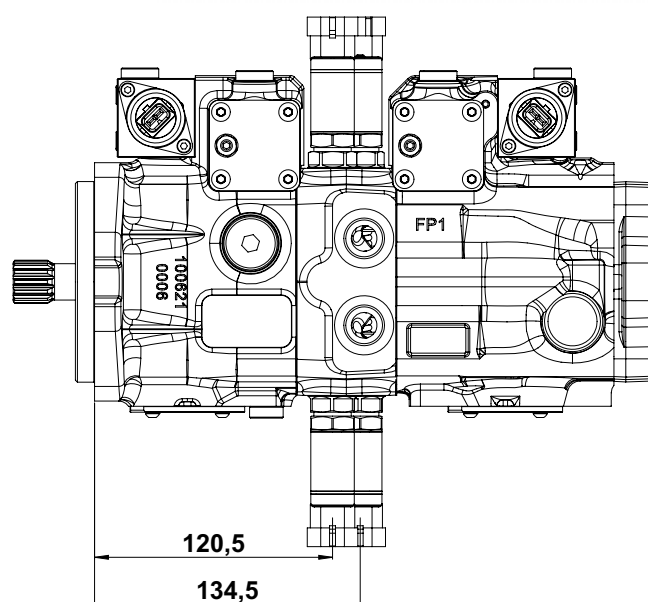
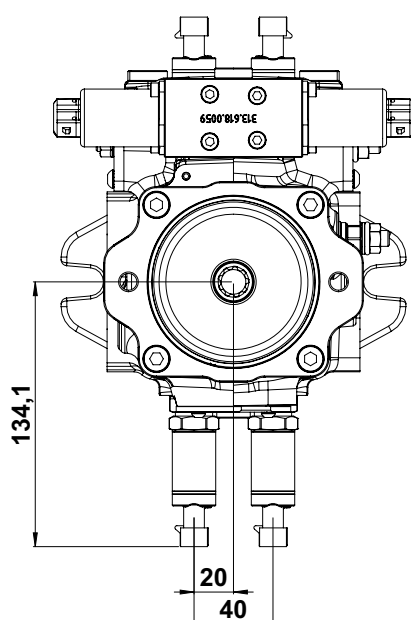
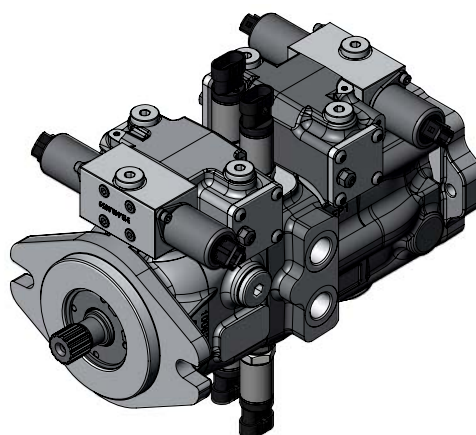
SENSOR FUNCTIONAL SCHEME



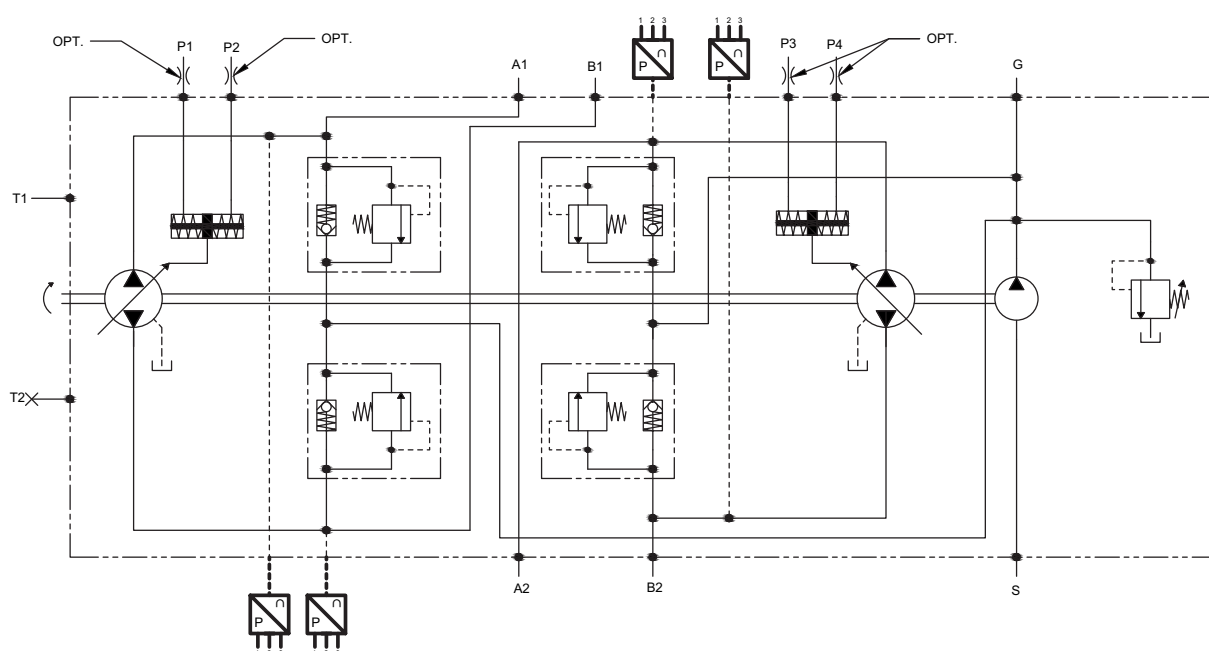
OPTIONAL PRS

PRESSURE SENSOR

The TPV-TPVTC 1500 can fit a pressure sensor to monitor the working pressure. These information sent and processed by an electronic remote system allow a continuous remote control of the pump performance. The technical features are shown on the next page.



HYDRAULIC DIAGRAM



(continued)

OPTIONAL PRS

PRESSURE SENSOR

TECHNICAL FEATURES

Pressure range: 0-40 MPa

Over pressure, max permitted: 80 MPa

Burst pressure: 150 MPa

Power supply U_B : 5 ± 0.25 Volt DC

Signal output, ratiometric @5V: 4.5 V (X)

Error levels, signal output: < 0.5 V and > 4.5 Volt

Response time: fast (< 1 msec)

Accuracy (IEC 61298-2): $\pm 0.25\%$ FS BFS

Max load, R_A : $\geq 5K\Omega$

Temperature range:

- Operating temperature range (process): from -40°C to $+125^\circ\text{C}$

- Operating temperature range (environment): from -40°C to $+105^\circ\text{C}$

- Compensated temperature range: from -20°C to $+85^\circ\text{C}$

- Storage temperature range: from -40°C to $+125^\circ\text{C}$

CE conformity acc. to: according to EU 2014/30

Mechanical shock: 100g / 11 msec according to IEC 60068-2-27

Vibration resonance: 20g max at 10...2000 Hz according to IEC 60068-2-6

IP protection class: IP65 / IP67

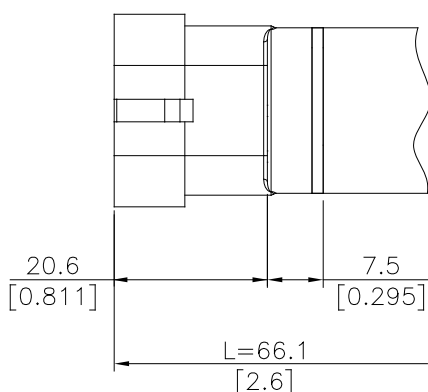
Weight: 80-120 gr. Nominal

Electric connector: AMP Superseal 1.5 (3-pin)

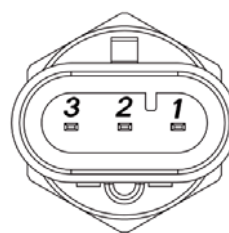
Hydraulic connection: G 1/4 gas male (DIN 3852-E)



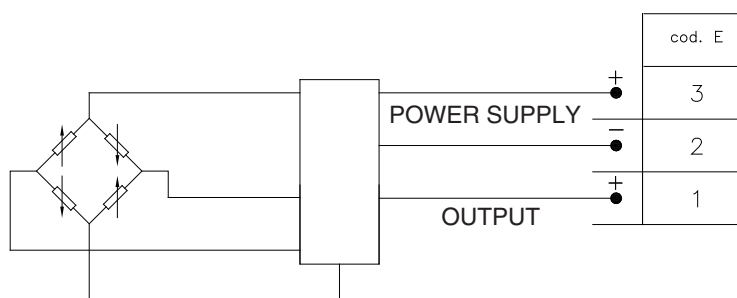
S - Connector AMP Superseal 1.5 (3-pin)



S – AMP Superseal 1.5



Protection rating IP67



TROUBLE SHOOTING

TROUBLES	CAUSE	REMEDY
High noise level	Too high rotation speed of the pump.	Reduce pump rotation speed.
	Wrong rotation direction.	Check the rotation direction of the pump.
	Obstruction in suction line - air in the suction line - wrong oil viscosity - diameter of suction line too small.	Check oil type and viscosity. Check internal diameter of suction line. Remove restrictions. Check oil level of reservoir. Eliminate air intake.
	Not correct connection of the pump. Not correct diameter of pipes/hoses.	Check the pump connections and the pipe/hose diameters according to notes.
	Vibrations of relief valves .	Check the inlet suction line - Check and replace relief valves.
	Internal parts worn out.	Check and replace.
	Wrong pump connection to the prime mover.	Check connections and rotation direction.
	Too low rotation speed of the pump.	Increase the pump rotation speed.
Low flow rate	Obstructions in the suction line - wrong viscosity.	Check oil type and viscosity. Check internal diameter of suction line. Remove restrictions. Check oil level of reservoir. Eliminate air intake.
	Low remote control pressure.	Check and adjust.
	High internal leakage.	Check the case drain flow.
	Low rotation speed of the pump.	Increase speed of the pump.
Instable or low pressure	Obstruction of suction line - air in the suction line - wrong oil viscosity - diameter of suction line too small.	Check oil type and viscosity. Check internal diameter of suction line. Remove restrictions. Check oil level of reservoir. Eliminate air intake.
	Vibration of relief valves.	Check the inlet suction line. Check and replace relief valves.
	Internal parts worn out.	Check and replace.
Over heating	High oil temperature at suction inlet.	Check the cooling system.
	Internal parts worn out.	Check - replace.
	Wrong setting of relief valves.	Check - adjust the setting of relief valves.

PUMPS



Closed Loop Axial Piston Pumps (Variable Displacement) - 6-110 cc

Model	Displacement cm ³ /n.	Rated Pressure MPa	Peak Pressure MPa	Maximum speed n/min.	Weight kg (single pump)
TPV 1000 TPV 1200 BTB	6, 8, 9, 11, 12, 13	21	30	3.600	8,8
	15, 17		28		
	18		27		
	19, 21	20	25	3.200	
TPV-TPVTC 1500	17, 18, 19, 21	35	40	3.600	14
TPV 3200	21, 28	25	35		22
TPV-TPVT 3600	26, 28, 30, 31, 32, 34, 36, 38	35	45		28
TPV 4300	32, 38, 45, 50	25	35		23
TPV 5000	46, 50, 64	30	40		29
TPV 9000	55	40	45	4.000	55
	72			4.100	68
	90			4.000	
	110			3.800	



Open Loop Axial Piston Pumps (Fixed Displacement) - 32-50 cc

Model	Displacement cm ³ /n.	Rated Pressure MPa	Peak Pressure MPa	Maximum speed n/min.	Weight kg (single pump)
TPF 60	35, 40, 46	35	42	2.800	20,5
	50		41	2.500	



Bent Axis Pumps - 12-130 cc

Model	Displacement cm ³ /n.	Rated Pressure MPa	Peak Pressure MPa	Maximum speed n/min.	Weight kg
TPB - TAP 70	12.6	35	40	3.300	7,5
	17.0			3.200	
	25.4			2.550	8,5
	34.2			2.250	
	41.2, 47.1			2.200	15,5
	56.0			2.100	
	63.6			2.050	
	83.6, 90.7, 108.0			1.700	27,0
	130.0			1.600	29,5
	The table values can change in function of the configuration.				

As HANSA-TMP has a very extensive range of products and some products have a variety of applications, the information supplied may often only apply to specific situations.

If the catalogue does not supply all the information required, please contact HANSA-TMP.

In order to provide a comprehensive reply to queries we may require specific data regarding the proposed application.

Whilst every reasonable endeavour has been made to ensure accuracy, this publication cannot be considered to represent part of any contract, whether expressed or implied.

The data in this catalogue refer to the standard product. The policy of HANSA-TMP consists of a continuous improvement of its products. It reserves the right to change the specifications of the different products whenever necessary and without giving prior information.



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GEARBOXES - ACCESSORIES**

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